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Practical Television

AND TELEVISION TIMES

VOL. 14, No. 165, JUNE, 1964

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The Mirage

FOR more years than the writer cares to think about, colour television has been "just around the corner". Prophets and pundits, both lay and learned, from industry, press and broadcasting, have been confidently predicting the arrival of colour TV on so many occasions that when it does materialise nobody will really believe it has happened!

This elusive corner must surely be one of the most stubborn to negotiate in history. Colour TV was once a matter of technical obstacles and economic difficulties. Now it has got itself bogged down in international conferences.

But now at last we know where we stand, as a result of the recent announcement by the Postmaster General. There will be no colour TV until at least 1967. Typically when we *do* get a decision it is a negative one! The evasive corner, having come tantalisingly close, is receding again like a mirage.

The series of talks, discussions, conferences and demonstrations staged last year and attended by representatives of the European Broadcasting Union was a sincere and earnest attempt to settle on a common standard for Europe. All aspects were probed—transmission, reception, the studio—with the wholehearted co-operation of the broadcasting authorities and the TV industry.

It soon became clear that the three main contenders for a European colour TV system (NTSC, PAL, SECAM) all had points in their favour. None of these three systems (or rather, one parent system and two variants) could be an automatic choice. And so the delegates found it impossible to come down firmly for one particular system. Possibly the issue was complicated by matters of national prestige in considering the two variants of the NTSC system. Britain, supported by Holland, favoured NTSC.

And now we must wait until 1965 for the next international conference, at which a decision will again be attempted. However, there is no guarantee that a decision will be made; nor, say some cynics, that by then there will not be even more alternative systems to consider, put up by other member nations!

To guard against such a contingency, the Postmaster General has declared that should this conference again produce no decision, Britain will "go it alone" on a system of its own choosing. It would take at least two years for such a system to become fully operational.

New problems spring readily to mind. The cost of colour sets will, at least for some time, be extremely high and even rental may be prohibitive to a large section of the public. Again, in 1967, "vintage" u.h.f. viewers in the London area will have sets only three years old; others, particularly in the other areas, will have sets very much newer.

How, then, can these viewers be expected to buy (or even rent) colour sets? And will the announcement, next year, retard the sales of new dual standard sets? Sales may well suffer while viewers "wait and see" before replacing their old sets.

We have an uncomfortable feeling that with the famous corner almost turned, we may have reached it too early—or too late!

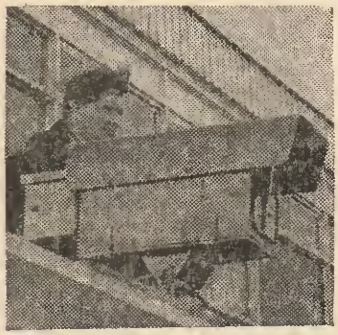
Our next issue dated July will be published on June 19th.

TELETOPICS

More C.C.TV Traffic Control Installations

THE knowledge that closed circuit television cameras were relaying live pictures of every vehicle on a motorway to a police observation post, would have a "sobering" effect on motorists; this may be assumed. A more immediately obvious advantage of such surveillance is, of course, that the cause of any interruption in the steady flow of traffic—such as an accident—is seen the instant it occurs on a television monitor when appropriate action can be taken quickly.

This then was the reasoning behind an experiment in television-assisted traffic control carried out recently by the Home Office Police Research and Planning Branch. The experiment involved an installation of four c.c.tv cameras mounted at vantage points above a selected two-mile stretch of the M6 and equipment to relay the televised pictures to monitors in the control room of the Knutsford (Cheshire) Service Area Police Post. For the test installation—which was supplied by Rank Telecommunications—the cameras were fixed-position types but with extensive use of remote-controlled types with pan and tilt and zoom facilities, it is foreseen that a whole motorway, such as the M6, could be scanned in ten minutes or less. Such an installation would naturally effect considerable saving in time, money and manpower.



In its weatherproofed housing, a TV camera scans part of the M6 motorway.

In a very different environment, yet relying on the same principles is a c.c.tv installation—this time manufactured by E.M.I. Electronics Ltd. —observing traffic conditions in and on the approach roads to the Mersey Tunnel. This closed circuit system was not installed on the same experimental basis however, but as an essential aid to the Tunnel police who face the problem of ever-increasing traffic using the Tunnel.

E.M.I. type 6 minicameras are used in the system and a number of these are sited unobtrusively inside the tunnel while others, mounted in special housings and remotely-controlled, view approaching and departing traffic at the Tunnel entrances. Pictures from all these cameras are relayed to a battery of receivers in the traffic inspector's office at one end of the Tunnel.

Triple-Standard Operation for Studio I

STUDIO 1, the Television Centre's largest. which was recently brought into service for the first time, is the BBC's fifth major production studio and as such has had incorporated in its design many features which experience with other studios at the Centre showed to be desirable. Although its basic planning is similar to other modern television studios, Studio 1 is unique for its facility of operation on 405-, 625- or 525-line standards.

The studio's equipment includes six 4½in. image orthicon cameras, manufactured by E.M.I. Electronics Ltd. A complex arrangement of hoists situated at various levels above the studio floor carries a multitude of lights and scenery.

Production Control Room, Sound Control Room and Vision and Lighting Control Room are all situated at a first-floor level in the studio, overlooking its 100ft. by 108ft. area through plate-glass windows.

Available among the studio's electrical outlets are supplies at both 50 or 60c/s to suit the 50 fields/sec of the British standard or the 60 fields/sec of the American 525-line standard respectively.

NEW CHANNEL 6 STATION WILL IMPROVE ITA COVERAGE

VIEWERS in an area between the London, Lichfield and Mendlesham ITA stations where poor reception of the Authority's programmes occurs, will eventually be served by a new station to be built at Sandy Heath in Bedfordshire. From this station, ITA programmes will be transmitted in channel 6.

Contractors for the aerial, mast and feeder system are E.M.I. Electronics Ltd., who in designing the mast have had to provide for the future requirements of u.h.f. aerials for both the ITA and BBC. The 750ft. triangular lattice-type mast will be erected by British Insulated Callender's Construction Co. Ltd.

Completion date for the contract is the Summer of 1965 and when transmissions begin they will be horizontally polarised.

TWO MORE BBC-1 STATIONS

TO improve reception of BBC-1 programmes in the western half of Lancashire, which during the summer months is prone to spasmodic interference from Continental transmissions, the Corporation has recently begun transmitting programmes from Winter Hill, near Bolton, on channel 12. The present television station at Winter Hill is, of course, that of the Independent Television Authority and until a new, permanent BBC station is completed some time next year, at the same site, temporary equipment will transmit in channel 12 from the ITA building.

A new station to improve reception was made feasible by the Postmaster-General's approval of the use of unallotted channels in Band III for the transmission of the BBC's first programme service.

The service area of the new station includes Blackpool, Preston, Southport and Liverpool. The vision and sound frequencies of channel 12 are 209·75Mc/s and 206·25Mc/s respectively and transmissions will be vertically polarised.

A second BBC-1 station to be opened recently is one in the Shetland Isles, operating in Band I, on channel 3 (vision 56·75Mc/s, sound 53·25Mc/s). This is a relay station receiving BBC television and v.h.f. radio programmes from Orkney prior to re-transmission. Television transmissions are vertically polarised.

This station, which is situated at Ward of Bressay, near Lerwick, is bringing these BBC services to some 17,000 people in the area for the first time.

Trade Test Times

ALTHOUGH BBC-2 transmissions from the Crystal Palace station are now well established, trade test transmissions are continuing - although there has of course, been a revision of the schedule. Subject to any necessary alterations, the new times are from 1000 to 1200 and 1400 to 1600, Monday to Saturday. The material transmitted will consist of either a test card alone, or a test card plus a 440c/s tone or recorded music.

Bristol College Transmits TV

TRANSMITTING equipment built by Mr. E. H. Davies of Bristol Technical College, assisted by some of the students, is currently being used to broadcast regularly from the College, every Wednesday from 2p.m. to 6p.m. It is eventually hoped to provide educational TV programmes catering especially for local needs and interests, for reception mainly by schools in the area. Already television sets belonging to local schools have been converted to receive the transmissions which are on a frequency of 432·3Mc/s specially allocated by the Post Office.

The equipment operates on the 405-line standard, but as more 625-line receivers are introduced it is intended to convert to the new standard. A transistorised camera supplied by E.M.I. Electronics Ltd. is used to televise the subjects for transmission.

PREPARING FOR THE THIRD CHANNEL

THE effect of an unforeseen power failure of a section of London's mains supply, was to postpone by one day, the opening of the second BBC television channel. Much more widespread effects however, have accompanied the advent of BBC-2 itself which have not been confined to the London area. Reports which continue to emanate from the BBC and other sources seem to indicate that in most parts men and machines are being prepared for its coming although in many regions this will not be for some years.

In the south, for instance, preparations are in hand for the construction of the first of the "fill-in" stations which will serve the shadow areas of the Crystal Palace service area. For one of these stations—Guildford—it has already been announced that Mullard Equipment Ltd. are to supply translator equipment for receiving the BBC-2 transmissions on channel 33 and re-transmitting on channel 46. The receiving aerial for this installation will, of course, be mounted in an area of adequate field strength and its transmitting aerial will be positioned to re-radiate the signal over the affected area. The Guildford station, in common with other fill-in stations, will operate automatically and require only occasional routine maintenance.

News from further afield is that British Relay Ltd. are able to announce that subscribers to their TV relay networks in such places as Cambridge, Ipswich, Peterborough and Basingstoke, although well outside the reception area of the new programme, are already viewing BBC-2 via the Company's links.

Preparatory activity is not restricted to the south-east however, as throughout the country Television transmitting masts originally erected by British Insulated Callender's Construction Co. Ltd., are to be modified by the same firm for the time when they will have to transmit BBC-2 programmes. These modifications will involve replacing and resiting on the masts existing Band I v.h.f. aerials and installing new Band IV and V u.h.f. aerials in the vacant positions. At the BBC's Rowridge station in the Isle of Wight, the u.h.f. aerial which is to be mounted on the existing 500ft. mast, is already on order from the Marconi Company.

Television in Aden

A TELEVISION service for the Aden Protectorate is to begin transmission this year from a station situated near Steamer Point in Aden. From this site the service will extend over a twenty-mile radius, covering much of the residential areas nearby.

Pye T.V.T. Ltd. are supplying the equipment, which includes a main studio with two 4½in. image-orthicon cameras and two telecine channels, together with monitoring and master control units. Low-power repeater transmitters will be used to relay signals where the hilly terrain would otherwise restrict the coverage.

When completed, a microwave link will connect the studio centre to the transmitter site.

C.R.T. Tester and Rejuvenator

BY R. ABEL

ONE of the most common problems that the service engineer or hobbyist encounters is that of the TV set with a low emission cathode ray tube. The symptoms are that the picture lacks contrast although fully modulated, has low brightness, and the frame flyback lines are very noticeable. Increasing the contrast beyond a certain point will turn the picture negative and increasing the brightness causes the picture to go "fuzzy".

The reason for this lack of life is simple—the cathode of the c.r.t. will no longer emit sufficient electrons at its normal operating temperature. This lack of emission can either be due to the emitting surface of the cathode having become partially poisoned so that only parts of it are emitting fully or that this surface has almost disappeared, having been worn away by prolonged use. If the first mentioned is what has happened, then there is a good possibility of prolonging the life of the c.r.t. by either permanent or temporary boosting, whilst if the latter has happened a certain amount of extra life may be obtained by permanent boosting.

Heater volts	S1 A	S1 B
3	12V	15V
4	20V	24V
5	20V	15V
6	24V	30V
8	20V	12V
10	20V	30V
12	0V	12V
15	0V	15V
18	12V	30V
20	0V	20V
24	0V	24V
30	0V	30V

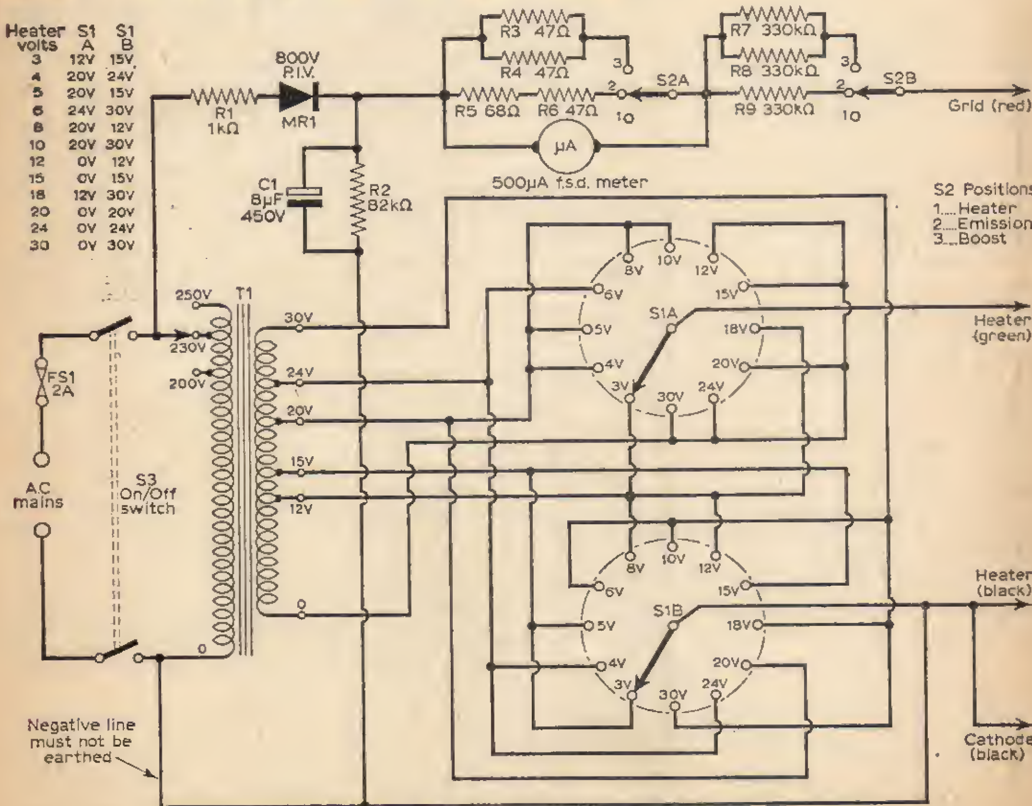


Fig. 1—The circuit diagram of the instrument.

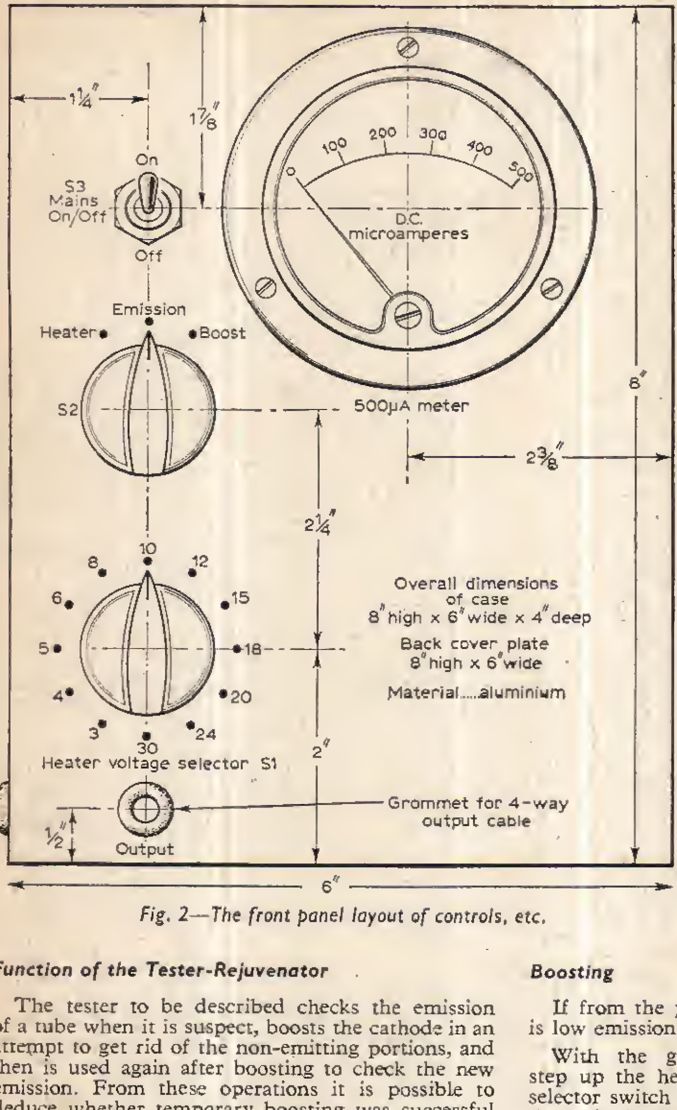


Fig. 2—The front panel layout of controls, etc.

and the required voltage is fed to crocodile clip leads which connect with the c.r.t. heater and cathode. The other lead, which goes to the c.r.t. grid, is either open-circuited or fed from a 300V positive supply via either of two resistors (R7, R8 or R9) which are in series with a meter.

Selection of the open-circuit position or appropriate resistor is made by switch S2B, while selection of the meter shunt required in each case is made by S2A.

The 300V supply is derived, through MR1, R1 and C1, from the primary side of the heater transformer.

Testing for Emission

When checking a suspect low emission c.r.t. the crocodile clip leads are connected to their appropriate base pins, the correct heater voltage is selected, and the grid switch S2 is put to "Emission".

The grid and cathode of the c.r.t. then act as a diode in series with 30kΩ across a 300V supply. If the cathode is emitting fully the forward resistance of the "diode" will be low, the current flowing will be approximately 1mA, and the meter will be deflected to full scale. This current is greater than the normal peak white beam current, but a good margin on emission is required if a c.r.t. is to have a useful life.

A low emission c.r.t. is indicated by the grid meter failing to reach anywhere near f.s.d. after running for some time.

Function of the Tester-Rejuvenator

The tester to be described checks the emission of a tube when it is suspect, boosts the cathode in an attempt to get rid of the non-emitting portions, and then is used again after boosting to check the new emission. From these operations it is possible to deduce whether temporary boosting was successful or that either permanent heater boosting or tube replacement is desirable. It should, however, be realised that there is no guarantee of success when trying to boost a c.r.t., and there is always the possibility of finishing it off completely. In most cases when a c.r.t. is well past its prime it is worth taking the chance.

Tester Circuitry

It can be seen from the circuit diagram (Fig. 1) that the main component is a multi-tap transformer T1 which is used for supplying the various heater voltages required for c.r.t. testing. These voltages are selected by a multi-way switch, S1 A and B,

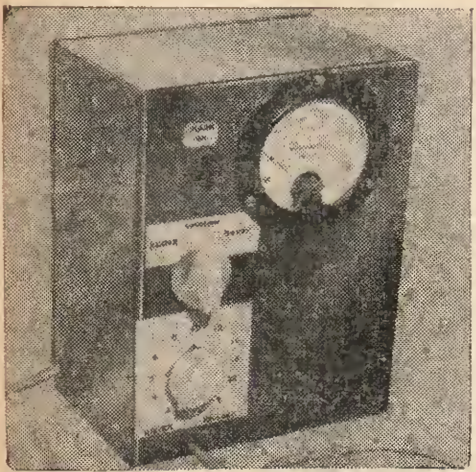
Boosting

If from the previous test it is found that a c.r.t. is low emission, boosting can be attempted.

With the grid switch S2 set to "heater", step up the heater volts by one increment of the selector switch for an hour or two. This will cause the cathode temperature to increase appreciably and the emitting surface will undergo a disruption that might cause some of its non-emitting surface to regain its powers of emission.

Check afterwards on "emission" with normal heater volts. If some increase in emission is noted, repeat the heater volts step up until either good emission is obtained or no further improvement can be had.

Temporary heater boosting is often sufficient to rejuvenate a tube, but if this method is unsuccessful, switch the grid selector to "boost" with the heater volts stepped up as before. The meter should deflect to full scale after a while. Once this has happened leave the c.r.t. in this condition for ten



The finished instrument ready for use.

minutes and then check on "test emission" at normal heater volts. This type of boosting strips the top layer of the cathode emitting surface and exposes an unpoisoned layer below if sufficient cathode exists. As before, if some but not enough improvement is found, repeat the treatment until sufficient emission is obtained. Sometimes increasing the heater voltage by more than one increment of the switch can prove effective, but permanent damage to the heater-cathode insulation may result.

Construction

As the circuit is simple and the component layout is in no way critical, any chassis or box convenient to the individual builder can be used. **It should be noted however that the h.t. supply is of an "a.c.—d.c." type, and so the three output leads to the c.r.t. should not in any circumstances be connected to the case of the tester, nor should they be earthed.**

Some guidance for the intending constructor is given in Fig. 2 and Fig. 3 which show the front panel and the interior arrangement of the author's unit.

An insulated crocodile clip is fitted to the end of each of the four output leads and so enables connection to be made easily to the c.r.t. pins.

It can be seen that there is no provision for c.r.t.s with 2V heaters. This is because in the author's servicing experience c.r.t.s of this type are so rarely encountered that it was considered preferable to have a higher heater voltage available for boosting emission on the line timebase valves and rectifiers.

If required by the individual builder, however, the heater switching can be rearranged to eliminate the 30V tap and substitute a 2V tap by means of a series 0·7Ω resistor from the 3V winding.

The author used a 0·5mA f.s.d. meter in the original tester, but any meter of f.s.d. up to 1mA can be used. If the meter resistance is known then the values of required shunts for the boost and test emission conditions can be calculated.

With a meter of unknown resistance the best method to find shunt values is to use a 200Ω variable resistor in parallel with the meter, adjusting this resistor so that meter just deflects fully when the grid and cathode leads of the tester are shorted together. Fixed resistors equivalent to the values found in this way can then be substituted. ■

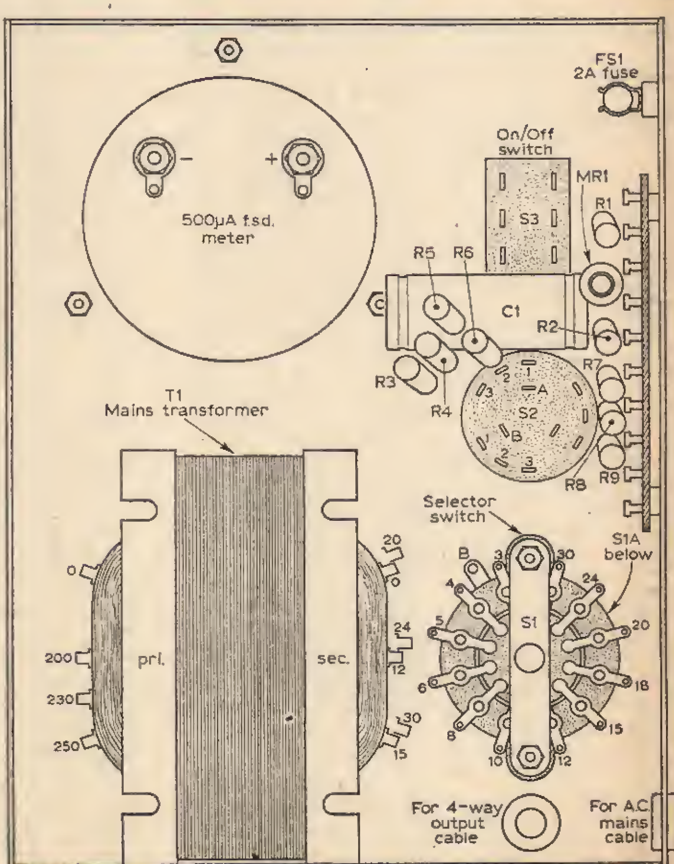


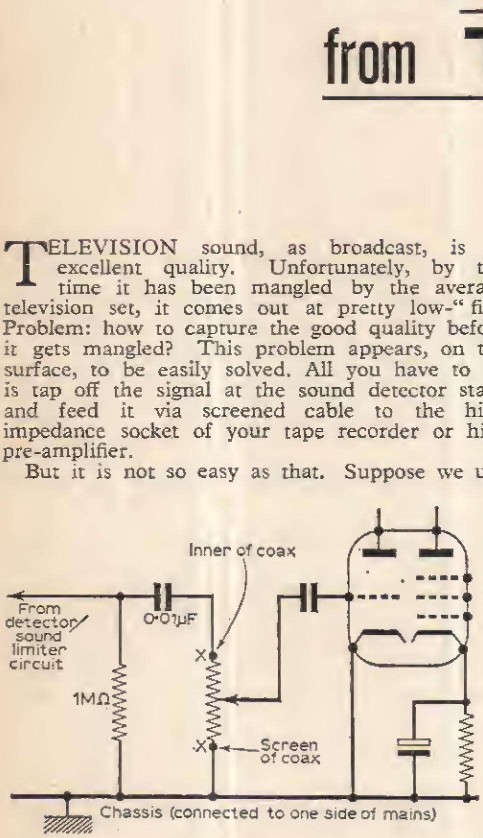
Fig. 3—The internal layout of components.

Getting the Best from TV SOUND

BY K. V. R. BOWERMAN

TELEVISION sound, as broadcast, is of excellent quality. Unfortunately, by the time it has been mangled by the average television set, it comes out at pretty low-" fi ". Problem: how to capture the good quality before it gets mangled? This problem appears, on the surface, to be easily solved. All you have to do is tap off the signal at the sound detector stage and feed it via screened cable to the high impedance socket of your tape recorder or hi-fi pre-amplifier.

But it is not so easy as that. Suppose we use



the TV receiver volume control as our take-off point, see Fig. 1a. The screened side of the cable has to connect to the earthy end of the volume control. However, this is connected to the chassis of the receiver—and the vast majority of TV sets, using a.c./d.c. technique, have their chassis connected to one side of the mains. You then have the highly dangerous situation where the screen of the signal cable is connected directly to one side of the mains. This method of connection can obviously be ruled out.

Well then, how about using isolating capacitors in each lead? (See Fig. 1b.) If you've ever tried this, you will know that it is seldom satisfactory unless the signal leads between the TV and amplifier are impossibly short. Even then, there are hum troubles.

All right, what about using an isolating mains transformer?

Are you kidding? Do you know how much they cost?

In any case, this method can also prove unsatisfactory. You are liable to get line whistle and frame buzz breaking through, and no amount of fiddling, it seems, will cure it.

Build a Tuner

No, you must resign yourself to the fact that if you want to feed an interference-free TV sound signal of high quality into a hi-fi system, you must

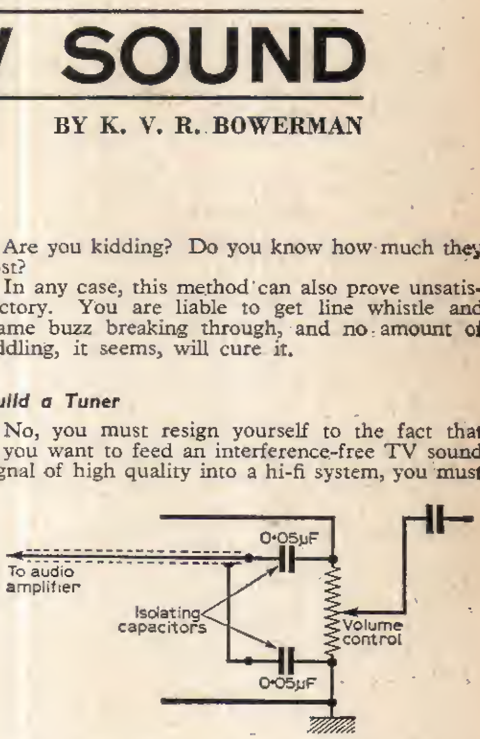


Fig. 1a (left)—Typical volume control circuitry in a receiver (take-off points marked "x").

Fig. 1b (above)—Fitting isolating capacitors.

build yourself a tuner. You needn't shy away. The tuner described in this article is easy to build, align and work, and it is quite inexpensive.

First of all, obtain from one of the advertisers in this magazine a turret tuner for Band I and Band III, fitted with biscuits for your local channels (e.g. Channel 1 and Channel 9 for London).

(These tuners are being sold at ridiculous prices—mainly because of the introduction of BBC-2. One firm, at the time of writing, offers such a tuner complete with valves and biscuits at 8/6!)

Next devise a simple i.f. amplifier and detector circuit (Fig. 2), using 38Mc/s i.f. transformers (either salvaged from old TV sets or can be obtained from Radio Clearance Ltd, Tottenham Court Road, or other suppliers).

Now couple the turret to the input of the i.f. amplifier strip, and the output from the detector to your a.f. amplifier. A simple power supply unit is required. For series-connected heaters use the arrangement shown in Fig. 3a, for parallel heaters use the arrangement shown in Fig. 3b.

The transformer for the power supply for series-connected heaters has an output of 17 volts to cope with the series total of heater volts on the PCC84 and PCF80.

Notes on Construction

The turret tuner can conveniently be mounted on a front panel cut from a piece of 5-ply. The normal method of fixing is by means of special screws which engage with three nylon bushes on the front of the tuner. If you can't get the special screws, wood screws of about No. 8 size will do a satisfactory job. Some other tuners are provided with brackets and self-tapping screws. And if all else fails, you can always use your ingenuity!

The 5-ply front panel (suggested layout in Fig. 4) can be secured to a baseboard of the same material by shelf brackets. The i.f. chassis can then be secured to the baseboard. The whole assembly may be shelf mounted or built into a box, according to taste. A chassis of about 8in. x 6in. x 1½in. (or even smaller) will accommodate the i.f. strip and power supply.

Alignment with Signal Generator

After testing for shorts on the h.t. line and for continuity in the heater line, switch on the tuner unit and a.f. amplifier and allow both to warm up thoroughly.

Next, connect a signal generator via a 1,000 pF capacitor to the test point on the turret tuner and set the generator to 38Mc/s with modulation on. Switch turret to Band I station.

With an insulated trimming tool, which can be made by filing the end of a No. 9 knitting needle to screwdriver shape, adjust each of the two cores on IFT3, IFT2 and IFT1 in that order, for maximum sound.

Now remove the signal generator and connect an aerial to the turret tuner. Set the fine tuner to the mid position, then adjust the oscillator core (usually accessible from a hole drilled for the purpose behind the fine tuner knob) for maximum sound and minimum "vision-on-sound". Vision-on-sound is an unmistakable raucous buzz.

Now switch to the Band III station and repeat the oscillator core adjustment.

That's all there is to it! You will be pleasantly surprised at the excellent quality sound obtainable.

Alternative Alignment Method

If you cannot lay hands on a signal generator but live in a fairly strong signal area, you may be able to align the equipment on signal.

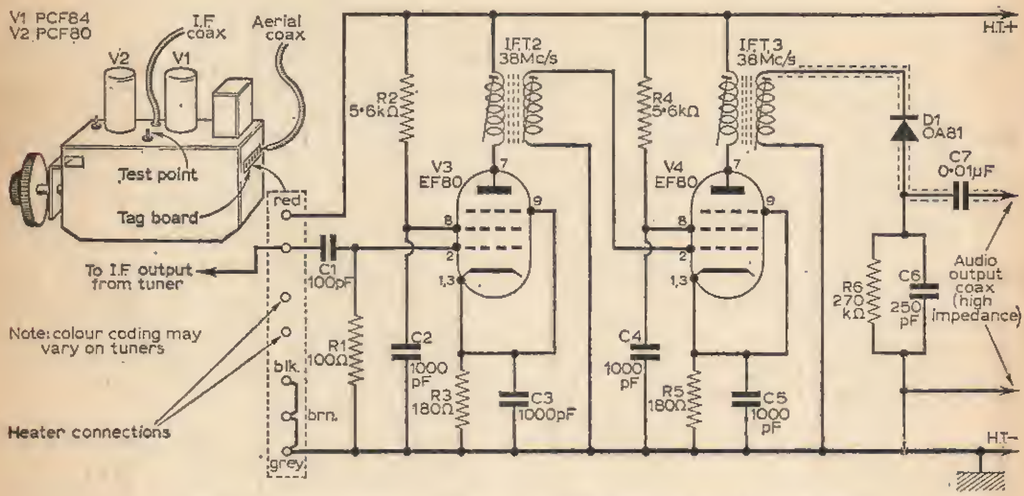


Fig. 2—The circuit of a simple i.f. amplifier and detector devised by the author.

COMPONENTS LIST FOR I.F. AMPLIFIER AND DETECTOR (Fig. 2)

Resistors:

R1	100Ω	R4	5·6kΩ
R2	5·6kΩ	R6	270kΩ
R3	180Ω		

Capacitors:

C1	100pF	C5	1,000pF
C2	1,000pF	C6	250pF
C3	1,000pF	C7	0·01μF
C4	1,000pF		

IFT1, 2 Double tuned I.f. transformer 38 Mc/s (Radio Clearance).
D1 OA81 Crystal Diode.
V1 PCC84, V2 PCF80 } (In turret tuner).
V3, 4 EF80
Turret tuner with V1, V2. (Radio Clearance, Arion Television, Clyne Radio, Lasky's Radio etc.).

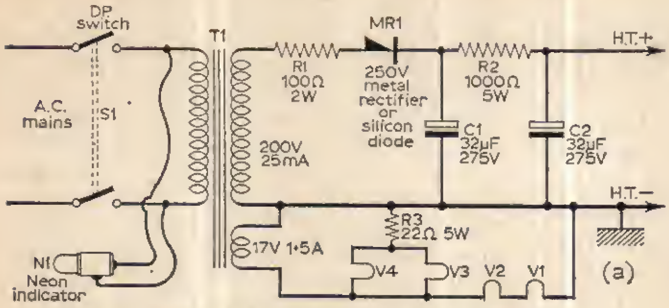


Fig. 3a—Power supply for turret tuners having series heaters.

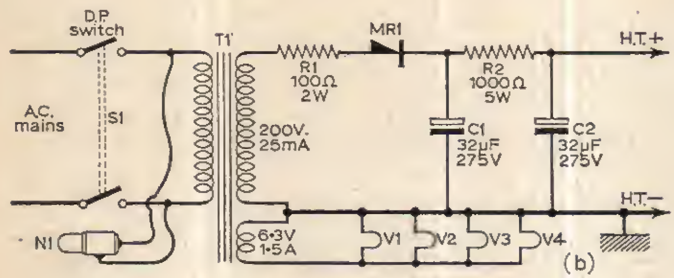


Fig. 3b—Circuit arrangements for turrets with parallel heaters.

COMPONENTS LIST FOR POWER SUPPLY UNIT (Fig. 3a and 3b)

R1	100Ω 2W
R2	1kΩ 5W
R3	22Ω 5W (Fig. 3a only)
C1	32μF } dual electrolytic 275V
C2	32μF }
T1	Mains transformer. Secondaries: 250V 25mA; 6·3V 1·5A (Fig. 3a) or 17V, 1·5A (Fig. 3b)
N1	Neon indicator
S1	D.P.S.T. switch

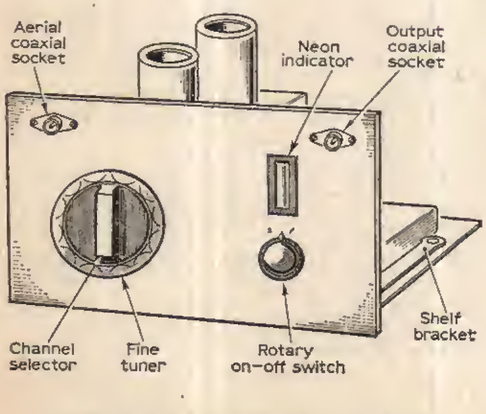


Fig. 4—A suitable panel design for the unit.

Connect the aerial, set the channel switch to your local Band I channel, and set the fine tuner to mid position. Switch on tuner and i.f. amplifier and allow to warm up.

Unscrew the cores of IFT3 and IFT2. Using an insulated trimming tool (see above), screw in each core by a quarter turn. Do this repeatedly in quarter-turn steps until a signal is heard, then adjust the cores of IFT3, IFT2 and IFT1, in that order, until maximum sound is obtained.

Adjust the oscillator cores on the turret as described above (signal generator method). Note that if, on the initial adjustment of IFT3 and IFT2 cores, no signal is obtained after the cores have been screwed in by about five turns each, unscrew them and try again after altering the fine tuner by a quarter turn. At some point in the rotation of the fine tuner a signal should be found. If not, the turret oscillator is too far out of adjustment. In this case, you'll have to borrow a signal generator, and use the alignment method described for that.

Tuner Connections

There are minor variations in these connections on tuners of different makes. But generally a tag board is provided on the tuner and the various connections can usually be traced out quite easily. A commonly used colour coding is as follows:

RED: H.T. +

BROWN and GREY, or GREEN and PURPLE: Heaters.

BLACK: H.T.—and Chassis. COAXIAL: I.F. Output.

WHITE: "Contrast" connection. COAXIAL: AE input Yellow or Green: Sometimes used for a.g.c. connection. But this is by no means universal. If you have no data about the particular tuner in use it is much safer to trace out each lead.

Some tuners have the "contrast" connection taken via a switch coupled to the channel selector shaft to two potentiometers mounted near the coaxial sockets for Band I and Band III aerials. These potentiometers then form sensitivity controls—one for each channel.

For the unit described in this article you may safely connect both "contrast" and "a.g.c." leads to chassis.

The "contrast" lead usually connects, via a resistance of 100Ω and possibly a choke as well, to pin 8 of the PCC84 valve. The "a.g.c." lead usually connects via a resistance of 10kΩ or so, to pin 6 of the PCC84. Heater connections find their way to pins 4 and 5 of both valves. H.T. finds its way via various resistors, capacitors or coils to pin 3 of the PCC84 and pins 6 and 3 of the PCF80. ■

Set Conversion for Continental Reception

Adapting Bush TV53, 62, 63 and 66 receivers to the 625-line, Band I transmissions of Europe

BY C. RAFAREL

THE choice of this particular range of receivers for Continental DX/TV reception is based on the following considerations:

(1) The receiver has an incremental type tuner which tunes continuously through Bands I and III and therefore permits accurate tuning of Continental channels which lie between the English channel frequencies.

(2) There are three vision i.f. stages, giving high sensitivity.

(3) The line oscillator and output stage will give (with minor modifications) reasonable scan width at 819 lines.

(4) The "Old Type" 3·5Mc/s bandwidth of these receivers will afford better selectivity for the rejection of unwanted local transmitters than the newer 625 line 5·5—6·0Mc/s bandwidth receiver now available here.

(5) The conversion is reasonably simple to carry out, and the receiver design allows us to make certain other modifications that will improve its performance for DX work and make it more versatile.

Conversion for Negative 625-line Reception

The following basic requirements must be fulfilled:

(1) The inversion of the video detector EB91, V6 (Receiver Deck).

(2) The adjustment of the bias on the video amplifier, PCF80, V7 (Receiver Deck). A reduction in bias is required.

It will be seen from Fig. 1 that the inversion of the video detector is obtained by using the section of EB91 (V6B) that was originally used as a vision interference limiter. As an alternative inverted diode this is achieved by means of the switch SW1.

This will deprive us of the use of the EB91 as a vision limiter on positive images, but if this is still required, we can reinstate a vision limiting circuit by means of a GX34 Crystal Diode and the switch SW2 (this is an optional modification).

The adjustment of the bias on the video amplifier valve PCF80 (V7) is achieved by means of SW3 and SW4 switches. SW3 opens the link between the 33kΩ resistor (R33) and Pin 7 (cathode) of the PCF80 (V7) valve holder. In its original position, R33, from the h.t. rail, drives the cathode more positive than would be the case if the 220Ω bias resistor R34 alone was employed.

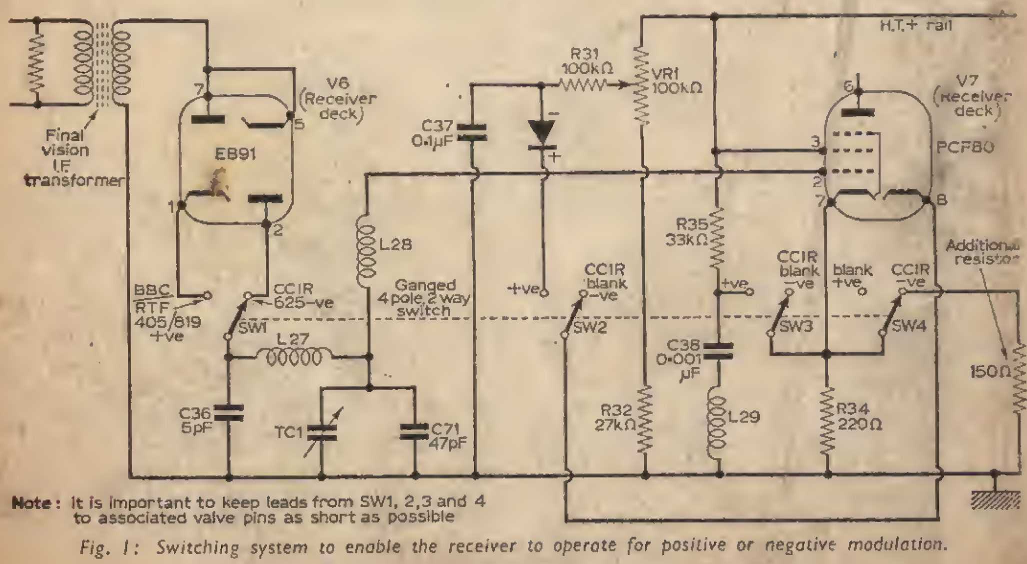


Fig. 1: Switching system to enable the receiver to operate for positive or negative modulation.

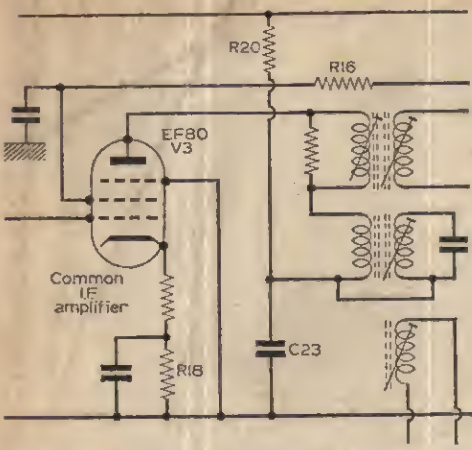


Fig. 2: Common i.f. amplifier. V3, R16, R18 and R20 are changed to improve gain.

The value of the bias is further reduced by shunting R34 with a 150Ω resistor in parallel, by means of switch SW4, for negative images.

In practice certain precautions must be taken. The leads from a Yaxley type 4-pole 2-way switch (SW1, 2, 3 and 4) must be kept as short as possible. The switch may be mounted either on top or below the chassis as near as possible to the EB91 and PCF80 valveholders. The switch operating knob can be brought out either through the side of the cabinet or an extension shaft can be fitted to locate it at the front of the cabinet.

We have already described methods of "setting up" for 625-line positive/negative and 819-line positive reception in a recent DX TV article, and this procedure should be followed when the receiver is put into service.

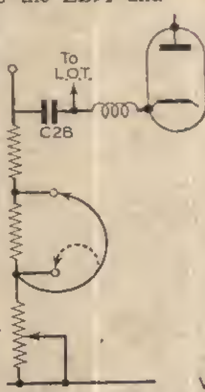


Fig. 3: C28 is changed in the l.o.t. circuit.

Further Modifications for Improving 625/819-line Reception

(1) Increased Gain.

(a) Change the PCC84 (V1) in the tuner unit to 30L15 (instability may result on channel B1 but this is of little importance as Continental stations do not use this channel).

(b) Change EF80 (V3) to EF183 and suitably adjust operating voltages as follows:

Change R18 (220Ω) to 33Ω (Cathode bias resistor).

Change R16 (470Ω) to 33kΩ (Screen feed resistor).

Change R20 (5·6kΩ to 3·3kΩ (Anode feed resistor).

(c) Change EF80 (V4) to EF184. No voltage modification required.

Change EF80 (V5) to EF184. No voltage modification required.

When modifications (b) and (c) are undertaken, the associated i.f. transformers will require repeaking due to changes in valve interelectrode capacities, it is recommended therefore that these modifications are not embarked upon unless the "line up" proceedure is fully appreciated.

Improved Performance at 819-lines

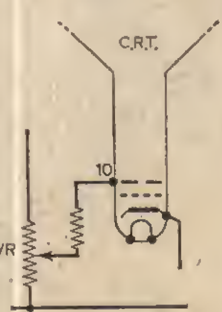
Substitute a suitable silicon rectifier in place of the two existing PY82 rectifier valves (V8, V9 on maindeck), fit a 25Ω surge limiting resistor in series with it, disconnect the existing anode and cathode leads to the PY82 valves but retain heaters in circuit as "dropper" resistance. This will increase the h.t. rail voltage from approx. 190V to approx. 225V and will improve overall gain and scan width on 819 lines.

A further width increase can be obtained in the TV 53, 62 and 63 type receivers by changing C28 (Main Deck) on the line output transformer from 175pF to 140pF (use 8kV working ceramic type) —see Fig. 3.

These receivers will normally run at 819 lines without modification to the line oscillator stage other than slight adjustment to the preset line drive capacitor TC2 (located on panel below chassis). It may, however, in some cases be necessary to increase R32 (usually 390kΩ or 270kΩ) to 500kΩ approx. R32 is in series with the line speed control.

Due to inherent characteristics of the line output

Fig. 4: Pin 10 voltage is made variable by VR.



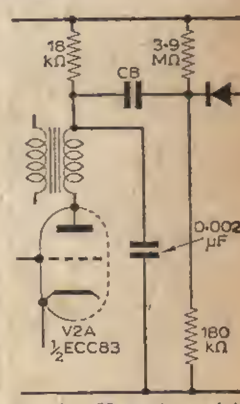


Fig. 5: C8 is changed in value to improve frame hold.

transformer, which works on third harmonic resonance at 405 lines, there will be some reduction in e.h.t. and consequently in picture brilliancy at 819 lines; this may be alleviated by two further modifications:

(1) Increase the EY51/EY86 heater winding on the line output transformer by adding two additional turns. This is relatively simple as the winding is of thick wire, but care should be taken to ensure good high voltage insulation. It should also be noted that the EY51/EY86 valve heater will tend to overrun at 405 lines and ageing valves may be expendable.

(2) Arrange variable adjustment of the voltage on

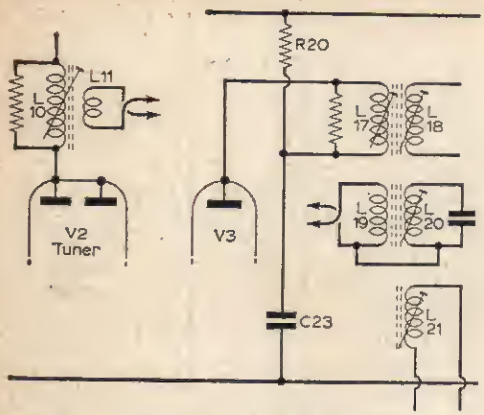


Fig. 6: Changes in the sound take-off wiring to accept the output of a second tuner—see text.

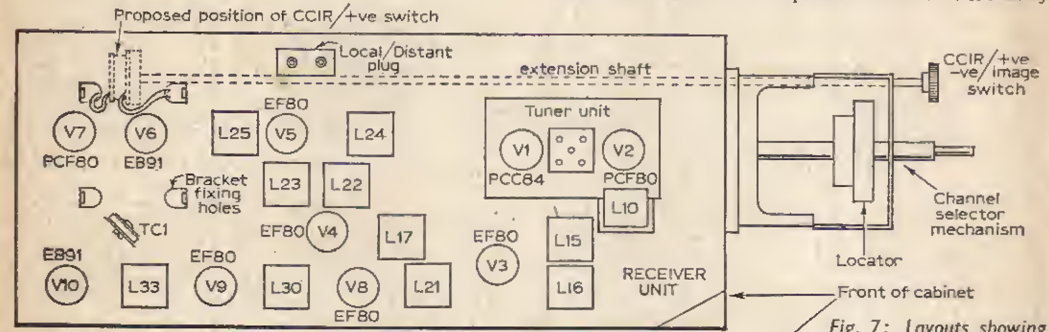
to 0·1μF.—Fig. 5.

(3) The following modification has been found particularly useful for two reasons.

At present the anode of the frame oscillator valve V3A PCL83 (Main Deck) is fed via R19 (1MΩ) from the boost-rail, the voltage of which depends on c.r.t. brilliance and current drawn by tube. When a fast-fading sporadic-E signal is being received, this change causes frame-roll; similarly any change in line speed from 405-625 to 819 lines will cause a change in e.h.t. on the tube as noted above, and this will require resetting the frame hold each time the line speed is altered.

If, however, we feed the anode of V3A from the main h.t. rail via a 330kΩ resistor, instead of from the boost rail via the existing R19, we shall have sufficient height and the above difficulties will be overcome.

A common fault after conversion is that when the receiver is switched for CCIR reception and the contrast considerably reduced by means of the contrast control, a flutter in brilliancy on the screen both "on" and "off" picture occurs. This may



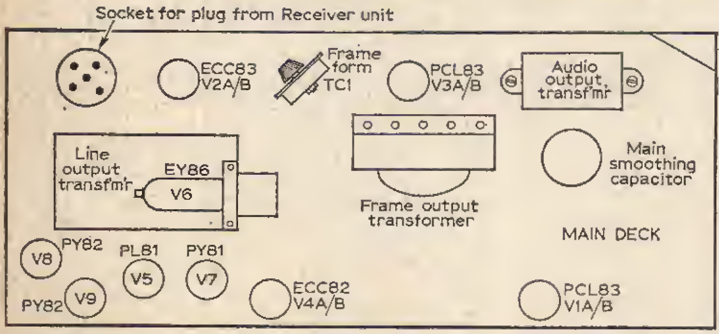


Fig. 7: Layouts showing location of valves and i.f.t.'s.

be overcome by increasing the decoupling of the AGC Line by means of a 1·0μF capacitor between the junction of R54 (47kΩ) and the local/distant plug socket to chassis.

Due to differences in sound vision carrier spacing, a British system receiver cannot be used for simultaneous reception of picture and sound from an RTF French TV station. The problem is, however, capable of a fairly simple solution with this range of receivers. (Note: this is applicable to a.m. sound channels only.)

From the circuit diagram it will be seen that the sound take-off i.f. transformer L19, 20 and 21 (Receiver Deck) has in fact a low impedance primary winding L19. This is disconnected from the bottom end of L17 and the anode feed resistor R20. R20, with C23 is then reconnected directly to the bottom end of L17 to restore the h.t. feed to V3.

We now have a low impedence input available to the i.f. section in form of the low impedence coup-

—continued on page 416

pin 10 of the c.r.t. Insert a variable resistor not less than 2MΩ between the boost-rail and chassis of feed-tag 10 on the c.r.t. from the slider. A slight reduction in voltage here will improve picture contrast at the reduced e.h.t. (Fig. 4).

Frame Hold

Frame hold may prove somewhat critical on weak DX signals but this can be improved as follows:

(1) By fitting a vernier frame-hold control in the form of a 50kΩ variable resistor in series with the existing 2MΩ VR2 (Main Deck) and using the original VR2 as a coarse pre-set control.

(2) By increasing C8 (Main Deck) from 0·001μF

BY H. W. HELLYER

STOCK FAULTS

PREVALENT TROUBLES IN COMMERCIAL RECEIVERS

PART 2 THE I.F. AMPLIFIER

CONTINUED FROM PAGE 367 OF THE MAY ISSUE

THE i.f. stage is the heart of a superhet receiver, It should also be the stage which gives least trouble. The reason is inherent in superhet design: by arranging an exact difference between oscillator and incoming signal, the frequency handled by the i.f. stages is constant. The designer can concentrate on preserving bandwidth and controlling gain. There are less variables to bother him—and us.

In practice it is the very attribute of exact tuning that proves the greatest bugbear. There is a regrettable tendency to twiddle the cores of the i.f. tuning coils when the gain of a set is low. Very often the cores thus maladjusted appear to make no direct difference to picture or sound and may be returned to a position not quite the original setting. The cumulative effect of several of these maladjustments is either sound-on-vision, vision-on-sound or a general deterioration that seems to defy an exact diagnosis. Putting this condition to rights can be the very devil without comprehensive workshop equipment.

Although alignment does not come within the scope of the present series of articles—and has been discussed at length in recent articles in these pages and in PRACTICAL WIRELESS—it is impossible to discuss stock faults peculiar to i.f. amplifiers without regarding some of the practical points about tuned circuits, their testing and adjustment.

The tuning coils and transformers found in and around the i.f. stages of a television receiver can be confusing if no circuit or layout diagram is available. As intimated above, they are not always direct coupling between amplifiers. There are sound-traps, rejectors, take-off coils and so on, with adjustment often precise and fault conditions that can be baffling.

A Typical I.F. Circuit

For the purposes of explanation Fig. 9 shows what might be termed a "composite" circuit. This is the common i.f. amplifier V1 with vision i.f. amplifier V2 and sound i.f. amplifier V3. The valves are conventional pentodes such as the EF80, Z749. 6F23, etc.

In many receivers the common i.f. stage will be based on a vari-mu valve such as the EF85 which, in conjunction with the a.g.c. voltage, provides a better control of the signal under conditions of varying input. Later sets employ frame grid valves such as the EF183 with even better control and a higher gain. We are only concerned with the design factors here in so far as they affect the faults we are likely to meet.

In the circuit of Fig. 9 the signal from the tuner unit at the intermediate frequency that is now standard, i.e. vision 34·65Mc/s, sound 38·15Mc/s, is applied to the tuned circuit L1, C1, in conjunction with the damping resistor R1, whose function is to broaden the bandwidth of the circuit.

One fault that has been met on some receivers, where the feed to the junction of L1, C1 was from a point at high voltage (such as a tapping on the anode load coil of the frequency changer), is a loss of gain due to the failure of C1 and a possible burnout of L1. The presence of R1 maintains signal transfer but attenuates it. The fault is often difficult to diagnose but can be proved by bridging the i.f. feed directly to the grid of V1 with a 1,000pF capacitor. First check that C1 is not short-circuiting the signal.

The automatic gain control voltage to the grid of V1 is applied via R4, decoupled by C2 and with a clamping diode D1 across the a.g.c. line. Circuits vary widely and the effect of component failure also varies.

In the circuit of Fig. 9 a single a.g.c. feed is shown. In practice there would probably be another feed, perhaps from a separately decoupled tapping on the main a.g.c. line, applied to the r.f. valve and possibly a subsidiary feed to the first vision i.f. valve V2. More than one clamping diode may be found, the circuit arranged so that in the event of signal failure the valves will not receive a positive voltage at the respective grids.

More detailed discussion of a.g.c. circuits, the specific faults which arise and test methods, will occupy us later in this series. For the present we are concerned with the effect of a short-circuited or open-circuited a.g.c. line.

Faulty Clamp Diode

The prime suspect for short-circuits is the diode itself. In Fig. 9 this would mean that no a.g.c. would be applied to V1 and the valve would overload on strong signals. As R4 is a high value the effect on low or "normal" signal strength may not be immediately noticeable except as a tendency for the picture to vary widely between low and high contrasted scenes.

An open-circuit of clamp diode would have little or no effect in this circuit except under overload conditions, but in some circuits where different standing bias is applied to stages the diode is also part of the safety circuit and can have a similar effect, when open-circuited, as the next fault, an open-circuit filter capacitor.

This is a fault that often gives rise to some head scratching, particularly where the a.g.c. is of the simple, mean-level variety with a negative voltage derived from the grid of the sync separator valve.

voltage is applied to several valves, a more positive check is to disconnect the a.g.c. feed (as at the arrow in Fig. 9) and apply a small voltage from a d.c. source in place of the a.g.c.

This voltage can be obtained from the multimeter by switching to the ohms range, remembering that in most cases the positive lead of the meter carries negative polarity when switched to ohms and vice versa. Thus the negative of the meter to chassis and the positive lead to the a.g.c. line with the meter switched to ohms should apply a negative bias to the controlled valves and reduce the contrast. Reversing the meter leads should have the opposite effect and may lead to overloading.

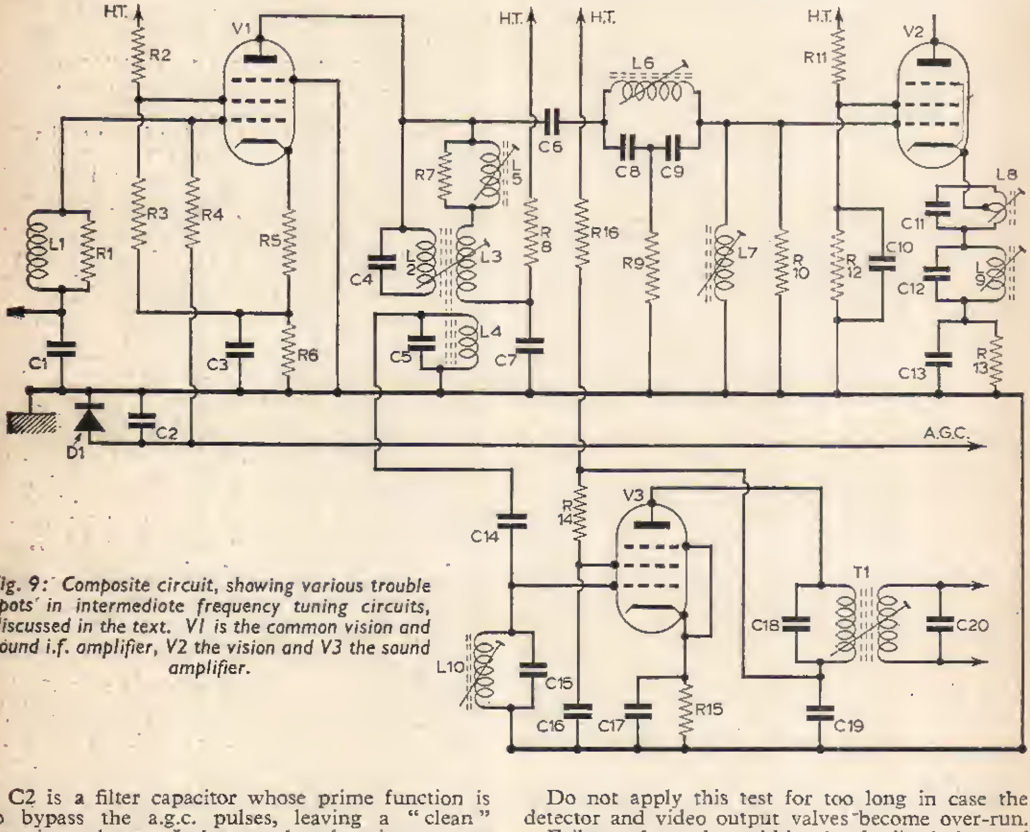


Fig. 9: Composite circuit, showing various trouble spots in intermediate frequency tuning circuits, discussed in the text. V1 is the common vision and sound i.f. amplifier, V2 the vision and V3 the sound amplifier.

C2 is a filter capacitor whose prime function is to bypass the a.g.c. pulses, leaving a "clean" negative voltage. It has another function as part of a time constant circuit employed to smooth out transient changes of contrast level. When the filter circuit fails the a.g.c. pulses are allowed to reach the controlled valves, resulting in reduced contrast and a tearing of the top of the picture. A quick bridging of C2 with a capacitor of similar value should prove the fault.

Checking Presence of A.G.C. Voltage

The presence of an a.g.c. voltage can be found with a high-resistance voltmeter, but as spurious results can be set up, especially where the control

Do not apply this test for too long in case the detector and video output valves become over-run.

Failure of a valve within the feedback loop of the a.g.c. circuit in such a way as to cause instability and a large false signal at the sync separator grid can have two quite different effects. In one instance the confusing symptoms of an overloaded video amplifier plus a strong a.g.c. voltage may lead to an investigation of the video stage, made even more annoying by the fact that the overload may have caused component and valve damage, but replacement of the faulty items does not cure the root trouble. In another case the overload can produce a balancing a.g.c. voltage, with a consequent weak and watery picture and little control of contrast, leading to an investigation of the detector.

Other Causes of Instability

The causes of instability, apart from a direct failure of a valve, placing a positive voltage on the a.g.c. line, and a high white level raster or negative signal, may be open-circuiting of decoupling capacitors or change of applied electrode voltages.

In the circuit of Fig. 9 the screen grid of V1 is seen to be controlled by a voltage taken from a tapping on a potentiometer across the h.t., consisting of R2, R3. The lower end of R3 is returned not to chassis but to the junction of R5, R6. This arrangement is to preserve a standing bias on the valve. The decoupling is by C2 and quite severe instability will be experienced if this component fails. Another prime suspect is the anode decoupler C7.

The decoupling capacitors of V2 may have a different effect. C10, across the lower part of the screen grid potentiometer R12, can reduce the gain of the stage, and C13, decoupling the cathode bias resistor R13, may also aggravate the lack of fine detail (altering the response curve by attenuating high frequencies).

The shape of the response curve is obtained by the accurate tuning of the circuits throughout the i.f. stages. For this reason Fig. 9 has been deliberately complicated by the inclusion of several different sorts of tuned circuits. It may be a designer's nightmare but is intended to demonstrate our argument, not serve as a working model. A few words on these tuned circuits may be appropriate here.

Rejector Circuits

Whereas in the superhet radio the i.f. coupling is generally obtained by tuning bandpass coils to the maximum response at the i.f. frequency, the function of the tuned circuits in the television receiver is to accept or reject a particular frequency, or band of frequencies, which may be quite different from the intermediate frequency.

Rejectors are necessary to prevent the sound channel from breaking through on vision, both at the fundamental sound i.f. and at the adjacent channel frequency.

In the case of a set using the "standard" intermediate frequencies of 34·65Mc/s vision and 38·15Mc/s sound the adjacent channel rejector, tuned to the next highest channel, will be 33·15Mc/s.

Both examples can be seen in the cathode circuit of V2, where L8, C11 is the sound rejector and L9, C12 the adjacent channel rejector. Each is sharply tuned, producing a high impedance and thus greater negative feedback at the rejection frequency.

Another example of a rejector circuit is L2, C4. This closed loop is termed an absorption rejector and is coupled to the main tuning coil L4. It may not be actually connected: sometimes it has one connection to chassis and at others is simply a closed loop not connected to anything but coupled by virtue of its proximity to the tuning coil and absorbing power from the tuning coil at the rejection frequency.

L4, C5 are also coupled to this circuit and serve to take off the sound intermediate frequency signal to be applied to the sound i.f. amplifier V3 via C14. C15, L10 act as a load at the grid of this valve and the sound i.f. output to next stage, or to the detector, is by "conventional" coupling T1.

The bandwidth of the sound channel is much narrower than the vision channel and vision rejectors are not so often found. The accurate tuning of sound i.f. circuits and rejectors serves to keep the vision out.

For this reason it is often necessary to tune the sound circuits accurately and set the rejectors before making final tuning adjustments that determine the overall response curve. Where the manufacturer's exact alignment instructions may not be available this is sound practice.

Bandpass Transformer

The remaining tuned circuits between V1 and V2 comprise a bandpass transformer, of which the primary is L5 and the secondary L7, and a coupling between them consisting of the very popular "Bridge-T" network.

This circuit, with many variations, has the advantage that a nearly square shaped response curve can be produced with a steep drop from the high-frequency end of the vision curve, giving excellent separation from the sound channel and hence good rejection with less chance of phase shift that can affect the design when a number of separate tuned circuits have to be used.

The primary and secondary circuits of the bandpass transformer are tuned by the respective input and output capacitances of V2 and V1. In practice the primary and secondary may be tuned to, say, 35 and 37Mc/s and the rejector L6 to the sound i.f., 38·15Mc/s.

The foregoing has not been a deliberate theoretical digression but should have underlined the point that accuracy of tuning is essential on the superhet television i.f. strip and, as sets become more complex, small errors of tuning, whether by maladjustment or components failing, can cause symptoms that may be misleading.

High Resistance Joints

The bugbear of instability, caused by open-circuiting or change in value of decoupling capacitors, has been discussed. Not so obvious is the instability that arises from a high-resistance joint at the lead-out point of a thin wire of a coil in the connection to a printed circuit board or the change in value of a damping resistor (such as R7 in Fig. 9).

The last fault has the effect of increasing the Q of the coil and giving unwanted "peaks". The effect may be a slight patterning on the screen, an overall grainy effect rather similar to valve noise, or even a complete blanking of the raster with noise. This kind of fault requires especially careful tracing. A reduction of contrast will often provide a clue if the tuned circuits are the culprits as the patterning symptoms will also reduce, whereas those that could be caused by external interference will remain, though progressively weakened with the signal.

Other common faults which cause a lack of gain rather than instability are broken or high-resistance joints at the points indicated by the arrowed lines X and Y in Fig 10.

Although the coils shown in this diagram are more often found in older receivers the same stricture applies where coils are of fewer turns, where fine wire is employed. A coil working loose

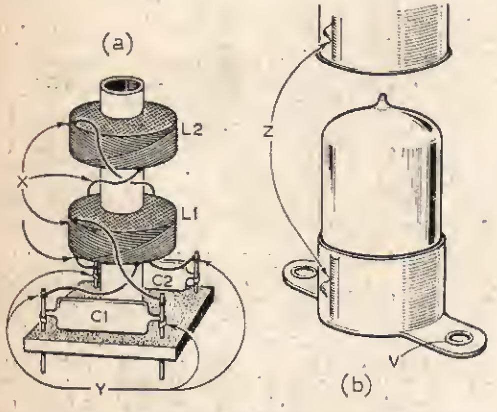


Fig. 10 (a) Tuning coil trouble-spots: (b) faulty screening can cause misleading faults.

on its former can cause curious detuning effects, as can a high-resistance joint at the connection of C1 to the stand-off wires.

A point to note here is that in servicing a receiver from above, with chassis inverted, care must be taken not to apply the soldering iron too long at the base connections of the i.f. cans. Dry joints, short-circuits or complete disconnection of coil wires can result from excess of heat.

Fig. 11 shows an alternative form of construction where the coil and component wires are anchored to lead-out wires that run the whole length of the can. They are kept in place by a paxolin or plastic piece with holes drilled appropriately at the top.

Sometimes the whole assembly is insulated with a sheet of thin plastic and a small piece of card may be glued to the inside of the top of the can

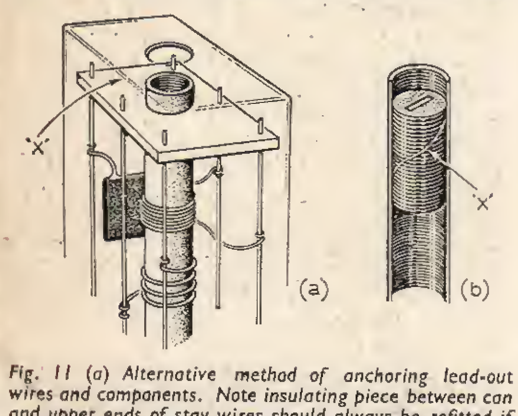


Fig. 11 (a) Alternative method of anchoring lead-out wires and components. Note insulating piece between can and upper ends of stay wires should always be refitted if dislodged. (b) Cracked iron-dust core is often difficult to trace.

in the position indicated at X. It is most important that these safety shields be replaced if dislodged.

Obscure Faults

Neglect of the last point is one of the common causes of intermittent faults. Poor screening, as at the can fixing of a valve (see Fig. 10b) V and Z, loose windings of coils (Fig. 10a) L1 and L2, high-resistance connections both within and at the joints with components, and cracked iron-dust cores as illustrated in Fig. 11b can all give obscure symptoms difficult to trace.

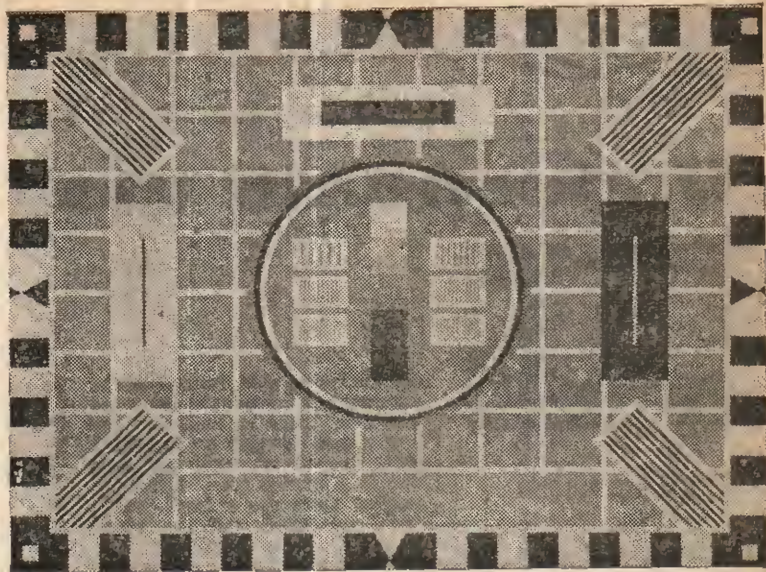
Where these faults affect tuning, sound-on-vision may occur. To prove whether this is indeed the fault turn the volume control to minimum, note that the symptoms vanish and tap gently around the circuit to provoke the symptoms.

Poor Contacts

Note that some of the poor contacts that can cause these common i.f. faults may not be physically obvious. Where screening is completed by machine pressing or riveting, as at V in Fig. 10b, deterioration with time may cause a fine film of oxidisation between the two surfaces, although the joint may appear to be mechanically sound.

It is worth while checking the fixing of screening cans, etc., and either adding nut, screw and shakeproof washer fixing or providing a short-circuit by soldering a short length of braid between the surfaces.

PART 3 WILL APPEAR NEXT MONTH



A new test card for television trade test transmissions has been designed jointly by the BBC, the ITA and BREMA, who jointly hold the copyright. There are two versions; Test Card "D" for 405-line transmission and Test Card "E" for 625-line transmission.

NEW TELEVISION TEST CARDS "D" AND "E"

ALTHOUGH similar to Test Card "C", a number of changes take into account improvements in television equipment in recent years. Each pattern on the card is designed to assess particular characteristics as follows:

Aspect Ratio

The central concentric black and white circles should appear truly circular when the width and height of the picture are adjusted to the standard aspect ratio 4:3.

Adjustment of Picture Size

The limits of the transmitted picture are indicated by the point of contact of opposing arrow heads on each side of the test card and by the outer edge of white squares in each corner. As most receivers have a display area aspect ratio of approximately 5:4, it is usual to adjust the receiver so that the top and bottom edges of the display area coincide with the arrow heads of the test card and the side castellations of the test card just appear in the display area of the receiver.

Resolution and Bandwidth

Within the circles is a group of six frequency gratings each consisting of alternate black and white vertical stripes corresponding to fundamental frequencies in Mc/s of:

Test Card "D"		Test Card "E"	
1·0	1·5	1·5	2·5
2·0	2·5	3·5	4·0
2·75	3·0	4·5	5·25

The gratings are designed to produce after gamma correction a signal of approximately sine wave form corresponding to 50% modulation (as opposed to the square wave form on the earlier cards). Thus the stripes will have a gradual transition from black to white.

Contrast

A five-step contrast wedge appears in the centre of the test card corresponding to a contrast range of about 30 to 1 as between the black and white squares at each end of the scale. Adjacent squares should give equal brightness difference on a correctly adjusted receiver. Within the top and bottom squares are small circular areas of slightly brighter tone. The merging of these areas into the surrounding area indicates white or black crushing as the case may be.

Scanning Linearity

The background of the test card is a medium grey, bearing a graticule of white lines. These should be reproduced in all parts as enclosing equal squares and the central black and white rings should appear truly circular.

Line Synchronisation

The alternate black and white rectangles forming the border serve to check the line synchronisation of receivers. Faulty line sync will show as horizontal displacement of those parts of the picture following the white rectangles, in particular giving the central circles an appearance of "cog-wheels".

Low-frequency Response

Poor low frequency response will show as streaking at the right-hand edge of the black and white areas of the rectangles at the top centre of the test card, and also at the right of the border castellations.

Reflections

The white vertical line with the black background and the black vertical line with the white background should appear free from images (ghosts). These lines represent pulses having a duration of 0·3 microseconds on Test Card "D" and 0·2 microseconds on Test Card "E". Reflec-

—continued on page 423

A MONTHLY COMMENTARY

Underneath the Dipole

BY ICONOS

HI-FI enthusiasts packed into the Audio Fair at the Russell Hotel, where the exhibition halls were supplemented by those sitting rooms, lounges and large bedrooms which could be adapted for demonstrations, mainly of the stereophonic type. Not much attention was paid to television, nor the extra bits and pieces which could improve the sound of the average domestic receiver. Very remarkable and impressive results were obtained on British equipment, and also on equipment which came from all parts of the world: microphones, pick-ups, disc turntables, tape recorders, loudspeakers — in fact, everything excepting domestic television sets, the sound on which was considered to be of poor average quality. For some years I have referred to the degradation of sound quality on most home sets, and have taken part in campaigns to encourage manufacturers to fit reasonably good loudspeakers on the fronts of the sets instead of being secreted away around the top or side. These certainly have improved on some of the TV sets during the last year or two. Facilities for separate plug-in external high quality loudspeakers would give good results, though these might reveal slight faults (e.g. low pitched hum from studio ventilation, and rustle from papers and "props"). In the same way, I have supported in these columns the re-introduction of d.c. restoration for the vision side, instead of the automatic gain control arrangement, in order to keep the low key scenes at their proper black level instead of averaging them out as a murky grey. Television studios make use of high quality (and expensive) monitors which give pictures superior to domestic receivers, of course, and the equipment they use for sound covers much ground apart from microphones and mixers, $\frac{1}{4}$in sound tapes being used in addition to high quality turntables and pick-ups. There certainly is plenty of flexibility in their use for music, effects, voices-off and reverberation control.

Drama on Locations

Dramatic open-air scenes on TV screens are common enough these days, but whether the subjects dealt with are cowboys, cops or robbers, they are mainly photographed on film. Whether the subjects are shot inside or outside the studio stages, the Americans use film cameras and carry on with the traditional processes of cutting and editing sequences, adding the complications of music and effects sounds to the dialogue, or post-synchronising additional dialogue to replace that which is marred on location by noises of wind, rain, 'planes, or screaming pop fans. The same techniques are occasionally used in British film studios, but the television companies on the whole prefer to use normal live television methods of recording on video tape, introducing occasional filmed sequences for exteriors only. *Steptoe and Son* was a particularly good example of this. The BBC version of T. S. Eliot's *Murder in the Cathedral* was recorded entirely on location at Canterbury, making use of mobile video tape recording channels for both picture and sound. The director, George Foa, was able to sustain quite long and dramatic scenes in this way, with a minimum of cutting and joining. Naturally, the exterior shooting conditions imposed upon scenes enacted on the real exteriors of Canterbury Cathedral—or on the interiors, for that matter—presented the director, technicians and actors with a lot of problems. The success of this lengthy production was largely due to the fine performance of Cyril Cusack as the Archbishop, whose acting and diction were excellently recorded by the TV picture and sound engineers. Much of the work was carried out during the night, and the cold weather conditions naturally tended to give visibility to the breath of the actors—particularly when their words were spoken in anger. *Murder in the Cathedral* was a tremendous and memorable achievement, making maximum use of the real building; but I think that most of the technicians concerned will turn with relief to the studio stages, settings and completely controllable lighting, apart from the luxurious comfort of their premises.

Diction

Dialogue in most modern plays is in a very different category from the clearly articulated words spoken by the actors playing in classics—such as in the BBC's *Murder in the Cathedral.* The same clarity of speech was notable in *Becket*, the new film of Anouilh's version of that historic event. How different is the mumble-jumble of dialogue which is difficult to hear in many of the modern TV plays—and plays in the theatre too. It is all a matter of opinion whether the stylised dialogue of Pinter, Beckett, Wesker, Osborne and the lesser known playwrights of today, matters very much when it is spoken with the sloppiness adopted by many actors. And yet the TV viewer is often in much the same position as the unfortunate last man to get into the gallery of a theatre. In her biography, the late Lady Bancroft, star of the London theatres of the eighties, related that the requirements of clearly delivered dialogue were impressed upon her at an early age. "How dreadful it would be to find that the poor man in the gallery cannot hear what the actors are talking about!" said her mother. "Think of him when you are acting and direct your voice to the very back of the theatre". It was not the volume of the voice which was increased, but the ability of the speaker to make every word heard, even in a whisper, in any auditorium, however large. This had to be achieved without shouting lines, nor by over-acting—generally referred to as "hamming". Years have gone by and the same rules can be applied to voice production for television or films, though with a lower volume level.

Foreign Accents

A further complication arises when local accents and dialects are needed. When the story takes place in a foreign land, be it France, Germany or Japan, the traditional method of presentation is to introduce some kind of foreign accent to English words. In BBC's *The Second Wall*, by Hugh Leonard, the producer, James MacTaggart, ignored the usual methods and had his players speak their lines quite clearly in English without a trace of accent. As all the characters in this drama were Germans on one side or the other of the iron curtain—or the wall in Berlin—much of the dramatic effect was lost and, at times, one imagined that the location was in London or Manchester. *The Second Wall* was directed by Gilchrist Calder, who applied a fast production pace to an exciting story of an escape, via the city's vast sewers, underneath the hated wall. The play ended with the kind of chase which makes an impressive climax, helped with an ingenious mixture of filmed exteriors and studio interiors.

"Oldies"

I must say that the BBC do seem to select films for their Saturday night programmes which occasionally come into the vintage class. Vintage is a good word but it implies the qualities of good well-matured wine. Vintage films of years ago, such as Chaplin's *The Gold Rush* can be compared with the best of the prolific flow of films of the silent days. Talkies had elementary qualities which became more complicated in the course of time. George Raft, big star in the days when stories of racketeers of alcoholic vintages and "hootch" filled the cinemas, changed over to a heroic role in *Johnny Angel*. As Captain Angel, master of a U.S. merchant ship, he found himself involved in a kind of "Marie Celeste" story, in which he finds and recovers his own father's ship, which is completely unmanned and abandoned. The story, complicated by the crooks, the racketeers, the night clubs and the hostesses, provided plenty of action around the town, mainly at night, kept moving by Hoagy Carmichael as the taxi-cab driver running up the figures on the meter. The technical interest of this film, which must be about ten years old, is seen in the remarkably good picture quality that was obtained in the mix-up of dim and low key night scenes and bright sparkling night clubs. Engineers at the BBC revealed, as expected, that it was reproduced on new Cintel Flying-Spot telecine equipment — equipment of the type which has been continuously in use for about twelve years!

Bold as Brass

Some long time ago, Jimmy Edwards and Beryl Reid appeared in an amusing Lancashire TV play *Man O' Brass*, which was repeated recently with great success. Jimmy played the part of Ernie Briggs, an enthusiastic performer on the large brass double b-flat euphonium of the local town band, providing the oom-pah notes so necessary for balance. The marching of the band down the streets and their performances on the band-stand in the park provided entertaining musical sequences in the story of this TV play, one sequence of which was suddenly ended by a rain-storm. Close-ups of various instrumentalists from the Ulverston town band were effectively handled by the conductor—and, in turn, by the television director. The devotion of Ernest Briggs to his brass band activities provided the Briggs family with amusing situations and a happy ending for the all-important band room, burned out by fire but restored by a baked-bean manufacturer. Not quite so happy was the first of the *Bold as Brass* series with Jimmy Edwards and Beryl Reid together again in an odd mixture of musical presentations, music hall cross talk and a simplified brass band playlet which lacked the more complicated story-line of the original *Man O' Brass* TV play. Nevertheless, Jimmy Edwards and Beryl Reid work very well together, both on stage and TV screen. I look forward to a few more unusual story twists being applied to *Bold as Brass* series, apart from the musical gimmick that has been proposed for each episode.

P

F

By J.G.Rans

THIS article provides details of suitable monitoring equipment for use in association with the Flying-Spot Transparency Scanner recently described in these pages. Two units are described: first a simple monitor which utilizes the scanner time bases; second, a more advanced and self contained version.

In order to facilitate reference back to the articles dealing with the scanner, the following particulars are given:

Part 1, January 1964, page 150, Figs. 1 to 7.
Part 2, February 1964, page 207, Figs. 8 to 15.
Part 3, March 1964, page 257, Figs. 16 to 21.
Part 4, April 1964, page 297. Figs. 22 to 25

The diagrams accompanying the present article continue in the same numbering sequence as these previous articles.

The Simple Monitor

The simple monitor is made up of the following basic units. The tube unit of Fig. 7 and two amplifiers of Fig. 9. The power supplies are obtained from the main power-pack of Fig. 4 which is just able to cope with the demands of this unit.

Scanning for the monitor is provided for by directly coupling the amplifiers of the monitor to the scanner time bases, and this means that synchronisation problems are overcome.

Should it be felt that blanking is a refinement which may be dispensed with, and the scanner is to be used only with this simplified monitor, then the circuitry of Fig. 19 may be eliminated from the transmitting unit. The only modification required to be carried out to the basic unit as it stands is the inclusion of the resistor Ra in the tube circuit—see Fig. 26.

Construction

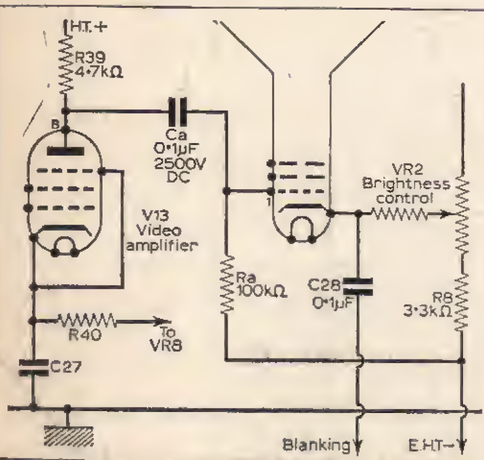
Construction follows the same lines as those laid down for the scanner unit, that is to say, following all the instructions relevant to Figs. 7 to 11 inclusive.

Each amplifier should be connected to the relevant time base generator in the scanner by means of a capacitor equal in value to C10 and C13 respectively. (See Figs. 12 and 15). All these connections must be made with coaxial cable.

The output from the video amplifier is taken to the tube grid by Ca as shown in Fig. 26. This capacitor must have a suitable working voltage rating and be of the highest quality.

Testing

Test voltages and procedures are the same as those described previously for the various units used. The final test is as follows:



COMPONENTS LIST

C.R. TUBE UNIT AND VIDEO AMPLIFIER (Fig. 26)

Resistor:

Ra 100kΩ ½W

Capacitor:

Ca 0·1µF 2,500V

Note.—The above are the *additional* items required. See also Fig. 7 and Fig. 16.

Fig. 26—The video amplifier and tube circuitry.

ICTURE MONITORS

R THE FLYING SPOT SCANNER

ne

Adjust the monitor tube trace for a fairly bright, finely focused race. Turn up the video gain controls to maximum and the picture will be displayed on the monitor. It will be found that while the brightness control affects the picture brilliance, the video gain control VR8 varies the contrast and the final picture quality is dependent on compromise settings between these two variables.

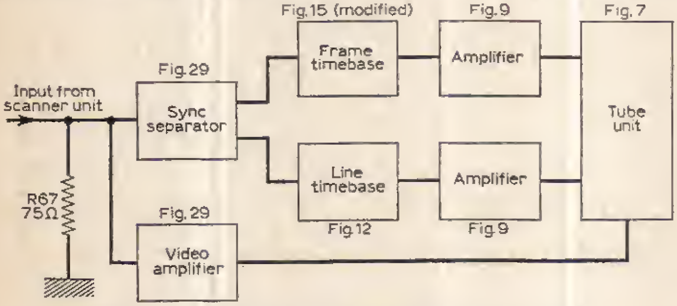


Fig. 27—A block diagram of the self-contained monitor.

More Advanced Monitor

The more advanced monitor is shown in block form in Fig. 27.

As can be seen from this diagram the unit has its own timebases and sync separator and is thus capable of processing a composite video signal. However, before this can be done we have to alter the output from the scanner unit.

An output at r.f. is not required, so the circuit of Fig. 24 is modified to that of Fig. 28. This arrangement provides a low impedance output for the signal so that the scanner may be connected to the monitor by any reasonable length of coaxial cable (up to several yards).

The only modification needed to the basic units used is the removal of R22 from the frame timebase generator circuit (Fig. 15).

Sync Separator and Video Amplifier

The only unfamiliar section is that shown as Fig. 29. The input from the coaxial line is correctly terminated by the 75Ω resistor R67 and the signal passed on to the sync separator V16 and to the video amplifier V17.

Video amplifier circuitry has been fully expounded in earlier parts of this series and therefore will not be dealt with here.

The purpose of the sync separator is to separate the mixed sync signal from the video signal and to further separate the line sync pulses from the frame sync pulses and pass them on to their relevant timebase generators.

Separation of the sync signals from the video waveform is performed automatically at the grid of V16 and this action is helped by holding the screen grid of this valve at a higher potential than the anode.

Amplified negative-going pulses appear at the

Fig. 28.—Amended version of the modulator.

COMPONENTS LIST

MODULATOR AND R.F. OSCILLATOR (Fig. 28)

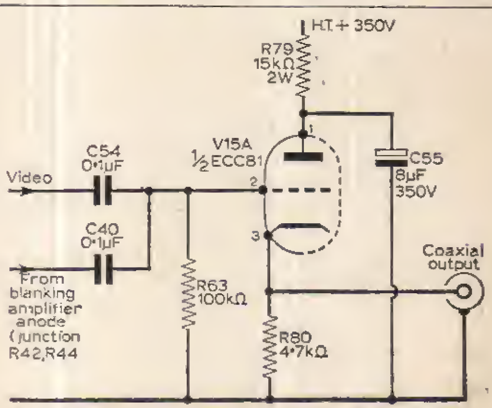
Resistors:

R79 15kΩ 2W   R80 4·7kΩ ½W

Capacitors:

C54 0·1μF paper 400V
C55 8μF electrolytic 350V

Note.—The above are the *additional* items required. See also Fig. 24.



anode of V16 and the pulses are taken from a split anode load. R70, R71 line pulses appear at the anode and are passed into a differentiating circuit made up of VC2 and the suppressor resistor, R18, of the timebase generator (Fig. 12).

A differentiator network is a circuit which does not respond very well to low frequency signals but, as can be readily seen by calculating the time constant of such a circuit, passes high frequencies. The differentiator thus passes the line sync pulses but blocks the frame pulses. The frame pulses appear at the junction of R70 and R71 and pass on to an integrating circuit consisting of C48, R73 and C49; this is a circuit which blocks high frequency pulses and passes low frequency signals.

The two outputs are fed to their respective timebases and lock the generator frequency to that of the scanner timebases.

Testing

It should be possible to set up a trace similar to that on the scanner, when the test voltages in the monitor will be very similar to those found in the scanning unit.

TEST VOLTAGES

H.T. line . . . 350V

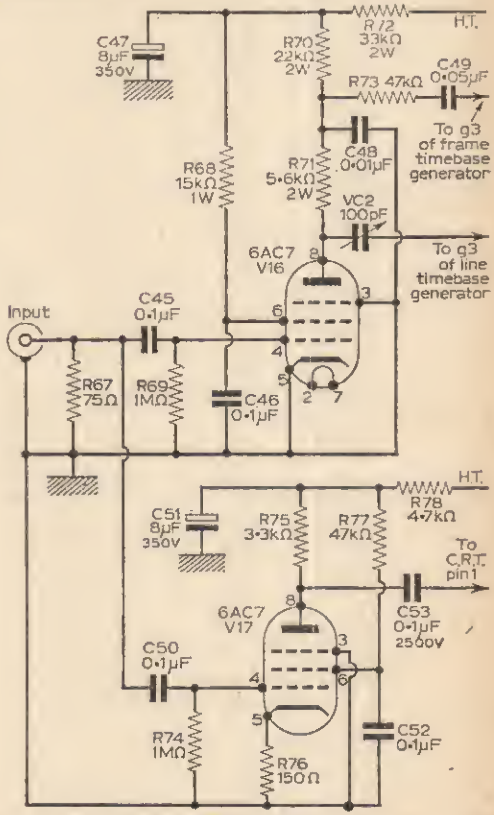
	Anode	Screen	Cathode
V1	180V	230V	0 V
V2	270V	180V	1·5V

All the above measured with a 20,000ohms/volt meter.

Using the headphone circuit described earlier (Fig. 18) a signal should be heard at the input to the unit. Sync signals should be detected at the two take-off points at the anode of V16 and the video signal should be detected at the anode of V17.

It will be found that the setting of the capacitor VC2 has a profound effect on the line synchronisation, and this capacitor should be adjusted for optimum conditions.

Fig. 29—Sync separator and video amplifier stages of the circuit.



COMPONENTS LIST

SYNC SEPARATOR AND VIDEO AMPLIFIER (Fig. 29)

Resistors:

R67	75Ω	R74	1MΩ
R68	15kΩ 1W	R75	3·3kΩ
R69	1MΩ	R76	150Ω
R70	22kΩ 2W	R77	47kΩ
R71	5·6kΩ 2W	R78	4·7kΩ
R72	33kΩ 2W		
R73	47kΩ		

All ± 10%, ½W carbon unless otherwise stated

Capacitors:

C45 0·1μF paper 400V
C46 0·1μF paper 400V
C47 8μF electrolytic 350V
C48 0·01 μF paper 400V
C49 0·05μF paper 400V
C50 0·1μF paper 400V
C51 8μF electrolytic 350V
C52 0·1μF paper 400V
C53 0·1μF 2,500V
VC2 100pF air spaced variable

Valves:

V16 6AC7 V17 6AC7

Construction

It is not proposed to describe in detail the construction of the monitor unit as it is felt that the reader will by now have acquired enough experience to tackle the job without any difficulty. The bulk of the circuitry follows that used in the scanning unit — any minor differences being obvious.

an AERIAL SYSTEM for DX work

BY GORDON J. KING

MANY interesting articles have appeared in past issues of this journal on the subject of TV DX, including those by Ian C. Ewens (April, 1963, and May, 1964), W. Berssenbrugge (June, 1963), and the regular series written each month by Charles Rafarel. These writers have made it clear that not only can a great deal of interest and excitement be derived from the reception of distant television transmissions but that with the advent of the dual standard television receiver a combination of European transmission standards can easily be catered for and, in this issue, Mr. Rafarel describes the conversion of certain older receivers.

Great Britain is within the "tropospheric propagation" distance of a large number of television transmissions originating on the other side of the English Channel. Whether this is good or bad depends upon whether one is a local viewer pure and simple or an enthusiastic viewer, for during the early summer months, peaking again during late autumn, v.h.f. television signals are carried well beyond their "local" range by a "ducting" effect in the upper atmosphere or the "troposphere".

The April, 1963, article referred to above investigates this phenomenon. Due to this, stations which are normally receivable over a maximum of 60 miles or so come romping in over distances of several hundreds of miles. This is good for the DX (long-distant reception) fan but unkind to the non-enthusiastic viewer, since it can badly upset his local reception, giving drifting ghost pictures, horizontal dark lines and a Venetian blind effect on the picture, and a loud buzz on the sound.

Tropospheric propogation occurs mostly on the Band I channels, but is sometimes present on the lower Band III channels. Reception of stations up to 500 miles distant is possible by this means, but even greater distance reception is possible by so-called sporadic E skip. Here, instead of the troposphere, the E layer of the ionosphere is concerned with the freak reception. This propagation is primarily tied to the lower frequency channels of Band I, and can give receptions over distances from 500 to 1,500 miles (sometimes greater distances by a "double hop" effect).

When the DX enthusiast observes the first signs of freak reception on the local stations his mind turns to ways and means of isolating the DX signal from the signal of the local station and then arranging his receiver to respond to it.

There are two basic requirements: (i) a good, high-gain aerial system tuned to the mean of the distant channel and orientated for maximum signal pick-up and (ii) a highly sensitive receiver with a very low noise figure. The receiver, of course, must be suitable for the DX transmissions, and information on the characteristics of European television stations is given in the articles mentioned at the beginning of this article. The April article also tells how a dual standard set can be arranged to work on 625 lines on the v.h.f. channels, as distinct from the u.h.f. channels. And, of course, elsewhere in this issue, prospective DX hunters can obtain information on the conversion of certain recommended receivers for DX work.

Theoretically, DX reception (and hence "co-channel interference") is not possible on the u.h.f. channels as such high-frequency signals penetrate both the troposphere and ionosphere and are lost in space without spoiling local reception, irrespective of the weather and sun-spot conditions. This is one of the reasons why America and some of the European countries are contemplating the abandonment of television in the v.h.f. channels in favour of a total switch to the u.h.f. channels. However, this does not always work out in practice, and with good tropospheric conditions DX on u.h.f. is certainly a factor to be borne in mind (see page 167, January, 1964; page 278, February, 1964, etc.).

The Aerial

Under severe conditions where a strong local station is interfering with a DX signal, traps and filters may not succeed in cutting out enough of the local signal to allow the distant station to be viewed or photographed. This is because adequate cancellation of the unwanted signal would demand many more decibels of attenuation than simple filters could possibly supply.

However, a method of cancellation of the unwanted signal is possible by the use of two aerials. The main, high-gain aerial is carefully tuned and orientated to pick up as much of the DX signal as possible, while the second aerial is arranged to pick up as much of the interfering local signal as possible and the smallest amount of the DX signal.

The idea, then, is to carefully adjust both the phase and the amplitude of the picked-up local signal so that it is of equal amplitude and of opposite phase to the unwanted signal picked up by the main aerial. In that way, complete cancellation of the local unwanted signal is theoretically possible. In practice, a very useful degree of unwanted signal attenuation is possible (see Fig. 1).

The two aerials are connected to a common downlead through a star network, but the second aerial signal is first passed through an attenuator and "phaser". As the main aerial will be orientated for maximum pick-up of the DX station, a certain degree, even though it may be small, of discrimination over the strong local signal will be achieved.

This means that the second aerial need not usually be so complicated as the main aerial, for the requirement here is that this picks up more local signal than the main aerial, and since it can be pointed direct to the local station this is rarely difficult to achieve, even with an ordinary "H" array or, in some cases, with a single dipole.

Amplitude Adjustment

It must be stressed, however, that the system will not work unless the second aerial picks up a little more unwanted signal than the direct aerial. The two unwanted signals are adjusted for equal amplitude by the attenuator in the downlead from the second aerial.

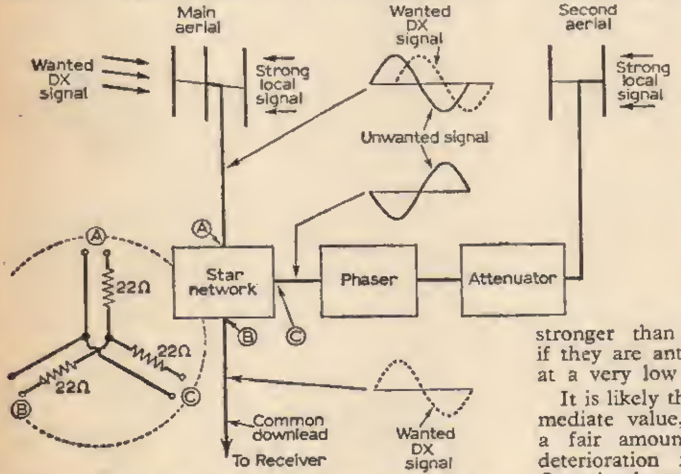


Fig. 1—By the use of two aerials a local signal can be cancelled leaving only the wanted DX signal. The main aerial is carefully turned for maximum pickup of the wanted DX signal while the second aerial is turned for maximum pickup of the local signal and minimum pickup of the DX station. After level balance and phase correction, as described in the test, the two signals are combined to a common downlead, where the unwanted local signal is cancelled.

Reasonable signal balance is possible by the use of Belling & Lee plug-in attenuators, but for optimum results a variable attenuator can be used. The range of attenuation will, of course, depend upon how much stronger the local signal is from the second aerial than the same signal from the main aerial.

If the second aerial signal is twice as strong, for example, a 6dB attenuator will be required; if three times as strong 9dB attenuation is required, and if four times as strong 12dB is required. The better the signal balance, the better will be the cancellation of the unwanted signal.

The biggest problem in setting up this system is, in fact, adjusting for signal balance. A signal strength meter solves the problem, for then the signal in the main aerial downlead can first be measured, and the signal in the second aerial downlead adjusted by the attenuator for an equal value. The "TV S-Meter," described in the July, 1963, issue of *Practical Television,* can be employed ideally for this exercise.

At a push, the two signals could be compared in terms of picture and/or sound on a receiver, but care should be taken if this method is adopted as the a.g.c. action of the set may tend to make both signals appear to be of similar levels, even though they may in fact differ by several decibels.

Phasing Adjustment

Once the signal levels are balanced and the arrangement set up, minus the phaser, as shown in Fig. 1, it is quite likely that a good amount of unwanted signal discrimination will have automatically taken place.

The reason for this is that the phase of the unwanted signal in the second aerial may be almost anti that of the unwanted signal in the main aerial. The phase of the signals will depend upon the standing wave conditions around the aerials, how well the aerials are matched to their downleads and their positions relative to each other. It is unlikely that the signels will be either "in-phase" or "anti-phase".

But if they are in-phase the unwanted signal will be much stronger than on the main aerial alone, while if they are anti-phase the unwanted signal will be at a very low level.

It is likely that the phasing will be at some intermediate value, indicated by the presence of still a fair amount of unwanted signal plus some deterioration in quality of the wanted picture. One simple way of securing the correct anti-phase condition is by a trial and error method.

This involves cutting the cable between the attenuator and the star network inch by inch until the right length for unwanted signal cancellation is established. If an extra 4½ft of cable is left at that point, the trial and error method should not give a great deal of difficulty.

Some simple cable clamping arrangement can be fitted to point "C" of the "star" so that after cutting, the cable can quickly be connected again, and so on. When the best conditions have been established a more permanent connection can be made.

If the second aerial picks up some of the wanted signal, the quality of the DX picture may suffer a little after setting up the scheme for maximum unwanted signal rejection. This is due to phase distortion introduced by having two *wanted* signals in the system. If necessary, the second aerial should be orientated for the *minimum* pick-up of the *wanted* signal, as distinct from the pick-up of maximum unwanted local signal.

It will be appreciated that the system described has a very great experimental potential, and apart from its applications for DX television it could also be experimented with for getting rid of co-channel interference, when the emphasis is on local reception rather than distant reception. ■

CONTINUED FROM PAGE 349 OF THE MAY ISSUE

CHANGING CATHODE RAY TUBES

PART 3: PYE, PAM AND INVICTA MODELS

By H. Peters

ALTHOUGH the layout of this article is similar to last month's, when the Ekco range was reviewed, the treatment cannot be as straightforward. The Pye policy is one of continuous improvement, resulting in a range of receivers which are the product of a number of basic chassis and a number of cabinet designs.

The job of replacing a tube is, therefore, divided into two parts; unboxing the chassis, and then removing the tube and clamp from the chassis or the cabinet.

To find the instructions relevant to a particular model, look it up in the index, and then refer to the basic chassis removal procedure dealt with in detail in the text, and then to the basic tube removal. By reading these two paragraphs in conjunction with the numbered notes, complete instructions for replacing any tube can be obtained. To save space the text is abbreviated, and readers who require greater detail of any particular point (e.g. the removal of a sticky e.h.t. connector) should refer to the first article of the series (April issue). Pam and Invicta equivalents where known are given, and although owners should be able to manage a tube change by reference to the nearest Pye model. it may not be exactly the same. No consideration has been given in this series to electronic chassis divergencies, should any exist.

once the chassis bonding strip is released, it is quite possible to work on the chassis, and in some cases (such as the V210) to change the tube without removing the control panel from the cabinet, by merely swinging the chassis out.

For the sake of completeness, directions are given in the text for the removal of the control panel, whether you choose to do so or not. When the chassis is removed from some of the later models, they tend to become "front heavy".

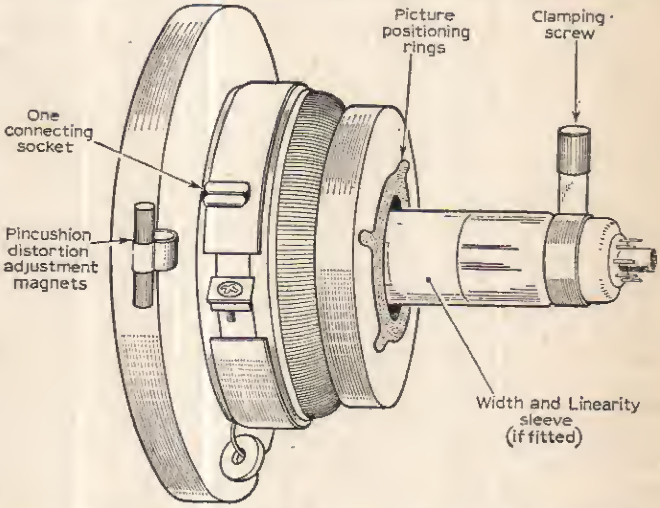


Fig. 1—A typical scancoil assembly (110°) used in most of the models dealt with this month.

The Family Tree

Up to V310 series, the c.r. tube comes out of the cabinet with the chassis, from which it is then removed complete with its clamping band. This band fastens round the widest part of the bowl, holding the rubber dust seal in place. After the V310 series, the tube and clamping band stay in the cabinet and the chassis is lifted away first of all.

The control panel, or autotuner unit if fitted, is separately attached to the cabinet by two screws at the front and one at the rear of the base. A foot of flexible lead connects to the chassis, and Care must be taken to prevent the cabinets falling on to their faces.

Mention is frequently made to the "critical distance". This is a measurement between the top of the cloth or blanket upon which the tube rests face down, and the front edge of the clamping band (see Fig. 2, Part 2, May issue) and should be measured before the clamp is finally removed.

V110. Chassis Removal

Take off back and knobs, remove four screws from bottom sides of cabinet and one from each

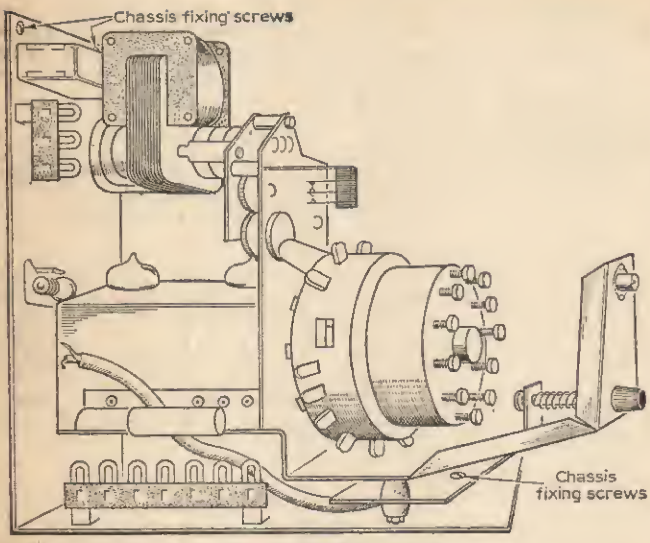


Fig. 2—The Pye Autotuner.

handle fixing. Pull cabinet out of grooves and lift off detaching loudspeaker halfway.

V110. Tube Removal

Remove Perspex front, e.h.t. and base connections, scancoils, screws securing top ends of side brackets to top plate, remove horizontal tie rod holding tops of side brackets. Raise tube slightly, and withdraw forward.

V200. Chassis Removal

Unplug, remove back, detach side panel (four screws) and feed in through hole to lay on chassis. Remove three front knobs (grubscrews), unplug speaker. Remove two screws from top of tube cradle and two from back of chassis. Slide chassis back out of cabinet, tilting forward as tube face emerges.

V200. Tube Removal

Take off e.h.t. and base connections and ion trap magnet. Mark and unplug scancoil leads. Slacken scancoils and slide back off tube. Slacken the hexagonal head bolts which tighten the tube clamp and pull the tube out forward complete with rubber. Clean all parts and replace in reverse order.

V210. Chassis Removal

Remove back. Unscrew two top fixing screws (long screwdriver needed) and two bottom hexagonal head fixing screws, disconnect bonding to control panel assembly. Tube and chassis will swing out to extent of lead to control panel.

V210. Tube Removal

Refer to V310 Tube Removal. There is no Dzus bracket to remove, but the top clamp is held to the chassis by a plate, from which the three self-tapping screws should be removed.

V300. Chassis Removal

Remove back. Pull off Volume, Brightness, Channel Selector, and Fine Tuner knobs. Remove side escutcheon and the two speaker retaining screws. Undo Dzus fixing at top of chassis ½ turn anticlockwise, and remove two screws from bottom corners of chassis.

Withdraw chassis, easing loudspeaker past rear edge of cabinet. Do not tilt exposed chassis forward or the volume and brightness spindles may snap off.

V300. Tube Removal

Unplug e.h.t. and base connections, remove ion trap. Unplug, slacken and remove deflector coils. Remove from each side of the clamping strap the two outer hexagonal head screws holding it to the chassis. Lift off tube and clamping strap. lay face down on cloth, measure critical distance and unclamp strap. Clean all parts before reassembling in reverse order.

V310. Tube Removal

Remove e.h.t. and base connections. Unplug and remove deflector coils. Unscrew the two 4B.A. nuts from the "U" pieces passing through the upper and lower clamping straps and chassis. Remove Dzus fixing two outer hexagonal head screws from both sides of the bottom tube clamping strip and chassis.

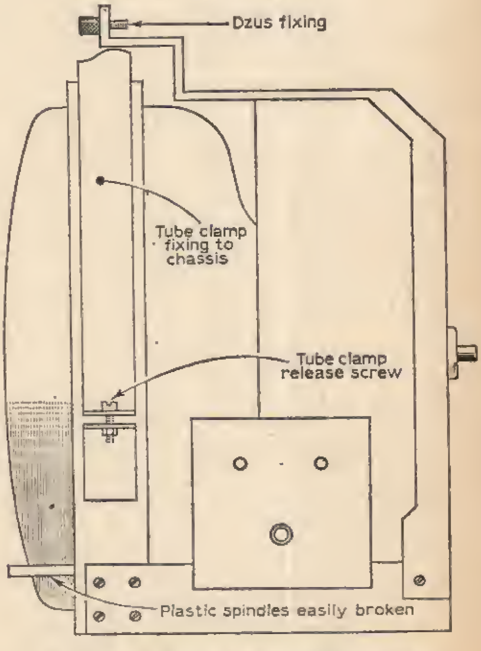


Fig. 3—A side view of the V300/V310 series showing the general layout.

Remove tube and clamps, lay face down on a cloth, measure critical distance, remove clamps and rubber seal. Clean and replace in reverse order.

V400. Chassis Removal

Remove back, pull off Channel Selector and Fine Tuner knobs, undo two screws thus revealed. Loosen wooden clip inside cabinet and release control panel. Disconnect leads to tube scancoils and speaker, undo two chassis fixing screws and remove chassis and control panel.

V400. Tube Removal

Lay cabinet face down. Release tube clamp fixing screws, slacken and remove deflector coils. Lift out tube and clamp, measure critical distance, slacken clamp and remove from tube.

V410. Chassis Removal

Remove back, unplug speaker, take off the two nuts and washers from chassis to tube fixing plate and release the plate from its securing screws. Remove e.h.t. and tube base connections, slacken, unplug and remove scancoils, remove rear chassis fixing screws and withdraw chassis from cabinet.

V410. Tube Removal

Lay cabinet face down on a cloth and undo the four nuts holding the tube clamp to the cabinet. Remove tube and clamp, lay face down, measure critical distance, remove clamp and sealing ring. Clean and reassemble in reverse order.

V430A. Chassis Removal

Remove back, unplug speaker, scancoils, e.h.t. and tube base connections, disconnect chassis braid from autotuner. Unscrew the two chassis fixing screws at the right-hand side (usually protected by card flaps). Swing chassis outwards, disengaging the stop arm if fitted on the chassis top. Undo the top chassis hinge pin and lift chassis clear of bottom hinge pin. Remove autotuner (note 5) and lift off tuner and chassis together.

INDEX FOR PART 3

Model	Basic Chassis Removal	Basic Tube Removal	Extra Notes	Identification	C.R. Tube	Nearest Pam Equiv.	Nearest Invicta Equiv.	Cathodeon Tubes
1 (Pioneer)	1	1		17" T. (Plastic) D/S	AW43/88 or		7007	
2	1	V410		17" T. (Wood) D/S	AW43/89 Later			
3	11	V410	6	19" T. D/S Tuner				
11	11	V410	6	19" T. D/S				
11U	11	V410	6	19" T. D/S Tuner				
15	11	V410	6	23" T. D/S		5114		
15U	11	V410	6	23" T. D/S Tuner				
V110	V110	V110	2	17" P.	AW43/88	690	638	C17/7A or C17/6A (Early)
PV110	V110	V110	2	17" P.	AW43/88			
V200	V200	V200	1 & 2	17" T.	AW43/80			
V200LB	V200	V200	1 & 2	17" C.	AW43/80			
V210	V210	V210	2 & 4	17" T.	AW43/88	800, 808 802	538, 146 939	
V210LB	V210	V210	2 & 4	17" C.	AW43/88	804		
V210A	V210	V210	2 & 5	17" T. A/T	AW43/88	802A	147, 540	
V220	1	1	7 & 2	17" T.	AW43/88			
V230	V210	V210	2 & 5	17" T.	AW43/88			
V300F	V300	V300	1, 2 & 3	17" T F.	AW43/80	680F		
V300S	V300	V300	1, 2 & 3	17" T.	AW43/80	606F	537	C17/5P
V310F	V300	V310	2 & 3	17" T. F.	AW43/88	600F	144, 144P 738	
V310S	V300	V310	2 & 3	17" T.	AW43/88	600S	5370	
V310SA	V300	V310	2 & 3	17" T. M/T	AW43/88	606S		
V400 (PANORAMA)	V400	V400	1 & 2	21" T.	AW53/80	680S		
V410	V410	V410	2	21" T.	AW53/88	821 (Near)		
V420A	V410	V410	2 & 5	21" C. M/T	AW53/88			
V430	V410	V410	2	21" T.	AW53/88			
V430A	V430A	V410	2 & 5	21" T. M/T	AW53/88			
V510	V210	V310	2	17" T. F.	AW43/88	801F 803F 805F 822F	145 739	
V530	V210	V310	2	17" T. v.h.f.	AW43/88			
V600A	V410	V600A	2 & 5	23" C. A/T	AW59/90	823A		23SP4
V620A	V430A	V410	2 & 5	23" C. A/T	AW59/90			
V630A	V630A	V410	2 & 5	23" T. A/T	AW59/90	123A		
V700	V430A	V410	4	19" T.	AW47/90			
V700A	V430A	V410	5 & 6	19" T. A/T	AW47/90	119A/120A		
V700LBA	V430A	V410	5 & 6	19" C. A/T	AW47/90			
V700D	V700D	V410	6	19" T. D/S	AW47/90	119D		
V700DU	V700D	V410	6	19" T. D/S Tuner	AW47/90			
V710A	V430A	V410	5 & 6	19" T. A/T	AW47/90	L119A L120A		
V710D	V700D	V410	6	19" T. D/S	AW47/90			
V720	V210	V310		19" Version of V530	AW47/90			
V830A	V430A	V410	5	23" T. F. A/T	AW59/90	L123A	941	
V830LBA	V430A	V410	5	23" C. F. A/T	AW59/90	L1000 & 1000		
V830D	V700D	V410	5	23" T. D/S	AW59/90			

Key to model identification: A/T= Autotuner, C= Console, D/S= Dual Standard, F= Fringe Area, M/T= Motor Tuned, T.= Table, P= Portable.

V600A Tube Removal

Lay cabinet face down on a cloth, remove eight 2B.A. nuts and washers from tube corner clamps, release corner clamps and remove tube from cabinet.

V630A. Chassis Removal

Proceed as for V410, but the top of the chassis screws to the cabinet and not to the tube clamping band.

V700D. Chassis Removal

Remove back, switch to "405", disengage knob from switch by sliding spindle retaining spring sideways. Hinge out and remove chassis as per V430A.

Model I. Chassis Removal

Remove back, pull off front knobs, remove 405/625 knob (one grubscrew). Lay face down on cloth, unplug speaker, tube base and scancoils. Remove ten screws securing chassis to cabinet and two securing control panel to cabinet. Lift up chassis, unplug e.h.t. lead, and lift chassis right out. When replacing chassis make sure that no leads are trapped round the edge, or forced towards hot components. If the u.h.f. tuner is fitted, make sure that the plastic universal joint engages.

Model I. Tube Removal

Remove scancoils. Remove earthing spring from Bowden cable and unplug earthing lead from speaker tag. Unscrew Phillips head screw from Bowden cable tension handle. Slacken cable and release three corner clamping brackets. Remove tension handle and cable, take out c.r. tube.

Model 2. Chassis Removal

Proceed as per Model 1, except that there are only six fixing screws.

Model 11. Chassis Removal

Remove back, pull off volume and brightness knobs. Remove u.h.f. and v.h.f. tuner knobs by depressing the spring key behind the knob. Pull off fine tuner extension, remove top two chassis fixing screws and lower chassis. Unclip coaxial from left-hand side of cabinet, remove four 4B.A. nuts fixing control panel to cabinet front, unplug speaker, e.h.t. and base connections and scancoil leads. Remove the two Phillips screws securing the chassis to the cabinet runners and withdraw chassis and control panel. Remove deflector coils if proceeding further to change tube.

Important: When lowering chassis ensure that the top of the line output transformer shroud does not foul the deflector coils, as heavy pressure on this point could snap the tube neck.

The following notes are to be read in conjunction with the text as appropriate.

NOTE 1.—Adjust ion trap magnet for brightest picture regardless of position. Repeat adjustment after picture position and focus have been set.

NOTE 2.—A "short circuit turn" sleeve adjustment is provided around the tube neck beneath the deflector coils to adjust width and line linearity. Width is decreased by pushing the sleeve forward and linearity is adjusted by rotating the sleeve.

NOTE 3.—To remove window V310, etc., pull off two front knobs. Hang front of set over bench edge. Remove bottom retaining bar and lower window for cleaning.

NOTE 4.—To remove control panel, pull off Volume, Brightness, Channel Selector, and Fine Tuner knobs. Release two screws at top of panel holding it to the cabinet front and one screw, nut or wingnut at the rear holding it to the bottom of the cabinet.

NOTE 5.—To remove autotuner, pull off Brightness and Volume controls, remove two 4B.A. nuts holding the assembly to the cabinet front, and the screw and washer retaining the rear of the assembly.

NOTE 6.—The Perspex guard is removed after the tube and clamps have been taken out of the cabinet. It is held to the clamping band by four Phillips screws.

NOTE 7.—Proceed as per Model 1, but disregard the references to the Dual Standard switching.

Next month Part 4; Murphy receivers

Set Conversion for Continental Reception

—continued from page 398

ling coil L19 and assuming we can obtain a spare second tuner unit the output of this tuner via L10 and L11 is also low impedance by virtue of coupling winding L11.

After suitable arrangement of h.t. feeds and heater supply to the second tuner we have only to couple L11 to L19 by a short length of coaxial cable and we have an incremental additional sound-only tuner (Fig. 6). This has the additional advantage that according to prevailing conditions we can "marry" any RTF picture channel to any RTF sound channel (assuming that they are carrying the same programme as normally) and thus we can choose the best vision and sound channels available.

With this arrangement we are, of course, depriving ourselves of the use of V3 as a common sound/vision i.f. amplifier but the reduction in gain on sound can be offset by changing V8 (Receiver Deck) from EF80 to EF184 and re-peaking the associated coils.

There is one point to note, however, in that the introduction of a second tuner together with its oscillator section and the associated harmonics can produce interference on certain channels tuned by the original vision tuner and if this happens the setting of the second sound tuner must be altered. If the sound channel we wish to use does clash with our chosen vision channel we can slightly repeak the sound i.f. to a different frequency. so that when the oscillator is retuned it does not cause an offending harmonic on the selected vision signal. ■

COMPONENTS REQUIRED

- 1 4 pole, 2 way Yaxley type switch
- 1 GX34 diode
- 1 50kΩ variable resistor
- Other resistors as noted in text, where required
- 1 Tuner Unit

SERVICING TELEVISION RECEIVERS

By L. Lawry-Johns

No. 102: G.E.C. BT2155 and BT8149

THE BT2155 is a 17in. table model and the BT8149 is a consolette with doors. There are, in addition, two very similar models but which have an extra i.f. stage and different a.g.c. system for use in fringe areas, these being the BT2254 and the BT8248.

These receivers are quite reliable in operation and such faults as do occur usually follow a pattern and can be speedily located and easily rectified.

The tuner unit differs from the type usually encountered and this should be borne in mind, particularly when changing valves and adjusting coil cores. The front valve is V1 B319 (PCC84) and the rear valve is V2 LZ329 (PCF80). These valves must not be transposed as damage to resistors and probably to the valves themselves will result. Oscillator coil core adjustment is from the side of the tuner toward the rear. (Refer to Fig. 3.)

Chassis Removal

The chassis is removed in one unit complete with tube, front mask and loudspeaker fret, etc., and there is no need to remove the front control knobs. With the rear cover removed release the two screws from the brackets at side at the bottom and remove the unit from the cabinet shell.

The lower i.f. plate may be easily removed from the main chassis and, incidentally, this plate may be of printed circuit design. There is a single video (yellow lead) and two power plugs to remove. With this done it is only necessary to remove the screw from either side in order to remove the sub-chassis.

Removal of Tuner

Remove the power plug from the left side of the i.f. plate and the i.f. coaxial plug. Remove aerial socket giving fixing screws and front control knobs (these pull off) and release the four fixing screws which secure the tuner brackets to the main supports.

Common Faults

One very common fault is that of no sound or vision due to the valves being unheated.

The usual neon tests may be made, first to chassis to ensure that this is not live. If it is, reverse mains leads.

With the leads properly connected mains should

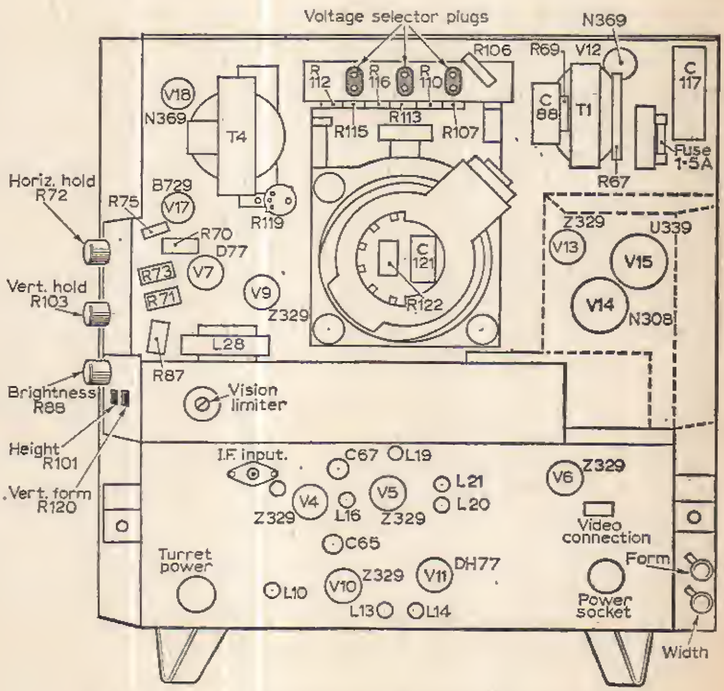


Fig. 1—A rear view of the chassis showing the general layout.

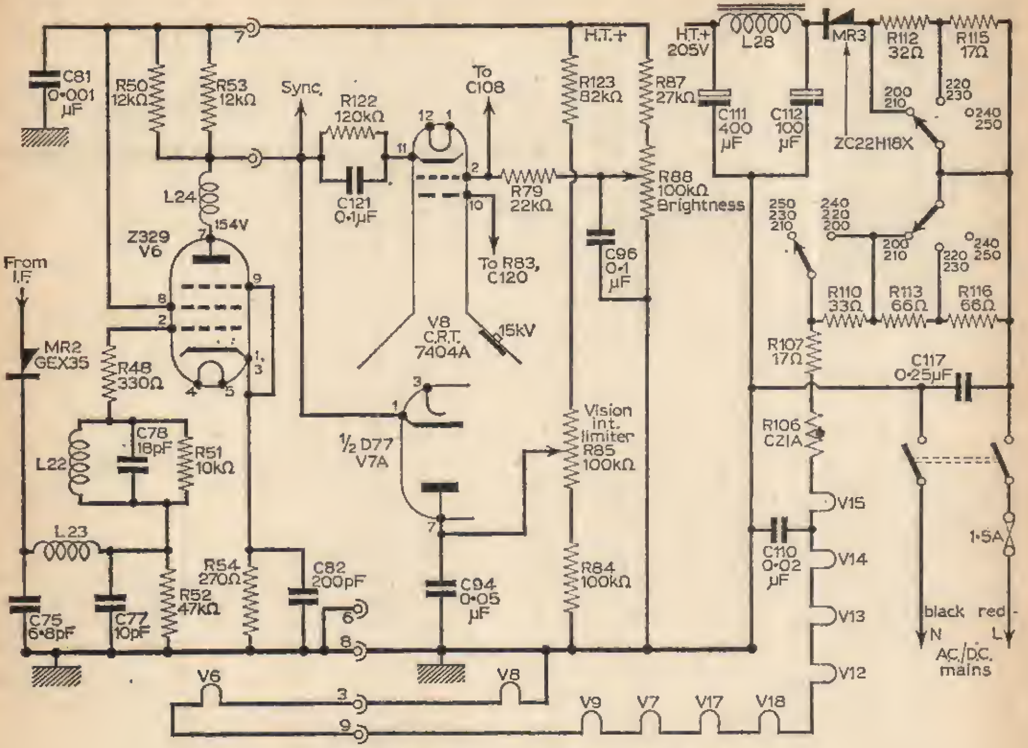


Fig. 2—The video amplifier, c.r.t. and power stages of the circuit.

be applied to the upper right side of 1·5A fuse, thence via the on/off switch to the mains dropper centre tags R116, R113. R110, R107 and the thermistor R106 (see Fig. 2). The neon should glow or an a.c. voltmeter should register at these points in the order given; the failure to give a positive indication at any point immediately pin-points the break.

If all points show a healthy indication of full mains potential check through the valve chain V15, V14, V13 etc.; V15 pins 7 and 8, V14 pins 2 and 7,

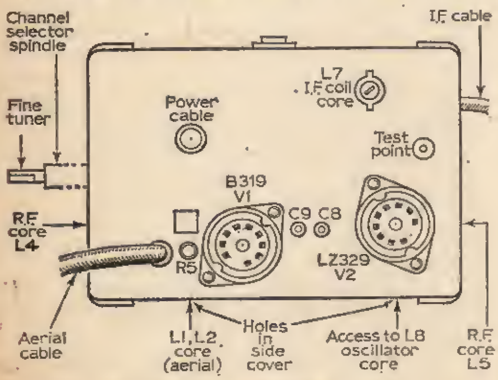


Fig. 3—A view of the tuner unit.

V13 pins 4 and 5 and so on until the faulty valve is located. It is not unusual for a Z329 heater to become open circuited in these receivers, and the D77 (V7) is also liable to be found at fault. Pins 1 and 2 of V8 complete the heater chain return to chassis.

No H.T.

Quite often it is found that the set is not functioning in any way except that the heaters are glowing. This should direct attention to R115 and R112 which are part of the dropper and form the surge limiter for the supply to the metal rectifier.

It is quite common for one of these resistor sections to become open circuited, thus cutting off the h.t. R112 is usually at fault and may be shunted by a 25 or 30Ω wire wound resistor.

Low H.T.

Quite often the first indication of falling h.t. voltage is lack of width and a tendency to defocus and expand as the brilliance is increased.

A voltmeter check should be made and if the h.t. voltage is much under 200V the metal rectifier should be replaced. A silicon diode such as the BY100 can be used for increased efficiency and may be wired across the existing rectifier in series with a 25Ω wire wound resistor. If the voltage is 200V or over, however, attention should be directed to the line output N308 and if necessary to the U339.

TO BE CONTINUED

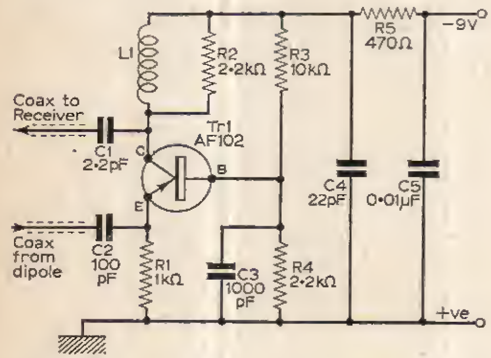
DX-TV

A MONTHLY FEATURE FOR DX ENTHUSIASTS

by Charles Rafarel

As I write these words conditions have not as yet "opened up" for the 1964 season, but I hope that by the time you read them the real DX will once more be with us.

The winter season has not run quite true to pattern this time. The "tropospherics" were often excellent in December and early January and we had quite a good, perhaps even better than average, number of Sporadic "E" openings during the same period.



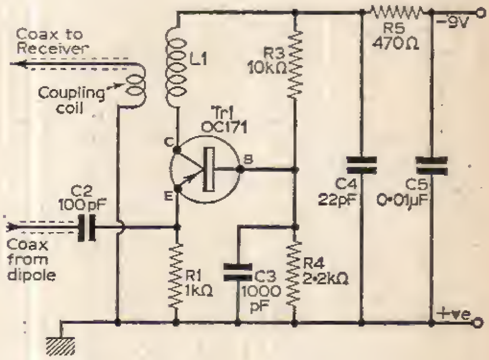


Fig. 1 (left)—The circuit of a Band I mast-head pre-amplifier. Fig. 2 (right)—The slightly different circuit for Band III.

From mid-January for the following three months, I think most of us would agree, conditions have been abnormally poor and it would seem "that spring is a little late this year"! If by the time you read these words conditions have not improved to "normal", be patient, for they *will* improve. I recall "late openings" in 1960 when June/July were the earliest "good" months.

This month then we had beter continue with details on how to improve our DX installation in order to get the best results. In conjunction with two other DX/TV readers of *Practical Television*, Mr. J. Snelling, of Southampton, and Mr. R. Bunney, of Romsey, I have been experimenting with mast-head transistor pre-amplifiers, and starting from a basic design we have evolved the following which you will find to be of considerable service in DX work. Details of this are as follows.

Method of Construction

First wind the appropriate turns on to the coil former, then group the associated capacitors and resistors around the coils, making sure that sufficient space is allowed for the transistor and that none of the components project beyond the top and bottom squares (the ends of the former). This will allow the completed unit to be enclosed in a 35mm film can. Use $\frac{1}{4}$W resistors and miniature capacitors.

Where the coaxial cables and the twin l.t. feed cables pass through the cover of the can a water-tight joint can be made by the use of "tight" rubber grommets and the screw cap of the can is sealed by means of a length of p.v.c. tape.

The completed unit is mounted (after test and adjustment of the coil core at ground level adjacent to the receiver) at mast-head level as close as possible to the aerial dipole.

The 2·2kΩ resistor across the coil is optional and is designed to increase the bandwidth over several

COMPONENTS LIST

Resistors:

R1	1kΩ	R4	2·2 kΩ
R2	2·2kΩ	R5	470Ω
R3	10kΩ		

All ±10%, ¼W carbon

Capacitors:

C1	2·2pF	C3	1,000pF
C2	100pF	C4	22pF
C5	0·01μF		

All miniature tubular ceramic

Inductor:

L1 Band III—4 turns of 18 s.w.g. tinned copper wound over ½ in. length.

L1 Band I—Channel E2. 12 turns of 24 s.w.g. enamelled wire close wound. 2½ turns of 24 s.w.g. p.v.c. covered wire wound over main coil as coupling coil. Channel E4, as for E2, except 8 turns for main coil.

All coils wound on Aladdin "square-ended" formers, ¼ in. diameter, with iron dust core.

Transistor:

Tr1 Band III AF102.
Band I OC171, or AF114 for slightly higher gain. If AF114 is used R4 should be 560Ω

Miscellaneous:

Aluminium 35 mm. film tin with screw lid. Three rubber grommets. P.V.C. tape. Wire for coils. Aladdin coil former with base and top square section, and fitted with iron dust core. 9V dry battery.

channels when used. If the coil is peaked to mid-band in, say, Band III, there will be appreciable gain even at both the h.f. and l.f. ends of the band.

The overall gain with the "damping" resistance in circuit in use is approximately 6/8dB and for single channel operation without it will be approximately 10dB.

It is not claimed that these preamplifiers give exceptional gain but it will be noted from the coaxial cable maker's specifications that they will more than "kill out" the down-lead losses at 200Mc/s, even if the cable is of standard type and not low-loss and the length is as long as 100ft.

The mast-head position ensures the best possible signal-to-noise ratio and transistors are very quiet in operation. The current consumption is between 0·75 and 1·0mA per transistor, and even if a number of them are used on different aerials a suitable dry battery will provide adequate power.

The use of this type of pre-amplifier has another advantage. The input impedance is such that it will correctly match all aerial impedances between 30Ω and 300Ω without modification, so if anyone has a 300Ω Continental array, here, too, is the answer to your impedance transformation for 75Ω down lead. The pre-amplifier output is correct for 75Ω; this, too, can help with that "home-made" multi-element array of "dubious" impedance—it will match almost whatever you do!

Two of these pre-amplifiers will work well in cascade, either both arranged at mast-head level or with the second one adjacent to the receiver.

Just one word of warning here. In one isolated instance (among many of these items in use) trouble was experienced with the Band III model due to "break-through" of medium wave broadcast stations, apparently due to "local" conditions and the fact that the input side is untuned. In this case improvement could be obtained by a reduction of the 9V supply, but this, of course, does reduce the gain a little.

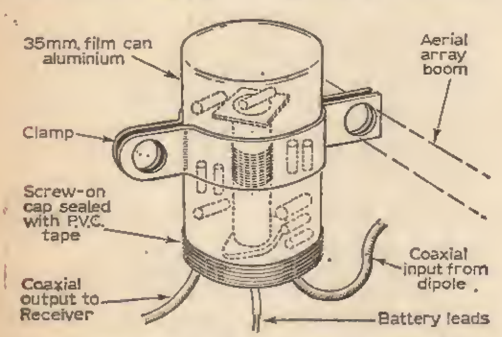


Fig. 3—The method of construction recommended by the author.

NEWS

As promised some time ago we are going to give you the details of the R.A.I. Italian station identification numbers. We are indebted to Mr. Albert Davis, of Gillingham, for this information and he has it on good authority from R.A.I. At this stage I propose giving Band I details only as Band III is a little optimistic!

Number.	Station.	Channel.	
3	Monte Penice	"B"	This covers all Band I transmitters over 5kW.
11	Monte Faito	"B"	
14	Monte Caccia	"A"	
23	Monte Cammarata	"A"	
31	Monte Nerone	"A"	

Mr Davis is also now informed that the position of the number on the test card is now in the centre of the right-hand corner circle, so if you want to see it be careful that your width control is not set too wide!

This is the latest news that I have following a recent visit to the R.T.F./TV centre at Quai de Passy (now Quay Kennedy if you wish to write) re R.T.F. 2nd chaine U.H.F.

Paris Eiffel Tower	Ch. 22	In full service from April 18, 1964.
Lyon-Fourvières	Ch. 58	Ditto.
Lille-Bouvigny	Ch. 27	Under test now. Service commences summer 1964.
Marseilles	Ch. 23	Ditto.

Good luck in the coming DX season!

Trade News

TV Aerial Signal Booster

THE "Telebooster" is a television aerial signal amplifier recently launched by Gordon J. King (Enterprises) Ltd. Unlike many other similar amplifiers, the "Telebooster" boosts both ITA and BBC reception simultaneously. Reception boost is claimed to be about eight times for BBC channels and about five times on ITA.

The "Telebooster" can eliminate the need for costly aerials and, in many cases, allows inexpensive indoor aerials to be used instead of expensive outdoor arrays.

The price of this unit complete is 75s. 6d. Power for the unit is provided by a 9V battery, and current consumption is 1½mA.

The "Telebooster" is available from *Gordon J. King (Enterprises) Ltd., Brixham, Devon.*

U.H.F. Aerials

THREE types of u.h.f. outdoor aerials—6-, 12-, and 18-element types—are being offered by Meadowdale Ltd.

Interesting features of these arrays are that they are one-piece constructions of light-weight welded steel, protected by a heat-cured polyester coating. The only separate part of the aerial is the back screen, which is quickly assembled by one wing nut. It has an advanced design dipole which ensures consistent precision matching.

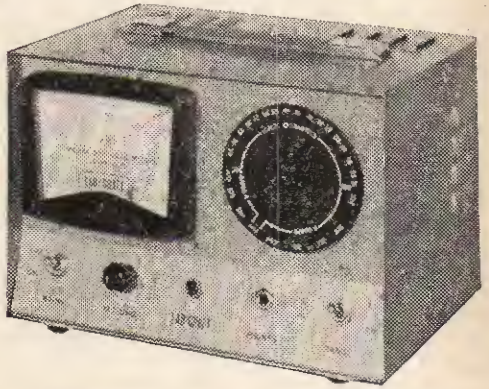
Meadowdale are offering these aerials at prices ranging from £1 6s. for the 6-element array to £2 19s. 6d. for the 18-element model. *Meadowdale Manufacturing Co. Ltd., The Dale, Willenhall, Staffs.*

Signal Strength Meter

THIS instrument is designed around a standard u.h.f. tuner working into a gain-controlled i.f. amplifier. The controlled current of one of the i.f. amplifier valves is read on the meter. The scale is calibrated in μV and mV, giving clearly readable calibrations from fringe to swamp levels, without the need for separate plug-in attenuators.

This highly sensitive instrument gives readings down to 10μV and will record low level signals and so can be used effectively in fringe areas.

The Signal Strength Meter (model 415) works from an a.c. supply of 200-225V or 226-250V, has a consumption of 36W and an operating frequency of 470-860Mc/s. The manufacturers are *Lab-Craft Ltd., Gainsborough Road, Woodford Bridge, Essex.*



Lab-Craft's new u.h.f. signal strength meter.

U.H.F. Masthead Amplifier

AERIALITE Ltd. announce production of a transistorised u.h.f. television signal amplifier —known as the Telextra—with a case no larger than a normal outdoor diplexer. The amplifier is broadband for all Band IV (channels 21-33), and so will boost not only the present BBC-2 transmission, but all future programmes to be transmitted in that Band.

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The amplifier's power is obtained through the main downlead from a battery power pack placed conveniently inside the house. The price is fixed at £4 19s. 6d. *Aerialite Ltd., Hargreaves Works, Congleton, Cheshire.*

Set-Top Aerial for Bands IV and V

A COMPACT elegantly styled broadband aerial for all channels on u.h.f. Bands IV and V is being marketed in the U.K. by Wells Electronics Ltd. This aerial, known as type FIA I Q2, is one of the extensive range of FUBA aerials manufactured in West Germany.

Two folded dipole elements are mounted one on either arm of a forked support, the lower end of which is connected to the base by a ball and socket joint. The setting of the aerial elements can thus be adjusted in both the horizontal and the vertical planes.

For reception on Band IV (channels 21-34), the longer dipole is directed towards the transmitter and the shorter dipole acts as a "director". To receive on channels 39 to 68, the aerial is moved so that the shorter dipole is towards the transmitter and the other element then functions as a reflector. *Wills Electronics Ltd., 42 Botolph Lane, Eastcheap, London, E.C.2.*

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Page 264, March issue, 1964

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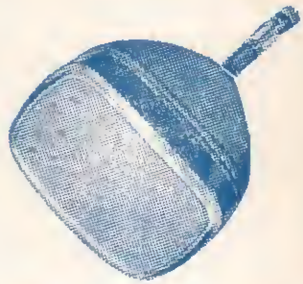

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