Practical TELEVISION

JANUARY 1967

2/-

COMBINING THE BAR/PATTERN GENERATOR & AERIAL INTERCOM

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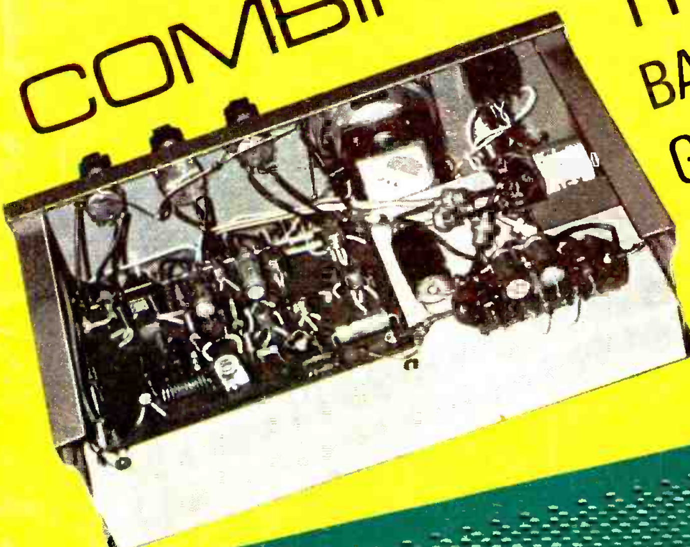

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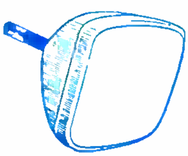

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Practical Television

ASSAULT ON DODGERS

JANUARY 1967
VOL. 17 No. 4
issue 196

AT last the Government is stirring itself for a vigorous assault on the ranks of the TV licence dodgers. The PMG is to introduce a Bill, and may well have done so before this gets into print, which should have the effect of prising a large proportion of the missing £10,000,000 per annum from the tight pockets of the 2,000,000 bilkers who are currently having a free TV ride on the backs of those honest enough to pay their way.

The provisions, we understand, will be two-pronged. The present maximum fine of £10 for operating a receiver without a licence is to be raised to something in the region of £50. This is a more realistic deterrent, since on the present basis, a dodger can get away with it for at least two years and even if caught will not be the wrong side of the ledger.

Retailers will be required to make a register of all customers buying or renting a set; the names and addresses to be submitted to the GPO for checking. Dealers and their trade organisation RTRA are strongly opposed to this and similar previous suggestions on the grounds that they would be acting as snoopers. We cannot entirely agree with this self-imposed definition for in this bureaucratic age we are all involved frequently in many more searching invasions of privacy than simply leaving a name and address!

While behind the PMG in his drive, we would consider it a gracious gesture if the forthcoming legislation could provide for a reduced fee for old age pensioners, for whom TV is a great comfort and for whom the licence fee is often a real problem. It would be tragic to see such people in court facing a £50 fine. It behoves all of us in better circumstances to ensure that neighbouring OAP's are not placed in this position.

A Happy Christmas and a Successful New Year

from the Editor and staff of
Practical Television

W. N. STEVENS

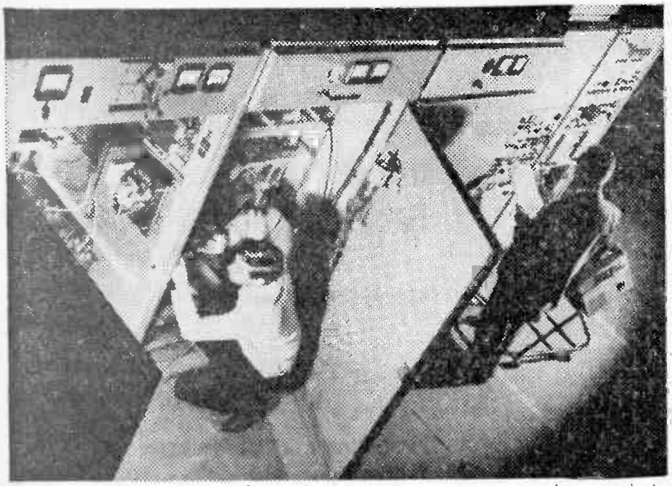
L. E. Howes, G3AYA — C. R. Riches
D. L. Gibson, G3JDG — D. C. Rolfe

THIS MONTH

OUR NEXT ISSUE DATED FEBRUARY WILL BE PUBLISHED ON JANUARY 20

TELETOPICS

British firm supply Danes with their first u.h.f. TV transmitter



DENMARK'S first u.h.f television transmitter, to be used for colour and u.h.f. propagation tests, is to be supplied by The Marconi Company. The transmitter will be installed at Gladsaxe, a suburb of Copenhagen, where black and white technical test transmissions are due to begin early this year, a preliminary to the start of experimental colour television broadcasts.

In the foreground of the photograph, work is shown in progress on the equipment section containing one of two 10kW klystron output tubes used in the transmitter.

EEV HIGH POWER KLYSTRONS IN NEW BBC TV TRANSMITTER

THE British Broadcasting Corporation have just placed the following orders for High Power u.h.f. Television Transmitters: Three 40kW transmitters from the Marconi Company Ltd. These will use EEV K3017 series Klystrons and associated mounts.

Three 25kW transmitters from Pye T.V.T. Ltd. These will use EEV K3014 series Klystrons and associated mounts.

Five 10kW transmitters from Pye T.V.T. Ltd. These will use EEV K370 series Klystrons and associated mounts.

EEV High Power Klystrons have already been ordered for use in transmitters being built in Germany, Denmark and Finland. Transmitters made in the U.K. are destined for Switzerland and Sweden.

'Virgin line' technique for Army

RR WIRED SERVICES (a division of Radio Rentals) has been awarded a contract worth £8,581 to install a v.h.f. wide band television relay system in the Army Married Quarters, Colchester.

This system, which will employ "virgin line techniques"—technical description of a signal carrying cable between amplifiers being unbroken, thus ensuring a pure quality of signal. The alternative would be the insertion of distribution and junction boxes throughout its length. The latter would have caused a degradation of signal quality—will be capable of distributing up to eight television channels with six v.h.f./f.m. radio channels also.

MUIRHEAD AT MILAN

MUIRHEAD & COMPANY LIMITED were showing precision electrical instruments, synchros and servo systems and fascimile communication systems at the International Exhibition of Automation and Instrumentation held in Milan from November 19 to 25.

The display was organised in co-operation with Muirhead's Italian representative, Ing. Silvio Garrone S.R.L., 40 Via Marco Besso, Rome.

Other instruments on show included oscillators and wave analysers, and there were also displays of standard cells, resistors and switches.

BOAC ORDERS

BOAC has placed a further order for airborne navigation and communication equipment with The Marconi Company for their fleet of VC-10 and Super VC-10 aircraft.

Equipment in the new order includes v.h.f. communication and navigation systems, automatic direction finding equipment and Doppler navigation systems.

TV Relay at Leigh Park, Portsmouth

RR WIRED SERVICES have been awarded the contract to install 900 houses with a television relay system at "The Warren", Leigh Park, Portsmouth. The Council will pay the complete rental for this installation. The relay system will be provided with full maintenance facilities from the Company (a division of Radio Rentals) and seven-day weekly monitoring arrangements and service will be carried out from their central control at Elm Grove, Portsmouth, wherefrom the existing relay service in the City is already being monitored.

LATEST BBC-2 LINK

THE latest Post Office TV link, to carry BBC-2 programmes to Pontop Pike, County Durham, is now in operation. This is one more link in the nation wide chain engineered to 625-line colour standards which now extend from Glasgow to Southampton and Cardiff.

AUSTRALIAN—BRITISH TV LINK UP

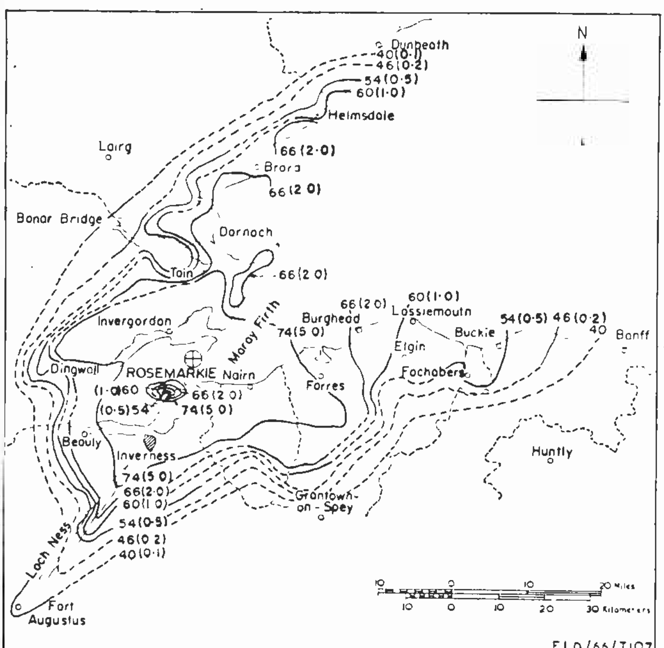
THE first live television programme between this country and Australia at 0625 on the morning of November 24th was introduced by Raymond Baxter and lasted for 22 minutes and included 12½ minutes of live material. There was, however, one small break in the picture. Raymond Baxter explained that the satellite was 25,000 miles above the Indian Ocean and that the pictures travelled 55,000 miles to reach this country.

There was no vision programme in Australia because pictures took several minutes to switch in the other direction but a recording of the programme made over here has been flown to Australia and was seen there a few days later. Aubrey Singer, head of Outside Broadcasting Features and Science Programmes, and William Cave, Programme Producer, commented that they were absolutely thrilled and delighted by the pictures from "down under". It was another major step forward in what will eventually be a round the world television service operating 24 hours a day. A BBC spokesman said that it was a marvellous achievement on the part of the BBC television engineers, the G.P.O. engineers and those of ABC television in Australia. The Americans, who were responsible for putting the satellite into orbit, should also be included in this tribute.

BBC-2 EXTENSION AT OXFORD TRANSMITTING STN.

THE BBC has placed a contract for the construction of an extension at the Oxford transmitting station to house the u.h.f. transmitting equipment for BBC-2.

It is expected that the BBC-2 service from Oxford will start towards the end of 1967. It will be on channel 63 with horizontal polarisation. Oxford itself, and a surrounding area including Wantage, Banbury, Buckingham, Aylesbury, Wallingford, Witney and most of Swindon will be served.



Engineers' Day Exhibition

TO encourage more young people to become engineers, the Government has sponsored "The Engineers' Day" exhibition at the Science Museum, South Kensington. The exhibition opened on November 18th and runs to January 14th. It is open from 10 a.m. to 6 p.m. Mondays to Fridays and from 2.30 p.m. to 6 p.m. on Sundays. Graphic displays, with films and lectures, have been designed to promote an awareness of the importance and achievements of engineers and technologists. Over 7,000 sq. feet on the ground floor of the Science Museum have been given up to the exhibition.

EMI AND SONY

EMI Electronics now have franchise for the sale of the Sony BV 120E Video Tape Recorder System through the United Kingdom, except for medical and industrial X-ray applications.

NO TV IN THE HOUSE

BY a single vote on November 24th the Commons rejected a proposal to hold an experimental closed-circuit televising of its proceedings. The vote was 131 to 130 and M.P.s were allowed a free vote. The delight of the opponents of this experiment was so great that the Speaker of the House had to reprove them.

The supporters of televising proceedings probably feel that the low total vote means that the decision cannot be expected as final as 360 M.P.s apparently did not think the issue important enough to vote on.

Rosemarkie BBC-1 Television Service

THE field strength contours on the map on the left represent estimated average values in decibels relative to the microvolt per metre (in brackets, millivolts per metre), for a receiving aerial height of 30 feet. The field strength at a particular site may differ by as much as 10dB (3-1) from that indicated.

Transmissions are on channel 2 with horizontal polarization. Vision frequency is 51·75Mc/s and sound frequency 48·25Mc/s. Maximum vision e.r.p. is 20kW with a directional aerial.

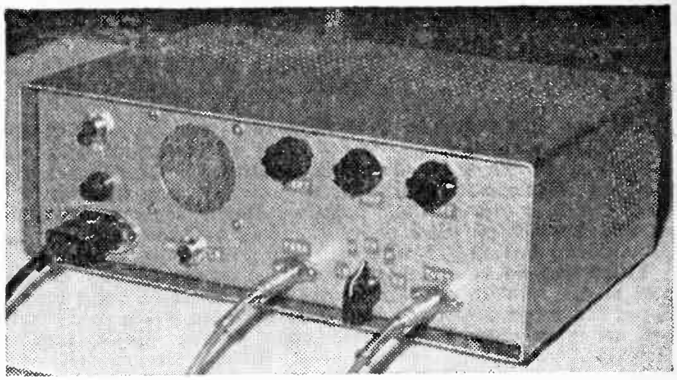
Combining the

Aerial Riggers' Intercom

and the

Bar and Pattern Generator

into a



SET INSTALLERS' HANDY UNIT

THIS article describes how the *Bar and Pattern Generator* and the *Aerial Riggers' Intercom*, which were featured in the November and December 1966 isues of PRACTICAL TELEVISION respectively, can be combined to make an extremely versatile unit for the set installer. Although the complete unit is small and has its own mains power supply, there is room to add extra circuits to meet individual needs. For example, one could easily include an efficient u.h.f. generator and detector for signal tracing.

If additional controls are consequently required on the front panel, various possibilities are available to the constructor. The existing potentiometers, for instance, may be replaced by tandem types, with the extra sections controlling the additional circuitry. The function selector switch S2 can be replaced by one with an appropriate number of extra positions.

Slight rearrangement of the panel would readily enable further controls to be accommodated, since in spite of the small size of the unit, the internal construction is not congested. Layout for the

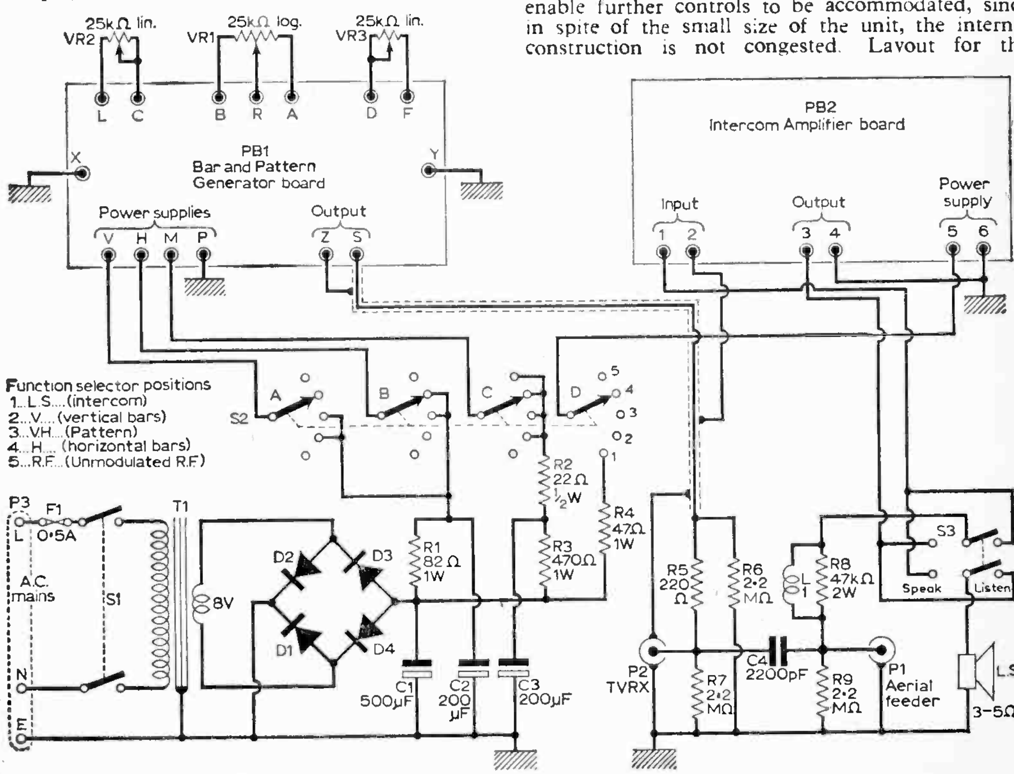
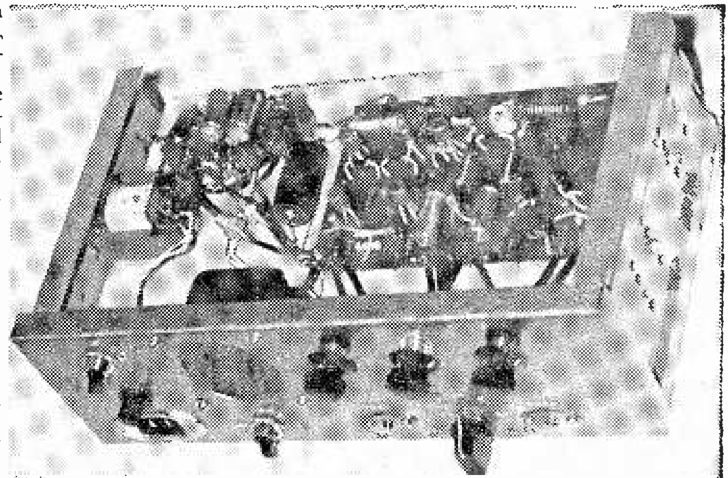


Fig. 1—Circuit o comp ete uni

existing circuitry as described in the present article is not critical, except for those points mentioned explicitly below.

For the composite unit, the bar and pattern generator circuit board on the one hand and the intercom amplifier on the other have been listed as respective "single components". They should be constructed according to the information given in the individual articles, but ignoring all components not actually on the boards themselves.



by M. L. Michaelis, M.A.

The *external* components and interconnections are different here, to meet the requirements of combining the circuits. All these ancillary components, including the manual controls, have been freshly numbered.

GENERAL CIRCUIT

The composite circuit is seen to comprise five sections as shown in Fig 1. Two of these sections are the respective circuit boards PB1 and PB2. The third section is the common mains power supply unit; the fourth section contains the loudspeaker, which is also used as microphone, as well as the listen/speak switch, and the final section is the crossover network. This serves the function of correctly routing the signal from the TV aerial to the receiver, the audio intercom signal and the pattern generator signal to the TV receiver.

POWER SUPPLY SECTION

A small bell transformer, or miniature mains transformer with an 8V 0·5A secondary, is required for T1. It is essential to use an 8V winding; a 6·3V winding is inadequate, since it will not produce a sufficiently high d.c. output voltage for the stabilisers on the pattern generator board to function correctly. However, there is no objection to rewinding the secondary of a miniature 6·3V heater transformer, or to adding a few turns which are connected in series with an existing 6·3V winding.

It is rather important to select a *physically* small mains transformer, in order to minimise its magnetic influence. Otherwise there is a certain danger of direct hum induction into the built-in loudspeaker when used as microphone; even when the spacing between the two components is considerable. It was found that screening the loudspeaker with magnetic or non-magnetic material was *far less* effective than using a *small* transformer, carefully orientating it and using a fullwave bridge rectifier circuit.

The small current drain of the circuits does not itself call for a bridge rectifier; a simple halfwave rectifier using a single diode could also have been used to supply the required current. However, d.c. magnetisation of the transformer core, and thus the stray field of the core, is very much less with a bridge rectifier circuit.

When building the composite unit as shown in Figs. 2 and 3, mount the mains transformer last of all, placing it in the position shown, but not yet fixing it down. Then switch to the intercom "speak" function, and connect any other small loudspeaker (low impedance) in another room, via a length of screened or unscreened cable to P1. Now turn and twist the mains transformer to find the position for minimum hum in the remote speaker, with the gain control on the amplifier set for normal working. Check this either by getting a second person to answer back from the remote speaker, or with the help of an oscilloscope connected in parallel to P1.

When the optimum location for the mains transformer has been ascertained in this manner, bolt it down in that position with the help of a suitable bracket Some further instructions for preventing hum on the intercom function will be given under that heading.

The function selector switch S2 serves simply to switch the supply voltages for the respective circuits on and off It carries no signal voltages, but merely smoothed d.c. voltages, so that the arrangement of its wiring is not critical.

THE INTERCOM CIRCUITRY

Although a double pole changeover toggle type of switch is quoted for S3, a pressbutton or key may be used in a "press-to-talk" arrangement if desired. It is not necessary to employ a switch with screening between the two sections, since there is no danger of oscillation at normal settings of the gain with the low input and output impedances involved.

It is, however, essential to use a *small* loudspeaker, not greater than 3 inches in diameter. Larger speakers give boomy and rather unintelligible speech reproduction when used as microphones. In the prototype, the selected speaker gave excellent performance as a microphone when

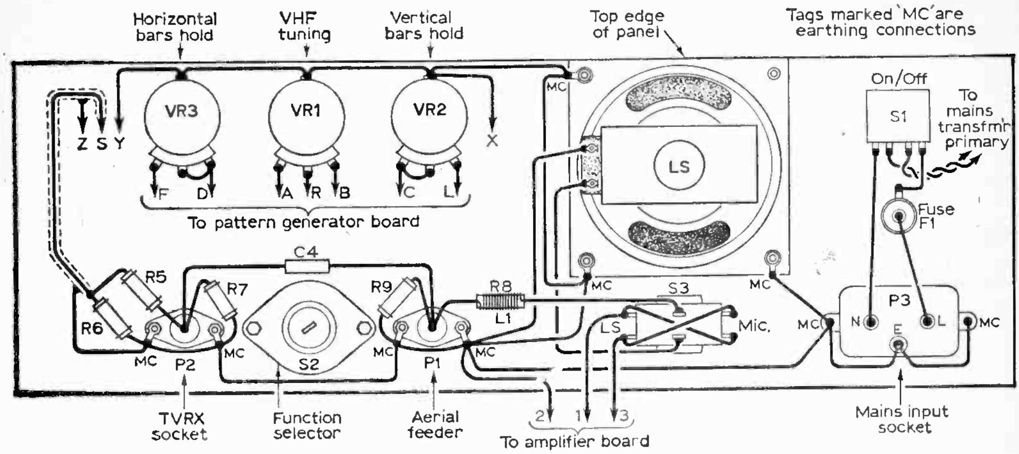


Fig. 2—Wiring on the rear side of the front panel.

standing unmounted on the bench, or when built onto the panel of the chassis slide unit with the latter withdrawn from its cabinet. However, as soon as the chassis slide assembly was inserted into the cabinet, the microphone performance was much less crisp and tended to "hoot" on a resonant frequency around 250c/s. This trouble was overcome by modifying some component values on the amplifier board.

In the prototype, the coupling capacitor to the top end of the track of the preset volume control (C11 on amplifier components list) had to be changed from 0·1μF to 4700pF; furthermore, a 22kΩ ½W carbon resistor had to be wired in parallel with the track of the preset volume control (VR1 on amplifier components list). These measures give very heavy bass cut, restoring speech quality with the speaker used as microphone to a crisp and very intelligible character even with the unit inserted in the cabinet.

These modifications also make the circuit much less sensitive to mains hum, so that they may even be required for that reason alone if any difficulty should be encountered in this respect with a given mains transformer and loudspeaker type. Thus the actual value for C11 on the amplifier board giving optimum performance in a given case will depend upon the particular mains transformer, the reson-

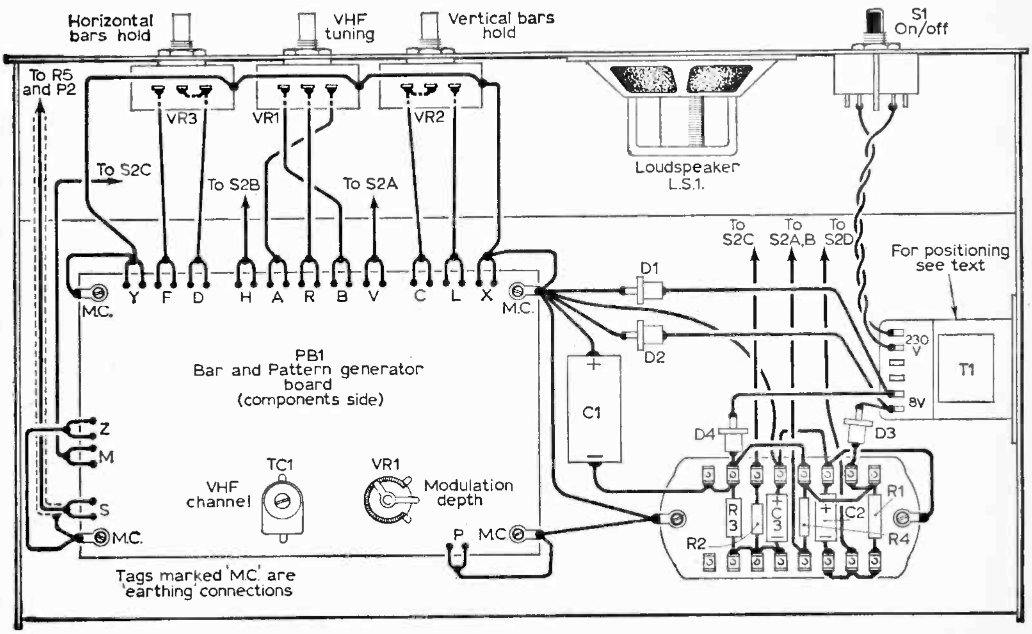


Fig. 3—Top view showing chassis slide construction.

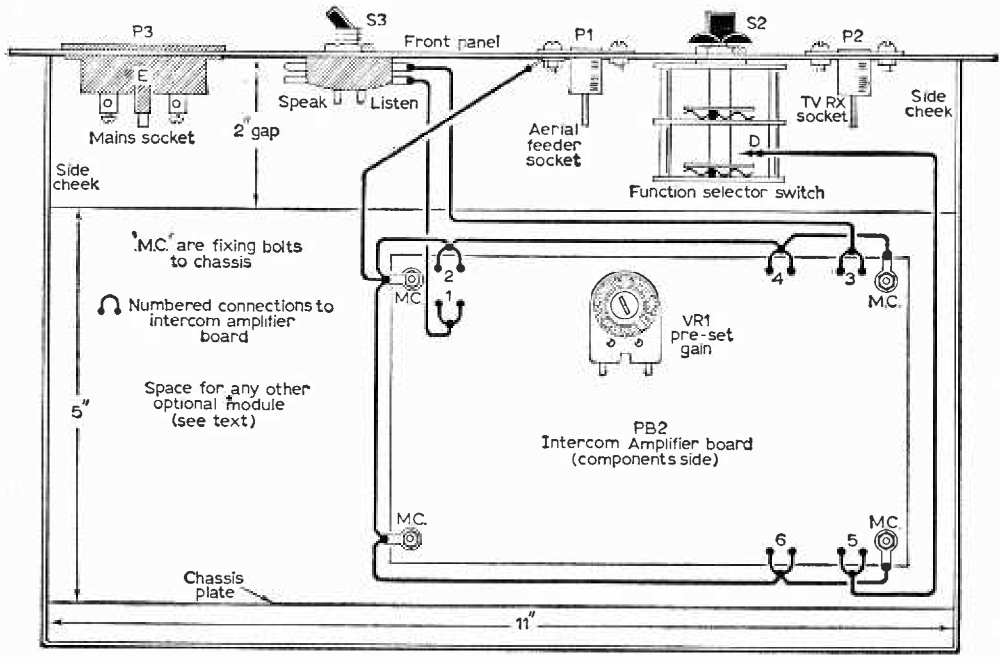


Fig. 4—Chassis slide construction, underside view.

ances of the particular speaker and their modification by cabinet resonances. A correct value should be found between 2nF and 10nF; the smaller the value, the greater the bass cut and treble emphasis. Similarly, the shunt resistor for the preset gain control on the amplifier board may need to take on any value between 10kΩ and 33kΩ according to individual circumstances. The smaller the value, the greater the treble boost.

After proper attention to these points, the correct setting for the preset gain control on the amplifier board was found to lie near the mid-point of the track, slightly on the lower side. Full output from the other speaker was then obtained when talking at a low conversational level into one speaker, from a distance of about two to three feet, or talking loudly across a room.

Hum was inaudible, even when using 12 yards of *unscreened* cable (lighting flex) trailing on the floor close to mains wiring. A *faint* hiss was, however, audible on the internal speaker with no remote speaker connected.

THE CROSSOVER NETWORK

Two coaxial sockets, P1 and P2, suffice for all input and output connections. P1 is intended for the feeder line to the TV aerial only, while P2 is for the cable to the aerial socket of the TV receiver, both on aerial-alignment intercom function and when using the bar and pattern generator.

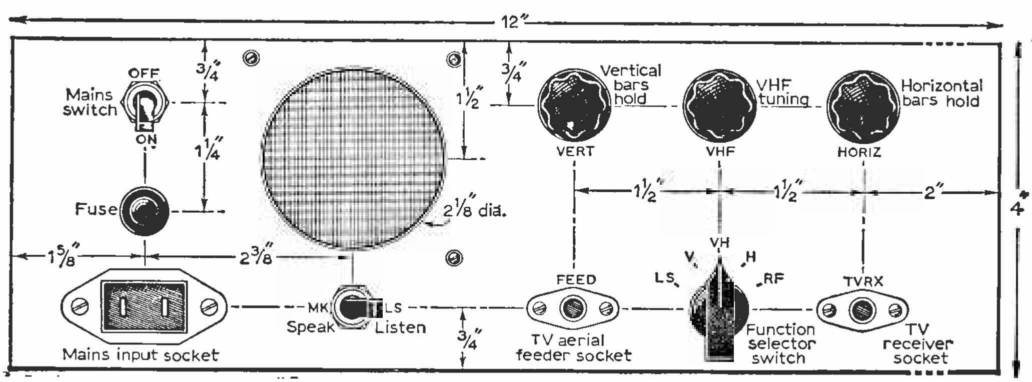


Fig. 5—Front panel details of the complete unit.

The test signal from the bar and pattern generator, of course, appears at both sockets, so that *it is important to withdraw the antenna feeder plug from P1 when using the pattern generator.* Otherwise the test signal can proceed up the feeder and will be radiated from the roof-top aerial, which would lead to interference to other television receivers over a wide area.

A possible refinement is to use a coaxial socket with a pair of break contacts which are actuated upon insertion of the feeder plug into P1, thereby interrupting the d.c. lines to S2A, B and C. The pattern generator is then unable to function while a TV aerial is connected to P1.

However, Post Office regulations would not generally demand such a safeguard, since TV service engineers often need to operate equipment which could, if used incorrectly, lead to interference and thus they are expected to possess sufficient training to operate the equipment correctly.

Capacitor C4 prevents any arrangement of the input circuits of the particular TV receiver which may represent a short-circuit at audio frequencies from shunting the intercom audio signals, but it allows the TV signals to pass through unhindered from the aerial to the receiver. The v.h.f. choke L1 prevents shunting of the TV signals by the audio circuits. R8 is merely a former for L1, while R7 and R9 provide discharge paths for any static charges picked up by the aerial or receiver if the respective arrangements happen to represent an open circuit for d.c. R6 forms a convenient tie-point for R5, which is a series resistor to limit the shunting mismatch produced by the feed from the bar and pattern generator, while still allowing adequate signal transfer from the pattern generator.

If the aerial feeder and/or set input is of the balanced twin feeder type, then the instructions given in the separate article on the intercom unit still apply for the present composite unit.

COMPONENTS LIST

Resistors

R1	82Ω, 1W
R2	22Ω, ½W
R3	470Ω, 1W
R4	47Ω, 1W
R5	220Ω, ½W
R6	2·2MΩ, ½W
R7	2·2MΩ, ½W
R8	47kΩ, 2W
R9	2·2MΩ, ½W

All ±10% carbon

Capacitors

C1	500μF, 30V Elec.
C2	200μF, 30V Elec.
C3	200μF, 30V Elec.
C4	2200pF, 500V ceramic

Potentiometers

VR1	25kΩ log.
VR2	25kΩ lin.
VR3	25kΩ lin.

Diodes

D1–D4 OY5061 or any other silicon l.t. rectifier 0·5–1A.

Miscellaneous

L1 80–100 turns 0·3mm. dia. CuL close wound on R8
LS1 Miniature loudspeaker 3–5Ω, 2½–3 in. dia.
T1 Small bell transformer, output 8V 0·5A.
F1 Panel fuse assembly, 0·5A mains.
S1 2-pole on-off toggle switch (mains).
S2 4-pole 5-way rotary wafer switch.
S3 2-pole changeover toggle switch.
P1, P2 Panel mounting coaxial sockets.
P3 Mains connector with earth pin, panel mounting.

Basic Units

PB1 Bar and Pattern Generator circuit board (described in November 1966 issue).
PB2 Aerial Riggers' Intercom unit circuit board (described in December 1966 issue). *Note:* (a) change C11 to value between 2–10nF, (b) insert resistor of value between 10–33kΩ in parallel with track of VR1—see text.

CABINET

The entire unit develops negligible heat; the output transistors on the intercom amplifier board run distinctly warm to the touch, but contribute nothing to the temperature of the unit as a whole. The cabinet design should thus be guided purely by considerations of good screening at TV signal frequencies, adequate dust protection and good appearance. Mild steel or aluminium can be used.

Although there is no real need for ventilation holes at all, it is advisable to drill some small holes in the lid of the cabinet so that a non-metallic trimming tool may be inserted to reach all preset controls (channel alignment and modulation depth control on the pattern generator, and preset gain on the intercom amplifier).

This facility can prove quite useful on occasions, for example in order to artificially reduce the modulation depth when testing receivers with faulty sync gating, to ascertain the actual gating level beyond which sync is lost. This function will be required only infrequently, which is why a modulation depth control was not fitted on the front panel.

It was considered useful to provide a fifth position on the function selector switch, to make a completely unmodulated v.h.f. carrier wave available. This is useful for making provisional assessments of the overall gain of a receiver chain, signal-to-noise ratio, a.g.c. efficiency, etc.

The screen of a BBC 405-line receiver should go bright *without* noise (snow), while the screen of a CCIR receiver should go dark, with no noise visible when the brightness is advanced to the onset of illumination, whereas strong noise should appear when the carrier is switched off (function selector to "intercom"). ■

BY H. W. HELLYER

STOCK FAULTS

PREVALENT TROUBLES IN COMMERCIAL RECEIVERS

NEW SERIES

PART 7. I.F. Stages

IN the intermediate frequency sections of most receivers, stock faults are few and straightforward. Mostly, we get valve faults, current-carrying resistors, decoupling capacitors, dry-jointed transformer windings and plain "finger trouble" resulting from misalignment, and the symptoms are common to the majority of sets. This would leave us little to discuss in the present article, unless we took a closer look at i.f. circuitry, illustrating our findings with commercial designs.

First, to recap on fundamentals. The i.f. circuits are fixed-tuned amplifiers operating at 34.65Mc/s vision and 38.15Mc/s sound on 405-line v.h.f. systems, and 39.5Mc/s vision, 33.5Mc/s sound on the 625-line u.h.f. system. Because the frequencies are more or less overlapping, it is possible to build an integrated amplifier for both v.h.f. and u.h.f. systems, switching in the requisite filters to tailor the response curves, but some designers have shied away from the complications of such switching and provide separate tuned circuits.

RESPONSE CURVES

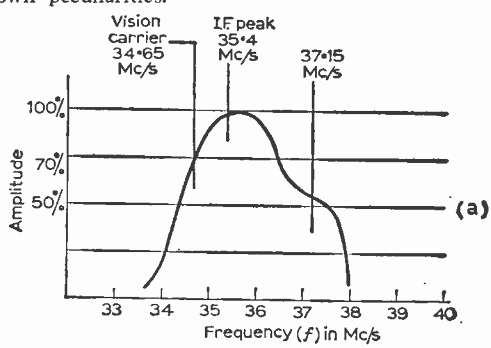
An important factor is the shape of the response curve, whose bandwidth must be such as to embrace the wide range of frequencies transmitted in the video signal. With u.h.f. reception, in which both vision and f.m. sound are amplified through the i.f. chain, and also where the f.m. signal requires itself a greater bandwidth than the a.m. signal of 405-line systems, broad flat-topped response curves are more than ever necessary.

This factor is stressed—because experience has shown that a few seconds' indiscriminate twiddling of tuning cores can cause a great deal of worry, and waste much time while re-alignment of the tuned circuits takes place. The first movement may seem to improve the picture slightly, or may seem to have no effect. But the response curve is built up by the "off-set" tuning of a number of circuits and altering of one, although it may make no perceptible change in the picture or sound, alters the curve shape slightly. The next slug or core that is moved then distorts the response more. By the time two or three of these off-tuning movements have been made, the deterioration may be visible or audible and then it is a job to redress matters.

STAGGER-TUNING

As individual circuits of a stagger-tuned i.f. chain are arranged to give a fairly high gain over a comparatively narrow bandwidth, the combined effect being the important factor, any fault which affects the tuning of an individual stage tends to upset the response—not merely reduce the gain. This point, which may seem too self-evident to mention, should be remembered when chasing odd faults of obscure origin.

We have discussed the effect of i.f. instability in previous parts of this series. Poor synchronisation, erratic triggering of one or other timebase, incorrect vision response that gives either smearing of the picture or ultra-sharp outlines and ringing, depending on the video and detector circuitry. The cause of such instability may be simple and obvious, or tantalisingly obscure. The following selection of "practical" faults has been chosen to illustrate the various possibilities. As before, the list is a guide rather than a catalogue; every set has its own peculiarities.



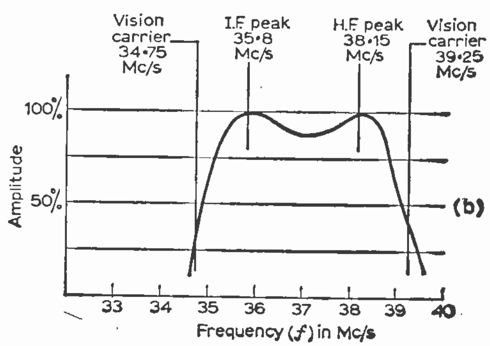


Fig. 31—Response curves of Bush and Murphy receivers showing (a) 405-line response of i.f. section, and (b) overall response of i.f. circuits when switched to 625-line operation. Note position of curve relative to carrier frequencies and shaping to afford rejection at unwanted frequencies.

"PRACTICAL" FAULTS

In discussing the tuning of i.f. stages, we passed over the fact that failure of one particular stage, perhaps because of a low emission valve, but more likely because of some other defect, causes distortion of the overall response curve, and gives a result that may mislead us into investigation of the video stages. The kinds of fault that can drag a stage down in this way are usually tricky —perhaps a dry joint on a fine lead-out wire of a transformer, perhaps the increasing of a load resistor. The former fault can crop up when a set is disturbed, even after years of faithful use. There was a classic case of an unsoldered joint on the system switch of an early dual-standard model, encountered many times before the production run caught up with it, and causing just such a fault—smeary vision, sometimes intermittent, sometimes in reply to light tapping, or the vibration of extra-loud sounds.

DECOUPLING CAPACITOR

On the GEC 2000 (also Sobell 1000, McMichael 3001 and 3002 and Masteradio 4003) there is a screened can containing the final i.f. transformer, the diode detector and associated r.f. chokes and tuning capacitors. A dry joint on this coil assembly, or a faulty decoupling capacitor on the common anode and screen grid h.t. line produces odd effects. On the Bush TV109 the 1kΩ anode load of the first i.f. stage can go high, again causing a smeared picture, and in worse cases, loss of sync. In the same maker's later range, the 125RU had a curious trouble of weakness on one channel only, usually the BBC. The cause was the 33Ω resistor used to feed the EF85 common i.f. valve, which went open-circuit after an overload. Always check the valve, running it to full heat and at full signal while observing current drain, when this sort of fault is noticed.

A resistor in the same position on the Philips 100U receiver, the 5·6kΩ anode load of the EF85 causes another peculiar fault when it increases in value. The vision is poor, and an increase in contrast to try and improve matters simply gives cross modulation; further increase distorts the sound and then the picture begins to improve.

Similarly, on the Murphy V430, the screen grid decoupling capacitor of the 30F5 can cause vision distortion—distortion of response, not shape, linearity, etc., and when the anode decoupler develops a leak, a queer blocking effect occurs, the picture coming and going in spasms at certain contrast settings.

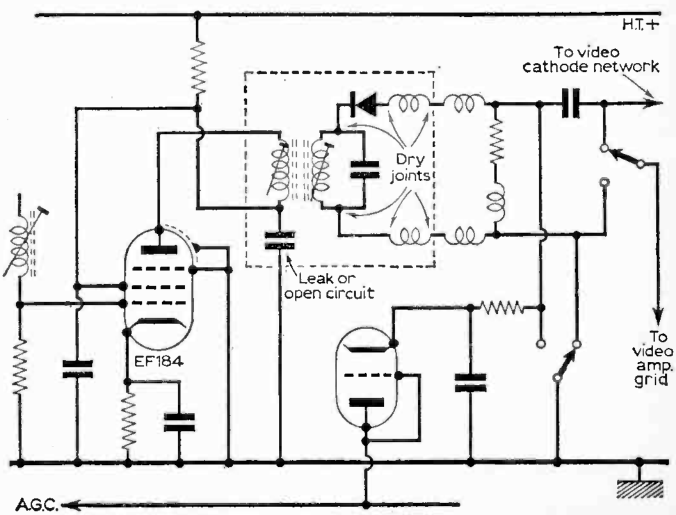


Fig. 32—Final i.f. stage of the vision strip of the GEC 2000 and associated receivers. Dotted line shows components within screened can.

SCREEN-GRID RESISTOR

Another common i.f. stage fault with unexpected results is the breakdown of the screen-grid resistor of the EF183 valve. An example occurs in the Ferranti T1093 to T1097 range. Whereas the vision becomes weak, the sound remains fairly strong, and the less critical range of our ears may kid us that there is actually a strong signal coming in and direct attention to a later stage. Actually, this stage, shown in Fig. 33, is finely balanced, and a good example of precise design. Unfortunately, precision has to be paid for by touchy operation when any of the parts of the circuit weaken. Note that in the example shown, the screen grid is fed from the tapping on a potentiometer consisting of R12, R13 across the h.t. In some models, the latter was omitted. Other modifications include the fitting of a 27pF capacitor across the feed from the v.h.f. tuner, another across the series pair C7, C8, C18B changed to 27pF, 22pF fitted across L7B and 33pF from L6/C18B to chassis.

FLAT RESPONSE CURVE

Lack of damping—used to "flatten" the peak of a tuned transformer—will cause the gain to shoot up at the frequency to which that section is tuned. Depending on where in the circuit this simple fault occurs, the response curve then distorts. Often the offending section is the secondary of the final i.f. already damped by the detector circuit. On the Ultra 6604 and associated models, this used to give a weak and smeary picture, and was often a break in the coil end itself.

Where there is a resistor feeding the anode and screen of the i.f. stage, excessive current which may be initiated by valve breakdown, sudden lack of a.g.c., instability in an earlier stage, etc., will cause overheating and change in value. The stage can either run weak, go unstable or pack up altogether. One notorious circuit in which this occurred was the Regentone Ten-6, where a 1·5kΩ resistor was used as the EF80 common i.f. screen and anode load. On this set, and similar models, if this resistor has burned out completely, always check around the valve-base for possible burning, low-resistance tracks, etc., before switching on again.

Another Regentone chassis which had i.f. faults was the VC1, and its "improved" successor, the VC2. A whole range of sets was covered by this general production run, precise description being confused by the fact that in some ostensibly VC1 types the VC2 chassis, with its different line and field transformer and scanning coils was fitted, and a number of sets, made for other companies and for mail-order and chain-store outlets, may have these chassis too. It does not matter to us at this point of discussion, but for the record we should note that the VC1 can be identified by its single contrast and two line hold controls, whereas the VC2 had a contrast control for each standard and a single line hold control.

The faults, to be fair to Regentone, were usually EF183 breakdown, but these valves seemed to develop a habit of interelectrode short-circuits. Low emission was a bit more tricky, generally causing field slip, the flywheel circuit of the line section enabling sync to stay effective that much longer. Poor sync on the later models, such as the K-B WV 60, RGD 726, Regentone 198 and companion models, could often be traced to the 1000pF decoupler of the final vision i.f. stage, an EF184, which also uses a single resistor for anode and G2 voltage dropping; value 2·7kΩ.

It is interesting to note that C.R.T.S. found it necessary to stabilise the screen grid of the common i.f. stage in the VC1 chassis, as shown in Fig. 34. Instead of being fed via a 33kΩ resistor from h.t., the screen grid has a potentiometer feed, the upper resistor changed to 15kΩ, and the lower leg being a 22kΩ returned to the junction of the two cathode resistors. To cope with the extra current thus flowing through it, the lower of these cathode resistors was then reduced to 100Ω from its previous 120Ω. Simple, but quite effective.

COGGING

The symptom of line cogging which happens when models such as the Ferguson 506, 546 and other "Flight" receivers have poor screen grid decoupling has been discussed in a previous article. The suggested modification was to increase the i.f. screen grid decoupler from the original 1000pF to 30000pF. But in addition, it is always wise, in these sets, to check the 50μF cathode bypass capacitor.

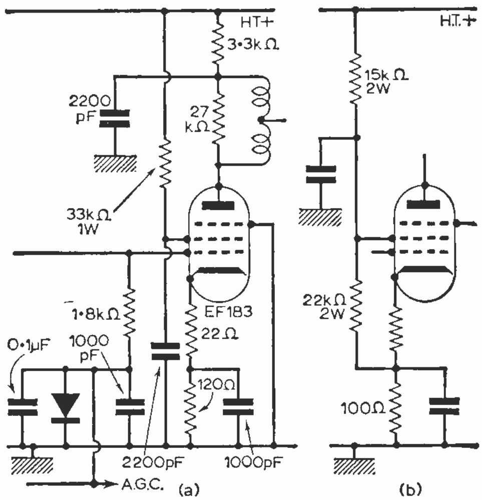


Fig. 34—Screen feed resistors of common i.f. valves are notoriously weak links. To improve regulation, modifications shown at (b) were proposed for C.R.T.S. VC1 and VC2 chassis. The original circuit is shown (a) and details are discussed in the accompanying text.

The main part of this article seems to have been taken up with a knock at decoupling and load resistors. These are certainly the weak links in the i.f. stages. Examples that cause patterning and instability are those of the McMichael MP20, which uses a PCL84 as first *sound* i.f. stage, and whose anode feed is decoupled by a 0·002μF capacitor. When this joker goes open-circuit, the stage goes haywire and the resultant instability reflects back through the coupling to the vision circuits! On the Murphy V500, something similar happens when the a.g.c. decoupler of the sound i.f. changes value. Interference bars rather like horizontal bursts of e.h.t. brushing appear on the screen.

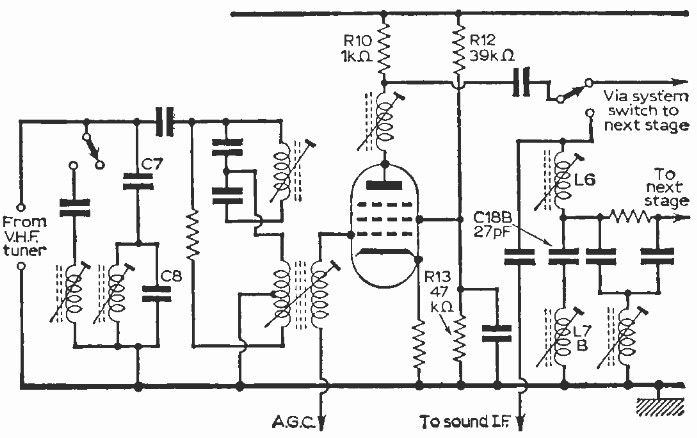


Fig. 33—Common i.f. stage of Ferranti 1093. For modification details see text.

INSTABILITY

Instability also occurs when the 1000pF bypass of the cathode of the 2nd vision i.f. stage of the Pye V11 fails, and on the Ultra 1981. Instability and very critical tuning should always lead one to an investigation of the decoupling capacitors of the common i.f. stage.

The Thorn 850 has another of these sound-and-vision peculiarities. The second sound i.f. stage is based on an EF89, also used as a limiter for

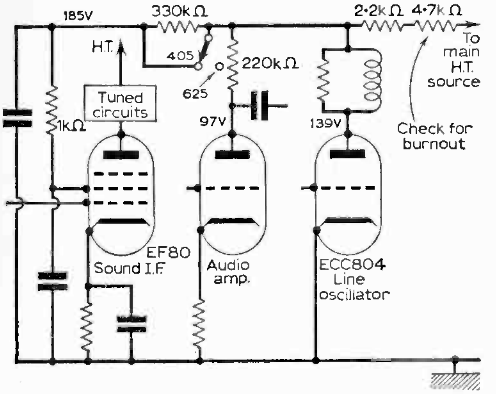


Fig. 35—Subsidiary h.t. feeds to different sections of the circuit can cause confusion. In the Thorn 850 chassis, one h.t. line feeds both the sound i.f. and the line oscillator. Failure of the EF80 sound amplifier usually causes burning-out of the common load resistor

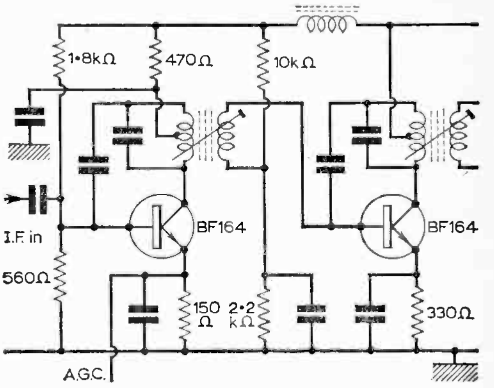


Fig. 36—Typical transistor i.f. circuitry as employed by Pye in the 40F model. Note the use of neutralising feedback capacitors.

f.m. sound on 625-line reception. This valve can develop internal shorts which burn out a resistor quite remote from the circuit. This is the 4·7kΩ that supplies h.t. to both the screen grid of the EF80 and the ECC804 line oscillator. Result—no sound or vision—from a sound i.f. fault. Most confusing the first time it happens, and a reminder of the old Serviceman's dictum: when there's no signal, chase up the sound section first.

INTERACTION

Talking of sound brings us to the old favourites, vision-on-sound and sound-on-vision. The latter often indicates an overload and the a.g.c. circuits should be checked if tuning is in order, as discussed in a previous article. Vision-on-sound may have different origins. If it is a buzz, only apparent on signal, the h.t. decoupling of the appropriate section should be checked. An example is the Murphy V290 range, where a separate 32μF electrolytic regulates the vision i.f. strip. And on the Bush 125, our old friend, the 2·7kΩ feed resistor of the common i.f. stage can cause this fault when it goes high. The VC3 chassis by C.R.T.S. had a buzz that was annoying even when the volume was turned down. To save fruitless searching around the output stage checking transformer laminations and so on first look at the anchor lead of the volume control where it goes to the system switch. If it is earthed at the switch end only, add an earth at the end going to the 0·01μF capacitor; often it will cure this fault.

TRANSISTORS

A short while ago one correspondent asked whether this series had set out to "deliberately ignore the growing tide of transistors". It is true that several current models have semiconductors in practically all stages—and there are now receivers that can be rightly termed "solid-state". But a series such as this deals mainly with sets just a little older than the current range; at least, out of guarantee. When our advice is to look for certain types of common fault, it is hardly likely to endear us to manufacturers if we encourage owners to attack their newer models. However, the present subject offers an excuse to take a look at one type of transistor circuit before going on to sound circuits.

Transistor i.f. stages have been used by Pye, Ekco and Ferranti, in a range of models with BF164s as first and second vision i.f. amplifiers, and BF158s and BF199s in the sound line-up. These n-p-n transistors are in stagger-tuned, tightly-coupled circuits and each stage is neutralised. Rank-Bush-Murphy employ p-n-p transistors, two AF181 common i.f. stages with an AF179 vision and two AF115 sound stages, again neutralised, and with special a.g.c. action that the use of transistors dictates. The G.E.C. Group including Sobell, McMichael and Masteradio, again use p-n-p types, neutralised by capacitative feedback from an overwind on the collector coil of one stage to the preceding base, with similar types to the Rank design but different styles of circuitry.

When trouble-shooting, it must always be borne in mind that the transistor is a current-operated device. Usually, the transistor will be found in the common-emitter-mode, as this gives greater gain (though a first glance at the circuit diagram of a hybrid receiver may give the impression that the transistors are hanging upside-down!) Neutralising is employed to balance out the internal feedback and this can raise problems when aligning. Neutralising is sometimes determined for the particular semiconductor in use, a greater spread of tolerance being necessary to allow for differences in capacitance.

Stagger-tuning may be used, to get the maximum gain per stage over narrower bandwidths, tailoring the response curve by rejector circuitry and using more stages; or synchronous tuning with wideband stages may be employed—this being a more feasible design possibility than with valves. In general, stagger-tuned circuits are more stable. Sound i.f. circuits have to have greater bandwidth to allow or the 6Mc/s f.m. bandwidth, and these we shall consider more closely next month.

CIRCULAR TV AERIAL for BANDS I & III

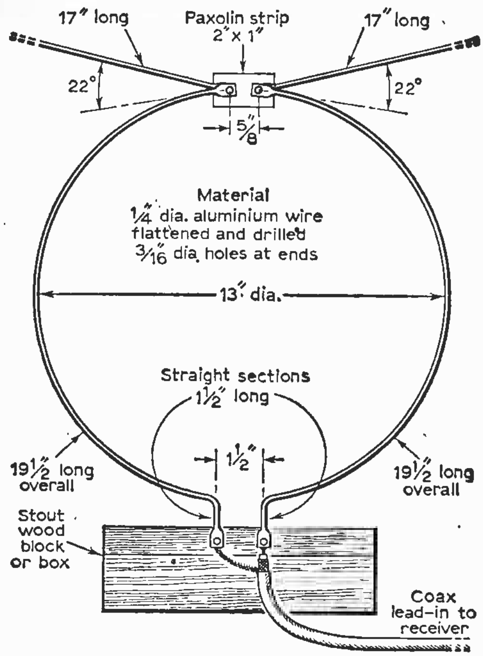


Fig. 1—The diagram shows full constructional details of the complete aerial. The base may be any block of wood of sufficient volume to support the assembly.

I WOULD like to pass on to readers of PRACTICAL TELEVISION the design for a home-made indoor aerial. It has the advantages of being easy to construct and costs very little to make.

I receive a very good picture from both BBC-1 and ITV over a distance of some forty miles from Armagh in Northern Ireland.

The aerial has not been tried on BBC-2 or on other channels, although variation in the size should prove a useful line of experiment.

The semi-circular elements were made from aluminium wire which may be obtained from any Electricity Board Works Department, scrap lengths cost a few shillings. Alternatively aluminium tubing should prove suitable.

Take one of the 17 in. lengths and flatten one end in a vice. Drill a 3/16 in hole in the flattened end. Repeat with the other 17 in. length. This completes the construction of the straight elements.

The two semi-circular elements should be flattened at both ends in similar fashion. A 3/16 in. hole should then be drilled at both ends of each of these elements. The 19½ in. lengths may now be shaped by bending them round an 8½ in. diameter circle. Anything will suffice, but perhaps the easiest and most readily obtainable would be a large saucepan. The 1½ in. bend in the lower ends of the semi-circular elements can be made with a pair of pliers.

A piece of paxolin 2 in. x 1 in. may be used for the insulator. Drill two holes 3/16 in. clearance spaced 5/8 in. apart. The two ends of the semi-circular elements and the 17 in. rods may now be bolted to the paxolin.

The base can be made from wood with two holes spaced 1½ in. to take the lower ends of the aerial.

Coaxial cable is now attached to these lower ends and the aerial is ready for use.

By making the nuts in the upper elements finger-tight, the two straight rods may be adjusted for best results, while the whole aerial may be rotated for maximum signal strength pick-up.

If the upper elements are to be constantly adjusted, i.e. for the reception of more than one station, then the nuts could be of the "wing nut" variety for ease of adjustment.—*G. Darling* ■

COLOUR CAMERA ADVANCE

The Marconi Company, of Chelmsford, claim that they have doubled the sensitivity of their Mk. VII colour camera and that additional lighting is no longer necessary. The camera will, to quote Marconi's, produce perfect colour pictures in the light levels found in any black-and-white studios. In technical terms, the camera will produce satisfactory colour pictures at full gain and aperture, with as little as 15 foot-candles of scene illumination.

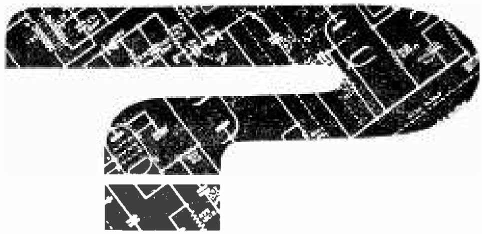
This enables Marconi to recommend a normal working light level of 80 to 100 foot-candles for studios using their latest colour camera. This achievement, which has obvious economic advantages (they have already sold over 200), will also increase the flexibility of operation of studios and will improve the limits of outside broadcasts.

One of the main features of the Marconi colour camera is its inherent stability which enables "hands-off" operation. This stability has also ensured that the correct colour balance can be maintained for long periods without re-adjustment. However, remote adjustment of colour balance is desirable in some circumstances. For example, during outside broadcasts it is not possible to control the colour temperature of the scene illumination, and this can alter rapidly with changes in the weather. In the studio, colour balance may also need adjustment to compensate for the effect of light reflected from brightly coloured objects. This effect is most noticeable in close-up shots of skin tones.

Fine adjustment can also remove minor differences between cameras to achieve perfect colour matching.

In addition to this colour balance control, Marconi's have also introduced as an optional extra a vertical aperture correction unit. This is said to give an outstanding increase in depth and sparkle of the picture, in a way which will be passed on to the average home receiver in terms of improved picture quality.

TV TERMS AND DEFINITIONS EXPLAINED



Gordon J. King

Part VIII

Noise

Noise is a random movement of electrons in the conductors and components of a television set. These random electron movements generate random pulses of electricity of very wide frequency range which look to the set something like ordinary signals. They manifest on the screen as grain or a "snow storm" effect and on sound as a hissing noise, not unlike air escaping from a high pressure air line.

These noise signals have an equivalent value of voltage at the input of the receiver and thus a ratio between the voltage of the wanted signals and the inevitable voltage of the noise signal is given. This is called the signal/noise ratio, and for the noise signals to be at subjective threshold the required signals must be 200 times stronger than the noise signals. This gives a signal/noise ratio of 46dB (equal to a 200 times voltage ratio).

It has been the aim of scientists and engineers over the ages to reduce the noise signal to the very lowest level to allow sets to work correctly with the smallest input signal. It is impossible to delete the noise signals completely, but modern techniques, including the use of low-noise transistors in the early stages of the receiver (i.e., in the tuner) and special pre-amplifiers and aerial amplifiers, keep the noise signals to the lowest possible level consistent with economic design.

The level of the noise signals, of course, sets the maximum useful sensitivity of the receiver, for once the noise signals have been reduced to their lowest practical level, the required signal/noise ratio can only be achieved by increasing the level of the input signal.

In practice, therefore, this means that if grain is troublesome on the picture or hiss on the sound, especially on the u.h.f. channels, which are more prone to noise effects than the v.h.f. channels, the solution lies in the use of a better aerial (i.e., one that is capable of abstracting more signal from the ether) or a super low-noise amplifier between the aerial and the set. Such an amplifier should have a noise performance better than that of the tuner which it is to feed.

Omnidirectional Polar Diagram

This term is used to describe the nature of signal pick-up by a single dipole aerial mounted vertically to respond to vertically polarised radio waves. Such a dipole, freely situated in space, is equally responsive to signals arriving from any point of the compass. This condition is shown diagramatically in Fig. 35, where the distance from the dot to the edge of the circle represents the relative response or sensitivity of the aerial.

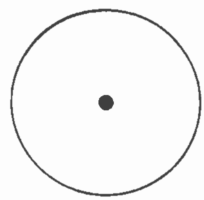


Fig. 35—Polar diagram for a vertical aerial.

This *polar diagram*, as it is called, is one of the simplest for aerials, and they become more complex, showing directivity and subsidiary lobes, as the response is modified by the addition of parasitic elements, like a reflector and directors (see under *Aerials*)

Note that the polar diagram even of a single dipole can be distorted by the proximity of metal items and the downlead. This kind of aerial assumes a figure-of-eight polar diagram when mounted horizontally to receive horizontally polarised signals.

Its position for maximum pick-up is then when the signals arrive broadside on, with virtually zero pick-up when one end of the aerial is pointing towards the station.

Overshoot

Due to unevenness in the response of the vision channels of a television receiver, the presence of a signal changing rapidly from one level to another, as may be represented by the edge of a black item on a white background, can cause the tuned circuits to oscillate or *ring* at their natural frequency.

The result of this is that the transition from black to white or white to black is reflected from the object on the screen in the form of diminishing contrast intensity of so-called black-after-white or white-after-black. This effect is best observed on a test card carrying frequency gratings, for then any such disturbance from a particular grating signifies that the ringing frequency is equal to (or near to) the frequency corresponding to that grating.

Excessive overshoot should lead to a check of the vision i.f. channel alignment, but just one circuit mistuned can considerably aggravate the effect, especially the sound rejector in the vision i.f. channel or the final vision i.f. transformer. A slight adjustment to the corresponding core while observing the overshoot on a test card can often clear the trouble completely.

Overshoot can also have its origin in the video amplifier stage, one major cause here being change in value of the capacitor across the cathode resistor of the video amplifier valve. Some early sets had a trimmer capacitor in this position to "sharpen" the picture by purposely introducing a little overshoot.

Padded Network

This term is often used to describe a coupling between one signal circuit and a circuit into which this signal is to be coupled. A padded network is a network of resistors and/or capacitors that permits the transference of signals from one circuit to another without introducing a bad mismatch.

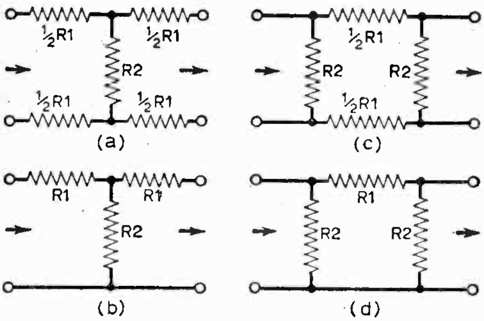


Fig. 36—Balanced and unbalanced T-attenuator pads at (a) and (b) and pi-attenuator pads respectively at (c) and (d).

The most common padded network is the simple attenuator. This is designed to reduce the level of signal from one circuit to another, while allowing both the input and output circuits to be loaded to their correct value of impedance. For example, the termination impedance of a downlead is nominally 75Ω equal to the aerial input impedance of the receiver.

Now, if an ordinary resistor were connected in series with the end of the downlead and the aerial socket of the set for the purpose of reducing the signal applied to the set, neither the downlead nor the set aerial socket would "see" 75Ω, as the series resistor would increase this, one to the other. A properly designed network or *pad* ensures that both terminations are correctly loaded.

Fig. 36 shows a balanced and unbalanced T-attenuator at (a) and (b) and a balanced and unbalanced pi-attenuator at (c) and (d). The balanced pads are used for twin feeder circuits and the unbalanced for coaxial cable circuits. The values for the resistors can be worked out from the following expression:

$$\text{for T-pads } R1=\frac{Z(N-1)}{N+1} \text{ and } R2=\frac{2Z\times N}{N^2-1}$$

$$\text{and for pi-pads } R1=\frac{Z(N^2-1)}{2N} \text{ and } R2=\frac{Z(N+1)}{N-1}$$

where Z is the impedance of the feeder and aerial input of the set and N the ratio of required input to output signal voltage.

The term "pad" is also sometimes used in unmatched applications. An example is the network employed in communal aerial systems to tap-off a certain level of signal for a receiver from a cable system carrying high-level signals.

Picture Noise

Noise, of course, cannot be seen, yet it is used with respect to a television picture. What is really meant is noise signal, which is the term given to the random movement of electrons in signal-carrying circuits, amplifiers and channels.

Picture noise is the grain or snow effect on a picture arising often from a weak aerial signal or from a tuner fault that emphasises the noise signal relative to the aerial signal, thereby impairing the signal-to-noise ratio.

Picture Shift

This term applies to movement of the picture as a whole on the screen, shift adjustments being provided in the form of magnets on the tube neck for shifting the picture vertically and horizontally and the combined effect giving diagonal movement.

It is thus possible to centre the picture on the screen of the picture tube, the principle being that the electron beam, near the gun assembly in the tube neck, is bent under the influence of the field from the shift magnets in such a way that the picture as a whole is moved across the screen.

In tubes with ion trap assemblies, the ion trap magnet can also bend the beam, causing a displaced picture, if incorrectly adjusted. Under this condition it may be impossible to centre the picture properly by the shift adjustments, and corner shadowing may result. The ion trap magnet must only be adjusted to obtain maximum picture brightness, never for shifting the picture nor eliminating corner shadows. Persistent corner shadows usually indicate that the scanning coils are not pushed hard against the flare.

The scanning coils are sometimes coupled through a capacitor to the field amplifier, and a d.c. magnetic field can exist if the capacitor's insulation is poor. This effect can displace the picture, making it impossible to centre by the shift adjustments.

Positive-Going Picture Signal

This implies that the vision modulation rises in a positive direction from the sync pulses from black to white. This is the nature of the modulation of the 405-line standard, as shown at (a) in Fig. 37. The negative-going picture signal of the 625-line standard is shown in (b).

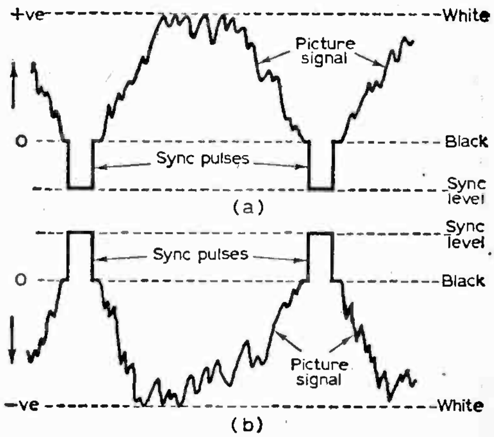


Fig. 37—Positive-going picture signal (a) and negative-going (b).

Printed Circuit Boards

Most current receivers have their various sections built upon printed circuit boards, instead of the old-style chassis construction. The boards, made of low-loss insulating material, have bonded upon them a thin conductive material etched to the pattern of the circuit, the components being fixed to the boards by their lead-out wires through small holes drilled at appropriate points on the printed circuits, the ends of the lead-outs then being soldered to the circuits.

Excessive dust and high temperatures sometimes reduce the insulation between adjacent printed circuit conductors, producing difficult-to-diagnose symptoms. Moreover, resistors on boards subjected to abnormally high temperatures have a tendency to *reduce* in value, opposite to the usual way that resistors in wired, chassis-type circuits are affected. This is worth remembering.

Quarter-Wave Coaxial Stub

A quarter-wave length of coaxial cable or transmission line shorted circuited at one end is known as a stub. Here the impedance at the open-end is very high, while that at the shorted end, of course, zero. A device of this kind is sometimes employed to match the high impedance at the end of a dipole to a low impedance feeder or download. This is shown in Fig. 38, where a tap is made a little up from the short-circuited end at a point where the impedance matches that of the download.

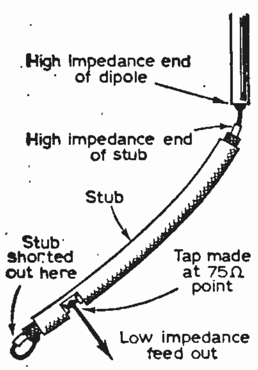


Fig. 38—The application of a short-circuit quarter-wave stub.

An open-circuit stub has a low impedance at the connected end and can thus be used as a rejector for signals of the same frequency (wave-length) to which it is cut. Sets, for example, which tend to have a high level of oscillator signal voltage at their aerial terminals, and which can cause interference on other sets tuned to a different channel, can benefit from the use of such a stub connected in parallel with the aerial input, as shown in Fig. 39. The stub in this case tends to short out the oscillator signal while having little effect on the wanted signals.

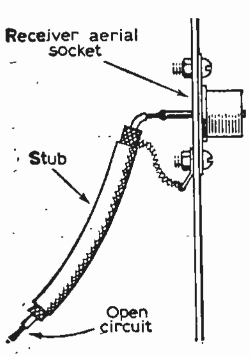


Fig. 39—An open-circuit stub can be used for oscillator signal rejection as shown.

Stubs can also be used for matching and, by cutting them a little longer or a little shorter, as the case may be, to balance out inductive or capacitive reactance at the end of an aerial downlead due to mismatch effects on the aerial system or at the aerial input of the set.

Raster

This describes the illumination make-up on the television screen upon which the picture is formed. A raster, for instance, is that rectangle of illumination on the screen when the aerial is taken from the set and the brightness control advanced. This, as the picture, is composed of many lines close together, giving the impression of one mass of illumination when viewed from a distance.

The number of lines making up a raster will not be the same as the number making up a complete picture. This is because a picture is formed of interlaced lines—405 or 625 in number—while a raster cannot be interlaced unless under the control of the picture signal and sync pulses.

The raster, however, which occurs at the start of a programme sequence or when the actual picture signal is faded out does contain the full number of lines, because in this case the timebases are under the control of the transmitted sync pulses, even though no picture information is present.

Reactivation

This term applies to a process that was at one time popular with service technicians and enthusiasts for prolonging the useful life of the picture tube. Indeed, special instruments called "reactivators" were then mode. The popularity has waned since those days, probably because regunned tubes are easily available at low cost and because reactivation was never really a great success.

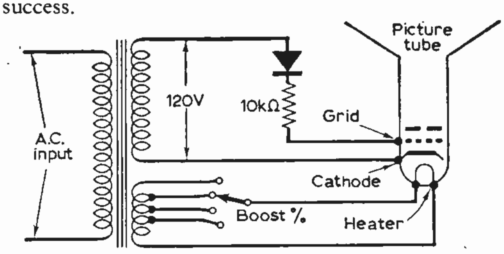


Fig. 40—Basic circuit of picture tube reactivator.

A tube was reactivated by applying across its heater a voltage up to 30% or more in excess of its nominal voltage, while at the same time drawing current from its cathode by connecting a positive potential to its control grid relative to the cathode. A series resistor was used in the circuit as a current limiter.

It was found that this treatment had the effect of improving the emission provided the heater could withstand the severe overload for any length of time, the emission remaining improved even with the tube later operating at its normal voltage.

The heater current and the voltage applied to the grid was sometimes pulsed to facilitate the reactivation process, but in practice this rarely helped much.

Sometimes the emission was improved and the tube could be put back into service with a reason-able picture for many months. At other times there was virtually no improvement at all, and it was not uncommon for the heater to fail when passing the abnormally high reactivation current.

Reactivators had a built-in emission tester, the emission being tested prior to reactivation and then at intervals during the process, the aim being to secure the best emission effect with the smallest value of heater current. The basic circuit of a reactivator is given in Fig. 40. Incidentally, owing to the rather high price of colour television tubes it seems as though the tube reactivator may again become popular.

Rejectors

In broad terms, a rejector is a tuned circuit composed of an inductor in parallel with a capacitor or an inductor in series with a capacitor, the former called a parallel rejector and the latter a series rejector.

The most well known television rejector is that in the vision i.f. channel, designed to reject the sound carrier, without which the picture would judder in sympathy with the sound accompaniment. This is the sound rejector, of which there are usually two, one where the sound signal is taken from the i.f. channel and another somewhere in the middle of the vision i.f. channel.

When tuned to the sound carrier, these filters put a sharp dip in the overall vision response curve and, in fact, help to tailor the shape of the response. The parallel-tuned circuit is the most frequently used, and the circuit at (a) in Fig. 41 shows the classic sound rejector in the cathode

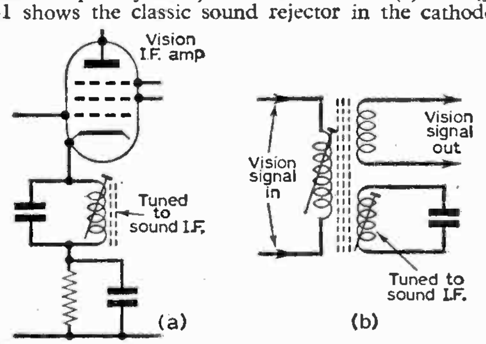


Fig. 41—Cathode sound rejector (a) and absorption type (b).

circuit of a vision i.f. amplifier valve. The circuit has little effect on signals removed from its resonance, but the sound carrier, which corresponds to its tuned frequency, sees it as a very high impedance, thereby dipping the gain of the stage at that frequency only.

An absorption type of rejector is shown at (b) in Fig. 41. This circuit, L1 and C1, is again tuned to the sound carrier (i.e., sound i.f.) and since it is coupled to an i.f. transformer in the vision channel it tends to absorb signals present at the sound frequency. In other words, it sucks out the sound carrier, leaving a large dip in the vision response curve at that frequency.

Sound rejection ratios as high as 60dB are possible by the use of two conventional circuits in the vision i.f. channel; but 60dB is only just about sufficient!

Part IX follows next month

DX-TV

A MONTHLY FEATURE FOR DX ENTHUSIASTS

by Charles Rafarel

LAST month's comments were somewhat premature, I am glad to say, and the Sporadic E Meteor Shower season was not in fact quite finished. In fact there was a very nice late opening, as shown below:—

21-24/10/66: Czech, USSR, and Austria. R1, E2a.
26/10/66: Spain E2, E3, E4. Italy IA, and IB, Portugal E3.
27/10/66: W. Germany E2, E4, and Czech R1.
29/10/66: Spain E2, W. Germany E2 (Grünten).
31/10/66: Czech R1, W. Germany (Grünten) E2, Austria E2a, Italy IA.
1, 3, and 11/11/66: Czech, Austria, USSR R1 and E2a.
14-15/11/66: Austria (very short strong bursts, believed meteor reflection).
17/11/66: The best day, Czech R1, Austria E2a, W Germany (Grünten) E2, Raichberg E4, Sweden (Hörby) E2, Hungary (Budapest) R1, Italy IA, USSR (? Minsk) R1, Spain E4, plus a new "mystery" weak test card on R1, vaguely similar to the French card; any ideas?

The short bursts on the 14-17 may well be "Leonid" meteor signals. Did any other DXers see any unusual propagation? We would like to hear.

NEWS

I have spoken many times in the past on the difficulties of USSR station identification and the following extract from a letter from Cpl. D. Maden of Cyprus will be of great interest.

" I noted a remark about USSR/TV, in P.T. some two months ago, re two programmes "floating" together. Below are a few conclusions I have gathered over the Summer:—

" The Central TV Studios are situated in Moscow, and they provide the bulk of the programmes for the country. Two regular programmes are produced there, plus a third experimental Colour service for Moscow only on Ch R8.

" The first programme called Central TV 1st programme (Tsentralyana Televidnie Pervaya Programma), and the second, Central TV 2nd Programme (Tsentralyana Televidnie Vtoraya Programma), these are relayed from Moscow, and are transmitted by the TV stations in the European part of the USSR, both programmes being radiated on all channels.

" The identification of the station, is (I hope) as suggested in P.T., that if the transmitter is at Kiev, then directly after the Test Card, the caption 'KNIB' (Ukranian) would appear, and if the following programme originated in Moscow, we would then have the "MOCBA" caption, after this identification becomes decidedly "dodgy".

" Using this method I have received 1st, and 2nd, programmes on Ch. R1 via Moscow, Leningrad, Sochi, Rostov, Nal'chik, Saratov, Noril'sk, and Pyatigorsk, and on R2 via Petrozavodsk, and Bryansk. The various Republics have their own regional programmes, some have two, eg. Kiev, but they rely on Moscow Central programmes as well (Compare Westward and Rediffusion).

" When regional programmes are being shown, the sound track and captions will be in their respective languages, eg. 'KNIB' in Ukranian, 'KNEB' in Russian. The various languages look and sound like Russian, except Band I-wise, Armenian which when written looks like a 'cramped' version of Arabic. The Regional stations that I have received are R1 Lvov, Erevan (Armenian Republic Vert. Pol.), and Minsk, and on R2, Tallin, Kiev, and Nikolaev.

" The all important test cards from the Far East of USSR are transmitted from 04·30 GMT, and from the European stations from 07·00-14·00 GMT, with the second programme starting later in the afternoon. To quote a Russian TV magazine, an interesting fact is that those who do not understand Russian fully, can at the turn of a switch, substitute a sound track of their local language.

" It seems clear from the above that they do not switch to another complete channel, they 'retune' the sound channel alone. From this it seems that we may well at times receive the same picture but with different sound tracks in different languages!"

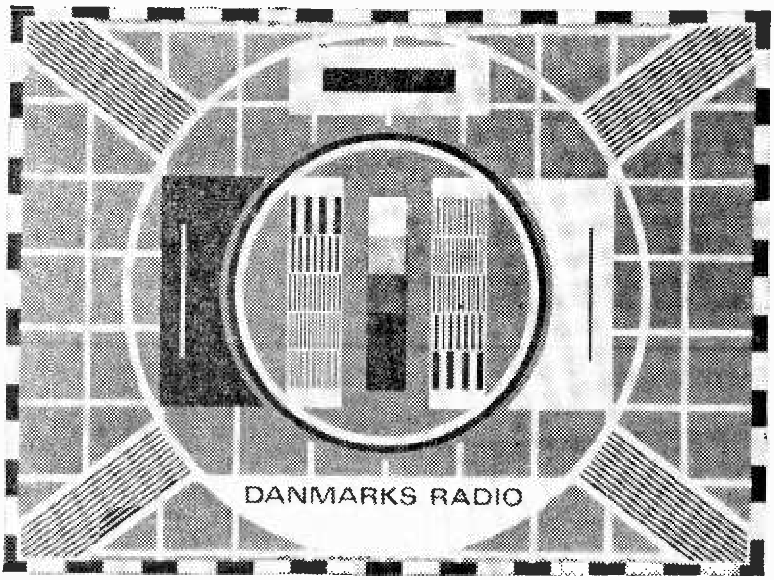
I suggest that we all bear the above details in mind for the 1967 SPE openings for we could, I am sure, improve our USSR logs very considerably.

Just two points, however. Remember that captions are in Russian script (except Armenia), so get out your Russian Dictionaries! Secondly, some captions that I have seen on Band I are of towns with Band III transmitters only. With regards to Far East stations we should have F2 openings next year but more of this later.

FROM THE SICK BAY

I know that you will be sorry to hear that two of our DX friends—I. C. Beckett and Roy Allen—have been in hospital. We wish them a very speedy recovery and back to the DX soon!

DATA PANEL 17 — DENMARK, NORWAY and FINLAND



Test Cards: These are shown in the photograph, subject to remarks on the lettering in the lower part of the centre circle.

DENMARK

Test Card: The card carries the word "Fyn" (Funen Is.) on E3 and either Kobenhaven or Danmarks Radio (as shown on E4).

Transmitters: Fyn on E3 and Copenhagen on E4 (fairly difficult to receive in the British Isles).

NORWAY

Test Card: The card carries any of the following lettering: (1) N.R.K., (2) Telegrafstyret Norge, (3) Telegrafvernet Norge.

Transmitters: Melhus and Griepstad on E2 (well received here), Gamlesveten on E3 and Kongsberg on E4.

FINLAND

Test Card: The card carries the following lettering: (1) Yliesradio TV1, or (2) Yliesradio TV2.

Transmitters: Taivalkovski TV1 and Tampere TV2 on E2, Tervola TV1 on E3 and Kajaani TV1 on E4. The two transmitters using channel E2 are vertically polarised. Finland is fairly difficult to receive in the UK and this may, in part, be due to incorrect aerials used on E2.

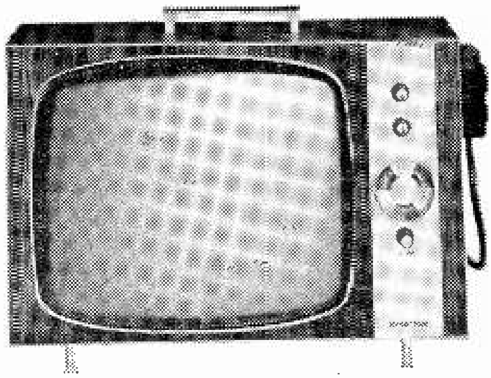
READERS' REPORTS

A new DXer C. Parnell of Widcombe, Nr Bath, has made a good start with Sweden, and Norway on E3, and Czechoslovakia on R2.

P. Wright of Andover must have given some thought to modifying Band III on his set, to get further i.f. He made it all right, with Rennes St Pern on F5; this is very far i.f. and beyond the scope of most British sets. He has had good SPE as well with USSR, Czech, Switzerland, Spain, Portugal, Poland, and Hungary all "in the bag".

Our old friend D. Boniface of Ripon did well during the Tropospheric opening when I was away, with W. Germany (Donnersberg) E10 (Langenberg) E9, and (Koblenz) E6. I really must give prior notice as to when I am going away as it always heralds a good opening that I miss! He too is now concentrating on u.h.f. and we wish him every success.

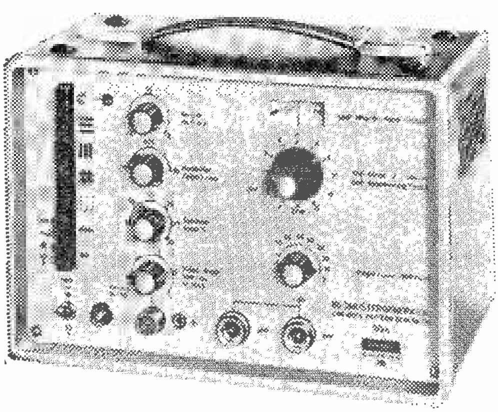
TRADE NEWS • TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS • TRADE NEWS



PORTABLE TV WITH REMOTE CONTROL

PHOTOGRAPH shows the new Dynatron "Courtier" 16in. 625/405-line portable television with remote control unit and pop-up handle. The Courtier features a transistorised integrated tuner, press-button, all-channel programme selection, high-gain transistorised i.f. panel, flywheel sync, stabilised horizontal output stage, tone control and automatic picture control. The retail price is 79 guineas plus a purchase tax surcharge of £1 3s. 11d. in teak or rosewood cabinet. *Dynatron Radio Ltd., St. Peter's Road, Furze Platt, Maidenhead, Berkshire.*

TELEVISION PATTERN GENERATOR SG4



FROM Grundig (Great Britain) Ltd. comes this fully transistorised instrument designed for the rapid checking of all TV receiver operations independent of TV transmission.

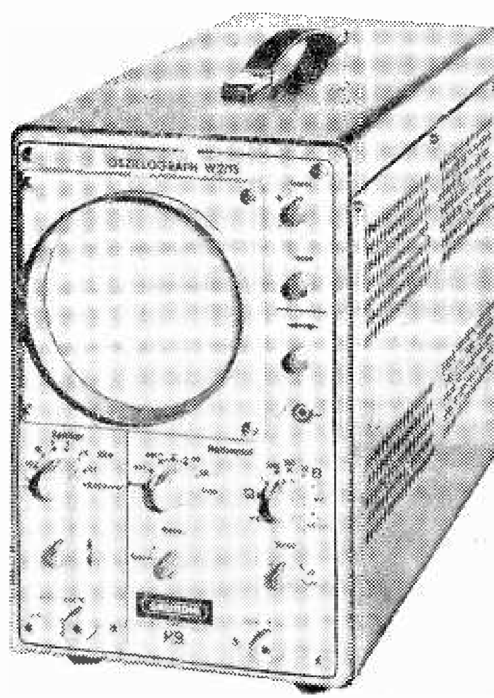
The unit provides a video signal of horizontal or vertical bars, crosshatch or dot pattern. The video and line frequency are adjustable. The synchronising pulse amplitude can be adjusted from zero to 30%. The video signal which can be of either positive or negative polarity, is continuously variable up to a maximum of 5V peak-to-peak including synchronising pulses.

The v.h.f. range covers channels 2-12 together with an i.f. output of 38·9Mc/s. A temperature stabilised 5·5Mc/s oscillator is frequency modulated with 1000c/s to provide the intercarrier sound frequency. The modulation is negative, but in addition the pattern generator can be modulated from an external video signal. The u.h.f. signal is obtained by mixing a variable oscillator with the already modulated channel 3 signal.

OSCILLOSCOPE W2/13

ALSO from Grundig Ltd. comes a general purpose oscilloscope using a 5½in. diameter c.r.t. giving high definition. Narrow or wideband operation of the vertical amplifier is provided and the extremely stable timebase ensures a steady trace under any conditions.

To facilitate TV receiver servicing, both line and field frequencies are marked on the timebase speed switch. A comprehensive range of accessories is available, making this instrument suitable for a very wide range of applications.



THE WORLD OF SERVICE

Part 1: THE OUTSIDE ENGINEER

By G. R. Wilding

BROADLY speaking, apart from the self-employed service specialist, and small dealer, there are three types of television service engineer. By far the largest group are the outside engineers, employed in many thousands by the large rental companies and multiple dealers.

Working almost exclusively in the customers' homes, they make an average of around eight to 15 service calls per day, although at busy times this can rise up to 20 or more.

Making so many calls per day, and often covering a substantial mileage, their work mainly consists of valve replacements, tuner cleaning and adjustments, the replacing of dropper or surge limiter resistors, pre-set controls, diode detectors, power rectifiers and electrolytics of various types.

The time available to each job more or less prohibits attention to faults of an intermittent nature, to sets requiring a tube change or line output transformer replacement or obviously requiring a fairly general overhaul. These are brought in for the attention of the bench engineer or "inside man", and it is to the "outside man's" constant perplexity why a service engineer should want to work inside a noisy, artificially-lit workshop all day with the service manager breathing down the back of his neck.

However, there is still another type of outside service engineer—those employed by the national trade servicing organisations, for instance, who must "kill" all customer complaints on the spot, or in exceptional cases, bring it to his own home to complete repairs.

This type of engineer usually covers a fairly wide area, mileages of 100 per day are not uncommon, but he usually averages no more than about eight calls a day.

Invariably, too, he gets rather more reward than the rental company outside engineer, for having to assume complete responsibility for all repairs in his area and employers usually prefer a man with a RTEB (Radio Trades' Examination Board) certificate for this type of position.

Outside engineers either provide their own car and get a substantial weekly allowance, plus petrol, or are supplied with a vehicle that they are able to use privately.

WORKING STOCK

Unless he is in the third category, and therefore has to carry a lot of spares, an outside engineer's working stock is usually quite limited, and after many years' contact I have rarely seen more than the following, nor indeed is more required:

(a) Very comprehensive selection of valves with at least duplication of those types that are most consistently needed. These are PL81, all forms of r.f. amplifier, PCF80/30CL, PCL82-86, EY86/U26, ECC82/12AU7, all types of efficiency diode, PY33, EF183 and EF184.

Despite their wide usage EF80, EF85 and PL36 valves are comparatively seldom needed.

(b) Multi-range testmeter.

(c) Miscellaneous collection of wire-wound resistors. Low value types for bridging o/c dropper sections and for replacing surge limiters and higher values for using as l.o.p. screen feed resistors. Various germanium diodes for vision and sound detectors, power rectifiers of the BY100 type, cathode bias electrolytics and one or two high voltage electrolitics. Fuses, spare knobs, mains leads, connectors, and coaxial plugs.

(d) Tools rarely comprise anything more than the usual small blade and cross-head screwdrivers, side cutters, pliers, plastic trimming tools and the indispensable electric soldering iron. There is an increasing tendency to use the quick-heat type of irons to avoid time wasting.

Very seldom are service manuals carried, for the outside man just doesn't have the time to get down to tricky faults, and in most instances complaints can be rectified by adjustment, valve replacement, the re-setting of fine tuner or the changing of a small component.

Most outside engineers also carry a tin of proprietory switch cleaner, a tin of the more recently introduced low-resistance contact lubricants, and possibly a small aerosol "Damp-Start" for spraying on e.h.t. connections or transformers that show signs of incipient breakdown or arcing, particularly for old models that may not merit expensive replacements.

TYPICAL CALLS

So much for an outline of the job, and now an uncoloured report on a typical day's service calls, which in the interests of receiver diversity is that encountered by an employee of a multiple dealer rather than that of a national rental organisation, who may well meet no more than 10 different models throughout the year.

CALL 1.—MODERN 19in. BUSH: "Uncontrollable contrast on both channels". As the receiver gave an almost negative signal with a roof aerial, the owner was using a room rod aerial, which gave acceptable results on ITA but was very grainy on BBC.

Normally with such symptoms one might conceivably suspect that an a.g.c.-controlled valve was passing grid current and off-setting the negative bias, but in this model the a.g.c. bias is derived not from the grid of the sync separator as is the usual case, but from a twin-diode voltage doubling arrangement fed via a capacitor from the cathode-follower video stage.

We first tested these diodes and found that the series member was virtually open-circuited. Replacement restored contrast control but it was found that great care had to be exercised when adjusting the push-buttons on Band III or vision-on-sound or sound-on-vision developed.

Under the chassis on this model there is a pre-set sensitivity control of the miniature slider type. We altered it, to decrease gain, and found that this completely removed the cross modulation that produced the effect.

CALL 2.—SLIM REGENTONE 17in.—Complaint: "Pale picture". Sound was normal but on increasing contrast the picture seemed to fade into the raster and leave an almost blank screen on high contrast settings. At first it seemed rather like a low emission tube, but as raster luminance was quite bright and there was no tendency to go negative, tried a new PCF80 video amplifier.

Superb response, with good black and white picture. Video amplifier had low emission and once a certain input voltage had been passed, increases in amplitude could produce no further increase in anode current and therefore changes in anode voltage.

CALL 3.—MODERN 23in. PHILIPS—Complaint: "Takes a long time to warm up". Sound came through normally but even after removing back and protective cover around e.h.t. section the set had still produced no raster. Changed PL81 automatically. Full-sized raster appeared quickly. Switched off again to re-test when set had cooled down and checked the coaxial plug which seemed very loose and hardly touching the braiding.

As suspected, the plug had been re-fitted previously with the insert braid clamp reversed, resulting in no positive connection to the braid. On switching on again picture appeared in normal time, and was re-adjusted for vertical linearity on Test Card.

CALL 4.—SEMI-SLIM RGD—Complaint: "Normal picture but distorted sound after a few minutes". Didn't bother to switch on but immediately removed back before switching on. Almost certainly the sound valve was at fault, drawing grid current when hot. There were two triode-pentode types apparent, both PCL82 and by rocking them in their holders we soon discovered the function of each, one sound, one frame. After five minutes, sound was distorted, and the PCL82 valve concerned was running almost too hot to touch.

Replacement completely cured the complaint, but as in Call 3 some re-adjustment was necessary to the various pre-sets and picture shift controls. Automatically, too, we cleaned the turret tuner and rocked all receiver valves in their holders to check if any pins needed scraping. We find this particularly important with sets that are fairly dirty and havn't been disturbed for months or perhaps years.

Cleaning valve pins and putting a spot of switch-cleaner over the valve-holder if it is of the ceramic type can work wonders in improving performance and freeing reception of varying contrast and background noise. However care must be exercised with bakelite valve-holders since most plastics are susceptible to chemical solvents.

CALL 5.—MODERN 19in. PYE—Complaint: "No picture". On test, found severe line tearing which completely vanished on re-setting line hold control. Long test showed no other fault. Owner said she had had the set a couple of years; it had never gone wrong and apart from switching on and from station to station, the knobs at the back had not been disturbed.

Obviously some slight change in either the ECC82 or PL81 valve characteristics, since they are connected in a multivibrator arrangement, had moved the line locking position. Although line lock was good and with plenty of tolerance, we decided to change both the relevant valves and be quite sure that no further drift would recur.

CALL 6.—MODERN 19in. EKCO—Complaint: "Picture going light and dark". Test showed that the real trouble was blooming of the picture when brilliance or contrast was advanced due to a low emission e.h.t. rectifier, but rapid scene changes could also produce the same effect. Replaced U26 and normal results were obtained.

CALL 7.—MODERN 19in. FERGUSON—Complaint: "Smell of burning and no picture". Inspection of chassis showed three badly burned carbon resistors on printed circuit chassis close to video amplifier, almost certainly due to internal s/c in this valve. Unable to check resistor values, so collected set for workshop attention.

CALL 8.—FAIRLY MODERN 19in. FERGUSON—Complaint: "Violent hum on sound, with strong hum bars and wildly unstable picture modulation". Very obviously an o/c smoothing capacitor. Found on connecting a wire-end 32μF electrolytic across one section of the multiple capacitor can that tolerable results, but with high hum level, were obtained. We soldered it in temporarily and ordered an exact replacement from service department. Television combined reservoir/smoothing electrolytics vary widely in capacitances and physical dimensions and it is usually essential to obtain the correct replacement for both correct operation and ease of fitting.

CALL 9.—SEMI-SLIM RGD—Complaint: "Sound normal but no picture". Inspection showed no e.h.t. with the screen of the PL81 glowing red hot. Obviously while screen voltage was present, anode voltage was not. Invariably this is due to the PY81 passing no current due to internal anode or cathode disconnection. We replaced the PY81, line whistle very soon developed, and e.h.t. came up. Although the PL81 had been under strain it appeared to be quite in order, giving adequate and constant output.

CALL 10.—MODERN 19in. DUAL-STANDARD BUSH: "Fit u.h.f. tuner and check aerial connection". The poor aerial connection turned out to be faulty coaxial aerial outlet on the skirting board. Fitting the tuner involved only the simplest of work, no soldering and only one securing screw.

On transferring the roof dipole, plus 5-element array into the u.h.f. socket, very grainy and fluttering results were obtained. However, when we put one end of a meter lead in the u.h.f. aerial socket, draped it round a curtain eyelet, absolutely first-class results were obtained. We left the owner with a small length of plastic wire to fix behind the set for best results and fasten to window frame with a couple of staples. The customer was as much surprised as us in view of the usual u.h.f. results in the area.

CALL 11.—SEMI-SLIM REGENTONE 17in. —Complaint: "Poor picture". Contrast was virtually non-existent and to get a viewable picture required advancing the brightness setting far beyond optimum and making all blacks "milky". A new PCC84 and PCF80 worked wonders, although changing the latter altered the fine tuner setting so that the best tuning point was almost at one end of the knob's travel.

In any case it is always advisable to adjust fine tuner setting to peak at the same spot on both stations, to minimise adjustments on change-over. Access to the oscillator coil slug, as in most of these older models is from the front and only involves removing the channel selector and fine tuner knobs.

On several of the older models care must be exercised in case the slug is semi-jammed due to the sealing compound hardening, in which case it is easy to turn the whole slug and coil complete so that one or more of the fine lead-out wires to the bakelite clip-in mounting may be broken. Some of the earlier Ferguson and Ekco models seemed to use a particularly hard-setting sealing compound and no attempt at re-adjustment could be made safely without first removing the sealer.

However, altering these particular slugs proved easy, although it was noticed that the paxolin fine tuner itself was slightly loose on its spindle. The real cure is to dismantle the rotor assembly, and tap the lipped-over spindle end with a light hammer. Unless this is done very carefully the paxolin trimmer will split apart, so to avoid taking chances on an old set, apply a light coating of really good adhesive; invariably this does the trick.

CALL 12.—GEC 23in. CONSOLETTE—Complaint: "No picture". Tests showed that the real cause of the complaint was failure of the line hold control to quite reach locking point even at its extreme travel. Normally this would prompt replacement of the line generator valve, but in this series of receivers there is an additional line hold setting control mounted on one of the printed circuit panels.

The drill is to put the exterior line hold control to the centre of its movement, then adjust the internal control until line lock is obtained. Upon following this action, normal reception was obtained but with grainy reception, particularly on ITA. We then changed the PCC89 tuner valve and increased gain 100% and killed the background noise.

CALL 13.—MODERN 19in. HMV—Complaint: "Poor picture shape". As anticipated, the complaint referred to poor vertical linearity but neither replacement of the PCL85 or adjustment of the linearity controls would completely cure the base cramping.

An ohms test of the pentode section cathode resistor showed it to be 280Ω instead of the stipulated 360Ω. Replacement completely cured the non-linearity although it was found necessary to also replace the PCL85 which obviously had been somewhat over-run by being under-biased.

Quite often the value changes in cathode bias resistors are the result of a cumulative action. Originally the associated valve may have gone slightly "soft" and passed excessive current, this then by exceeding the rating of the resistor produces a depreciation in its value, reducing the bias to further increase valve current.

Furthermore, in practice, service engineers find that they have to change more resistors in printed circuit receivers than in conventional wired circuits, probably due to the fact that close mounting the resistors on the panels inhibits heat dissipation, and also conducts heat from neighbouring valves mounted on the same panel.

It was also noticed in this instance that results from the roof-mounted aerial seemed very grainy, and after removing the coaxial plug from the lead and inserting the central conductor only into the socket results were immeasurably better. On contacting the coaxial metal braiding to the outer ring of the coaxial socket results depreciated, while contacting the outer braid only to the central hole in the socket gave very weak results.

Obviously something was wrong with the aerial installation, probably a short circuit or disconnection inside the aerial junction box, or where a staple may have pierced the insulation. So we left the set working on the central conductor only and arranged for a rigger to check the aerial installation.

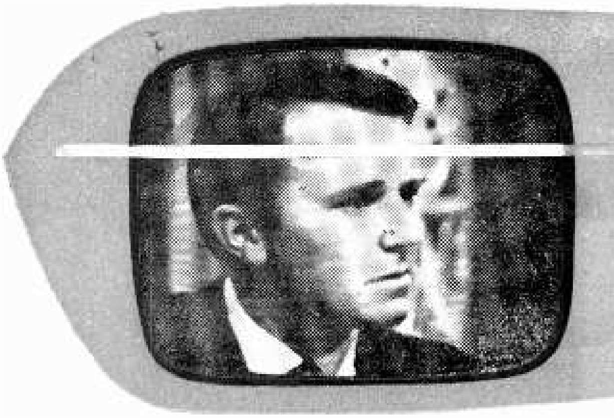
QUICK DIAGNOSIS

Well, there you have some representative calls. In nine of the calls a valve or valves were changed, in only three instances was it necessary to use a meter or the soldering iron, while only two separate components were replaced—a germanium a.g.c. diode and the temporary 32μf capacitor.

Possibly the most important attributes for the outside service engineer is an ability to quickly diagnose the cause of the fault from the various valve or component failures that can produce the symptoms, quickly determine the function of each valve and identify the various main components, and assess whether or not the repair can be expeditiously carried out on the premises.

For instance: consider that quite simple fault—a white horizontal line indicating failure of the field generator or output stage. Is it the triode oscillator, the pentode amplifier, scan coils, output transformer, blocking transformer, height control or an open circuit feed capacitor? Obviously when having to devote so little time to each call, the correct diagnosis of such faults requires no little skill, a lot of experience and much theoretical knowledge.

When the job has to be done in a small room with two young boys wanting to see what's going on, the chassis is "live", and your shoes are damp, and the room rod aerial keeps falling down, you sometimes think that perhaps the "inside man" is right after all. So next month let's see what his job looks like.



SYNC LIN
SELECTC

FAULTS in television scanning circuits often prove difficult to diagnose unless an oscilloscope is available for waveform display. This is particularly true in the case of synchronisation faults where the malfunction may occur for only part of the field scanning cycle and may also be dependent upon picture content.

A typical example of this is "pulling on whites" when the line sync signal is displaced in time due to the modifying effect of a dull modulation, or "white" signal occurring at the end of the previous scanning line. It may be necessary to select the triggering time for the oscilloscope timebase very carefully if the transient malfunction is to be effectively displayed and studied.

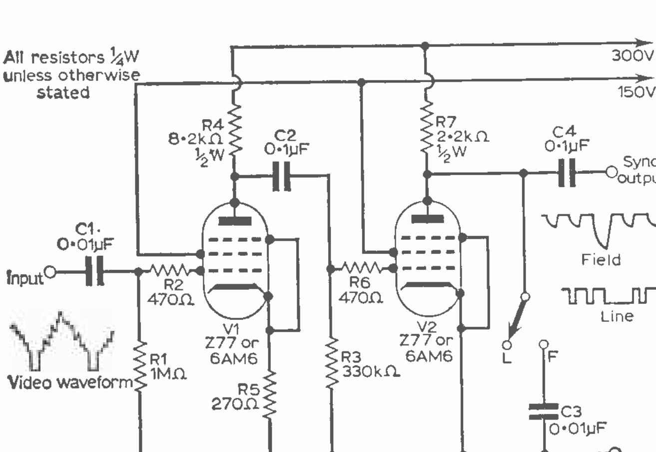
In the case of synchronisation difficulties it is often not sufficient to apply a standard commercial oscilloscope to the problem of waveform display, since in most oscilloscopes the triggering action for the timebase is dependent simply on the amplitude of the applied trigger signal. If we use the television scanning circuit waveform we wish to display for triggering purposes, then it will be necessary to ask ourselves if the waveform will initiate the oscilloscope display sweep at the correct time to show the malfunction.

SYNC SEPARATION

In the receiver, the scanning circuit trigger signals are derived from composite sync signals containing line and field pulses of equal amplitude. This presents a difficulty if we wish to examine waveforms synchronised to the field cycle since premature synchronisation of the oscilloscope to the line pulses can take place.

Our first need is to precede the oscilloscope trigger input with a sync separator circuit to give the alternative of field and line sync pulses from the incoming video signal. Any of the well-known sync separator circuits used in television receivers can be adapted for this purpose, two of these are suggested in Figs. 1 and 2.

The first of these is for valve operation in which the video signal (capacitively coupled from the grid of the television c.r.t.) is applied to a limiting amplifier V1 and conveyed as a positive-going signal to the grid of V2. C2 and R3 act as a d.c. restoration circuit in conjunction with the diode formed by the grid and cathode of V2. The picture content is removed by this action and a series of rectangular pulses are made available for synchronisation purposes at the anode of V2. To



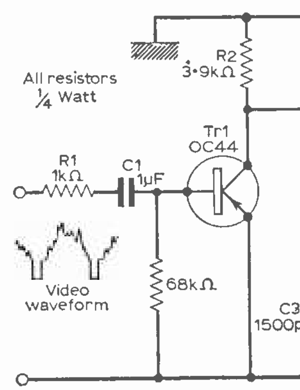
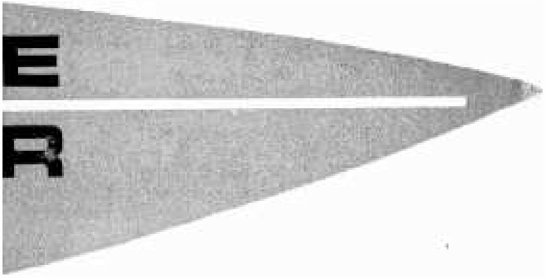


Fig. 1 (left)—Typical sync separator
Fig. 2 (above)—Solid-state sync sep
Figs. 3 and 4 (right)—Block schemat



by G. K. FAIRFIELD

separate the line from the field signal, when position F of the selection switch is used. a capacitor C3 is included. This provides an integration of the output signal which has a more pronounced effect on the narrower line sync pulses than on the wider field pulses, as shown in the diagram.

A similar principle is used in the solid-state sync separator shown in Fig. 2. Here a positive going video signal is applied to the base of Tr1 via R1 and C1. The transistor is thus effectively turned off for the duration of the video waveform and on for the sync pulses. By returning the collector to earth via load resistance R2 and the emitter to a positive potential, we are able to obtain positive going line and field sync pulses from the collector. These are available directly for line synchronisation, and via a double diode clipping and integrating circuit for field synchronisation. An integrated sync waveform is developed across C3. This capacitance is charged via D1 and discharged on a longer time-constant via R3. The field sync pulse will be the most positive component of the waveform, and diode D2 is arranged to conduct only during this period to provide the required field sync pulse.

LINE SELECTION

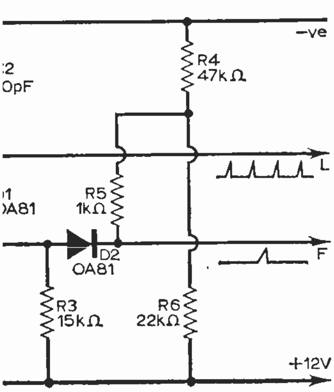
Instead of triggering the oscilloscope timebase from any line or field pulse it is often desirable to trigger from a selected line pulse. This would be the case where a fault is noticed occurring at a particular place in the transmission test pattern. For this purpose it is first necessary to select which of the two fields is required and then the line it is intended to sample. Circuits which achieve this selection and provide a sync pulse at the appropriate time are called "line selectors" and are basically variable delay pulse generators.

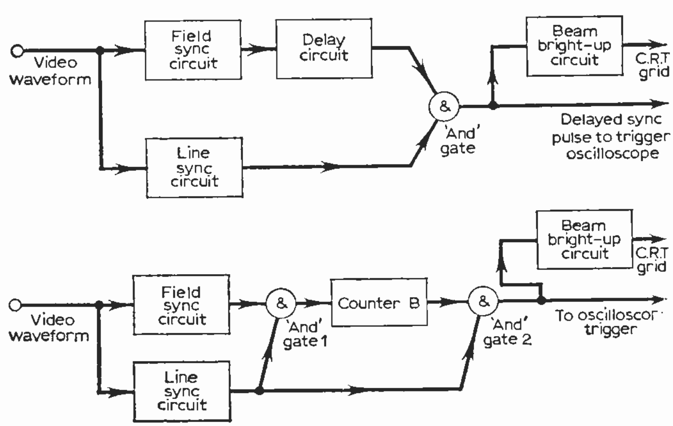
The operation of these circuits can be understood from Figs. 3 and 4. The first makes use of a delay circuit which is initiated by the incoming field pulse and produces a delay pulse at a time equivalent to the time displacement of the required line to be examined from the top of the picture. This pulse opens a gate and allows the next sequential line pulse to pass through it to trigger the oscilloscope timebase. At the same time this pulse is also used to intensify the brightness of the receiver cathode tube at the line selected.

As an alternative to the delay circuit a pulse counter can be used as shown in Fig. 4. Here the field sync pulse which initiates the raster at the top of the picture, opens gate 1, and allows the line sync pulses to be applied to the pulse counter B. This is present to cause an output to be generated after a given number of pulses have been applied (and hence scanning lines). This counted pulse opens gate 2 and allows the next line sync pulse to pass to the oscilloscope timebase circuit and c.r.t bright-up circuit.

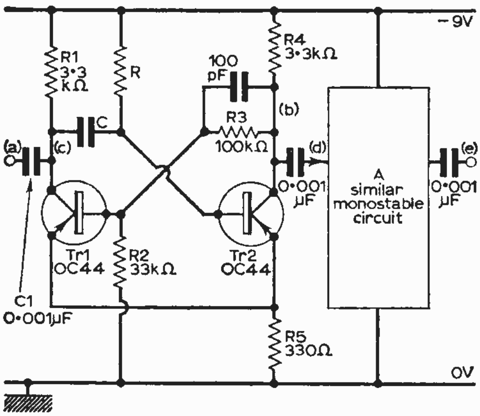
CHOICE OF CIRCUIT

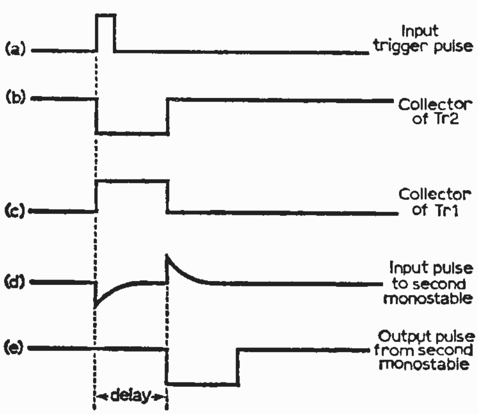
From the point of view of accuracy of line selection the counter circuit is to be preferred since it can be made to operate repeatedly at exactly the line required. It is, however, a fairly expensive circuit to construct and will require a minimum of 8 bi-stable or flip-flop counter circuits and two gate circuits in addition to the sync separator circuit as described earlier. If we use a simple counter design involving two transistors per stage and use diode gating circuits then the total complement for this type of unit would need some 20 transistors and 4 diodes.





...iit.
...or circuit.
...iagrams of variable delay pulse generators.





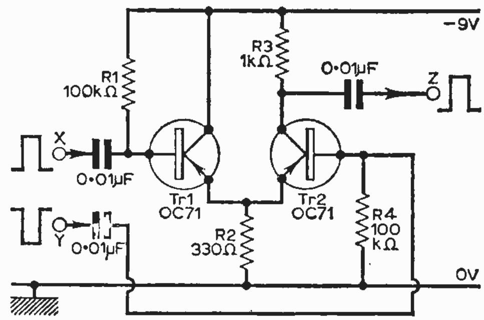


Fig. 5 (top left)—Monostable delay circuit.
Fig. 6 (bottom left)—Waveforms to accompany the monostable delay circuit.
Fig. 7 (above)—Simple gate circuit.

I propose, therefore, to describe a simpler unit using a monostable delay circuit, which, although rather more difficult to set up to select a particular line, will be much cheaper to construct. Should any reader be interested to try the counter circuit I will be pleased to provide details of the circuits involved.

A PRACTICAL DESIGN

Before a full description of the complete circuit is given the principal components will be mentioned for the benefit of those readers who are not familiar with delay and gate circuits.

The delay circuit given in Fig. 5 is known as a "monostable" circuit and is, in fact, a multivibrator circuit with one of its a.c. couplings replaced by a d.c. coupling. Its operation is as follows.

In its quiescent state Tr2 is rendered conductive by the return of its base resistance R, to the negative supply line. The collector potential of this transistor thus assumes a potential very near to that of the ground potential. Since the bias current for Tr1 is derived from a potential divider connected between the collector of Tr2 and ground, then little base current flows in Tr1 and this remains non-conductive. Its collector potential therefore becomes very nearly that of the full supply potential.

If a narrow positive pulse is now applied to the base of Tr2 via C1 and C, then this transistor is momentarily cut-off and its collector falls from near ground potential towards the negative supply potential. This negative charge is conveyed via the potential divider R3, R2 to the base of Tr1 and turns this transisitor on. When the amplitude of the trigger pulse falls to zero the conductive states of the two transistors do not immediately revert to their original value since the charge stored by C maintains the cut-off state of Tr2. Reversion only occurs after the charge stored in C leaks via R. The waveform available at the collector of Tr2 is therefore a negative going pulse as shown in Fig. 6 and whose time duration is dependent on the value of the chosen CR time-constant.

If this output pulse is connected to a similar monostable circuit via a capacitor then this will be triggered by the rising edge of the pulse, shown as (d), and this will initiate a new pulse (e), delayed by time (t) from the initiating pulse (a).

We see from the above that accurate setting of the delay period is obtained by adjustment of C and R. The range of delay variation we require is from 100μS (a delay equal to one scanning line) to 20 mS (delay equal to one field period or 202 lines). A somewhat greater range is required for the u.h.f. transmissions where 625 lines constitute the picture raster. This is too great a range to be obtained by variation of R alone since a positional accuracy of better that 0·5% will be required and a very large gain from Tr2 in the minimum resistance position. If we split the range into say five parts and select the value of C accordingly then the range required for R is not so large and adjusting this for the particular line selected becomes much easier.

This arrangement is included in the complete design given in Fig. 8, which gives suitable capacitor values to cover the range of delays required for both 405 and 625 line working. A second monostable circuit is shown following the first and this provides a gating signal wide enough to keep the gate open long enough for the next line sync pulse to pass and trigger the oscilloscope timebase.

GATE CIRCUIT

The gate circuit employed is simiar to that used in digital computer techniques where it is known as an "AND" gate; i.e. both pulses X and Y must be present at the same time at the gate inputs

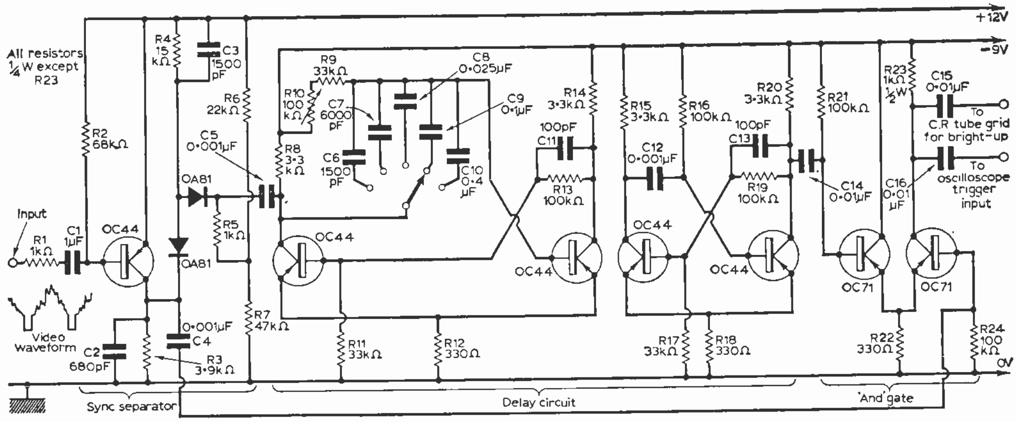
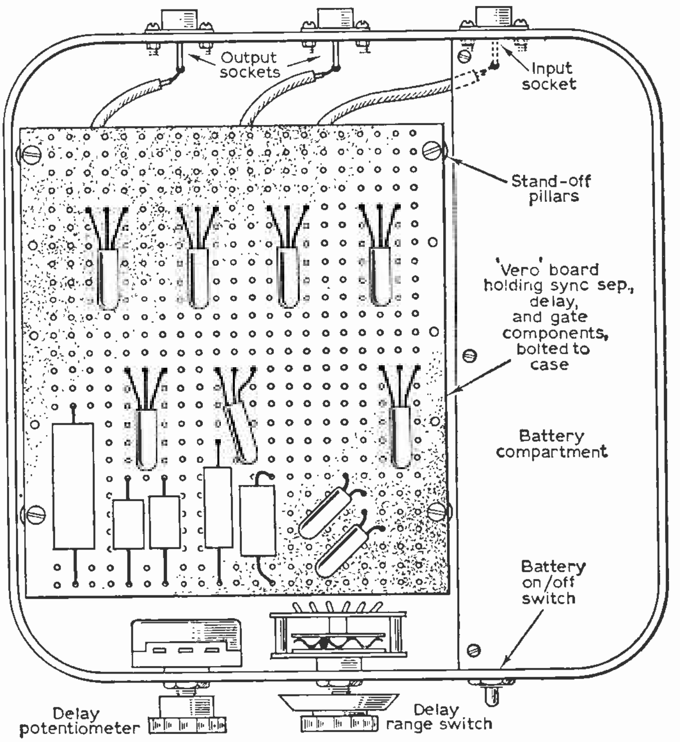


Fig. 8 (above)—Complete circuit of a sync line separator.
Fig. 9 (right)—Suggested layout of the major components



before a pulse is allowed to pass through to the output terminal. If either X *or* Y are present then the gate is made non-conductive and no pulse is conveyed to the output. The operation of this circuit is described with reference to Fig. 7. The base current bias resistors R1 and R4 are returned to the negative supply potential and ground potential respectively so that in the quiescent state Tr1 is made conductive and Tr2 non-conductive. A common emitter resistance R2 limits the collector current flowing in Tr1 and ensures that Tr2 is kept non-conductive even when a negative pulse, Y, is applied to the base of Tr2. Before Tr2 can be made to conduct it is necessary to apply simultaneously a positive pulse to the base of Tr1 and a negative pulse to the base of Tr2. The positive pulse serves to cut Tr1 off and remove the bias potential previously developed across R2, thus permitting the negative pulse applied to make Tr2 conduct.

COMPLETE CIRCUIT

The video signal is coupled from the cathode of the television's c.r.t. and applied to the sync separator input of Tr1 (see Fig. 8). The field output pulse is applied to the first monostable input, Tr2 and, after a delay dependent on the value of C6 to C10 and setting of R10, passes a pulse to the second pulse-forming monostable input at Tr4. The gating pulse from Tr5 is applied as one input to the "AND" gate formed by Tr6 and Tr7.

The second input comes from the line sync pulse output of Tr1. When both pulses are present then a pulse is produced at the collector of Tr7 and can be used for triggering the display oscilloscope and brighten the trace at the selected line.

CONSTRUCTION AND POWER SUPPLIES

There are no special features employed in the construction of this line sync selector. All the components can be mounted on a strip of paxolin material (Veroboard is ideal for this purpose having copper strips bonded to the board to which components can be soldered).

The power supply requirements are only a few milliamps from a +12 volt and a −9 volt supply; allowing the batteries to be included in a small metal box containing the transistor circuit board. A suggested layout is given in Fig. 9. ■

Servicing TELEVISION Receivers

No. 130 - BUSH TV80 continued

by L. Lawry-Johns

Line Hold

If the line hold will not lock the picture horizontally attention should be directed to the PCF80 and the 1·2MΩ resistor from the hold control to pin 9.

No E.H.T.

If the line whistle is audible and the e.h.t. to the EY51 anode seems adequate the heater of the EY51 will probably be o.c. and a new valve will probably restore normal conditions. Where the whistle is absent but starts up when the top cap of the PY81 is removed immediately suspect the 0·1μF boost line capacitor.

No Picture

If the line whistle is audible and e.h.t. is present but no raster can be resolved when the brilliance is advanced check the first anode supply to pin 10 of the c.r.t. base. This will often be found absent due to the 2μF electrolytic (500V) shorting to chassis. Disconnecting the capacitor will prove the point but the resulting raster will be unevenly illuminated.

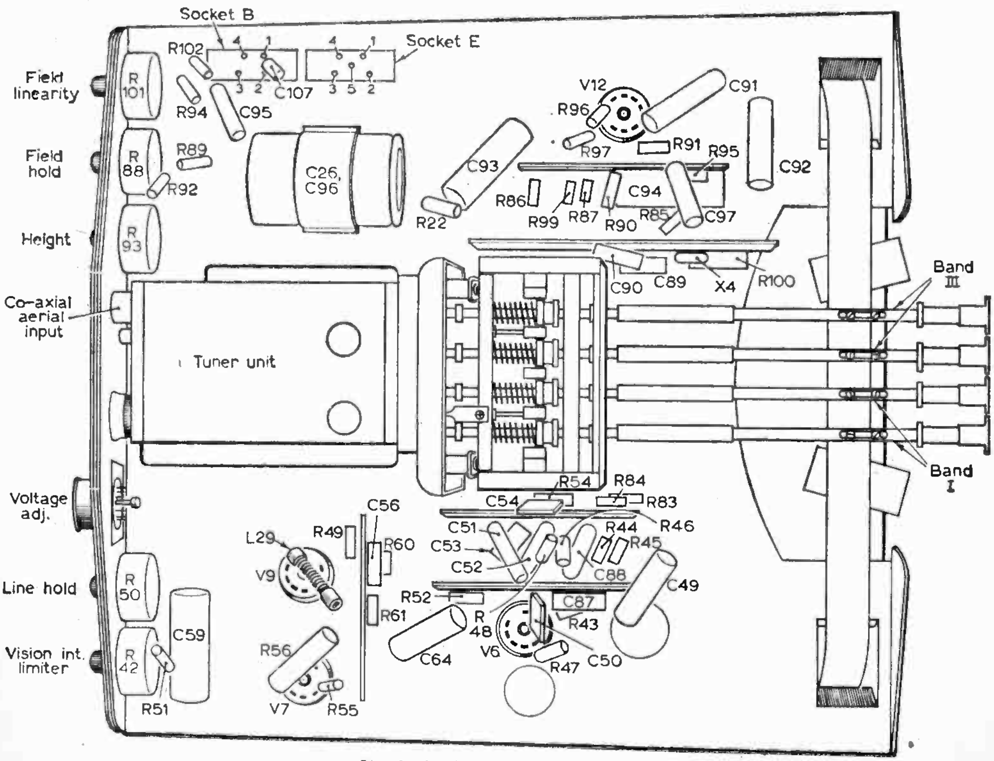


Fig. 4—Underside view of chassis.

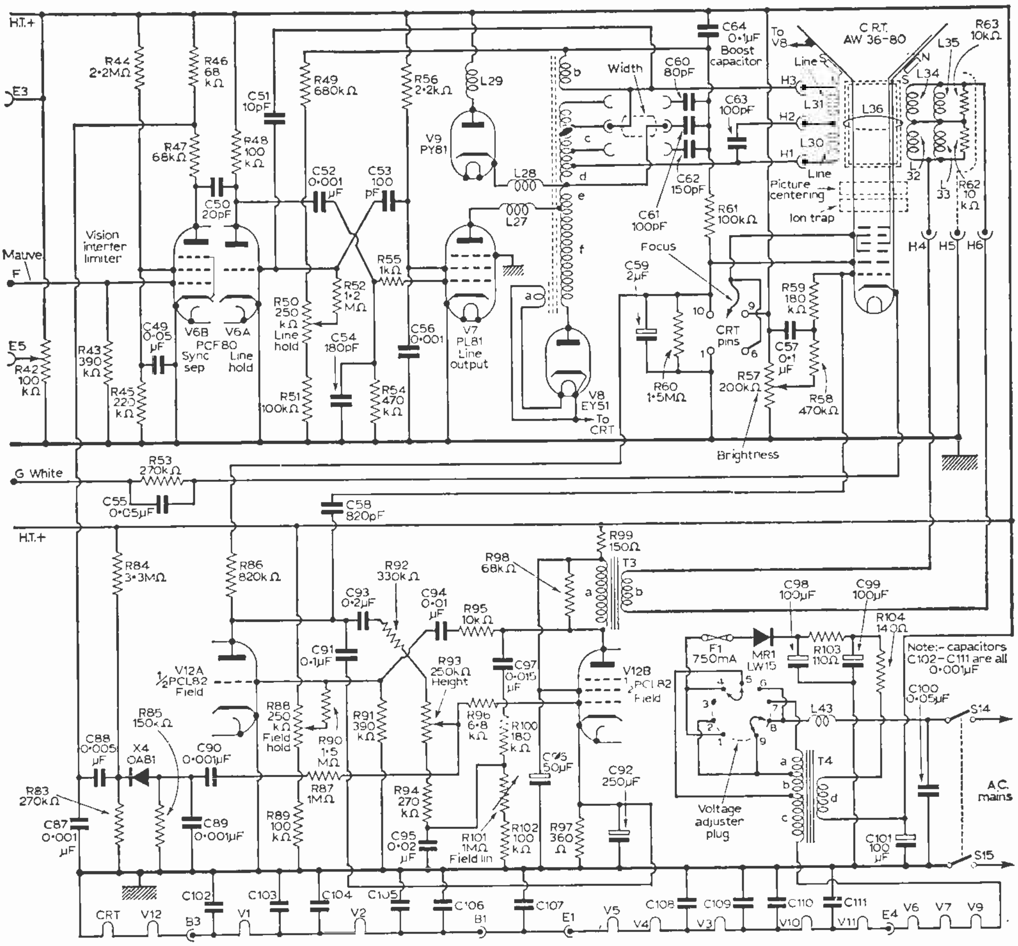


Fig. 5—Field and line timebase circuits: also power supply and c.r.t.

If the first anode voltage is present at pin 10 (over 400V depending upon the meter used) check the setting of the ion trap magnet, the voltage to pin 2 which should vary from zero up to h.t. as the brilliance is operated, and the heater voltage across pins 1 and 12.

Pin 1 connects to chassis and therefore pin 12 should stand at about 6V. A low voltage here will normally denote a partially shorted heater which may respond to a sharp tap with the handle of a screwdriver, perhaps restoring normal conditions at least for a brief period.

Distorted Field Scan

The field oscillator-output valve is a PCL82 and a fault in this valve or its associated circuitry may produce one or more of the following symptoms. Bottom compression—check PCL82, 250μF electrolytic cathode capacitor, 360Ω bias resistor, 50μF h.t. feed capacitor, 0·015μF and 0·02μF linearity capacitors. Bottom foldover—check PCL82, 0·2μF coupling capacitor (pin 9 to height control circuit), and above mentioned components.

Lack of Height

This assumes even loss of height top and bottom. The PCL82 is not likely to be at fault. The suspect is the 820kΩ to pin 9. This resistor can "go high", more often in fact than the 330kΩ which is in series with the height control. There are other possibilities but this shows the different line of "attack" to be employed when the symptoms are different.

No Field Scan

A narrow white line across the screen. First turn the brilliance down to avoid burning a line across the tube face. Check the PCL82 and its base

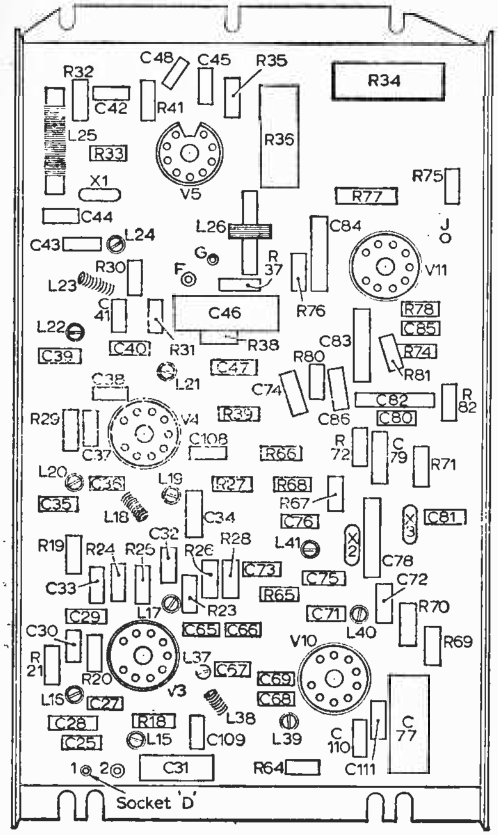


Fig. 6—View of the component side of the receiver unit.

voltages. If normal h.t. is at pin 7 but very little at pin 6 the indication is that the irritating job of replacing the field output transformer is more than a distinct possibility. If there is no voltage at pin 6 or 7, check back to the 150Ω h.t. feed resistor and if this is o.c. check the 50μF for shorts before replacing. If the line is very faint and this at maximum brilliance check the boost line supply at pin 10 of the c.r.t. base and the 2μF 500V if this is absent.

Field Hold

If the picture is rolling with the control at the end of its travel check the 1·5MΩ resistor from the control to pin 1 of the PCL82 valve base. If accompanied by field distortion check the PCL82 and the 0·01μF (also to pin 1).

Poor Sync

If the picture rolls up and down without a positive locking point check the OA81 interlace diode and associated components. If the effect is a trifle illusive check the 2·2MΩ resistor to pin 3, particularly if the line hold is critical.

Sound Troubles

Starting from the condition of no sound; check the PCL82 audio output if there is no sound of any kind from the loudspeaker. Also check the continuity of sound output transformer and of course make sure the loudspeaker is connected! Distorted sound can also be due to a faulty PCL82 or a leaky 0·01μF coupling capacitor (pin 9 to pin 3). If the distortion varies with the signal strength check the 1MΩ load resistor of the OA81 noise limiter diode. Check loudspeaker cone for free movement as heat can distort the speech coil.

Adjustments

Focus: Pin 6 is the focus electrode pin and the lead from this can be connected pin 1, 9 or 10 for optimum results.

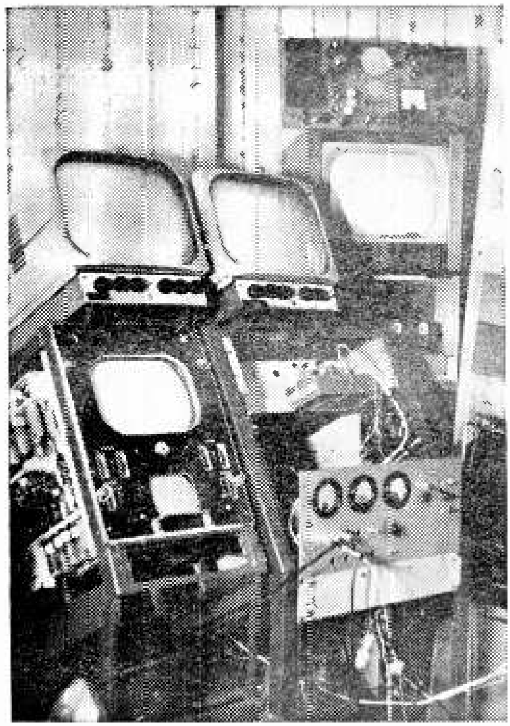
Sensitivity: Quite often cross modulation, vision on sound etc. is only due to the sensitivity plugs being incorrectly selected. There are two plugs and four sockets, a plug and pair of sockets for each band. Switch to BBC select the white lead plug and plug into the local socket, if the picture is clear and free of grain leave it there. The distant socket should only be used in fringe areas. Repeat with the pink lead with an ITA button selected. The idea is to get a grain free picture without a vision buzz upsetting the sound.

Width: Disconnect the supply before removing the width plug and resetting it.

Line Linearity: There is a closed loop linearity sleeve on the neck of the tube. Leave this projecting about ½in. from the deflection coils. Pushing it in too far may cause overheating of the deflection coils.

Tilt: Slacken the 4BA brass screw on the moulded ring of the coils. Rotate the assembly to straighten the picture and tighten up.

Centring: The centring magnet is on the tube neck close up to the deflection coils. Don't bring it back too far or it will interfere with the ion trap magnet and affect the brilliance. It has a clamp which will rotate the whole device and a separate adjustment allows the magnet itself to be rotated to centre the picture correctly on the screen.

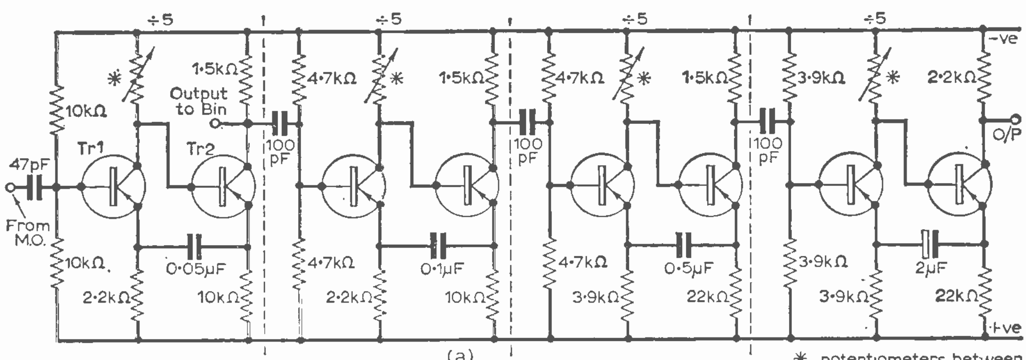


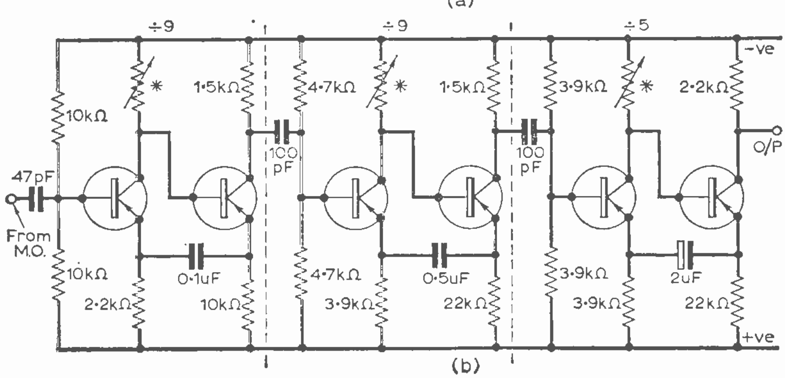
IDEAS FOR..... amateur TV

M. D. BENEDICT.

Part VII

TO understand the operation of this pulse generator the reader will need some knowledge of pulse circuits and, in particular, multivibrators. In this pulse generator, examples of all three types of multivibrators are to be found. The most simple of these types is the free-running astable, as used in the divider chain in Fig. 35. This is similar to the type used in the simple pulse generator shown in the first article of this series. The multivibrator runs free at a particular frequency or can be locked to another frequency as in the divide by 405 line or divide by 625 line circuits. Here the astable circuits run at about one-fifth of the frequency of the input pulses which trigger the multivibrator so that it runs at exactly one-fifth of the speed. The exact division ratio is set to the values shown in Fig. 35 by adjustment of the pre-set potentiometers. With three or four of these multivibrators in series the complete circuit will divide bv 405 or





✳ potentiometers between 3kΩ and 5kΩ depending on availability

All transistors OC44 or equivalents

Fig. 35a—A 625 divider showing astable multivibrator circuitry.

Fig. 35b—Similar circuitry for a 405 divider.

625 as required. A variation on this astable circuit is used in the master oscillator circuit to be described later.

The next type of circuit is the monostable multivibrator circuit (Fig. 36). This multivibrator has one stable and one unstable state. The stable state is with Tr1 conducting and Tr2 cut off. If a negative going input pulse is received on the base of Tr2 it starts this transistor conducting, so its collector, and hence the base of Tr2, goes positive, so that Tr1 cuts off and its collector goes negative, driving Tr2 on harder. Capacitor C discharges through resistor R and after a delay the voltage at the base of Tr2 is positive enough to start to bias Tr2 off, which results in a negative rise at the collector and hence the base of Tr1, and the circuit returns to its stable state. This state continues until another pulse is received at the input. The output waveforms are shown in Fig. 36.

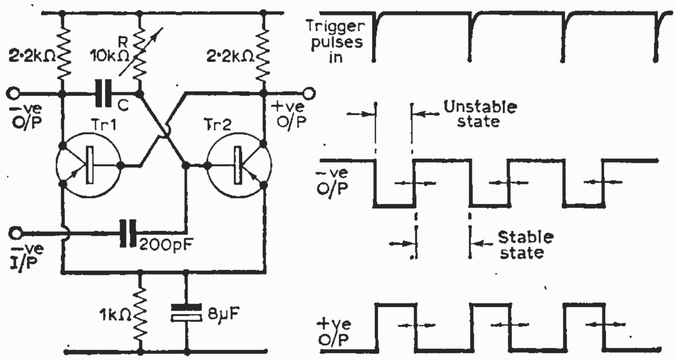


Fig. 36—Circuitry and waveforms of the monostable multivibrator.

MV type no.	Approximate period μS or lines	Value of C (pF)
1	1·5—3·2	68
2	4·7—6·5	120
3	8·0—12·0	200
4	17·5	330
5	4 lines (405)	8,200
6	7½ lines (625)	10,000
7	14 lines (405)	33,000
7	20 lines (625)	33,000

Table I—Details of the values of C (Fig. 36). See text for use.

This circuit produces an output pulse of controllable length (varying resistor R) when a trigger pulse is applied to the input. If the trailing edge of the output pulse is used to trigger another circuit, this will occur after variable delay. Using this circuit one can obtain pulses of the correct width, or delay a trigger by a variable time.

The last multivibrator circuit is the bistable circuit shown in Fig. 37. This circuit has two stable states as it can remain with Tr1 or Tr2 conducting with the other transisor cut off for an indefinite period. If Tr1 is conducting and a trigger is applied to the input, D1 conducts and passes this pulse on to Tr1, which is then cut off. Tr2 is turned on by this action and this state continues until another negative pulse is received, which will pass through D2 rather than D1 and, in a similar manner turn off Tr2.

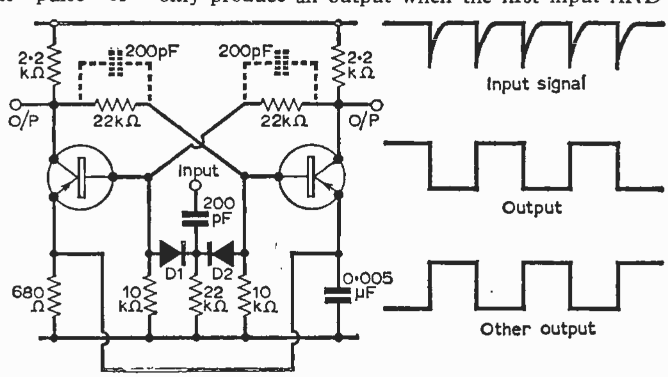


Fig. 37—A binary counter. See text for information on capacitors shown dotted.

Here, then, is a circuit where an input pulse changes its state, hence the delay produces one output pulse for two input pulses. This circuit is symmetrical so in theory either transistor may conduct when switching on. Adjustment of the collector loads will determine which transistor will conduct. The speed-up capacitors (200pF, shown dotted) may be required with certain transistors. This circuit is used to produce field gating waveforms from the field divider. It is also used in its divide by two mode.

Other circuits used in the pulse generator are "Gates," emitter followers and a combined clipper and emitter follower. Gates, Fig 38, are used to combine input signals in various manners to produce one output signal; there are four main types, those accepting positive or those accepting negative impulses, 'AND' gates and 'OR' gates. In this pulse generator all inputs are triggered by negative going pulses. The delay circuits use the negative going trailing edge of the positive going pulses after differentiation. Hence all gates are negative. 'OR' gates produce an output when the first input *OR* the second input *OR* the third input, etc., is negative. 'AND' gates, however, only produce an output when the first input *AND* the second input *AND* the third input are negative. The 'AND' gates are used to control the flow of pulses from the pulse generators.

Emitter followers are used to buffer one stage from following stages. The high input impedance and low output impedance reduce the loading on the previous stage, especially where several stages are to be fed. By limiting the current through an emitter follower used as an output stage, the output signal is arranged to bottom and by adjusting the bias, the circuit could be made to cut off when no pulse occurs. This clipping action removes spurious spikes and interference from other stages, hence cleaning up the output pulses.

The block schematic of the pulse generators is the version as used by the author but it must be emphasized that, due to variations in transistors, and hence output impedances and voltages, it may

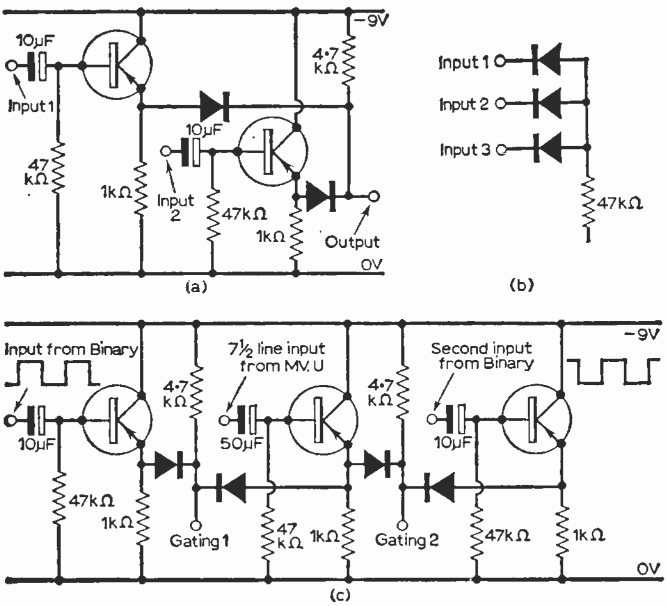


Fig. 38a—Negative 'AND' gate with two inputs. Fig. 38b—Negative 'OR gate with three inputs. Fig. 38c—Gate circuits in the field gating section.

be necessary to add amplifier/clipper stages or emitter followers, if one stage affects another stage. Having discussed the building blocks of a pulse generator, let us discuss what the pulse generator must generate (Fig. 40). These waveforms are the standard television waveforms so in most respects this pulse generator is of professional quality.

The block schematic diagram (Figs. 42 and 44 for the two types of pulse generator) shows the functions of each part of the circuit. As may be imagined a complete circuit diagram would take up far too much room to reproduce satisfactorily here. The letter by each block refers to the text numbers in the blocks of each multivibrator (monostable unless stated) refer to the Table I Fig. 36. The exact period of each multivibrator of output from the multi-vibrator is as shown in Fig. 36. The exact period of each multi-vibrator is set by adjustment of R to the time shown in the block. The times against the inter-connections are relative to the start of line syncs. (as in Fig. 40) and the frequency is indicated by line frequency (LF) or twice line frequency (2LF) or 50c/s for field frequencies.

As will be appreciated, the timing and synchronisation of the various pulses is very important. Any old circuit lashed up just will not perform satisfactorily. Since the frequency stability is a vital factor then the answer lies in an oscillator whose frequency is determined by a stable quartz crystal.

The master oscillator, which is shown in detail in Fig. 41, is an astable multivibrator triggered by a crystal oscillator or controlled by a d.c. voltage. This d.c. voltage is an error signal and used to pull the pulse generator into lock with the mains frequency (mains lock) or to lock it to an incoming video signal (genlock). These points will be dealt with in a later article, but for the present, crystal operation is satisfactory. The crystal should be an exact multiple of 20,250c/s (405 lines) or 31,250c/s (625 lines), the most popular ones being the X 5 (101 25kc/s) for 405 lines and the X 4 crystal (125·00kc/s) for 625 lines. The exact choice will depend on availability and price. The master oscillator multivibrator is set to divide by the correct ratio to give the above master oscillator output frequencies. This is performed by adjusting the bias to the bases. Twice line frequency outputs are used as the broad pulses and equalising pulses are at this frequency.

As the 405 line and 625 line pulse generators are different in many respects, they will be described separately. The 405 line operation is fundamentally simpler so the 625 line operation will be covered.

In Fig. 42, twice line frequency pulses from the master oscillator (A) feed a 4·7 micro-second multivibrator (B). This produces a broad pulse, the leading edge of which is earliest with respect to start of line syncs. These pulses are controlled by Gate (C).

The next timing required is the start of line drives and line blanking at −1·5 micro-seconds relative to line sync start. A 3·2 micro-second delay (D), followed by an emitter follower (E), produces pulses at this time which feed another delay (F) of 1·5 micro-seconds. This is followed by an equalising pulse generator (G), which

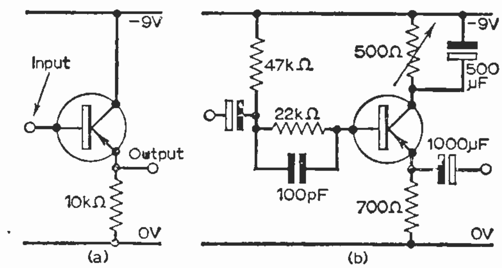


Fig. 39—Emitter ollower circuitry, a— as a buffer stage, and b— as an output stage and clipper.

produces 2·3 micro-second pulses controlled by Gate (H).

The −1·5 micro-second triggers from emitter

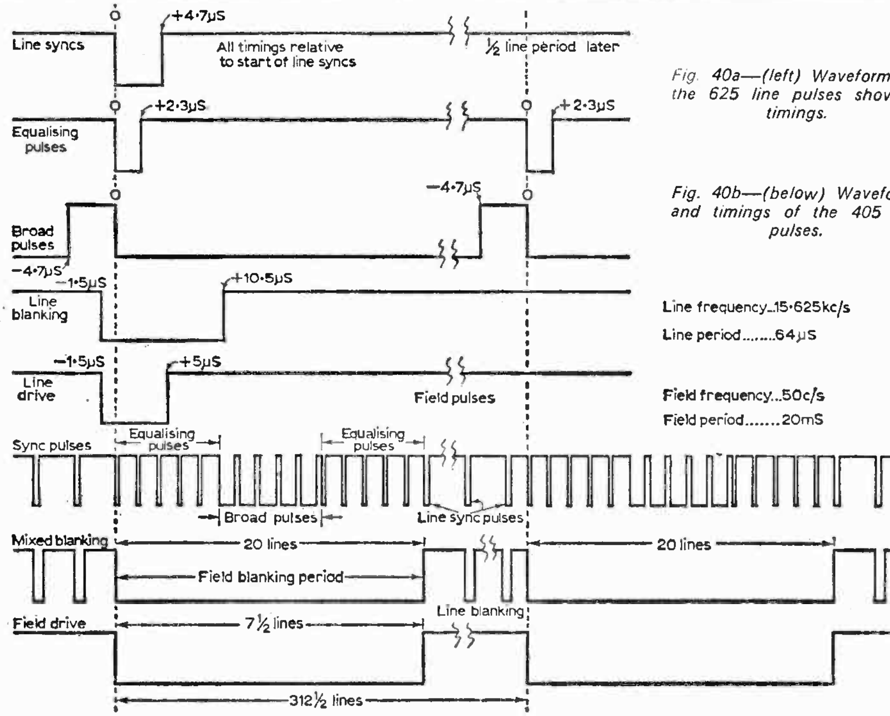


Fig. 40a—(left) Waveforms of the 625 line pulses showing timings.

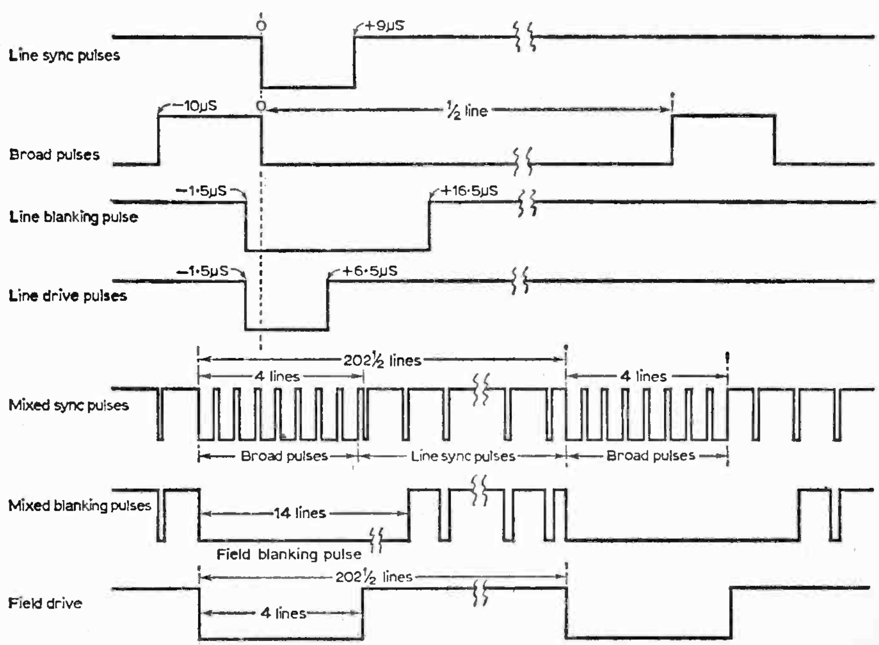
Fig. 40b—(below) Waveforms and timings of the 405 line pulses.

Line frequency...15·625kc/s

Line period.........64µS

Field frequency...50c/s

Field period.......20mS



follower (E) are also fed to a binary counter (J) which produces one output for two input triggers, hence the output pulses are at line frequency. These line frequency pulses are fed via emitter follower (K) to the line sync chain. This consists of another 1·5 micro-second delay (L), followed by the line sync generator (M) with a 4·7 micro-second period and the usual control gate (N). Suitable waveforms are applied to the gates (C), (H) and (N), which allow the pulses through when the gating waveforms are negative. These waveforms are generated by the field divider. The outputs of these gates are combined in the negative 'OR' gate (P) and are fed to the output emitter follower and clipper (Q) to produce mixed syncs, the most complex waveform required, the reader will be relieved to hear.

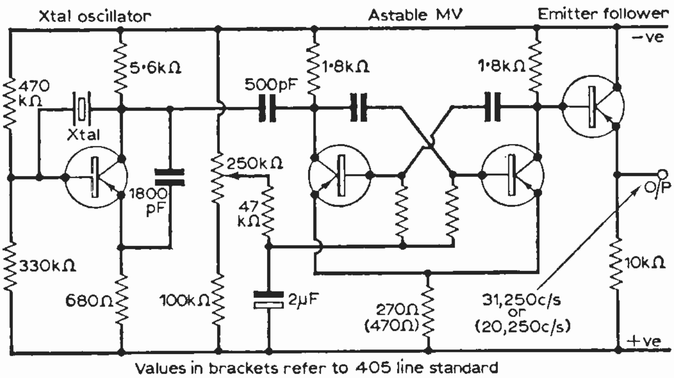


Fig. 41—The master oscillator circuit. The exact frequency of the crystal is discussed in the text.

The −1·5 line frequency pulses out of the emitter follower (K) are also fed to the line drive multivibrator (R) with a 6·5 micro-second period, followed by output emitter follower and clipper (S). Line blanking pulses are similarly generated in multi-vibrator (T) (12 micro-second period).

Field blanking pulses, like the rest of the field waveforms, are obtained via the main field divider (U), which divides by 625 to give a 50c/s output which is buffered by emitter follower (V). This output triggers multi-vibrator (W), the field blanking generator, whose period is set to be 20 lines. This output is now combined with line blanking in the negative *OR* gate (X) and fed to emitter follower and clipper (Y) to produce mixed blanking. The 50c/s output of the divider and the emitter follower (V) also feeds the field drive generator (Z) of period $7\frac{1}{2}$ lines. The field drives are clipped in emitter follower and clipper (a).

Gating Waveforms

Multivibrator (Z) is also used to generate the gating waveforms discussed earlier. These are generated by taking an output from the first divider (see Fig. 35) which is fed to a binary counter (c) via emitter follower (b). This produces the waveform as in Fig. 43 where the gating process is shown in greater detail. The $7\frac{1}{2}$ line period of gate multivibrator (Z) is adjusted to be very slightly less than $7\frac{1}{2}$ lines so that no spurious pulse occurs in gating waveform 1.

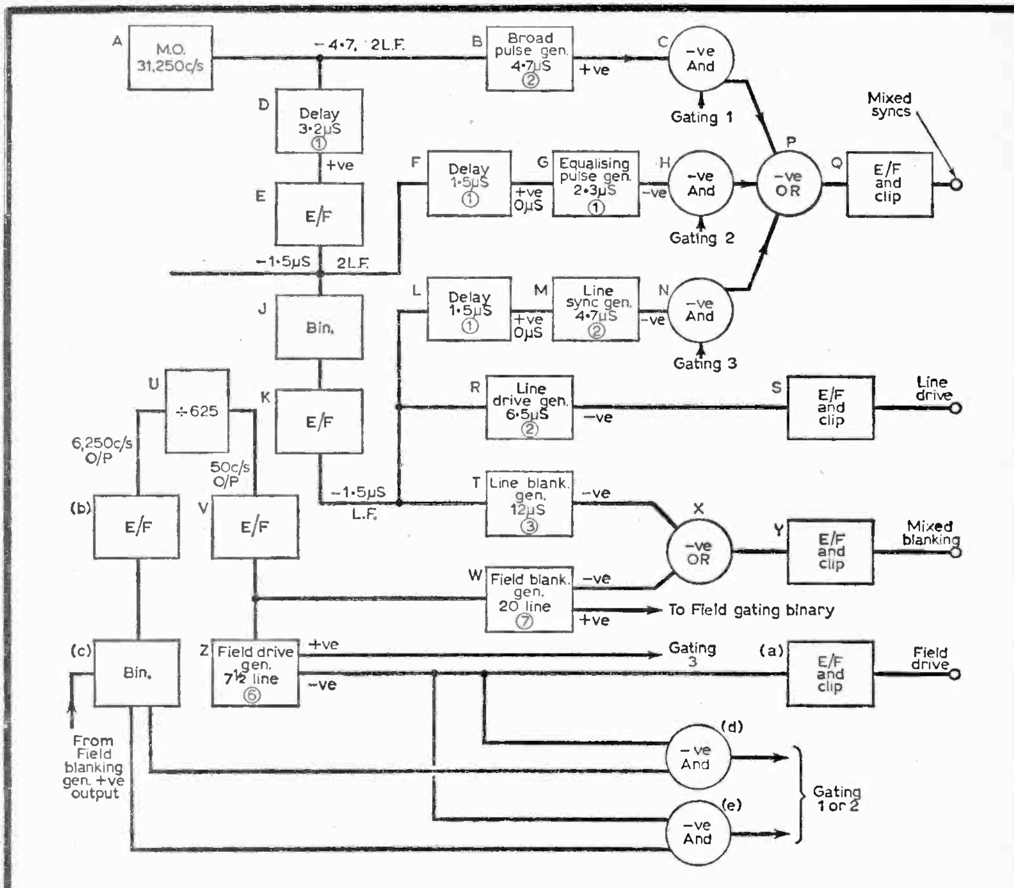
The gating waveform 1 consists of a $2\frac{1}{2}$ line negative pulse $2\frac{1}{2}$ lines after the start of field syncs. This will allow 5 broad pulses through gate C. Gating waveform 2 consists of $1\frac{1}{2}$c/s of a square wave consisting of $2\frac{1}{2}$ lines negative, $2\frac{1}{2}$ lines positive, and $2\frac{1}{2}$ lines negative, controlling the equalising pulses at gate H. Gating waveform 2 allows 5 equalising pulses through gate H and then cuts off these pulses as it goes positive, when gating waveform 1 allows 5 broad pulses through gate C. As gating waveform 2 goes negative again it allows the final 5 equalising pulses through gate H to complete the field sync period. Line syncs are interrupted in this period by gating waveform 3, which is the positive output of the field drive generator (Z). All gating waveforms occur once per field. The output of the binary changes its state each time it receives a trigger. The output of the first divider, however, is 125 triggers per field period, so the state of the binary will be wrong. To avoid this, an extra pulse (the trailing edge of field blanking, in fact) is used to make up the triggers to 126, thus ensuring that the binary is in its correct state at the start of the field sync period. Exact timing of the field blanking is not very critical so adjust multi-vibrator (W) to give reliable re-setting of the binary.

The 405 line pulse generator (Fig. 44) is similar in basic design to the 625 line pulse generator, the difference being in the timing of the different mixed sync circuitry. Here only 4 lines of broad pulses comprise field syncs, and these are gated by the field drive waveform. Except for the timings, the rest of the circuits perform a similar function to the 625 version, so similar circuit blocks are marked with the same letters as Fig. 42.

Power for all the circuits is stabilised and reduced to 9 volts by the stabiliser circuit in Fig. 45. A Zener diode stabilises the base of an OC81 whose emitter sets to the voltage on the base. This arrangement allows the pulse generator to be run off the station 12 volt supply (or a 12 volt car battery for mobile use).

Construction of the pulse generator is quite simple provided that each individual part is built and tested before proceeding. Obviously, then, the master oscillator should be built first and its operation checked; next the field divider and gating waveform circuits. The delays, waveform generators and output stages then follow.

As can be seen in the photograph published previously, the pulse generator was constructed on Veroboard supported vertically on top of a large Eddystone box containing the power supply. As the layout of the pulse generator is not critical, no more constructional details should be needed, except to suggest that earth and h.t.



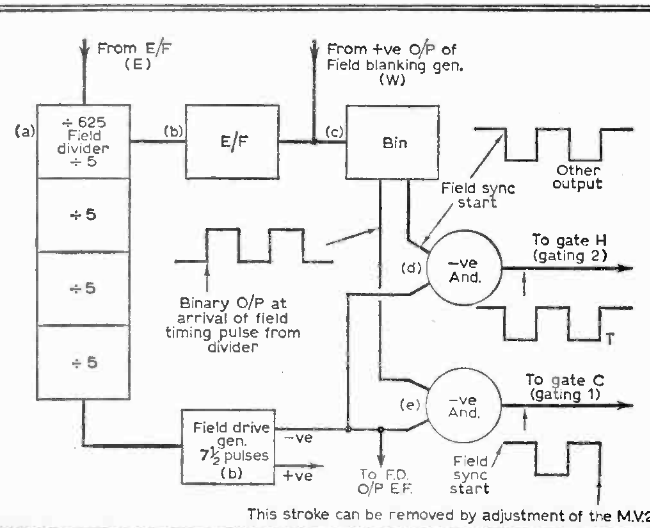


Fig. 42—(above) Block schematic of the 625 line pulse generating system.

Fig 43—(below) Block schematic diagram of the field gating circuits.

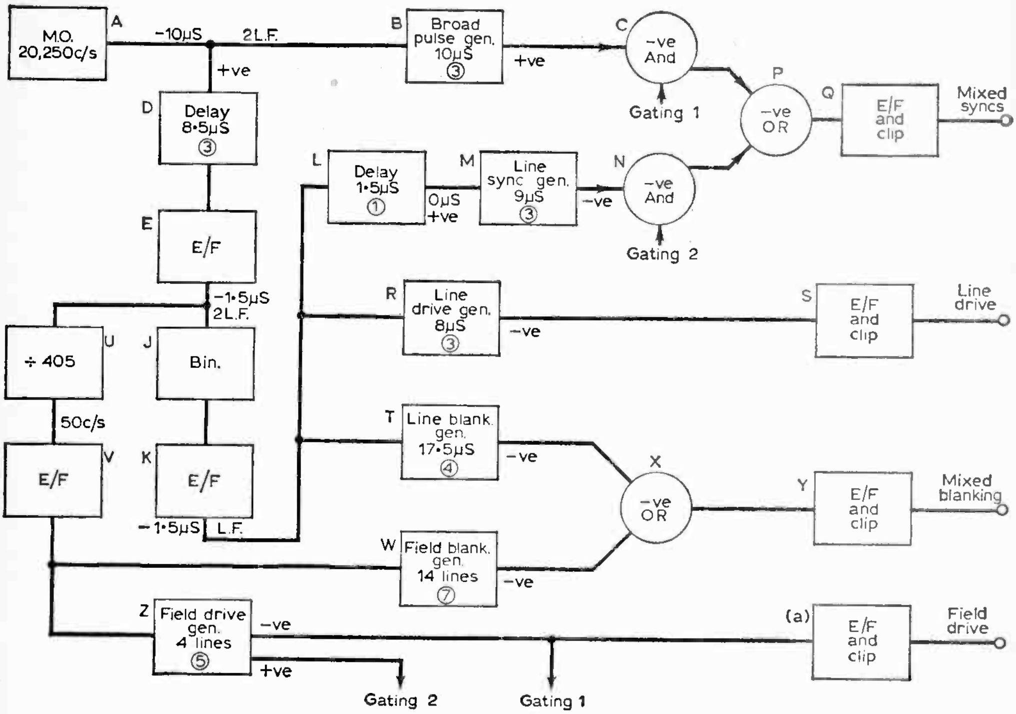


Fig. 44—Block schematic diagram of the 405 line pulse generating system

rails are placed five strips apart and the strips in between are used as interconnections and supports for various components. A future project is to rebuild the pulse generator on to Veroboard circuit cards which will be slotted into a 19in. rack. This rack will also contain a vision mixer, distribution amplifier and similar cards. The rack construction provides a simple method of mounting transistorised apparatus in modules. Several makes of card and racks are available but the author can recommend equipment made by Vero Electronics Limited.

Although this is not the cheapest rack assembly, they are very flexible in use. For example, the user can obtain a case (the Alton) which carries the whole rack, giving protection for exhibition or outside broadcast use. The pulse generator cards can be slotted into a smaller case carrying its own power supply to provide a small portable pulse generator for use in a simple camera set-up. Any further details which may be needed can be obtained from Vero Electronics Limited, Industrial Estate, Chandlers Ford, Eastleigh, Hants.

Three cards are to be used, one with master oscillator, mains lock and genlock (to be described), another carrying main divider, gating circuits and delay circuits, and a third, pulse generators and output stages. Controls for genlock and mains lock are to be mounted externally on a control panel.

Setting Up

A double beam 'scope is extremely useful for setting up pulse generator circuitry as the relationship between the input triggers and the output can be viewed simultaneously. However, some indication can be seen on an ordinary 'scope by removing the earth lead to the 'scope or the power supply and connecting the earthy input lead to the output of a second circuit; the 'scope

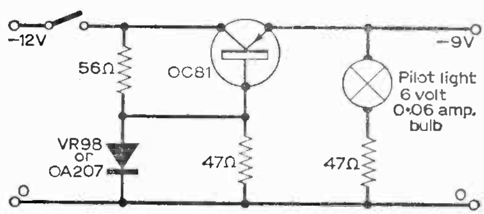


Fig. 45—Suggested circuit for a power supply stabilizer

then displays the difference between two inputs. Alternatively, the circuit under test can be run off a battery. The delay of each multivibrator should be set to clip at an amplitude of 2 volts across the output when loaded with a 75Ω terminating resistor. Broad pulse width, Delays

—continued on page 183

UNDERNEATH

THE DIPOLE

THE British television companies plus a large number of film organizations who have interests in both the cinema and television fields, were cautiously progressing with plans for adopting a British standard for magnetic stripe on 35mm. film, when—wham!—news came of another advance with optical sound tracks. I refer to the new photographic sound track system called "PFET".

This idea was developed for the U.S.A.'s National Aeronautical Space Administration and forms an integral part of the space satellite used for transmitting pictures from the moon. PFET stands for the photosensitive field effect transistor sound pickup, which now supersedes the previously used phototransistors as well as so-called solar cells.

The first tests with the PFET photo pick-up indicated a signal to noise ratio of about 90dB, which is at least twice as good as that of the best photoelectric cells used for sound play-off in telecine machines or cinema projectors. The output of the new device fed into all-transistor amplifiers has, it is claimed, outpaced conventional methods of optical sound reproduction.

Well, we will see—or rather, hear! Excellent sound can be reproduced from film by magnetic methods, with fine dynamic range and a complete absence of the clipping of the first modulations of transients; due to the quiescent effect of ground noise reduction shutters or biassed light-valves on all optical track film sound recorders. Still, if "PFET" halves the cost of release prints and still maintains good sound quality over the entire range of audible frequencies, it will be a big step forward.

Corn—that Cotton Cereal

In an age when 405 or 625 figures on television tend to look the same, be they M.P.s, disc jockeys, pop groups or band leaders, let us hail a genuine British character, Billy Cotton. I can remember when Billy Cotton took part in motor racing on the great Brooklands track, Weybridge. No doubt his "Wakey Wakey!" catch - phrase was developed over the roar of his Amilcar's engine as he arrived at the repair pits for a wheel change! Proud of his "square" routines, Billy Cotton is still batting with over 150 television shows on the scoreboard in the BBC's Top Brass Pavilion. What is more, his 150th show was transmitted *LIVE*—which shows that the viewing public still likes corn, as long as it's rich, crisp and it crackles.

Many of Bill's discoveries were on this special edition, including Russ Conway — and Jimmy Edwards, once again "covered" after his exploits as Mr. Jorrocks, M.F.H. Here's to the 200th, Bill!

Unfair to Paper-backs

Our *avant - garde* theatre directors are having a field day with free publicity with their "let's-be-beastly-to-the-critics" line. Whilst ICONOS has no pretensions to make learned remarks or observations that can be quoted on billboards outside West-End Theatres—he is a critic: but so is everyone!

The theatre, in its broadest sense, has since time immemorial tried to shock an audience. From the earliest Greek tragedies, through the drama and comedy of the Elizabethans, to the cruelty of the Jacobean and Hanoverian eras which led to an inversion when the great Grimaldi got laughs with a red hot poker! More recently was seen Edward Bond's "Saved" with its stoning of a baby in a pram by "beatnik" yobs.

With the growth of the subsidised theatre in London and a few provincial towns, directors have a right to shock—but have they the right to insult their critics? No doubt the paperback publishing barons will join the queue for Jennie Lee's (M.P.) cultural subsidies and financial aids for the live theatre via the Arts Council; after all, what's sauce for the goose is sauce for the gander. And why shouldn't the purveyors of erotica on television (alas! mainly BBC drama) take a bigger slice of the £6 television licence fee (when it comes). Why should a voyeur read, when all he has to do is to look!

Taxpayers have the right to grumble when they realise that the Arts Council appear to give subsidies which assist political propaganda as well as "pornography".

Bentine and Bennett

Years ago on the music hall stage there was an act called "Mr. Hymack" who specialised in using complicated trick "props" such as ties that whizzed round and changed colour, luggage which performed peculiarly on the platform of a weird railway station, "Missit Junction". For years he kept on introducing new props, even more astonishing, but then suddenly, he all but vanished from the halls. The reason? His props had all been made by one man, a brilliant craftsman and inventor, and he had died. So as the act, "Mr. Hymack", had prided itself on its newness it was doomed.

Michael Bentine uses involved props, but he is not reliant on them alone—they gild his art. In "All Square" on ITV, Bentine has the fullest scope for his gadgetry comedy. My favourite episode in this series included a wonderful "Englishman's Castle" sketch complete with an Inland Revenue Task Force with a fire engine hosing out the noble Lord Bentine and his serfs. The garage sketch with the accent on slapstick with oil and paint was in the classic vein of

Laurel and Hardy's "Selling a Christmas Tree".

So many words have been written about satire and most have linked the word with the famous revue "Beyond the Fringe". The original cast of this show have all gone on to further achievements, notably Dudley Moore and Peter Cook, who have made a considerable niche for themselves with their television series, whilst Jonathan Miller has concentrated on the other side of the camera as a director. For me, it was the fourth member of the quartet who was the true satirist—Alan Bennett, almost unsung by the general public. But when I saw "Fringe" in the final week, and this was the third time I'd seen it, it was the Bennett sketch material which retained the greatest freshness, the bite—and yet the underlying sympathetic vein of true satire.

"On the Margin" is Bennett's new TV series, which carries with it the hallmark of Bennett humour, careful observation and clear writing. What a contrast between the Bennett and Bentine shows and the Des O'Connor show, surely one of the most puerile so-called "comedy" shows to be seen on television anywhere.

Films and Television

Film makers are growing closer to television makers—or should it be the other way round? At any rate, television programmes are becoming more valuable in the world TV market if they are on 35mm film and preferably colour film. It therefore seemed perfectly normal for the Technical Sub-Committee of the Independent Television Companies Association to hold one of its routine meetings in the Boardroom of Pinewood Studios. It was the first one of its kind and therefore an historic occasion, which the General Manager, Mr. "Kip" Herren, saluted by entertaining the whole committee to lunch and a conducted tour of the splendid new dual purpose stages, with television lighting grids, television floors, control rooms, radio mikes, etc., etc. Suitable for feature films for the cinema or for television, both in black and white and in colour, with arc lamps or with incandescent tungstens, with back projection or with travelling matte, the complex was seen to set a new standard by amalgamating the best of both worlds. Chief Engineers or their representatives from Grampian, Scottish, Tyne Tees, Ulster, Border, Granada, ABC, ATV, Anglia, Southern, TWW, Rediffusion and Westward attended, with Bernard Marsden, Chief Engineer of ATV in the chair and the Secretariat of the ITCA in attendance.

Cut the Cackle

The highest honour that can come to a performer is to appear in the Royal Variety Performance. The proceeds from this Gala Show maintain the Brinsworth Home for Variety Artists at Twickenham, and with the advent of video-taping and tele-recording, the fund has been able to help even more of the old-time variety performers. The 1966 Royal Show on BBC-TV had plenty of stars, but once again it underlined the need for specialised material for use on the two mediums—the real live show and the recorded TV show. The comics that scored the greatest success were Frankie Howerd and Morecambe and Wise—both acts stuck to variations of scripts that were tried and trusted. It contrasted so much with the syrupy mutterings of many of the other talking and singing acts with their arch-modesty of the honour of being in the show, and coy tales of jet journeys from the four corners of the earth. So, Mr. Delfont, next year tell 'em to cut the cackle and get on with the show.

Iconos

IDEAS FOR AMATEUR TV

—*continued from page 181*

(D), (F) and (L) should be checked to ensure that the negative going pulse edge of mixed syncs always occurs at the same time whether line sync pulses, equalising pulses or broad pulses. This is because line timebases trigger off this edge and any variation would tend to upset this action. Most other timings are not so critical. Failure of a circuit to perform correctly may be due to interaction between circuits, and an emitter follower used as a buffer stage should be tried.

Many members of the B.A.T.C. obtain bulk orders for the transistors used in the pulse generator (approximately 50). These can be obtained from various sources in orders of several thousand, and are then sold at very low prices. For example, the author's transistors are unmarked but are, in fact, similar to XA131's, yet the cost was about 6d. each when bought in large quantities. All the transistors except the output transistors (2G103's) are OC44 equivalents. Almost any type of diode seems to work satisfactorily in the circuits, so the very cheap types found on the surplus market can be safely recommended.

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.

A VIEW ON COLOUR TELEVISION

SIR,—I would like, if I may, to put an ordinary person's point of view regarding colour television.

It would seem that the BBC has been committed to using 625 lines u.h.f. to provide this service.

Judging by the signal strength here in Petersfield for black-and-white, we shall be condemned to watch b and w for ever. I do not think the gain in definition provided by 625 lines even in a good area from what I have seen, is much gain over a good 405-line receiver.

Having also been in the photographic trade for some years, I know from experience that the general public will certainly accept the 405-line picture in colour. The line structure will not be noticeable with the colour information added.

Incidentally, I watched the BBC's last experimental colour transmissions in black-and-white from the London transmitter all the way down here with a single dipole and had much better signal strength than the u.h.f. signal from the Isle of Wight.

All in all I think it would be advisable to let both companies do colour for 3 or 4 hours a day on the existing channels, leaving the BBC to sort out 625-line black-and-white at their leisure, if they still wish to persist with building about 300 transmitters at enormous cost to the country. If we must have two channels, move the armed forces, etc., out of the top half of band 3 for the extra space.

With reference to the colour tests that I received here on 405. The picture was perfectly compatible and when the colour information was added, the picture quality was even better.—D. GOODALL (Petersfield, Hampshire).

ANYONE HELP?

SIR,—If any readers have a copy of the February, 1966, issue of PRACTICAL TELEVISION they do not want, would they please send it to me. I am willing to pay all expenses, etc.—G. GRIFFIN (23 Tully Street, Whyalla, West, South Australia).

A USEFUL HINT

SIR,—It is possible that other readers may be interested in the following information.

Two years ago I fitted a 23in. c.r.t. to an Ekco 311 chassis and the only modification necessary was to fit 110° scancoils designed for use on an Ekco 344. I have perfect field and line scan and although the flywheel sync is absent on this model, I get perfect fringe reception and trouble-free viewing. I was also fortunate to obtain a surplus console cabinet.—G. MULVIHILL (Wicklow, Ireland).

ATTEMPTED CONVERSION

SIR,—I am attempting a 625-line switchable conversion on a Pam 800 (similar to a Pye 210) with a Pye-Ekco 625 Converter Unit, type AE01603. I would be grateful to hear from any readers who have accomplished such a conversion, especially for line output stage.—W. L. WILLIAMS (40 Glasslyn Road, Crouch End, London, N.8).

OLYMPIC ISSUES

SIR,—Could any reader please sell or loan me the April, May, June, July and August 1965 issues of PRACTICAL TELEVISION concerning the Olympic II. I am willing to copy and return any issue lent to me.—J. T. STOCKDALE (2 Highfield Drive, Longridge, Preston, Lancashire).

A POINT OF VIEW

SIR,—Criticism is always welcome but sometimes Iconos oversteps this mark and reveals an amazing lack of knowledge of TV techniques and problems.

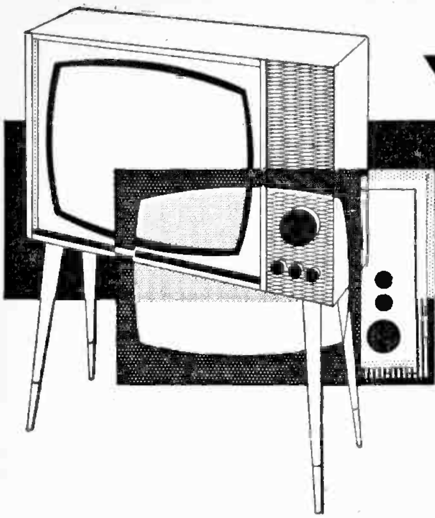
In the October issue of PRACTICAL TELEVISION he levels criticism at the BBC for poor make-up, wardrobe, lighting, unnatural poses, etc.

Firstly, the "pseudo-withit" directors frequently work for ITV then transfer to BBC and vice versa, so this point cannot presumably be the reason for "Especially those from the BBC".

Secondly, the lighting problem mentioned is not one of which the experts need to be reminded. TV unlike film is necessarily a compromise. Shot follows shot without pauses for relighting. The height of lamps is not usually the problem. The angle of illumination is the important factor. If the angle is at the optimum, however, shadows of the camera can be caused on close-ups. Lamps attached to cameras have been used for many years in TV. 500W lamps on the tops of the cameras introduce further difficulties, increasing the camera height and making camera shadows on close-ups much more likely. Moving cameras with headlamps on the tops can cause endless frustration for boom operators, which incidentally, is my profession. Lamps mounted each side and slightly below the lens avoid these problems but the results are unnatural. Perhaps Iconos should consult M. D. Benedict in the same issue on the subject of lighting.

Wide angle lenses are not normally used for close-ups, but a track from a long shot to a close-up demands a wide lens to avoid visible camera shake (we cannot use rails in TV).

Finally, may I say that my years of service may not match those of Iconos, but my work for the Corporation began in radio, so perhaps we may have something in common.—Name and Address supplied.



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 188 must be attached to all Queries, and a stamped and addressed envelope must be enclosed

EKCO T2317

At switch-on the set behaves quite normally, the sound signal starts to build up and then as the line timebase comes into operation the sound vanishes and an only partially controllable raster appears. As this happens, the video anode voltage drops by some 30V. After this, the picture and sound appear very briefly from time to time.—L. Newman (Oxford).

This symptom could be caused by instability in the vision stages. The oscillatory signal so produced would be rectified by the vision detector and overdrive the video amplifier, causing its overheating. The vision and possibly the sound would be affected. Check the i.f. valves, preferably by substitution and, if necessary, the small i.f. decoupling and bypass capacitors.

FERRANTI 14T6

There is no raster and the sound is normal. I have momentarily shorted cathode to grid pin on end of tube, but the tube remained blank. Tube bias and e.h.t. are normal.—J. A. Fenton (Diss, Norfolk).

Lack of raster, normal tube bias and e.h.t. would imply trouble in the picture tube. Check the setting of the ion trap magnet on the tube neck if this looks as though it has shifted in position. Adjust, only if necessary, for maximum screen illumination. Make sure the e.h.t. is correct at the tube final anode and, if still no response, have the tube tested for emission.

FERGUSON 206T

On switching on the set the picture comes but after 3 to 4 minutes it collapses with a straight bright line down the centre of the tube face. I have changed PL81 and EY86 but without improvement. Could the line output transformer be faulty?—G. R. Wilson (Aughton).

If the white line persists (which it probably does not) you will have to replace or at least check the line deflector coils on the c.r.t. neck. If the line disappears or fades out almost as soon as it appears however, check the ECL80 line oscillator and associated components, but only if the PL81 overheats. If the PL81 does not overheat, check the 0·25μF boost line capacitor before fitting a new line output transformer. A transformer can be ordered from one of our advertisers, Direct TV Replacements for example, or from a dealer who will order it from B.R.C.

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. If somebody in a programme walks from right to left, he gets fatter.—J. Nichols (Kendal, Westmorland).

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

BUSH T67

The picture narrowed and there was a black band down one side. Now there is no picture at all. The sound is perfectly normal.—J. Marston (Northampton).

You should check the PL36 line output valve and the PY33 if necessary although as the sound is not affected, we do not suspect this valve which is the h.t. rectifier.

EKCOVISION T221

There is a good raster. E.H.T. voltage is present but there is no picture or sound. At first it was only ITV I could not get, but now I can only get BBC-1 now and again with a broken-up picture. I have changed PCF80 and PCC84 and cleaned the tuner contacts but this has made no improvement.—E. Bairstow (Wakefield, Yorkshire).

The fault is in the tuner unit. Check the h.t. to pin 1 of the PCF80. If low, check the 15kΩ feed resistor and other tuner components. Check oscillator tuning.

G.E.C. BT308

This set is completely dead. All the valves and tube are OK and h.t. is present on all points. The mains dropper and metal rectifier, fuses, switch, etc. are in order.—R. W. Hill (Hanham, Bristol).

The information you have given us cannot be correct. First ensure that only one side of the mains input to the receiver is alive; check plug and socket if both leads are live.

Then ensure that the chassis is not live; reverse leads if it is. You should then be able to check the live side from the fuse to the on/off switch, to the dropper sections, thermistor and along the valve heater chain until the break is found, including the c.r.t. heater if all the others are alive

PAGEANT 7P20

This set has no picture. Raster and sound are present. The brilliance control is operative although it does not blank the screen effectively. On band 1 a "slight" trace of sound-on-vision is noticeable. I have interchanged valves 4 and 5 with valve 6 (sound i.f.) and tried substituting these 6F23's with new EF80's with no result.—M. Day (Birmingham, 24).

You will have to check the V4 and V5 valve base voltages, h.t. at pins 7 and 8 and bias at pins 1 and 3. If these are in order, check the CG12E (or OA80) vision detector diode (inside L18-L19 can) also the video choke from this diode to the valve base.

MURPHY 240

There is a line whistle present. The PY81/20P4 are OK. There was a blue glow in the 20P4. I replaced this valve but the glow appears in the new one also. This glow moves up and down when the line hold is adjusted. To make a neon light, you have to touch the top of the PY81/20P4.

E.H.T. at the tube connection is almost nil and when this connection is removed it makes no difference. I cannot tell whether the e.h.t. rectifier is lit.—N. Irvine (Solihull, Warwickshire).

If the circuit is working properly, the neon would light when placed in the vicinity of the transformer. Check the 0·25μF boost line capacitor and resistors to pin 4 of the 20P4 base.

G.E.C. BT5348

On occasions, the picture and sound disappear suddenly, leaving a blank bright screen. After switching off for a few moments then switching on again, the picture and sound come back. This might happen once every few days or a couple of times during an evening's viewing.—J. Marshall (Westcliff-on-Sea, Essex).

The symptoms indicate that the circuit is intermittently going into oscillation. First check the decoupling capacitors (0·001μF) by bridging each in turn with a test capacitor of near value. Check that from pin 8 of the V3 base to chassis and other valvebases pin 7 to chassis. Check tuner decoupling and aerial socket.

EKCO T327

There is no horizontal hold. The 30PL1 has been changed with no improvement.—G. Wilson (Northwich, Cheshire).

We fail to see why if the horizontal hold has failed the 30PL1 should be suspected as this is the field oscillator-output.

The line oscillator is part of the 30FL1. If the field is at fault check the 2μF decoupler of the 30FL1 screen grid (sync separator section) and the interlace diode.

BUSH TV95

When switched on, the picture does not appear. Sometimes the screen remains blank and sometimes there are lines running across it. I normally have to wait about 25 minutes before I get a worthwhile picture. I have changed two ECL82's and a PCC89, but this has made no difference. —J. O'Reilly (Glasgow, Scotland).

Your description of the fault is not too clear, however we presume that when the set is first switched on, there is no picture signal but the sound is normal. We presume the picture then gradually fades in after some 25 minutes. In this case you should check the video amplifier stage, first changing the PCF80 valve (V205) upper left side.

FERGUSON 506T

The contact studs on the tuner of my Ferguson 506T require cleaning, can you say the best way to do this?—A. E. Bellfield (Birmingham, 26).

You will have to remove the chassis from the cabinet. Release the two left-side screws and swing open the left side. Spring off the back of the tuner, undo the centre 2B.A. nut and remove the coil disc. Clean the studs and replace.

K.B. VV70

BBC-1 and ITV give no trouble, but on BBC-2 there is a weak raster and barely discernible picture which is too big for the screen. Manipulation of the controls slightly improves the picture but not to a usable degree. Increase of the brilliance control causes the picture to start disappearing from the centre outwards. The picture also stretches to the left giving a ghost image of the missing part of the picture in mirror form at that side of the screen. The sound is OK apart from being "slightly out of tune".—P. Ryan (London, S.W.8).

We would advise you to change C128. This is a 0·12μF 500V capacitor between the line output transformer and the system switch to the deflection coils.

BUSH TV105

The width of the picture is just short of filling the screen even with the control advanced to maximum.—D. Pillinger (Keynsham, Bristol).

You will probably find that the h.t. metal rectifier is in need of replacement. Compare the a.c. input to the d.c. input which should be higher.

AERIAL DIMENSIONS

Could you please tell me the dimensions of a BBC-2 aerial for the loft?—G. A. Wilford (York).

It is virtually impossible to answer this question without the following information: (i) prevailing signal strength conditions (i.e., how many elements will the aerial require to abstract sufficient signal to work the set correctly?) (ii) is the aerial to be tuned to just the one existing local u.h.f. channel? (iii) if so, the channel number (iv) is the aerial to be tuned over the local *group* of channels?

McMICHAEL M21T

The picture will not stay still for long but when it does it is slightly negative and all objects have a bright line surrounding them. The contrast does not seem to work either.—G. Gorodini (Ewell).

This seems like overloading of the video amplifier: also indicated by lack of operation of the contrast control; the set now probably running in its full-gain condition. Check the contrast control, the associated supply circuits, and the vision i.f. and tuner valves that are controlled (i.e., from the vision a.g.c. line) as a heater/cathode short in one of these could cause the effect.

PHILIPS 21TG100U

The top of the picture is cramped and does not fill the screen. Reducing the height control makes the picture a little better but it still does not fill the screen by 3in. top and bottom. Increasing the height, the picture fills the screen momentarily then drops at the top by about 2in. and is cramped.—A. L. Brown (Bolton, Lancashire).

Check the h.t. feed to the field timebase generator (via the width control). Check the resistors and capacitors here and those connecting to the boosted h.t. line. It would seem that a resistor is high in value but that initially the supply to the oscillator is sufficient due to the charging of a capacitor, the charge, of course, quickly exhausting when the generator takes current.

QUERIES COUPON

This coupon is available until JANUARY 20th, 1967, and must accompany all Queries sent in accordance with the notice on page 185.

PRACTICAL TELEVISION JANUARY, 1967

TEST CASE -50

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

? *A dual-standard set suddenly developed the fault of vision failure on 405 lines, operation normal on the 625-line standard. When switched to the 405-line standard the raster faded out altogether (sound remaining normal) and, though the line whistle could be discerned by running the horizontal hold control over its range with the aerial disconnected, it was less prominent than when the set was working correctly on both standards.*

Internal examination showed that the screen grid of the line output became red hot when the set was switched from 625 to 405 lines.

What could be responsible for trouble of this kind and what tests could easily be made to prove this? The answer will be given in next month's PRACTICAL TELEVISION *along with a further item in the Test Case series.*

SOLUTION TO TEST CASE 49
Page 140 (last month)

While two faults could have developed on the Thorn 850 chassis, one in the sound channel, causing the distortion, and the other in the vision channel, killing the picture, this is not very likely and the first test should be that to establish the possibility of a common fault.

The symptom of no line whistle, of course, indicated failure of the line timebase, and a simple test with a voltmeter on the control grid of the line output valve revealed lack of line drive. Normally, a substantial negative voltage is present on this electrode when the line oscillator is delivering line drive to the output valve.

Consequently a check was made of the line oscillator section, and it was soon discovered that the anode voltage on this valve was well below that given on the circuit. The oscillator anode load resistor was of the correct value, and the top end of this was traced back to the h.t. positive line.

It was found that this circuit was completed through a decoupling resistor which also served to feed the screen grid of the final sound i.f. valve. The resistor checked normal value, but the voltage on the screen grid was below specification. It was then soon discovered that the screen grid decoupling capacitor had poor insulation to chassis, and the d.c. flowing through this was pulling down the screen grid voltage and, of course, the voltage to the anode of the line oscillator. While the sound i.f. valve had just about sufficient voltage to make it work after a fashion—with distortion—the voltage was too low to sustain line oscillation. Capacitor replacement cured both symptoms.

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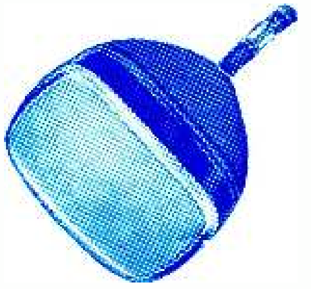

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