Practical TELEVISION

MARCH 1966

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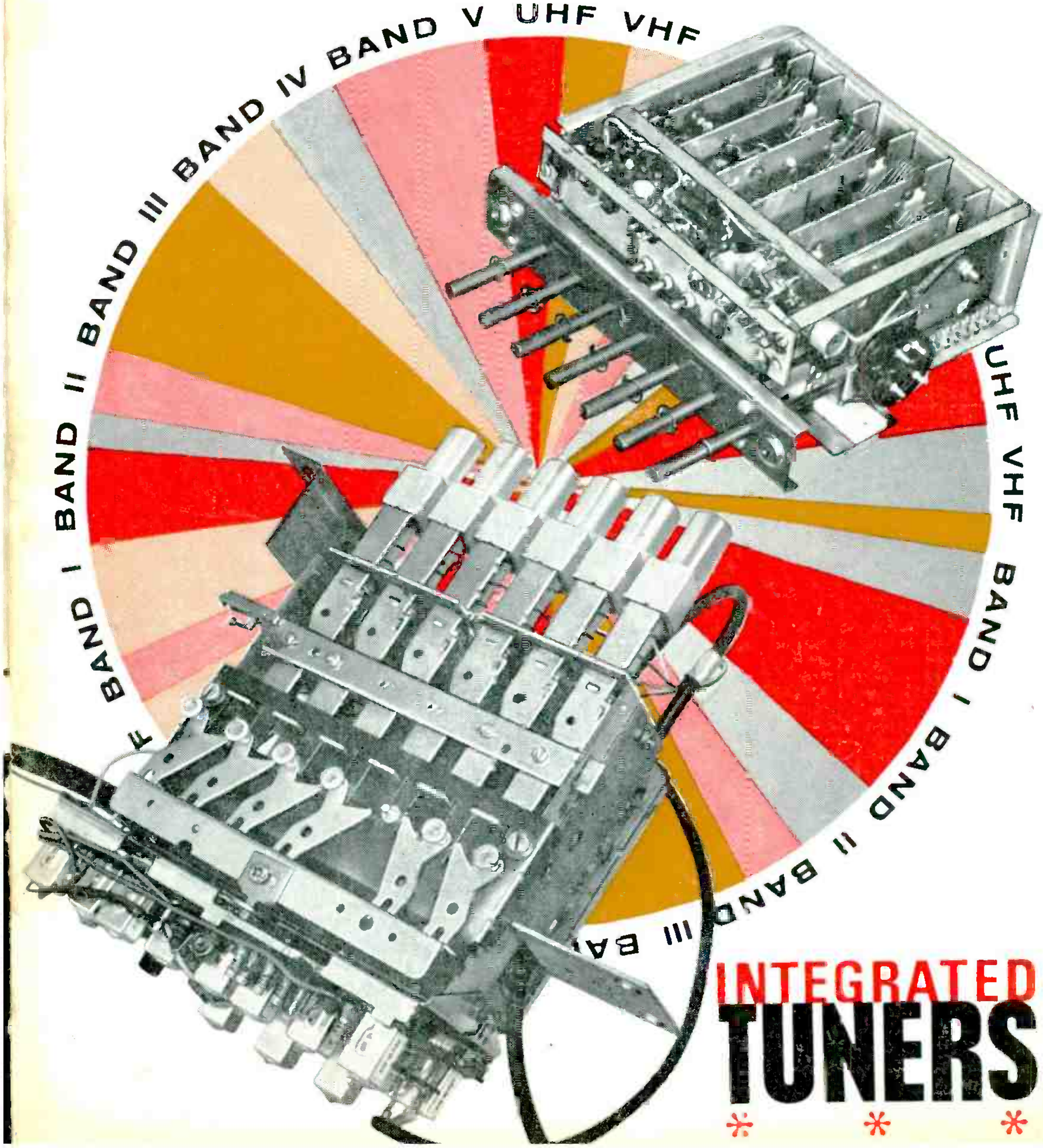

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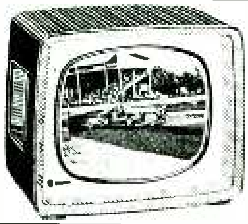

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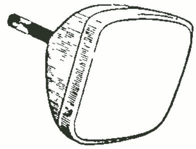

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Practical Television

THE BACKSLIDERS

FOR every four TV set owners, or renters, who comply with the law and obtain the necessary licence, one other TV set user does not. Projecting this to the total involvement, it means that 2,000,000 licence dodgers are getting away with it to the tune of £10,000,000 each year.

In a recent address, Mr. Norman Collins, Deputy Chairman of Associated Television, called for the abolition of the BBC licence system. "It is," he said, "a ridiculous anachronism, a left-over from the days of headphones and cat's-whiskers . . . Any tax on viewing is as ridiculous as the infamous Window Tax which was abolished in 1851." The answer, he went on, was that all BBC services should be financed by Government grant-in-aid.

Anachronistic or not, most countries operating public corporation TV still seem to prefer to raise revenue by the licence system. Moreover, total Government finance of the BBC would, in fact mean that **everyone** pays, indiscriminately. People who do not view would be subsidising those that do. This would, in effect, still be the "tax on viewing" that Mr. Collins complains about.

Other recent suggestions have involved the co-operation of the retailer—purchaser producing a licence; retailer issuing licence with set; etc—but the RTRA dislikes such schemes since dealers would become "tax collectors" or "snoopers". A misguided attitude, surely, for licence dodgers have no right to expect protection.

In the meantime, the GPO in their battle against the dodgers seem to rely on their nine detector vans which cruise the country as their main weapon. True, they obtain worthwhile results, but the vans cannot be everywhere at once. Your editor has lived in his present home for over five years, yet in that time there has been no sign of a GPO detector van in the area. The vans contain equipment valued at around £150,000 and the running costs plus the complement of 27 crew adds up to quite a lot of licence revenue.

So, do we scrap the licence and introduce, in effect, taxation spread over the whole community, or do we devise some easily administered and fool-proof system of licence collection? Whatever is done should be done soon, for it is absurd to continue to allow consciencious licence payers to subsidise 2,000,000 backsliders.

MARCH 1966

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THIS MONTH

OUR NEXT ISSUE DATED APRIL WILL BE PUBLISHED ON MARCH 24th

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TELETOPICS

NIR – Russia's Colour System?

The B.B.C. Comments

LAST month Teletopics announced the first news of NIR—another colour TV system.

Now the BBC, who over the last few years has thoroughly tested NTSC, SECAM and PAL to see which would best form the basis for a unified European colour system, is studying NIR. Given enough time and information they will form an opinion of this apparently Russian system.

The BBC says, " It is of interest to note that this proposal appears identical with one made by Mr. B. W. B. Pethers, a BBC engineer, in April 1963, but which was not pursued because at the time it was thought its advantages, with respect to the other systems, were not sufficiently attractive ".

World Cup Facilities

FOOTBALL commentators from many countries will be able to talk to viewers all over the world watching this year's World Cup Series to be held in Britain.

Pye TVT Limited of Cambridge are equipping a special mobile sound truck to be staffed by operators from countries taking part in the Series.

Fifteen simultaneous commentaries in different languages will be broadcast from each ground where a match is being played, and through the sound control vehicle, football fans throughout the world will hear, as well as see, how their teams are doing.

PARIS DRAWS THE WORLD TO THE COMPONENTS SHOW

EVERY year about this time, the electronic world goes to Paris to show and be shown all that's new in components.

The 1966 International Exhibition of Electronic Components held in the first week of February, provided an outstanding range of exhibitors—900 of them from 20 different countries. At the same time the second International Exhibition of Audio equipment was held next to it, in Paris's Porte de Versailles exhibition grounds.

ITT Standard of Brussels showed Europe's biggest range of electronic and electromechanical components from their thirty manufacturing plants scattered throughout the continent, including ten STC factories in Britain.

British Prizewinners at P.T. Filmshow

BRITAIN did well at this year's International Festival of Scientific-Teaching Films organised by the University of Padua (Italy), having seven of the ten British entries chosen for screening and gaining three awards.

The Mullard film " Thin-film Microcircuits " was selected, by the international jury, from over 150 films entered by 18 countries, for a silver medal (first prize) in its category. This film, which deals with manufacture of a new type of electronic component, was shown at the Practical Television Filmshow at Caxton Hall on February 4th.

Another film shown then was Mullard's " Electromagnetic Waves—Part 2 ", which won a bronze medal at Padua last year.

KEEPING IT CLEAN—AT EMI's

FORCEPS please, nurse. No, she is not handing a swab to the surgeon in an operating theatre, but as far as cleanliness goes, that's where she might as well be.

In fact our picture shows an operator critically examining a copper mesh which will be used in one of the 4½in. image orthicon camera tubes being made at EMI's Hayes factory, where cleanliness conditions sometimes exceed those of an operating theatre.

Any particle of dust which may have settled on the mesh is revealed by oblique illumination from a projector and will be removed by the finely controlled air jet held by the operator.

These meshes provide a conducting surface but allow a high proportion of electrons to pass through. Two meshes are employed in every tube, one on each side of the glass target. A dust particle on a mesh would prevent electrons passing through and thus create a blemish on the resultant picture.

Meshes are made in different grades up to four million apertures per square inch.

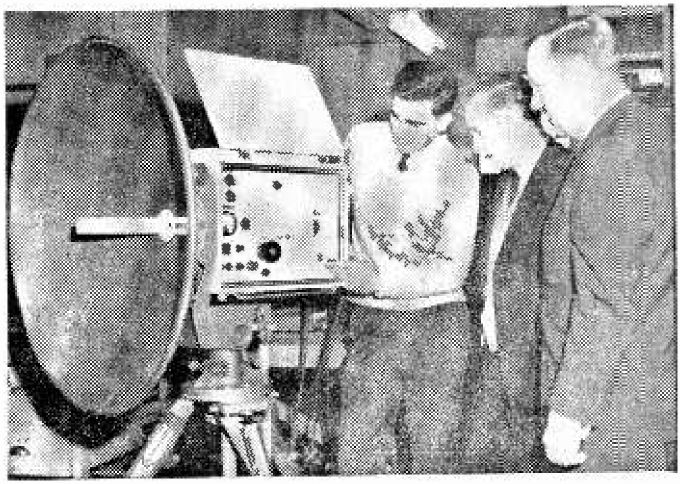
EMI EXPORT MICROWAVE LINKS WORTH £65,000

AMONG Britain's latest exports to New Zealand is a series of microwave links to improve and extend that country's television coverage.

Total value of link equipment supplied to the New Zealand Broadcasting Corporation by EMI Electronics Limited is about £65,000.

Recently despatched under the order are type ML4C units capable of transmitting colour or monochrome television signals. Before it was shipped, senior New Zealand trade officials visited EMI's factory at Hayes, Middlesex, to inspect the equipment (see photograph).

The equipment, which provides facilities for transmitting sound as well as vision signals over long distances, operates in the 7,000Mc/s band.



TELEVISION AIDS FOR ABBEY AUDIENCE

MANY people who attended the service last December, marking the 900th anniversary of the consecration of Westminster Abbey, saw the whole ceremony on television receivers.

These people, who would otherwise have had no direct view of the ceremony, were able to see and hear the proceedings via television monitors and a permanent sound reinforcing system installed by Standard Telephones and Cables Limited.

Thirty-two 23in. KB receivers were placed around the Abbey where direct vision of the audience was obscured, while 85 separate loudspeakers carried sound throughout the building.

Medway Colour Demonstration

MEDWAY Town Councillors and educational authorities from as far afield as Portsmouth, attended a demonstration of colour television last December arranged by Rentaset with BBC co-operation.

Pictures were carried two miles by co-axial cable from the relay aerial on the top of Chatham Hill to two receivers in the town. The BBC provided special transmissions during the demonstrations, which also included closed circuit television displays.

BRITISH WORLD-BEATERS AT E.E.E.

23-30th March — Earls Court

ON March 23rd Mr. Harold Wilson, Britain's Prime Minister, will open the 13th Electrical Engineers Exhibition at London's Earls Court.

Visitors to the Exhibition this year will see represented, trends being followed in this country by the electricity supply industry which provides Britain with one of the largest and most powerful systems in the world. They will see displays by the country's electrical manufacturing firms who supply components to the rigorous specifications laid down by an industry nationalised since 1948 and demanding only the best.

And to prove that Britain still leads, the exhibition illustrates, amongst other things, the world's largest nuclear power programme, the world's most powerful transmission system and electrification of the world's busiest main line (between London, Birmingham, Liverpool and Manchester)—all British trends.

RAINDROPS AND SPORADIC E

E. TRICKETT and J. Clarke have been awarded the BBC Engineering Division's 1965 research scholarships.

Under his scholarship, one of six maintained by the Division, Mr. Trickett, who graduated with second-class honours in physics from Durham University, will undertake research on the subject of "the electric charges and masses of raindrops"

Mr. Clarke who achieved first-class honours in electronic and electrical engineering at Birmingham, will study "Sporadic E in the atmosphere using aperture synthesis".

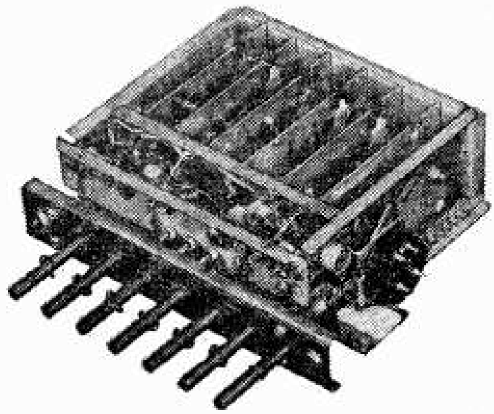
Studios Equipped in under 7 weeks

WITHIN six and a half weeks of receiving a £40,000 order for studio equipment, EMI electronics Limited supplied and installed cameras, telecine, monitors, pulse generators, vision mixers, amplifiers and cabling in two broadcasting stations in Zambia.

The contract, from the Zambian Broadcasting Corporation, provided for equipping stations at Lusaka and Kitwe, and to meet an iminent start-of-broadcasting date, EMI obliged with speedy delivery. Installation work at Lusaka was carried out in a record five days.

Integrated TV Tuners

FROM FIXED-TUNED SINGLE CHANNEL TO MULTI-CHANNEL "ALL BAND" TV FRONT ENDS



by K. ROYAL

DURING recent times there have been many developments associated with the front ends of television receivers. In very early sets the front end consisted first of an r.f. amplifier and frequency changer built into the main chassis and fixed-tuned to one local Band I channel. Then a modification arose whereby the front end could be pretuned to any one channel in Band I.

This was followed by the "turret" and "switched" tuner designed as a separate assembly with a selector knob and fine tuner to switch and tune to any channel in Bands I and III, and in some versions facilities were available to tune over Band II, the f.m. broadcast band.

Separate Tuners

This philosophy of the front end being independent of the main chassis is still with us and with the coming of television in Bands IV and V on the 625-line standard we have seen the addition of a second front end in terms of the u.h.f. tuner. Thus many current dual-standard sets feature two tuners, the v.h.f. tuner that switches and tunes over Channels 1 to 5 in Band I and Channels 6 to 13 in Band III (with facilities in some for tuning over Band II) and the u.h.f. tuner that embraces Channels 21 to 34 in Band IV and Channels 39 to 68 in Band V (note that Channels 35 to 38 are not at present allotted).

All dual-standard sets at present have a switch gear system whereby the set is changed to the appropriate standard when the tuners are switched. Thus when the u.h.f. tuner is in circuit the set is automatically "programmed" to the 625-line standard and when the v.h.f. tuner is in circuit the set changes to the 405-line standard.

Eventually the v.h.f. transmissions as well as the u.h.f. ones may be on the 625-line standard and facilities are available in most current dual-standard sets to rearrange the dual-standard switching so that the 625-line circuits are in operation on the v.h.f. channels as well as when the set is switched to u.h.f. channels.

This facility is required sometimes even now because certain television relay systems that employ coaxial cable for signal distribution translate the 625-line signals to a v.h.f. channel as the distribution losses at u.h.f. are far too great to permit coaxial cable distribution on the u.h.f. channels.

Of course when there is only the 625-line standard (a long way in the future yet!), dual-standard switching in the set will not be required, though the sets will still have to feature tuners suitable for both v.h.f. and u.h.f. transmissions.

V.H.F. tuners have not altered a great deal during the last two or three years but there have been several changes in u.h.f. tuners since their advent a year or two ago.

Continuously Variable Tuning

U.H.F. tuners differ essentially from their v.h.f. counterparts in that they use continuously variable tuning by ganged capacitors over the u.h.f. bands. v.h.f. tuners, it will be recalled, use either separate coils for the channels in a turret arrangement or increments of inductance that are switched into the tuned circuits to provide the required frequency shifts between the Band I and Band III channels

Switched coils or inductance increments cannot be utilised in u.h.f. tuners owing to stray capacitances and the extreme difficulty to keep the inductance sufficiently low to allow the tuned circuits to resonate at frequencies as high as 847·25Mc/s, corresponding to Channel 68 in Band V. Short tuning lines or "lecher wires", as they are sometimes called, are thus used in u.h.f. tuners instead of conventional coils and the lines are tuned by capacitors.

Modern u.h.f. tuners have four lecher wires and a four-ganged capacitor to tune them. The length of the lines is equal to either the *electrical* half wavelength or quarter wavelength of the tuned frequency. The physical length is considerably shorter than the electrical length. This is because the capacitances of the circuits and the tuning gang serve to reduce the length. In addition the variable sections of the gang effectively "vary" the length so as to make the lines tunable over the u.h.f. bands without switching.

A Mullard Tuner

A Mullard u.h.f. tuner circuit is given in Fig. 1. Here the gangs of the tuning capacitor tune lines L2, L4, L5 and L8, corresponding respectively to the aerial tuning, the anode of the r.f. amplifier tuning, the frequency changer tuning and the local oscillator tuning. L4, L5 and L6 form a bandpass coupling to maintain the response characteristics of the tuner over all the channels.

V1 is in the form of an "earthed grid" r.f. amplifier, an arrangement which is commonly adopted in u.h.f. practice, while V2 is a self-oscillating frequency changer, also in the earthed grid mode, the signal being applied to the cathodes of both valves.

The i.f. signal appears in the anode circuit of V2 and is developed across L10. It is then fed out of the tuner through a filter network which eliminates unwanted signals.

Valved u.h.f. tuners employ half wavelength lecher wire but because of the length shortening process, explained above, the wires are only about 5 to 6cm in length as distinct from 25cm or so for the calculated electrical length given from standard formulae. Actually a half wavelength line at 470Mc/s would have a physical length of about 32cm and at 860Mc/s about 17·5cm. Now when the tuning capacitors are rotated the zero voltage point on the lecher moves along the wire and it is this action that provides an effective variation in length and tuning. This should be remembered.

From valves the u.h.f. tuner graduated to transistors. At u.h.f. transistors are better than valves because they add less "noise" to the wanted signals. This means that a set with a transistor u.h.f. tuner will provide a picture of given noise (i.e. grain) content at a lower input signal. In practice the signal can be as much as 50% below that necessary for a valved tuner. This is rather the same as saying that a set with a u.h.f. transistor tuner will work at greater distance from a transmitter than a set with a valved u.h.f. tuner. There are other factors, of course, that come into this reasoning but from first principles the above statement is perfectly sound.

U.H.F. Transistor Tuner

Transistor u.h.f. tuners also use lecher-wire tuning but often the wires are of quarter wavelength. A tuner circuit of this kind is shown in Fig. 2. This particular circuit only has a three-ganged capacitor, tuning lines L1, L2 and L3, the r.f. amplifier, bandpass coupling and oscillator circuits respectively. Some tuners, as when valves are used, employ four-ganged tuning so as to improve the selectivity and reduce the tuner's response to spurious, unwanted signals.

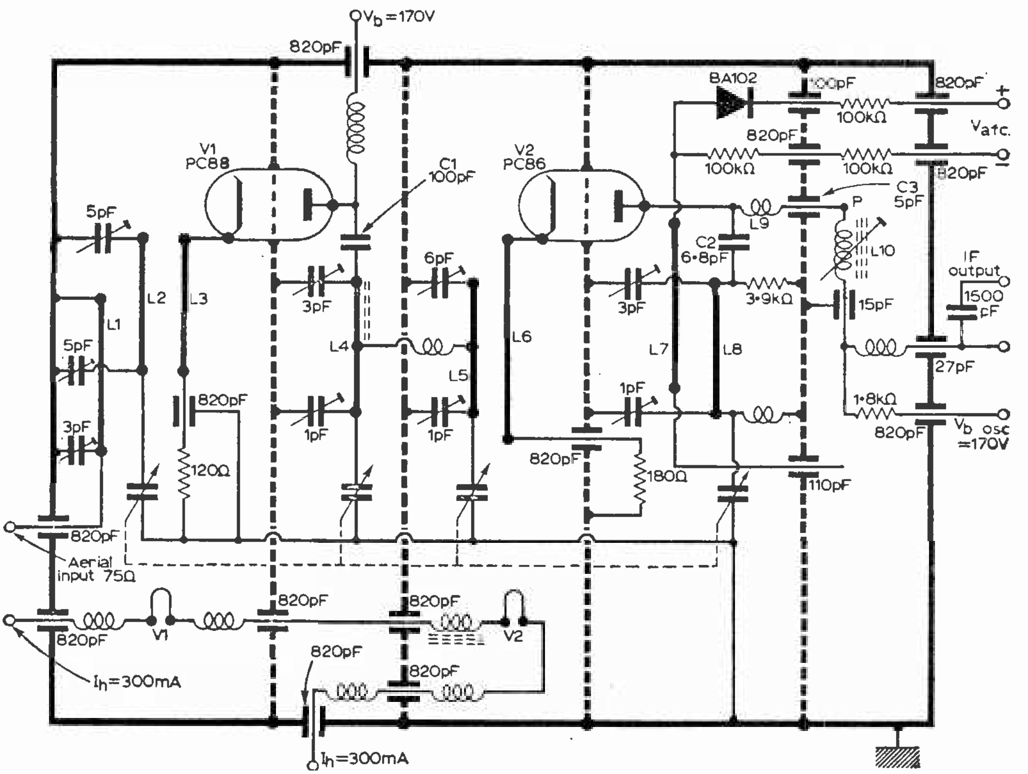


Fig. 1—Circuit diagram of Mullard u.h.f. tuner, using valves and half-wavelength lecher wires.

Now half wavelength lines (see Fig. 1) are arranged so that both ends are capacitively loaded: One end is loaded to the input or output capacitance of the valve itself and the other end to the tuning gang section. Trimmers are also used to permit optimum tracking adjustment over the whole u.h.f. spectrum.

Quarter wavelength lines, on the other hand, have a short-circuit at one end, the far end being loaded into the capacitances of the associated tuning gang section and the transistor collector. The short-circuit at one end of the lines in the circuit in Fig. 2 is shown by the lines being connected direct to the metal chassis. The quarter wavelength lines, of course, are that much shorter than those used in "half wave" tuners but they may not necessarily be exactly half the length. The function of effective "line shortening" as the tuning capacitors are rotated is similar however.

Quarter wavelength tuning is more advantageous in transistor u.h.f. tuners because of the very short transistor-to-line connecting leads that are possible. In valved tuners the pins of the valves and the leads to their electrodes constitute a part of the tuning line.

In Fig. 2 the first transistor is the r.f. amplifier in the "earthed-base" mode, while the second transistor is a self-oscillating frequency changer, also in the earthed-base mode. Quarter wavelength transistor tuners are much smaller than their valved counterparts. They are equally as efficient and are 3dB or more better noisewise.

All-band Tuners

We now come to the very latest idea in tuners, the "integrated tuner". This is a transistor "all-band tuner that combines the functions of the earlier separate v.h.f. and u.h.f. tuners. Thus dual-standard sets employing an integrated tuner have only one front end.

At the time of writing only about two firms have developed tuners of this kind but already one manufacturer (Pye Ltd. and associated group companies) have produced a receiver featuring an integrated tuner. The Pye tuner is worthy of note since it embodies some very interesting aspects and is almost certain to set a trend in future set design.

The circuit of this tuner is given in Fig. 3. Four transistors are used and a clever patented arrangement avoids switching in the u.h.f. sections as we shall see. Continuously variable lecher-wire tuning is used in the u.h.f. section but this has been extended to the v.h.f. section so that the tuning-gang sections perform both on u.h.f. *and* v.h.f.

This technique leads to simplified mechanical design and to advantages in size, installation, cost and technical facilities over the two-unit counterpart. The integration also leads to common stages. The r.f. amplifier, for instance, is common to both v.h.f. and u.h.f., a technique that avoids the complication of switching in this critical section of the circuit.

The Pye Tuner

A block diagram of the Pye tuner is given in Fig. 4 and this can be examined in relation to the circuit in Fig. 3. The u.h.f. aerial input circuit is coupled direct to the r.f. amplifier transistor Tr1, the output of which feeds the u.h.f. bandpass circuit, L14 and L21.

The output of the bandpass circuit feeds into the self-oscillating frequency changer, using transistor Tr2, and the output of this is switched to Tr3 which, in the "u.h.f." position, acts as an i.f. or "buffer" amplifier. The output of this amplifier connects to the i.f. coil and thence to the set's i.f. channel. It will be noticed that there is no actual signal switching at all in the u.h.f. section.

Now in the "v.h.f." position either the Band I

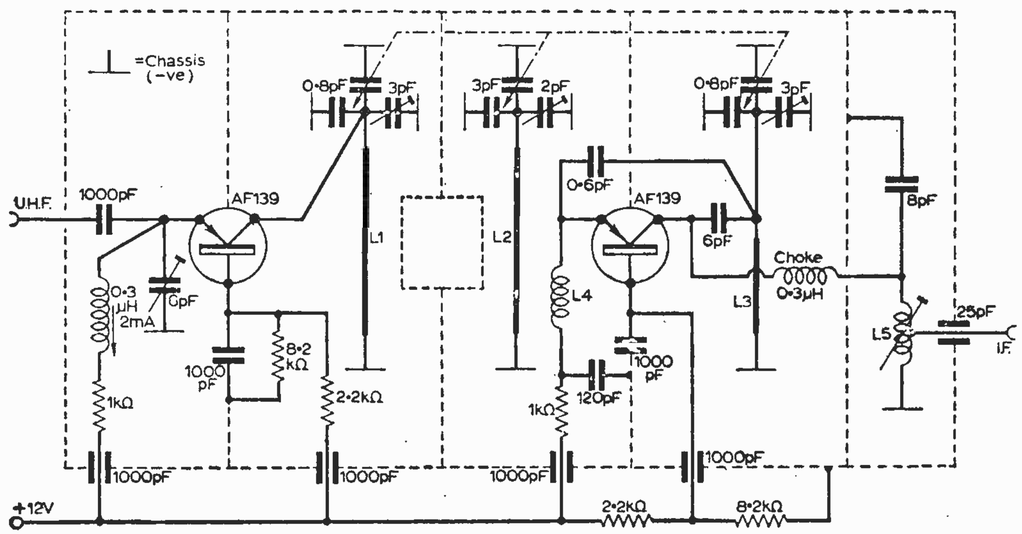


Fig. 2—Circuit diagram of a transistor u.h.f. tuner using quarter-wavelength lecher wires.

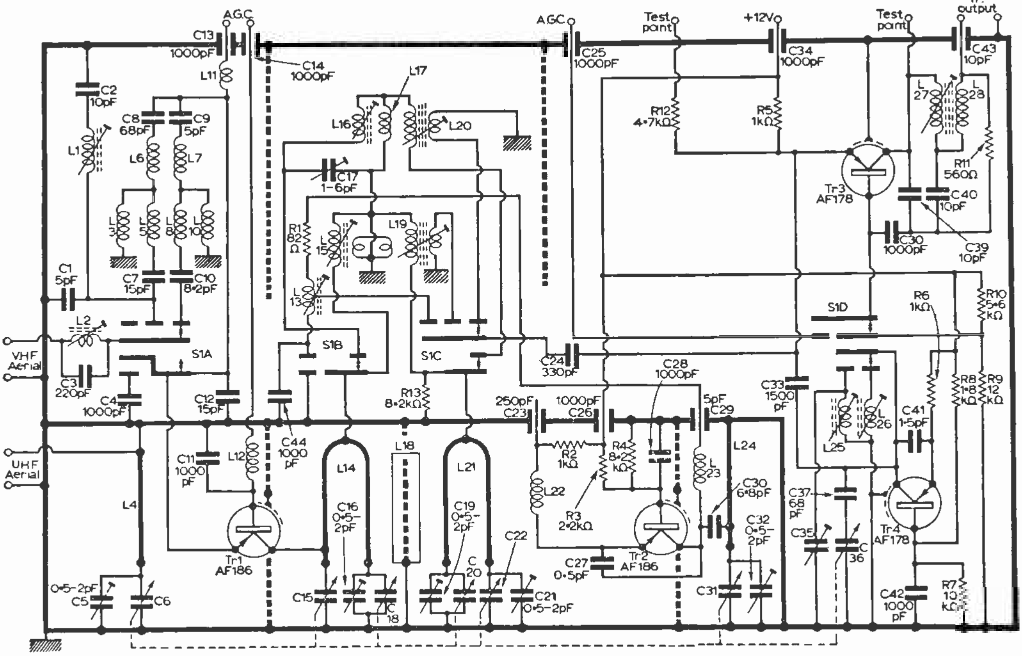
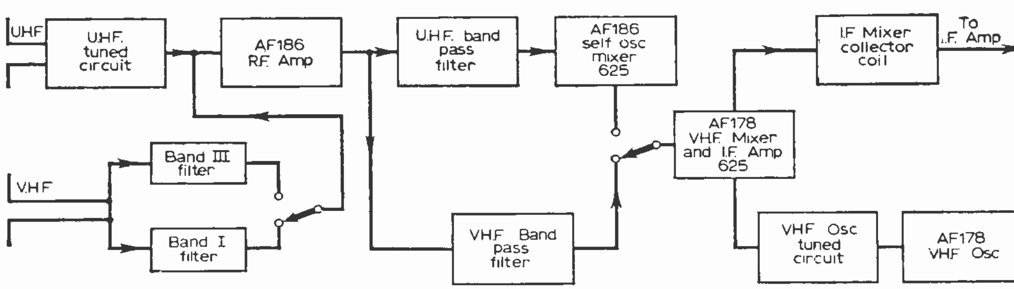


Fig. 3 (above)—Circuit diagram of the Pye "all-band" television tuner. This is fully described in the text.

Fig. 4 (below)—Block diagram showing the various stages of the Pye all-band tuner.



or Band III aerial filter circuit is selected, the output then feeding into the common r.f. amplifier (the presence of the u.h.f. input circuits here has no effect on the v.h.f. performance), then to the v.h.f. bandpass filter (which again is switched for Band I and III) and on to Tr3 which, on v.h.f. acts as a mixer.

This mixer is also fed with v.h.f. oscillator signals from the v.h.f. oscillator transistor Tr4 and the output from this stage is again fed to the i.f. mixer coil, the output of which goes to the set's i.f. stages as before.

It will be appreciated that the "band switch", which is always necessary, is concerned mainly with the switching of the v.h.f. circuits and oscillator switching. The u.h.f. tuning employs U-shaped half wavelength lecher wires tuned at both ends rather than single wires tuned at one end. This is related to the patent mentioned earlier. The two-end tuning is performed by split-stator gang sections.

Doubled Ended Tuning

It has already been told that with single-end tuning the zero voltage point on the lecher moves along the wire as the tuning capacitor is rotated. With double-ended tuning this is not so and the zero voltage point remains at the centre (i.e. the U bend) of the wires over the tuning range.

This means that an unswitched coupling from the u.h.f. circuits can be made at the U bend of the wires without detracting from the u.h.f. performance of the tuner. The centre connections can be seen in the circuit and the lecher wires act simply as low inductance couplers on the v.h.f. channels.

—continued on page 271

FAULTY RESISTORS

— THEIR EFFECT IN TV RECEIVERS —

F. A. GRINDTHORPE

THIS article is not concerned with specialised elements such as VDRs, Metrosils, etc. We are concerned with ordinary carbon, wire-wound and variable resistors such as are generally met.

Wire Wound

These are generally used where some amount of heat is dissipated and as an example the commonly met mains dropper may be cited. The purpose is to drop the mains voltage to the figure required to correctly operate the circuit. Whilst this could be done by a transformer the equipment could then only be used on a.c. mains. Therefore if the sum total of a number of valves' heater voltages is, for example, 140V, operation from a 240V main supply necessitates "losing" 100V. This is lost in heat caused by current flow through a resistor, resulting in a drop of voltage across it. If the valves are all rated as 0·3A and 100V is required to be dropped the dropper would have to have a resistance of 333Ω. The product of the voltage drop and the current flowing results in 30W of heat dissipation. Smaller sections are tapped to give different voltage settings between 200-250V and these may have a value of between 10-70Ω depending upon the type of circuit. The fault which afflicts droppers is a tendency to fracture or open circuit at any particular point. Some seem to go at the tags—where repair is possible—whilst others seem more prone to pop off halfway along a section.

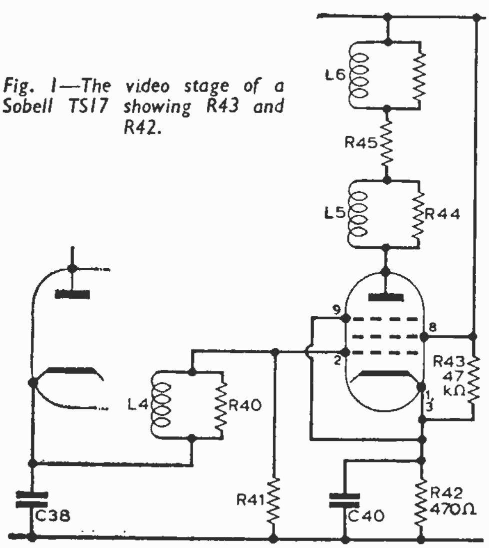


Fig. 1—The video stage of a Sobell TS17 showing R43 and R42.

A "hot" test with a voltmeter (or a neon) or a "cold" test with an ohmmeter soon locates the faulty section, whereupon the repairer has a choice of replacing the whole dropper, shunting a replacement section across the faulty one or, if the defective section is in one of the voltage tapping sections, shorting it out and bringing in an unused section if available. To make this quite clear, if the defective section is between the 200V and 220V tappings and the receiver is set up for 220V the section can be shorted across and the voltage setting reset to 240V. Different circuits use different methods of voltage selection and the requirements of the h.t. and the heater circuits must be taken into consideration. Resistors, be they sections of the dropper or separate units, in series with the h.t. rectifier, have two functions: they not only drop the voltage to that required, they also set as surge limiters to limit the amount of current flowing through the rectifier in any near short-circuit conditions. Remember that there is a heavy surge of current as the electrolytics charge up, particularly at the moment of switch-on when the rectifier is of the "cold" type, metal or silicon. An open-circuit surge resistor gives the condition "valves light up but there is no other sign of life from the receiver".

Variable Resistors

It is often necessary to use a resistor the value of which can be varied for the purpose of regulation or control. Such elements or units take many forms, the most familiar of which is the three-tag potentiometer. The outer tags connect to the ends of the resistive element, which may be wire wound or carbon, whilst the centre tag connects to a slider which can be set at any point between the two ends. Here again the wire-

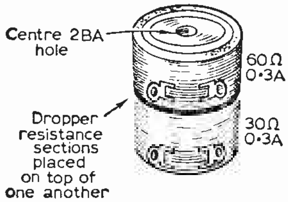


Fig. 2—Commerically made mains dropper sections (Radio Spares Ltd.).

wound variety, which does not often exceed a value of 50kΩ, usually only suffers from a fracture somewhere along the track, but most often at one end, and it is not impossible to bridge the fracture by a small clip in order to restore normal working. Quite often, however, where the element has been used in a fairly high current carrying circuit the resulting heat buckles the former on which the element is wound, causing the slider to make erratic contact. It is in the more widely used carbon types where we encounter most trouble. The faults which can beset these controls or presets are numerous. Noisy volume controls are well known and here the improper contact of the wiper on the track can usually be improved by applying cleaning fluid or light oil direct on to the track, at the same time rotating the spindle to wipe a clean surface contact. The fact that the improper contact causes audible noise directs attention to it, but a similar fault in a field (frame) timebase control may not be so obvious. The appearance of irregular black lines and persistent jumping up and down, depending upon the part of the circuit affected, is usually an indication that a control could be at fault.

The 1MΩ line hold control in the Bush TV53 and 63 series often gives trouble, due to irregular control, and replacement is the best cure. The present contrast control in the recent Pye, Pam, Invicta, etc., series, dealt with in the August-September issues, is another example of a common failing in a carbon preset. Thus a control can be noisy, due to imperfect contact as in the case of the Bush, open-circuit as in the case of the Pye, or of changed value as in the case of the early Ferguson 14in. and 17in. models (996T, etc.), and more recently, where focus is varied across a 2MΩ element associated with the boosted h.t. line, this causes not loss of focus, as might be expected, but loss of height or brilliance, according to the circuit. What happens is that this particular line may be obtained from the boost supply through, say, a 1MΩ resistor to the focus (which is 2MΩ to chassis), first anode and height control circuits. The focus element drops in value to, say, 500kΩ over a period, leading to a gradual loss of height and brilliance as the ratio of voltage across the two resistors changes. This is an extremely common fault, more common than the limiter changing value in some Philips-Stella models, causing the line hold to be lost, due to the association of the two controls.

Fixed Carbon Resistors

This is where we meet the most trouble and where misleading symptoms are caused. Some of the effects are well known, others cause engineers to age prematurely. Well-known examples include screen droppers to the line output valve falling in value, causing overheating, lack of width and rapid valve deterioration. An oft-encountered one is in the Decca DM1-2-3-4 series where the 4·4kΩ screen resistor to pin 8 of the PL81 falls to about 500Ω. Unless this resistor is replaced, PL81 valves fail at a rapid rate. The usual practice is to fit a wire-wound 5W of about 3kΩ and no further trouble is experienced.

Resistors in the video circuit also give a lot of trouble, not so much the anode load resistor but usually the h.t. to cathode loader, which may have an initial value of between 22kΩ and 47kΩ. A 1W 22kΩ or a ½W 47kΩ can change value quite quickly, leading to a virtual h.t. short. Not only does the faulty resistor itself burn out but also the series cathode resistor, which normally has a value of between 200Ω and 470Ω. The Sobell TS17 series (R42 and R43) and more recent Ekco-Ferranti models suffered particularly from this defect. The fitting of higher wattage resistors was easy in earlier wired receivers but the printed panels of some Ekco-Ferranti and some Alba models did not lend themselves so readily to the fitting of more bulky 2 or 3W carbon resistors. However, such modification, even if it doesn't look so good, is well worth while. It is also well known that the 6·8kΩ 1W resistor fitted in some tuners at the triode-anode load can cause trouble, this time going high. As it increases in value the Band III signals fade off first, leaving the Band I channels apparently unaffected, until the resistor really starts climbing up to the 50-100kΩ mark. The Philips wired models exhibited this fault quite regularly and the Sobell-McMichael tuner, where the resistor is a 10kΩ, also gave trouble. A less-well-known resistor fault occurs in the Bush TV75-95 series.

To cite an actual case, the complaint was "No BBC, only faint sound. ITV OK for about an hour, after which it gradually faded". On the bench this was confirmed with the added and rather confusing symptoms that as the ITV faded the sound developed an audible hum and the faint picture was shaded by the same hum signal. The very weak BBC sound was not affected by this hum ripple, neither was the raster shaded. Valves were checked to no avail and capacitors bridged as an initial check. Eventually the bottom cover of the tuner was pulled off and valve base voltages read—which is not all that easy. It was the pin 3-G2 (PCF80) reading which revealed the fault, the voltage here being absent. The 150kΩ feed resistor was out of sight under the switch panel, but it was obviously o.c. as there was no short to chassis through the decoupling capacitor. The faulty resistor was cut out and appeared quite charred, no doubt caused by a previously fitted faulty PCF80. A carefully fitted new resistor completely restored normal signals on both channels and it was noted that the PCF80 was indeed a recent replacement.

The symptoms here were completely misleading and again proves the worth of immediate and thorough voltage checks. The control grid resistor of the mixer section is worth checking when the voltage readings appear to be in order; this can go high. To round off this "high and

—*continued on page 266*

UNDERNEATH THE DIPOLE

THE BBC used to present an image to the listening and viewing public which was affectionately regarded as "Auntie BBC". This has disappeared, because that pernickety old lady is in her second childhood. She is now like that little girl with a curl in the middle of her forehead—when she is good, she is very, very good and when she is bad she is horrid. There is still plenty of good in her, though, with a commendable number of programmes made co-operatively with other countries.

"Opera" Behind Opera

Take *The Golden Ring*, for instance. This was a musical programme made in Vienna and produced by Humphrey Barton in co-operation with the Austrian Television Service and the Decca Record Company. It was an exciting documentary of the recording on videotape and film of Wagner's *Götterdämmerung* by the Vienna Philharmonic, conducted by George Solti. All the intricate details of the complicated processes of rehearsing and recording this dramatic opera were revealed in a manner in which surprisingly, the music dominated everything—excepting the talented Georg Solti himself.

Back-Stage Gimmicks

Who would have thought that the sight and sound of the singers, orchestra and conductor, all in their street clothes and sweaters, no make-up and apparently completely oblivious of the eavesdropping by cameras and microphones, could be so absorbing throughout this 90-minute programme? Who would have thought that the recording room atmosphere could be even more impressive than the fully-costumed opera on a theatrical stage?

The narrations made by Humphrey Barton himself contributed so much and yet were unobtrusive, the whole programme being brilliantly thought out, photographed and edited. Usually, I think that the gimmick of revealing the back-stage mechanics of a television studio in a programme is rather boring, but in this case the display of back-room recording techniques in no way detracted from the music. As a matter of fact, the programme prompted me to order the particular stereo LP discs of this Wagner opera.

Don't Shoot the Composer

As might be expected, something of the same kind of presentation was used in the BBC's feature series of the arts and artists. But the mixture was not quite as before. Ken Russell devised a high speed filmed interview with the French composer, Georges Delerue, at home and at work—not to mention him also at work at home!

The only disconcerting ingredient to me was the jerky titling of stills and captions at the beginning which were hard on the eyes and must have confused and deterred many viewers.

Sibelius

Another BBC musical programme of great merit was the tribute to the great Finnish composer, Sibelius, which was documented by Caspar Wredi and produced in collaboration with the Finnish Television Service, Helsinki. This documentary film included several sequences from newsreels which were of great historic importance, dating back before the first world war and thus covering a period of political changes which led to the rebirth of Finland.

Finlandia

Finland is in the forefront of European countries in television, as I saw for myself on a recent visit to Helsinki. It has 86 sound broadcasting transmitters and 43 television transmitters, the latter covering 95% of the population of the country, sparsely spread over difficult and mountainous geographical obstacles. Most of the programmes originate from Helsinki, the capital where a huge new radio centre in the suburb of Pasila is being constructed to centralise the thirty different offices and studios in various parts of Helsinki which have gradually grown up during the last few years.

Administrative and technical executives of the Finnish Broadcasting Company visited almost every television and film studio in Europe before they planned the Pasila broadcasting centre and when I looked around parts of the new buildings recently completed and those under construction, I recognised the thoroughness of their appraisal. Here I saw ideas copied from BBC, ITA and German television stations and film studios, plus a number of developments progressed by the Finnish company's engineers.

Particularly was I impressed by the work of the film units and the remarkable quality of the pictures they obtained with three-inch image orthicon cameras.

British Equipment

There was a fair amount of British equipment such as lighting grids, lamps and accessories from Mole Richardson, electronic apparatus from Marconi, Pye and EMI. Producers, writers and engineers all seemed dedicated to their particular crafts, which were put at the disposal of the BBC producers who prepared the documentary programme on Sibelius. There is no doubt at all that radio and television has had a remarkable effect upon the happiness and advances of a nation with such a short summer and a predominantly cold climate.

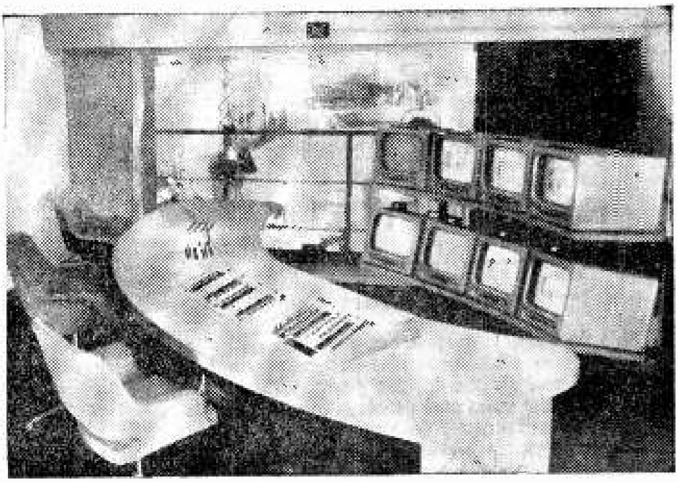
Pinewood, a British film studio with progressive ideas, sent a deputation of technicians to study the Pasila broadcasting centre and other studios in Europe and they tell me that in many ways, it equals the superb design of the German Baden-Baden Studios.

The Idiot

My own opinions of the more attractive characteristics of the BBC, are not wholly devoted to exterior documentary subjects made in foreign lands. Strangely enough, they concern interior subjects, made in the BBC studios with foreign settings and backgrounds. Full marks, I think, for the new serial *The Idiot*, based by Leo Lehman on Fydor Dostoevsky's great story of Russia in the nineteenth century.

Here was a shining example of a play with an attractive background of glossy opulent settings, a scintillating cast and brilliant direction. With a strong story line (unusual in most TV plays) and first rate technical qualities, it had the same kind of appeal that the great film producer, Alexander Korda, injected into his films.

Korda always had good-looking females in his films, and no complaint can be made about them in this production. BBC so often select females who look like beatniks or the ugly sisters in "Cinderella". Remember *Catherine the Great*, *The Private Life of Henry VIII* and the clips we saw recently on television of *I, Claudius* (which never reached the cinema)? Well, *The Idiot* has the ingredients of those masterpieces and BBC-2 were bold enough to follow up with a repeat performance on that channel. Which reminds me that, prodded recently by one of our readers, I re-sited my BBC-2 aerial for the seventh time and, at last, found a spot with an extraordinary good pick-up and a greatly improved signal-to-noise ratio. This programme alone was worth catching a cold for and putting on the gumboots suggested by an enthusiastic correspondent some months ago.



A production control room at Helsinki, with vision mixing and special effects panels. Sound mixing and lighting control rooms adjoin.

BBC-2 In the South

My own efforts to look for the *Lost Chord* were partly due to an excellent BBC-2 test picture I saw on the South Coast, sixteen miles from the BBC-2 Isle of Wight transmitter, in the window of a television rental shop. It was the best BBC-2 test card I had seen outside the White City TV Centre—with perfect geometry, grey scale and resolution.

He told me that they had quickly lashed up a BBC-2 aerial in a convenient place on the roof as a temporary measure and that it gave that result immediately. Still disbelieving that this could possibly be the best site for the strongest signal, they erected a much more elaborate aerial array. Sadly, he told me, their efforts were of no avail. Changing the aerial site once again the results were worse. Ultimately he returned to the original position —and once again the picture was perfect.

It only goes to show that BBC-2 aerials have all the unpredictability (and charm) of women and trout fishing. They are all worth considering, except when dealt with by the lunatic fringe of the BBC programme side. Unfortunately I couldn't wait to check whether the sets had any d.c. restoration or the ingenious Mothersole circuit, and the manager didn't know about this. You have to wait for fade-outs or low key scenes to detect the evil presence of "unmothersoled" a.g.c.

The Liars

Please don't think that I rarely look at London's channel 9. I do. *The Liars* is my favourite selection, and is a good bet for the 21.40 programme on Thursdays from the Granada TV course. Here is a series, beautifully shaped cameos, based on stories by famous writers: Guy de Maupassant, Saki, Hugh Walpole and Lord Dunsany. They are tailor-made to fit painlessly in between commercials.

Well-cast and well directed, the artistic side is equally well supported by the technical side. How to tell a tall story without really trying is an art in itself, which is rarely achieved by TV script writers.

BBC Ratings Up

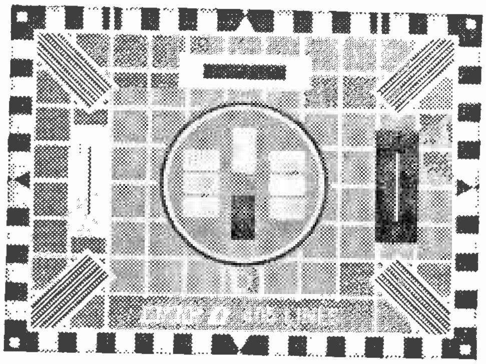
The increase in the proportion of BBC viewers during the Christmas holidays is fact, not fiction. Both TAM and the BBC Audience Research Reports indicate respectively 57 (43) and 69 (31), the ITA figures being those in brackets. This was for Christmas Day itself, but the trend continued for a time.

Iconos

GORDON J. KING

TOWARDS BETTER TV RECEPTION

Part Three of a Series



In this final article we concern ourselves with the other factors which considerably influence the reception, namely the applied power voltage and the setting of the main and preset controls. Let us look first at the "power" factor.

Television sets are particularly sensitive to input voltage—just as they are to aerial signal. If the voltage is too low the valves, and hence the various sound and vision stages, are under-run. This means that each stage is not giving its full efficiency. On the other hand, if the voltage is too great all the valves—and the picture tube—are over-run and, while under this condition they may be working at top efficiency, they are also being damaged, so that should the voltage eventually be restored to its correct value neither the valves nor the picture tube would again work at top efficiency.

Under-running shows up more in the "power" stages than in the low-level signal stages. The line output stage is particularly vulnerable. Low voltage here is often revealed as low line scan. That is, the picture is not as wide as it should be and dark, vertical edges occur at either side of the picture in spite of the width control being set to its "maximum" position.

In some cases the field scan is also affected. The picture is then also of insufficient height, this time with the height control at maximum. This symptom is often accompanied by compression at the bottom of the picture and expansion towards the top, resulting from the user endeavouring to increase the picture height by misadjusting the field linearity control.

The line timebase is generally the one most affected by power supply troubles. This is sometimes reflected into the field timebase circuits in sets where the field oscillator is energised from the boosted h.t. supply. When the power supply is low, but not low enough to cause an overall reduction in picture width, the right-hand side edge of the picture may suffer compression. Such a symptom is shown in Fig. 11. This happens because the line output valve is unable to deliver full output at maximum scan amplitude, being inhibited by the low voltage. Compression on the left-hand edge of the picture generally signifies different trouble such as a low emission booster diode or misadjustment of the line drive control.

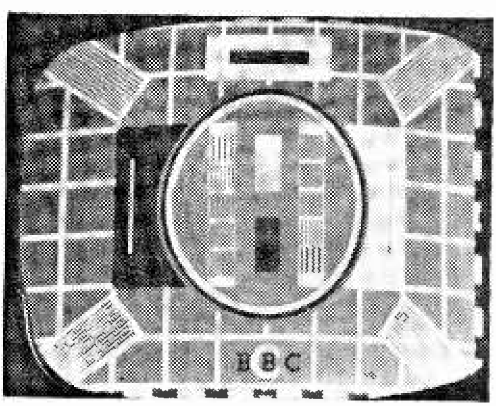


Fig. 11—Compression towards the left-hand edge of a picture can be caused by low mains voltage or by the mains voltage selector being set to a value above that of the mains voltage.

Fig. 12—Insufficient height may also be caused by low mains voltage or by incorrect setting of the mains voltage selector. The lines at the top of the picture are the display of test pulses which are radiated by the station during the field blanking pulses. They should not normally be seen, since they should be hidden in the black which separates the fields or frames.

There are less frequent cases where the field scan is the one chiefly affected by the low voltage. The resulting symptom is shown in Fig. 12. The lines at the top of the picture may or may not be present. These are the display of test pulses radiated by the authority during the field blanking pulses. We shall deal with these later.

Other symptoms of low-power voltage include unbalance of the various main and preset controls. For instance, accompanying one or more of the

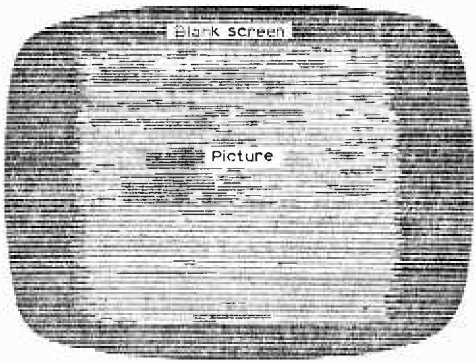


Fig. 13—One symptom of a low emission picture tube as described in the text.

symptoms already mentioned it may be found that the line or field hold control is at the extreme end of its range to secure a mediocre lock, that the width and height controls are at maximum to get full picture size, that the fine tuning control needs to be at the end of its range for correct balance of sound and vision and to clear sound from vision and so forth.

LOW MAINS

At this juncture it must be made clear that all the effects and symptoms mentioned could be caused not only by the mains input voltage to the set being low but also by low h.t. voltage within the set itself. How, then, can one tell whether low mains or low h.t. (which amounts to the same thing) is responsible?

The obvious answer to this, of course, is "check the mains voltage with an a.c. voltmeter". This is rather important in any case, for all sets have a mains voltage adjustment either inside or at the rear of the cabinet and to get the best out of the set it is essential that this be adjusted to match as closely as possible the mains voltage applied to the set. Unfortunately this adjustment is not always considered as important as it really is. This is probably because most sets will work if they are fairly new at almost any setting of this adjustment without any apparent ill effect.

UNDER-RUNNING

When it is adjusted to a voltage which is *below* the mains voltage applied to the set the valves, picture tube and components are all over-run and when set *above* the applied mains voltage under-running occurs. It is not often realised that under-running can be as harmful to the set as over-running. This is because under-running starves the heaters of the valves and the picture tube of power. The anode voltages are less affected. This means that the valves and the tube are called upon to supply full power when there are insufficient electrons being emitted by the "underheated" cathode to supply the power requirements The effect is that the cathodes of the valves and the tube tend to suffer premature failure due to the anode voltages endeavouring to draw electrons from them which are not available. The emissive coatings on the cathodes are stripped off eventually and the emission drops sadly. When a valve or tube reaches this state there it not a great deal that can be done to save it. Temporary improvement may be noted by this time "over-running" the heater!

Over-running does not result in better efficiency provided the valves and the tube are free from fault. A brand new set, for instance, would work at full efficiency at the correct mains voltage and would not give any better performance due to the application of a higher mains voltage. The higher mains voltage, however, would tend to overheat the valves and larger components and the receiver would deteriorate and require a new set of valves and a new picture tube well in advance of a similar receiver operating at the correct mains voltage.

OVER-RUNNING

Now should it be discovered that the set is being badly over-run some time afterwards, restoring the mains voltage adjustment to the correct value may give the symptoms of an under-run receiver! This is because the valves and the picture tube have become accustomed to the higher voltage so that as far as the normal voltage is concerned they are effectively low emission. The solution in this case is either to replace the valves and tube and run at the correct mains voltage or continue to use the impaired components at the lower mains voltage setting, hoping that the other parts in the set will themselves stand up to the over-running until the valves and picture tube are ultimately replaced. If the damage is not too great one may prudently decide to run the set at the correct mains adjustment, even if this now means that the reception is a little below the original standard. The symptoms will be comparable to those of an under-run set as already described.

To recapitulate, therefore, a new set should very carefully be adjusted to suit the local mains voltage. If the mains voltage is unknown a telephone call or card to the local electricity authority would soon provide the answer. It is not always a good idea to take for granted the voltage marked on the supply meter or switch gear, especially in these days of new developments and overloaded mains systems!

A second-hand set should be likewise adjusted. If such a set now exhibits the symptom of under-running one can conclude either that the set has been over-run by its previous owner or that the

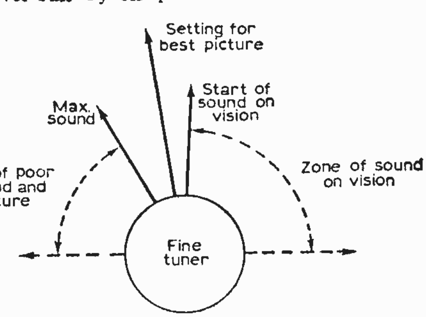


Fig. 14—This diagram shows the best setting for the fine tuning control.

symptoms are the result of normal valve and picture tube wear. As already intimated, the power valves are most vulnerable to over-running, so it is quite feasible that by replacing the h.t. rectifier, the line output valve, the field output valve and possibly the booster diode normal reception will be restored at the correct voltage adjustment.

C.R.T. SYMPTOMS

Symptoms resulting from under or over running the picture tube should also be considered. An over-run tube will not give a better picture than a tube correctly run but it will not live so long. An under-run tube, on the other hand, will usually exhibit the symptoms of low emission. This is also a harmful condition to tube life, as we have seen. Low-emission symptoms are lack of brightness, poor focus, the picture tending to turn "negative" when the contrast and brightness controls are turned up in an endeavour to secure a brighter picture and the picture gradually spreading out across the screen as though the picture were water and the screen were grease (see Fig. 13).

It should be noted here that under-running of the tube, leading to low-emission symptoms, results only from misadjustment of the mains voltage selector and *not* from low h.t. voltage due to a fault in the set.

In some districts the mains voltage is subject to variations from its nominal value. depending upon the loading conditions on the local network. Under heavy loading conditions, particularly during cold spells when many electric heating appliances are suddenly switched on, the supply may drop by 10V or even more. The effect on television receivers is that of under-running and just how bad the symptoms depends on the condition of the set, on its design and on whether the circuit features automatic compensating controls. Early sets had no compensating circuits at all. These, then, are wide open to mains voltage variations and wear in the valves and the picture tube can show up in the ways already described by a fall in voltage. There is not a great deal that can be done about this but if the symptoms are aggravated by excessive ageing of the components a few replacements may be considered worth while.

In areas where there are wide variations in supply voltage the symptoms on certain sets can be really bad. The use of a constant voltage transformer can certainly help to keep the voltage applied to the set constant irrespective of what happens to the actual supply voltage. But as these transformers are expensive they are rarely used by domestic viewers.

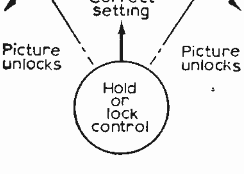


Fig. 15—The correct setting for the hold controls. Note that on dual-standard receivers there are separate line holds for 405 lines and 625 lines.

Of course the trouble can be combated simply by dropping the mains voltage adjustment by the amount that the mains voltage falls. This is not a very good thing to do, however, for there is no knowing when the voltage is going to rise to normal and, unless the mains adjustment is restored, over-running will result. Moreover, continuous monitoring of the mains voltage as applied to the set is essential for manual correction of this kind.

Fortunately sets of more recent vintage contain voltage and current dependent elements cleverly arranged in circuits which tend to compensate for normal variations in supply voltage without the variations affecting the picture. These have been written about in past issues of *Practical Television.*

ADJUSTMENTS

Even though a television receiver is connected to a good, strong aerial signal and a mains supply the voltage of which matches that selected on the receiver mains adjustment it will still fail to give the good reception that is should (assuming the set to be free from fault) unless the main and preset controls are adjusted correctly.

The main controls are designed for ease of adjustment and are usually located either on the front of the set or on the side panel. These are called "user's controls" and include the "volume control", "brightness control" and/or "contrast control", "channel selector control" and "fine tuning control". Provided the preset controls are set correctly then all the ordinary receiver adjustments can be handled by the main or user's controls. The operation of some of the controls, of course, is obvious. Nothing needs to be said, for instance, about the volume control and the channel selector.

The fine tuning control (if fitted) can sometimes cause a query in the mind of the user. This control should always be adjusted after the required channel has been selected, assuming the set to be otherwise adjusted correctly. Adjustment should be made for maximum sound consistent with minimum sound interference on vision. This interference shows up by the picture juddering in sympathy with the sound accompaniment. So adjusted the picture should theoretically be at the best quality. Unfortunately owing to minor alignment shortcomings this may not always be the case and the control may need a little further adjustment to secure the very maximum of definition on the picture. It often happens that the fine tuning control can be rotated over a fairly wide range while maintaining good sound volume and freedom from sound on vision. The best setting is then just before the point where sound on vision appears.

FINE TUNER

If the point for maximum sound volume occurs close to or at the end of the range of the control a small adjustment is required on the oscillator coil corresponding to the affected channel to bring the maximum sound point towards the centre of range of the control. The oscillator adjustment is merely a preset extension of the fine tuning control in terms of adjustment, for it is the job of the fine tuning control anyway to adjust the oscillator in the tuner. The best point of adjustment is illustrated in Fig. 14.

Sets with no fine tuning control on the front usually either have a preset control at the rear or some other arrangement for adjusting the oscillator of each channel separately. With some push-button models, for instance, the tuning is adjusted by depressing and turning the button corresponding to the particular channel. On the Pye TV11/U the fine tuning control is in the form of a preset at the rear.

BRIGHTNESS CONTRAST

Early sets often had the brightness as a main control and the contrast as a preset. Since the advent of automatic contrast control (i.e. vision a.g.c.) the contrast is generally a main control and the brightness a preset. These two controls are nevertheless best adjusted in conjunction with each other. With the aerial disconnected the brightness control is turned up just until a raster (screen illumination) appears. The aerial is then reconnected and the contrast adjusted for the best black-to-white ratio as depicted on a test card. Owing to the use of mean-level a.g.c. final adjustment is required on the brightness control to obtain the best overall illumination, depending upon the nature of the picture.

The preset controls can be classified as "user's presets" and "engineer's presets". The former can be adjusted by the user, while the latter are located inside the set out of reach of the ordinary viewer. User's presets include the "height control", sometimes the "width control", sometimes the "horizontal linearity control", the "line hold (or lock) control" and the "field (or frame) hold control". All these controls are best adjusted on a test card.

HOLD CONTROLS

The field (frame) and line hold (or lock) controls should be adjusted first. The idea is to adjust these controls to a point between where the picture unlocks in one direction of rotation and where it unlocks in the opposite direction of rotation as shown in Fig. 15. When the correct position has been established the height and width controls should be adjusted so that the screen is filled by the picture. If this is done on a test card both vertical and horizontal non-linearity will be revealed.

FIELD LINEARITY

Field non-linearity should be corrected first. This is achieved with the frame, field or vertical linearity (or form) preset. It will be discovered that this control affects the height of a section of the picture only, while the height control affects the whole of the picture. The height and linearity controls should be adjusted in conjunction with each other until the picture is geometrically linear from the top to the bottom as revealed by the squares on the test card.

Some more recent sets have an engineer's field preset somewhere on the printed circuit board (usually near the field timebase valve). This should only normally require adjustment in the event of field timebase valve replacement. However, due to wear in the field valves its adjustment is sometimes advantageous if optimum field linearity cannot be obtained with the user's preset alone. The engineer's preset is much more critical than the user's control, and may affect the opposite side of the picture (that is, the top, while the user's control affects the bottom).

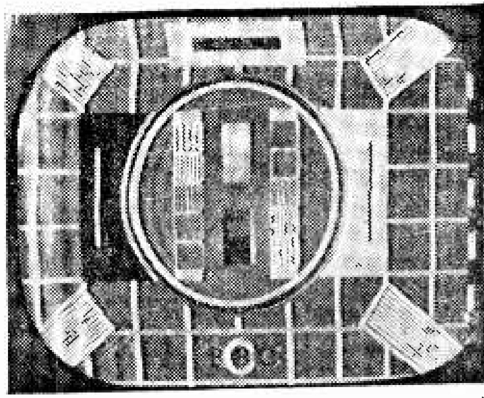


Fig. 16—Interaction between the field and line scanning coils is responsible for the wavy effects at the top and at the left of this picture. A preset control is sometimes fitted on the scanning coils to neutralise this effect.

LINE LINEARITY

Next the line linearity should come under attention. It should be noted here that not many recent receivers feature a line or horizontal linearity preset. The linearity is set during manufacture by means of a special metallic loop beneath the scanning coils on the tube neck. Linearity is affected by moving this loop in or out of the scanning coil field. If it is pushed in too far the scanning coils will overheat and the picture width will be reduced.

Both the picture width and the line linearity on other models are adjustable by means of low-loss cores sliding in and out inductors connected to the line timebase circuits. These adjustments can only be made from inside the set. For line linearity, some other models employ a small magnet pivoted near the line linearity inductor.

Other engineer's presets include a variable resistor or capacitor on the scanning coils to counter interaction between the line and field scanning coils. Mutual coupling between these two coils can cause a wavy effect towards the left-hand side and the top of the picture, as shown in Fig. 16. Adjustment should be made to the preset mentioned to minimise this effect.

Sets with a "line drive" preset usually call for the measurement of the boosted h.t. voltage while the control is being set, adjustment then being finalised at a specific boost voltage. If a meter is not available, however, the control can generally be set by first turning it clockwise until a light, vertical line appears approximately half way across the picture, at which point the control is slowly turned back until the line just disappears.

Finally, the lines at the top of the picture in Fig. 12. These should not normally be visible, since they occur during the black section between fields. If they do show, as in the picture, it means either that a fault exists in the field timebase circuits or that the field height and linearity controls need extra special adjustment.

Servicing TELEVISION Receivers

No. 122 The Bush TV99 continued.

by L. Lawry-Johns

IF the sound is in order but nothing can be resolved on the screen, listen for the line timebase whistle. If this is harsh and strained remove the top cap of the EY86. If this restores a normal whistle, replace the EY86 which is probably internally shorted. If the whistle is quite normal and e.h.t. is present at the EY86 top cap but the EY86 is not lighting up, the heater is probably o.c. and a new valve is required. If the whistle is subdued or difficult to hear at all and there is little or no life at the EY86 top cap, check the PL81 and PY81 valves. If these are not at fault check the two series 8μF boost line capacitors. It is not necessary to use two 8μF for a quick test. Disconnect them and use a 0·25μF 750V (or similar) as a temporary boost capacitor. A further word on this part of the circuit is necessary. Quite often the h.t. fuse or both fuses may be found blown. Replacements may hold until the line timebase warms up. If the fuse(s) then fails attention is directed to the PY81 which may have impaired insulation between heater and cathode. If a new valve is fitted, watch it closely as it warms up. If it overheats immediately switch off and check the 8μF capacitors.

This is what often happens:—One 8μF shorts. This puts the other direct from the boost line to chassis. The voltage rating of the capacitor is severely exceeded and this then breaks down. This virtually shorts the PY81 cathode to chassis. The valve becomes red hot and if the h.t. fuse has not blown by this time a heater-cathode short occurs causing the heater fuse to fail. None of this applies if the PL81 is seen to be overheated. This normally indicates that it is not receiving line drive. Although this could be due to a fault in the PL81 itself, quite often it is the line oscillator ECC82 just above the compartment which is at or, of course, an associated component. Therefore first check the ECC82 if the PL81 if found to be overheating. The writer recently encountered a rather irritating fault of this nature. The fault only showed briefly once every few days and then cleared itself. It eventually turned out to be an intermittent short between the plates of the preset line hold control TC1.

Despite this it is usually the ECC82 which is responsible for lack of line drive and loss of line hold.

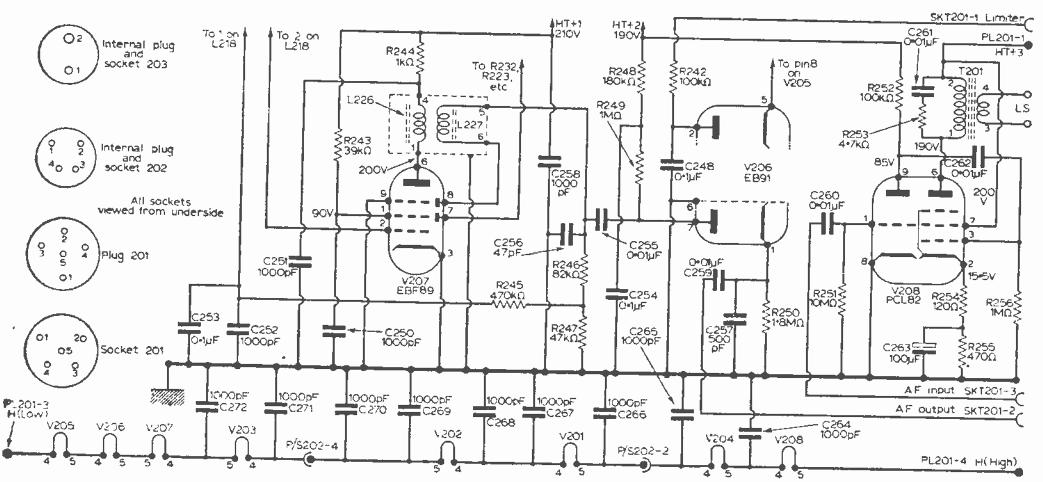


Fig. 4—Sound i.f. and output stage.

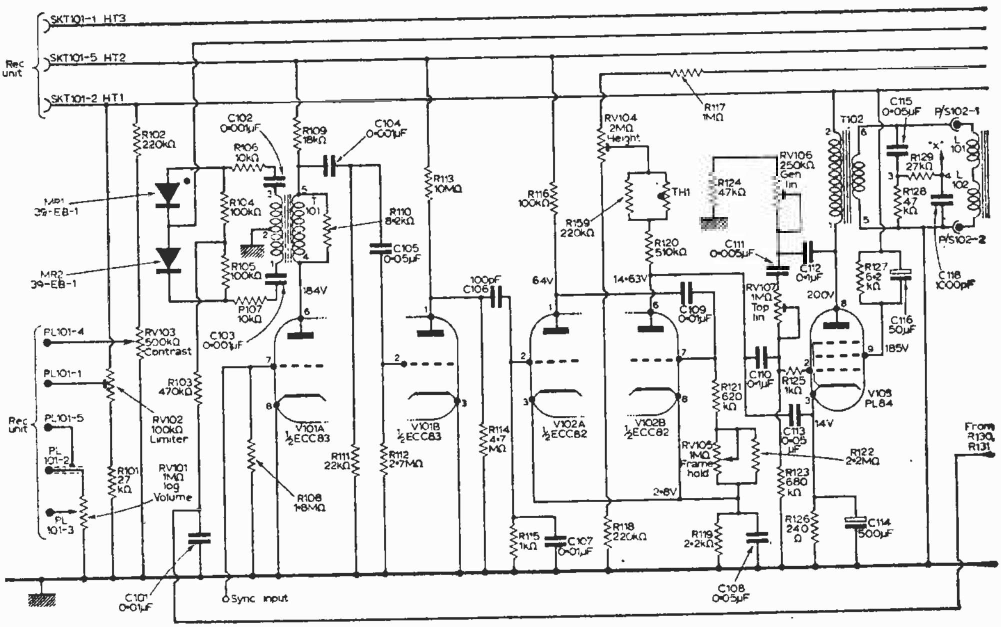


Fig. 5—Sync separator and field timebase circuits.

Field (Frame) Timebase Troubles

Loss of field hold, resulting in the picture rotating with the hold control at the end of its travel; check the ECC82 (top centre) oscillator. If necessary check the 680kΩ resistor associated with the control and pin 7 of the ECC82. The ECC82 is often responsible for complete loss of field operation which manifests itself in a bright horizontal white line across the centre of the tube. If the ECC82 is not at fault check the PL84 and associated components.

Bottom Compression

The PL84 is most often responsible for this fault and the sometimes resulting foldover. If the PL84 has been passing too much current its bias resistor R126 may be found charred and of changed value. If left in this condition a new PL84 may not work under the proper conditions of bias, may thus present a distorted raster and may quickly fail. The electrolytic capacitor across this resistor C114 (500μF) can become open circuit resulting in severe loss of height particularly at the lower part of the scan. It is a simple matter to bridge another (test capacitor) across it to check this however.

An even loss of height—equal top and bottom, if not due to a maladjusted height control, may well be due to R117 (1MΩ) from the boost line to the height control changing value. Unequal field scanning, if not due to any of the above items, may well be due to a faulty component in the linearity network and C111 and C112 should be checked both for leakage and correct capacity.

Weak Picture

If it is found that the displayed picture lacks contrast and is inclined to be "milky" although there is ample reserve of brilliance, attention should be directed to the video amplifier stage in general and the PCF80 V205 in particular. Replacement of the valve may well restore normal conditions. If it doesn't and particularly if the sync is poor, the resistors of the video stage should be checked. R235 does change value resulting in excessive bias voltage across R237. This results not only in a weak picture but more severe clipping of the sync pulses. The fault is not necessarily in the PCF80 circuit however, and the OA70 detector diode (CD201) may well be found at fault. Check the i.f. stages if necessary although these are less likely to cause trouble.

The Sound Stages

The sound i.f. valve V207 (EBF89) also functions as the sound circuit detector and a.g.c. clamp. V206 (EB91) functions as the sound and vision noise limiter whilst V208 (PCL82) is the audio and output. Severe hum is often caused by impaired heater-cathode insulation in the EB91, and this is easily checked by breaking the heater circuit further up, removing V204 for example and quickly replacing so as not to impose too much strain on the other heaters. Most distortion troubles originate in the V208 stage and if the PCL82 is not responsible a thorough check on associated components should quickly reveal the cause. If the distortion lessens when the contrast is reduced or a weaker signal is received, check R249 which may be high.

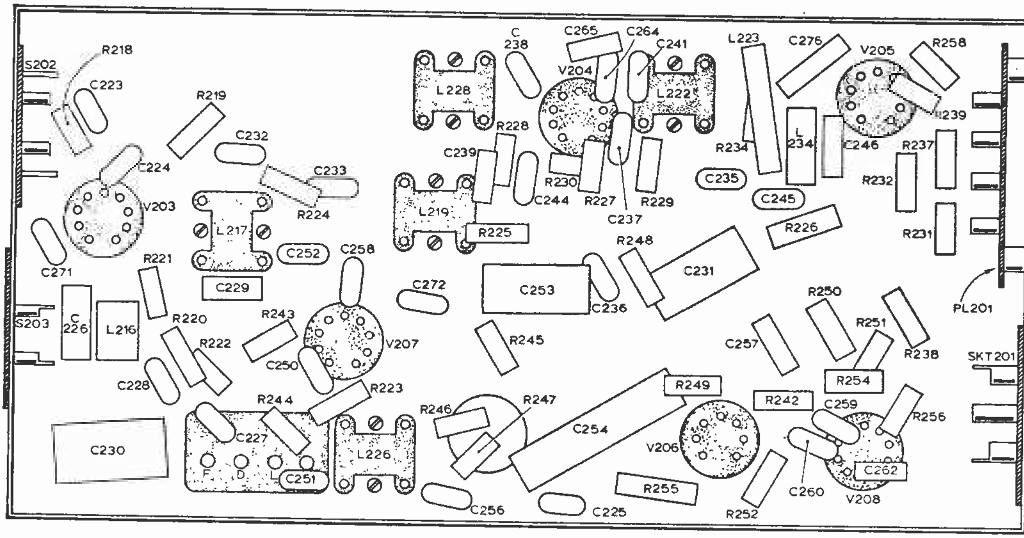


Fig. 6—Underchassis layout of sound receiver.

Hum and Picture Distortion

It was mentioned above that hum should direct attention to the heater-cathode insulation of the sound valves. Quite often however, the valves are not at fault and the trouble is likely then to be due to an open circuited electrolytic capacitor. This can not only affect the sound but also the displayed picture which may appear curved, irregularly shaded and of extremely weak sync—almost impossible to lock vertically or horizontally.

R.F. Sensitivity

A pair of sockets on the lower left side of the i.f. unit provides a means of presetting the degree of sensitivity required for each programme. The D (distant) socket is to be used in areas of low signal where the highest gain is required. Sound on vision and vision on sound may be experienced if this socket is used in areas where the signal is higher. The relevant plug should be inserted in the L (local) socket where there is any sign of cross modulation. In very weak signal areas insert the relevant plug in the F (fringe) socket. This cuts out the a.g.c. from the tuner completely and should not be used in service areas. ■

Field Circuits Analysed

By W. Jones

WHILE few television circuits so visibly indicate even the slightest of faults as the field timebase and amplifier they often require much time-consuming component isolation and testing to effect a cure.

Particularly is this true of printed circuit panels and where faults such as bad linearity, insufficient height, "creep" or weak sync lock produces no complementary voltage change in the circuit and where any resistance checks are covered by ancillary components necessitating complete isolation.

Determine each Sub-section

In such instances the prime object, once valves have been eliminated, is to determine the functioning and complement of each sub-section and narrow down the area to be investigated. For instance, in a typical modern field circuit as shown in Fig. 1 there can be up to 30 components or more, but if it is mentally broken up into the four sub-sections of sync feed, generator, amplifier and negative feedback loop(s) it becomes a much less formidable problem.

This is not always easy to do with certainty but if a few guiding rules are observed it will reduce the time spent in subsequent component testing.

First of all it must be appreciated that modern field circuits take one of two forms, either (a) using two triodes as the sawtooth generator feeding a pentode power amplifier or (b) using a triode-pentode only where the pentode section functions as half of the multivibrator pair as well as the power amplifier.

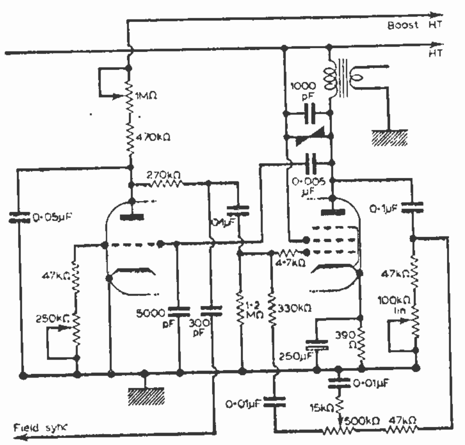


Fig. 1—Typical modern triode-pentode field generator and output circuit (Sobell, McMichael). For rapid fault diagnosis and minimum component checking, identification of the four sub-circuits, sync feed, generator, amplifier and linearity loops is essential.

Secondly, when separate triodes are used as the sawtooth voltage generator they can be coupled together to give the required oscillation in two different ways: (a) via a pair of cross-connected capacitors from each anode to the other's grid or (b) via a common not fully decoupled cathode resistor.

In practice both systems are used but in the triode-pentode arrangement capacitive cross-coupling is always employed as the negative feedback engendered by the incompletely bypassed cathode resistor would alone be prohibitive.

Blocking transformer circuits are now completely superseded by these multivibrator systems.

Although details will vary from make to make the basic design of the two systems must follow those shown in Fig. 2, although when only one triode in conjunction with the output pentode is used the primary of the field output transformer takes over the function of the anode load resistor and the pentode would be separately biased by an individual cathode resistor.

Failure of Oscillation

Complete failure of oscillation in such circuits is usually due to defective feedback capacitors, leaky or o/c, and in case of example (a) only can also be due to a short-circuited cathode resistor preventing inter-valve coupling.

Incorrect running speed is most often caused by a material value change in the bias supply components, while insufficient height is nearly always caused by inadequate anode voltage due to a rise in the value of the small wattage h.t. feed resistors.

In example (a) there is a removable shorting link across one of the anode feed resistors to compensate for height variations brought about by valve and component changes and this refinement will be found in many different models.

In many dual-standard models there is an arrangement for keeping the height "spot-on" for each system by varying the boost h.t. voltage to the field oscillator triode so that field "hold" settings will be unaffected on change-over. In many Ferguson models this is simply executed by switching in a 1·5MΩ resistor from the boost supply point to chassis when on 625, the additional load just lowering the available voltage so that height is exactly the same as on 405.

Practically all field output stages follow conventional pentode amplifier practice but mention must be made of the circuit used in many Decca models where instead of the usual step-down transformer feeding low-impedance scan coils we have a step-up auto-transformer feeding high-impedance scan coils.

The arrangement is shown in Fig. 3 and it will be apparent that there is a 400Ω decoupling resistor and 100μF decoupling capacitor common to both anode and G2 and with a particularly simple linearity and field form system.

These linearity systems vary so widely in current design that it is difficult to generalise but in the main they usually incorporate two inter-connected feedback loops, one to adjust the overall linearity and one to adjust the raster top. Even the two grid resistors in the Fig. 3 Decca circuit, which ostensibly only vary the input resistance of the PCL-85, change linearity by determining the percentage of negative feedback developed across the valve grid circuit.

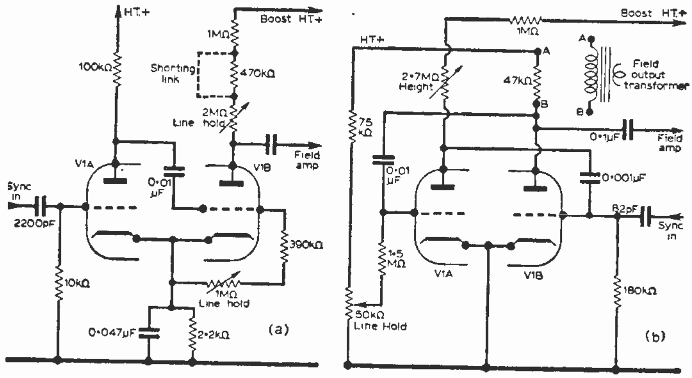


Fig. 2—The two types of field multi-vibrator circuits used in modern receivers, (a) using both capacitive and common cathode resistor coupling. (b) using purely capacitive coupling.

Within wide limits varying input resistance produces little effect on low-frequency signals but as input impedance is increased a larger proportion of the fed-back waveform develops across it. However, they can invariably be recognised by their anode-to-grid configuration, but when not functioning correctly their circuit capacitors rather than their resistors should be the first suspects, since the latter are never current carriers and therefore seldom materially change in value.

The slightest leak in a feedback capacitor, even if it does not affect the valve bias, will completely ruin the characteristics of the loop by shunting the reactance of the faulty capacitor with a resistance equal to its reduced insulation value.

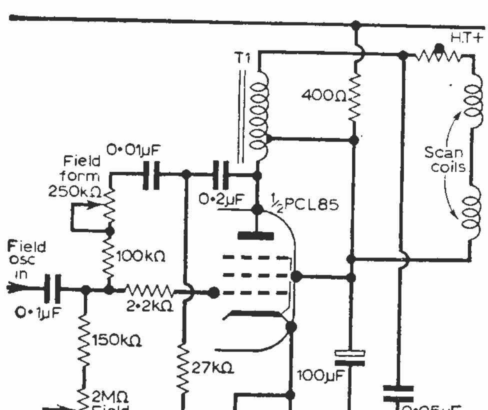


Fig. 3—Unusual field output circuit used in many Decca dual-standard receivers. Scan-coils are directly connected to auto-transformer T1 via thermistor, while 400Ω decoupling resistor feeds both anode and screen of pentode.

While VDRs are now widely used to stabilise height (by maintaining oscillator voltage constant) and to eliminate high flyback transformer voltages (by shunting the primary), all being previously outlined in these columns, the inclusion of miniature thermistors in series with the scan coils to stabilise the overall winding resistance is now practically universal.

Similarly all makes incorporate means for blanking out the field flyback retrace should brilliance be set too high by the viewer and is usually accomplished by coupling a medium sized capacitor from a suitable take-off point on the scan coils to the first grid on the tube.

This first grid, whose d.c. potential is determined by the brilliance control setting, then receives a strong negative pulse on flyback to completely blank out the beam during the retrace. Such a circuit, taken from a modern GEC range of receivers, is shown in Fig. 4.

Diversion in Sync Feed

Now while there are only really three basic valve arrangements and two differing output stages in common usage, with some variety in linearising circuitry, there is great diversification in the sync feed systems.

These range from simple series RC combinations, through biased limiter diodes (many makes) and triode pulse shapers (Bush), to the grounded grid triode pulse amplifiers used in many dual-standard RGD, K-B and Regentone receivers.

However, first let us reconsider field timebase locking pulses and why more care and ingenuity must be devoted to them than their corresponding line sync pulses.

As seen in Fig. 5, line sync pulses are fed through a differentiator which gives an output waveform approximating to the ideal, having an almost vertical, sharply defined leading edge.

In contrast the much longer field pulses must be fed to an integrator to separate them from the line pulses, and as each succeeding 40μSec. pulse charges up the capacitor (discharging fractionally during the 10μSec interval between pulses) we get the usual slowly rising serrated waveform across the capacitor to trip the timebase. A far from ideal shape.

Differentiator Incorporated

In an effort to sharpen up the leading edge some designers incorporate a differentiator or other pulse shaping circuit additional to the integrator and, while these often prove very effective, can make it difficult for the service engineer to "read" the function of the various components involved unless they are individually itemised.

In such circumstances it is best to assume that all precise valued picofarad capacitors in the sync feed circuit are so employed. Furthermore, designers aim to make the rising integrated waveform trip the field timebase no later than the third or fourth pulse before the serrated edge tends to flatten off, otherwise if timebase firing occurs towards the end of the eight-pulse train the voltage difference between successive pulses becomes so small that succeeding frames can be fired at different points along the serrated edge, resulting in vertical "jitter" or "bounce".

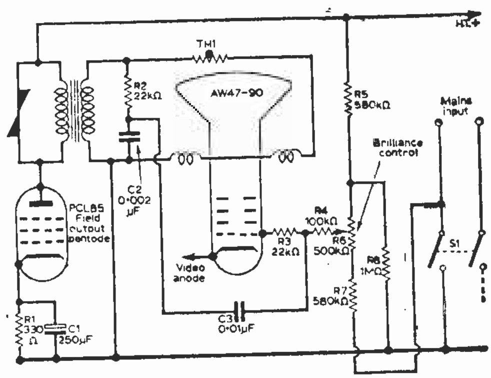


Fig. 4—Typical field flyback suppressor (GEC). On flyback a negative pulse developed across C2 is fed via C3 to the tube grid and blanks out the re-trace. Thermistor TH1 reduces in value as heat increases the resistance of the scan coil windings thus maintaining height. R7 is returned to the mains side of the mains switch to reduce duration of the "switch-off spot".

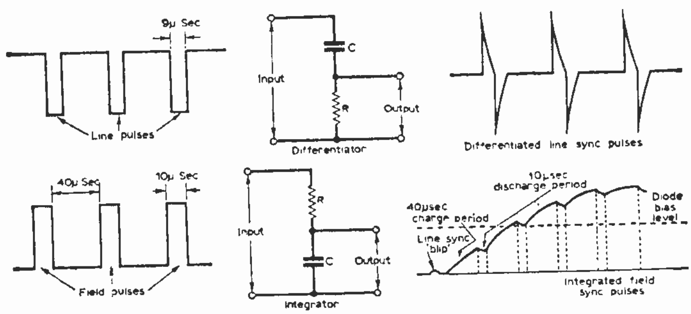


Fig. 5—Line sync pulses after differentiation have a good timebase triggering waveform. Field sync pulses after integration (essential for separation) have an inferior slowly rising front produced by the 40μSec charge 10μSec discharge 8 pulse train. The difficulties imposed by this waveform disparity are reflected in the more complex field sync supply systems shown in Fig. 6.

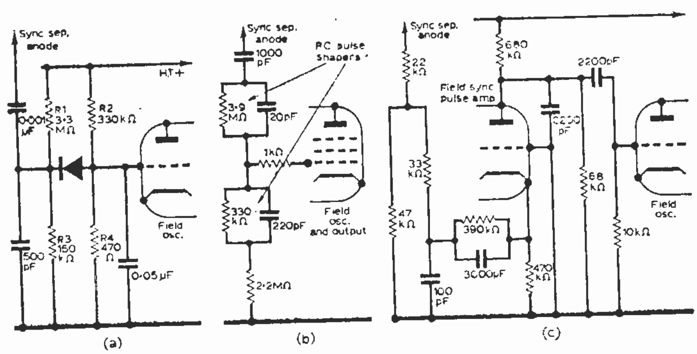


Fig. 6—Three completely contrasting field sync feed systems, a biased diode limiter (conducting when pulses exceed pre-determined value), (b) capacitive with two series RC pulse shaper circuits, (c) grounded-grid triode field pulse amplifier shaper.

Sometimes it is advisable to protect the field timebase from firing too early due to line pulse "pips" or bursts of interference near the end of the scan precipitating the action. To this end many designs incorporate a miniature rectifier in series with the pulse supply to the field generator and which only conducts when the amplitude of the pulse exceeds a predetermined figure. This voltage level is indicated by the dotted line in Fig. 5, so that even although the first one or two field pulses fail to completely clear it this bias line eliminates all voltage peaks below this level and the timebase operates then solely on the rising serrations above.

A typical example is shown in Fig. 6a, used in many Decca models and where the so-called limiter diode is biased by the two fixed potentiometers R1-3 and R2-4 which hold the diode anode slightly less positive than its cathode, thus holding it non-conductive till the rising level of pulse outline drives the cathode voltage less than its anode voltage and passes the pulse. The very slight fraction of a volt positive bias applied to the anode of the diode and thus also to the triode grid is well outweighed by the 3V negative bias developed across its cathode resistor, so the triode is always correctly biased.

—continued on page 266

TRANSISTOR AGC CIR

ONE of the most difficult aspects of transistor receiver design is the provision of an adequate a.g.c. system that doesn't unduly load the detector circuit yet keeps output reasonably constant over a wide range of input levels.

The difficulties are entirely due to the characteristics of these semi-conductors, for unlike valves, transistors are (a) current operated and therefore require power to vary their gain, and (b) have an input and output impedance which varies with changes in their biasing, so that mistuning effects can occur at the extremes of amplification.

In all types of valve receiver, we are accustomed to a negative voltage, derived from the detector or separate diode, varying in amplitude with the strength of the signal and being fed to the i.f. and f.c. valves, as a controlling force.

Such a voltage application imposes no loading on the producing diode since no current is consumed, and its variation of the valves amplification factor right up to maximum is free of any significant mis-tuning or damping effect except at the highest TV frequencies.

Even then, the inclusion of a small value unby-passed resistor in the cathode lead will completely nullify this mis-tuning effect, and such an arrangement is now standard TV practice.

Varied Gain

The gain of a transistor can be varied in two quite different ways.

(1) By varying the emitter current while keeping collector voltage constant as shown in Fig. 1 (reverse a.g.c.).

(2) By varying the collector voltage as depicted in Fig. 2 (forward a.g.c.).

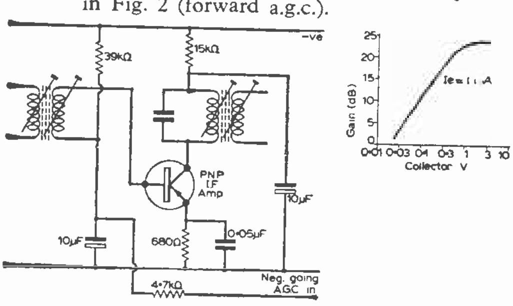


Fig. 1—Typical circuit for varying transistor gain by varying its emitter current as used in most modern receivers. The graph shows gain variation with I_e variation. With usual p-n-p. transistors, a.g.c. voltage must be positive-going. The slight negative voltage developed across R4–5 aids D1 rectifying action by giving it a slight forward bias.

In practice, although both of these systems are in current use, the former is by far the most popular for radio receivers.

Fig. 1 also illustrates how this "reverse bias" is applied to a typical p-n-p common-emitter i.f. amplifier as used in the vast majority of receivers, and with the necessary positive-going control voltage from the diode detector.

As the amplitude of the received signal increases, so does the rectified positive e.m.f. from the diode, to bias back or reduce the applied negative bias given to the base by the base feed resistor. The

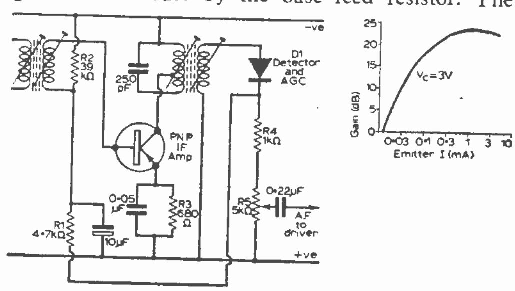


Fig. 2—Basic circuit for varying transistor gain by varying collector voltage. High value resistor must be included in collector (or emitter) lead so that negative-going a.g.c. voltage increasing emitter current develops a large voltage across it to reduce the actual emitter potential. Mainly used in transistor TV's, the a.g.c. source is often seperately amplified. Graph shows transistor gain with variations of V_c.

base/emitter voltage then goes less negative, thereby reducing emitter current and thus gain.

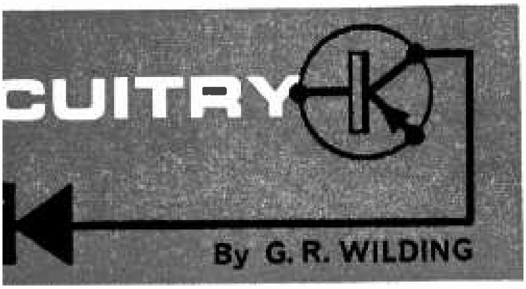
To vary transistor gain by varying emitter voltage, Fig. 2, and with the same p-n-p transistor, demands that the collector be fed with a series resistor of quite high value and that the control voltage is negative-going.

Reception of a strong signal developing a large negative d.c. bias at the transistor base tends to increase emitter current, but the resulting heavy *IR* drop across this collector resistance then reduces collector voltage and thus the transistors gain.

Reverse a.g.c.

Reverse a.g.c. is most popular since it produces less impedance variation in the transistor than does forward a.g.c., while the absence of the high value resistor in the collector feed permits operation from a lower voltage supply.

Of course, many transistors controlled by



reverse bias have a small value resistor in the collector lead, but in such instances it is purely for decoupling or "overload diode" purposes, and will not materially affect the collector voltage as the a.g.c. bias varies.

These "overload diodes" augment the action of the single stage a.g.c. by conducting on very strong signals and shunting the dynamic resistance of the tuned circuit with their own low forward resistance plus that of a low value limiting resistor. A typical example is shown in Fig. 3.

Positive-going a.g.c.

Under average-signal conditions the voltage at the anode of D1 is slightly more negative than its cathode so that it is non-conducting. However, on receiving a very strong signal the positive-going a.g.c. voltage decreases the normal Tr2 collector current and thus also the slight voltage drop across its collector decoupling resistor.

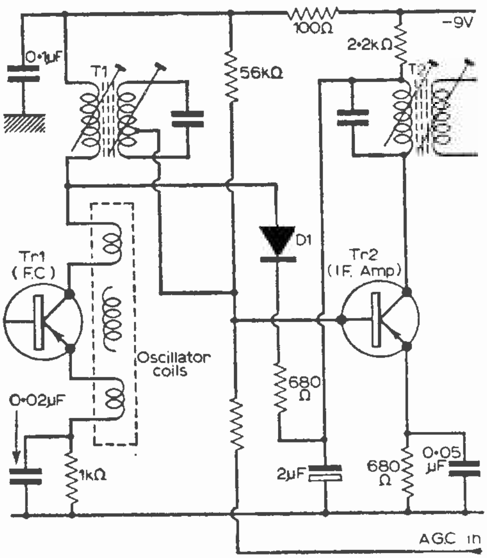


Fig. 3—Overload diode circuit as used in many Alba receivers. Normally TR1 collector voltage exceeds TR1 collector voltage so that D1 fails to conduct. However if a large positive-going a.g.c. voltage reduces Tr2 collector current sufficiently, Tr2 collector voltage will rise above that of Tr1 the diode will conduct and shunt the primary of T1 with its low forward resistance plus that of the 68-Ω series resistor. In this way, overloading on very strong signals is prevented.

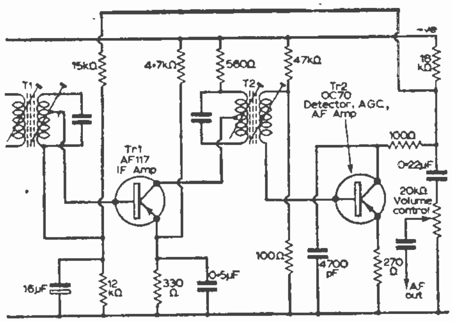


Fig. 4—STC (Regentone, KB, RGD) a.g.c. circuit. Biased to the point of max I_c curvature, Tr2 performs signal rectification, a.f. amplification and also supplies a.g.c. control to i.f. amplifier Tr1. As increasing input decreases Tr2 collector voltage, Tr1 bias falls, thus reducing its emitter current and gain.

This raises the Tr2 collector potential to a more negative value and thus also the cathode of the tube. The diode then conducts and acts as a load across the T1 transformer primary, greatly reducing gain and any possibility of overloading later stages.

Although most manufacturers use a conventional germanium diode for this purpose, some current designs now use a transistor but connected as a diode. In the RC2 chassis used in many STC

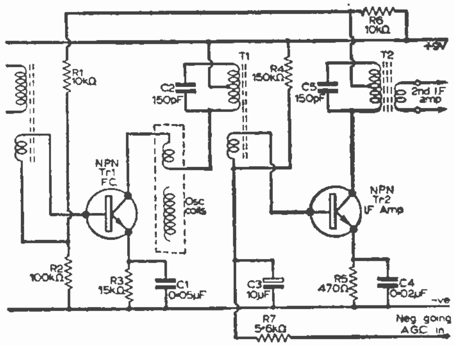


Fig. 5—Dual a.g.c. circuit (Sony) using "reverse bias" to Tr2 which then automatically "forward biases" Tr1. As negative-going a.g.c. voltages reduces Tr2 collector current and thus its gain, the resulting reduced voltage drop across R6 increases Tr1 base current. This produces increased Tr1 emitter current through the high value emitter resistor R3 and develops a big voltage drop across it, thereby reducing the effective collector/emitter PD and thus the transistors gain. Note that by using n.p.n. transistors, polarity of a.g.c. voltage must be reversed to that of conventional British p-n-p. systems.

receivers, (RGD, KB, Regentone) for instance, a Y159 transistor is used with its collector and base replacing the anode and cathode of the rectifier, and with its emitter terminal left unconnected.

Similarly, although the great majority of circuits use a miniature diode for providing detection and a.g.c. there is a growing tendency to use an r.f. type of transistor which additionally provides a.f. amplification.

This type of transistor is biased to a point of greatest curvature on its characteristic so that it functions rather like a valve "anode-bend" detector. A typical arrangement is shown in Fig. 4, and it will be seen that the base of the controlled i.f. amplifier AF117 is fed from the collector circuit of the OC70 detector.

The stronger the received signal, due to working on this point, the lower the OC70 collector potential and thereby also the lower the AF117 base voltage. This results in reduced AF117 emitter current causing reduced gain.

Dual Control

Although practically all transistor radios employ only one a.g.c. controlled stage, a few imported makes (such as Sony, for instance), control both the frequency-changer and the i.f. amplifier by a dual system which imposes no extra loading on the detector a.g.c. diode.

This is accomplished by having a fairly conventional "reverse bias" a.g.c. feed to the i.f. amplifier, and by including a 10kΩ resistor in its collector lead to which is connected the 10kΩ base feed resistor of the frequency-changer.

Further, the emitter resistor of the f.c. transistor is 15kΩ instead of the usual 680Ω−3·9kΩ. Thus as increasing a.g.c. voltage lowers the collector current of the i.f. amplifier and thereby the voltage dropped across its collector feed resistor, base current to the frequency-changer rises. This then causes a heavy *IR* drop across its 15kΩ emitter resistor, which reduces the emitter/collector p.d. and also its gain.

D.C. Amplifier

Somewhat similar systems are also used in all-transistor TV receivers to increase the dynamic range of a.g.c. control. Generally, however, transistor TV a.g.c. circuits closely follow those of radio receiver design, but with the addition of an OC71 d.c. amplifier interposed between the vision detector and the controlled stages to boost the a.g.c. voltage range.

Even then, the a.g.c. control is applied to only the first of the four vision i.f. stages in the Pye models, and to only the first two transistors in the Ferguson 5-stage i.f. vision strip. ■

FAULTY RESISTORS —continued from page 251

low" resistor business we would mention the sound circuit noise limiter load resistor, which can have a value of from 1MΩ-10MΩ and which habitually goes high, causing severe distortion, more especially on strong signals. The anode load 100kΩ-330kΩ of the audio amplifier, say to pin 1 of a PCL83 or ECL80, which again goes high, causing severe loss of volume, and the output valve (say pin 7—PCL83) cathode resistor, which is often damaged and falls in value. This causes a new valve to pass excessive current and distortion again develops before the valve is ruined. We quote a PCL83 because this is where the trouble occurs most often. A PCL82 is also liable to this sort of cathode bias trouble, the cathode pin here being pin 2.

Thus a few examples of how resistors misbehave. Heaven help us when those tiny resistors found in small transistor radios find their way into TV receivers. You know the ones we mean—bend the printed panel and all the resistors part company with their wire ends! ■

FIELD CIRCUITS ANALYSED —continued from page 263

System (b) in the same illustration shows a conventional capacitive feed to the field oscillator but augmented by two RC pulse-shaping pairs designed to sharpen the rising integrated waveform.

System (c) depicts the more complicated cathode driven field pulse amplifier/shaper used in many STC receivers. The d.c. level at the anode of the sync separator (not shown) is maintained right through to the cathode of the triode by a resistive network and, with the grid grounded, there is no input/output phase change.

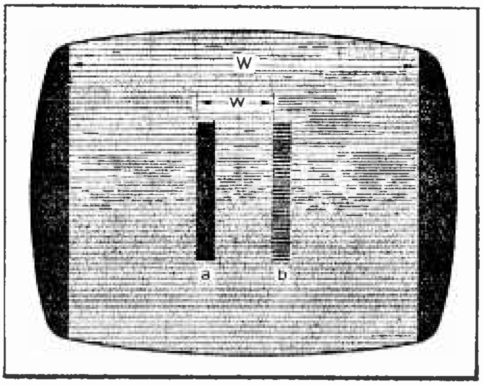
Although these three particular examples are so very different in approach, and there are many other types and variations, they each bring field locking to the same standard as is afforded by the more acceptable peaky line sync pulses. ■

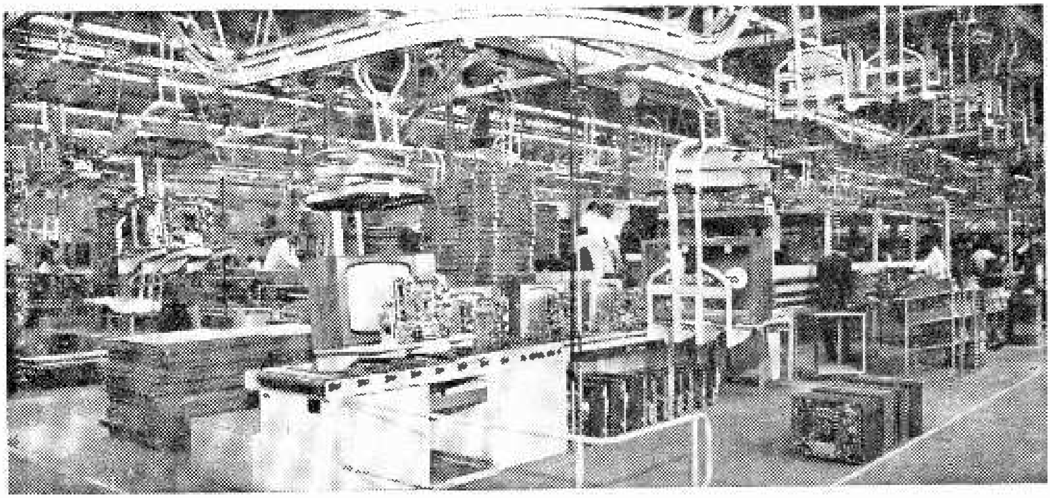
"LAYING THE GHOST"

by G. W. Nixon

Page 202 February 1966, P.TV. Fig. 1 illustrated a television receiver screen with a direct signal trace (a) and indirect signal trace (b). The period of lagging was indicated by "w", but this was unfortunately indicated incorrectly on the sketch.

The corrected sketch is reproduced on the right.





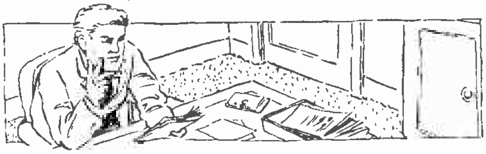
MEET THE SETMAKERS

PART 2: SPECIFYING A NEW RECEIVER

P. WESTLAND

LAST month we left our TV-to-be as a small dot on a large chart hanging on the wall of the sales manager's office. Since then nothing has happened of commercial importance to cause any change of plans, but the time is fast approaching when our sales manager will have to decide exactly what he wants, and then set the wheels in motion to get it designed and produced by a certain date. We can picture him sitting brooding at his desk, meanwhile hoping that his phone will not ring yet again to disturb his concentration, and that his secretary will soon bring in his mid-morning cup of coffee.

If we look over his shoulder we can see that this all important chart shows his type programme for two or three years ahead. In other words, it lists all the different models of TV that he is going to need, and the dates on which they should go into production. Furthermore, there is not merely one



Choosing a Range

black dot that has to be specified in the very near future, but ten, and these are spread over a period of a very few months.

The problem our sales manager has to face is not simply to specify a particular new model of TV, but a complete range of models to cater for a whole season's sales programme. Each model does not exist on its own, but forms part of an overall pattern tailored to suit the anticipated market. Why is a complete new range of models needed, and how does our sales manager set about tackling a problem that the average man-in-the-street could only boggle at?

Some Commercial Facts of Life

Our sales manager, of course, is a true professional and, as we mentioned last month, he has a range of specialist services at his command to reinforce his years of experience at the game. Indeed he has only to lift the telephone, and within a few hours his in-tray will be so full of statistics that he can only get through them all by taking them home to read in the evening.

Let us leave out the statistics, which would be out of date by the time you read them, anyway, and list the basic facts of life that determine what models will be produced, and the limitations that have to be borne in mind.

Why New Models?

The great British public have decreed that the setmaking industry shall, in general, bring out a complete new range of models every year. They have proved this to us time and again by refusing to buy in adequate quantity any models that have been available in the shops for more than about a year. There are exceptions, of course, and sometimes a model that proves particularly popular may continue in production for two years, but this is all in the luck of the game and can very seldom be planned in advance. It is a bold man that will back his horse to the limit.

Nowadays most consumer goods are of adequate quality for their price range, and represent good value for money. The public therefore choose their goods very largely on the basis of appearance. Obviously a new model of TV that has just been launched on the market will attract a great deal more attention than an equally good model that has been hanging around in the shops for the past year. It is this state of affairs that has largely been responsible for the annual facelift. It can only be altered by very determined action on the part of the public or the setmakers, and it seems almost inevitable that the process will continue.

How Many New Models?

Even a cursory look at the Earls Court Radio Show will reveal that the countless different brands of TV are, in fact, produced by about half a dozen big setmakers. Each firm will have an average three or four brand names, with correspondingly different styling presentation. The chassis will be common to each brand, and considerabe ingenuity is displayed in making the same type of cabinet shell and control panel look different by using different colours, qualities and trim. This gives the public a bigger range of models to choose from, and a better chance of finding something to their liking amongst a range of prices.

The main parent brand might well comprise a range of cheap rental standard, and de luxe 19in. models, with rental and standard 23in. models. This leaves a total of five more models to be shared between two subsidiary brands. Say two 19in. and one 23in. for one brand, and one 19in. and one 23in. for the other. This makes our total of ten.

It is quite possible, of course, that at the last minute one or more of our big customers will come to us and place an order for some thousands of receivers, with styling presentations of their own choice, to be marketed under their own trade names. Our factory will then have to grit their teeth and achieve the almost impossible task of producing extra new types with quite inadequate notice.

Competition

The TV market in this country is to all intents and purposes saturated. In other words there are very few customers who do not already own a television receiver, apart from newlyweds. We call this market a "replacement market", and the annual figures of receivers sold by the setmakers are of the order of 1·8 million. Clearly this market can only be increased significantly by persuading households to have two TV's each, just as the car makers have been busy promoting two-car households.

This large demand has caused very intense competition to develop, and the smaller setmakers have long since been swallowed up. The competition is so keen that a price war has been in operation for a long time. Regardless of what the cynics may say, the profit margins for setmakers are so slim that it is surprising that firms continue to invest large sums of capital for so small a return. The public really does get good value for money, and if you doubt this statement compare the pre-war and early post war prices of TV's with the current ones, bearing in mind the general rise of prices on virtually all other goods.

This statement is not just a neat piece of free advertising for the setmakers (at *Practical Television's* expense!) but has been made to emphasise the vital importance of costs in every aspect of specifying a new TV. It crops up at every stage and in every process of design and production, and also in the whole sales and service operation.

Rental

Nearly two thirds of all TV disposals in this country are through some form of rental organisation. Probably one third are disposed of by the few large rental companies; one third are rented out by ordinary radio dealers, and the final third are sold outright—also by dealers.

The big rental companies buy in such large quantities that price is of the essence, and all product planning is aimed at the lowest possible cost, as we mentioned earlier.

The Theory of Momentum

If you put yourself in the place of a sales manager you may well ask how you can possibly take the responsibility of ordering some hundreds of thousands of television receivers every year. Supposing they don't sell? What do you do with enormous stocks of unsold TV's worth several million pounds?

The answer is that every business has built into it a wonderful priceless asset—momentum. Industries selling luxury goods, or goods dependent upon the weather, have uncertain momentum. The basic food industries have almost infinite momentum. (Eating must go on.) Somewhere in between come the setmakers. Providing they turn out a product that is up to standard and competitive in price, their highly geared sales organisation will be able to maintain their share of the market: at least more or less.

If stocks begin to become embarrassing, then a "flog-off" operation can be carried out to selected big buyers at special low prices. True, a loss is made, but the play goes on.

Planning

We are now nearly at the end of our exploration of the basic commercial background. The last item to cover is planning. The first point to make is that it takes nearly a year to turn the sales manager's dot into mass produced receivers ready and waiting in the stores. This means that he must begin to plan a new season's range of models before he has gained any experience of how the current season's models are selling. He could hardly have a worse handicap—unless, perhaps, he sold cars instead. They take about three to five years to get into production!

Another important point is that you cannot start producing ten new models simultaneously. Most factories will be reluctant to start more than two or three in any given month, so the new programme has to be spread over several months. The peak selling season starts in about August and continues until Christmas, so substantial stocks of all ten models must be built up by mid-summer. In order to do this the first new model must start production early in the year.

We now see that the new range has to be specified nearly a year and a half before it is launched on the market. We can also see that it is not possible to cater for everyone's tastes by producing a large range of models, because it would cause too much dislocation in the factory.

Beginning a Spec

The basic facts of life that we have just been discussing have long since become an instinctive part of our sales manager's know-how. These, together with many other factors, form merely a base upon which to build up an appreciation of what our detailed requirements for next season are going to be. For instance, estimates will have to be prepared of the number and type of receivers that are likely to be in stock at that time; and the total anticipated sales, broken down into types and brands. From this it will be possible to decide in which order existing models should be replaced, and the quantities that should be ordered from the factory of each new type.

Let us assume that all this homework has been done, subject to revision from time to time, and return to our brooding sales manager. In our absence he has arrived at several basic conclusions regarding the new models, and these can be listed as follows:

(1) Costs must be reduced because the competition is becoming ever more keen, and the already small profit margins are in danger of melting away.

(2) The television receiver cabinets must be made slimmer from front to back in keeping with current trends.

(3) The styling presentation must be made more attractive, and must provide more impact when seen in a dealer's shop window.

(4) There must be a wider range of styling in order to give the public more freedom of choice.

(5) The possibility of improving the technical performance must be assessed, together with the engineering implications of the previous four items. A decision must be made whether the current chassis can or should, be retained, or whether a completely new one should be commissioned.

Firstly costs. These fall into two categories—selling costs and unit cost. The selling operation is under the direct control of the sales manager, and it is up to him to strike a nice balance between the expense of a large staff and extensive advertising on the one hand, and the number of sales and the resulting financial turnover on the other.

The unit cost is largely outside his direct control because it depends upon the design of the receiver, the efficiency of the factory and the number of receivers amongst which the factory overheads and tooling costs, etc., have to be shared. Obviously the bigger the production the lower the unit costs will be. Similarly bigger sales can result in lower selling costs per receiver. The combination of these two effects means that a comparatively small change of production and sales can cause a disproportionately large effect on the profits or losses.

Design Department

Having put his own selling house in order the sales manager must now turn to the design department to state his requirements and seek advice how best to implement his decisions. At this stage he will probably have informal discussions with the chief engineer, perhaps over the lunch table in the staff canteen if they both work in the same building, to settle some of the basic issues: How to reduce costs, how to improve the styling, how to get better performance.

After discussions with his staff and the results of detailed design studies about various aspects of a possible new design have been obtained the chief engineer is able to clear up a number of basic issues before proceeding to further discussions about detailed requirements. He will tell the sales manager that slimmer cabinets can only be used with the existing chassis at a greater cost because a bigger back cover will be needed, together with various extra metal brackets. Perhaps a longer cabinet will be needed, too, in order to house the chassis and tuners within the contours of an acceptable back cover.

Secondly, he will say, his engineers have devised new circuitry which will give the same or better performance at lower cost. Probably new types of valves or transistors have become available which have made this improvement possible.

His next point is that c.r.t.s have been released by the manufacturers for operation at higher values of e.h.t. and this will enable customers to have brighter pictures with better focusing. It means, of course, that the frame and line timebases will have to be redesigned.

Retooling

All three points make it clear that the existing chassis simply will not do. A new one must be commissioned. The factory will not be pleased about this because a change of chassis means extensive retooling, a complete reorganisation of their assembly shop and a consequent loss of production. However, there is no choice in the matter.

The next question to be asked concerns the chief engineer again. Has he enough design effort to produce a complete new design in time for it to enter production by the required date? In practice, of course, this question does not come out of the blue. There is close co-operation between the sales and design departments and the design work load is carefully co-ordinated to ensure that effort is available at the appropriate time to tackle major new projects that can generally be foreseen in outline well in advance.

As a result of this careful planning the chief engineer is able to say yes and so the new requirement is established. The sales manager feels a lot happier. He can have a new basic design and within strictly controlled limits he can have what he wants. But what *does* he want? So far he has only discussed generalities about reduced cost and improved styling and performance.

Down to Details

Now that the sales manager has been given the go-ahead, numerous further discussions between the sales and design departments will take place in order to settle the electrical and mechanical requirements of the new chassis and the styling brief for the range of models in general and each individual model in particular. All three aspects of the design are interdependent, especially the mechanical design and the styling presentations, but we will take a look at each in turn in order to simplify things.

The Electrical Performance

As we commented in Part 1 there is a considerable interchange of information between dealers and the sales department. From this it is known that the new receiver should have slightly better sound and vision sensitivities to improve the performance in fringe areas. An out-and-out fringe area model cannot be specified because the resulting design would be too expensive and, anyway, only a mere handful of potential customers would ever need to use the extra performance. As in all engineering enterprises a compromise has to be reached.

The better vision sensitivity means that the synchronising performance will have to be improved, too. Extra gain is of no use if the frame slips or the line tears. The electrical engineers are beginning to see all sorts of implications from the sales manager's simple request!

More sound gain implies that the sound interference limiter will have to be made more effective, too. How about the audio bandwidth? Will this have to be reduced to lessen the amount of hiss when the receiver is working at full gain? Or does the sales department want a tone control? This question is immediately countered by another: How much would it cost?

And so it goes on. Dealers have complained of rings on the picture on current models and these must be eliminated on the new one. Other dealers have asked for a vision interference limiter: how much would it cost? Again, the current chassis has an unnecessarily high sound output. How much can be saved by reducing it to a sensible level? How much extra will it cost to provide the higher level of e.h.t.? Can push-button tuners be specified for both v.h.f. and u.h.f. bands? How about a.f.c.: can this be incorporated, too?

These and many other questions will be asked of the electrical engineers and often it will be necessary to carry out further design studies before a clear-cut answer can be given about the practicability and cost implications of the various matters raised. Whilst the design studies and costings are being carried out we will move on to questions of mechanical design. What issues arise here?

The Mechanical Design

The sales manager and his staff will have a series of discussions with the mechanical designers along the same lines as we have just been discussing. Just how all these discussions are arranged will depend upon the particular organisation of our hypothetical set maker. In some cases a series of large-scale general meetings will be arranged, whilst in others it will be a simple man-to-man discussion. In either event the process is basically the same.

The sales department will tell the chief mechanical designer that they want a receiver with a slimmer cabinet, perhaps one that is less tall, and in response to dealers' requests the ease of servicing must be improved. The designer replies that the minimum overall front-to-back dimension of the receiver is governed completely by the size of the c.r.t. and a slimmer cabinet means using a deeper back cover. Is this acceptable? The height of the cabinet is controlled by the size of the c.r.t. and the minimum clearance that the factory needs in order to be able to assemble the tube into the cabinet under high-speed mass production conditions.

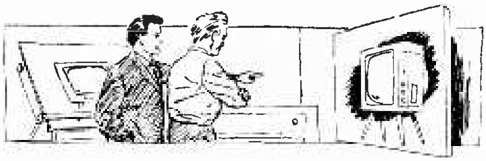
With regard to ease of servicing he will initiate a mechanical design study to see if chassis hingeing is the answer or whether there is a better solution to the problem.

The sales people may then go on to say that on each model the speaker and all customer controls will be on the front of the receiver and that none of these items will be needed mounted on the side. The designer breathes a sigh of relief. Here is one hurdle crossed anyway. One less permutation to cater for.

He breathed too soon. They then mention that in order to give customers a wide range of styles to choose from they will be asking the styling department to cater for implosion safe tubes in some models, push-through bull's eye presentations in others and masked tubes in the remainder.

A slightly acrimonious discussion follows. "*Can't we standardise on one basic type of presentation?*" pleads the designer. "*What are the factory going to say when I tell them about all the different mechanical arrangements that will have to pass down the same assembly lines? Think of the costs caused by factory dislocation on the one hand and the extra tooling cost on the other*". Finally a compromise is reached. No masked presentations will be called for.

Other details follow. Tuner push-button travel and pressure must not be too great and agreement is reached on speaker sizes. When the main details are settled the sales people move on to the styling department and the process begins all over again.



The Styling Brief

First of all the commercial background to the new range of models is outlined with regard to the types of receiver wanted, i.e. 19in. or 23in., rental, standard or de-luxe, and an indication is given of how much money can be spent on the cabinet and styling parts. Then each model of each brand is discussed in turn and agreement is reached on the general choice of cabinet, veneer and colouring, choice of trim (silver, gold, copper, etc.), positioning of controls and the overall styling that is required.

This will tend to be subdued, with an air of luxury, on the higher priced models, but more cheerful and eye-catching on the cheaper versions.

When the stylists feel that they know what the sales people want (as far as these non-specialist gentlemen have been able to express themselves on such an aesthetic matter!) the meeting breaks up on the promise that styling sketches or provisional styling models will be produced to form the basis of future discussion and choice.

The Final Specification

When all the discussions are complete and agreement has been hammered out on all outstanding points the final decisions will be recorded in a written specification which will form the basis for the whole new design. On the electrical side performance parameters such as sound and vision sensitivities on 405 and 625 lines will be specified, together with sound and vision bandwidths, tuner noise factors, etc. The presence or absence of such things as sound and vision limiters and tone or remote controls will also be listed.

The styling requirements will probably be recorded in some detail, together with any special mechanical requirements. A final important point is the total number of receivers to be produced, because this is essential for all costing estimates.

When this point is reached the discussion stage is over and the engineers get down to the task of turning a written specification into a final polished design complete in every detail. We will see how they tackle the problem next month.

Part 3 follows next month

INTEGRATED TUNERS

—continued from page 249

Coupling between the two bandpass lechers, L14 and L21, is accomplished by wire L18 and by the loops between L15 and L19 on Band I and by L17 between L16 and L20 on Band III. In the v.h.f. section there is a pair of bandpass circuits, one for Band I and the other for Band III. These are switched by S1B and S1C, while the u.h.f. coupling always remains in circuit as already explained.

Signals from the u.h.f. bandpass coupling are fed to the emitter of the u.h.f. frequency changer Tr2 via L22. This stage is of the common-base mode with the base "earthed" by C28. Oscillator coupling is between the emitter and collector by C27. L24 is the oscillator lecher tuned by C31 section of the gang.

On u.h.f. i.f. signals from Tr2 are passed through L23, tuned by L13, and fed to the emitter of the i.f. amplifier/buffer Tr3 via S1C and C24. This stage is also in the common-base mode, the collector being loaded by the i.f. transformer L27 and L28 from which the i.f. signal is taken.

On v.h.f. the u.h.f. frequency changer transistor is switched off and the v.h.f. local oscillator transistor Tr4 is switched on. The oscillator applies a signal to the i.f./buffer transistor Tr3, which then acts as a mixer on v.h.f. It also receives a signal from the v.h.f. bandpass filter. The 405-line i.f. output is developed in the collector circuit and passed out of the tuner as before.

The v.h.f. local oscillator is also in the common-base mode with feedback between the collector and emitter via C41. Tuning is by C36 section of the gang, while L25 and L26 are the Band I and Band III oscillator coils respectively. These are switched, as also is the oscillator, by S1D.

Press Buttons

The Pye integrated tuner is press-button controlled, there being a choice of two channels in Band I, two in Band III and two u.h.f. channels. Each press button can can be continuously pretuned over the appropriate bands so that when the button is depressed the required station is immediately available. Any combination of channels and bands is possible, and when a u.h.f. button is depressed the set is automatically "programmed" for 625-line working, but it is possible to rearrange the mechanism (for coaxial relay systems) so that the 625-line standard occurs when selected Band I or Band III buttons are depressed.

A further aspect of the Pye tuner is that it carries the complete i.f. channel of the receiver in which it is installed, the i.f. channel also being transistorised, valves being used only in the audio and power stages of the set. This gives the latest hybrid set which is certain to be adopted more and more by all manufacturers as time goes on.

Another integrated u.h.f./v.h.f. tuner is made by Sidney S. Bird and Sons Ltd. (i.e. "Cyldon"). This also uses two Mullard AF186 and two Mullard AF178 transistors. The overall tuner size is 7in. wide by $2\frac{1}{4}$in. high by $5\frac{1}{2}$in. deep. It uses push-button control and to facilitate direct linkage between the push buttons and the tuning gang a gang with a 60° rotation is used. This avoids reset errors which can occur in geared drive systems.

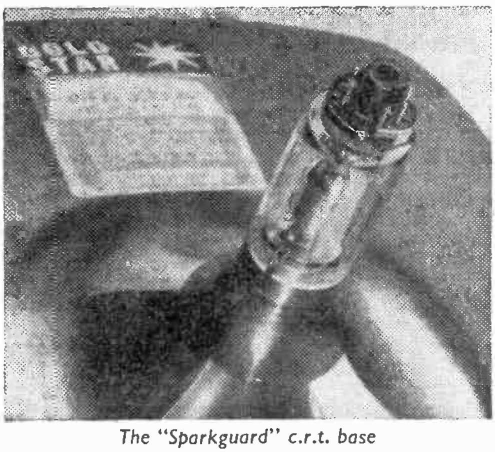
The author acknowledges photographs supplied by Pye, of Cambridge, and Sidney S. Bird and Sons Ltd. used in association with this article. ■

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

MAZDA SPARKGUARD c.r.t. BASE

A NEW British development being introduced by Thorn-A.E.I. Radio Valves and Tubes Ltd., on all their television tubes in the Mazda "Gold Star" range and Brimar "Plus" range of tubes, is the Sparkguard base and e.h.t. Insulating Lacquer. The Sparkguard takes the form of a specially designed base moulding fitted over the tube base pins, which includes within it two critically spaced spark gaps. These gaps are between a metal plate and the first anode and focus electrode pins respectively. The plate is provided with an external connecting tag emerging from the side of the Sparkguard moulding, and this is connected by the setmaker to the external conductive coating of the tube.

If a flashover occurs within the tube to either of the above mentioned electrodes, a spark jumps across the appropriate spark gap and limits to a safe value the voltage applied to the rest of the receiver via the electrode supply leads. Thus with the spark gaps located so near the source of original flashover, the protection is more effective and minimum disturbances pass them into the remainder of the receiver circuitry.



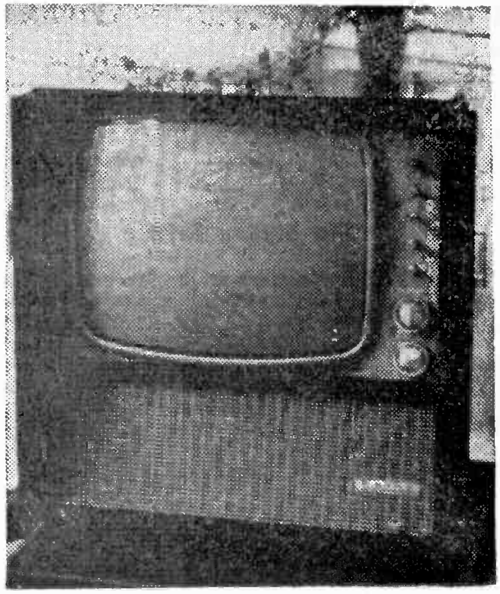
The "Sparkguard" c.r.t. base

COLOUR SETS FROM BAIRD

IN the past one of the arguments against colour television from a domestic point of view was that the set had to be a huge, bulky and, in the majority of cases, cumbersome affair.

The American market with the advent of colour television found themselves in the same position, but they were not at all perturbed by the size of receiver. As their standard of living usually runs on much enlarged lines to their English counterpart the big design fitted in with the size of the room and decor.

English homes in the main were not designed to accommodate huge pieces of furniture and Baird Television Ltd., a member of the Radio Rentals group of companies, realised this problem very



Baird colour receiver

early on in their experiments and they have striven to bring the size of a colour television set down to a more acceptable one.

A contribution to the large size was the necessity to use a round tube; recent experiments, however, have produced a tube of the acceptable rectangular shape and manufacture of them is taking place in Holland. Although the production is in short supply Baird Television Ltd. have acquired a delivery to help them in their intensive experiments.

So successful have these experiments been that at a recent colour demonstration in Chatham by another of the Radio Rentals group, Rentaset Wired Services Division, Baird were able to display two working receivers, fitted with 25in. colour tubes, adapted from the Baird luxury console model 648. These receivers, measuring 32½in. high, 27¾in. wide and 18¼in. deep, demonstrate admirably the type of receiver that could be made available to the public as soon as the Government decide the date on which to allow Britain to have her first colour transmissions.

CRT FOR OSCILLOSCOPE APPLICATIONS

THE T980H is a 5in. instrument tube specifically designed by English Electric Valve Company of Chelmsford to be used with transistorised circuits. For this reason, the deflection sensitivity is high, 2·7V/cm in the "X" direction and 8V/cm in the "Y" direction. Greater sensitivities can be achieved if the gun voltage is reduced.

Anode modulation plates are incorporated, allowing the beam to be cut off without any perceptible spot movement. In fact, the specification limit on spot movement blanking is zero, whilst the voltage required for blanking is less than 30V.

With a PDA ratio as high as 12:1, the T980H can produce an extremely crisp, bright trace. In addition, the writing speed of this c.r.t. is particularly good, traces at speeds of 10 metres per mc/s having been observed with the naked eye.

A.F.C. PART 1

A Discussion on Automatic Frequency Control Circuits

By S. George

FOLLOWING a wave of popularity in the late fifties, flywheel line oscillator circuits fell rather out of favour, but now with the spread of 625, most manufacturers incorporate such systems as standard or as optional plug-in-units, although now they are usually termed Automatic Frequency Control circuits.

The primary reason for their new popularity is that with the negatively modulated 625 transmissions, random noise pulses are in the same phase as the sync pulses, so that the line synchronisation is more easily affected by them, resulting in tearing or irregular firing.

The latter, though not so objectionable as the former, slightly displaces succeeding horizontal lines so that the left hand edge of the raster, and thus all verticals, have a ragged wavering outline which completely ruins high frequency definition.

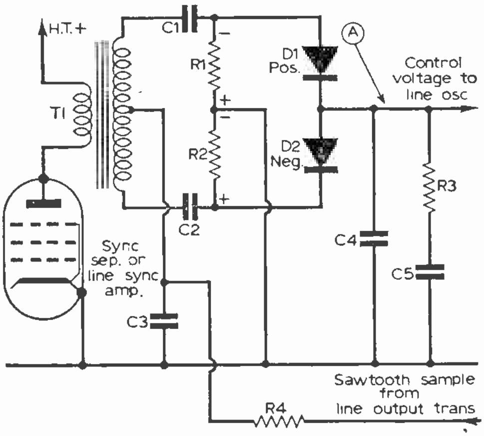


Fig. 1—Basic duo-diode discriminator circuit. T1 feeds equal but opposite polarity sync pulses to diodes D1 and D2, which develop identical value outputs across R1 and R2 but which results in a net zero output at (A).

C1/R1 and C2/R2 time constant being long, each capacitor charge is only slightly depleted when the succeeding pulse arrives so that diode conduction occurs on the tips.

During this brief conduction period, the instantaneous value of the injected sawtooth waveform adds to one diode's output and subtracts from the other, leaving a net difference as control voltage. Should oscillation frequency change, this control voltage will alter, and restore the original speed.

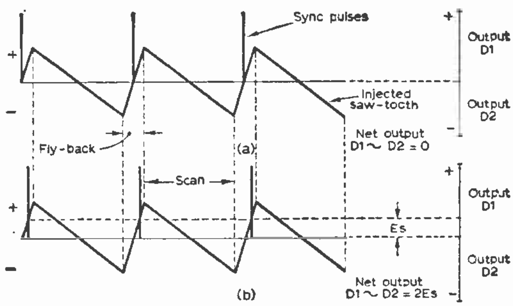


Fig. 2—Discriminator action of Fig. 1. When sync pulses coincide with points of zero voltage on the injected sawtooth waveform as at (a) the net discriminator output is zero, and the line oscillator receives no controlling voltage. If the t.b. alters its frequency so that these points fail to coincide as at (b), a positive or negative controlling voltage is developed to restore the t.b. frequency to its original state.

Line generators are much more susceptible to noise than field generators for two reasons.

1 The time interval between line sync pulses is so much shorter than the time interval between field sync pulses that the probability is equally greater that the noise pulses will occur just prior to their arrival and so cause premature "tripping". When noise pulses occur just after, or in the middle of the scan (much longer for field than line), they produce no effect on the oscillator frequency.
2 The differentiator circuit feeding the line generator acts as a high pass filter which accepts the noise pulse equally as well as the sync pulse, whereas the integrator feeding the field generator tends to absorb the brief noise pulse.

A.f.c. circuits designed to ignore these random noise pulses and rely on a comparatively long term inherent stability (flywheel effect) in the line generator, can be divided into two main sections.

1 The Discriminator. To provide a negative or positive controlling or rectifying voltage whenever the locally produced oscillation tends to increase or decrease away from the sync pulse frequency.

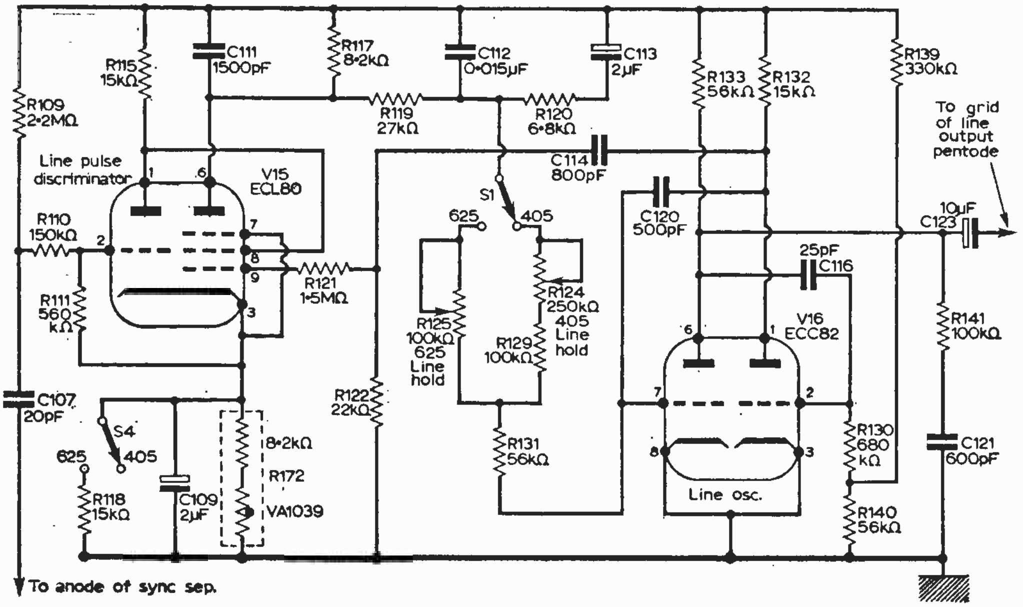


Fig. 3—Complete Decca dual-standard a.f.c. circuit. V15 triode amplifies the line sync pulse and feeds it to pentode G2 by sharing a common h.t. feed resistor. A sample sawtooth from one triode of V16 is fed to the pentode G1. The degree of co-incidence of the two pulses determines the pentode anode voltage and thus the grid potential of the other triode of V16. Variations in pulse phasing occasioned by drift in the line oscillator result in a pentode anode voltage change being fed back to rectify the drift.

2 Voltage controllable Line Generator which by application of the discriminator output voltage can be maintained "spot-on" frequency. Discriminators can take various forms, but possibly the commonest, since it was invariably used in the older models is that incorporating a transformer and two series connected diodes as shown in Fig. 1. Briefly, its functioning is as follows.

The application of a sync pulse to the transformer primary results in two equal but opposite voltages being applied via C1 and C2 to the two diodes, which then develop a rectified d.c. output across the two equal value resistors. The resulting net d.c. output at the junction of the two diodes and the feed point to the line oscillator is however zero irrespective of the amplitude of the sync pulses, as the two equal outputs cancel at this point. Simultaneously a sample of the sawtooth waveform obtained from the line output transformer is fed via R4 to augment these sync pulses, and for the proper working of the discriminator it is essential that the maximum amplitude of this waveform be only half that of the sync pulse. The time constant of each diodes R-C pair is such that the charge on each capacitor be only slightly depleted by the time the next pulse arrives, so that,

a diode conduction occurs only at the tips of succeeding pulses, and

b the instantaneous value of the sawtooth injection at this precise point then becomes additive to the pulse in determining the total voltage developed across R1 and R2.

Thus neither the sync pulses nor the sawtooth waveform *on their own* will produce a d.c. output, but only the combination of the two, and then only if the instantaneous value of the latter is above zero.

If at the moment of diode conduction, a slight positive voltage is being injected via R4, the diode handling the positive end of the secondary sync pulse output will have its total applied e.m.f. so increased, while the other diode handling the negative transformer output will have its total applied e.m.f. equally reduced, with the result that the two outputs of the diodes no longer balance, and a difference voltage is produced at the diode junction to control the line generator.

Ideally the pulse and the point of zero voltage in the sawtooth injection should coincide, but in practice so long as the picture is locked near this point so that there is ample tolerance both ways, control will be effective.

Fig. 2 graphically shows how a control voltage is produced when the sync pulses fail to coincide with the points of zero voltage on the injected sawtooth waveform. A voltage equal to the difference between the outputs of the two diodes is developed for feeding to the voltage controlled line oscillator, and should its frequency subsequently alter, the correction voltage will change one way or the other and bring back the oscillation frequency to its original figure. Of course this control voltage is only quite small, and as all forms of oscillator demand a considerable voltage change to alter their c.p.s. some manufacturers like Ekco and Ferguson employ a directly coupled triode or pentode d.c. amplifier to

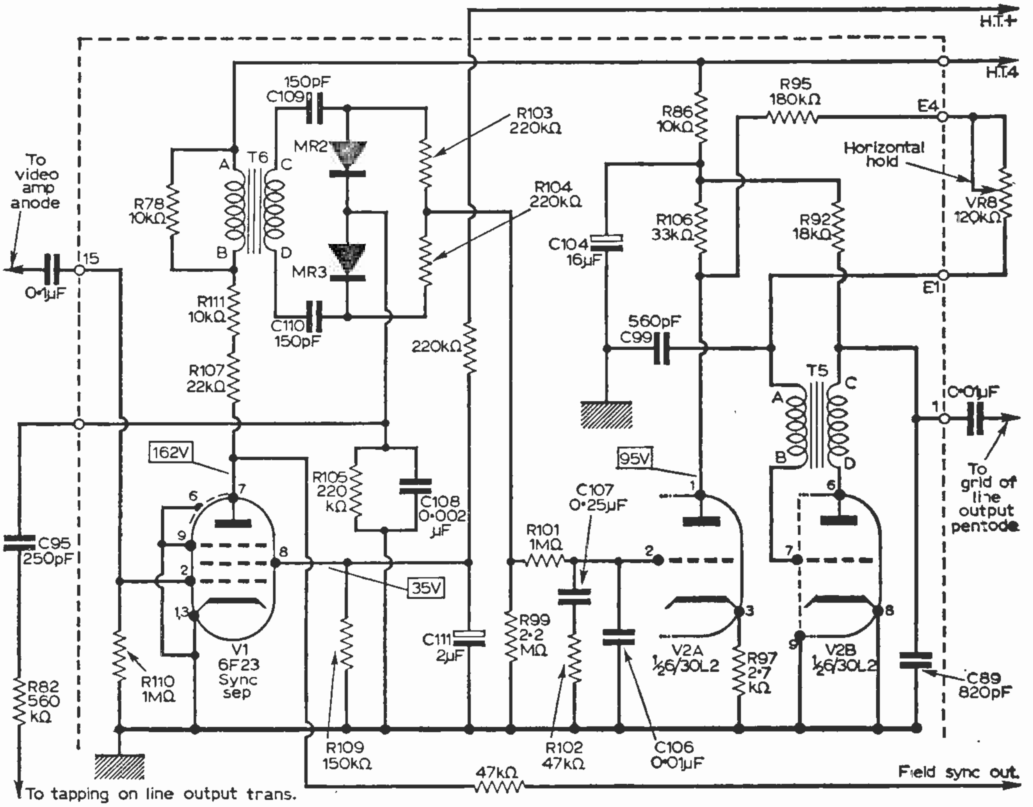


Fig. 4—Complete a.f.c. line oscillator circuit (Ekco-Ferranti) showing sync separator, discriminator, control voltage amplifier (V2A) and blocking oscillator (V2B). Control of V2B frequency is obtained by varying its grid potential by tying it to the anode of V2 instead of the h.t. rail. Sawtooth waveform sample is fed to the junction of the two diodes, with the control voltage taken from the junction of the twin 220kΩ resistors, a re-arrangement of the system shown in Fig. 1.

boost this voltage before feeding it to the actual line generator.

In most of their models Ekco use the duo-triode 6/30L2, with one section operating as the d.c. amplifier and the other section functioning as a conventional blocking oscillator, whose grid is then tied to the anode of the former so that the anode voltage variations directly affect its grid potential.

In the Ferguson 900 range of receivers on the other hand, an EF80 is used, although again its anode is directly tied to the grid of the following PCF808 triode line generator to swing its grid potential should it drift away from correct frequency.

However, there are other forms of discriminator in current use, with the coincidence or phase detector finding increasing popularity. Basically this type of discriminator is a heavily biased pentode or other multi-grid valve which passes negligible anode current till a strong positive grid signal is fed in. Positive going sync pulses are applied to one grid, usually G2, while a smaller amplitude sample waveform from either the line generator or line output stage, is fed to G1. Correct line lock is obtained when the zero voltage point of the sawtooth coincides with the sync pulse, so that if the time-base speeds up or slows down, a negative or positive voltage point on the waveform will coincide with the larger value sync pulse to increase or decrease its net value.

The anode voltage to the pentode is supplied by a long time-constant R-C combination with the result that the varying amplitude of the sync pulses varies the overall voltage level. This supply also biases the grid of one of the triodes in the conventional line multivibrator via the line hold control, so that its frequency of operation is determined by the potential of this supply and the setting of the "hold" control. Once locked to the transmission, any deviation by the timebase results in a rectifying change of voltage in this supply sufficient to bring it back to the original.

Many Decca receivers incorporate an a.f.c. system based on this principle, as shown in Fig. 3, and it will be seen that the pentode section of an ECL80 is used as the actual discriminator, with the

—continued on page 278

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.

LETTER OF THANKS

SIR,—thank you for your reply to my "Olympic II" query, also many thanks to Mr. Bowman for providing the information. I am obtaining parts for this receiver as finances allow; and intend to build it as a portable. To save battery drain when used as a portable, I intend to use a different a.f. amplifier unit, fed from its own internal battery with switched input, to allow use separate from the TV circuit if required. Also for personal use, a one transistor amplifier fed from the detector into a jack socket would allow a small stethoscope type earphone unit to be used. To add extra versatility to the set, I shall add an all-wave communication type unit to feed into the a.f. amplifier with provision for tape-recording the audio of either TV or radio. I have been taking your magazines, "P.T.", "P.W." and now "P.E." for years and both Mr. Bowman and Mr G. J. King are contributors who constantly improve and are up-to-date in thoughts and I look forward to many more interesting transistor projects from both in future issues.—M. J. SHEPHERD (Canvey Island, Essex).

CAN ANYONE HELP ME?

SIR,—I should be glad to hear from anyone who could sell or loan me a volume of PRACTICAL TELEVISION, 1934, or the appropriate copies.—P. M. K. HARTLEY (38 Whitefield Road, Stockton Heath, Nr. Warrington, Lancashire).

OLYMPIC II

SIR,—I would like to thank readers for the very many letters sent on the topic of the Olympic II television receiver. There has been, I regret to say, some considerable delay in replying to a good many of them; this has been partly due to circumstances over which I have no control, and partly due to the large numbers involved.

I have had literally hundreds of letters about the receiver, and they still come in! This is very gratifying, since it means that many readers have found interest in the techniques described. However, the volume of work involved in replying has proved very considerable, and I ask readers' indulgence accordingly.

Readers who have recently asked for a copy of the theoretical analysis will, I regret, have to wait a little longer. Of those originally sent in reply to requests only one (an incomplete one) has been returned to me, and so I shall have to prepare some more copies. This will take a little time. It would be much appreciated if those to whom copies are sent on loan would be meticulous in sending the copy on to the next on the list, within ten days of receipt.—D. R. BOWMAN (Cranwell, Lincolnshire).

TV COMPONENTS

SIR,—It occurs to me that many readers like myself, dismantle a wide variety of TV sets in the pursuit of their hobby and frequently accumulate a number of specialised components such as scancoils, line and field output and oscillator transformers etc., which cannot be readily used in other sets.

Many of us would, no doubt, be glad to give such components to anyone requiring them and willing to pay the postage. Perhaps use could be made of these columns to inform others of what is available.

Such a scheme would not only save a great deal of money and waste but should also improve the spirit of comradeship in a basically introverted hobby.

At the moment I have parts of Masteradio TG7T, Ferguson 992T and Ultra VT9-15 sets which anyone willing to pay the carriage on is welcome to. — A. RODEN (32 Brocket Road, Stanborough, Welwyn Garden City, Hertfordshire).

V.H.F. AMPLIFIER

SIR,—I have been unable to obtain parts for the V.H.F. Amplifier, by G. J. King, in the October issue of PRACTICAL TELEVISION. In fact few suppliers even had lists covering the transistor type required, and none of them knew where to obtain ferrite toroids.

Could you please suggest where I can obtain the two above items—i.e. Mullard AF186 transistors and ferrite "beads".— E. COOKE (Bristol).

[*The Mullard transistor is in current production (see advertisements in the magazine) and the ferrite beads can be obtained from most dealers, they being marketed by Radiospares Ltd., and others.*—Editor.]

PUZZLING FAULT

SIR,—I wonder if any of your other readers have had the following puzzling fault in an Alba T909.

This set has been to about six dealers who have been unable to correct the fault. The picture brilliance varies with camera changes. All the a.g.c. components including the a.g.c. valve ECC83 and all the vision valves have been checked. The video amplifier components and valves have been substituted but the fault still persists. The sound remains normal.—V. JEREMY (Merthyr Tydfil, Glamorgan).

[*We would advise you that in our view, the fault is either in the circuit associated with the ECC83 or in the tube itself which could have a high resistance connection in the grid or cathode electrodes.*—Editor.]

DX-TV

A MONTHLY FEATURE FOR DX ENTHUSIASTS

by Charles Rafarel

IT is indeed with pleasure that I write this month's article, for the "depression" of last month's news on DX conditions has given way to better things. For instance, we had a good late Sporadic E opening in December 1965, and a good Tropospheric one in January 1966.

The Sporadic E opening was not applicable to my own area (Bournemouth) and therefore missed last month's report, but later news received from other DX-ers shows that it was, in fact, widespread throughout many parts of the British Isles, including Eire. These "late" openings have been noticed over a number of years, and we wonder if there could be some "pattern" in this, as it seems almost to be predictable.

CONDITIONS

Sporadic E Band I on December 10/11; very good openings in all directions.

West Germany on E2.
Czechoslovakia, Poland, and Hungary on R1.
Austria on E2a and E4.
Italy on IA.
East Germany on E3 and E4.
Switzerland on E3.
Spain on E4.

Tropospheric Band III opening of January 5, 6, 7.

Holland E 6, Belgium E 10, on January 1.
Denmark E 5, E 6, E 7, and E 8 on January 6.
Norway E 6, and E 8, on January 7, Exceptional "ducting" paths to N.E.

Tropospheric U.H.F., also best on January 5, 6, 7.

Holland Chs. 31, 32 and 27.
France Chs. 22, 25, 27, 29 and 33.
West Germany, also received on many Channels.

All this is, of course, a great improvement, and I hope that by next month things will be even better.

NEWS

A new station in the u.h.f. Band is coming in well, N.T.S., Holland, goes Ch 32, now well received in many parts of the country.

I shall be off to Paris late January for a few days. and hope to bring back the latest news re O.R.T.F. 2nd chain u.h.f. transmitters now going into service. The reason for the Paris trip is a personal one, but you may be interested to hear about it.

"Yours truly" made his first 30-line TV set in 1932, and in fact his first real DX/TV was London to Leeds (200 miles) in 1935. This old museum-piece scanner has fortunately survived for over 30 years, and now it is going to a permanent resting place in Paris.

A French Government Committee on behalf of O.R.T.F. have selected it for inclusion in a permanent Museum of the History of Radio and Television which is being inaugurated for the Public at the TV centre at 116 Quai Kennedy, Paris. So my wife and myself are off to Paris with the "body in a box", and I feel sure that a good time will be had by all.

Another piece of personal news is that the Belgian *Siera* set here has now been successfully converted to u.h.f. and results for the January opening were most satisfactory, but the mast-head pre-amplifier has just packed-in and we are temporarily off the air awaiting the sub-zero weather to subside so that repairs can be carried out. DX/TV is quite a handful at times!

Just one final bit of news, from R. Bunney of Romsey: West Germany is starting a 3rd chain on u.h.f.

Bantiger (Switzerland) on E2 is raising its power from 30kW to 100kW.

READERS' REPORTS

R. Roper of Torpoint profited by the opening of 10—11/12/65, with a new one for him, East Germany (Helpterberg) E3. He also had good reception from Czechoslovakia, and Poland on R2, as well as R.A.I. Italy on Ch IA.

J. Boswell of London is a new contributor to this column, who has been doing exceptionally well over the past twelve months, his log is as follows:—

France: Caen F2, Amiens F11, Nantes F4, Caen Ch25, and Lille Ch27.
Belgium: Ruiselede E2. Wavre E8, and E10, Liege E3.
Holland: Lopik E4, Roermond E5, Smilde E6, Goes E7, Lopik Ch27, and Roermond Ch31.
West Germany: Langenberg E9, Koblentz E6, Heidelberg E7, Köln E11, Aachen Ch24 and 5 unidentified on u.h.f.
Denmark: Sydjaelland E6, Sonderjaelland E7, and Vestjaelland E10 for the Tropospherics.

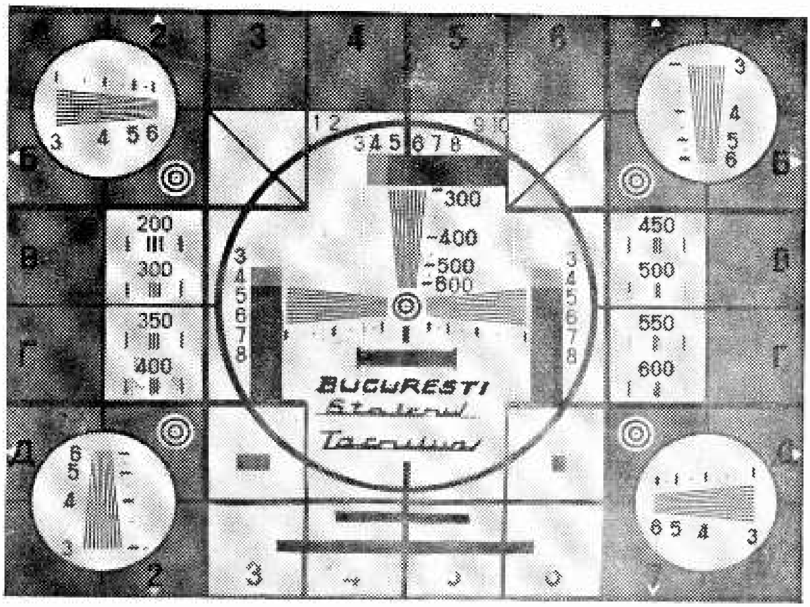
On Band 1 via Sporadic E his log includes: Italy, Portugal, Spain, Jugo-Slavia, Poland, Czechoslovakia, Hungary, East Germany, Norway, Denmark and Finland, which adds up to a very fine log indeed.

D. Boniface of Ripon is back once more with results of the December opening, when he received Poland, Hungary, Czechoslovakia R1, Czechoslovakia R2, West Germany E2, Austria on E2a, and E4, Switzerland E3, Spain on E4, and Italy on IA, whilst the opening of 6/1/66 gave him London Ch33, and Lille Ch27.

D. A. Mountjoy of Gloucester, also did well on 12/12/65 with Czechoslovakia, Hungary, and Poland which we identified for him by his test card sketch on R1, and he also had a number of unidentified stations on programme.

DATA PANEL-7

ROUMANIAN TV



Test Card: As photo (apologies if this is not up to the usual standard but no original photo is available from Roumania as yet). Since this card is very similar to that of the U.S.S.R. we are giving it directly after the publication of that card so that a comparison can be made.

Note that the Roumanian card does not carry the Russian word, and the number 0249 in the circle, but it has the words: "Bucuresti Studionel de Televiziune" in the lower part of the centre circle. The card is otherwise similar to the U.S.S.R. test card.

Stations: R2. Buchurest (often well received in the British Isles). R3. Oradia (test card as R2, this station has also been received here under good Sporadic E conditions).

Programme and Test Card Times: We regret that we have no precise information at present, but full details will be given when available. The test card, however, appears to be transmitted daily from about 14.00 to 17.00 G.M.T. Programmes start at about 17.00 and continue until about 22.00 G.M.T.

A.F.C *—continued from page 275*

triode section used to amplify the line sync pulses from the normal sync separator before feeding them into the pentode G2, by utilising a common h.t. feed resistor. G1 is fed with a sample of the line sawtooth obtained from the anode of one of the multivibrator triodes via an 800pF capacitor.

Normally the pentode section of an ECL80 is biased to about 8V but in this system it is biased to 24V and 625 and 30V on 405, while a miniature thermistor in the cathode lead stabilises its operating point. The triode section has its grid leak returned directly to the common cathode, so it is free of this heavy bias.

The control grid of one of the ECC82 triodes is coupled to the pentode anode via the system switch and one or other of the line hold potentiometers connected as a rheostat, while the anode of the valve feeds the line output pentode in the usual way. Thus any change in the phasing of the sawtooth with relation to the sync pulse results in a decrease or increase in pentode anode voltage which, when applied to the oscillator grid, steps up or slows down its speed to maintain synchronisation.

However, no outline of current a.f.c. systems would be complete without reference to the sinewave generator/reactance valve circuits used in several makes, notably Regentone, K-B and RGD, and in the concluding Part 2 of this article we will cover these extremely interesting arrangements.

TO BE CONTINUED

Sound Channel Problems

Noise Limiters—Their Application in TV Receivers

by J. D. Benson

DIAGRAMMATICALLY the circuitry for sound in radio and television differs very little up to the detector stage. At this stage extra circuitry appears which constitutes the noise limiter. The output stage, in most cases, follows radio practice, but in some television receivers the constant current characteristics of the output valve, a pentode are used to control the focus of the c.r.t. In the early days of television, the sound and vision circuits were completely separate in many receivers, t.r.f being employed. Modern receivers are, without exception, superhets, mainly by reason of the number of channels and to simplify manufacturing problems.

Before the advent of the turret tuner, manufacturers had to turn out separate chassis for each channel for t.r.f. receivers. These were followed by superhets with variable tuning and finally, with the commencement of Band III, the turret tuner. All receivers, whether t.r.f. or superhet, had one common factor, some form of noise limiter. Electrical interference on sound, mainly from car ignition, is particularly bad at Band I frequencies, so it was imperative that some form of interference limiter be fitted, as without it listening became impossible, except in areas of very strong signal strength.

The Dickert Effect

The earliest form of noise limiter was a form of Dickert limiter, well known to shortwave enthusiasts. The Dickert circuit was often referred to as a "Chopper" by reason of the fact that it not only removed the intereference pulse but also a portion of the modulation signal. This circuit employed a diode valve which was arranged to conduct on interference pulses which is exactly opposite to the modern noise limiter which cuts off only when an interference pulse is received.

In understanding the action of the noise limiter it is necessary to investigate the nature of the interference pulse a little more fully. Interference pulses are of short duration, varying from 1-20μ/S and are generally of large amplitude. Because of their very short duration they are at very high frequencies, and for their correct suppression these characteristics must be preserved, which in turn means that the band pass of the tuned circuits preceding the detector must be kept fairly wide. In radio circuits the tuned circuits are generally peaked for maximum output and for a band pass of 9kc/s—this is in order.

Re-alignment

In television sound tuned circuits, band-passes of from 100—200kc/s are not uncommon and when realigning sound circuits the manufacturers' instructions should always be faithfully carried out or failing this, the tuned circuits should be de-tuned slightly, either side of the peak, which will give the increased band width. Re-alignment of tuned circuits should not be carried out until the receiver has reached its working temperature, which is about 20 minutes after switching on. More time should be allowed if the chassis is out of the cabinet. This delay is necessary to allow for oscillator drift, which is also another reason for having a wide band width.

Restricted band width has the effect of broadening the interference pulses and reducing their amplitude which defeats the action of the limiter and mars sound reproduction (see Fig. 1). To fully understand why this action takes place, a detailed description of the functions of the noise limiter is necessary.

The Dickert limiter which was referred to earlier

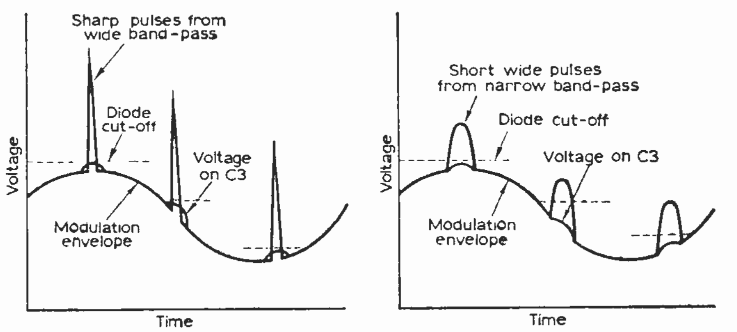


Fig. 1—Effect of wide or narrow bandwidth on interference pulses.

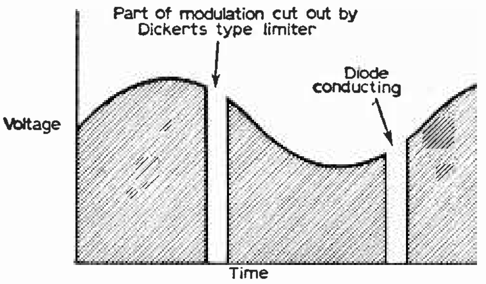


Fig. 2—Showing how part of modulation is cut out when the diode conducts.

operates in very much the same way as the vision interference limiter. Fig. 2 shows how part of the modulation is cut out when the diode conducts upon receiving a pulse of interference.

To digress slightly, it has often been asked why a series limiter, similar to the modern sound noise limiter, cannot be used in video circuits. The reason is that the very high frequency pulse nature of the video signal precludes the use of such a limiter, as it is of the highest importance to retain the highest frequencies transmitted, as these determine the detail content of the picture.

The limitations of the Dickert or "chopper" type limiter led to the development of the series or follower type limiter. The modern limiter discriminates between the narrow short interference pulses and the comparatively slow modulation frequencies, the amplitude of which are fairly constant.

Series Limiter

Fig. 3 depicts a fairly representative circuit containing a series limiter using germanium diodes, these could be equally replaced by diode valves or a double diode with separate cathodes. D2 is sometimes a miniature metal rectifier, it is therefore necessary in cases of breakdown to replace the faulty diode or rectifier by one of exactly the same characteristics. Up to D1 the circuitry follows radio practice except that the values of C's and R's are very different from those used in radio. A.g.c. for the sound i.f. valves is taken off before the series diode and follows general practice, so need not be gone into detail here.

In order to describe the action of a series limiter, the diode circuits have been extracted from Fig. 3 and shown in simplified form in Fig. 4, for ease of understanding diode valves have been shown in place of the germanium diodes. It will be seen that D1 is connected to produce negative going signals, therefore the interference pulses will also be negative going.

The first step to understanding the action of the series limiter is to consider the conditions at D2 when no signal is applied, h.t. flows through R2, D2 and R3 and charges C3. When normal modulation is applied to the anode of D2 from D1, the current changes in D2 in response to the variations of the modulation and so follows modulation provided that the values of R2, R3 and C3 have been correctly chosen. When a large negative going interference pulse is passed to D2 from D1, the anode of D2 is driven negative and D2 is cut off. The cathode of D2 cannot follow the rapid change as C3 can only discharge slowly through R3. Immediately the interference pulse ceases D2 conducts again and follows the modulation voltage from D1.

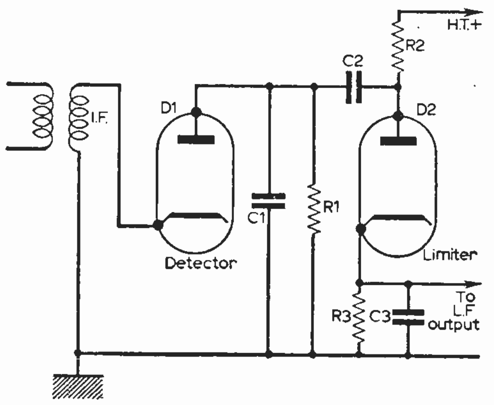


Fig. 4—Simplified form of Fig. 3, diode valves being shown instead of germanium diodes.

It will therefore be seen that the series limiter conducts until presented with an interference pulse whilst the Dickerts type limiter only conducts during bursts of interference. This is the principal difference which makes the series limiter so effective in eliminating interference.

R3 is generally a high value resistor, 2-10MΩ, and is very often the cause of trouble in the sound section. It is well known that high value resistors are liable to change value, generally after a considerable working life. Distorted sound can often be traced to R3 which has gone high and therefore prevents D2 from conducting at the correct level which results in distortion.

The opposite can also happen, R3 can go low in value, which causes D2 to conduct at all levels of signals and will no longer be able to cut off for interference

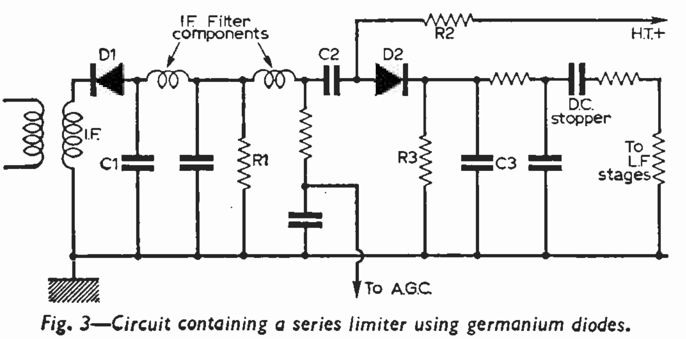


Fig. 3—Circuit containing a series limiter using germanium diodes.

pulses, the result is that all the interference pulses are passed on to the output valve and amplified.

Series Diode Position

Occasionally the series diode is found in a different position, i.e. following a stage of l.f. amplification before the output valve. The action of the circuit is the same as has been described, but when fitted in this position, it is very necessary that the high frequency response of the l.f. stage preceding the limiter preserves the narrow interference pulses in order to obtain good limiting.

There are some notable exceptions that the author has met with where the limiter does not follow the circuitry described in this article. One case in particular is to be found in the Philips 1100 series, where only one valve is used in the sound i.f. stage, working under reflex conditions. In these receivers the series limiter does not obtain its biasing from the h.t. line, but has its cathode negatively biased, with respect to the anode, by the output from the detector which is negative going; this results in the valve conducting. Negative interference pulses cause the anode of the limiter diode to rise above the cathode potential which causes the the valve to cut off for the duration of the pulse.

Distortion Causes

Faults in the sound output have already been referred to but it should be noted that faults in the germanium diodes or valves can also be responsible for distortion. One of the more frequent causes of distortion is due to the series diode, germanium or metal rectifier, going open circuit or high resistance. The diodes can be tested for front to back resistance using a good ohmmeter. A good diode will give a low reading in one direction and a very high reading in the other. Faulty diodes most often show a very high reading in both directions or the reverse, but this is less frequent.

The output stage of the sound section generally follows standard practice, even in the case where f.m. is included. The f.m. ratio detector circuits are brought into action when the receiver is switched to f.m.

Occasionally the sound output circuits are interrelated with other sections of the receiver, one manufacturer used the bias voltage of the output stage to control the line oscillator valve. By altering the bias voltage, line hold was controlled. In quite a number of cases, either the bias voltage or anode current of the output valve was used for energising the focus coil. Failure of emission in the sound output valve resulted in poor focus. Breakdown of decoupling in some cases resulted in an effect very much like sound on vision. These effects could be very disconcerting until one got acquainted with the circuits.

In conclusion then, when repairing television sound circuits it is of particular interest to ensure that adequate band width is maintained throughout the tuned circuits and that where components are replaced, the same values are used in order to preserve the time constants of the circuits and thereby ensure good quality sound output. ■

LAWSON BRAND NEW CATHODE RAY TUBES

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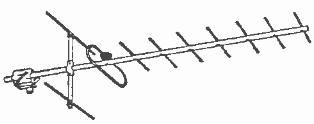

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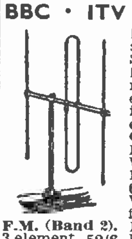

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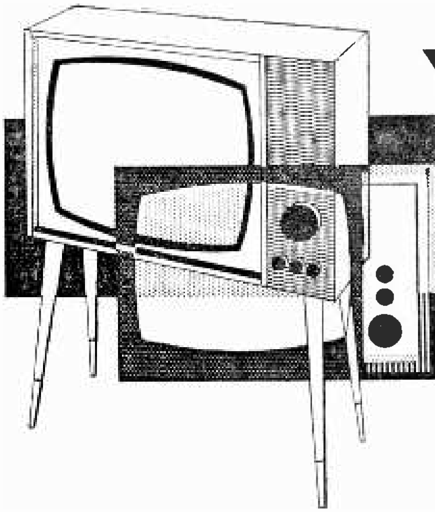

Your Problems Solved

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

FERGUSON 306T

There is a vertical black line about 3in. wide down the right-hand side of the screen. I have pushed the tube back and the deflection coils forward, but the fault remains. Is it possible that either R33, R32, R31 is causing the trouble, or could it be R139 or R140 in the width control. —L. Bull (Huddersfield, Yorkshire).

If the deflection coils are well up to the tube bulb adjust the shift knob on top of the focus housing by screwing it up or down. If necessary strip and reassemble coils and magnets.

BUSH TV67

The picture rolls from top to bottom and also sideways. There are several pictures on the screen at the same time. The contrast control does not seem to work either. The sound is OK and I have substituted all the valves. When I replaced the ECC82 valve, the e.h t. rectifier would not light up, hence no e.h.t., which puzzled me as the same valve worked in another set.—T. Flack (Nr. Royston, Hertfordshire).

If the ECC83 sync separator valve is not at fault check associated components to pin 1 and the sync coupling to pin 2 from the video circuit via the flylead, particularly the 0·1μF capacitor. Also check the other video components.

FERGUSON 3600

This set has suddenly lost its contrast on channel 9. Channel 1 is satisfactory with plenty of contrast. Sound is OK on channel 9. I have replaced V1 (PC97) and V2 (PCF86) but with no results. All components in the tuner and in the region of V3 appear to be in order. — L. Dupries (Egham, Surrey).

We would direct your attention to the small 18kΩ resistor to pin 9 of the PCF86 valve base and the 5·6kΩ oscillator anode load resistor.

Also note the effect of shorting the a.g.c. to chassis.

FERGUSON 3619

There is an intermittent vertical flash on the screen. The picture goes black leaving a vertical white line. It has now stopped and there is a picture with poor interlace.—G. Richards (Glamorgan, S. Wales).

The white line and flashing was probably due to arcing inside the PY81 efficiency diode or PL36 (30P19 or BL302) line output valve.

The poor interlace may be due to a faulty V7 ECC804 (or 6/30L2) or PCL85 field timebase valve.

FERGUSON 315

Changing channels results in loss of picture and sound leaving unmodulated raster. Switch off or meter one end R45 will restore normal operation till channels are changed. I have renewed V1, V2, V6, V7, V10 and V19 and have had all the tuner contacts serviced.—S. Stephenson (Dagenham, Essex).

It is possible that (a) the i.f. and tuner a.g.c. stages are muted by trouble on the a.g.c. line or (b) that the set triggers into oscillation when changing channel. In the former case attention should be given to the a.g.c. line and the a.g.c. source voltage, diodes, decoupling components and filters, etc., while in the latter case a poor decoupling capacitor in the i.f. stage may be responsible.

K-B WARWICK

When the picture comes on, it flies up and down for about 10 to 12 seconds then rights itself. I can stop it by adjusting the vertical hold but I have then to re-adjust to the previous setting to stop it rolling.—W. Harrison (Newcastle-upon-Tyne, 3).

There are two valves concerned. One is V8, a PCF80, and the other is V9, a PCL85. Either could be at fault.

COSSOR CT1921A

A fault has just developed on BBC-1 channel 2. Switching on, I received a normal picture, gradually breaking into "bars" of various patterns. Sound is good, but there is now no picture. If there is a brief pause during a talk, the bars disappear, leaving only a raster on the screen.

On ITV channel 9, I receive good picture and sound.—J. J. MacGregor (Liverpool, 6).

This suggests a fault on the BBC channel 2 coil in the tuner. You may have a defective coil biscuit, or the trouble may be due to poor contacts or dry soldered joints.

ULTRA WR21-62

Recently I find that when advancing the brightness control the picture enlarges, goes out of focus, dims and finally disappears altogether, but returns immediately the control is reduced. I also have to keep the focusing coils practically touching for the best results.

This symptom is almost certainly caused by low emission of the e.h.t. rectifier valve. It is best to check this substitution. Other causes are low emmision of the line output valve, booster diode and poor insulation or core trouble in the line output transformer. Low h.t. voltage can also aggravate the trouble.

MARCONI VT163

When first switched on, the sound is OK and the picture is good. After approximately three minutes, there is intermittent crackling from the speaker. On vision, the picture is good then slowly goes dull but remains crisp (when dull, the contrast control has no effect). A quick twist of the channel selector switch restores the picture to normal.

This picture fault occurs for approximately three hours then the picture returns to normal. D. T. Walters (Alfreton, Derby).

On the sound, the interference is often caused by the poor contact at the PCL82 audio output valve base.

On vision, check the choke to the left of the PCL84 video amplifier—clean and resolder both ends and check the valve base contacts, OA70 detector diode, etc.

EKCO T345

The picture is perfect until a snow scene or a bright sky appears, then an intense flickering is set up which is so severe as to be almost impossible to view. This flickering can be somewhat reduced by using the contrast control, but then the picture becomes too dull.

A re-gunned tube and two new valves (V11-6/30L2 and V13-30 PL13) have been fitted recently.—S. G. Blake (Norwich, Norfolk).

The T345 is quite likely to produce the symptoms that you describe in strong signal areas due to an unstable a.g.c. circuit. This may be overcome by increasing the decoupling of the a.g.c. line from 0·04μF to 0·25μF, but we suggest you also check the vision detector diode inside the top of the last i.f. can, and also the video amplifier stages.

EKCO TC217

I fitted a replacement CRM 172 in place of the original CRM 171. I did not earth the outer graphite coating, but retained the 0·001μF e.h.t. smoothing capacitor.

I also fitted a new U25 as the original was sparking over with a green glow. After being on for several hours, the picture suddenly faded out, and I find that the EHT has fallen to about a $\frac{1}{16}$in. spark, instead of the previous $^1/_{12}$in.—C. A. Salter (Belfast 8).

The trouble could be due to a faulty U25 rectifier, or to failure of the line output transformer. It is advisable when replacing the C.R.M. 171 with the 172 to remove the 0·001μF e.h.t. smoother and earth the outer graphite coating, otherwise peculiar flashing effects can sometimes be observed.

BUSH TV56

After switching on and getting a good picture, the picture suddenly goes too bright. Turning the brilliance down to its lowest setting makes the brightness all right, but contrast is then too low and I cannot get correct brightness and contrast together. By switching off the set for five minutes and then switching on again the picture is all right, but for a small time only.—D. Hunkin (Luton).

The C.R. Tube does, indeed appear to be the most likely cause of your trouble. You may be able to check this by gently tapping it, in order to stimulate the symptoms. Check also the PCF80 video amplifier stage at the back end of the i.f. strip, or loose base connections on the cathode ray tube.

MURPHY V759

The picture has reduced in size leaving a black band top, bottom and sides about 1in. in width. If I increase the picture height to remove the top and bottom bands, I get tall figures on the screen. The width control makes no difference. Apart from this, the picture quality is good.—P. McGinley (County Tyrone, N. Ireland).

The symptoms you describe suggest low h.t., usually due to a faulty metal rectifier. This is situated at the front of the lower chassis, and may be replaced by a BY100 silicon diode.

EKCO T164

I cannot hold the frame steady. It either goes up or down or stops in the middle, having half the picture at the top and half at the bottom of the screen. I have put in a new sync separator valve (V7) and a new frame blocking oscillator (Y8b) and also a new output valve (V9). I have also checked and replaced the capacitor (feeding sync separator V7) C31, but with no success.—W. Akam (West Worthing, Sussex).

The most usual cause of the fault you describe is a defective interlace diode. This is coded orange and yellow, and is below the chassis near the frame blocking oscillator transformer.

PHILIPS 1115U

The frame continually tries to collapse this stack with line appearing at the top, then two bright lines about 2in. from top and bottom. Everything will then be normal for perhaps five minutes, and then start again. I have interchanged PL82 and ECL80, replaced C76 and R102, and some of the resistors in same circuit as well as the three parts. Some time ago the frame completely collapsed and I was able to restore picture by switching on and off several times in succession.—S. Canter (Tooting).

If you are sure the field time base valves and components are in order we would suggest you check the voltage at the field oscillator transformer primary. An intermittent partial open circuit 9 shown by fluctuating voltage at the anode end often causes the fault described.

CHANNEL 10 AERIAL

I propose to purchase some wire netting and make a slot aerial for ITV reception. Would you please give me the size of the slot for channel 10. —J. Mitchell (Glasgow, S.2).

For channel 10, the slot should have a length of 28in. and a width of about 4in.

TEST CASE -40

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.

The symptom on a Philips Model 1757U was normal sound but a picture lacking in brightness. Increasing the setting of the brightness control failed to improve the brightness, while turning up the contrast control made the picture abnormally black and white. It was also noticed that a raster could not be resolved with the aerial removed from the set and with the brightness control at maximum.

All the normally responsible components for a fault of this kind were checked either by test or substitution. It was found that the ion trap magnet was set for maximum picture brightness, that the video amplifier valve and picture tube were both well up in emission and that the brightness control was, at least, capable of turning a picture—although itself dim—completely off.

Subsequent voltage tests, however, revealed that the voltage at the grid of the tube, relative to chassis, could only be pushed up to about 40V at maximum setting of the brightness control.

Thinking that, perhaps, the resistor from the top of the brightness control to h.t. positive had increased in value, this resistor was checked for value. There was definitely an increase in value from 279kΩ to almost 500kΩ. The resistor was replaced, but the fault still existed. What other component could have been causing this trouble? See next month's Practical Television for the solution to this problem and for a further item in the Test Case series.

SOLUTION TO TEST CASE 39

Page 236 (last month)

A useful clue is sometimes given in the case of line trouble in dual-standard sets by comparing the symptoms at the two line speeds. It will be recalled that the set in Test Case 39 had low width on 405 lines and full width on 625 lines, although a 625 line transmission was not present in the area in which the set was in use.

A number of things happen in the line timebase when the standards change switch is operated. For one thing, the line repetition frequency is changed from 10,125c/s on 405 lines to 15,625c/s on 625 lines. Another major change concerns the "S" correction at the two speeds. In the McMichael 762DS, "S" correction takes the form of a capacitor only in series with the line scanning coils on 625 lines, while on 405 lines a switch puts in parallel a second capacitor and an inductor.

Thus, the experimenter should have investigated this switched circuit, for if all the speed change functions, with the exception of the "S" correction function, take place on 405 lines, lack of 405-line width is highly probable.

In the case cited, the inductor was proved to have shorting turns, but a similar symptom could have resulted from a defective switch or parallel capacitor.

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