Practical TELEVISION

FEBRUARY 1967

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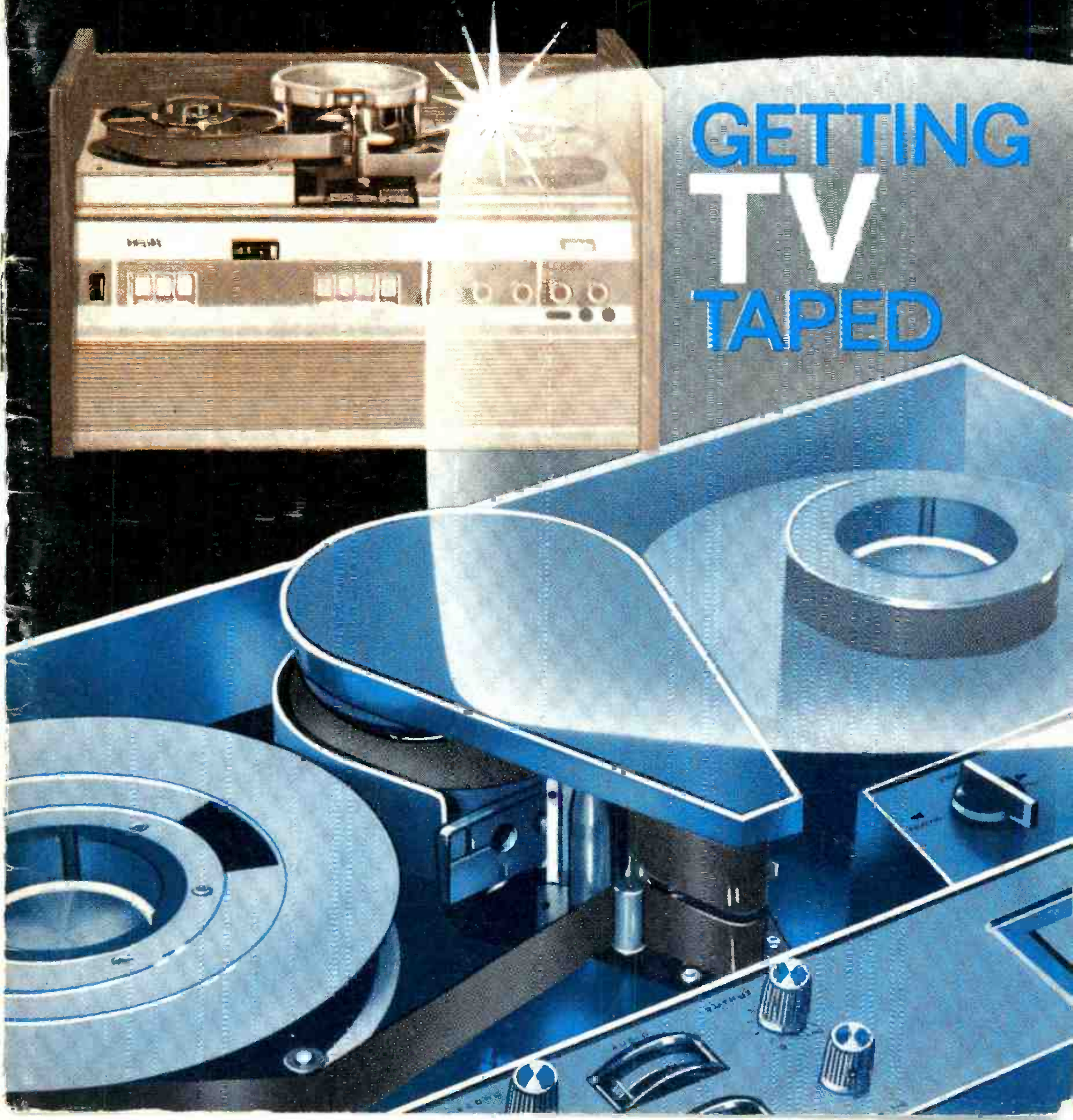

GETTING TV TAPED

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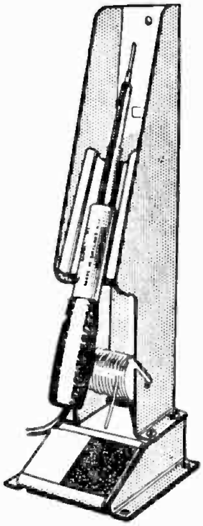

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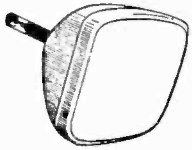

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Practical Television

£10 TELEVISION LICENCE

THE long awaited White Paper on Broadcasting brings little happiness to the television enthusiast. For there is to be a supplementary licence fee of £5 for those lucky enough to own colour receivers; there is to be no increase in the number of hours allowed for television broadcasting; and there is to be no new television services within the next three years. Nor is there a decision on how and when the present 405-line BBC-1 and ITV services will change-over to 625 lines.

On the brighter side, the Government is considering an educational television service for the Open University scheme. Also the Government state that it will not be necessary to raise the normal radio and television licence fee before 1968, and that colour broadcasts will definitely begin on BBC-2 later this year.

According to the White Paper, "It is the Government's view that the cost of colour programmes, which are likely at the outset to be available only to a small minority of viewers because of the cost of receivers, should not fall upon viewers in general." Is this the right attitude for the Government to adopt? Those able to buy a colour receiver without feeling the pinch in these hard times will not worry about the extra £5 licence fee. But what about Mr. Average who wishes to see colour television and has either to rent a colour receiver or have one on the never-never? He will have to find a large down payment plus the supplementary £5 licence fee. We doubt if he will be prepared to do this for the privilege of watching the odd programme in colour. Thus, we can only assume that the Government—a Socialist one at that—wish to restrict colour television to those in the higher income bracket.

Answering questions on the White Paper, Mr. Edward Short, the Postmaster-General, stated that the £10 colour television licence is here to stay and will not be reduced as colour becomes more popular. "If people want this colour TV service, they will have to pay for it."

The Government's attitude towards colour television is not at all encouraging. Surely this is wrong, since valuable foreign currency can be derived from exporting programmes. Independent Television, who have been extremely successful in selling their shows overseas, have for present been denied colour. This is not right in a progressive society.

W. N. STEVENS—*Editor*

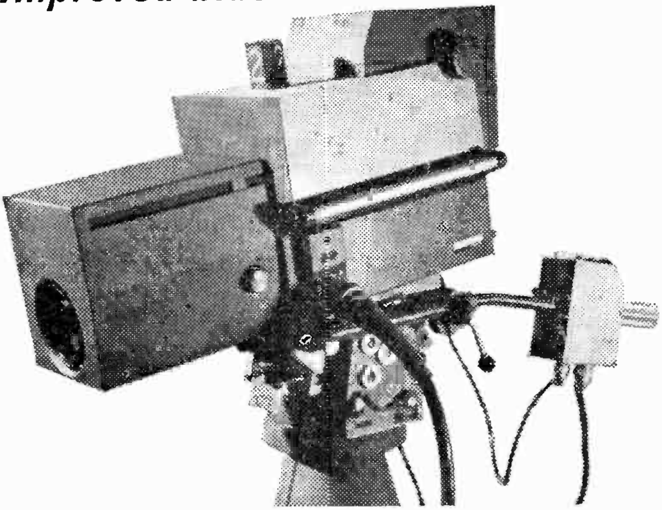
FEBRUARY 1967
VOL. 17 No. 5
issue 197

THIS MONTH

OUR NEXT ISSUE DATED MARCH WILL BE PUBLISHED ON FEBRUARY 24

TELETOPICS

Improved black-and-white camera



THIS is the Marconi Mk VI black-and-white TV camera, which in its basic form is designed for telecine operation using a vidicon tube.

The camera uses similar types of zoom lenses to the Mk V 4½in image orthicon camera and the Mk VII colour camera.

The Mk VI will resolve perfect pictures at less than 50 foot-candles which is said to be less than half that of a normal black-and-white studio light level.

John Logie Baird's widow visits Britain

MARGARET BAIRD, widow of Scottish TV pioneer arrived in this country recently. Her visit occurred shortly after a BBC Documentary concerning the discovery of Television and which has since caused some controversy. Reviews on this film vary from "Unfair to Baird" to "At last TV Invention put in true perspective".

Adding more fuel to this argument is J.L.B.'s son, Dr. Malcolm H. I. Baird who in a letter published in Time and Tide (November 10th) wrote:

"The national craze for debunking British achievements has often been deplored in your columns. But in your article on 30 years of television, the craze has spread to my late father's work, and I must ask that you will allow me to reply on his behalf.

"Neither the rejection of the Baird system by the BBC in favour of the EMI system, nor the early predictions (on paper) of television, should obscure the fact that my father was the first to transmit pictures instantaneously. In other words, J. L. Baird invented television. If the anonymous writer of your article disputes this, he might as well say that Marconi did not invent wireless because his transmitting system (by electric spark) subsequently became obsolete.

"Perhaps we have not heard the last of my father's mechanical scanning system, as the Americans are currently using a version of it in the development of laser television. It is a pity that this exciting development could not have taken place in this country".

TV Transmitter Pocket Reference

A POCKET reference listing all the BBC and ITA television transmitters has been produced by Belling-Lee Aerials Ltd., Heysham Road, Netherton, Bootle 10, Lancashire.

All BBC-1 TV stations are listed with channels and frequencies and are located on maps. BBC-2 stations are listed with channels and expected service dates. A map shows the approximate service areas.

ITA transmitters are listed with channels and polarisation.

A chart in the booklet details all television channels with their frequencies.

Copies are available from Belling-Lee Aerials Ltd.

EMI TELEVISION FOR CYPRUS

THE Cyprus Broadcasting Corporation has awarded a contract to EMI Electronics Ltd. for television studio solid-state equipment which includes both versions of the new 4½in. image orthicon camera channels type 206 and 207, twenty-five picture monitors (types 1402 and 1902), vision mixing and special effects equipment, stabilising amplifiers, sound-mixing and communications equipment. The bulk of the equipment is to be used to equip a new studio from which a commercial television service is scheduled to begin operations early this year. The contract is worth approximately £60,000.

Schoolboys' and girls' exhibition

HELD in the Empire Hall, Olympia, from December 27th to January 10th, this exhibition featured among its exhibits a TV videotape studio presented by Ampex Ltd., where children were able to mime an action or play a charade and see their performance played back immediately on a monitor screen.

They were also able to play the "Match Game" against an electronic machine—the Mullatron—devised by Mullards, which stores many thousands of sound effects on tape which can be played back at the touch of a finger.

Advertising as a source of revenue

IN the new edition of the handbook "ITV 1967" published recently, Independent Television claim to have demonstrated that it is possible to maintain as equally high a standard of broadcasting service supported by advertising revenue, as a state service supported by the Exchequer or licence fees.

It is perhaps interesting to note that in 1956 only three other European services used advertising as a source of revenue. Now, seventeen countries finance TV services either wholly or partly from the sale of advertising time.

NEW PRESIDENT OF THE ROYAL TELEVISION SOCIETY

LORD BOWDEN OF CHESTERFIELD, Principal of the University of Manchester Institute of Science and Technology has accepted an invitation to be President of The Royal Television Society. He has succeeded Mr. F. N. Sutherland, Managing Director of The Marconi Company.

Lord Bowden, a former Minister of State for Education and Science, has held several senior Government and industrial appointments. During World War II he was with the Ministry of Supply and in May 1943 took a British research team to the U.S.A. to develop a new naval radar system. In 1946 Lord Bowden returned to Britain and joined the Atomic Energy Research Establishment at Harwell. After this he became a partner in a consultancy headed by Sir Robert Watson-Watt, to give technical advice to the radio and film industries.

In 1950 he joined Ferranti to take charge of the applications of digital computers. He became Principal of the Municipal College of Technology, now the University of Manchester Institute of Science and Technology, in 1953. Lord Bowden was Minister of State for Education and Science from October 1964 to October 1965.

GIRVAN RELAY STATION

THE BBC's TV relay station at Girvan, Ayrshire, was brought into service on December 19th. It transmits BBC-1 on Channel 4 with vertical polarization.

This relay station provides improved BBC-1 signals for some 8,000 people in Girvan and Dailly. When the station began transmission, some viewers in the area receiving BBC-1 from Kirk o' Shotts on Channel 3 found difficulty in obtaining a satisfactory picture. This was not a fault of the TV set or of the transmission, but due to the strong local signal from the new station. These viewers should have found that a much better signal is received by tuning to Channel 4. Some receivers required slight adjustment and aerial position had to be changed.

Electroniques Hobbies Manual

ELECTRONIQUES (proprietors STC Ltd.) the recently formed component and equipment supply service for radio and electronics enthusiasts have published their first annual "Hobbies Manual of Supplies and Ideas", priced 10s. 6d.

Containing 608 pages, this book gives prices and descriptions of eleven thousand items together with useful circuits and construction tips.

TRADE TESTS

AS from January 1, this year trade test transmissions from all the Independent Television Authority's transmitters are being broadcast asynchronously, that is the field frequency is no longer locked to the mains frequency but to a crystal.

This change to asynchronous transmission has been made to work towards general standardization with the accepted European standard.

Guildford Relay Station

THE Guildford BBC-2 relay station was brought into service on December 19th. Transmissions are on u.h.f. Channel 46 with vertical polarization.

CCTV FOR COMPREHENSIVE SCHOOLS

COMPREHENSIVE schools in Cirencester now have closed circuit TV for teaching purposes, installed by RR Wired Services.

The installation of CCTV in the schools comprises a studio with two cameras controlled by a modular console unit (see photograph).

One of the great advantages of this system is that is will enable four classrooms to receive simultaneously a carefully prepared lesson—which obviously is better than repeating one lesson four times.

The cost of the fully integrated studio is less than £1,500.

GETTING TV TAPED

by K. Royal

RECORDING audio signals on magnetic tape is an art well known to most readers. The sounds to be recorded, you will recall, pass through a recording amplifier whose output drives signal current through a winding on the recording head. The pole pieces of this head terminate at a very narrow gap across which a magnetic field continuously changes in sympathy with the signal current in the winding. The tape is arranged to traverse this gap at a constant velocity, and as a consequence, the changing magnetic field is affectively transferred in the nature of a "magnetic pattern" along the length of the tape.

To translate this magnetic pattern back again to audio signal, the tape is fed through a gap terminating the pole pieces of the playback head. Into the winding on this head is induced a signal corresponding to the signal current originally present in the recording head. This signal is then amplified in the usual way. However, the playback amplifier is usually designed to produce a response characteristic with falling treble at the rate of 6dB per octave to counter the 6dB per octave treble rise in signal output across the playback head, which is an inherent characteristic of electromagnetic transducers. The overall frequency response is often extended by the introduction of treble lift on both playback and recording.

To yield a reasonably linear transfer from signal to tape and from tape back to signal, the signal being recorded needs to be fed to the recording head along with a frequency some four to five times higher than that to be recorded. This is called tape bias, and without it there would be serious non-linearity and consequent signal distortion.

TREBLE PERFORMANCE

The upper frequency that can be recorded on magnetic tape by the process outlined above is governed by several factors. An important one is how well the playback head gap is able to "define" the very narrow magnetic patterns on the tape corresponding to higher frequencies. For the best top-frequency response, the tape needs to be in close contact with the pole pieces of a playback head which should have an extremely narrow gap. Modern audio playback and recording/playback heads have gaps of about 0·00012 in., while heads for recording only have gaps in the order of 0·0004 in.

The tape velocity also has a bearing on the top frequency performance, for the higher the velocity of the tape past the head, the more stretched-out will be the magnetic pattern corresponding to frequency, thereby making it possible for the playback head gap to define the signals more accurately.

The very high audio frequencies create very short "magnets" on the tape, and their short length tends to cause them to demagnetise themselves, thereby resulting in a loss of high audio frequency information actually imparted upon the tape. The effect is aggravated by the presence of the h.f. bias signal, for the magnetic field set up by it across the gap of the recording head also tends to attenuate the higher audio frequencies. Currently it is possible to record and replay signals up to 2,000c/s per one-inch/second of tape velocity past the heads. Thus, at 2i/s, 4,000c/s can be recorded and replayed, at 4i/s the top frequency is about 8,000c/s, while at 8i/s it is 16,000c/s and so on.

The standard tape speeds for audio are 3¾i/s and 7½i/s, permitting equalised treble responses up to about 7,500c/s and 15,000c/s respectively. In practice, the very small playback head gaps and treble boost of recording and playback signals make it possible to reproduce at almost 20,000c/s at 7½i/s, but this is close to the top limit. Professional audio machines often record and playback at 15 and 30i/s. This makes it possible to use less exacting heads, which are less affected by wear while maintaining a treble response up to about 15,000c/s.

The audio field is thus adequately satisfied so far as magnetic tape recording is concerned, for there is little point in taping and replaying signals above about 15,000c/s, since they are inaudible.

VIDEO TAPE RECORDING

For more than ten years, magnetic tape has also been used to record and playback television signals, but it has been very much confined to professional applications, with video tape recorders, as they are called, carrying price tags up to £25,000. However, considerable development work has been focused on inexpensive machines in recent years which should bring video tape recording into the home and open up a fascinating and completely new field of home interest and entertainment. It is pleasing to report that a fair degree of success has been attained, and already there are several domestic video tape recorders from which to choose, although some are still very much in the high-price bracket, but nowhere near the cost of the professional models.

One of the major problems in the design of video tape recorders is that of arranging for the tape to pass the recording and playback heads at an extremely high velocity to maintain a top freqency in Mc/s as distinct from kc/s in audio systems.

The horizontal definition of a television picture is determined by the speed at which the video signals at the picture tube can change from one amplitude to another. This can be looked upon in terms of frequency, and 405-line video signals carrying very fine horizontal detail can be considered as having components approaching 3Mc/s, while 625-line signals, with horizontal definition balanced against the improved vertical definition given by the greater number of lines, have top frequencies in excess of 4Mc/s. Pictures of a sort can be obtained if the bandwidth of the system falls somewhat below 3Mc/s on 405 lines, but the limited bandwidth makes the picture rather fuzzy horizontally, and small horizontal detail just cannot be resolved. A 405-line bandwidth of 2Mc/s to 2·5Mc/s is quite reasonable, and many sets up and down the country are already running at this limited bandwidth, due possibly to mis-alignment of the vision i.f. stages or tuner or due to a fault in the video amplifier. The absolute bandwidth of a picture can be judged by a test card containing gratings of vertical lines corresponding to specific video frequencies.

TAPE VELOCITY

If a video bandwidth of 1·5Mc/s at 405 lines is satisfactory for domestic recorders, we would have to run the tape at a velocity past the heads equal to about 100 times that of an audio recorder running at 7½i/s. Indeed, this velocity is in excess of the rewind of some domestic audio recorders! Even if equalisation and specially tailored head gaps improved on the top freqency performance, the velocity would still be in the order of 500i/s, using normal audio techniques.

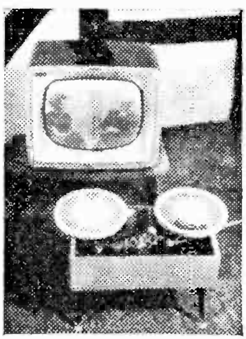


Fig. 1: Early Wesgrove video tape recorder working through a domestic television set.

In spite of this, some early domestic video tape recorder pioneers concentrated on this so-called linear system of recording. Figure 1 shows such a video tape recorder, by Wesgrove Electrics Limited, operating in conjunction with an ordinary television receiver. For maximum definition, this machine runs at 120i/s and is claimed to possess a video response extending to 2Mc/s, this being achieved by special circuits and equalisation systems. The machine was originally presented as a constructional kit at £97 10s. 0d. complete with full instructions. In spite of its apparent shortcomings, this machine certainly represents a landmark in the field of domestic video taping.

Professional video tape recorders, used for broadcast applications, employ four heads mounted equidistance on the periphery of a drum, and these are arranged traversely to scan 2 in. wide

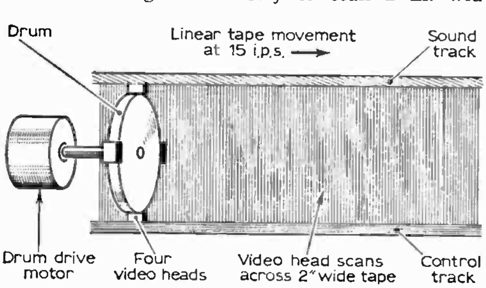


Fig. 2: Professional video tape recording system where four heads are mounted equidistant on the periphery of a drum coupled to a drive motor; the tape being transported to give across-the-tape scans.

tape as it is transported at a linear rate of 15i/s. The idea is shown in Fig 2. It results in an effective head-to-tape velocity in the order of 1,500i/s, thereby producing a bandwidth sufficient for most television systems.

Some domestic video tape recorders adopt a compromise of the linear and rotating head techniques, with a single head rotating within a drum, around the outside edge of which the tape is transported in a helix. Before going on to consider this system, however, a word or two about a linear system which is the outcome of a new mode of tape biasing evolved recently by the Japanese Akai Electric Company.

CROSS-FIELD BIAS

This is called "cross-field" biasing, and instead of the h.f. biasing signal being applied to the recording head along with the signal being recorded, it is applied to a separate head. The signal head is located normally so that its gap traverses the oxide side of the tape, while the bias head is located at the opposite side of the tape with its gap slightly displaced from that of the signal head, as shown in Fig. 3. In this diagram, 1 is the ordinary signal head, 2 the bias field, 3 the direction of tape travel, 4 the recording field and 5 the cross-field bias head. With the conventional system of applying bias to the recording head, the bias signal tends to restrict the recording head frequency response due to erasure affects. However, with the cross-field system, the tape is pre-magnetised between points A and C (Fig. 3), while the actual recording on the tape takes place at point B. Thus, the recorded signal is outside the range of the bias field, and the upper frequency losses associated with the conventional system are considerably reduced.

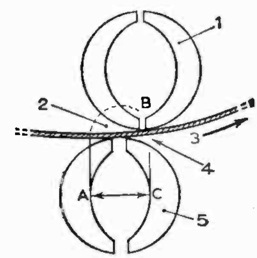


Fig. 3: Cross-field bias is used to extend the top frequency limits

It is claimed that the cross-field system makes it possible to record at the rate of 7,000c/s per inch/second of tape velocity past the heads, and there are developments in hand using similar techniques that will make it possible to record even higher frequencies per inch/second of tape velocity. This is revealed in the specifications of the latest Akai video tape recorder for domestic use which, at a linear tape speed of 30i/s, records and replays video frequencies up to 1Mc/s. This is equivalent to a little over 33,000c/s per inch/second.

Of course, 1Mc/s video bandwidth is not all that may be desired even for domestic use, but at least the system shows a mapor breakthrough towards practical video tape recording without the complexity of rotating heads and tape scanning techniques.

HELICAL SYSTEM

A system which has proved itself over many months, and which is now within range of the enthusiasts market, features the so-called helical scanning principle. In its most sophisticated form this is used in the Philips EL3400 and the Ampex HVR series of video tape recorders developed for commercial and educational applications.

The main features of the Philips machine are shown in Fig. 4. Video head *a* rotates in drum *b* so that the active pole area appears through a slit and is in intimate contact with the oxide side of 1 in. wide tape threaded between guides round the periphery of the drum in the form of an helix. Guide pins *c* are used to ensure that the tape passes almost fully round the outside of the drum when the machine is running.

The tape passes sound head *d*, which adds the accompanying sound signal to one edge of the tape in the ordinary way, and the tape is transported round the drum by capstan *e* in conjunction with pressure rollers *f*. It is also guided to and from the spools via tape guides *g*, and before entering the machine (switched to record) the whole width of the tape is cleared of previous recordings by erase head *h*.

The linear velocity of the tape through the capstan system is 7½i/s, so 1,800 ft. of 1 in. tape on an 8 in. diameter spool will run continuously for 45 minutes. The high tape velocity relative to the head required for video recording is accomplished by the rotating action of the head. This operates at a speed of 3,000 r.p.m. and at this speed the head passes the surface of the tape at a velocity of 906i/s, giving a bandwidth of 2·5Mc/s.

This technique records a track on the 1 in. tape approximately 500mm in length and lying obliquely on the tape for each revolution of the head. Thus, a series of such tracks adjacent to each other are eventually recorded on the tape, and the design is such that the centre-to-centre distance between two adjacent tracks is 180μm. The width of the video head gap is about 1·5μm. Fig. 5 shows the nature of one recorded track on the tape, plus two extra linear recordings at the sides of the tape. One is for the sound signals, and the other for controlling the speed of the head motor. These tracks are located in a similar way to those shown on the tape in Fig. 2.

The control head is located below the sound head, and while recording, the rotational speeds of the head and capstan motors are synchronised by the field pulses of the television signal itself; special servo motor-control systems being used for this purpose. The field pulses are also recorded on the control track, so that they can be used for motor control on playback. The control track is analogous to the controlling perforations on cine film.

Rather complex circuits are used to process the pulses, and the drive motors themselves also create pulses as they rotate by means of an electro-optical system whereby light is directed through slits and holes in discs which are mechanically coupled to the spindles. This light is monitored by light-sensitive devices to produce pulses which are directly related to the speed of the motors. These are compared with the field pulses, and any deviation causes more or less power to be fed to the motors to maintain constant speed. In the Philips (Peto Scott) machine, both the head motor and the capstan motor are so controlled.

The video signal is first frequency modulated onto a carrier before being applied to the recording head. On playback, this modulated carrier is amplified and then demodulated, leaving only the video waveform, which is further amplified before leaving the machine.

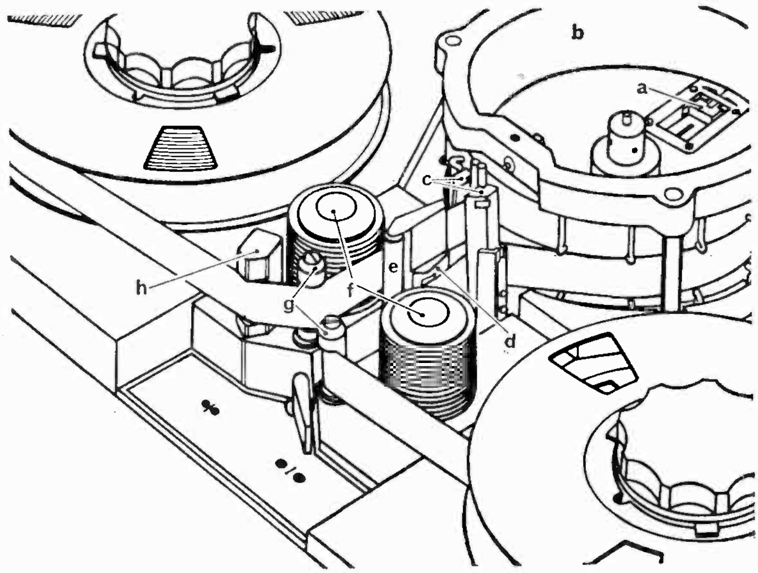
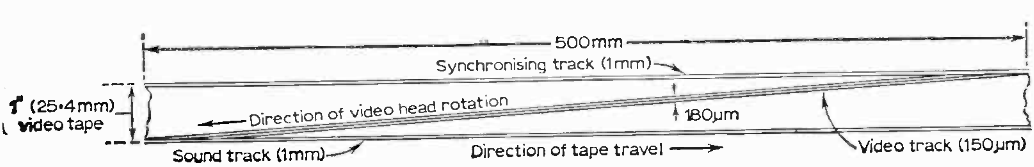
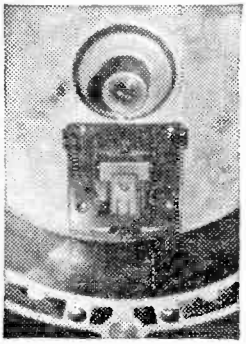
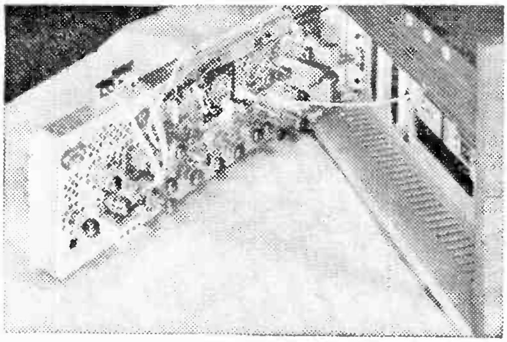


Fig. 4 (right): The helical system adopted by the Philips (Peto Scott) tape recorder

Fig. 5 (below). A single scan across the tape produced by the Philips (Peto Scott) helical system. On one edge of the tape is recorded the sound channel, and on the opposite edge field sync pulses for controlling the speed of the motors.







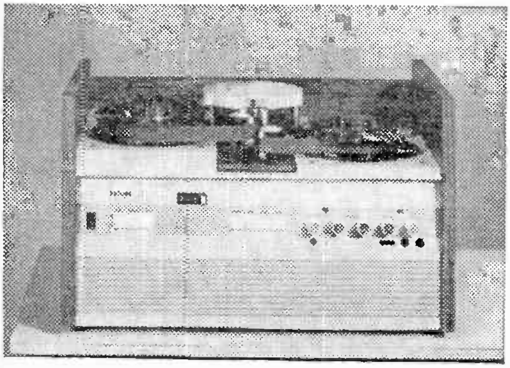


Fig. 6 (top left): View of the rotating video head of the Philips (Peto Scott) recorder.

Fig. 7 (top centre): Inside view of the Philips (Peto Scott) tape recorder.

Fig. 8 (top right): The Philips (Peto Scott) tape guide system.

Fig. 9 (left): Front view of the Philips (now Peto Scott) video tape recorder.

It is also possible to modulate the video signal, complete with sync pulses, onto a v.h.f. carrier wave, so that the whole may be applied direct to any domestic television receiver without having to break into the video amplifier stage to reproduce the recorded programme. The sound can also be conveyed to the set in this way, and this is relatively simple where inter-carrier sound of the receiver can be exploited.

The video head mounted on its carrier inside the drum of the Peto Scott machine is shown in Fig. 6, while an inside view of the same machine is shown in Fig. 7. Fig 8 shows how the tape is passed round the guides, while Fig. 9 shows the Philips version of the machine in its original form.

The Ampex machine, which also uses the helical system, is shown in Fig. 10. This is a two-speed model, giving 9·6 i/s and 4·8 i/s, with bandwidths of 3Mc/s and 2Mc/s respectively. Again, the tape width is 1in., and with 9½in. spools, continuous recording/playback of 1 hour at the high speed and two hours at the reduced speed are possible.

Ampex was one of the first companies in the field of video tape recording, and the HVR series represents their entry into the lower price, domestic and educational fields. The company also produces camera and microphone equipment to match the recorders. Some of the machines come complete with monitor receivers, for monochrome and colour. The capstan drive and the heads of the Ampex machine are shown in Figs. 11 and 12, while Fig. 13 illustrates a neat, portable

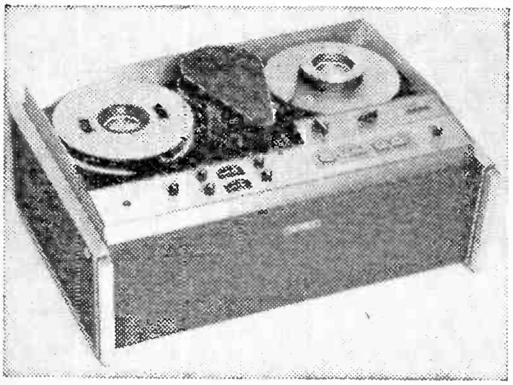


Fig 10: The Ampex home video tape recorder. This also uses the helical system.

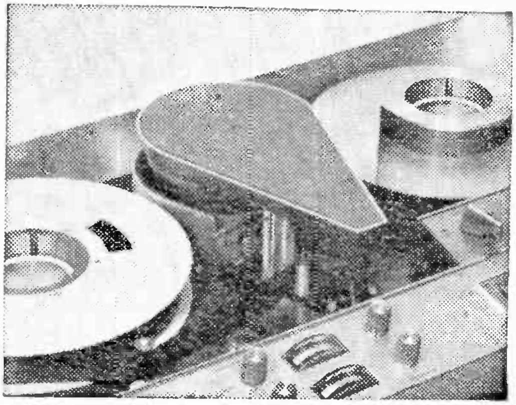
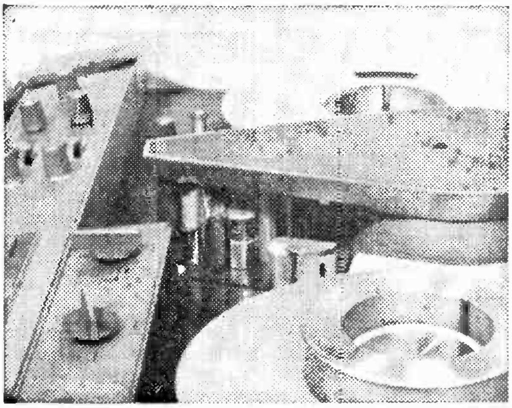
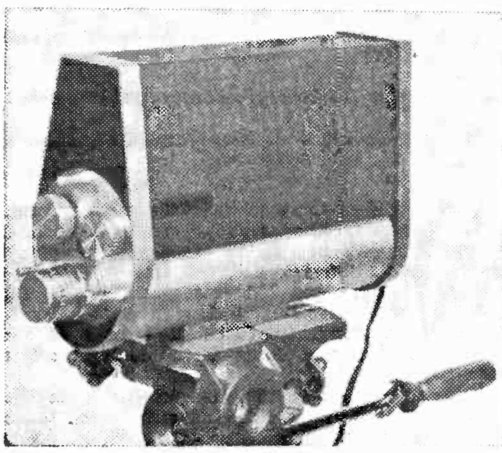


Fig. 11: Capstan tape drive and section of the control panel on the Ampex machine.





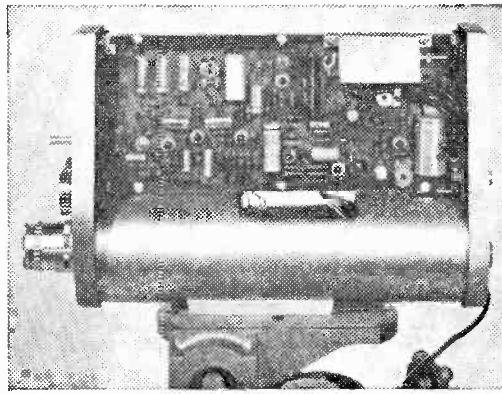


Fig. 12 (top left): Here is shown the rear head system of the Ampex.

Fig. 13 (left): A three-lens turret television camera, designed for use with the Ampex video tape recorder.

Fig. 14 (top right): Inside view of the Ampex camera, showing the transistor circuitry. The cylinder below encloses the camera tube.

camera, using a three-lens turret. The inside of this transistor camera is shown in Fig. 14; the metal cylinder below the circuit board encloses the camera tube.

Another arrangement of the helical system is employed in the latest Sony video tape recorder. In this machine the rotating assembly features two heads which work in conjunction with $\frac{1}{2}$in. magnetic tape, the tape passing linearly through the transport mechanism at $7\frac{1}{2}$ i/s, while the head assembly rotates at 1,800 r.p.m.

One of the rotating heads is employed to record the signal on the tape, but it picks up every other field, and not each sequential field, while for replay both heads are brought into action in a way that the second head "re-scans" the same field as the first head. This gives a playback display which appears to be composed of two sequential fields fully interlaced (as in ordinary television reception), when in fact the complete picture of 405 lines is made up of two $202\frac{1}{2}$-line fields, but with each field carrying the same information.

This is a clever arrangement, for it keeps picture flicker to the normal 50 fields per second and requires only half the bandwidth of an ordinary 405-line system. The overall definition is not so good as that obtained with the more expensive helical systems, but for domestic applications the picture quality is fair; video bandwidth in the order of 1·5Mc/s. This recording unit has a monitor receiver, but camera and associated equipment are considered extras.

APPLICATIONS

So much then for the principles of video tape recording, but what about applications? There is little doubt that home video tape recorders will one day be as popular as audio recorders are today.

When video taping really gets going, one will almost certainly be able to purchase or rent complete television programmes on tape, rather like pre-recorded audio tapes. Then, of course, there will be the unlimited creative potential of making one's own television programmes. Indeed, it is possible to do so now using portable video tape recording equipment and miniature cameras. ■

TV TERMS AND DEFINITIONS EXPLAINED

Gordon J. King

Part IX

Remote Control

Applied to the television receiver, this term relates to a method of switching the set on and off, changing channel and to adjusting the volume, contrast or brightness by means of a control box remote from the set itself. The control box is sometimes designed to rest on the arm of the viewing chair.

Original remote control systems were connected to the receiver through a multi-conductor cable, while a motorised tuner on the receiver facilitated channel changing by button pressing at the remote control box. The variable controls were effectively an extension of their partnering controls at the receiver proper.

A more recent system uses a remote control box that is not inhibited by a set connecting cable. Communication from the remote control to the set is obtained either by a beam of light from a flashlamp or by a supersonic (above audio) signal.

The light-control method utilises light-dependent resistors located behind lenses on the front of the set's cabinet, upon which a beam of light from a torch (which represents the remote control unit) is directed. Light-dependent resistors exhibit the property of dropping from a very high value of resistance to a considerably lower value when illuminated.

Two such devices are generally used and one is arranged so that when it is lit momentarily a pulse of voltage is created which, after amplification, is caused to operate a relay in the set, and the contacts of this operate the motor tuning. A drum mechanically coupled to the tuner spindle carries a master "peg", and after the appropriate number of impulses applied with the torch, the peg locates the on/off switch and switches the set off. A second light-dependent resistor may operate the volume control by virtue of a solenoid "clicking round" the spindle of the internal volume control.

The supersonic control system employs an in-built microphone at the set which is "tuned" to respond mostly to the supersonic signals sent out from the control box. The microphone signal is amplified and then processed to operate the motor control relay, as with the light system.

There are two methods used for generating the supersonic control signal at the remote control box. One creates the signals mechanically by the press-button control causing a striker to hit a reed which then vibrates at the frequency required for the control, while the other method employs a supersonic transistorised generator.

S-Correction

Owing to the fact that modern tubes use almost flat screens and that the deflected electron beam in the tube describes an arc, the speed of the scanning *spot* relative to the surface of the screen is faster towards the edges than at the centre. On the line timebase, this would give compression of the picture at both sides relative to expansion towards the centre, owing to the so-called "S-shaped" rate of scan. This is combated by S-correction.

Basically, such correction takes the form of a capacitor connected in series with the line scanning coils from the line output transformer, the presence of which reduces the speed of the scan (or beam deflection) progressively towards the start and finish. The value of the capacitor is rather critical, and in dual-standard sets it needs to be switched to a smaller value when changing from 405 lines to 625 lines. The circuit in Fig. 42, of a section of a dual-standard line output stage, reveals the S-correction capacitors.

Scanning Angle

The scanning angle is that angle over which the electron beam in the picture tube is deflected for full vertical and horizontal amplitude of scan. Clearly, the angle of deflection is a function on both the size of the screen and on the length of the tube from the origin of deflection (within the deflecting field created by the scanning coils) to the inside of the screen.

Early 9in. and 12in. picture tubes were about 15in. in length and were thus able fully to deflect over an angle in the order of 60° to 65°. Screens then became larger, going from 14in. to 17in. to 21in. and to 23in. and so forth. To maintain the original scanning angle, the length of the tubes would need to be increased in proportion to the increase in screen size. This, of course, would make the tubes far too long to fit-in with the current slim-line philosophy. The alternative was to increase the scanning angle, and this has now risen from the early 60° to 110°, via 70° and 90° stages. Fig. 43 discloses the scanning angle definition.

Sensitivity Control

This control is rarely seen these days. Early sets incorporated such a control (sometimes two of them, one for the BBC channel and the other for the ITV channel) which, in effect, was an r.f. gain control associated with the first stage in the set proper or (later) in the tuner.

This control allowed the sensitivity of the set to be adjusted to suit the strength of the aerial signal and to allow an i.f. signal balance to be achieved over the various channels, relative to a fixed setting of the contrast control.

Modern sets do not need the control to the same extent because automatic-gain-control (a.g.c.) circuits are incorporated which work from both sound and vision signal levels. Thus, the modern set is endowed with a form of automatic "sensitivity", which adjusts without manual control to suit the signal level applied to the set from the aerial. The adjustment accommodates any difference in level between the signals over the various channels.

Nevertheless, it is still possible for the tuner of modern sets to be overloaded by a particularly strong aerial signal and no amount of internal gain or sensitivity control will solve this problem. The solution lies in reducing the level of signal on the offending channel by means of an aerial attenuator.

If the signal from one channel is well below the overload level (usually on the ITV channel), while the signal on the other channel (BBC) pushes the set hard into overload, a differential attenuator can be connected in series with the aerial downlead to the set, so that the required degree of attenuation can be applied to the overloading channel, while the weaker channel is unaffected. An attenuator of this kind is made by Labgear, of Cambridge.

Overloading gives rise to cross-modulation trouble, causing uncontrollable sound-on-vision and vision-on-sound interference.

Set-top Aerial

This kind of aerial is designed for standing on top of the television set, and is often a condensed dipole with the two halves arranged in the form of a "V" or so-called rabbit's ears. The dipole half sections are telescopic so that their lengths may be adjusted to give the best results on both channels. In many cases, however, re-adjustment has to be made on changing channel to obtain the best overall results.

The very latest set-top aerials have tuning arrangements for securing the best matching and signal transfer on the channels used, in addition to the rods being telescopic. There are also "all-band" models, suitable also for the u.h.f. channels.

Such aerials are suitable only for locations where the signal field is abnormally high and free from local interference. If used at distances far removed from a transmitter, the results are unpredictable, interference is troublesome and the signal is greatly influenced by people moving about in the room.

While a set-top aerial may give reasonable reception on the v.h.f. channels (BBC1 and ITV), it does not follow that similar reception will be obtained by a partnering u.h.f. set-top aerial. Indeed, in many cases an elaborate outside array is necessary to get the best BBC2 reception and, unfortunately, many viewers are putting up with a bad BBC2 picture simply because it is expected to get a simple indoor or set-top aerial to pick-up on u.h.f. the same level of signals as the aerial abstracts from the v.h.f. transmissions. In actual fact, two or three times *more* signal is needed on u.h.f. to give a BBC2 picture comparable in quality to that of a v.h.f.-derived picture.

An advancement on the simple set-top v.h.f. aerial takes the form of an aerial system coupled to a small (BBC and ITV) base transistor amplifier working from a small battery. This provides set-top aerial reception over a distance in excess of that possible with a non-amplified aerial, but even this type of aerial is no substitute for a good outside array in areas where the signal conditions are poor.

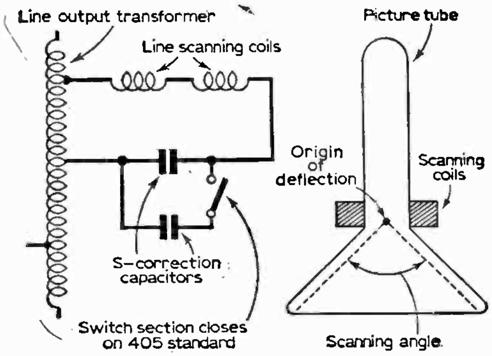


Fig. 42: Section of the line output stage, showing the S-correction capacitors. On the 405-line standard, the extra capacitor is switched in parallel with that used only on 625 lines. This is necessary to compensate for the lower line frequency.

Fig. 43: This diagram defines the picture tube scanning angle.

Short-circuited Turns

This term signifies that adjacent turns of wire of an inductor or winding of a transformer are shorted together as the result of breakdown of the wire insulation. When this happens the winding appears to have wound round it a closed loop formed by the shorting turns, and while this may not affect the d.c. conditions or the effective overall resistance of the windings by any marked degree, it does, however, greatly affect the inductance and the transformer action.

The most likely component to be affected by this fault is the line output transformer, as the very high voltage pulses developed across its windings during the line flyback make it vulnerable to insulation breakdown. Typical symptoms of short-circuited turns in this transformer are lack of e.h.t. voltage; failure of the heater of the e.h.t. rectifier to light; very small (if any) pulse voltage at the anode of the e.h.t. rectifier, line output valve and at the cathode of the booster diode; and possible overheating of the line output valve and booster diode. The line timebase whistle can usually be heard at lesser intensity than normal when the line hold control is adjusted over its range with the aerial plug removed from the set (this, to unlock the line timebase generator).

Slot Aerial

The basic aerial of this kind consists merely of a slot of suitable size, governed by the wavelength of the signal, cut into a large piece of metal, and for most "domestic" applications this can be a piece of wire netting. The aerial is the slot, and its length should be approximately the length of an ordinary dipole aerial, while its width is usually related to its length in the ratio of about ten-to-one. Thus, if the dipole needs to be cut, say, to 10ft., then the width would be 1ft. The width, however, is not unduly critical from the tuning aspect, though it does affect the bandwidth and the matching.

The basic metal should be as large as possible theoretically, but in practice reasonable results—comparable with those obtained from a conventional dipole (sometimes a little better) — are obtained when the metal round the slot is some two to three times the width of the slot.

One of the biggest problems with this kind of aerial lies in securing a correct impedance match to a 70Ω coaxial feeder. One way of loading the slot to this impedance is by means of a stub formed by a rod of fairly thick copper half the length of the slot. This is suspended by thread so that it is positioned in the centre of the slot, right at one end. The inner conductor of the coaxial is then connected to this rod (at the centre of the slot), while the outer braiding is secured along the side of the slot (to the metal) in parallel with the stub.

A slot aerial responds to the signal in the opposite way to an ordinary dipole. This means that while an ordinary dipole needs to be vertically orientated to respond to vertically polarised signals, a slot needs to be horizontally orientated—and vertically positioned for a horizontally polarised signal.

Soft Tube

This is the term given to a picture tube (or valve) when its vacuum is impaired. The gas (or air) in the tube then tends to become ionised due to electron bombardment and ions as well as electrons contribute to the electron beam. This upsets the focussing performance, increasing the cathode current, loads up the e.h.t. circuits and produces poor e.h.t. regulation, and often causes a bluish glow to appear in the tube neck. The quality of the picture also suffers, an accompanying symptom being clipping of peak white picture content. There is no cure for this trouble, the only remedy being in tube replacement.

Spark Test

The operation of the line timebase and e.h.t. circuits can often be proved by the so-called spark test. If the line timebase is working correctly, for instance, an arc can be made to occur between the metal tip of a screwdriver and the anode of the e.h.t. rectifier (or, to a lesser extent, from the anode of the line output valve or the cathode of the booster diode) by holding the screwdriver carefully by an *adequately insulated* handle so that the tip is about a quarter of an inch removed from the source mentioned above. Sometimes an arc up to almost half an inch can be obtained at the e.h.t. rectifier anode if all is well. But on no account should the arc be encouraged to "earth" (i.e., the set's metal chassis or h.t. negative line).

A much smaller yellowish discharge can be obtained from the cathode of the e.h.t. rectifier (or final anode of the picture tube) by adopting the same technique, but since the potential here is d.c. it is permissible to secure this discharge to a chassis or set "earthed" metal fixture. If the pulse arc is normal, while no e.h.t. discharge can be obtained, the e.h.t. rectifier should be suspect. Lack of pulse arc would indicate trouble in the line timebase (see also under *Short-Circuited Turns*).

Star Network

This kind of network can be used to work two television sets simultaneously from one aerial while maintaining a correct impedance match at each set and at the aerial feeder. The circuit is shown in Fig. 44 and the resistors each have a value equal to a third of the nominal impedance at each termination. Thus, to match to 70Ω each resistor should have a value of 23·3Ω; but in practice the preferred value of 22Ω is perfectly adequate.

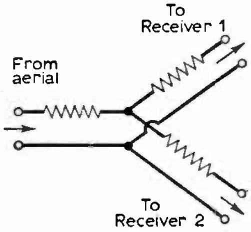


Fig. 44: The classic "star network". This allows two sets to work simultaneously on one set of aerials, the signal on each set being reduced by 6dB over the aerial signal which is the price that has been paid for maintaining a correct impedance match at all terminations.

Each termination must be loaded in use, and the network exactly halves the aerial signal to the two receivers, which is the price that has to be paid for maintaining a correct match.

Standard Intermediate Frequencies

The standard i.f's. for sound and vision on the 405-line system are 38·25Mc/s and 34·65Mc/s respectively. On the 625-line standard, the vision i.f. is 39·5Mc/s and the sound uses the inter-carrier technique, being the 6Mc/s difference between the British CCIR sound and vision carriers (see also under *Intercarrier Sound*).

Surge Limiters

These refer to the low-value resistors connected to the anodes of the main h.t. rectifier or to the a.c. input (one resistor here) of a metal rectifier. Their values range from about 25Ω to 100Ω, depending on the nature of the circuit, and their purpose is to avoid a sudden current surge through the electrolytic capacitors when the set is first switched on.

An overheating surge limiting resistor would indicate either a short in the h.t. rectifier or a short or leakage path on the h.t. plus line.

Third Harmonic Tuning

This applies to the line output transformer, where the loss inductance in conjunction with strays of capacitance and fixed capacitance tune the transformer to correspond to the third-harmonic of the line flyback frequency. This technique arranges for zero current at the finish of the flyback in the loss inductance and capacitive elements of the transformer, the result of which is an increase in the pulse voltage at the anode of the e.h.t. rectifier valve and a decrease in the pulse at the anode of the line output valve.

These factors give a greater e.h.t. voltage, improved e.h.t. regulation, reduced load on the line output valve and booster diode and an overall step-up in line output stage efficiency.

Triplexer

This defines an aerial "crossover filter" that combines the signals picked up by a Band I TV aerial, a Band III TV aerial and a Band II FM aerial to a common aerial downlead.

The Band I, Band III elements have already been covered under *Diplexer,* while the Band II section of the filter comprises a band-pass section, described under *Filters.*

Twin Panel Tubes

These are the latest types of picture tube in which a plastic safety guard is bonded direct to the face of the tube, thereby eliminating the need for a separate glass or plastic "window" mounted on the cabinet. This kind of tube gives the same protection against possible implosion as the older "safety window". The chief advantage is that since the front of the tube protrudes through the cabinet front the need for extracting the tube from the cabinet for cleaning is deleted, for it is impossible for dust or grime to collect between the bonded guard and the screen. Moreover, since there are fewer surfaces to reflect ambient light and to suppress the normal transmission of light, the contrast of the picture is improved.

U.H.F. Channels

These are the channels in Bands IV and V which at the present carry the second programme of the BBC and which will shortly carry the colour transmissions (see under *Bands IV and V).*

Video

This term means the "picture" sections of the receiver. While the term *video* amplifier is used, however, the detector in the picture side of the set is often called *vision detector.* We speak of video signal, though, rather than picture or vision signal.

This concludes the present series on TV Terms and Definitions.

Book Reviews

PHOTOFACT GUIDE TO TV TROUBLES
By Donald E. Herrington and C. P. Oliphant. Published by Foulsham-Sams Technical Books Ltd. 160 pages, 8½in. x 5½in. Hard covers. Price 24s.

THE adage *one picture is worth a thousand words*, is justified amply by this handy guide to television receiver servicing.

Many pages of photographs show practically all the symptoms one is likely to meet—and a few we hope never to come across! These are accompanied by sectional diagrams and a precise, no-nonsense text.

Much thought has gone into the layout. In particular, cross-referring the diagrams to photos with a "component failure chart" is an excellent idea. Each chapter, or section, tackles one part of the receiver and begins with a few words on general fault conditions relating to that section. Not a word wasted: this is one of the few books on the subject that pay the reader the compliment of assuming a prior basic knowledge.

For the British reader there are one or two pitfalls, apart from the obvious ones pin-pointed in the foreword. There are many circuit variations not covered, or even hinted at. Differences in circuit, such as in the sync, video, a.g.c. and line stages, will give widely differing symptoms. But the intelligent reader will certainly be able to fill in these gaps for himself.

A book of this nature can hardly be as comprehensive as we would like. However, for the "owner-driver" who will be unlikely to come across many of the fault symptoms, presenting them in this compact form should be both instructional and entertaining.

At least, he'll have some sort of answer ready when the wife and kids say anxiously: *Whatever's the trouble with the goggle-box?—HWH.*

SOLVING TV TOUGH-DOGS
By Robert G. Middleton. Published by Foulsham-Sams Technical Books Ltd. 160 pages, 8½in. x 5½in. Hard covers. Price 24s.

AS we are reminded in the inevitable introduction to this book, "tough-dog" is an expressive description of the kind of troubles that every technician dreads—those exceptionally time-wasting faults that are hard to trace and difficult to cure. The experienced dog-chaser would add: *. . . and hard to prove, as well.*

Mr. Middleton's idea is a good one. PRACTICAL TELEVISION has done this several times in series of articles and the author uses a similar approach. His six chapters split the subject neatly into grouped symptoms, rather than by stages. After an opening chapter on diagnosis, using instruments, making proving tests and generally using one's loaf, he takes his subject logically and Chapter 2 deals with No-picture troubles.

After a chapter on Poor-picture troubles, Chapter 4 discusses Framing and display faults and the next is concerned with the raster and its production. Finally, a chapter on inter-related video-sound troubles rounds off an easily readable book.

Despite its trans-Atlantic angle (Mr Middleton is a well-known American freelance), the book should be an aid to any chap who wants to widen his TV experience without having to rip his own receiver to bits.—*HWH.*

HOW TO BUILD TV ANTENNAS
By F. Rydstrom, O. Engelstoft and J. Fialla. Published by World Publications, Hellerup, Copenhagen. 98 pages. 8in. x 5½in., paperback. Price 18s. 9d. post paid.

HOW TO IMPROVE YOUR TV RECEPTION
By J. Vastenhoud. Published by World Publications, Hellerup, Copenhagen. 71 pages. 8in. x 5½in., paperback. Price 16s. 3d. post paid.

THESE two booklets can be bracketed together for convenience—but not in any other way. *How to build* is a very useful publication, with a wealth of practical information packed into its 19 chapters and sizeable appendix.

There are some technical subjects that do not date, and apart from the influence of semiconductors on boosters and splitters, the basic matter of TV antennas has undergone little change since Professor Yagi invented the multi-element array. This was some time before TV, as a public service, came into being, and the book takes care to underline the fact that TV is just a convenient label.

Equally important is the radio aerial at v.h.f. and u.h.f. frequencies, where its dimensions allow it to be made into one or other type of array. Thus, the tables and descriptions should appeal equally to the amateur who is eager to improve his f.m. radio reception.

These tables are most comprehensive, giving constructional dimensions for all manner of antennae from the simple dipole to the 20-element stacked array, with some esoteric designs thrown in for good measure. Lengths are mainly in centimetres, but that is—or should be—a very slight deterrent.

Moreover, full details are given for *all* the world's broadcasting systems. A bonus for the DX-er and, to be hoped, some incentive for we slugabeds who simply want to avoid putting our installation in the hands of so-called riggers.

How to Improve is by no means to commendable. Only one chapter purports to follow the intentions of the title. The other 13 are concerned with description of how a TV signal originates, is propagated, received and resolved, in very general terms.

Very few practical circuits are given, and in these, component valuation is the exception rather than the rule. The international test cards, the map of the Eurovision network, and tables of worldwide frequencies, bandwidths and systems are of interest, but little practical worth.

With both these books, the odd spelling mistake in translation has slipped past the proof-readers but the quality is better than most imported copy, and the printing is well done.—*HWH.*

INTERPRETING SYMPTOMS

by —————— V. D. Capel

It's all too easy to act on impulse. This is particularly so when it comes to TV servicing. In this short article the author describes how to interpret intelligently the symptoms of a sick set, thus saving time and avoiding impulsive pitfalls.

SOME service men, professional and amateur, when called in to attend to a faulty television receiver, tend to have the back off and begin testing and substituting valves with minimum delay. Such tactics may be inspired by the thought that this instant action gives the impression of businesslike efficiency.

It may, in fact do just this. But time can usually be saved by carefully observing and interpreting the symptoms manifested by the defective receiver.

Any one of a large number of components can give trouble and each of these can have a number of different faults. But the field is usually narrowed to one section of the receiver by the very nature of the symptoms, and even a quick glance will tell whether the fault is in the sound or vision receiver, the field or line time base, or the synchronising circuit.

This process of elimination can be carried considerably further by accurately observing all symptoms and interpreting them correctly. It is important not only to note what is affected by the fault but also what is *not* affected. The settings and behaviour of the various controls and pre-sets should also be taken into account.

LACK OF HEIGHT

Let us see how a more searching examination can produce much more information. Starting with the field time base, a common symptom is insufficient height, so logically the first thing to check will be the operation of the height control to check the effect it has on the field linearity. The linearity may be good with the height control at a low setting but begins to distort as the height is advanced to fill the screen. This often takes the form of cramping of the top third of the raster with an extension of the bottom part.

This indicates that the output stage is overloading when the input voltage from the generator reaches a certain level, that level being lower than would normally be expected. This is almost always caused by ageing in the valve itself or low h.t. voltage on either its anode or screen electrode. So the search is limited to two or three possibilities.

The effect of the width control on the line amplitude can also be tried. If the width is also insufficient then this points to some common factor between them, most likely the h.t. rectifier. While the possibility exists of two separate faults, one in the line and one in the field time base, the most likely culprit will be the rectifier and so the next test will be checking the h.t. voltage.

Cramping at the extreme top of the picture accompanied perhaps by fold-over is due to the start of the scan being heavily damped. A leaky linearity capacitor from the anode of the output valve or a leaky capacitor shunted across the output transformer primary winding is the most likely answer in this case.

Lack of height combined with cramping at the bottom of the raster can be attributable in some circuits to the output valve or the cathode bypass capacitor. Another possibility is a change in value of the cathode resistor due to overheating because of an electrode leak in the valve itself.

If, on the other hand, the scan is insufficient to fill the screen but is perfectly linear, the trouble is unlikely to be in the output stage. Most probable causes are the field generator valve, or an increase in value of one of its anode resistors.

Sometimes the symptom is *too much* height. In such cases, turning the height control to its minimum position will reduce the amplitude only a little below the full screen scan. As the valves cannot miraculously increase their efficiency beyond normal, this can only be due to an absence of negative feed-back. The feed-back is applied through the linearity network, so the first thing to do is to check that the linearity controls are working. If they are not then one of the linearity components must be open circuit.

FIELD SLIP

Another effect often encountered is that of field slip, with the picture rolling in one direction or the other. This can be due either to some change in the time constant of the generator circuit, or to a lack of sync. The fault can be determined by operating the field hold control.

If it is not possible to change the direction of the rolling, then the field speed is incorrect, is out of the range of the hold control, and the fault lies in the speed determining components of the generator circuit. If the rolling can be slowed down almost to a standstill it can then be determined whether sync pulses are present and at sufficient amplitude. If they are, the picture will jump into position as it passes; if they are not it will float freely through the field of vision, and there is a fault in the sync circuit.

We can now check line sync by operating the line hold control and noting whether the picture jumps into position or quickly breaks into lines in either direction. If line sync is present the search can be confined to the field coupling components between the sync separator and the field generator Should the line sync be weak also, then the sync valve or its associated components would appear to be at fault.

NO FIELD SCAN

Another frequently found fault is total collapse of the field scan, leaving a single horizontal line across the centre of the screen. If the height control is operated rapidly from one limit to the other, the line may jump about due to noise on the track. This would suggest that the output stage was in order and the fault is in the generator circuit.

If the output stage is working, random noise and residual hum will prevent the formation of a very thin line and a slight vertical displacement will be taking place. If, however, the line is thin, the fault is probably in the output stage.

NO LINE SCAN

Coming now to the line circuit, a complete failure here produces a blank screen as, of course, the e.h.t. is derived from the line output circuit. Therefore, there are few symptoms to go on. The only one that can be of help in this case is the line whistle. If this is present and appears to be of the correct frequency, then it is certain that the line generator is operating.

LACK OF WIDTH

Lack of width is one of the commonest faults here, and if present check whether the height can be over-scanned. If it, too, is insufficient, then low h.t. is the most likely cause and the h.t. rectifier the possible culprit. The start of the line scan is provided by energy stored in the boost circuits. This can give a helpful clue where poor line linearity is concerned. If the left-hand side of the picture, which constitutes the start of the scan, is cramped, then a fault in the boost circuit would be indicated. whereas if the right-hand side of the picture is cramped, then the line output valve itself or its associated circuitry is the most probable cause of the trouble.

BALLOONING

One symptom which is easily recognised is ballooning of the picture as the brilliance control is advanced, in which the picture expands in all directions, growing darker at the same time, until it completely fades out. This is almost invariably due to the e.h.t. rectifier, but before replacing it check that the width is adequate before the picture starts expanding.

Sometimes there is insufficient current for the e.h.t. rectifier heater, which is due in turn to a low emission line output valve. This will, of course, give rise to lack of width as well. If, on the other hand, there is plenty of line scan then the fault can be taken to lie with the rectifier.

LINE SYNC

The remarks in connection with the field sync apply also to the line circuits. Operating the line hold control and observing the effect will determine whether there is a fault in the line sync circuit or in the frequency determining components in the line generator. If the former, then observing the field sync will give a clue as to whether the trouble is in the line sync coupling components or in the synchronising circuit itself.

Sometimes the symptom is too much width. This overscan will not be due, as with the field circuits, to lack of negative feed-back through a linearity network as this method is not employed in the line circuits. Some manufacturers fit high voltage capacitors across part of the line output transformer windings. These are in the nature of 100—300pF and they absorb a certain amount of energy from the line output circuit. If they go open-circuit excessive width will result. Any such symptom should immediately suggest that one of these capacitors is defective.

NO VISION

If the fault is lack of vision, the raster can be examined to determine whether it is clean or whether noise is present. If noise is present, this is an indication that the video output valve and detector and possibly last vision i.f. is functioning. The trouble will most likely be in an earlier i.f. stage or a tuner unit.

The possibilities can be further narrowed by rotating the channel switch on the tuner. This should produce flashes on the screen and noise on the sound and if it does, it indicates that the trouble is in the r.f. stage or the oscillator section. Of course, if sound is present at full strength this would eliminate the tuner and the fault must lie in one of the vision i.f. stages.

SOUND FAULTS

Similarly if there is no sound, the presence or absence of noise will give a clear indication as to whether the fault lies in an early or late stage. Rotating the volume control to and fro a few times will, in many cases, produce crackling due to dirt on the track and thus show that the output stage and speaker are all in order.

The origin of sound distortion can often be pinpointed by noticing whether it is present at low or high volume or at any setting. Slight distortion which is present at low volume but which is not noticeable at higher volumes is often due to the loudspeaker itself, the rasping noise of the speech coil rubbing on the magnet being masked at higher volume levels.

Distortion that appears at higher volume levels only is usually due to the output stage, either the valve ageing and hence overloading at a low signal level or some defect in the cathode bias circuit. When distortion is present at all volume levels, likely causes are leaky a.f. coupling capacitors or an o/c high value resistor in the noise limiting circuit.

HUM

Hum can produce many effects in a television receiver, the precise effect indicating the source of entry. Apart from the familiar low frequency note on the sound, there may be hum on vision giving a black bar across the picture, also hum modulation of the line time base giving a wavy edge to the raster. Loss of sync can also be, in some cases, attributable to hum.

If all these effects are in evidence, the main smoothing capacitor is almost certain to be the cause of the trouble. If, however, only one of these effects is noted, while the main smoothing capacitor cannot be completely ruled out, the trouble is much more likely to be due to a heater/cathode leak in one of the valves associated with that circuit.

—continued on page 225

DX-TV

A MONTHLY FEATURE
FOR DX ENTHUSIASTS

by Charles Rafarel

CONDITIONS for the period 20/11/66 to 20/12/66, as expected, showed a general reduction of Sporadic E reception. Also, Tropospheric propagation during the period has been terrible.

For as long as I can remember, we have had some pretty good openings towards the end of the year, but not this time. The unusually cold, windy, and wet weather (snow in some areas), has wrought havoc and in my area the only passable day was 11/11/66, when stations to the South were coming in fairly well.

Sporadic E has been more rewarding, both in my own and other areas, so we can find some solace in this! My own log shows short duration openings on 20-22 November, and 7-9, and 12-14 December mainly to USSR, Czechoslovakia, West Germany and Austria, but further West things appear to have been better.

D. Bowers of Saltash, Cornwall, reports openings on 24-28 November, and 3-6 December to Norway, Denmark, Italy, Austria, and Spain, with reception on frequencies as high as E4, which is good for this time of the year.

NEWS

Firstly a correction: Tirana, Albania is not 50kW as noted in the December issue, but only 50 Watts! I fear that after peering at TV screens for years, I must want my glasses changed! Sorry Roger Bunney, it must have been wishful thinking on my part! The power has, in fact, increased from 20 watts to 50 watts, but still not much chance of a new country here after all!

O.R.T.F. France is now scheduled to commence colour TV by the SECAM system on the u.h.f. second chain in the Autumn of 1967. Who will be the first DXer here to get colour from France or any other European country?

We had a further meteor shower (the Geminids) ending about the 13/12/66 and this, like the earlier Leonid shower, appeared to produce some very short duration reflections, but nothing very startling, still they are worth keeping an eye on.

F2 LAYER REFLECTIONS

I promised last month some information on what we hope will prove to be some very long distance openings in 1967/8, and these may be really spectacular.

We are already beginning to approach the sun-spot maximum at the next 11 year cycle, and recently confirmed reports of African TV reception by readers shows that things are really on the move at last.

The peak of F2 layer activity is expected for May-June 1968, so we should be preparing for it now, and gathering what information we can about what is to be expected.

For F2 reflections the "sky is the limit", but in theory at least the distances for reception could be up to 12,000 miles, and that means Australia! This happened at last sun-spot maximum, and remember that then there were not nearly so many TV stations, and the powers were much lower, so we should have greater scope this time.

The reflections arise from clouds of ionized gas at much higher altitudes than the E layers. The best times for DX will be when the greatest section of the reception path lies in daylight, i.e. for the USA from midday until 20.00-22.00 BST. But as this is the time when local stations are going "full blast" it might be better to try after midnight when things are quieter.

There are pronounced characteristics for F2 reflected images. They nearly always exhibit multi-path "ghosting", and the picture "streaks" off to the right in an alarming manner, which is not going to help us with reading station identification letters and captions.

U.S. RECEPTION

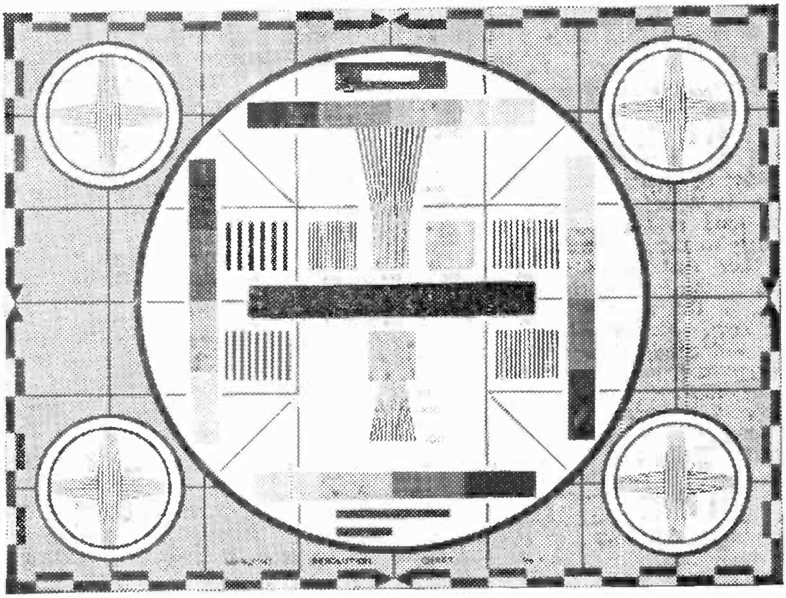
The norms for USA "A" channel TV are 525 lines negative modulation with f.m. sound, field frequency is 60c/s instead of the European 50 c/s. Those with converted 405 line sets, should not have many problems for if we can get 405 lines and 625 lines then the 525 line setting will lie between them.

The 60c/s field frequency does, however, present more of a problem. Consult the service sheet for your receiver, and study the field hold circuit. This is often in the form of a resistor network, with three resistors in series, the middle one being the variable hold control. Reduce the value of the two outer ones, and increase the value of the variable one; this should give enough scope to reach 60c/s.

How do we know when we have reached 60c/s in the absence of a USA picture? I suggest that

DATA PANEL, 18

YUGOSLAVIA J.R.T.



Test Card: As photo and details below. A number of test cards are used by Yugoslavia:

(1) The Marconi Resolution Chart No. 1, as photo.

(2) The Polish/Hungarian Type Card shown in Data Sheet No. 17, but with the letters "R.T.V." at the top of the inner circle, and at times the name of the TV studio, i.e., Ljubljana or Zagreb.

(3) The West German/Austrian type of Test Card with the above lettering on it.

(4) Captions often give the words *Studio Zagreb or Studio Ljubljana.*

(5) Black-and-white check-board patterns similar to Lopik Holland are also used.

Channels:

E3, two transmitters, (1) Kapaonik, and (2) Kum.

E4, two transmitters, (3) Labistica, and (4) Psunj.

All transmitters are horizontally polarized, and have been well received in the British Isles.

you borrow a calibrated audio oscillator, inject a 60c/s signal, and adjust until you get stationary horizontal bars on the screen. Any other ideas?

How are we going to know when there is a chance of F2 DX being about? You can watch the 28-30 Mc/s bands for long distance amateur or broadcast stations, as this is a good guide to possible 45-60 Mc/s TV openings as well. It is also worth while noting the predictions for propagation in the 28 Mc/s band, which are published in specialist radio amateur periodicals.

So good luck for the F2 trans-Atlantic stuff in 1967, and we eagerly await the first reports.

READERS' REPORTS

Due to lack of space this month I regret that readers' reports will have to be held over, but please continue to send in details of your results.

BROADCASTING

We are to publish a report on the Government's White Paper on "Broadcasting" in the March issue of "PRACTICAL WIRELESS"

—*Editor.*

LETTERS TO THE EDITOR

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

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

WILL IT EVER COME?

SIR,—One way or another it is the general public that "cops it" eventually. The continual rise in food prices is a cause of ever-increasing anxiety to the housewife, and of course, any rise in beer and cigarettes reproduces a sister symptom in the man of the house.

This passing of the buck to the man in the street is not new. Numerous governments of varying beliefs and denominations have all failed to stop the rot, even though pre-election speeches promise glowing improvements.

When it comes to television, things should improve—or should they? If the countless sub-committees and reports are anything to go by the answer should be a resounding "yes!"

In the case of colour television; now, we are assured, just around the annual corner, grave doubts are looming. The inescapable conclusion is that this promised multi-colour marvel will turn out to be nothing but a rainbow millstone for the man in the street. Back to square one.

Numerous reports have been publicised on the inability of some local TV engineers to cope with repair problems on black-and-white receivers, and one reads of sets which spend a considerable part of their lives shunted from dealer to buyer and back again with monotonous rhythm. The trade informs that there just aren't enough trained servicemen to go round, and the only solution open to dealers is to lower the standard.

Colour receivers are considerably more complex, and it is not unreasonable to deduce that they will require even greater skills in their adjustment and servicing. Back to square one again!

Perhaps the end result might be that the sets of the future will be all plug-in units, and the apprentice will merely substitute along the line until the fault is cleared. This would be an expensive solution since the cost of the new unit might prove high; never mind, the man in the street will have to pay.

At £250 a time, with high servicing costs and a serious shortage of trained engineers one still wonders if we are any nearer getting colour television than we were ten years ago. All that appears to have progressed in that time is the number of committees, and the establishment of firm belief that it might all be a very expensive myth. Anyone for tennis?—R. COLLINS (Walthamstow, E.17).

NIVICO PORTABLE TV

SIR,—I am most anxious to contact someone who owns a Nivico 4½in. portable television receiver and in particular to find out where spare parts may be obtained.—P. SADO (11 Stanhope Gate, London, W.1).

ISSUES FOR DISPOSAL

SIR,—I have 150 copies of PRACTICAL TELEVISION and 100 copies of PRACTICAL WIRELESS for disposal. If any of your readers are interested will they please write to me.—R. SHIPLEY (33 Hawthorne Road, Blackenhall, Wolverhampton).

ISSUES REQUIRED

SIR,—I would be grateful if any reader could sell me the PRACTICAL TELEVISION of February, 1966.—P. DU FEU (6 Tavistock Road, Launceston, Cornwall).

SIR,—Would any reader be kind enough to supply me with the issues of PRACTICAL TELEVISION from January, 1963, to April, 1964.—A. S. JABBAL (93 Cotswold Avenue, Northampton).

SIR,—Regarding a missing issue in my binder collection of PRACTICAL TELEVISION, which is not available through your Subscription Department, I would be greatly obliged to you to ask other readers if they would kindly supply me with the January 1966 PRACTICAL TELEVISION.

To avoid too many copies being sent to me here in The Netherlands, would it be possible for readers to send the issue to your office and for you to send just one on to me?—S. HADIDA (The Netherlands).

[*I think that as this reader lives in another country, we could in this case ask for copies of the January 1966 issue to be sent to our office as it would save readers the expense of airmail charges.*—Editor]

SIR,—Could any reader please supply me with the issues of PRACTICAL TELEVISION for April, June and August, 1965 (on loan if necessary) to enable me to complete my Olympic II TV set. —J. T. STOCKDALE (2 Highfield Drive, Longridge, Preston, Lancashire).

RADIO AND TELEVISION SERVICING VOLUMES

SIR,—I would like to ask if any readers could sell me either singly or the lot of the volumes of "Radio and Television Servicing" from 1957-8, 1959-60, 1960-61, 1961-62, 1962-63, 1963-64, 1964-65. Please state price required.—S. F. BENT (11 Palm Street, Droylsden, Nr. Manchester).

THE WORLD OF SERVICE

Part 2: THE INSIDE ENGINEER

By G.R.Wilding

LAST month the "outside engineer" was featured. This month we feature the "inside engineer" whose task is to rectify faults that are outside the scope of the field man. The "inside engineer"' must have a better understanding of television receivers than his counterpart, and also have a better selection of test gear. The amount of knowledge, and for that matter test gear, varies considerably from one person to another, and from one establishment to another.

Some inside men will tell you that they work with a multimeter and a few shunt capacitors, while others make use of wobbulators, 'scopes, pattern generators, signal generators, bridges, and so on. Again, the conditions under which they have to perform vary from dingy little rooms above the shop to smart little booths set-up like a production line.

Now to a typical day in the service department of a multiple dealer organisation. This was chosen in preference to a service department attached to one of the rental companies, since a greater variety of sets are dealt with.

JOB 1.—SLIM 17in. PETO-SCOTT: "Blows fuses on average two or three times a week. New PY82's fitted".

After checking that the correct fuse was fitted in the common a.c. feed to the heater chain and to the twin PY82 rectifiers, the set was opened-up and left on test. The most frequent cause of fuse-blowing is due to spark-overs inside thermionic rectifiers, but was discounted in this case as the PY82's had already been changed. The next most likely is a heater/cathode short in a valve higher up in the heater chain, causing excessive heater current. When such a defect occurs it usually stays on when the fuse is replaced or quickly reappears, and again in this instance could be discounted. After ensuring that no leads passing through the chassis to the dropper had damaged insulation and might be intermittently touching metalwork, the set was left to "cook".

JOB 2.—MODERN 19in. FERGUSON: Picture lockable on ITA only and set generally unstable.

This was an understatement: on plugging-in there was sound-on-vision, vision-on-sound and an over contrasty picture which was difficult to lock. Although it gave the impression that a common i.f. stage was bordering on self-oscillation or that the complete i.f. strip had been mis-aligned, it was found that the contrast control had little effect on the symptoms, so we then tended to think that the mis-alignment symptoms were due to overloading and cross-modulation in an early stage or stages. A simple test confirmed that the second impression was correct. We removed the normal aerial feed and substituted an indoor type. Immediately we obtained a picture free from cross-modulation, though very grainy and still with very weak sync lock.

The excessive gain on the outdoor aerial and the slight effect produced by operating the contrast control indicated a failure of the a.g.c. system, and as in this particular model, the negative a.g.c. voltage is derived from the grid of the sync separator, we assumed a defect in this stage to be the cause of all the troubles. Replacement of the sync separator valve produced no noticeable improvement so a new video amplifier valve was tried. Again no significant improvement, so we commenced voltage checking around the former valve first. Both anode and G2 voltages were a little down and the G1 negative voltage when receiving a signal was very low indeed. The grid feed to this valve from the video amplifier is via a series connected 8·2kΩ resistor and 0·1μF capacitor; the resistor is included to free the video anode load from excessive capacitive loading. Although these components are virtually in the timebase circuit, they are mounted on the i.f. printed panel and on making further tests the resistor appeared to be open circuit. Some pressure on and around the resistor caused readings to appear on the meter, and a dry joint at one end was found. Dry joints are most likely to develop when, as in this instance, there is no direct current flowing to break the high resistance bond. Re-making the soldered connection restored continuity, and on test, normal contrast control was obtained with normal locking and complete freedom from cross-modulation even on the outdoor aerial.

JOB 3.—MODERN 19in. ULTRA: Replace the cathode ray tube.

Possibly the most important point about tube replacement is to first check how far the securing band fits over the tube rim and ensure that the replacement is far enough forward for correct mask fitting, otherwise a lot of extra work can be caused. If scan coils stick firmly to the glass a spot or two of switch-cleaner allowed to flow between them will often break the seal. In this particular instance no difficulties in fitting were involved, but it was noticed on test that "blooming" occurred at high brilliance levels. This was due to a slightly ageing U26 e.h.t. rectifier, not able to cope with the increased current demands of the new tube. On withdrawing the U26 valve from the protective polythene cover it was found that its base pins and anode cap were all covered with green corrosion. The valveholder also was affected so that a replacement U26 would get similarly corroded after being in service for a while. The problem was then to either replace just the e.h.t. valveholder or the complete line output transformer since they form an integral unit. As it was difficult to assess the full extent of the corrosion spread, it was decided to take the latter course, for some of the invisible transformer windings may well have been affected.

JOB 4.—MODERN 19in. RGD: Raster brilliance excessive in centre of picture. Valves OK.

On plugging-in, and without aerial input, there was a bright horizontal band four or five inches deep across the centre of the screen. Usually such faults or "hum bars" are caused by a heater/cathode leak in a video or vision i.f. valve. (Outside engineer's reason for mentioning he had changed all relevant valves without success). From this it was assumed that a smoothing or decoupling capacitor somewhere in the receiver

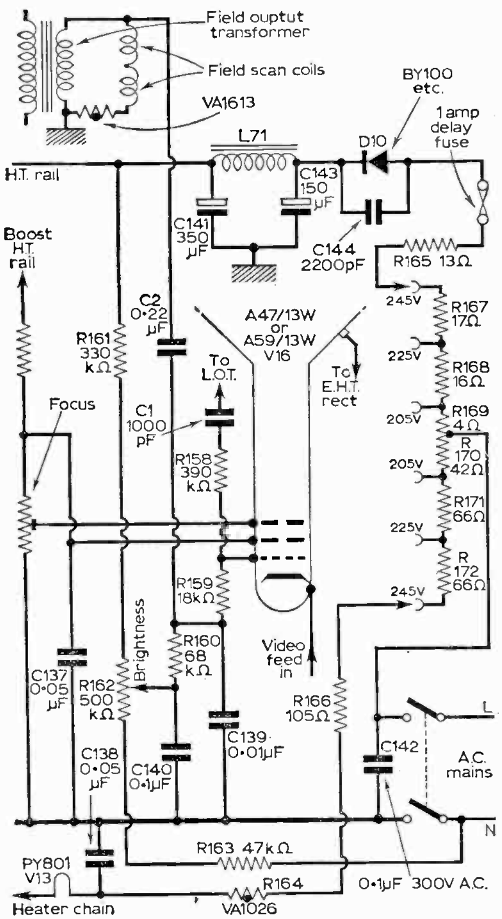


Fig. 1: Basic power and tube supply section of RGD receiver referred to in Job 7. Capacitors C1 and C2 are line and field fly-back suppression capacitors respectively.

section was open circuited. With the help of some spare electrolytics and paper capacitors fitted at one end with a croc clip on a flexible lead and a test prod on the other, various capacitors were checked by paralleling all suspects indicated in the maker's service manual. Apart from the main h.t. smoothing and reservoir capacitors of 350µF and 150µF respectively, there is a 50µF electrolytic in the adode circuit of the PCL84 video amplifier and a 16µF decoupling the PCF802 line generator from the h.t. rail. Shunting all these with capacitors of comparable value produced no noticeable effect, so we next directed our attention to the smaller decouplers associated with the tube itself. Immediately on contacting a 0·01µF capacitor from the tube G2 grid pin to chassis there was a considerable levelling in raster brightness and although not representing a cure, it showed that we were in the area of the fault. The decoupling to this pin from the slider of the brightness control is by two separate capacitors, one a 0·1µF and the other a 0·01µF. Shunting either with an equal value replacement would improve, though not remove the effect, although testing of the capacitors concerned showed them to be serviceable. On this set the top end of the 500kΩ brightness control is returned to the h.t. rail via a 330Ω resistor, while the bottom end is returned to chassis via a 47kΩ resistor, so it seemed that the only way the a.c. content (or ripple) could get to G2 was due to the h.t. rail. Since the main smoothing and reservoir capacitors had been checked, the only reasonable assumption was shorted turns in the series smoothing choke, so the ht. supply was broken at this point and an additional choke wired in without success. However, on applying an earthed 0·1µF capacitor to the "earthy" end of the brightness control, a major improvement was effected, though still not a complete cure.

Obviously the a.c. input was through the bottom end of the brightness control. Careful tracing then showed that, as the service diagram indicated, only a 47kΩ resistor was between this point and the earthed switch pole. However, closer investigation showed that this resistor instead of being returned to the earthed on/off switch was connected to the live on/off switch section. Apparently the control had been replaced at some time previously, and the unfortunate transposition then made, resulting in a pure a.c. voltage being fed to the tube G2 via this 47kΩ resistor. Connection to the correct switch contact then completely cured the defect which had proved to be quite puzzling.

JOB 5.—RE-EXAMINE JOB 1.

Still running normally and no amount of lead moving or probing would cause the fuse to blow. However, on applying a little pressure to the line output transformer it was noticed that it "rocked" a little and on holding it to one side, vivid sparks could be seen arcing underneath. Closer investigation showed that there were four soldering tags at the base of the transformer passing through separate half-inch diameter chassis holes which were no longer centrally situated.

On re-positioning and securing the transformer with the tags all central in their respective chassis holes, we set up the receiver using the Test Card and passed it for return to customer.

JOB 6.—REGENTONE 17in.: Change PY81 valve-holder.

Valveholders seldom become so bad that their replacement is the only cure, but in this instance there was an intermittent open circuit connection between the cathode pin and appropriate soldering tag, resulting in intermittent line output. Being a PY81 and having only four connections, to anode and cathode beside the two heater connections, its replacement is comparatively simple, but replacing those in i.f. or r.f. stages can be extremely intricate and involve replacing several of the small components attached to it. When valveholder replacement is unavoidable, the best procedure is to drill the underside of the rivets with a medium-sized bit, and knock through with a fine punch. Normally, poorly contacting valveholders can be cured by gently pressing the sides of the pin sockets with a fine, strong needle and putting a drop of switch-cleaner down the sockets and plugging a valve with roughened pins in and out of the holder. But only the gentlest of pressure must be applied to those sockets that have obviously widened pins or else they may crack.

JOB 7.—MODERN 19in. SOBELL: Intermittent field collapse. Not valves.

The latter obviously referred to the triode-pentode PCL85 type of valve commonly used in modern dual-standard receivers as the field generator and output pentode and cross-coupled in the conventional multivibrator arrangement. When plugged in reception was normal, and despite levering and pressing on the printed panels the set failed to produce the symptom. However, after ten minutes or so, the raster collapsed and immediately we applied a small a.c. input to the grid of the valve pentode section to determine whether the cause was lack of saw-tooth generation or power output. The response was more than adequate, so clearly the triode oscillator circuitry was at fault. Voltage on the triode anode was between 10-15V, depending on height control setting, instead of the maker's figure of 35V. This drop in anode voltage by no means indicated a leak from that point to chassis since once a valve stops oscillating the "grid leak bias" disappears, anode current rises, and produces a heavier voltage drop across the load resistor and lowers anode voltage. In this particular series of models the triode anode is returned via a 560kΩ resistor to the slider of the 500kΩ height control which in turn is fed from the h.t. rail. Thus, the slightest change in anode current from normal would produce a big change in voltage drop across it.

In case the fault might disappear on switching off for ohms-test, it was decided to check whatever could be done while the set was on, and the most likely "probables" were the two cross-connected feedback capacitors. With the aid of a 0·1μF capacitor connected to test prods, each suspect was paralleled in turn, and on shunting C134 in the service manual, a 0·005μF connected from the pentode anode to the triode grid, field scan immediately reappeared. On removing the shunt capacitor the field collapsed again. Replacement completely cured the defect.

JOB 8.—SLIM-LINE COSSOR: Low gain. Not valves.

Naturally low emission valves are the commonest cause of low gain followed by open-circuit or dry jointed screen and cathode decoupling capacitors. The quickest way to check for these is to stab a good replacement across each in turn, although in most instances, with the meter set to a high voltage range, the negative lead to chassis, application of the positive prod to these points will invariably apply sufficient capacity to show up any deficiency.

However, we removed the chassis and switched on. Even with our particularly good workshop aerial it was obvious that gain was down, while there was also a slight tendency to background patterning. This further increased our suspicion of an o/c decoupler but first we carefully examined coil slugs to check if any adjustments had been made. They appeared untouched and results viewed on the Test Card showed definition to be up to standard. While checking valve seating, we brushed the long coaxial lead extending from the aerial socket on a panel at the rear of the set to the tuner, and immediately gain increased. Further inspection showed that the outer braiding of this lead had become completely unsoldered from the inside of the tuner.

On re-soldering (quite difficult since the large metal area conducted the heat from the soldering iron), reception reverted to normal and the slight background patterning ceased.

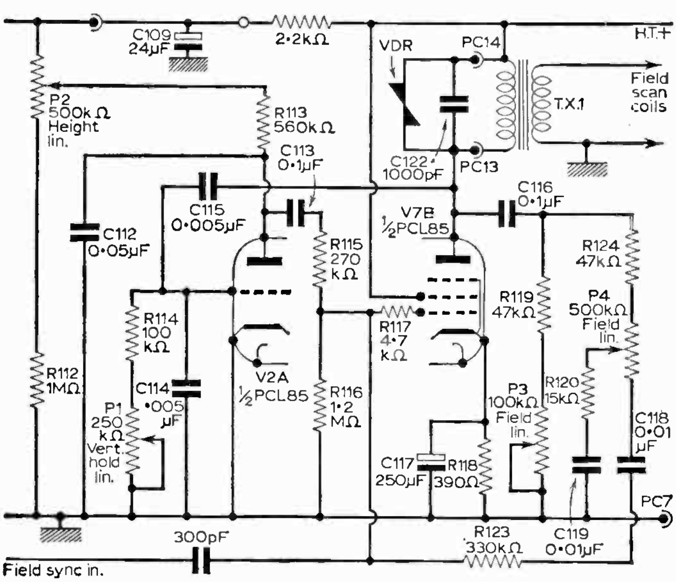
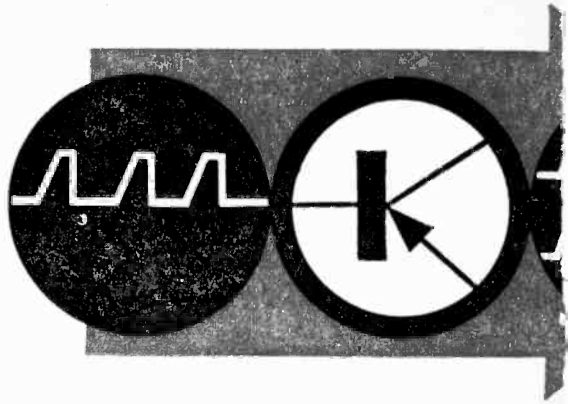


Fig 2: Field circuit used in many GEC/Sobell receivers referred to in Job 7.

COMPANION UN



IN the previous issue of PRACTICAL TELEVISION I described a synchronising line selector for attachment to a standard oscilloscope as an aid to fault-finding and circuit development in the television receiver.

Another device of value when used with an oscilloscope is the Multiplexer. This enables a single-beam oscilloscope to be used as a double-beam unit, sharing a common time-base. The ability to display simultaneously two waveforms is very often required, particularly in scanning circuit work, and enables the coincidence of events occurring at different parts of the circuit to be quickly seen.

Basic Principles

The principle of the electronic multiplexer is illustrated in Fig. 10. Alternative samples of the two waveforms A and B, to be examined are selected and conveyed sequentially to the Y plates of the oscilloscope cathode-ray tube. If this sampling is carried out at a frequency much greater than that of the highest frequency we wish to display then the two waveforms will appear to be continuous and the presence of a series of gaps in each waveform will not be seen.

To prevent the two waveforms from appearing one on top of another d.c. shift levels are added to each waveform during the preliminary amplifying stage. Sampling is controlled by a square-wave oscillator (usually a multivibrator) such that the sampling period for waveform A coincides with the gap or non-sampling period for waveform B, and vice-versa.

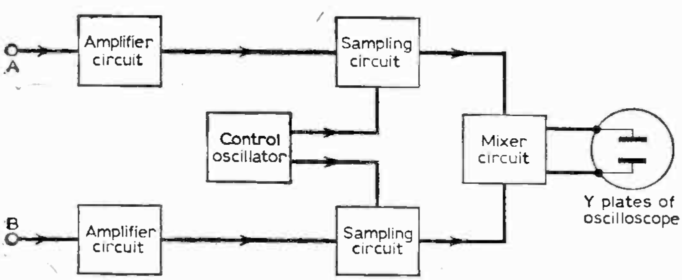


Fig. 10: The principle of the multiplexer.

The actual movement of the beam as it traces out the two waveforms is shown in Fig. 11 with the sampling frequency much reduced in order to illustrate the principles involved. The almost vertical straight lines traced by the spot as it connects consecutive samples of each waveform are very faint due to the choice of a high sampling frequency, and are not generally seen unless the brightness control is advanced too far.

Building Blocks

From this basic description we see that the electronic "buildingblocks" of the system are: two amplifiers with provision for adding a d.c. level shift; two gates controlled from the multivibrator; a mixer for the two sampled and amplified signals; a multivibrator to control the sampling, and an output stage for feeding to the Y-amplifier of the oscilloscope.

It is often possible to combine two of these functions in a single stage. The frequency response of the circuits following the mixer must be wide enough to pass the high sampling frequency and for this reason a low impedance output stage is necessary to obviate the capacitative effects of the lead coupling the unit to the oscilloscope.

Circuit Diagram

A circuit for a transistorized multiplexer is given in Fig. 12. The input signals A and B are applied to a two-transistor pre-amplifier Tr1 and Tr2, the first stage of which acts as an impedance converter in order to present an impedance of about 0·5MΩ at the input terminals.

The amplifier outputs are a.c. coupled to the base of the two mixer transistors Tr5 and Tr6. Provision for d.c. shift is included by returning the base bias resistors R10 and R12 to a centering control potentiometer R11. This is adjusted to separate and position the two traces on the oscilloscope screen in conjunction with the Y-shift control on the oscilloscope.

The collectors of Tr5 and Tr6 are connected together so that mixing of the signals takes place at this point. These two transistors also act as the switching gates by returning their load resistors R13 and R14 to the outputs of the oscillator.

The Sampling Oscillator

Four transistors are used to provide the square wave switching waveform. Tr8 and Tr9 act as an astable multivibrator with the frequency of oscillation controlled by the values chosen for C11 and C12. The sampling frequency is 100kc/s for the values given and this will be found high enough for most purposes. Other frequencies can be obtained by altering the value of C11 and C12 in accordance with the formula; $C = \frac{1}{68f}\mu F$, where f is the frequency in kc/s.

G.K.FAIRFIELD

MULTIPLEXER

It is sometimes difficult to initiate oscillation with a transistor oscillator since the inevitable circuit disturbances, which generally start oscillations, such as noise and 50c/s hum are often quite small or not present at all. In order that the multivibrator starts easily at the higher frequencies Tr9 is arranged to be more heavily biassed than Tr8 by the omission of a base-emitter resistor from across Tr9

The multivibrator output waveform is not sufficiently square to be used directly and is applied instead to trigger a bistable multivibrator (flip-flop) Tr10 and Tr11. This is similar to the one described in my previous article but uses in addition four extra diodes. All leads must be kept as short as possible to prevent interaction between circuits. Layout on the Vero board is, however, not very critical. Any logical arrangement can be used provided precautions are taken against unwanted coupling.

The components board can be mounted within a metal box (or even a baking tin having flat sides!) which also carries the potentiometer, switch and input/output sockets. The batteries can also be included.

Testing the Unit

It is convenient to solder the transistors in position on the board last of all and in the order given below to facilitate testing.

First solder in Tr8 and Tr9 and connect power supplies. Connection of an oscilloscope between point P (Tr9), and earth should show a rectangular waveform although possibly with rounded edges. Check that the switching frequency is correct.

Next solder in Tr10 and Tr11 and check waveforms at points Q and R. The waveforms should be identical although of opposite phase, and much squarer than that observed at point P. Note that the frequency is exactly half that at point P. This is because a bistable circuit will act as a frequency divider circuit as I explained in my last article.

Now place transistors Tr5, Tr6, and Tr7 in the circuit and connect an oscilloscope to point S. The centering control R11 is now varied and the two straight-line traces on the screen should be separated at the extreme clockwise and anticlockwise positions and should merge at approximate mid-position of the control.

Finally transistors Tr1, Tr2, Tr3 and Tr4 are soldered in position and the complete unit checked. Two different waveforms are applied to inputs A and B and exact reproductions of these should appear at the output terminals S. Variations of the centering control should not cause the amplitudes of these waveforms to vary only to merge and separate them in the Y direction.

The Multiplexer should be coupled to the d.c. input terminals of the oscilloscope and of course the oscilloscope amplifier must have a bandwidth compatable for the sampling rate used. In this case the bandwidth must be at least 100kc/s. A symptom of inadequate bandwidth is the appearance of switching transients or spikes at various points in the displayed waveform. Unless these are very serious, however, they will not detract from the value of the observations made with the unit.

D1 and D2 are "speed-up" diodes used to decrease the pulse rise time at high switching frequencies. D3 and D4 are "pulse-steering" diodes and their purpose is to allow only the positive half of the driving pulses to trigger the transistors. They can be omitted at low sampling rates.

Since the collectors of the mixing transistors Tr5 and Tr6 are connected via their load resistors, to the collectors of Tr10 and Tr11 then as Tr10 and Tr11 switch alternatively between conduction and cut-off so Tr5 and Tr6 also switch or gate alternatively. Signals applied to their bases thus

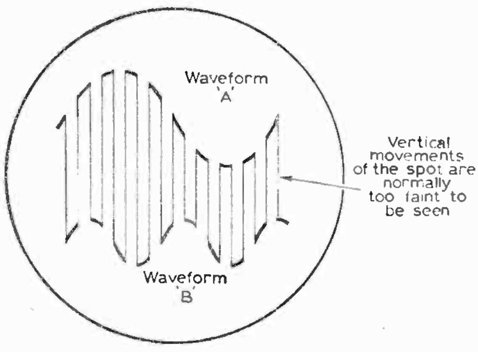


Fig. 11: The actual movement of the beam.

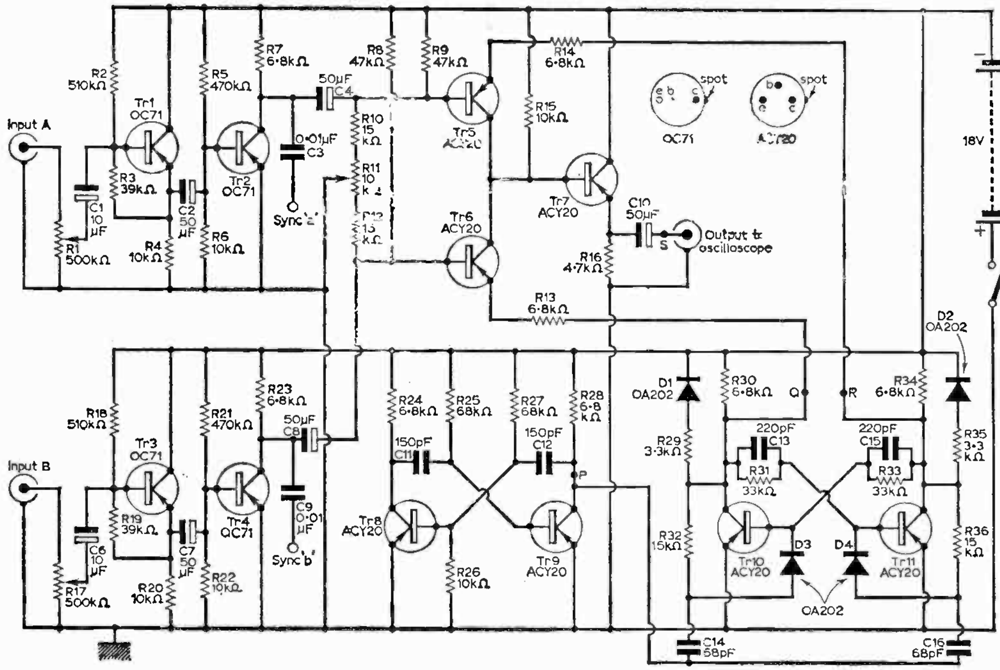


Fig. 12: The complete circuit diagram. All resistors ½W 10% all electrolytics 25V

appear alternatively at the output in multiplexed form.

The collectors of Tr5 and Tr6 are directly coupled to the base of an emitter-follower Tr7. The output impedance of Tr7 is so low (500Ω), that there is no loss or distortion of the signal applied to the oscilloscope input. Correct operating bias for Tr7 is obtained via R15.

Synchronisation of the oscilloscope time-base may be made to either input waveform, and two output synchronisation terminations are provided following the signal amplifiers as shown in Fig. 12.

Power Supplies

The complete circuit requires a power supply of 18 volts at about 20mA. This can be obtained from two 9V batteries and is preferable to deriving the voltage from the oscilloscope power supply. The reason for this is the difficulty of keeping the switching pulses from reaching the oscilloscope circuits via the power supply connections. Very careful decoupling is necessary if this is to be attempted.

Construction of the circuit can, as with the line selector, be carried out using Vero laminated board. All components with the exception of the potentiometers and coaxial input/output sockets can be mounted from their leads by soldering directly to the copper strips formed on the board. Interconnections between components can be made by "jumping" a wire between strips and the strips themselves, running the length of the board, can be broken where required to prevent unwanted connections. A sheet of board about 6in. by 6in. will be found adequate to carry all the components for the unit. ■

MORE COLOUR TRANSMISSIONS

During the next few months the BBC are to extend their experimental colour television test transmissions to the whole of the BBC-2 network. As a first step, these transmissions are now being carried by Emley Moor (Channel 51) as well as by Crystal Palace (Channel 33). Also, the relay stations at Guildford, Hertford, Reigate and Tunbridge Wells are now carrying colour. The new schedule is as shown.

Day	*Time*	*Programme*
Monday & Tuesday	1400–1415	Black-and-white test card
„ „	1415–1425	Colour bars
„ „	1425–1500	Colour slides
„ „	1500–1800	As for 1400 to 1500, repeated
„ „	1800–1830	Black level and syncs
„ „	1830–1835	Colour bars
„ „	1835–1915	Colour slides
Wednesday, Thursday & Friday	1400–1835	As Monday
„ „	1835–1915	Colour slide followed by colour film

Servicing TELEVISION Receivers

No. 131 - REGENTONE 195 and associate models

by L. Lawry-Johns

THE chassis used in this range of receivers is a basic one employed by many well-known makers from time to time. For example, the same, or at least a very similar chassis will be found in the Peto Scott TV960, where one would normally expect to see the usual Philips-Stella chassis.

The R.G.D. 624 and 625 are the same as the Regentone 195 and 196, while the Defiant 9A50-3A60 series differ only in minor details. Several other well known and lesser known brand names have used these and very similar chassis. The differences occur in the type of tuner used both for v.h.f. and u.h.f. Also either Mullard or Mazda c.r.t.'s and valves may be found fitted. To avoid too many "ifs and buts" this article will specifically deal with the Regentone and R.G.D. models. A u.h.f. tuner may not be found fitted and the tuner for v.h.f. may differ. The mains input should be a.c. between 200 and 250V, and total power consumed will be 160 watts.

Servicing

Care must be exercised when handling printed circuit boards, otherwise damage may result. Do not use force when removing components, particularly those which have been bent over by the manufacturer. Another worth-while point is to cut and shape the leads of replacement components before attaching them to the board.

Most components are mounted on two printed

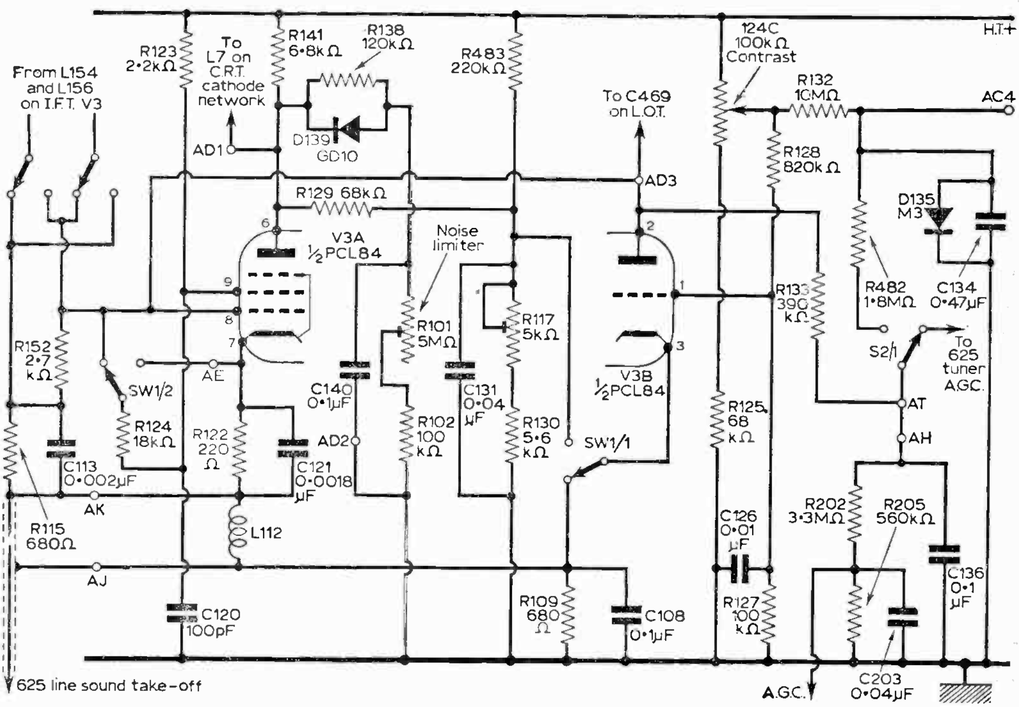


Fig. 1: The video output stage and a.g.c. circuitry

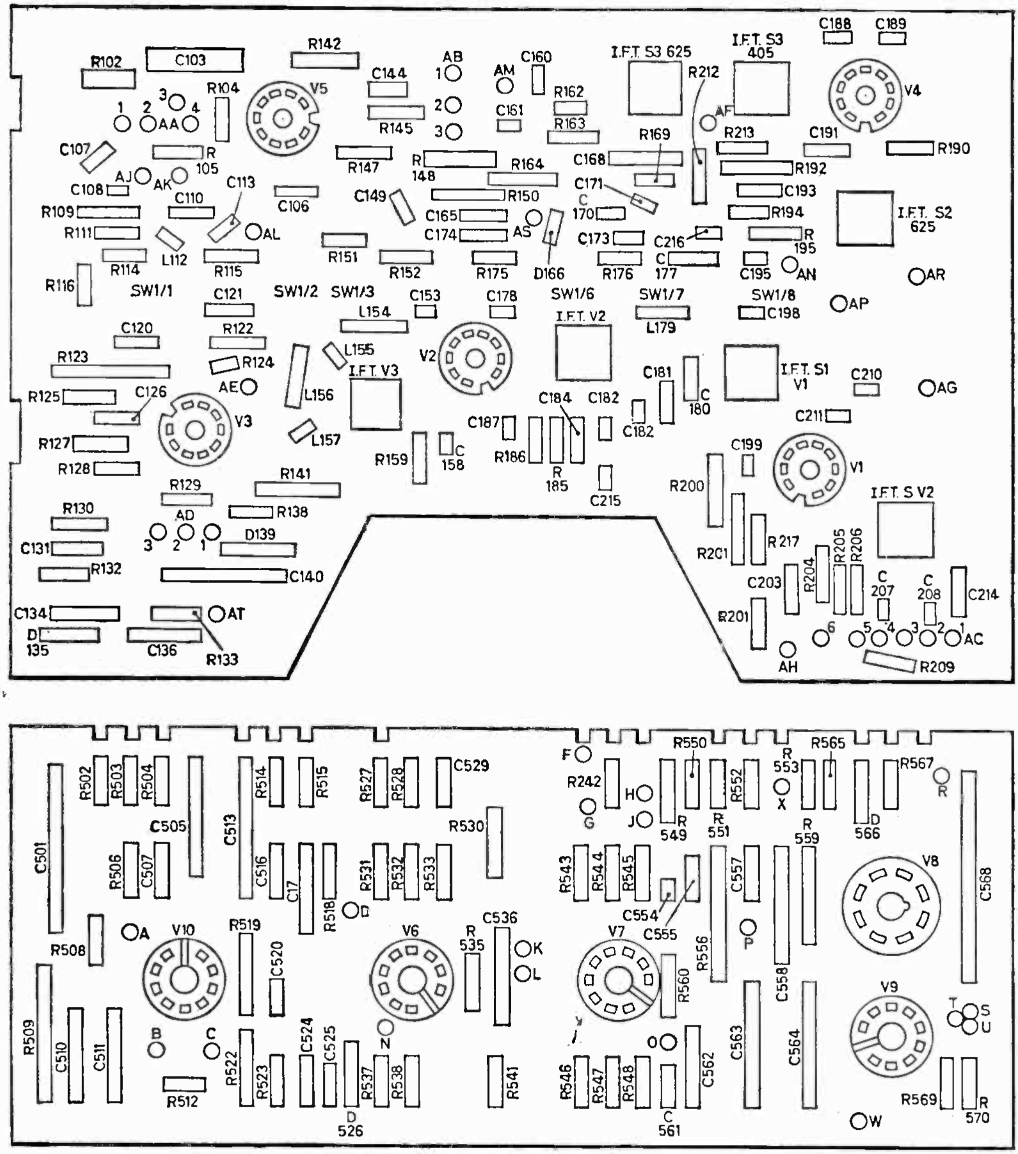


Fig. 2: The i.f. printed board is shown above the timebase board.

panels. When the rear and bottom covers are removed, nearly all components are accessible, making removal of the chassis unnecessary except when the tube needs to be taken out. When this is necessary the following procedure should be adopted.

Removal of Chassis

Remove rear cover, remove the four 2BA slotted nuts holding the chassis to the cabinet. Pull the top of the chassis toward the rear and the chassis is then completely removable to the extent of the control leads and tuner. Pull off control knobs and release the nuts holding mounting plates.

Remove c.r.t. base connector and e.h.t. clip. Slacken deflection coils clamping screws and slide off assembly from c.r.t. neck. Slacken the retaining strap and carefully remove c.r.t. from the cabinet if necessary. The l.o.p.t. can be replaced without removing the chassis.

Precautions

The makers stress the necessity of correctly setting the *width* control. The voltage on the

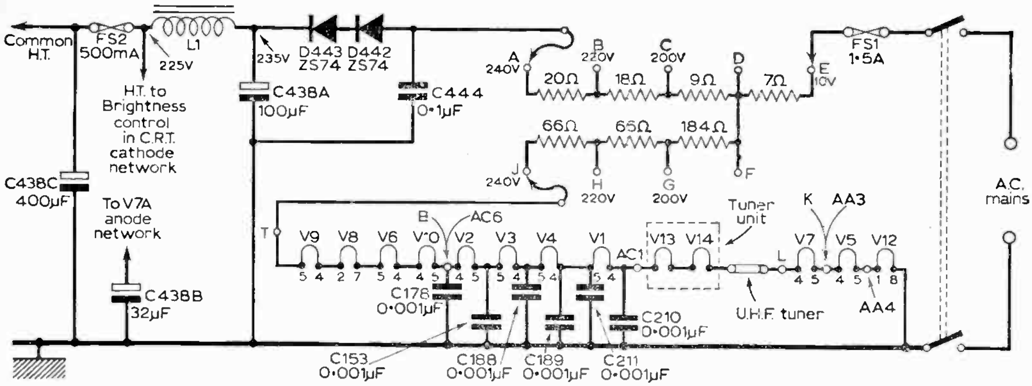


Fig. 3: The power supply circuitry.

Boost line must not be outside the limits 760-840V, otherwise damage may result to the l.o.p.t. and, or, the line output valve. The width control should be set to produce a boost line voltage of 800V measured between R570 and chassis. This is tag U on the bottom panel. Slight adjustment may be made for correct width provided the boost voltage remains between 760 and 840V. Thereafter the width is, or should be self-compensating.

Faults

Almost without doubt the most common fault which will be encountered is that due to a section of the mains dropper failing i.e., becoming open circuit. The location of the fault and its remedy are equally simple. A quick check along the tags with a neon screwdriver or an a.c. voltmeter will show the faulty section. A replacement section of the correct or near value can then be *wired* and soldered across the tags where the break has been located. The temptation to short the tags across should be resisted as this only leads to incorrect working and seriously shortened life expectancy of the receiver generally.

Improper Contact

The next most common fault is the inability to select the required channel properly. No trouble should be experienced here but the exact steps depend upon the type of tuner unit fitted (v.h.f.). In any event it is a simple matter to expose the channel selectors and clean the contact surfaces, relubricating with silicon oil. If the contact settings have been disturbed on the type PC80 push-button tuner the following procedure should be carried out.

Remove the top cover by undoing the two screws and snapping off.

Set all buttons to channel II. Release the lock-nut on each of the gate screws. Depress button number 1 and adjust the gate screw adjacent to it to position the oscillator contacts evenly on the channel II pad. Depress the number 4 button and adjust the gate screw at that end to centralise the oscillator contacts on the printed pad. Repeat both operations until an exact setting is obtained. Relock the gate screw locking-nuts and check all four buttons. Examine the contacts to ensure that they all sit centrally on their pads. If any contact is misplaced at one end, redress it into position with a suitable tool. Do not scratch the printed tracks.

Completely rotate each button over channels 1 to 13 and ensure that the contacts cover the printed pad in each position.

Replace the top, ensuring that the two prongs enter the sockets on the main printed panel.

If a rotary tuner is fitted trouble can be caused by the biscuit studs having differing heights where one may not have sufficient dome to engage the leaf spring properly. Either replace the biscuit, or very slightly increase the bow of the contact spring. Other remedies may suggest themselves, but whatever is done, must be done carefully without distorting the smoothness of the studs and the even bow of the springs.

U.H.F. Tuner

When a tuner is fitted it should be remembered that its output is fed not to the i.f. stages but to the grid of the v.h.f. tuner frequency changer. Hence a fault in the v.h.f. tuner can affect BBC-2 reception.

to be continued

Censorship by Lord Chamberlain or Soho Square?

FROM time to time I have referred in these columns to censorship on TV—both the pros and the cons. This is a vexed problem in all the fields of entertainment—be it a Clubland comic's gag to a "stag" audience, or a "thinking" play with homosexual overtones in a subsidised theatre. On the one hand, there are those who hold that there should be no control at all on anything written, spoken or seen in public—those of an anarchist trend of thought who delight in shocking, and whose minds are on a level with the scrawlings on the walls of railway station WCs. A psychologist would point out that these people are in fact as inhibited as the puritans who would have total censorship—so that all is "milk and honey", and the goodies always come out winners.

In the theatre and in films there is, to my mind, an enlightened form of censorship which keeps pace with public taste which is constantly changing. In these media the playwright and the producer have to keep to certain standards—there is opportunity for revision in the rehearsal room or the cutting rooms. With TV, any control on what is transmitted rests in the final instance with the director alone as he picks his camera shots on the monitors in the Control Room. Thank goodness that the vast majority of TV directors are neither Marquis de Sades nor are they Dr. Bowdlers or Mrs Grundys.

Today's vocabulary

Terms like "censor", "committed", "partisan", "progressive" and the all-purpose term "fascist" or "reactionary" are part of today's vocabulary of comment—a rarer term is "equitable" or "impartial". Of course, censorship can be carried into "sports"—prohibition by law has stamped out cockfighting and bearbaiting in Britain, and there are some who would abolish all field sports, even angling!

The TV director has the greatest responsibility of all

UNDER NEATH

THE DIPOLE

entertainment producers — he is the guardian of public taste. By the flick of a switch he can cut a callous or gruesome close-up in an actuality transmission of a disaster. Let a censor be an inquirer not an inquisitor! And let him remember that the real rot was started when the "purity" of *Lady Chatterley's Lover* was defended by Professor Hoggart, a talkative member of the Pilkington Committee.

Sports' commentators are a race apart in broadcasting circles—and many the minority sport that has a commentator on radio or television to thank for becoming a majority sport. On the whole, the BBC have the edge with their team work of cameramen and commentators, and on television they do *comment*. Peter West is a prime example of a man who knows his sport and yet does not credit the viewer with being a complete dunce as to the laws of Rugby Union Football. His commentary on the Wales versus Australia match was concise, informative and exciting — and highlighted this historical victory by the Wallabies. When the viewer sees what is happening —the commentator has to adopt a different technique to the "Arlott" style of the radio commentator. One can't shout "It's a goal!"—any fool can see that —but he can tell the viewer who scored it.

Husbands and wives — may they always meet

All tars and ex-tars will recognise my paraphrase of the well-known naval toast—but I am speaking of two pairs of TV husband and wife teams—Warren Mitchell and Dandy Nichols, and Thora Hird and Freddie Frinton. A third pair, but they're not "married off" (yet!!?) are Peggy Mount and Sid James. The first thing that strikes you about all three teams is their sheer experience of all facets of the acting profession, and indeed their very professionalism. Their age group is closer to the Burns and Allen team rather than the Dick van Dykes—in short, they epitomise the average British "mum and dad". And although there are very few colonel's housekeepers and chauffeurs, Peggy and Sid mirror real life characters.

Warren Mitchell was awarded the Actor of the Year Merit Award for his work in BBC's *Till Death Us Do Part* series —a most deserving prize-winner and one of the unsung heroes of many films and television plays. Warren has the ability to create a real person out of a few lines of dialogue. Freddie Frinton toured the variety halls for years with his "drunk act" and in pantomime, his outstanding "dame" spot was a surefire draw—but *Meet the Wife* with dear Thora Hird has brought his face before millions instead of thousands. Sid James, another solid stalwart of countless films, plays and, of course, the Hancock series, does battle with a doughty female in Peggy Mount, in *George and the Dragon*. On the distaff side, Dandy Nichols, Peggy Mount and Thora Hird are all actresses who can conceal the complexities of their craft with overwhelming confidence, which is art within art. The ICONOS trophy for M and F teams '66 is hereby awarded to this trio of "couples"!

Awards are rewards?

During the "freeze" period, one thing that still remains unfrozen is the annual award giving—most of the West End hotels will house a convention of professional diners, and many committees will produce their lists of the greatest this or that of 1966. As you see above, even Iconos has got on the bandwagon — though no professional guild has invited him to its annual dinner in a West End hotel to disclose publicly his meditations!

I do think that while the awards to performers are justified, as an indication of the esteem an individual actor or actress is held by a particular body, it is far harder to be fair to the work of the technicians and designers—too often one feels that a particular gimmick in a production swings the vote, and with the cachet attached to being an Award winner, there is a danger that gimmicks are used purely for their own interest and can affect the balance of a programme as originally envisaged by the author.

Kiddies' Korner

How do you explain to a child that a play can continue with a new principal actor—in fact, that *Dr. Who* can continue without William Hartnell? But those Daleks have perhaps taken over after all!!!

Pantomime is a tradition of theatre, films and—I hope, television. Turning a pantomime into a black comedy will disappoint viewers who switch on. It will also disappoint viewers who don't switch on, just because it is announced as a pantomime. Mr. Potter, the author, should emulate the actors who play the part of Dick Whittington's cat or *Mother Goose* or the Wolf in *Red Riding Hood* and who usually offer their services to management (with "own skin"). Mr. Potter's skin is too thin to embark on that much-loved establishment, pantomime.

"If music be the food of love, play on" said the Bard in *Twelfth Night*. When he wrote those words about 300 years or so before transistor radios were invented, the air was not filled on high days and holidays with the harsh and distorted sounds which have disgraced the name of transistor. This is the main reason, possibly why a new name has been evolved for it—"solid state circuitry" which sounds much more respectable than "semiconductor", a half-truth which has now become a whole truth. Of course, transistor with any name should "smell as sweet", as the Bard also wrote apropos the names of roses in *Romeo and Juliet*.

Summer Bank Holidays on Plymouth Hoe are usually filled with picnic parties with portable radios blazing away like rival transistorised Towers of Babel. It is a sight for sore eyes and cacophony for sore ear-drums! But Plymouth Sound is another matter altogether. Not only is it a geographical feature of Devon but it now represents a new approach to sound whose reproduction in the home on TV and on the radio, in cinemas and even in theatres where the acoustic engineers do their best to adjust reverberation electrically if they cannot do it acoustically. Inarticulate speakers can at least be heard even (in this day and age) if they are not properly understood.

Vision of the future

Nineteen sixty-seven will be a sound year for television-set manufacturers and it may also be a picture year, too, with three manufacturers already proposing to restore true reproduction of picture and sound content on television sets. Iconos, with his ear to the ground, forecasts that the Plymouth Sound will be something more than a geographical refuge for shipping. It will be an inspiration for manufacturers to do a little bit better with both picture and sound and not to pay quite so much attention to the one-armed bandit appearance of the cabinets of their sets. Plymouth will lead the way and this will be made possible by the co-operation of the BBC with one of the ITV companies, Westward Television, whose studio is at Plymouth.

It has always seemed to me that the hi-fi enthusiasts of high-quality sound from discs, tape or radio are equally fastidious in the external styling of their equipment. Apart from *being* functional, it looks functional. At least, that is the fashionable trend today for the advanced phonographist, as the enthusiast was called in the days of the Edison Bell cylindrical phonograph. Today, television sets lag behind the clinical appearance of the cabinets of the high-fidelity stereophonic offerings of Scandinavia.

Television receiver manufacturers' salesmanship is centred on cabinets and styling; flashy, brassy, as a one-armed bandit, and full of alleged tomorrowness. Tomorrow is here, these vulgar-looking cabinets are likely to be decidedly declassé.

The next style

Will the next craze for TV-set cabinets favour the style of massive Gothic chests or dainty Hepplewhite what-nots with large flat tops (for displaying cut-glass vases of Van Gogh flowers)? I shudder at the thought! Perhaps they will be gawky 5 ft. high Chinese Chippendale creations, with panels painted to represent the symbolic figures of Peace, Justice, Intelligence and Temperance (built-in cocktail cabinet £15 15s. 0d. extra). More likely they will become third-class imitations of Swedish furniture, looking depressingly utilitarian and gauche. Or will they go all Louis XIV, Donatello or Mary Quant?

Iconos makes one last appeal to manufacturers. Please, PLEASE think more about what goes inside the cabinets to give good picture and good sound. Picture reproduction that deserves a Good Housekeeping kind of gold seal. Sound reproduction which is brilliant and full-blooded—not soft and flabby nor piercingly painful. *Watch this space!* Solutions have been sent to me—which will be revealed next month.

Stand by for commercial by Iconos!

ICONOS—THE ALL-SEEING EYE AND EAR! THE MOVING FINGER WRITES AND HAVING WRITTEN MOVES ON!

Iconos

A TV COIN SAVER

SAVING WITH SOMETHING IN VIEW

by —————— **A. Farman**

LIKE many other people, the author has a habit of saving threepenny pieces in odd boxes, bottles, etc., but usually succumbs to temptation when the receptacle is only half full! It was decided, therefore, to construct a simple electronic device which would produce more satisfactory results.

There were many pieces of equipment that the coin saver could have been used in conjunction with—radio, TV, garden pump, immersion heater, etc., providing suitable contacts were available—but the TV set was finally chosen as this is in frequent use.

Most of the components required may be found in the spare parts box and the circuitry itself is very straightforward. The device functions in the following manner.

A threepenny piece is made to "make" a microswitch, so energising a relay X/1. The X/1 contact holds the relay on when the microswitch is "broken" after the coin has passed. A second relay Z/1 is also energised, its contact being used to supply power to the required appliance and a neon indicator is incorporated to give visual indication that this has been done. When the circuit is disconnected from the mains, the relays drop out and another coin is necessary to start the operation again.

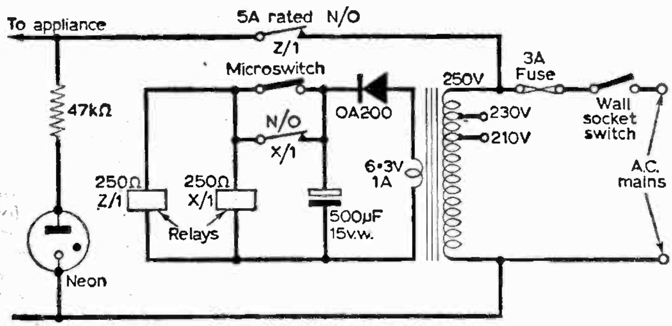


Fig. 1: Theoretical circuit of the coin saver. Some mains neons have a resistance already incorporated, in which case the resistor may be omitted.

CONSTRUCTION

The chassis is an easily obtainable one (size 6in. x 3in. x 2½in.) with a top plate to suit. The layout of components is not critical and will depend on what type of relays etc. are used. The smaller the components are, the greater will be the coin compartment. The coin compartment divider is made by cutting a piece of aluminium (size 4in. x 2½in.) and bending in the required direction (see Fig. 3).

The coin channel dimensions (see Fig. 2) must be adhered to otherwise the coins will either jump over the microswitch or stick between it and the packing piece. The use of paxolin or hardboard for the packing piece allows easier adjustment if small errors are made in the channel dimensions. The channel should be mounted parallel to the top of the chassis box.

The neon is mounted in the centre of the lid and the resistor is wired direct to it and covered with sleeving. A small piece of aluminium, the size of a threepenny piece, is cut out from the lid

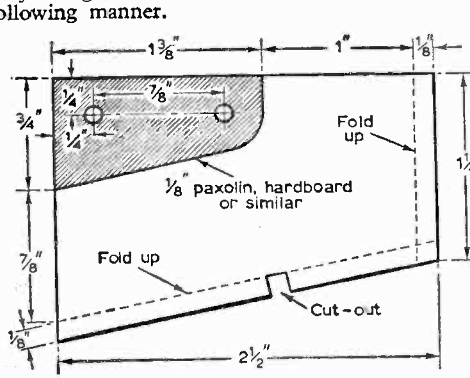


Fig. 2: The coin channel dimensions. These measurements should be adhered to. (See text.)

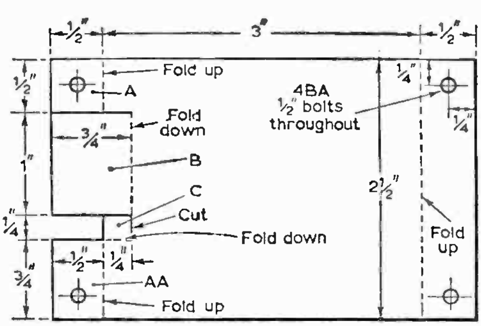


Fig. 3: Drilling and bending dimensions for the coin compartment.

above the channel position. The fuse value is governed largely by the power required by the appliance and the current rating of the Z/1 contact.

CONCLUSION

It will be found that approximately £1 5s. 0d. worth of coins can be held before the unit requires emptying. As the original unit was to be kept as simple as possible, no form of time control was provided, although it would be possible to do this if necessary.

In case of difficulty, suitable relays may be obtained from Messrs Keyswitch Relays Ltd., 120-132 Cricklewood Lane, London, N.W.2. The specification when ordering is as follows: Type 1051, 6 volts d.c. 50mA, 120Ω. The price is 9s. 6d. each, plus 1s. 3d. postage and packing per two relays. Although these relays have a different coil resistance they are entirely suitable.

The microswitch used in the prototype was a Honeywell type V3 9001. ■

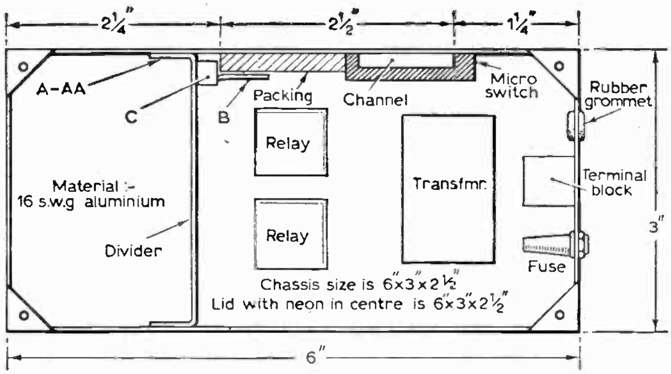


Fig 4 Underside view of the complete box showing positioning of the major components.

INTERPRETING SYMPTOMS

—continued from page 209

So far we have described conventional symptoms and how they can be interpreted to pinpoint the cause of the trouble. Sometimes more unusual faults occur and symptoms appear which may be considered unimportant and hence overlooked. Every detail, however, should be taken into consideration. A few examples should demonstrate this point.

On one occasion a radio was brought into the workshop with intermittent distortion. As soon as any attempt was made to connect test instruments, the fault cleared. It was noticed that the volume control, normally silent, became noisy when the fault occurred.

Examination of the circuit diagram revealed that the top end of the volume control was connected to the anode of the a.f. amplifier through a coupling capacitor. An intermittent leak in this capacitor would, therefore, pass current through the control and put a voltage on the grid of the following valve. The capacitor was changed and a long soak test confirmed that the fault had been cured. Failure to observe the noisy control would have meant a lot of unnecessary testing.

DECOUPLING

Another example concerns a television receiver that had a loud howl on sound when first switched on. After a few minutes this noise gradually lessened until it became just a background burble. It was then noticed that the improvement coincided with the line circuit warming up and coming into operation. Furthermore, it was found that the effect was worse with the volume control at minimum position.

A quick check with the circuit diagram produced the information that the bottom end of the volume control was taken to the line oscillator circuit in order to provide negative bias for the sound output stage through the wiper of the control. This negative supply from the line oscillator was decoupled by a 0·5μF paper capacitor.

This seemed the obvious source of the trouble and subsequent tests confirmed that this was so. Hence the defective component was localised without a single test being made, only an intelligent interpretation of the available symptoms.

Now an example of a fault where a tell-tale symptom was ignored. A TV receiver came in for repair with a blown rectifier and an h.t. short. When checking on the h.t. line with an ohmeter, it was noticed that a slight crackling occurred in the loudspeaker. This, however, was ignored and detailed tests were made isolating various parts of the receiver until the fault was eventually found in the sound output transformer.

There was a leak between the primary and secondary winding, the secondary being earthed to chassis. When testing with the ohmeter, current from the meter had been flowing through part of the primary winding, causing noise in the speaker.

It is not only essential to interpret the symptoms accurately but to correctly observe them in the first place. Sometimes a symptom may appear that is very similar to a more familiar one and hence be mistaken for it. This is illustrated by the case of one television receiver that manifested what appeared to be sound on vision.

Investigation of the sound rejector circuits and the i.f. alignment failed to bring any improvement. It was then noticed that the defect disappeared as the volume control was turned down, indicating that the disturbance from the sound was taking place from the output stage.

A closer examination of the picture itself showed that the disturbances were modulating the line scan rather than the video picture content. The trouble was then soon traced to the loudspeaker leads which were lying across pre-set line hold.

It can be seen, then, that much can be learnt about a fault and even, in some cases, a specific component pinpointed by observing and interpreting the symptoms, often without even removing the back from the receiver. ■

BY H. W. HELLYER

STOCK FAULTS

PREVALENT TROUBLES IN COMMERCIAL RECEIVERS

NEW SERIES

PART 8: Sound Channels

IN the last section we talked about the importance of tuning to preserve the available bandwidth. Whereas a distortion of the vision response curve will cause all manner of queer faults, from ringing, streaking, flattened picture to loss of sync or touchiness of either timebase, the narrower and sharper bandwidth of the sound i.f. channel is, at first sight, more straightforward. In practice, a number of faults can affect both vision and sound, but originate in either section. A typical example of an unstable i.f. stage causing the a.g.c. to block off has already been described. Somewhat similar is the common i.f. "low-load" fault, which results in poor sound but little deterioration of vision when the signal is fairly strong. An example is the Bush TV125, whose 2·7kΩ anode decoupling resistor of the common i.f. goes "high" and can cause a perplexing sound channel hum, while the lack of vision gain is not always obvious.

On the same receiver, another cause of hum may be a "return loop"; the coupling capacitor to the volume control is connected via a screened lead which may be earthed at the i.f. panel and at the control. Open the control return connection as a first test. (Refer to the remarks about "Loop Leads" on the C.R.T.S. chassis, in the last section.)

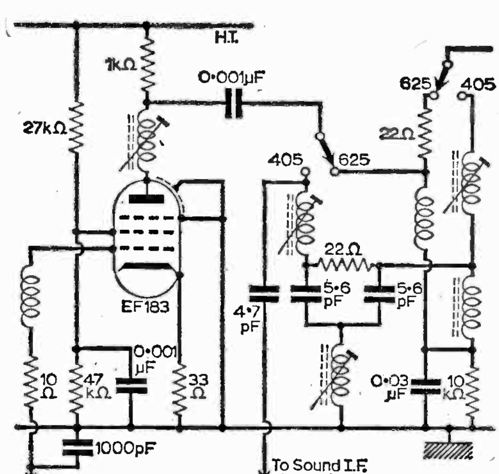


Fig. 37: Common i.f. stage of Pye TV11. Typical of modern valved design, but with features that are discussed in the text, producing confusing fault symptoms.

Another fault, "common" in more ways than one, is the sound hum which is variable with field frequency or sync input—easily tested by varying first the vertical hold then the input gain. A little thought should make it apparent that the unwanted pulses are finding their way into the sound circuits by common coupling—and the obvious route is the h.t. line. Cure—replace the smoothing capacitor. With this type of fault, and with poor sync, sound-on-vision, vision-on-sound, and a host of other "ticklish" troubles, the professional engineer wastes little time, but simply slaps a test electrolytic into the circuit. Take heed, however, and make a correct replacement. Because the capacitor is usually part of a multiple unit, the couplings can easily be between sections, and a simple bridging test may be inconclusive.

VOLTAGE COUPLING FAILURE

A further common fault which bears repeating is the voltage coupling which fails when—in most cases—a valve develops an inter-electrode short-circuit. Classic cases are the second sound i.f. amplifier of the Thorn 850 chassis, whose screen grid shares a supply with the line oscillator—the fault "killing" the set completely, after the initial puff of smoke.

A set which has several "shared" valves, and can be confusing to service is the Pye TV11 (the range can be extended in general to cover the model 15 and in many respects the 3 and 12, also the Pam 5100, 5102, 5106; Invicta 7013, 7019, 7020; Ekco T418, 419, 420; Ferranti T1093, 1094, 1095 and Dynatron TV70, 71 and 72].

Fig. 37 shows the common i.f. stage, and is typical of other makes. Note the potentiometer screen grid feed, the cathode resistor with no de-coupling, and the way the inductance in the anode is used as part of the load, the tapping to further i.f. stages being taken, via a system switch, from the junction of this inductance and the 1kΩ resistor. This inductance is used to produce the response curve shaping, actually the dip in the middle of the overall curve, and should never be twiddled in an attempt to "improve the signal".

On this chassis, the sound i.f. amplifier is part of a PCF80, the triode section being part of the field oscillator—so field collapse coupled with lack of sound may indicate simple valve failure, and is certainly first test. Similarly, the sound output valve is the pentode section of a PCL84, whose triode is the line oscillator. Going even deeper, these sections share an h.t. line in a curious fashion—the anode of the output valve being powered from the main h.t. point (silicon diode rectifier),

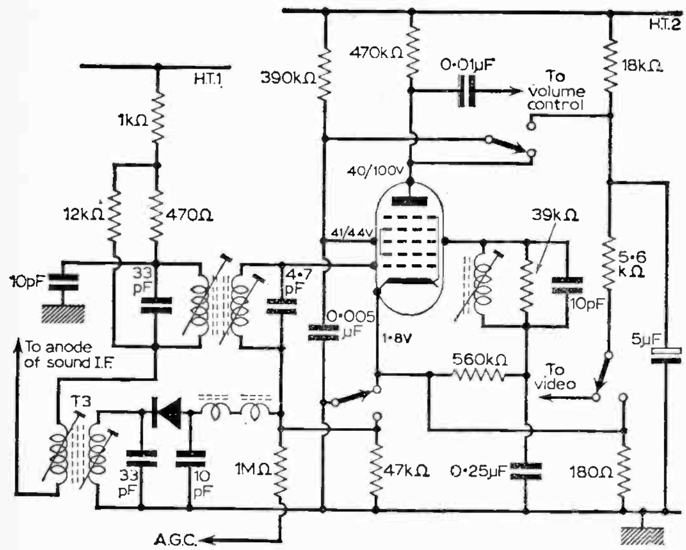


Fig. 38: AM/FM detector circuit of the Pye TV11, using an EH90 discriminator.

via the output transformer, while the screen grid of the output valve, and the anode of the line oscillator, along with other sections of the receiver, have further filtering in their h.t. supply. A common fault is partial h.t. drain, with the line output valve glowing merrily because of lack of drive and the sound signal being strangled almost to oblivion. Left to develop, the fault will eventually "kill" the set by open-circuiting the 560Ω h.t. feed. This component is mounted on the panel near the tag strip with the silicon diode on it and is easily identified. Before switching on again—always check for h.t. short-circuits or low resistances. If there is apparently *no* low resistance reading, be sceptical. The trouble is probably the PCF80, in the middle of the upper section of the chassis, whose pentode is also in the h.t. shared line and acts as vision i.f. amplifier. Check the EF183 common i.f. amplifier also—and especially check any EF184 that may have been fitted, *in any set!*

INSTABILITY & LOW GAIN

As a general rule, open-circuiting of a screen-grid decoupling capacitor in a sound i.f. stage will result in instability, whereas the load decoupling causes a drop in gain, unless the circuit is very sharply tuned. On the chassis illustrated, the secondary of the final sound i.f. (405-lines) feeds a detector circuit which in turn supplies the EH90. This valve operates as a normal driver on 405-line system and as a "locked-oscillator" discriminator on 625-lines. Fig. 38 shows the layout and the switching, and points to note are the connections to the ends of T3 itself, where poor soldering, or soldering with incomplete removal of insulated covering, can cause trouble, the filter capacitors, especially the 10pF detector filter, and the 180Ω cathode bias resistor of the EH90, which is shorted on 625-line operation. A negative voltage on the grid, or intermittent operation, especially when the set warms up, may be caused by dirty contacts on this section of the function switch.

Still in the sound i.f. section, we should take note of the decoupling troubles that some earlier Murphy receivers suffered. Howls and other protests of instability were fairly common and the V-410, V470, V430, V510, V519 receivers all had a tendency to this fault. Check the screen grid decouplers when instability is evident. On some of these sets there was insufficient cathode bypass decoupling in the sound i.f. section. The result was pick-up of field pulses, and a tunable hum, often more noticeable on one band than the other. Beware also the wiring to the volume control of these models, which is quite critical and can be another source of hum pick-up if disturbed.

Other sets in which the screen grid decoupling capacitors gave trouble were the Cossor 948 and 950 (where the series crystal diode noise limiter was also a persistent offender), and the GEC BT302 and Ekco T330 (312 series). No doubt there are others—these come quickly to mind and should illustrate the general rule—check the decouplers on the older set. Very often it is necessary to substitute rather than bridge, and also necessary to use fairly short leads and precise placing. Often, too, it is necessary to replace two or three decouplers in the i.f. strip of an older set before it can be brought up to specification. Suspect, particularly, those that are mounted in the heat field of valves.

Philips receivers seem to suffer less from these faulty decoupler faults. A quick check on earlier receivers was to measure the voltage on the grid of the first sound i.f. valve, where a heavy negative reading would indicate blocking a.g.c. action and point to an unstable valve within the loop. The usual offender was an EBF80.

A similar fault on a later range, 19TG156A, produced confusing symptoms. Sound distortion when the set warmed up was not infrequent. Crackling which varies with the signal and with operation of the volume control can also lead one astray. Check the a.g.c. voltage on the yellow wire running up the middle of the i.f. panel. Tune in a fairly good 405-line signal for this test. If there is no a.g.c., disconnect the lead and measure from pin 2 of the EF85 base at the bottom right of the panel, with valve removed. The meter should be up around the infinity mark. Anything less will indicate leakage in either the 56pF decoupler in the adjacent i.f. can, or the coil itself. The latter is unlikely.

Curiously, a similar circuit used in the Style 70 range, and shown in Fig. 39, is less prone to this trouble, so far.

Reverting to the 156—when the distorted sound

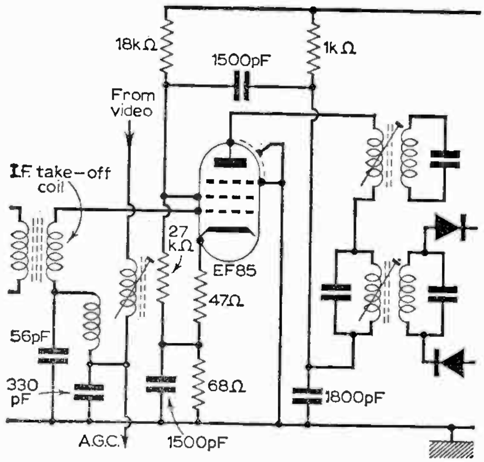


Fig. 39: Typical Philips sound i.f. circuit, as employed in the Style 70 receivers.

symptom originates in the driver section. This triode of the PCL83 is fed, as is common Philips practice, from the boost line. A reading of approximate boost volts on the anode of this valve only indicates that it is not passing current, usually because it is blocked off at the grid (check for high negative reading, 30 volts or more), and this is because the i.f. strip preceding it has gone unstable. It is at least even money that the culprit is that little 56pF in the first sound i.f. transformer can! Back to square one.

DETECTOR STAGES

Next the detector and limiter stages of the receiver, where the obvious troubles may be encountered, i.e., crystal diodes and small metal diodes generally, and limiter biasing. Here we have to be careful as the detectors used for dual-standard operation are not always what they seem to be. We have already seen a circuit of the EH90, and it is worth noting the differences in voltages on its electrodes for the two systems. Changes in quite unexpected components can cause problems. In the GEC 2000 (see Fig. 40), the grid leak of the EH90 is the not-so-obvious 1MΩ resistor that comes after the 625-line transformer winding, if we trace the circuit through. This can go "high" and the symptoms are a baffling fading on 405-line operation which can be jolted back to life by system switching, or even flicking a light switch in the room. The resistor is a little difficult to find—looking at the back of the set, the tuning coils in their cans are grouped towards the left and one is farther over than the others. Just to the right of this can is one section of the system switch, and the culprit is mounted towards the end of this. In the later, 2010 range (including Sobell 1010), the layout is more roomy, but the position and the circuit of this section approximately the same.

On the Ekco T418 range, low volume on 405-lines can be caused by the detector diode, which can go almost short-circuit yet still detect, simply because its position, feeding the EH90, allows the latter to augment the action and produce low but undistorted sound.

Diode limiters are always suspect when distorted sound appears to originate between the i.f. section and the output stage. The bias on these is important for correct limiting, but if the upper leg of a potentiometer feed goes high, or a series resistor open-circuits, the sound clipping will be quite drastic. In the Thorn 900 circuit, for example, the limiter diode receives its bias via a 3·9MΩ resistor from h.t. The general rule is, where high value resistors carry current, check that they have not gone too high.

SOUND LIMITING

But this circuit, Fig. 41, is given for other reasons: it illustrates the effect of limiting, and shows the a.m. and f.m. detector circuits very plainly. Here, if the sound limiting is not good enough, the makers advise shunting 5 to 10pF across the 2000pF section of the time-constant pair. This will cut top response slightly, and the amount of capacitance fitted depends on the cut that can be tolerated. In fringe reception conditions it can be useful.

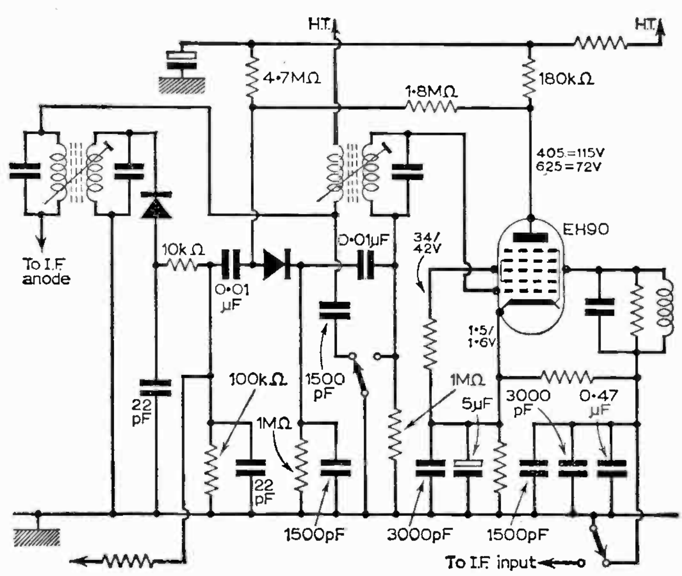


Fig. 40: G.E.C. 2,000 detector circuit, in part, showing the system switching.

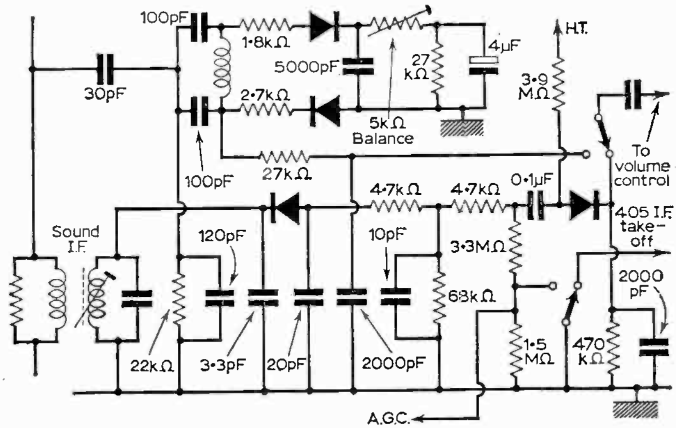


Fig. 41. Thorn 900 detector and limiting circuit, illustrating the limiting dependence on correct circuit conditions.

It is worth remembering that sound interference limiting is rather different from vision limiting, and time constant circuits are very different. The interfering pulses, a few microseconds in duration, are rapid in contrast with the a.f. waveform, and the circuit is designed to accept the slower moving voltage changes and reject the rapid variations, by the forward resistance of the limiter diode and the time constant of its associated components.

F.M. DETECTOR

In the same section of this receiver, and its companion models, the typical f.m. detector can be seen. Here, the 4μF electrolytic is a prime offender, as are the diode pair. After replacement, adjustment of the discriminator should be re-checked. This will only mean a slight movement of the core of the final transformer. The variable resistor adjacent, which is a ratio detector balance control, should not be altered. If it has been—these gremlins get everywhere, don't they?—then tune to a good and steady 625-line signal (Test Card period, tuning tone, is preferable), and reset the control for minimum "buzz".

Talking of buzz brings us to the vexing problem of intercarrier buzz, caused by many things external to the receiver, and mistakenly "tuned-out" by many field engineers. The trouble occurs when the amplitude of the BBC-2 sound carrier approaches that of the vision carrier. At the transmitter there is a 24dB depression of the sound carrier to circumvent this—but propagation conditions can play havoc with this. Ghosts, ground-effect, diffraction, bad aerial siting, all play their part. All we can do, at our end, is make sure the receiver is getting a good vision signal at a correct ratio to the sound signal.

Video frequencies on 625-line systems approach the sound i.f. and the more the h.f. content of the picture increases, the worse the buzz gets. A slight reduction of the h.f. response of the set—again, if it is tolerable—is the accepted remedy. In the Decca circuit of Fig. 42, L3 is the vision i.f. rejector, L1/L2 are tuned to pass on the 6Mc/s intercarrier signal to the sound i.f. stages while blocking it from the video, and both the 10pF and 4pF capacitors are extremely important.

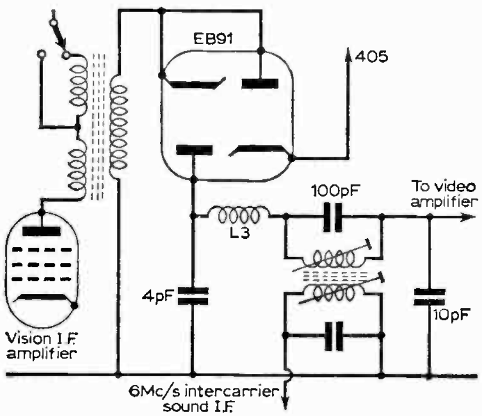


Fig. 42: Decca intercarrier take-off circuit.

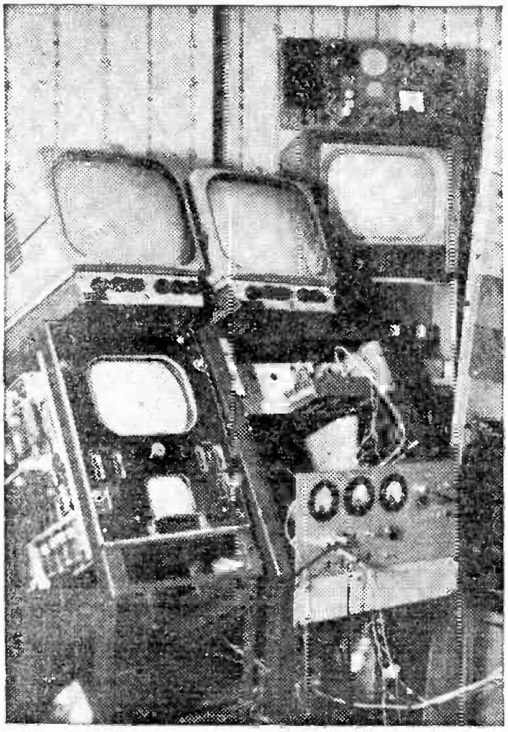
SOUND OUTPUT STAGES

Sound output stages require little comment, and there are few that depart from the conventional. Faults that occur are also conventional. Cathode bias resistors are a prevalent source of trouble, and distortion may be caused by drying out of cathode bypass capacitors. Some circuits use tapped cathode circuits to provide voltages for other sections as controls, and here the associated faults will offer clues. H.T. feed lines are another possible source. The Bush TV125 has a 2kΩ screen feed which may open-circuit.

Again, the common coupling problem can be found around the output stage. An example of simple faults with perplexing symptoms could be found in the Murphy V320, where a chassis return of the width coil went to a tag on the screw holding the same return connection for the secondary of the ouput transformer. Loose screw—audio in the line circuit—baffling sound-on-vision.

TRICKY FAULTS

Another tricky one is sometimes found on the Philips 23TG164A range, where two loudspeakers are employed. These are in series, and if the connections to the tags are reversed, the speakers are out of phase, with results generally summed-up as "weak and widely varying sound". This was almost as bad as the c.r.t. earthing spring of certain Pye models, which caused hum pickup, usually on one channel only. Life is full of variety —thank goodness!



IDEAS FOR..... amateur TV

M. D. BENEDICT.

Part VIII

ALTHOUGH the pulse generator as described last month is complete, there are two very useful additional items of circuitry. These circuits control the pulse generator by altering the master oscillator frequency. The first circuit locks the field pulses to mains frequency, so reducing the effect of hum bars on viewed pictures. Hum bars can occur anywhere in the transmission chain and are usually caused by slight hums from the power supplies.

The mains lock circuit (Fig. 46) consists of a bistable multivibrator which divides the field drives by two, followed by a monostable multivibrator. This delays the 25 cycle pulses from the bistable multivibrator by a variable amount, so varying the phase of these pulses relative to field drive. The pulses from the monostable multivibrator are differentiated, amplified and clipped to produce fairly narrow pulses to be fed into the phase splitter which drives the diode bridge. About 4 volts of 50c/s a.c. from the mains (via a transformer) is fed to this bridge, where it is sampled by the pulses. The d.c. output from the bridge is smoothed and used to control the master oscillator. The crystal oscillator is switched off for this mode of operation and bias for the master oscillator astable multivibrator is derived from a different bias chain fed through the bridge. This is set to operate the master oscillator at a similar frequency as a crystal oscillator when the mains reference is not applied to the bridge. When correctly set up the pulse generator will pull smoothly into lock with little or no disturbance when switched to the master oscillator.

Alterations to the original master oscillator circuitry (Fig. 41) are as follows:—The connection to the slider of the bias potentiometer of the original master oscillator circuit is broken and a

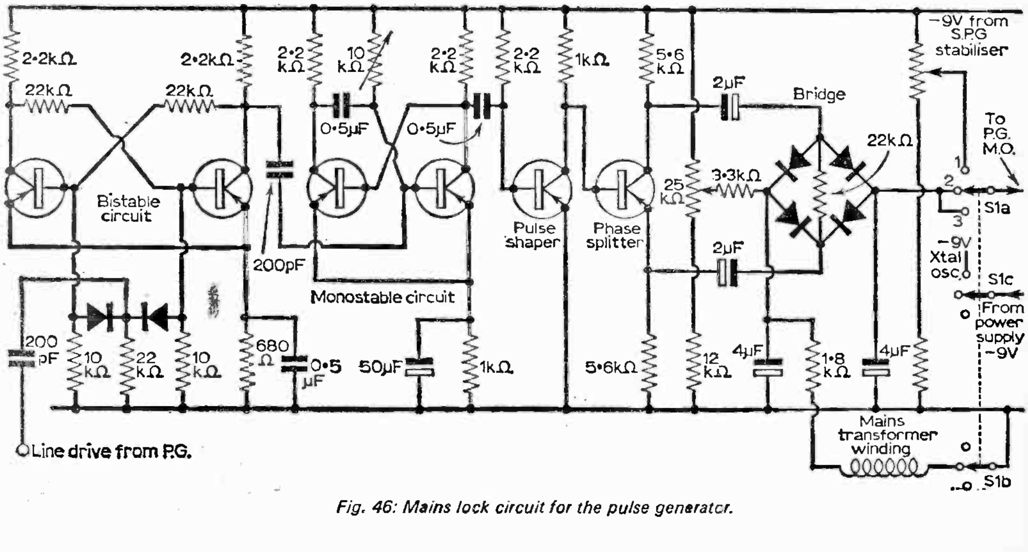


Fig. 46: Mains lock circuit for the pulse generator.

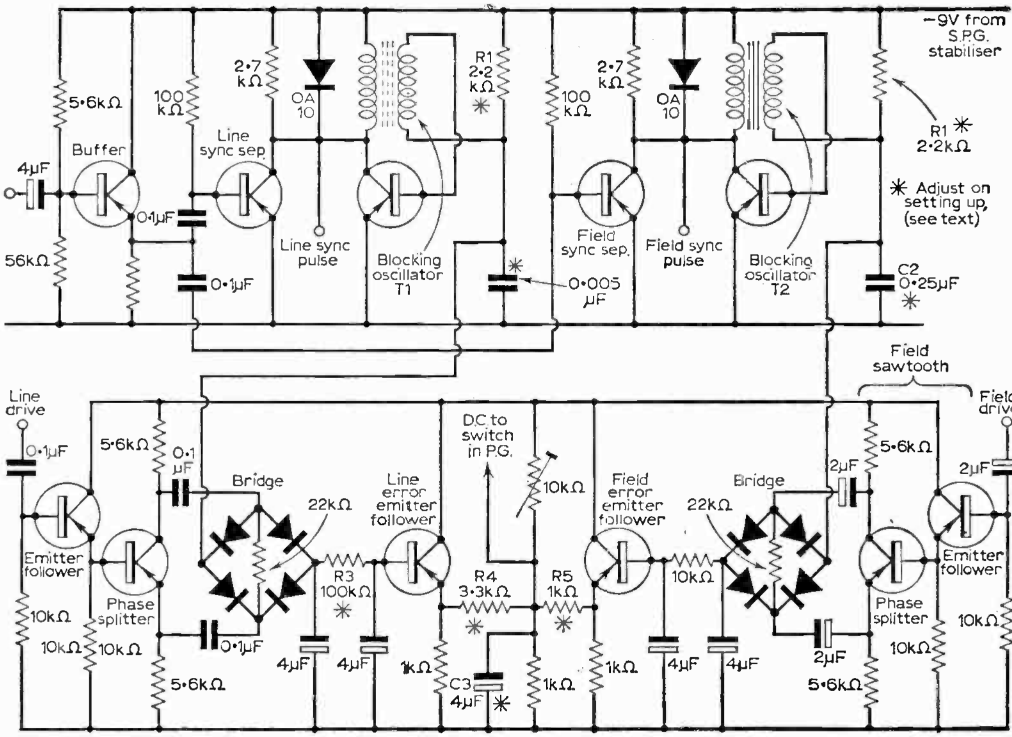


Fig. 47: The genlock circuit. C1, referred to in the text, is the 0·005μF capacitor at the junction of R1/T1.

3-pole, 3-way switch is inserted. Position 1 is crystal control and the bias to the bases is fed as originally shown. Position 2 and 3 breaks the -9 volts to the crystal oscillator and feeds bias from the bridge to the bases, and in position 2 a.c. is fed in to the bridge. In the prototype circuit 4 volt r.m.s. is fed to the bridge via a padding resistor. However, other voltages of 50c/s could be used as convenient with suitable adjustment of the padding resistor.

This circuit and the genlock circuit which follows could well be built as part of the pulse generator proper and similar construction is suggested. Transistors and diodes used in these circuits are similar to those used in the pulse generator.

Error Signal

The genlock unit alters the local pulse generator to bring it into exact synchronism with a video signal from a remote source, that is, a source driven by another pulse generator. This facility is useful for demonstrations where remote sources such as one of the national networks or signals from another amateur, transmitting from his home, can be treated as a local source. The differences between local and remote sources will be discussed when dealing with the vision mixer.

The genlock unit produces an error signal which controls a master oscillator, which controls the mains lock circuit (Fig. 47). Remote signals are fed via a buffer stage to two sync. separators, followed by blocking oscillators, one for line syncs. and one for field syncs. The blocking oscillator transformers are the normal line or field blocking oscillators found in many types of valve television sets. Although the exact choice of transformers is not critical, it may be necessary to try several types with various values of capacitors C1/C2. A rough sawtooth is obtained at the points marked and are then fed to the bridges. Line and field syncs. are fed to phase splitters and the output of these is used to "open" the bridges and the line or field sawtooth signals are sampled. As can be seen in Fig. 48, when the sampling pulses (line and field drive) sample the sawtooth a pulse proportional to each amplitude of the sawtooth at the moment of sampling is produced These pulses are smoothed to a varying d.c. level for filter circuits and fed to emitter followers. The line and field phasing control signals are combined; but the field error signal has more effect due to the smaller padding resistor (R5), hence field phasing takes place first, and, while this is being performed, the line error filter circuits smooth out the changes in line phasing control voltage and the field phasing has to be nearly complete with the rate of phase change very small before line phasing takes effect.

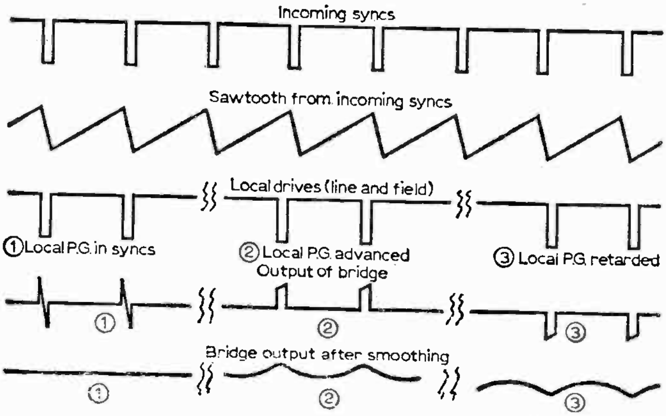


Fig 48: Waveforms for the genlock unit.

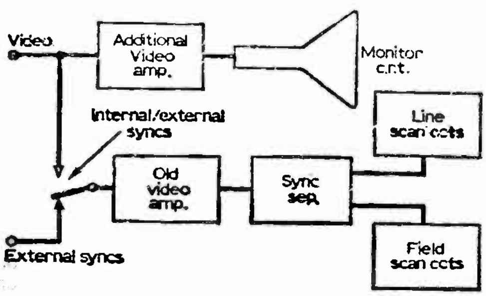


Fig. 49: Block Schematic of genlock monitor.

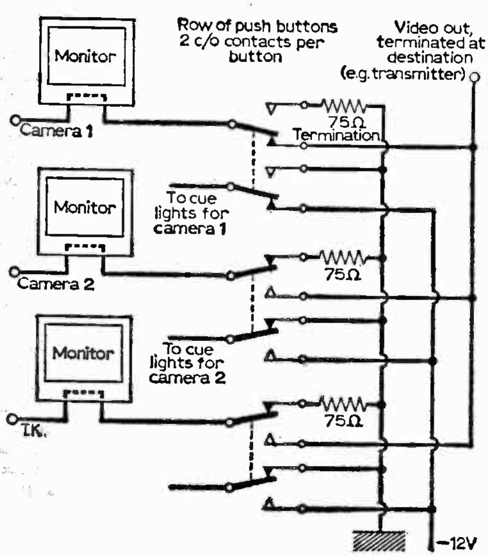


Fig. 50: Basic circuitry of video "switch".

The exact balance of the time constants for the various parts of the circuits will depend on the master oscillator characteristics and several components may need adjustment.

R1 and C1 are adjusted to give correct locking and line pulse width out of a blocking oscillator. R2, C2 perform a similar function to the field pulses. The pulse width should be similar to the line and field drives on the particular line standard used for the pulse generator. With the sawtooth input to the bridges removed, the 10kΩ pot. is set for correct master oscillator frequency. Connecting the field sawtooth to its bridge R5 is adjusted in conjunction with C3 to give a suitable rate of locking for the particular pulse generator in use. Too high a rate of locking will disturb the field divider and will affect some VT recorders (these are occasionally hired for use in demonstrations and several amateur groups are developing video tape recorders, so this point should be borne in mind). A 10-15 sec. pull-in from a maximum field phase error is satisfactory for most uses. With the line sawtooth reconnected, R3 may need reducing if the line phasing is sluggish while R4 balances the line phasing and field phasing control voltages and should be the minimum consistent with reliable locking from all phase difference between the two video signals. When setting up these circuits a convenient remote source is one of the national networks taken from an 'off air' receiver. However, occasional pulse disturbances may take place, which may affect the operation of the circuits and this should be borne in mind.

The stable control of the pulse generator should occur when local drives are in synchronisation with the syncs. of the incoming video signal. This means that local line sync. pulses are 1·5μS. after the incoming line syncs. This is not a great disadvantage as the syncs. still lie within the blanking period, but if desired, a monostable delay unit such as described for the pulse generator should be placed in the line drive fed to the genlock unit. Varying this delay would give control of the line phasing, a useful facility if the unit were to be used in several different studio layouts.

Genlock Monitoring

There are two techniques of "viewing" the pulses during genlock; the most obvious method is used of a twin-beam oscilloscope triggered by field drives. Although more complex, a better method is to use a specially modified monitor whose scans are driven by local syncs. and displaying a remote vision source on the tube. When the sources are not synchronous the display is similar to that obtained mis-alignment of line and field holds, however, when genlock is achieved the display becomes stable as the local and remote syncs. are then in step. Fig. 49 shows a schematic for this monitor where the original video amplifier is fed by local sync. pulses and drives the sync. separator and uses the scan circuits. Remote video signals are fed via a new video amplifier circuit (similar to that shown in Part V) to the tube. An internal/external switch restores the operation to normal by feeding the incoming video to both amplifiers should this facility not be required all the time. This system gives positive indication of the state of genlock, so is used in most professional studio centres.

All the vision sources are fed to the vision mixer, which allows the selection of any source by switching, by mixing or by wiping from one to the other. It is convenient to have the vision mixer controls mounted on a panel in a control desk in front of the camera and other monitors. Usually much of the studio apparatus, such as pulse generator, power supplies, etc., are mounted on racks or similar frameworks. In this case, the video must be fed from here to the control panel and back again, unless the control panel operates remote switches and faders mounted in the apparatus bay. The latter course is the most popular, and modern techniques encourage this form of construction, although it is more complex.

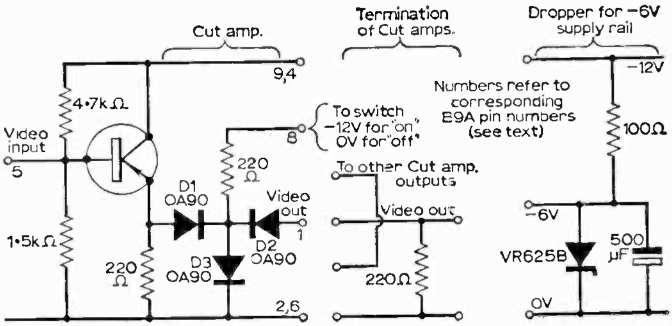


Fig. 51. Cut amplifier and associated circuitry.

Video Switching

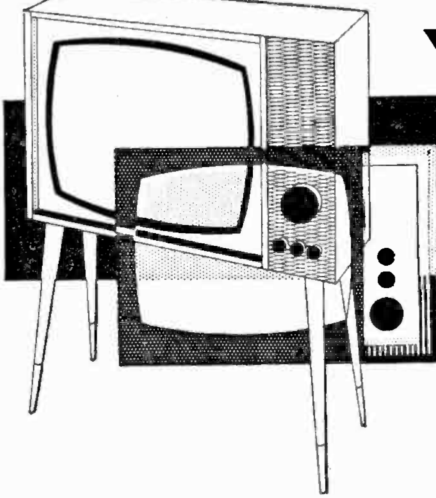
Cutting can be performed directly on a row of push buttons. Each button should be latching and must carry two changeover contacts, one for the vision, the other carrying d.c. to switch cue lights on cameras and monitors to indicate which camera is "on the air". The video contacts are wired as in Fig. 50 where the monitors are shown "looped through". Direct switching of the video in this manner has several disadvantages, as mentioned earlier, video has to be fed to and from the buttons mounted on the control panel, requiring extra coaxial cable. Alternatively, the video is actually switched on relays, but operated by the push buttons on the control panel, mounted in the apparatus bay with the rest of the equipment. In this case only one set of changeover contacts are required and the relays operate off the same d.c. as the cue light. Miniature sealed relays tend to minimise a basic fault on mechanical switches, that of flashing occurring during the switching, caused by dirt on open contacts. Disturbances to sync. pulses are a similar problem with all mechanical switching systems, although sealed relays also minimise this fault. Ordinary relays suffer from h.f. loss as well as faults due to dirty contacts as above. With a mechanical switching system, each channel is always terminated in a 75 ohm load, as, when it is selected, the channel is fed to a cable feeding monitors or transmitter and this cable must be terminated at its far end. To avoid changes in level when selecting a channel, channels not selected are terminated with a resistor so that the input impedance is constant. In Fig. 50 and other diagrams in this article, the outers of the coaxial cables are not shown, but, in fact, they are earthed at the input and output sockets and coaxial cable is used for internal wiring. Coaxial cable used in this manner isolates each channel from the others, reducing crosstalk and making layout unimportant.

Electronic methods of switching do not suffer from any of the above disadvantages, and with transistors the units are both more compact and cheaper than sealed relays. Fig. 51 shows such a switch controlled by d.c. from push-buttons.

The switch, generally called a cut amplifier, is an emitter follower followed by three diodes. D1 and D2 conduct, passing the video, when the control voltage is negative, while D3 is cut off. When the control is positive, D1 and D2 cut off, blocking the video. D3, however, conducts and removes any remaining video which passes through the capacity of the reversed biased diodes. The load resistor is common to all the cut amplifiers and the selected output is taken from across it. In order to bias the cut amplifiers fully off, the power supply is split to give a −6 volt supply as well as −12 and 0 volts.

Although these amplifiers produce a clean cut, a certain amount of d.c. bounce occurs, disturbing the brightness at the instant of cutting. If, this cut occurs during field blanking, this is avoided, so an additional circuit for inter-field cutting is required. This consists of two gating circuits which allow field drives through one circuit when biased negative. The field drives then switch the bistable multivibrator which follows the gates into the "ON" state (negative output to video switch). When the push button is cleared, the bias becomes positive, the first gate ceases to allow field drive through. However, the second gate feeds field drive through to a second input to the bistable circuit and this switches it into its other state, so the output goes positive. Switching of the bistable only occurs with a field drive pulse, so the vision cut occurs during field blanking. Field drives will continue to arrive through the gate to either input of the bistable but having once made the switch, successive pulses have no further effect. Such a mode of operation is called a "toggle circuit".

To be continued



Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from page 237 must be attached to all Queries, and a stamped and addressed envelope must be enclosed.

FERGUSON 505T

I have installed a Pye/Ekco transistorised u.h.f. converter and find that I cannot obtain full width on 625 operation. The picture is 2in. short at each side of the screen, has a 1½in. shadowy fold at the right-hand side and the brilliance is set higher than normal.

I have tried reducing the 3rd harmonic pulse capacitor C76 to 30pF, increasing C78 by 300pF and installing a variable resistor in series with C71, but none of these alterations have been successful. — C. R. Pullin (Newcastle - upon - Tyne, 2).

Remove the width control L42 and R97 from the circuit and use the closed loop sleeve on the tube neck for adjustment. Make small alterations to C76 and C78 for optimum scan and change C77 to 0·1μF if necessary.

MURPHY 410

This set has an intermittent fault which takes the form of a sudden jump from a well contrasted picture to one lacking contrast and focus. The sound is not affected.—J. Small (Henley-on-Thames, Oxfordshire).

We would advise you to check the 30FL1 video amplifier and its 16μF h.t. decoupler.

BUSH TV85

This set takes about three to four minutes for a picture to appear after switching on. When the picture does appear, it continues to get brighter for the first half-hour so that the brightness and contrast controls have to be set a number of times before the picture finally settles down.—D. James (Swansea, Glamorgan).

The heater circuit thermistor may be faulty and should be checked by noting how long it takes for the valve heaters to glow normally. If the heating up time is normal try a replacement PY81 if the e.h.t. whistle is delayed, and the PCF80 video amplifier if the line timebase whistle is normal.

STELLA ST6417U

This set has a line linearity fault on which the control has little effect. This takes the form of stretching on the left hand side of the screen. —J. Nichols (Kendal, Westmorland).

Check the PL81 valve and the components associated with the width and linearity coils, especially the 6·8kΩ resistor and 390pF capacitor.

K-B KV005

I am having trouble with the u.h.f. tuner. BBC-2 reception varies from excellent to very poor, and sometimes disappears altogether. Replacement of the PC86 brought the picture back, but the fault persists.—N. Collins (Brighton, Sussex).

If the fault lies in the u.h.f. tuner the best plan is to let your dealer send the tuner to the manufacturer for repair. This procedure is, in fact, suggested by the manufacturers themselves as there are many problems in re-setting this type of tuner for optimum performance, and special instruments are required. However, make sure that the u.h.f. aerial is in order.

PYE C17

The picture is slowly closing in from the top and bottom. I have changed PL83, PL81 and PCF80 in turn in the hope that I could open the picture, however, this has made no difference.

If lack of width should occur at some time, could you please tell me what might be the possible cause?—G. Ibbs (St. Neots, Hunts.).

There are so many variations in the chassis likely to be encountered in your receiver that it is difficult to give specific advice. Check the screen grid and cathode electrolytic decouplers of the PL83 (if fitted) and check the boosted h.t. line which supplies the ECC82 oscillator valve via the vertical amplitude control. A first anode lead on the c.r.t. can produce a low boosted h.t. line.

Lack of width is usually due to low h.t. caused by a faulty h.t. rectifier.

PYE VT17

I have replaced the selenium rectifier with a BY100. I have also replaced the main smoothing capacitor. The line timebase valves have been replaced together with those in the field time-base, sync separator and turret. The picture still continues to jump all the time and cannot be stopped.

The line hold control is rather critical and either side of a point the vision-on-sound noise is very loud. Cramping on the right side of the picture is evident and the verticals on the picture mostly to the left-hand side, have a double curve in them from top to bottom.—L. Whittall (Oldbury, near Birmingham).

Make sure that you have not given your receiver excessive h.t. by fitting a BY100. Other causes of your symptoms are imbalance in the flywheel sync discriminator section, or a fault in the i.f. alignment.

DEFIANT 9A41

I should like to know which tuner is fitted to this set and also if there are any difficulties in fitting the u.h.f. tuner. — J. Adamson (Fife, Scotland).

The tuner used is a standard "Fireball", by A. B. Metal Products. Conversion to the 625 standard involves the replacement of the i.f. panel as well as the fitting of the u.h.f. tuner.

FERGUSON FR20

When switched on, I have to re-set the horizontal hold control two or three times on account of the picture pulling across the screen. I have replaced many valves.—F. Ramsey (Knottingley, Yorkshire).

Replace R71 560kΩ, which seems to be changing value. Check C59 if necessary.

EKCO T283

Will this TV take a 17in. picture tube (electrically speaking: i.e., CRM171 or CRM172)? It originally had a 14in. CRM141 but from the service sheet it would appear that the T284-17in. version of the T283 using a CRM171—uses the same chassis.

Presumably if the 17in. CRM171 fits, then the 21in. CRM211 will also fit.—J. Cross (London, S.W.13).

You are correct in assuming that a CRM171 or CRM172 can be fitted without any electrical modification. A softer picture will result if you fit a 21in. tube. For this reason we recommend that you should not try any bigger tube than a 17in.

MURPHY V759

I find that the contrast control has little effect when fully on, which makes the picture rather grey and dull. Substitution of most of the valves does not improve the performance.—J. Williams (Gwalchmai, Anglesey).

The symptoms suggest that the tube is failing but it would be as well to check the video amplifier and associated components.

PAM T908

Distortion of the sound low notes has occurred. I have changed V14 (EF80), V15 (EF80), V16 (ECL80) and have renewed C85 (112μF) and C87 (200μF). I have also substituted a good known loudspeaker.—J. Somers (Portsmouth).

A frequent cause of the symptoms you describe is instability of the last sound i.f. stage, due to a faulty screen grid decoupling capacitor. Check also the bias decoupling electrolytic on the sound output valve.

K-B LFT50

The sound and vision are perfect on BBC-1 (local channel 2). No sound and vision present on ITV (channel 12 coils which I obtained from the manufacturer). The roof-mounted aerial provides an excellent signal to both channels of another TV set I have.—H. Croot (Oxford).

The trouble—if not in the aerial—must lie in the tuner. Perhaps the channel 12 coils are not correctly set-up to the signal. Adjust the core in the oscillator coil, for instance, with the fine tuner at range centre for maximum sound and best picture.

MURPHY V270

The picture is excellent when working, but once or twice during the evening the picture seems to break up. Just before or just after this occurs, the picture rolls upwards and the flyback lines appear.—S. A. Whitmill (Andover, Hants.).

It would appear that a disturbance occurs in the vision strip which upsets the video and sync stages. This could be merely a poor valve base contact, a dry joint, a faulty capacitor (decoupling) or even incorrect i.f. (sound rejector?) alignment.

HMV 1870

I am getting a cog wheel effect on ITV with bent verticals, also with "pulling" to the left, yet on BBC it is perfect.—J. Malpass (Walsall).

Since the BBC picture is unaffected we feel that the trouble lies either in the ITV aerial system or diplexer. It is possible that the aerial signal has weakened due to a fault here. Another possibility is misalignment of the tuner, for in this event the sound would be weak and the fine tuner would have to be turned fully one way or the other for reception.

MARCONIPHONE 4613

When I change from 405 to 625 the picture breaks up horizontally. This cannot be cleared with the line hold control. If the preset line hold control inside the set is altered, I get a perfect picture. When changing back to 405 the control has to be reset.—E. Lawrence (Bulwark, Chepstow, Mon.).

We feel that the trouble lies in the preset and main control line holds. Carefully adjust the main control for 405-line lock and then the preset for 625-line lock. This should balance the circuits over the two standards. If not, then there may be a change in value of an associated resistor or capacitor.

EKCO T221

The fault is a dark screen in the centre. I can just about see the lines in the raster at the top and bottom. By adjusting the brightness control, it makes the raster disappear. I have checked all the voltages at the c.r.t. base.—H. Kirby (New Barnet, Hertfordshire).

Check the 10F1 video amplifier valve. If this is not at fault (heater-cathode insulation failure) check the 6D2 and vision i.f. 10F1 valves.

PETO SCOTT 733

When switching on recently, no stations could be received, although a correctly shaped raster was seen and there is the normal hiss and hum on sound. The aerial socket is "dead"; the tuner controls have no effect. All heaters are alight and all other controls work. I have unsuccessfully changed the PCF80 frequency changer.—R. Field (Stonehouse, Glos.).

The PCC89 valve is probably at fault but there is no reason why there should not be a defective resistor in the tuner unit. Check these possibilities and then check the EF85 valve and stage resistors, etc.

BUSH TV97

The picture width is 1in. short either side. I cannot trace any width control. The adjustment on the neck of the tube does not give sufficient width.

The field control is critical—the picture tends to roll and lock in the wrong position.

Also could you tell me the method of access to clean the face of the c.r.t.—J. Begg (Renfrew).

Check the PL81 line output valve and change the h.t. rectifier if the h.t. voltage is low.

Check the high value resistors associated with the ECC83 pins 1 and 2.

To get to the tube face, release the top center screw and bottom chassis screws. Release the push-button screws (do not remove) after pulling off the front.

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PRACTICAL TELEVISION, FEBRUARY, 1967

TEST CASE -51

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.

? *This trouble occurred on a GEC Model BT302, it being found impossible to obtain maximum sound consistent with good vision by adjusting the fine tuning control. If the control was adjusted for the best sound, the picture quality was poor, while if the adjustment was made for the best picture quality (i.e., definition and brightness) there was no sound.*

This effect is often caused by alignment drift of the sound and/or vision i.f. channel, but in this case examination showed that the tuning cores were solidly locked by wax and had not been tampered with. Substitution tests of associated i.f. and rejector fixed tuning capacitors proved these to be in order.

Not having equipment for re-aligning the set, the experimenter was stuck. What other simple tests could he have made to establish the cause of this trouble?

See next month's PRACTICAL TELEVISION *for the solution to this problem and also for a further item in the Test Case series.*

SOLUTION TO TEST CASE 50
Page 188 (last month)

A glowing red hot screen grid in the line output valve usually signifies lack of anode voltage, the screen grid then passing all of the cathode current. Since this trouble was not present on 625 lines, yet the whistle was present on 405 lines, even though weaker than normal, the implications are normal operation of the 405-line line timebase generator and lack of line output valve anode voltage on this standard.

Tests, in fact, proved these deductions, and subsequent testing was concentrated in discovering the reason for the anode voltage collapse on the 405-line position. It is not good policy to make d.c. voltage measurements at the line output valve anode for fear of high amplitude pulse voltages damaging the testmeter. A voltage test was thus made at the anode of the PY800 boost diode, and the voltage was lacking here.

Further investigations showed that the circuit on this electrode was completed via the width control, the standard changeover switch section and a winding on the line output transformer. With the set switched off, continuity tests cleared both the switch section and the width control, but the transformer winding was found to be open-circuit.

This winding was located in the third-harmonic tuning and on 625 lines was shorted out normally by the switch section. Thus, only on 405 lines was there a lack of supply to the line output valve anode. A temporary cure was effected by shorting the coil with a length of wire, pending the arrival of a replacement line transformer.

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