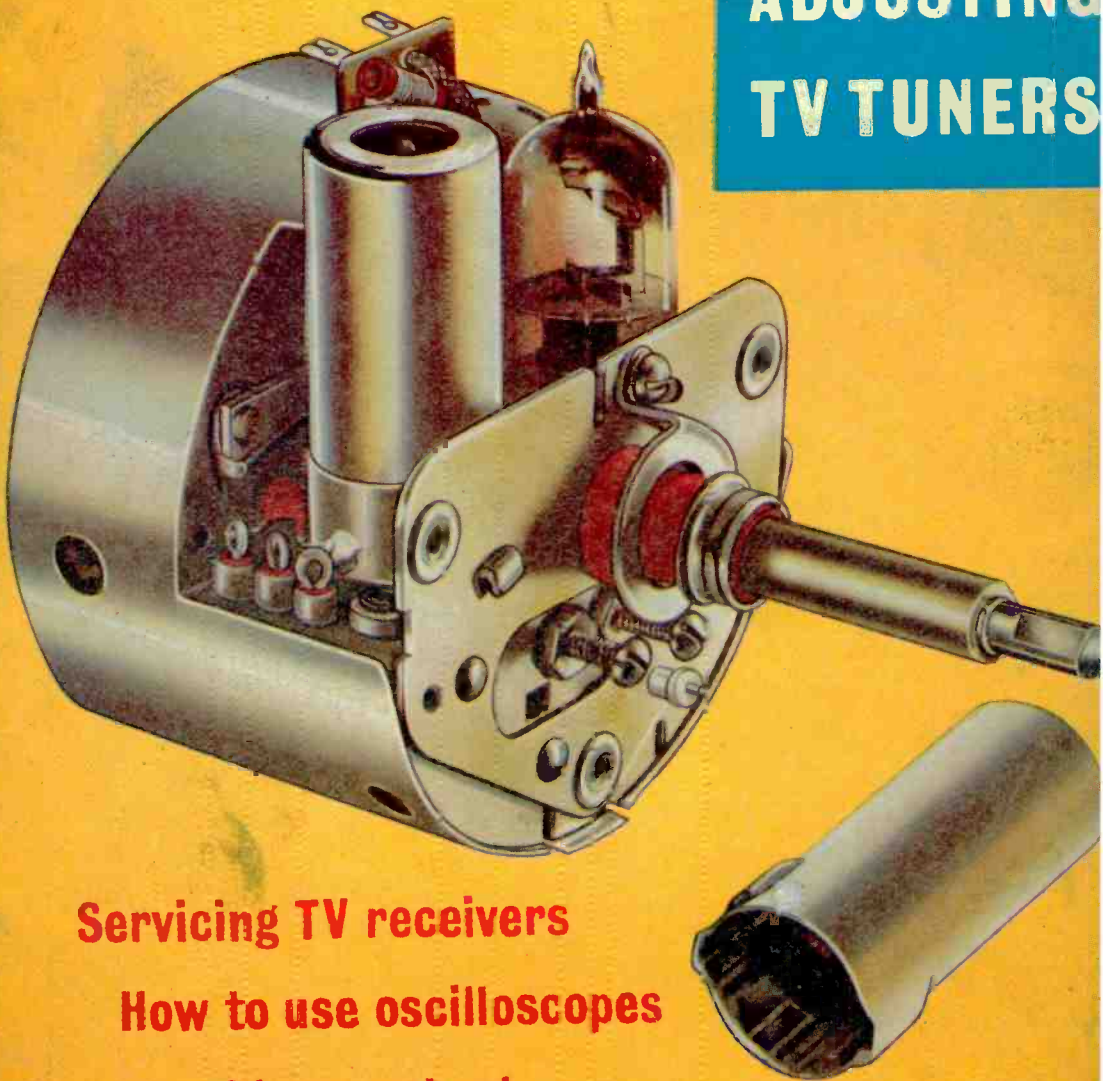
Practical TELEVISION

AUGUST 1961

1/6

ADJUSTING TV TUNERS



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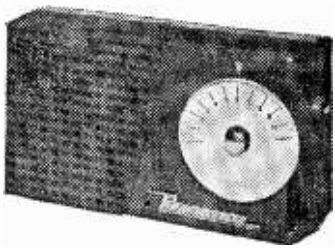

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EF50(A)	4/-	MSP4	17/6	UL41	9/-	6D2	5/-
EF80	5/-	MU14	9/-	UL84	7/6	6F1	15/6
EF85	5/6	MX40	17/6	UY41	7/6	6F12	4/-
EF86	11/-	N142	9/6			6F13	17/6
EF89	10/-	N153	11/6			6J5G	4/6
EF91	4/-	PCC84	9/-			6J7GT	9/6
		PCF80	9/6			6K7	4/6
						6K7G	3/-
						6K7GT	10/6
						6K8G	7/6
						6K8GT	12/6
						6L1	15/6
						6L6G	7/6
						6L18	12/6
						6L19	21/-
						6N7G/GT	7/6
						6S L7GT	6/6
						6SN7GT	5/6
						6V6G	5/-
						6X5GT	5/-
						7B7	10/6
						7Y4	7/6
						8D3	4/-
						10LD11	15/-
						12AH8	10/-
						12AT6	9/-
						12AT7	9/-
						12AU7	9/-
						12AX7	9/6
						12BA6	9/-
						12BE6	9/6
						12BH7	15/-
						12J7G/GT	9/6
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Practical Television

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Contents

The Pilkington Committee

FROM time to time notices are received from various organisations concerning recommendations which they are putting before the Pilkington Committee. As our readers know, this Committee is sitting to investigate the position of television broadcasts in all its aspects, but it is becoming evident that its task is not an enviable one. Instead of concerning themselves with matters such as line frequency, colour, and channels, it now appears that they will have to include an investigation of programme material and advertisement copy on the commercial channel, as so many organisations are taking an opportunity of trying to enforce their points of view. Temperance bodies, church and religious organisations, anti-betting, anti-noise and so many others are placing the most comprehensive documents before the Committee, that one wonders whether the latest estimate of the time when their Report is due will not be very seriously lengthened. We were told that it would be received about the beginning of next year, if all these other matters are also to be investigated it appears to us that the more important matters, namely channels available, line definition and colour are being very seriously interfered with, and perhaps it would be as well for the Committee to split its work up into sections, dealing with the most important first, and leaving the remainder for later study. In this way we could arrive at a decision for the future of television as a whole, and this would give both the BBC and ITV the chance to plan their broadcasts for some time ahead, then the contents of the programmes would automatically fall into place,—the probability of an additional channel perhaps simplifying programme planning.

Perhaps arrangements could be made for an interim report to be issued, or some time limit could be placed on the supply of further information and so allow the Committee to proceed with their investigation undisturbed and perhaps shorten the period over which we must wait before their deliberations are finalised.

THE TRADE SLUMP

THE latest figures released by the Radio and Television Traders Association show that there was a fall in sales, which they attribute to the aftermath of the Easter spending spree. Is this in fact, the correct explanation? Could it not be caused by the many conflicting reports which have been published in the National Press concerning line definition and colour, and the resultant doubts which have been raised in the minds of the general public as to the expediency of buying a receiver which might be made obsolete in a very short time? It would appear to us that greater publicity should be given by the two broadcasting companies to the actual position, so as to remove these doubts, and the manufacturers themselves should also commence a publicity campaign at the same time. Our correspondence files show that this is a real factor governing the so-called stagnation or lack of interest in buying, whilst this doubt concerning the life of new receivers still exists.

Our next issue, dated September, 1961, will be published on August 22nd.

Telenews

Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of May, 1961, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	Total
London Postal	1,932,145
Home Counties	1,578,925
Midland	1,708,999
North Eastern	1,836,275
North Western	1,490,524
South Western	966,522
Wales and Border Counties	687,497
Total England and Wales	10,200,887
Scotland	1,025,300
Northern Ireland	165,676
Grand Total	11,391,863

Outside Broadcast Vehicle for Russia

THE Russian Authorities have purchased the Marconi television outside broadcast vehicle which gave daily working demonstrations during the British Trade Fair in Moscow.

This vehicle embodies latest technical advances, including four Marconi Mark IV television cameras as used by the BBC and other television authorities throughout the world. This is the camera which recently won the engineering award of the American National Academy of Television Arts and Sciences.

Broadcasting Exhibition

THE British Broadcasting Corporation is to present, in conjunction with the National Book League, an exhibition, "Broadcasting : Radio and Television", of books and archives on the history of radio and television. The exhibition will take place from 31st October to 25th November in the Stallybrass Galleries of the National Book League.

Current and out-of-print books, documents and papers from archives, historic BBC equipment, models and BBC publications will be among the exhibits.

Trooping the Colour on Russian TV

ON 10th June the Trooping the Colour ceremony was televised direct to Russia. Mr. Fokin, chief television commentator and head of news for U.S.S.R. Television, expected fourteen million Russians to view the ceremony, for which he gave the commentary.

Beforehand, the cameras overlooking Horse Guards Parade and others at vantage points in Central London, presented a special forty-minute programme about London for Russian viewers.

Television Transmitting Station for Scotland

A 750ft mast to carry the aerials of the new South-East Scotland television and VHF sound station, which is to be built at Dryden Hill, between Selkirk and Hawick, will be supplied and erected for the BBC by J. L. Eve Construction Co. Ltd.

This is one of several stations which the BBC is building to extend and improve the coverage of its television and VHF sound services.

The South-East Scotland station will serve an area including Galashiels, Lauder, Duns, Selkirk, Hawick, Jedburgh and

Looking at a Marconi Mark IV, 4½in. image orthicon camera, in this picture is Mr. A. H. Victory (centre), Chief Engineer of Television of Iran. Accompanied by his wife, Mr. Victory recently paid a visit to the Marconi works at Chelmsford.

Coldstream. It is expected that the station will be completed by the autumn of 1962.

Advertising by Unit Trusts

ON the recommendation of its Advertising Advisory Committee, and after consultation with the Postmaster-General under Section 4 (5) of the Television Act, the Independent Television Authority has amended its rules about financial advertisements expressly to allow advertisements by authorised Unit Trusts. The advertisements must be strictly limited to the name and description of the Trust, the address of its manager, and an invitation to write to the manager for full particulars of the units available. No person may be shown on the screen during the course of the advertisement.

Additional Officer for Scotland

MR. JOHN LINDSAY has been appointed as additional officer in Scotland of the Independent Television Authority. He took up his appointment on 1st June.

Mr. Lindsay has been associated for many years with a wide variety of BBC radio and television programmes. He is well known as a commentator, interviewer and announcer at the National Radio Show.

Distribution Research in Northern Ireland

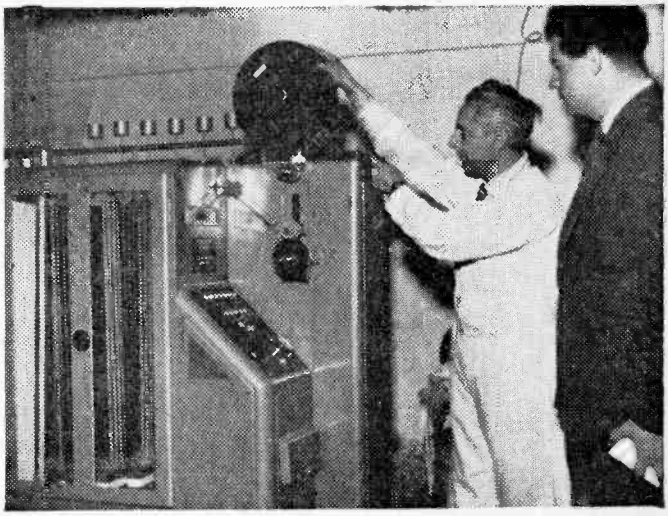
A TEAM of experts visited Northern Ireland during June to begin fieldwork on a major research into the distribution of consumer goods in the province.

This survey into the Northern Ireland market has been commissioned by Ulster Television. It is the first comprehensive investigation to be undertaken into distributive channels in Northern Ireland and will provide advertisers with vital information on the Province.

Northern Ireland is not included in the Board of Trade's "Census of Distribution" and the results of the research should make a valuable contribution to the present statistical coverage of the area.

New Director

MR. C. R. THOMPSON has recently been appointed an executive director of Pye T.V.T. Ltd., Cambridge. Mr. Thompson, who is 49, joined Pye in 1930. From 1941 to 1945 he was a civilian Technical Officer in the Royal Air Force, and returned to Pye in 1949, since when he has been Service Manager of Pye T.V.T. Ltd.



This Lawley film processing machine plays an important part in the production of Westward Television's news programmes.

Iran TV Engineer in Britain

MR. A. H. VICTORY, Chief Engineer of Television of Iran, recently paid a visit to Marconi's Wireless Telegraph Co. Ltd. He and his wife toured the Marconi works at Chelmsford, Essex. Mr. Victory showed some interest in a Marconi Mark IV 4½in. image orthicon camera, which he saw in the Broadcasting Division.

Weather Service for Airport

AT Idelwild Airport, New York, B.O.A.C. has installed its own closed-circuit television, to provide pilots with weather briefing.

This new weather service consists of daily, and continuous weather briefing on international flying conditions. This improvement in ground operations will undoubtedly result in greater efficiency in weather briefing and in time-saving convenience for pilots.

Television on "Queen Elizabeth" Liner

THE Cunard White Star Company, in conjunction with Westward Television Ltd. and Wolsey Electronics Ltd., recently carried out a programme experiment during the "Queen Elizabeth's" return voyage from New York to Southampton.

Westward Television Ltd. opened their Axminster transmitters at 7.30 to provide a special programme of welcome to V.I.P. American guests on board the "Queen Elizabeth".

A television set was installed especially for this transmission and a Wolsey Interceptor Broadside array was erected 150ft high on the uppermost deck.

TV coverage of Archbishop's Enthronement

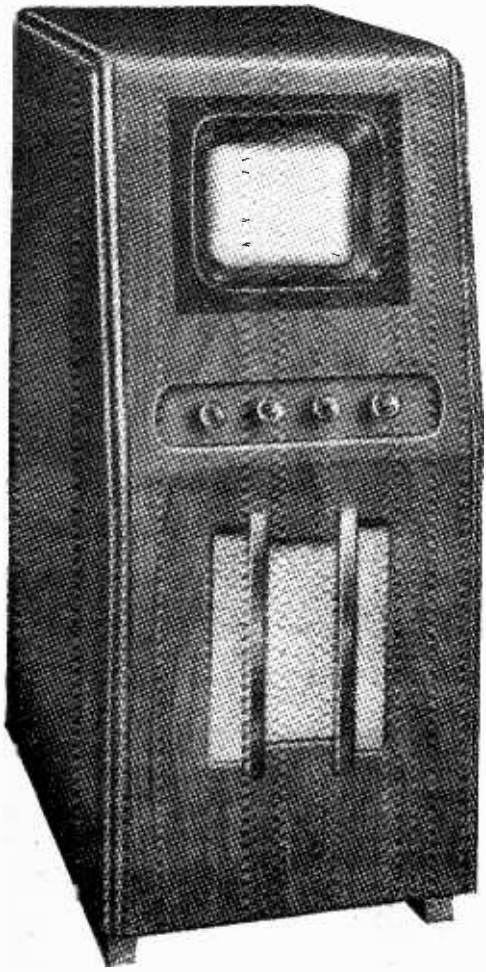
WHEN Dr. Michael Ramsey was enthroned as the 100th Archbishop of Canterbury, on June 27, eight EMI Electronics image orthicon cameras brought, to the ITV network, complete television coverage of the scene inside Canterbury Cathedral during the two-hour ceremony.

The enthronement posed particularly difficult problems, because of the large area to be covered and the different floor levels.

For the first time in the long history of the Cathedral, modern electronic equipment was housed in the ancient vaults of the Crypt, which was turned into a television control studio for the occasion.

Some Interesting Features of a Pre-War Receiver

IN THE YEARS PRECEDING THE SECOND WORLD WAR, TELEVISION MANUFACTURERS INCORPORATED MANY INGENIOUS DEVICES IN THEIR SETS, SOME OF WHICH ARE EXPLAINED IN THIS ARTICLE.



A Cossor television receiver of 1939.

By M. B. Allan

ALTHOUGH the basic design of television receivers has changed very little over the past 25 years, some early models used circuits which, in detail may appear strange to eyes used to scanning post-war designs.

Misplaced Video-amplifier

For example we are used to finding the vision detector or demodulator followed by a video amplifier. Therefore the circuit shown in Fig. 1 may appear most unorthodox, perhaps to some unworkable. However, it did work and very well since the receiver in which it was used was operating efficiently until quite recently. The circuit shows a full wave detector (following a double side-band TRF amplifier), feeding the CRT grid and sync separator directly.

Since there is no H.T. at the diode cathodes, the need for an isolating sync coupling capacitor did not arise. The brilliance control biased the CRT cathode from zero to 120V. The use of fly-back suppression (C54-R56, Fig. 1), is also an interesting point, bearing in mind that the particular receiver was marketed in 1938. It was also quite common practice to omit the audio stages and loudspeaker! The audio signals from the detector were taken to output terminals or via a screened lead for connection to the pick-up sockets of a radio receiver. This had several disadvantages since if a fault occurred in the radio, there was no TV sound. The radio had to be kept near the TV receiver in order for the sound to issue from approximately the right place and of course both receivers had to be on at the same time.

The Cathode Ray Tube

The tube is a tetrode with quite low first anode voltage, 165V, and an EHT for the final anode of about 3·5kV. The EHT is mains derived from a special winding on the mains transformer and rectified by an HVR2 half-wave rectifier.

Focus control is achieved by a normal coil on the tube neck, shunted by the focus control and a series resistor, wired in the H.T. negative return. Most of the biasing is derived from this circuit which also includes two smoothing chokes.

Smoothing

These latter items are necessarily quite bulky since the smoothing capacitors are three 16μF sections of a single 350V electrolytic block. The H.T. line to the frame timebase and line oscillator are further smoothed by 2μF capacitors. Thus the total smoothing capacity is very small compared to modern standards.

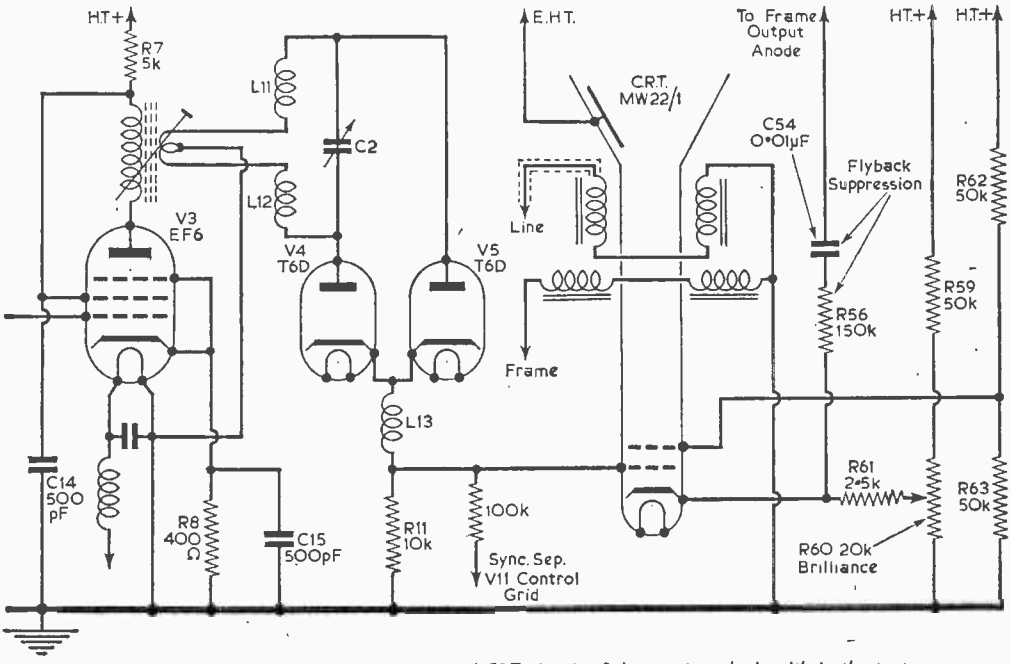


Fig. 1.—The final vision R.F. detector and CRT circuit of the receiver dealt with in the text.

Timebases

A triode-tetrode is used for the line timebase. The triode is a blocking oscillator coupled to the tetrode output section with a double wound output transformer. The frame timebase is very similar, using a triode-hexode with a sync coupling winding on the blocking oscillator transformer.

Sync Separator

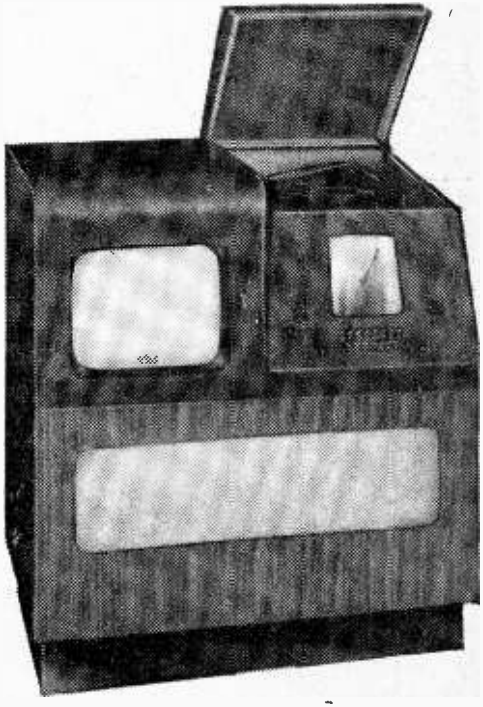
A pentode is used with a variable control in the cathode circuit, which for optimum sync holds the cathode at about 15V. The anode is very low (considering the 15V cathode) at 27·5V and this voltage is applied to the suppressor grid, via a different network. The line sync pulses are taken from the anode, the frame pulses from the suppressor. The screen grid is held at about 30V.

R.F. Stages

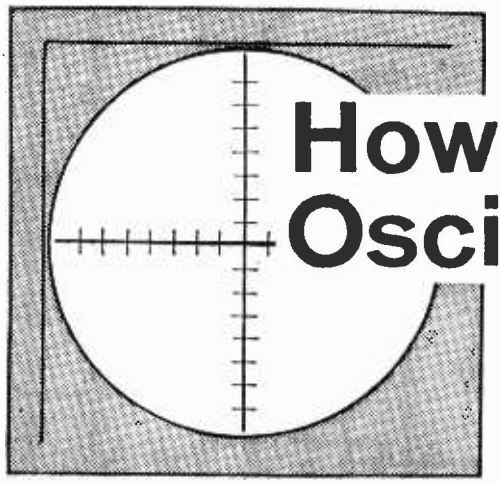
The aerial input is split to feed a three stage vision R.F. amplifier and a two stage sound R.F. amplifier. Cathode bias is fixed and separate sensitivity controls are fitted to provide negative bias to the suppressor grids of the amplifiers, the first two video and both sound amplifiers.

The only control on the front is the "Brightness-On/off". The picture size on this particular receiver is 4in. x 3$\frac{1}{2}$in.!

Another very similar receiver was produced by the same company, at the same time, having a 9in. tube, and full sound equipment. It should be mentioned here, however, that 9in. screens were by no means the largest available. Large console receivers with 15in. tubes and a separate all-wave radio were quite common and very reasonably priced. ■



A pre-war G.E.C. receiver, which incorporated a radiogram.



How to use Oscilloscopes

By D. R. Bowman

CONSTRUCTING AN ADVANCED INSTRUMENT

(Owing to lack of space, this article was omitted from the July issue, and so is continued from page 455 of the June issue.)

PREVIOUS articles have outlined the uses of the oscilloscope, and an indication has been given of the requirements of an instrument. The recent article by H. Peters (June and July issues) described the construction of a simple and effective instrument, and its limitations were stated. Here, a somewhat more advanced instrument will be described, which can use some of the components specified in the above article. This means that the cost of development will be relatively small for a constructor who, having made the simpler oscilloscope, wishes to improve on it later.

The timebase generator consists of a Miller valve which is connected as a transition oscillator. One big advantage of using the Miller effect is the very precise linearity obtained at even the highest frequencies. This circuit is arranged to give only a relatively small voltage output, and the sawtooth is amplified by a two-valve push-pull stage before application to the X-plates of the cathode ray tube. As a result of the application of push-pull deflecting voltages the average potential of the X-plates is kept sensibly constant during scan and flyback, thus eliminating, or at least minimising, deflection defocusing which would otherwise prevent focus being obtained all along the trace at the same time. As direct coupling is used between amplifier and X-plate, a simple potentiometer control enables an X-shift readily to be obtained without the need for readjustment of the focus.

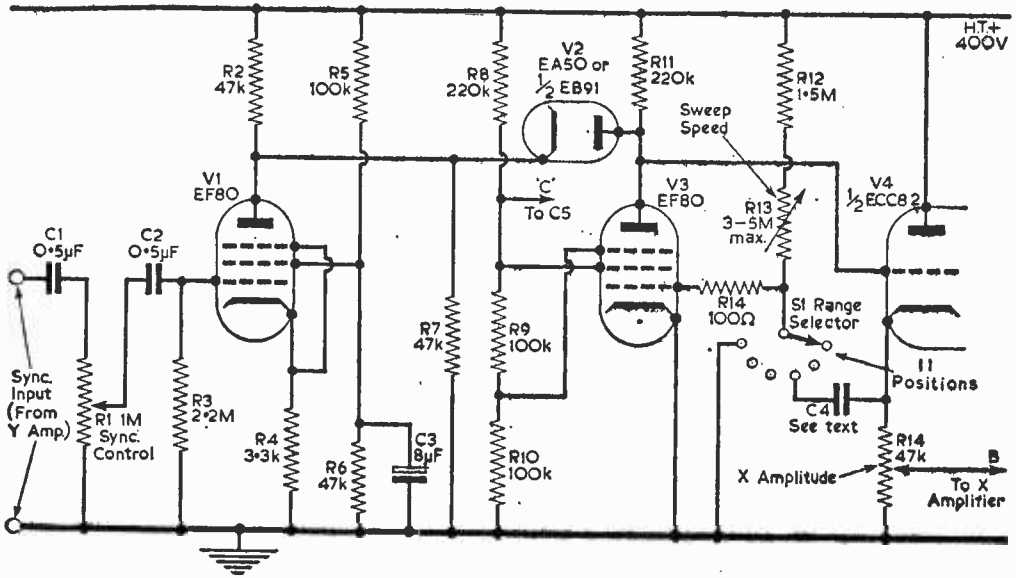
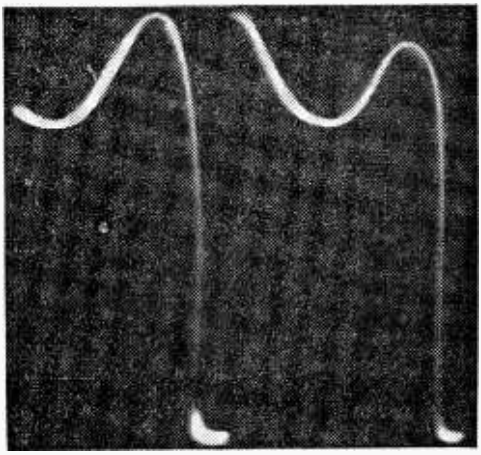


Fig. 9.—The circuit of the Timebase generator.



The oscilloscope trace of a screen pulse (for fly-back blanking) :f=100kc/s.

One of the chief problems with the Miller saw-tooth generator is the maintenance of a rapid fly-back at the higher frequencies. Too much should not be made of this drawback; although the whole of the leading edge of a pulse can be lost because it occurs during the flyback period, all that is needed is to display two pulses rather than one and the whole pulse may then be examined. However, a long flyback does mean the flyback trace itself may be visible, or may turn up unexpectedly when a long exposure is made for photographic purposes. Accordingly, a cathode follower circuit is used to reduce flyback time, and by using a pentode as a limiter, provision can be made for ' automatic ' synchronisation.

The action of the Miller-transition sweep generator will be familiar to all readers, and the only points in which Fig. 9 differs from the well-known circuits are as follows. First, direct coupling is used between suppressor and screen. This avoids having to change the coupling capacitor as the speed of the timebase generator is altered, and helps in obtaining a quick flyback. It is also possible to omit the coupling resistor R9, relying on stray coupling inside the valve, but results are more predictable with EF80 if it is included.

Secondly, Miller feedback is applied via the grid-cathode conductance of V4, the cathode follower. This can occur because the grid of V4 will be always a little positive relative to the cathode during the sweep—the run-down of V3 anode voltage. When the valve V3 is passing its maximum current, at the end of the sweep Miller feedback ceases—the valve is said to be ' bottomed '. The H.T. now dives V3 grid positive via R12 and R13. The capacitor C4 now changes, but its time-constant is dependent only on the input resistance of V3 under grid-current conditions and the output resistance of the cathode-follower V4; in all the resistance is only of the order of 1k and the changing time is very short. The resistor R14 does not add appreciably to this —R14 is included to avoid parasitic oscillations that may occur under certain circuit conditions—one prototype built by the writer was found to emit radiation at about 70Mc/s—heavily frequency-modulated by the timebase frequency. Similar grid-stoppers are added in the amplifiers. The flyback is fixed at a definite value by the above circuit, and hence there is a progressive decrease in the ratio of sweep to flyback in each switched range as the frequency is increased by varying R13. This is quite unimportant in the circuit given.

A negative pulse is obtained at the screen, of good square shape, on the flyback. This is however of insufficient voltage to give good blanking by application to the grid of the cathode-ray tube. It is hence applied to the grid of one half of an ECC82, and the positive pulse at the anode of

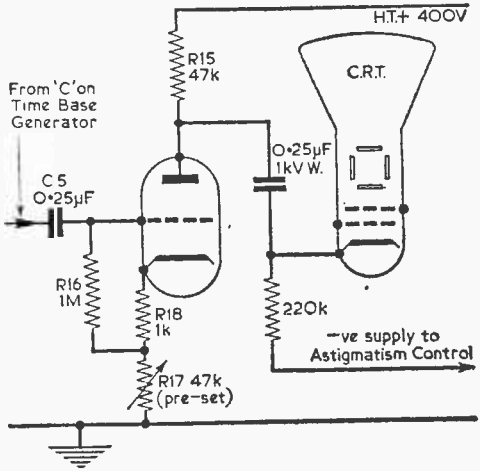
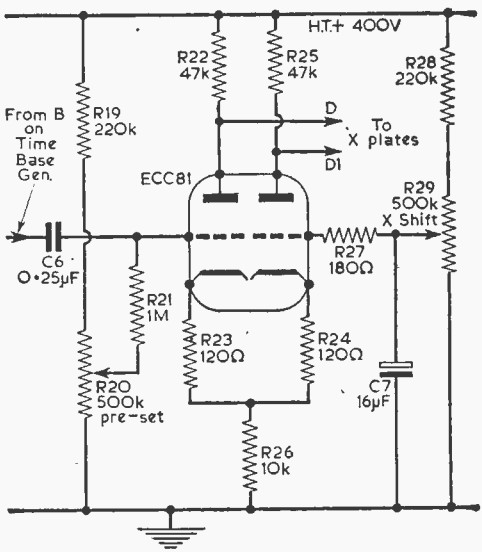


Fig. 10 (above).—The cathode connection to the CRT, with flyback blanking.

Fig. 11 (below).—The circuit of the X-amplifier, including the shift control.



this valve is applied to the cathode of the cathode-ray tube. The lead from connection C in Fig. 9 is the take-off point for this. Fig. 10 shows the circuit—R17 is made adjustable, a pre-set control—so that the D.C. potential of the anode can be altered. It does not need adjustment, once set, so is not brought out to the front panel of the instrument.

Suitable values for C4 are as follows:

10c/s	—	50c/s	—	1μF
40c/s	—	250c/s	—	0·25μF
200c/s	—	1·5kc/s	—	0·1μF
1kc/s	—	5kc/s	—	0·02μF
4kc/s	—	20kc/s	—	0·005μF
18kc/s	—	35kc/s	—	0·001μF
30kc/s	—	100kc/s	—	250pF
80kc/s	—	250kc/s	—	75pF
250kc/s	—	750kc/s	—	25pF

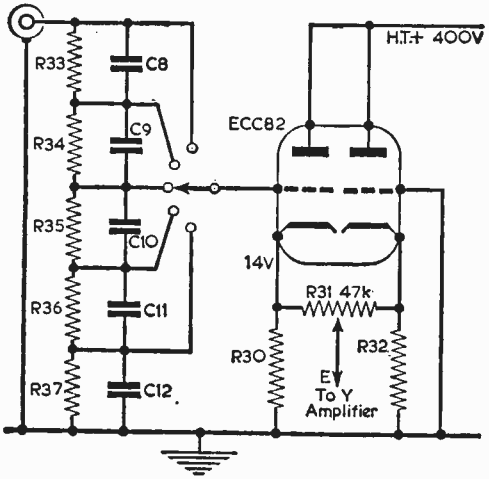


Fig. 12.—The input attenuator and cathode-follower input to the Y-amplifier. R30 and R32 are equal in value (2·2k) and should be matched.

A spare connection is allowed for, since it may be desirable to experiment a little at the higher frequencies to get the correct coverage of frequency, especially if only a 3M variable resistor is available for R13. Calibration of the ranges will be required in any case. The final connection connects the grid of the Miller valve to chassis to put the sweep generator out of operation so that D.C. measurements may be made, or an external timebase generator used.

The X-amplifier

The X-amplifier produces a push-pull voltage for driving the spot. Its bandwidth does not need to exceed about 500kc/s, since sweep at higher frequencies is very seldom required. The required gain can thus be obtained with a single valve. Direct coupling is used between the anodes of the X-amplifier and the X-plates of the cathode-ray tube. D and D1 in Fig. 11 connect direct to the X-plates.

R20 and 29 have to be adjusted together to obtain the correct conditions. The procedure is as follows:

(a) Set sweep generator to about 2kc/s and by manipulation of the controls obtain a trace on the tube;
(b) Rotate R20 and R29 (one with each hand) and adjust for maximum width of trace: if necessary, reduce the input by varying R14.

R20 is a pre-set control, and should only need adjustment at infrequent intervals to correct for ageing of the valves. R19, 20, 28 and 29 should not be put anywhere in the case where they will become hot, and should be of ample wattage rating (1W minimum).

Hum may be picked up by the anode circuits, so if any great distance separates D and D1 from the CRT, low-loss co-axial cable, semi-air-spaced, should be used to make the connections, the outer of the cable being earthed to chassis.

The Y-amplifier

The Y-amplifier must be constructed so that all circuit capacitances are kept as small as possible. Since voltages of the order of 250 maximum may

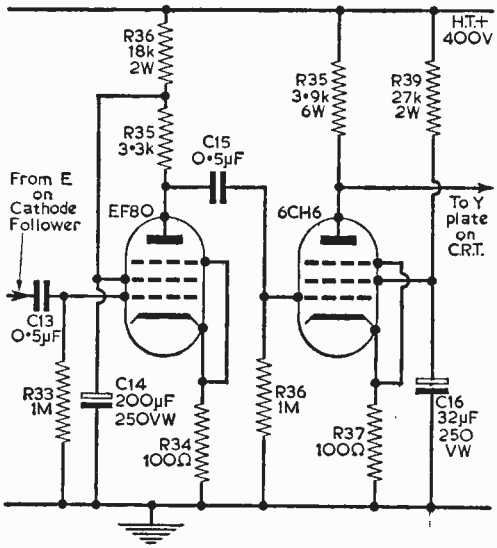


Fig. 13.—The Y-amplifier circuit: A.C. coupled only. The gain is about 800, and the bandwidth is approximately 3·4 Mc/s.

need to be displayed, an input attenuator of flat frequency response is provided. The circuit diagram is shown in Fig. 12. The values of R33 to R37 are 100k each. C8 to C12 are each 5pF, on the assumption that the usual values of stray capacitance emit. Care should be taken to keep these strays to a minimum in constructing the switch. The attenuator should be placed as near the co-axial socket as possible, and so should the ECC82 cathode follower. The connection E should be of plain insulated wire well spaced out from anything connected to chassis, and may be several inches in length.

Fig. 13 shows the first of the two Y-amplifiers which may be built.

(To be continued)

THE uses to which modern transistors may be put are forever increasing. This article describes the development and operation of two television tuners—both evolved in the U.S.A.—which employ transistors.

Transistor Tuners

The swift development of the transistor has allowed designers, in all fields of electronics, to use them in equipment which at one time had to employ valves, as the requirements of the circuits were beyond the scope of the transistor, owing to its limited capabilities. Now, however, the transistor is being used more and more in place of valves, and the transistorised TV turret tuner is accepted, in the USA at least, as standard equipment on some television receivers.

A lead in making transistorised TV tuners was taken by the Philco Corporation of America when, two years ago, their designers began work on transistor television receivers, including VHF tuners. They also designed F.M. tuners using transistors.

Although as yet not as suitable as valves, the gain of early transistor tuners came remarkably near to that of valve types and the noise figure remained only slightly higher.

Engineers of the Lansdale division of the Philco Corporation made the first transistor tuners by replacing valves and most of the circuitry of a Standard VHF tuner with transistors; keeping the turret and most of the coils.

The single channel circuit of one of these early experimental tuners is shown in Fig. 1. The R.F. signal from the aerial passes, via a 75Ω coaxial cable, through an F.M. trap to earth, and through a 45Mc/s trap in series with the input circuit, to the base of a T1694 transistor. This transistor is the R.F. amplifier which uses a common-emitter circuit with fixed neutralisation. The output signal is coupled inductively and injected into the base of the mixer. The opinion of C. R. Gray of Philco, on this form of coupling, is, that, although straight-

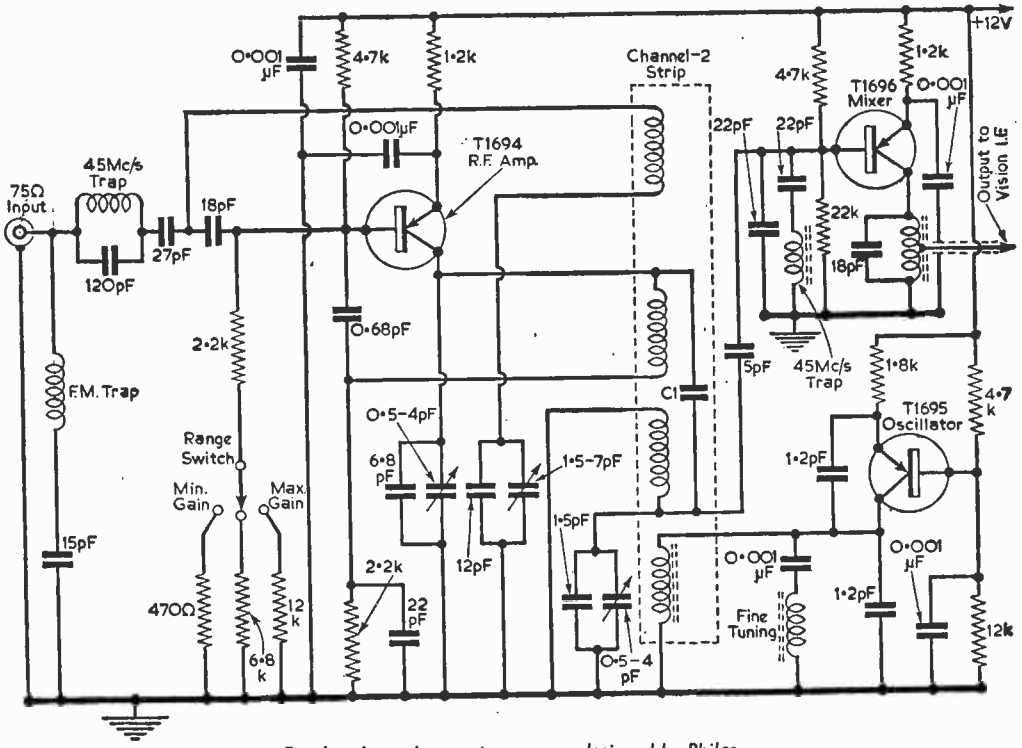


Fig. 1.—An early transistor tuner, designed by Philco.

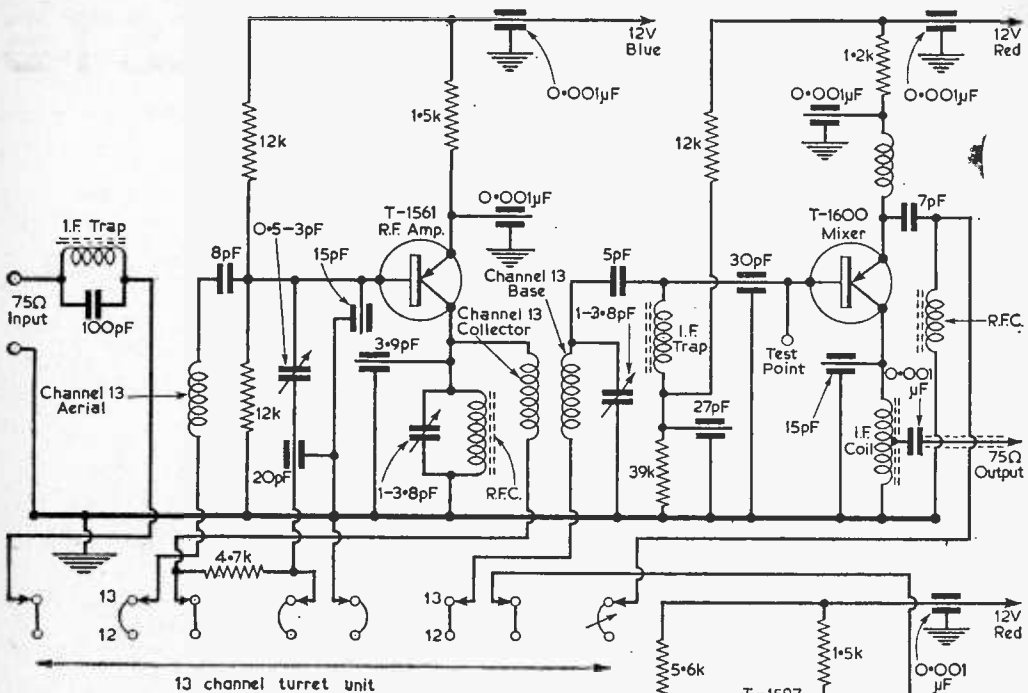


Fig. 3.—The circuit of the Sickles Mark 6T VHF tuner.

forward emitter injection produces slightly higher mixer conversion gains, it is difficult to employ this in a turret tuner, as unwanted coupling is obtained, through the coils. One of the means taken to overcome the lower mixer conversion gains is the 45Mc/s series trap to the base of the transistor, which eliminates 45Mc/s degeneration in the mixer. In this early Philco design, the local

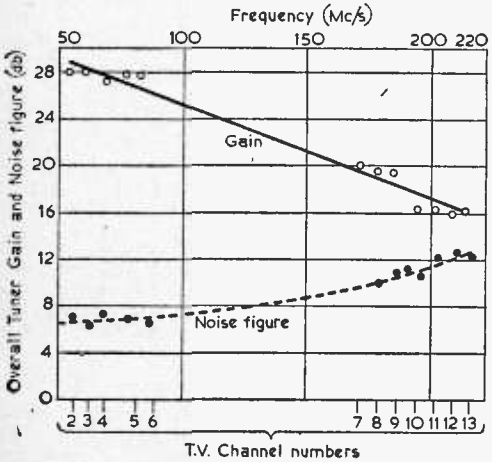


Fig. 2.—The gain and noise figures of the tuner shown in Fig. 1.

oscillator, a T1695 transistor, was specified to deliver a minimum of 1·5mW of power at 257Mc/s (for channel 13). The mixer was planned to give high conversion gain with a minimum of 1·0mW of power injected by the local oscillator. The overall gain and noise figures are shown as a graph in Fig. 2. There are obviously two groups of channels to consider; 2 to 6 and 7 to 13. The low-band VHF channels—2 to 6—have an average gain value of about 28dB, with a noise figure of 7dB. As might be expected, channel 10 to 13 have much lower gain figures, and higher noise figures; approximately 17 and 13dB respectively.

In the tuner shown in Fig. 1, a manual gain switch is employed. The three resistors of this range switch are used for base bias.

(Continued on page 563)

ADD-ON COLOUR TESTS

(2) COMPLEMENTARY COLOURS

By A. O. Hopkins

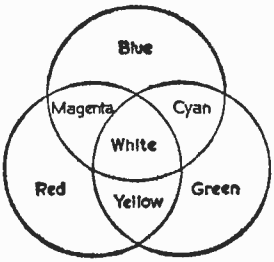
(Continued from page 509 of the July issue)

Saturation

THE ordinary meaning of saturation—to be too full to accept more—does not apply in colorimetry. Instead it means "absence of white", which seems difficult in view of rod function and brightness curves. What is this mysterious "white" which can desaturate a colour—without taking anything from it?

Very simply, a single primary or any combination of two are *always saturated*, simply because the *third primary is missing*. The saturated colour does not need to be bright or vivid in hue. For example, green of medium brightness remains a saturated colour when strong red is added to form orange.

Desaturation would occur if blue were added to the orange. If the blue were weak it would form a *white level* with part of the green and red, giving a pastel tone to the predominant orange. More blue would made the orange paler. Blue as strong as the red could not raise the white level above the green level, so the blue and red excess would form purple made pale by the medium brightness white.



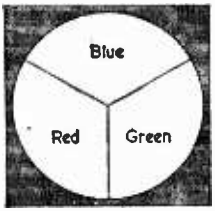


Fig. 7 (left).—Additive colour primaries superposed to show the formation of white and three complementary colours.

Fig. 8 (right).—A primary colour separation filter for use with a single lens—it consists of three equal sectors mounted in a frame.

Complementary Colours

With the "additive colour" effects of the three primaries understood in theory, several experiments can be made with inexpensive home-made apparatus with a view to testing whether the add-on principle could provide a practical colour system for current TV transmission.

If three similar lenses (cheap "reading glasses" will do) are available, an "opal" lamp mounted horizontally behind each, and a simple light-proof box with three openings for them will make a triple-projector. The three circular lamp images can be made to overlap as in Fig. 7 by adjusting the lamp-holder positions. Colour filters in the three primaries are required, and for best results they should be "gelatin" filters such as Ilford's Tricolour Red (205), Blue (306) and Green (405), specially made for colour experiment. For these stiff filters a simple slip-in frame as in Figs. 2 and 3 can be easily added in front of each lens. Some Cellophane wrappings are in good primary colours, and are worth trying singly or in pairs over each lens. For example magenta and yellow give a red filter for a quick test, while blue and yellow give green.

If the primary colours are balanced, the central area on the screen will be white. If tinged you will know which colour is too strong, and that filter can be partly covered by a piece of card. When central white is obtained the three overlapping areas about it will each be in the colour complementary to the primary colour opposite it on the screen, as shown in the table:—

Primary	Complementary
Blue	Yellow (G+R)
Green	Magenta (B+R)
Red	Cyan (B+G)

Colour Sectors

If you have only one lens you can still test the colour balance of your filters. Form complementary colours, and test whether the three primaries will reproduce every colour with which you test them. Fig. 8 shows how the three filters share the lens as equal sectors of a circle. Each filter receives $\frac{1}{3}$ of the light from an "opal" lamp mounted horizontally. Cut one corner of each filter to the wide angle of 120°, and mount them to overlap slightly. They are best mounted as a "sandwich" between two cut-out cardboard frames.

A white card about two feet away will receive a circular image of the lamp. To form colour combinations, a postcard partly covering the lens at different angles will admit a different colour for each position. The pure primaries and complementaries may be seen by dividing the card with an angle-cut of 120° to the centre to form two masks. The larger mask will just cover two primaries, admitting the third. The smaller mask covering each primary in turn, will separate the complementaries. Intermediate colour combinations will appear as each mask is turned about the lens centre.

Picture Tests

The coloured magazine covers previously tested can now be "reproduced" in their exact colour by either of the three-colour projectors. If the room illuminant is similar, on switching if off and switching on the projector the colours in the picture should not change when all filters are exposed.

As with the two-colour tests, the pictures should be illuminated in each primary in turn. Of the three "colour positives" obtained, the green will be found to give best contrast and most natural rendering of light and shade. It will not be difficult to visualise it as a monochrome picture on a TV screen. Now admit the blue and red light from the projector, virtually "adding on" (by illumination) two colour positives, to complete the picture in full colour.

Colour Wheel

If you have made the three-lens projector, some very simple masks will enable you to project a nine-colour wheel image. First cut three pieces of cardboard to leave wide-angle sectors of 200° as shown in Fig. 9(a). Cut six pieces of tracing paper and fix over each mask to overlap each side of the open sector by 40°. A touch of grease or vaseline will make these small sectors translucent. A clear sector of 120° is left (360-160-40-40). With the colour filters in place over the lenses cover each with a sector mask set mutually at 120° to the others. Focus the three primary images to superpose in sharp registration, and the colour wheel will show nine sectors in distinct hues ranging through the spectrum from blue to red and back through magenta and purple as illustrated in Fig. 9(b). Unfocused, this projector will throw white light to your screen.

Newcomers to colour may wonder what has happened to "brown". Well, brown is really a whole group of hues and shades, but always contains green and red. Unless desaturated (made greyish) by blue, brown is merely dark orange or dark yellow ("dark" meaning little light), as experiment with your projector will show.

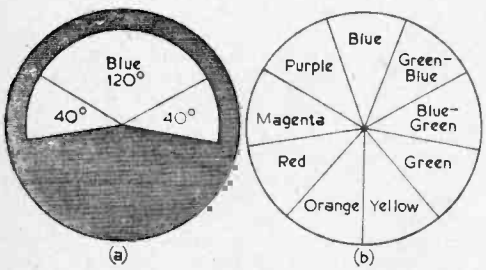


Fig. 9.—A nine-colour wheel. Three primary images are superposed to form the wheel on the screen. One positive mask is shown.

Colour Focus

Serious experimenters who have scanned monochrome film or slides for closed circuit TV may have wondered how to combine the three primary images of a three-colour scan. They will know that the three scans can be made on one CR tube or on three, and that ordinary monochrome tubes can be employed. It is clearly an advantage if the optical system can be tested on a well-lit scene or colour transparency, but three lenses with filters cannot bring their focused images to coincide on a screen. To bring the three diverging axes together three pairs of reflectors can be used, but this complication is not attractive.

I have simplified the optical arrangement to employ only four reflectors, and combine three of them with lens and filters for easy handling. Fig. 10 shows the arrangement in diagram, including a convex reflector positioned on the "normal" or main axis of the viewing screen and with its back to the focused scene. I group lens, filter and reflector (a hand-bag mirror does nicely) as a "sandwich" to form a compact optical unit for

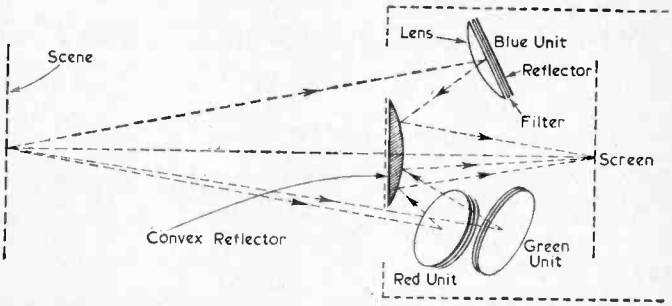


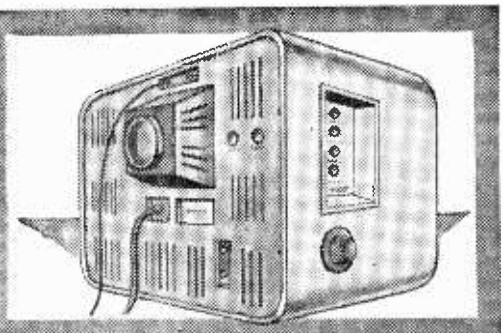
Fig. 10.—Colour focus camera; the focused scene is analysed into three primaries and combined on the screen. The colour units are optical "sandwiches" of lens, filter and reflector. The convex reflector collects and registers the coloured rays.

each colour. Each unit is actually a magnifying reflector, doubling the power of the lens. I mounted the three units at equal spacing round a circular plastic frame (which originally held a mirror), clipping each to a plywood holder with a stiff hinge connecting it to the frame for easy adjustment. The hinges had one-screw fixing to give "universal" movement to the units. The convex reflector, collecting light from the three units, must be firmly fixed to a base, and so must the frame holding them. A piece of half-inch board is a suitable base, and the viewing screen, preferably a piece of "flash opal" glass, can be mounted to slide along this for easy focus. A cardboard box, with open back extending to "hood" the screen, and three openings in front of the lens units, will be adequate for this colour-focusing camera. The paths of the diverging and converging axial rays are indicated in the diagram, and the relative size and shape of the box is shown in outline.

To test the efficiency of this method a well-lit scene or colour transparency may be focused with the three units so that the primary images coincide. If colour scanning is tackled later on, the three flexibly mounted units will easily collect and register the three scans however they may be traced on CR tube or tubes.

Less experienced readers will, I hope, feel that the mystery of colour is now dispelled, and that a profound knowledge of optics and a well equipped laboratory are not essential if new ideas are to be tested. Principles upon which great inventions depend are simple, and television is waiting for a new principle, not complicated apparatus, which will lead to the development of a colour system which everyone can afford. ■

Servicing Television Receivers



No. 70—THE REGENTONE TR177 AND ASSOCIATED MODELS

By L. Lawry-Johns

(Continued from page 522 of the July issue)

THE frame oscillator consists of a multivibrator circuit employing the triode sections of V13 (PCL82) and V7 (PCF80). The frame amplifier is the pentode section of V13.

Bottom Compression

This is normally caused by a low emission PCL82 (V13), but if lack of width is also compression after the height control has been adjusted to compensate for the initial loss of overall height.

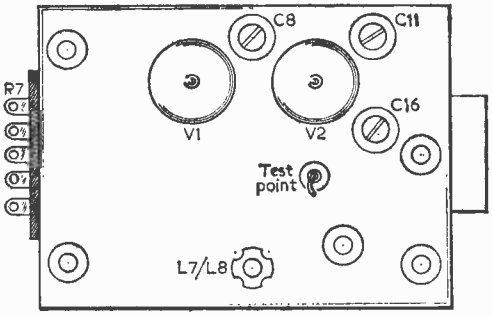
When the height of the picture is reduced equally top and bottom, check R59 (820k).

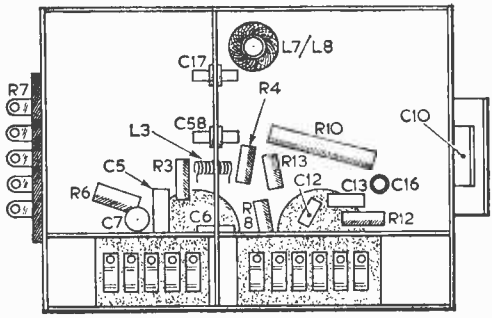
Distorted Frame Scan

When one section of the picture is vastly distorted or stretched with respect to a remaining narrow strip, check the linearity controls (500k each) which sometimes become o.c. at one end of the track. When this happens, it is sometimes possible to restore normal conditions by rewiring the defective control so that only one end and the centre tag is in use at a time.

Frame Hold

If the hold control is at one end of its travel the 680k resistor wired from the hold control to pin 9 of the PCF80 (V7) should be checked. This sometimes "goes high", putting the hold outside the range of the control. Also check V7.





(Left).—These two diagrams of the tuner unit were included in last month's issue, but it has been found desirable to repeat them with this instalment.

If the picture rolls up or down but will not lock securely, the OA71 (MR3) interlace diode should be checked and, if this is not at fault, the 0·01μF feed capacitor (C77) is the next suspect.

Erratic Hold

If the setting of the hold control is frequently changing, necessitating constant adjustment, the control itself (R64 1M) should be changed.

Heater Chain

The heater circuit is quite conventional, all the heaters being in series in a single chain. Quite obviously if one heater becomes o.c. the entire heater chain will be broken and no valves will light up. It is then necessary to trace the mains voltage through the chain until the break is located at one valve base. A replacement valve should then restore normal conditions. It is not necessary to use a voltmeter (when the set is on) or ohmmeter (when experienced, check the H.T. as the PY32 could be responsible.

If the PCL82 is in order, and the H.T. is normal check C89 (100μF 25VW), which sometimes dries up or becomes o.c. This results in current feedback, which appears on the screen as bottom

the set is off) to trace the break; a simple neon screwdriver serves this purpose, and the following procedure should be adopted when using a neon. With the receiver switched on touch the neon to chassis. It should not light. If it does, reverse the mains plug or wires. Then apply the neon to R91 mains dropper to ensure that the mains is applied to this point (if not, check the 1A fuse and on/off switch, mains cable, etc.). Having ensured that the mains is present at the dropper, check that it is present at all tappings (one section could be o.c.) to the white lead. Then follow to the thermistor, thence to the valve chain, PY32 pin 7, then pin 2, PY81 pin 4, then pin 5, PL81 thence through the heater chain where all heater pins are 4 and 5 except, of course, for the PY31 (2 and 7), the EB91 (3 and 4) and the tube (1 and 12).

The chain terminates at the tube, and if the neon lights at pin 1 and not at pin 12 the tube heater is open circuit. In this case the break can sometimes be welded by applying a high pulse voltage from a fairly low impedance source (such as the top cap of the PL81) to pin 12, with pin 1 connected to chassis (the base socket being removed, of course).

Defects in the heater circuit are not confined to an open circuit, which results in the whole chain being out of action. A heater-cathode short in a valve will result in a heavy current flow through those valves preceding the defective one in the chain, with the remainder being unheated. For example, should V7 develop a heater-cathode short in section A, the heater current flow will be through the dropper, V10, V9 and V8, resulting in these valves lighting up very brightly, possibly sustaining damage, blowing a heater or causing heater-cathode shorts in one or all three, and and then causing the 1A fuse to fail. Therefore, when the fuse is found to be blown it is prudent carefully to observe the behaviour of the circuit when a replacement is tried, with one hand on the on/off switch. The correct procedure is, of course, to check the circuit for shorts before fitting a replacement fuse.

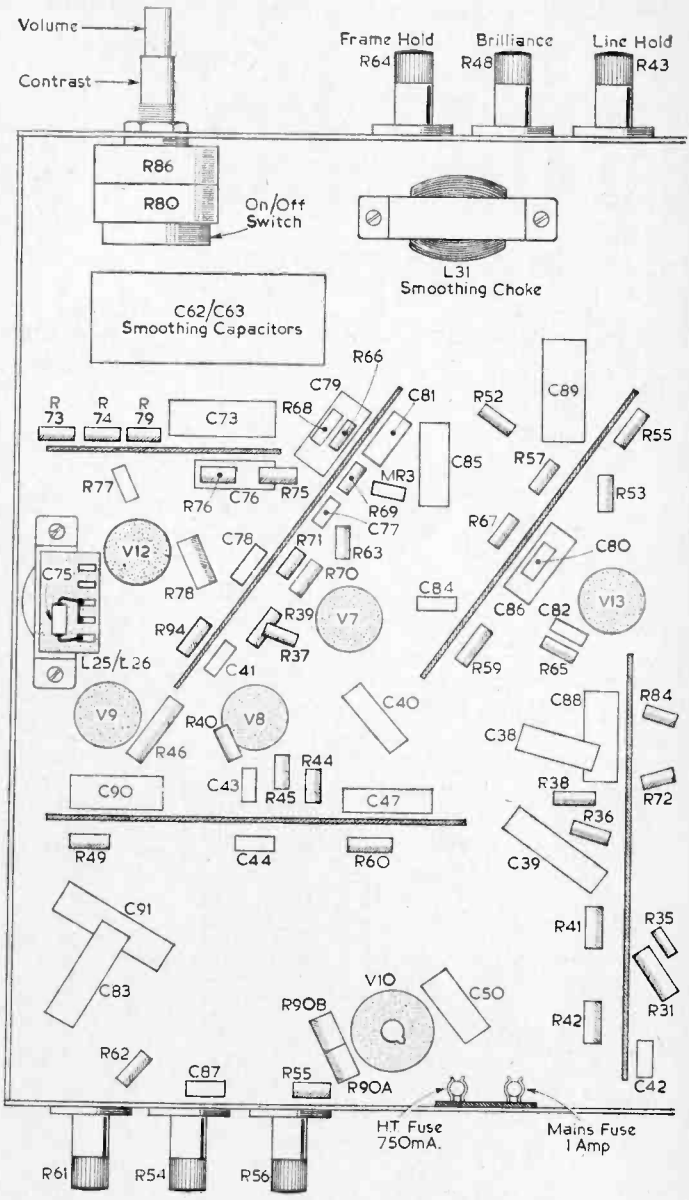


Fig. 6.—The underchassis view of the receiver.

Tube Troubles

Quite a number of AW43-80 tubes seem to fail owing to an impaired vacuum, which results in a purple glow in the gun assembly, and perhaps arcing between the electrodes. Replacement is the only cure for this condition.

Focus

The focus is preset; the focus electrode is brought out to pin 6, and the lead from this may be connected to pin 10, pin 9 or pin 12 on the tube base, whichever gives optimum focus.

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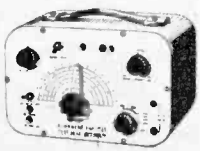
TYPE MC12



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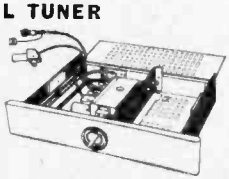

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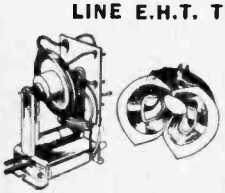

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1S4	8/-	6P25	8/6	30FL1	9/6	ECC82	4/-	KTW62	5/9	U145	6/-
1S5	4/9	6P28	12/6	30P4	12/6	ECC83	4/6	KTW63	5/9	U147	5/6
1T4	3/9	6Q7G	6/3	30P12	8/-	ECC84	9/-	KTZ63	5/6	U149	7/-
2A3	7/9	6Q7GT	8/9	30PL1	10/6	ECC85	6/-	MU14	8/-	U150	6/6
2D21	4/6	6SA7	5/9	35L6GT	9/-	ECC81	5/6	N18	7/3	U151	8/-
3A4	4/9	6SG7	4/9	35W4	6/9	ECC82	6/-	N37	11/-	U152	7/-
3Q4	7/-	6SH7	4/6	36Z4GT	5/3	ECC83	6/9	N78	15/-	U153	6/-
3S4	6/-	6SJ7	4/-	30CD6G1	9/-	ECC84	8/9	N108	16/-	U154	6/3
3V4	6/9	6SK7	5/3	50L6GT	9/-	ECC85	7/9	PC86	7/-	U191	11/-
1R4G	9/6	6SL7GT	6/-	615T	16/-	ECF80	8/6	PC88	7/-	U281	9/6
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5U4G	4/9	6SQ7	6/-	185BT	18/-	ECH21	12/6	PC88	19/-	U309	7/-
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5Y3G	5/9	6U4GT	10/6	807(E)	3/9	ECH42	8/6	PCF80	7/-	U339	11/-
5Y3GT	6/-	6V6G	5/6	955	3/9	ECH81	8/-	PCF82	7/3	U403	9/6
5Z4G	8/6	6V6GT	6/6	956	2/6	ECL80	7/-	PCF84	16/-	U709	6/6
5Z4GT	11/-	6X4	5/-	9001	4/-	ECL82	9/6	PCL82	7/3	U801	19/-
6A8	8/-	6X5G	5/-	9003	4/-	ECL83	12/-	PCL83	10/6	UABC80	8/6
6A8G	9/6	6X5GT	5/6	ATP4	2/9	EF22	7/-	PCL84	7/6	UAF42	8/-
6AC7	4/3	6Y6G	7/9	AZ31	9/-	EF54	3/3	PEN25	4/6	UBC41	7/9
6AG5	3/6	7B5	9/-	B36	8/6	EF80	4/9	PEN45	7/3	UBF80	8/6
6AG7	7/9	7B7	7/9	B65	4/6	EF85	6/8	PEN46	5/3	UBF89	7/9
6AK5	6/6	7C5	7/3	C1C	8/6	EF86	9/-	PL33	9/3	UBL21	14/6
6AL5	3/6	7C6	7/3	CBL31	21/-	EF89	6/9	PL36	10/6	UCH21	12/6
6AM6	5/-	7H7	7/6	CCH35	14/-	EF91	3/-	PL38	16/6	UCH42	7/6
6AQ5	6/-	7S7	9/-	CL33	11/9	EF92	4/6	PL81	8/9	UCH81	8/6
6AT6	6/-	7Y4	7/-	CY31	9/9	EL22	12/6	PL82	6/9	UCL82	11/3
6AU6	7/6	10C1	11/-	D63	1/6	EF32	4/6	PL83	6/9	UCL83	13/6
6B9G	3/6	10C2	13/6	DA90	2/6	EL33	9/-	PL84	9/-	UF41	8/6
6BA6	6/-	10F1	5/9	DAC32	9/9	EL35	7/-	PY31	7/9	UF42	5/6
6BE6	5/9	10LD11	14/6	DAF91	4/9	EL37	11/6	PY32	10/-	UF80	7/6
6BG6G	12/6	10P13	9/-	DAF96	7/3	EL38	12/6	PY80	7/-	UF85	8/9
6BW6	7/9	10P14	9/-	DF33	9/6	EL41	8/-	PY81	6/-	UF86	14/6
6BW7	5/9	12AH7	6/9	DF91	3/9	EL42	9/-	PY82	6/3	UF89	7/-
6C4	3/6	12AH8	9/9	DF92	3/6	EL84	7/-	PY83	7/6	UL41	7/-
6C6	4/9	12AT6	7/6	DF96	7/3	EL91	4/6	PZ30	9/6	UL44	11/-
6C9	8/9	12AT7	5/6	DH77	6/-	EM34	8/6			UL46	9/9
6CD6G	21/-	12AU7	6/-	DH81	9/-	EM80	8/6	R18	11/-	UL84	7/6
6CH6	8/3	12AX7	6/9	DK32	11/3	EM81	8/9	R19	11/-	UL80	9/6
6D6	4/9	12J5GT	3/6	DK91	5/6	EM84	9/9	T41	7/6	UU6	12/6
6F1	4/9	12K7GT	5/-	DK92	7/6	EM85	10/8	TDD4	7/6	UU7	9/6
6F8G	6/3	12K8GT11/-		DK96	7/6	EN31	16/-	U14	8/-	UY1N	11/-
6F12	3/-	12Q7GT	5/-	DL33	3/6	EY51		U18	9/-	UY41	6/-
6F13	6/9	12SK7	4/9	DL35	9/6	Small	8/-	U22	6/9	UY85	6/6
6F14	9/6	12SK7GT		DL91	8/-	EY86	8/-	U24	15/-	VR105/30	
6F15	9/6		4/9	DL92	6/-	EZ40	6/6	U25	12/6		5/6
6H6	2/-	12SN7GT		DL93	4/9	EZ41	7/-	U26	9/9	VR150/30	
6J5G	2/9		8/6	DL94	6/9	EZ80	6/-	U31	7/9		6/9
6J5GT	3/9	13D3	7/-	DL96	7/3	EZ81	6/8	U33	14/-	X63	9/6
6J7G	5/-	14S7	22/6	EA50	9d.	GT1C	7/-	U35	11/-	X66	11/-
6J7GT	7/6	19BG6G	15/-	EABC80	7/6	GZ30	11/-	U37	26/-	X76H	12/-
6K6GT	6/6	20D1	8/6	EAF42	8/6	GZ32	8/9	U50	5/9	X78	14/6
6K7G	2/3	20F2	8/6	EB34	1/6	HABC80	9/6	U52	4/9	X79	16/6
6K7GT	4/9	20L1	16/-	EB41	7/-	HBC90	7/6	U70	5/6	Y63	6/3
6K8G	5/6	20P1	9/9	EB91	3/6	HL41DD	9/6	U71	8/-	Z66	9/6
6K9GT	9/9	20P3	12/6	EBC33	4/9	HVR2	7/6	U74	9/-		
6K25	7/6	20P4	17/-	EBC41	8/-	KT33C	6/6	U76	5/6		

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PORTRAIT OF A SIDEBAND

By L. E. Higgs

AN UNUSUAL METHOD OF MAKING CLEAR SOME OF THE INTRICACIES OF WAVEFORM

***VISUALISING** electronic processes in the form of mental images helps us in understanding abstract, invisible radio concepts. Pictures of electrons boiling off red-hot cathodes, electrical currents as water flowing through pipes from a water tank battery, and lately, transistors playing a game of Chinese chequers—electrons flowing up the crystalline board one way, leaving holes flowing the other way, are all means of understanding electrical technicalities.*

A common picture painted in schools and text books is of the amplitude modulated carrier wave. This familiar waveform is shown in Fig. 1. Most of us can picture it snaking across the ether from the transmitter to our aerials carrying the audio on its back, ready for amplification, sliced down the middle by the detector, R.F. smoothed, and fed to the volume control.

The Problem

This presents a perfectly clear explanation, until the word "sideband" appears; and when a non-mathematical practical man with little or no knowledge of trigonometry looks at this wave shape, he wonders where the sidebands are. Despite this gently undulating single frequency, the practical man realizes that sidebands exist if only from the broadness of a radio station on a receiver scale. The efforts made by designers to damp down coil Qs, stagger tuned wideband vision amplifiers, and the appearance of test card C definition gratings when the wrong slug is turned in the vision strip, are further manifestations of the width of sidebands.

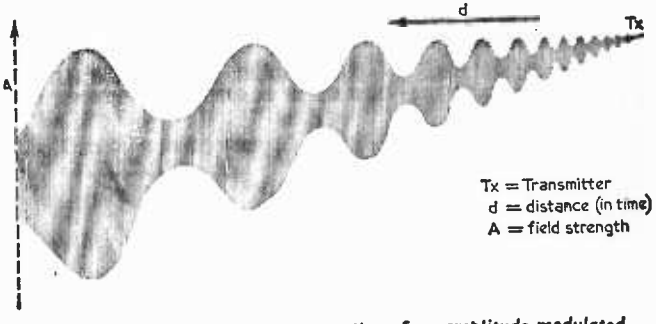


Fig. 1.—The well known representation of an amplitude modulated carrier wave.

We can manage quite well with the carrier envelope image of modulation in radio and TV work, provided it is confined to orthodox A.M. practice, but with the coming of colour, certain processes such as chrominance sub-carrier interleaving and carrier suppression are impossible to envisage this way. With reference to Fig. 1 once more, how can one visualise removing the carrier from this gently undulating wave that is so obviously all carrier? It can be shown, however, that Fig. 1, consists of a central carrier and two side frequencies. This is done either graphically, mathematically or experimentally with a communications receiver possessing "razor-edge" selectivity, whence three separate spot frequencies will be received.

Modulation

Another mental image is now required to help us to visualize the width and composition of a radio signal and will enable the extraction of the carrier to be "seen" clearly. Just as a number of musical instruments playing together different musical notes can be simulated by a complicated wobbly groove on a gramophone record, so the complex A.M. waveform is produced by the separate sound frequencies mixing with the carrier. If this complex wave is considered instead by its constituent components all through the communication system, the production of sidbands becomes clearly understood. Consider the many different audio frequencies from the microphone being amplified, and mixed or frequency-changed at the modulator with the steady carrier R.F. The resultant sum and difference frequencies developed in the transmitter tank coil will be audio band plus carrier, carrier minus audio band and the original steady R.F. (The audio cannot exist in the R.F. tuned transmitter output circuit.) These three separate components can now be easily pictured as two mirror image sidebands grouped on each side of a steady unchanged carrier central frequency. This is modulation explained in the simple frequency changer action that is well understood in receiver

superhets. The sidebands will vary in spectrum width according to the highest audio frequency applied, and the space within the sideband filled with many or few spot frequencies that may be present with the complexity of the sound input from moment-to-moment. The size or amplitude of each of these side frequencies will depend on the strength of the audio at the microphone but will never exceed half the power of the central carrier for unity modulation index. Clearly the carrier can be picked out, if required, from this picture by filters or phase cancelling and the side bands left to radiate unaffected. This spectrum view of a radio signal can be made more real by combining it with a time axis. When mechanical engineers wish to make a workshop plan and elevation of a object immediately recognisable, they give them a three-quarter twist and produce the isometric view. By giving the spectrum/amplitude and time/amplitude graphs a similar twist but in perspective, we get the best of both views with a portrait as in Fig. 2. Points to note in the diagram are the steady high-amplitude central carrier frequency—unaffected by modulation, the mirror image sidebands—always lower in amplitude than the carrier with a maximum of half the modulation index of it—and amplitude variations on a single side frequency being caused by changes in tone volume. During pauses in the modulation, side frequencies all disappear, leaving the steady carrier.

Complex Modulation

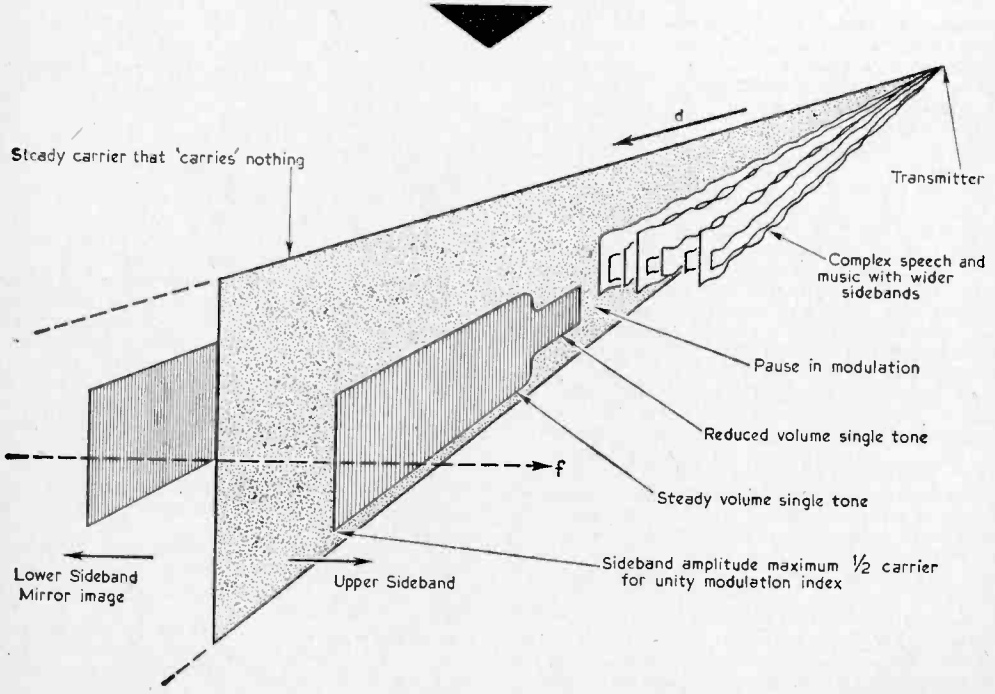
Complex modulation — the irregular ragged speech or music envelope—now shows as a variable series of sinusoidal Fourier component frequencies. Amplitude and the number of side frequencies change from moment-to-moment with the composition of the modulation. Low modulating tones are closest to the carrier and the side frequencies extend out from the carrier with pitch, until the highest note sets the outer limit of the sidebands. It is these outer frequencies that suffer from cramped receiver bandwidth, causing treble loss in sound and fine definition blurr on vision.

Having produced this working picture of sidebands from the action of modulation how does it apply to detection or demodulation?

Demodulation

Demodulation is well understood in terms of envelope modulation waveform (Fig. 1) as a passive process of blocking each half cycle of R.F. With the sidebands and carrier view however, an interesting picture of heterodyning, of all things, appears. When the group of frequencies comprising the radio signal present themselves to the non-linear demodulator at the receiver, the steady central carrier mixes with every side frequency in both sidebands, producing a pair of sidebands at twice the carrier frequency (addition components) and a pair of heterodyne audio frequencies (subtraction components). The energy from the audio pair add together and pass through the R.F. smoothing circuit to the volume control and on to further amplification. The addition components, being R.F., are bypassed to earth by the R.F. filter circuit. This explains why the carrier steady frequency must be present at the demodulator,

Fig. 2.—A spectrum view of an audio modulated wave.



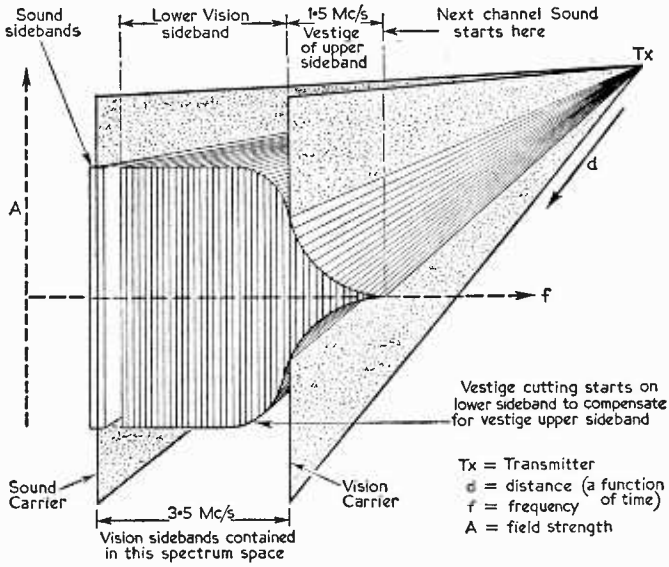


Fig. 3.—A "picture" of a television channel with equal vision/sound power ratio.

naturally with A.M. or artificially inserted with carrier suppressed signals, in order to heterodyne the A.F. from the signal sidebands.

Television

Television channels are particularly interesting when viewed as in Fig. 3. This shows a channel as a solid spectrum space boundary in which sidebands can occur. The vision vestigal upper sideband and the whole lower sideband, depict the cutting action of the vestige filter commencing slightly inside the lower sidebands. This is deliberately arranged to compensate for the rise in low vision frequency response that results from the presence of the vestige of the upper sideband—the power of which adds to its equivalent components in the lower sideband. The sound channel position of the next adjacent channel is seen to commence only 1·5Mc/s away from the central vision carrier of the lower channel instead of 3·5Mc/s that would be required if double sideband working were used; thus saving spectrum space.

Colour TV

The vision channel spectrum differs from that of the sound in having the sidebands distributed at discreet 10,125Mc/s intervals from the carrier, continuing up to the 3Mc/s outer sideband limit. These clusters of sidebands around each harmonic of the line frequency are caused by the "chopping-up" of the carrier at the line repetition rate, and between the clusters are empty spaces never reached by line harmonic side frequencies. Colour television makes use of these unused gaps by interleaving the chrominance of colour signal between them (similar to the positioning of the teeth of two identical combs into each other). The colour signal is carrier suppressed and a locally generated carrier has to be accurately inserted at the receiver.

With only the carrier envelope notation to guide us the processes of carrier suppression, sub-carrier interleaving, and even sidebands are difficult if not impossible to envisage. ■

Transistor Tuners

(Continued from page 554)

A more recent Philco design has forward AGC applied. To achieve this, the upper end of the 1·2k resistor (see Fig. 1) in the emitter circuit of the R.F. amplifier, is disconnected from the upper end of the 4·7k resistor in the base circuit. The AGC voltage is then applied through this 4·7k resistor. In this design the 2·2k resistor and the three resistors of the range switch are omitted.

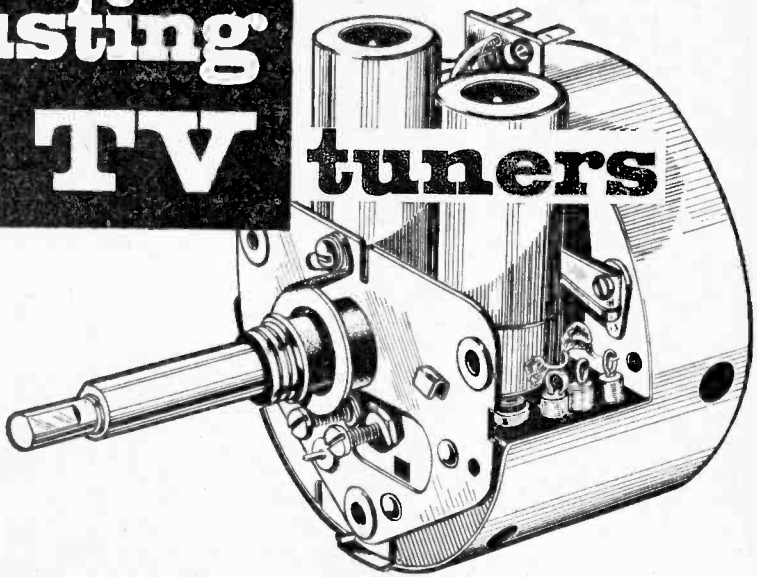
The Sickles Mark 6T Tuner

The circuit diagram of this tuner is shown in Fig. 3. The 75Ω aerial input is unbalanced, as this tuner was designed for use with a portable TV receiver, which used a whip aerial. After the I.F. trap, the signal passes to groups of aerial coils, which are selected by switch. Neutralisation at the R.F. amplifier is obtained by including in the circuit, a variable capacitor. The pairs of coils—for the different channels—on the turret unit, couple the amplified R.F. signal to the base of the mixer, a T-1600 transistor. (Note the channel 13 collector and base coils in Fig. 3.) As in the Philco tuner in Fig. 1, the mixer base of the Sickles tuner is connected to earth via an I.F. trap. The Sickles tuner, however, uses a common-base local oscillator, with selective and tunable oscillator coils in the collector circuit. The local output is from the emitter and this oscillator signal is injected into the mixer base.

The mixer is a common-emitter type, with its output—the desired I.F. signal—appearing at the collector terminal and then going to the tunable I.F. coil as shown.

The measurements obtained when using a Sickles Mark 6T, warrant some attention, as they show a marked improvement over the experimental Philco tuner. The gain of the lower channels ranges from 34·5 to 29dB, and channels 7 to 13 ranges from 24 to 21·5dB. The corresponding noise figures are 4·8 to 5·3dB, and 9·1 to 10·4dB. ■

adjusting TV tuners



By K. Dawe

The "Fireball" tuner is used with many television receivers, and any adjustments made to it—as with any TV tuner—must be executed with the greatest care. Servicing either the mechanical or electrical parts of the tuner, should be attempted only if some knowledge of the construction of the unit is available. This article provides this information and also the procedure for making some adjustments to the tuner.

This, by now, well known tuner unit is fitted in a large number of receivers of various makes. Although all tuners of this type look alike there are many circuit variations and the diagrams shown are representative only.

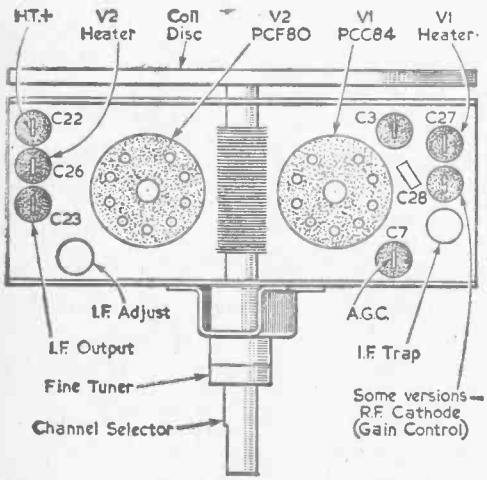


Fig. 1.—The top view of the original Fireball tuner. The shaded components are lead-through decoupling capacitors.

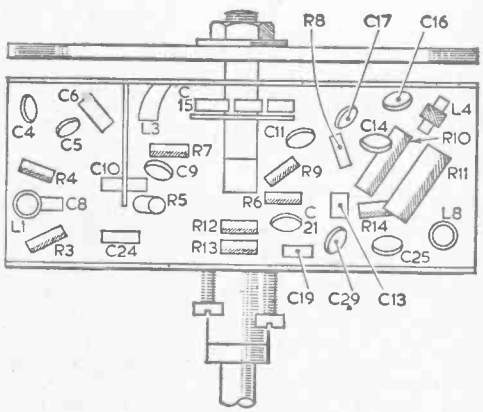


Fig. 2.—The underchassis view of the first Fireball.

The Basic Design

Basically the design consists of a radial arrangement of coils on a disc which is rotated by the channel selector to engage with a horizontal bank of spring contacts. The exact point of contact is, or should be, determined by a spring loaded stop-pin, engaging in the grooves of a star wheel or sprocket on the channel selector shaft.

The coil disc has two grooves set at an angle which fit two corresponding rises on the star wheel and is held in this position by a retaining nut. The

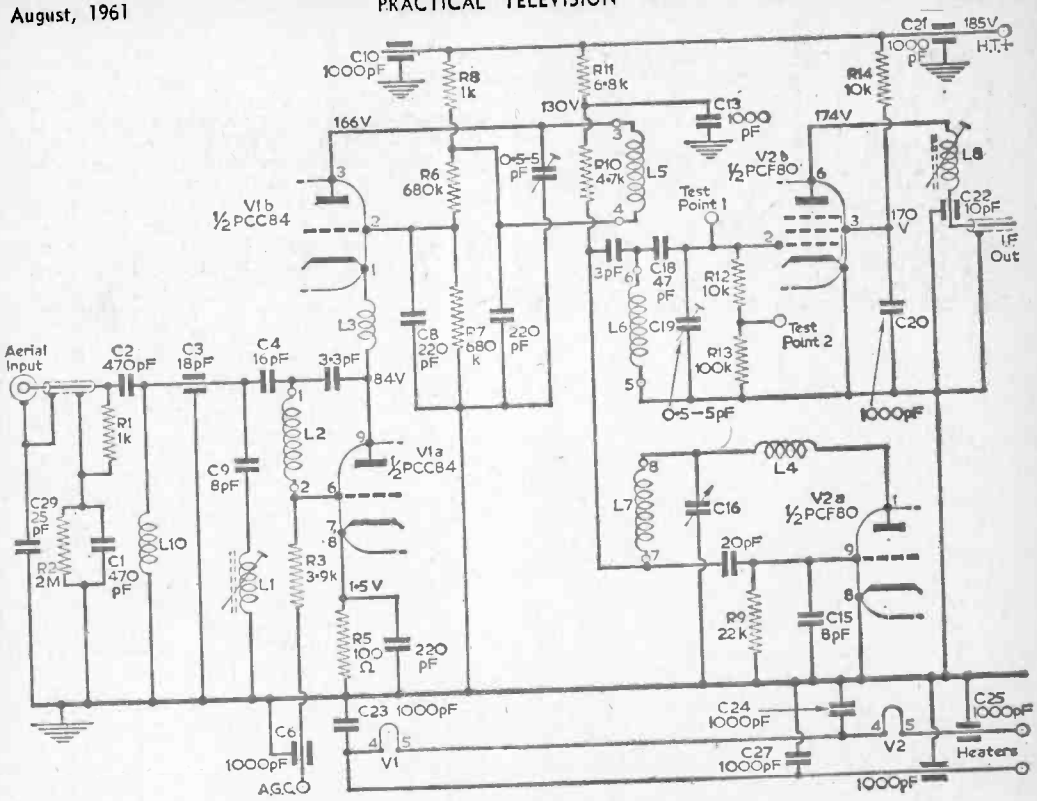


Fig. 3.—The circuit of the tuner.

coil disc and underside of the tuner are covered by a metal shell which has two slots at the top and one at the bottom-centre. This latter fixing, which is a clip fit, may be found soldered. When removing the cover this bottom fixing must be released first to enable the cover to be swung up and off the top fixings. Removal of the cover exposes the coil disc (not the contacts) and circuit components under the valve bases.

Contact Studs and Springs

To gain access to the contact studs and springs, the retaining nut and washer should be removed and the disc lifted off. The coils are connected to silver plated studs on the front face. These studs, of course, tarnish in time and therefore require cleaning in precisely the same way as those on normal turret tuner coil biscuits.

Cleaning the Studs

Different schools of thought exist on this subject of cleaning. It is maintained by some that thorough polishing of the studs is all that is required (and desired); this to be done with a soft cloth using no cleaning fluid or contact lubricants either before or after cleaning. Others support the stud polishing but recommend a light smearing of a proprietary lubricant, such as MS4 or Electrolube to preserve the surface contact and delay further tarnishing. Normal switch cleaner is not advised.

The leaf contacts should be similarly cleaned, and it should be noted that these leaves locate in slots at their free end. *On no account are these leaves to be distorted or kinked* as this can not only

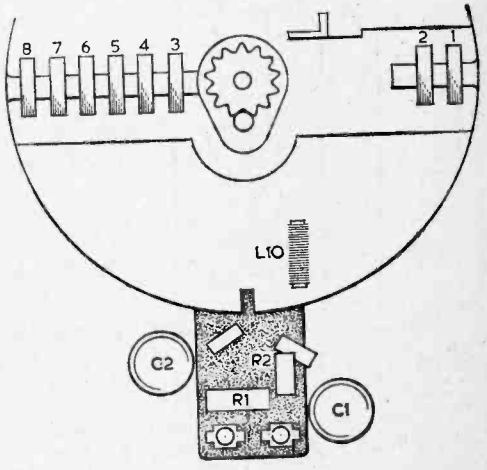
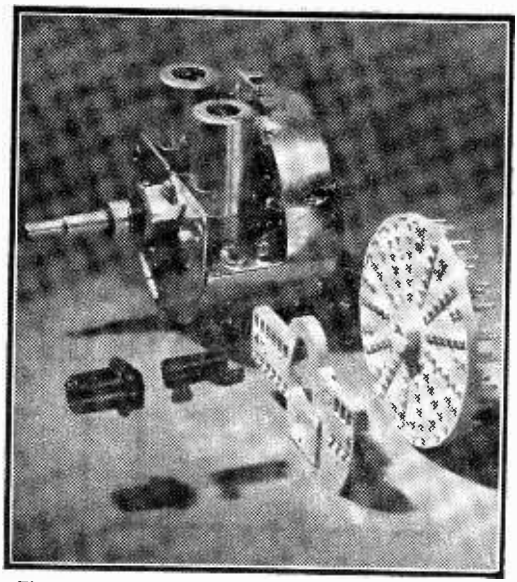


Fig. 4 (right).—The rear of the tuner with the disc removed to show the contacts and the star wheel.



The Fireball tuner with the Bakelite mouldings which form a large part of the tuner.

cause obvious damage, but also failure of the disc to locate properly, as the position is determined by the bow of the leaves rather than the star wheel and stop-pin, which, as previously stated, is spring loaded but not heavily so. When refitting the disc, ensure that the centre grooves engage with the corresponding rises on the star wheel, and tighten the retaining nut to maintain this fitting. When programmes are received in the wrong switch positions and give unreliable reception, it should be ensured that the disc is properly located and the nut tightened.

Circuit Faults

Apart from switch location and poor contact troubles, complaints of poor reception, particularly on Band III are usually the result of a low emission PCC84 or PCC89 valve in the VI position. Note: these valves cannot be interchanged. If the poor reception is not due to local reception conditions or aerial troubles, i.e. the reception has previously been acceptable and the valves are not at fault, check the resistors under the tuner, particularly the H.T. feed resistor(s) of the PCF80 triode section, R10 and R11 in Fig. 3, noting that the value may be found different in varying types of tuner. (Some versions may use only a single 6·8k resistor in this position.) Also check the values of R6 and R7 which should be equal. If V1 and

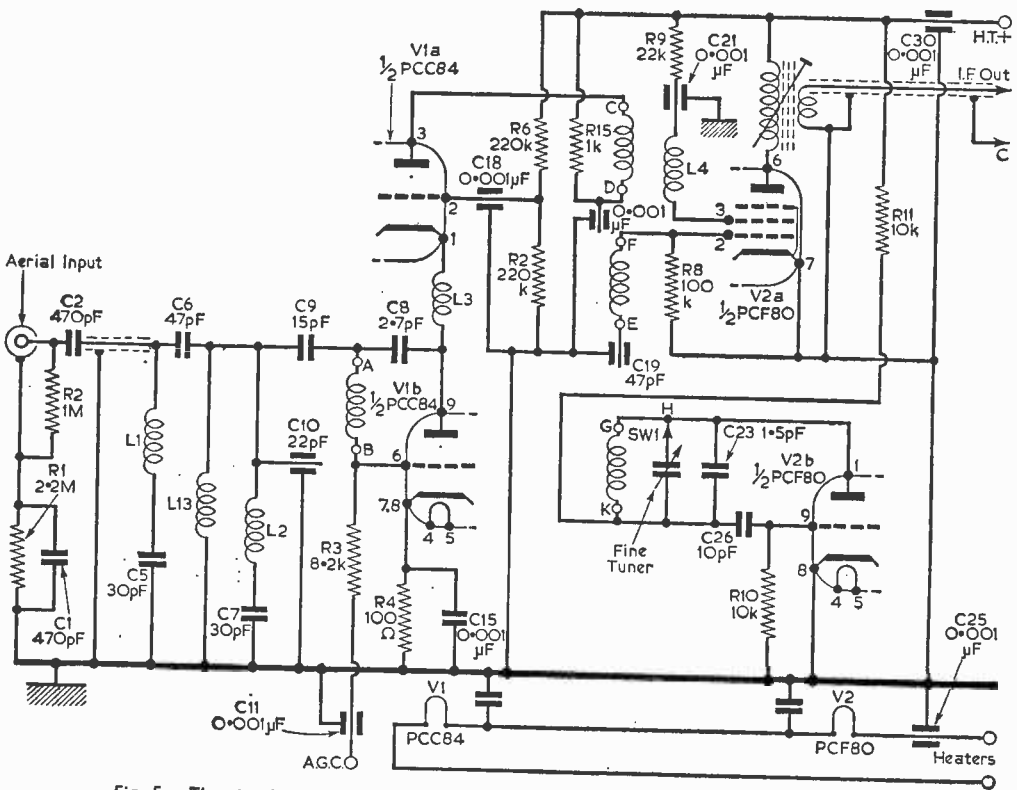


Fig. 5.—The circuit of the unit used in recent Sobell and McMichael television receivers.

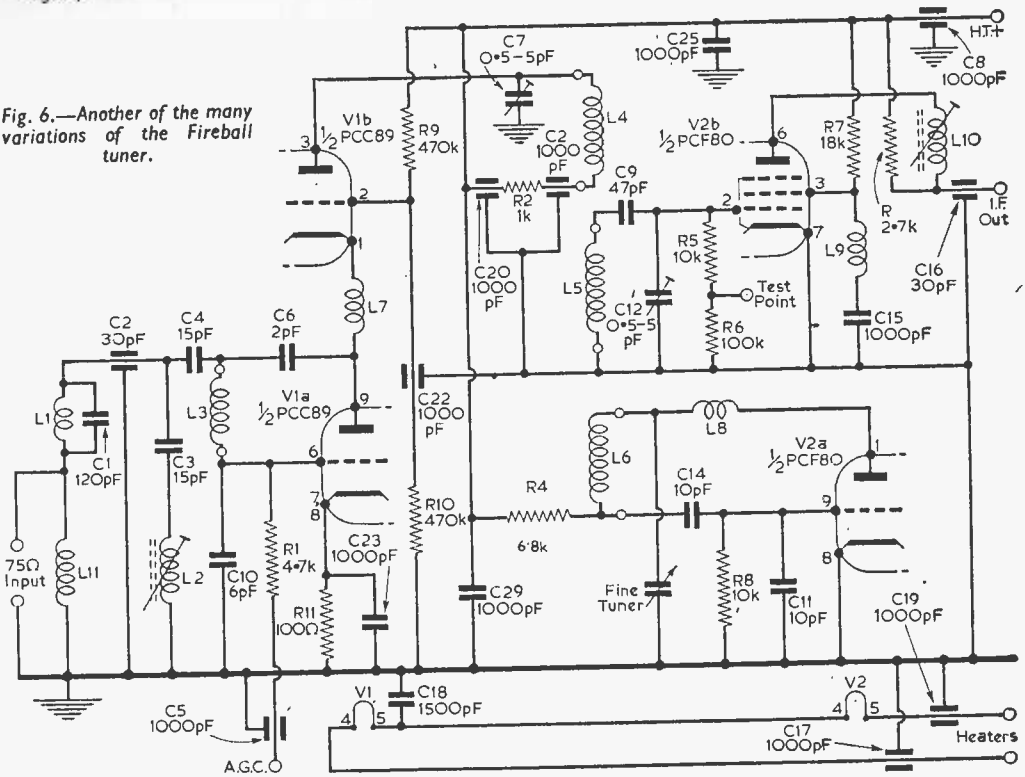
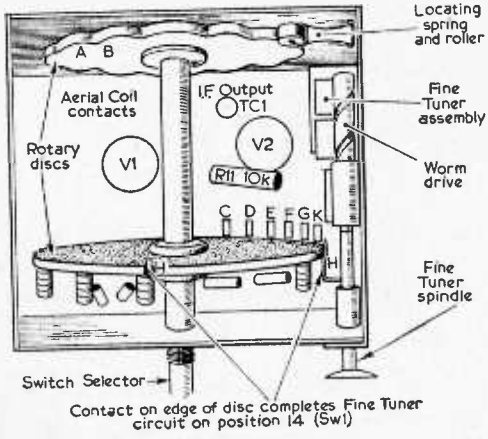


Fig. 6.—Another of the many variations of the Fireball tuner.

V2 are ever accidentally transposed and subsequent reception is nil or poor after the mistake has been rectified, check R5 (pins 7 and 8 of V1 to chassis) and R8 (H.T. feed to V1).

When the fine tuner fails to bring in the required channel, with the selector correctly set, or the sound can only be received with a vision buzz superimposed on it, (not caused by incorrect setting of contrast or sensitivity or excessive signal input) it is necessary to adjust the oscillator coil core for that particular channel.

(Continued on page 572)



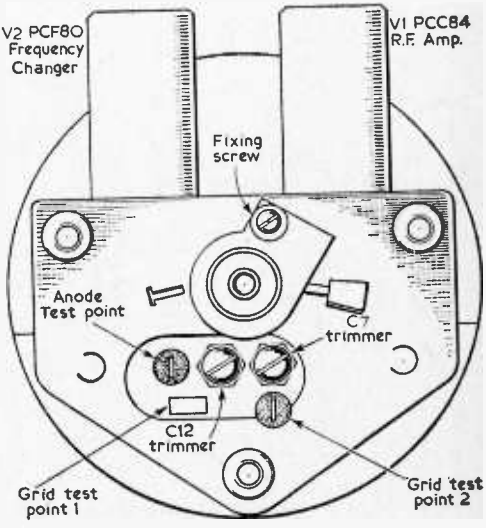


Fig. 7 (left).—The version of the tuner which is used in some Sobell and McMichael receivers.

Fig. 8 (above).—A front view of the tuner, showing tuning and test points.

Underneath the Dipole

A MONTHLY COMMENTARY

By Iconos

SIMPLICITY! That should be the keynote of all art directors, designers, graphics, caption artists or anybody else who is responsible for the visual backings to light entertainment on television.

The simple approach is especially necessary for musical and dancing features, quiz games and the like, where the personalities in the foreground are the centre of attention. "Something Old and Something New"—Associated Rediffusion's late-night musical is a fast-moving cavalcade of song and dance in which the scenery is practically non-existent, but a sense of design is provided by variations of lighting patterns on the background: cyclorama, use of stairways, rostrums etc. A few simple character costumes and stage properties are introduced as required; but for the rest, the main background is provided by the bright cheerful pre-recorded vocal and orchestral music, which sets a cracking pace and gives the choreographer (Ross Taylor) scope for rapid moves without the usual microphone impedimenta. The miming of chorus songs is first rate. Presentation of this kind would possibly appear stark and contrived if the artistes in the foreground were not of the highest professional standard.

In the case of "Something Old and Something New", the foundation of the show is the skilled orchestration which includes dozens of songs old and new, in a cheerful continuous half-hour of familiar music performed by the Cliff Adam Singers and a star guest artiste. The adroit transitions from one tune to another are accomplished with skill and precision by musicians and dancers.

Quiz Shows

Simplicity should be the guiding factor in dealing with quiz shows too. The problem is not quite so easy. Many of the quiz shows have elaborate mechanical and electrical stage props, such as Granada's "Criss Cross Quiz" and Westward's "Ordinary People". Here, the designer has a difficult time in avoiding the patterning and interference caused by visually "busy" backgrounds which are essential parts of the games and competitions.

No quiz game has had quite the impact of "What's My Line", which Maurice Winnick brought over from America to the BBC years ago and which has stood the test of time. This always has the simplest of backgrounds.

Associated-Rediffusion's "Double Your Money" and "Take your Pick" have high ratings because they are not complicated and are very professionally steered by Hughie Green and Michael Miles respectively. It is interesting to note that some of the most successful quiz games are recorded on film and are afterwards cut to the right length, sometimes with contestants transposed in their order of presentation, so that the game can work up to a climax. Give-away and competitive quizzes can be very chancy. There is always the risk of competitors being such morons and so nervous that they can scarcely speak above a whisper, completely putting a damper on the proceedings, with poor entertainment value as the end-product. It is the Question Master's job to draw these people out and make them interesting to the viewer, without subjecting them to ridicule.

Some American companies running television quizzes habitually pre-select their quiz audiences by personal interviews and questioning, to make sure that contestants will be bright and interesting. This is legitimate and

The Rt. Hon. Peter Thorneycroft, Minister of Aviation, recently visited the Mullard research laboratories. The illustration shows him inspecting an experimental colour television receiver.

necessary for the elimination of bores, exhibitionists and cranks—always a danger when a quiz game is sent out live.

Even more dangerous, however, has been the inclination to give contestants clues about their probable questions; a course of action which was inevitably exposed and which pretty well finished quiz games for a time in the U.S.A. Over here, the Independent Television Authorty and the BBC are extremely strict about these things — and woe betide the producer who doesn't toe the line!

The Royal Wedding

Once more, television had a royal outside broadcast day out, when H.R.H. The Duke of Kent and Miss Katherine Worsley were married in York Minster.

Enormous technical and staff resources were allocated to this event both by the BBC and by the ITV—the latter being a joint effort by Tyne Tees, Granada, ABC and others. This joint ITV effort fielded twenty-one cameras, thus being one up on the BBC's total of twenty cameras, although the BBC had six cameras actually in York Minster compared with ITV's five.

It was possible to compare results by viewing the tape recordings later in the day. The presentation by both organisations was first class, though I thought that visually the ITV version had the slight edge on the BBC because of certain unusual following shots of the bride and bridegroom walking down the aisle after the ceremony. One of these was a beautifully operated zoom lens close-up of the bride smiling at her friends as she slowly progressed. On the sound side, however, I thought the BBC put up a better show, the musical balance being superior and the commentary of Richard Dimbleby following his usual quiet and authoritative style for such occasions.

It has been suggested in some quarters that the competitive television coverage of royal occasions is wasteful. I disagree. It is because there is this competition that the job is so well carried out and so well worth looking at, no matter which channel you decide to use. It is doubly interesting to be able to see how the rival networks did the job, thanks to video tape recordings.

The National Anthem

The playing of the National Anthem at the beginning or end of an entertainment has been a custom of many years standing. Its execution has varied from just the first few bars only, hurriedly played by a music hall orchestra, to the elaborate arrangement for symphony orchestra and organ, played at the Albert Hall. Ballet seasons and opera are usually preceded by a full playing, after which it is not played again until the end of the final performance of the season.

The BBC end both sound and television programmes with the National Anthem, as do most of the ITV companies—the elaboration varying according to local tastes and customs. Ulster Television presents a very fine visual and sound anthem at the end of each day's programme—probably the most elaborate and impressive of the lot. Westward commence each day's programme with the anthem including an informal sequence of the Royal Family at home. Granada do not have a National Anthem on television, a regrettable break with tradition.

Opinions differ as to which is the right way to deal with this matter. Personally, I like to hear (and see) the National Anthem at the end of a television programme but would prefer to have its presentation varied a little from night to night, either by different musical arrangement or by a variation of the film sequence.

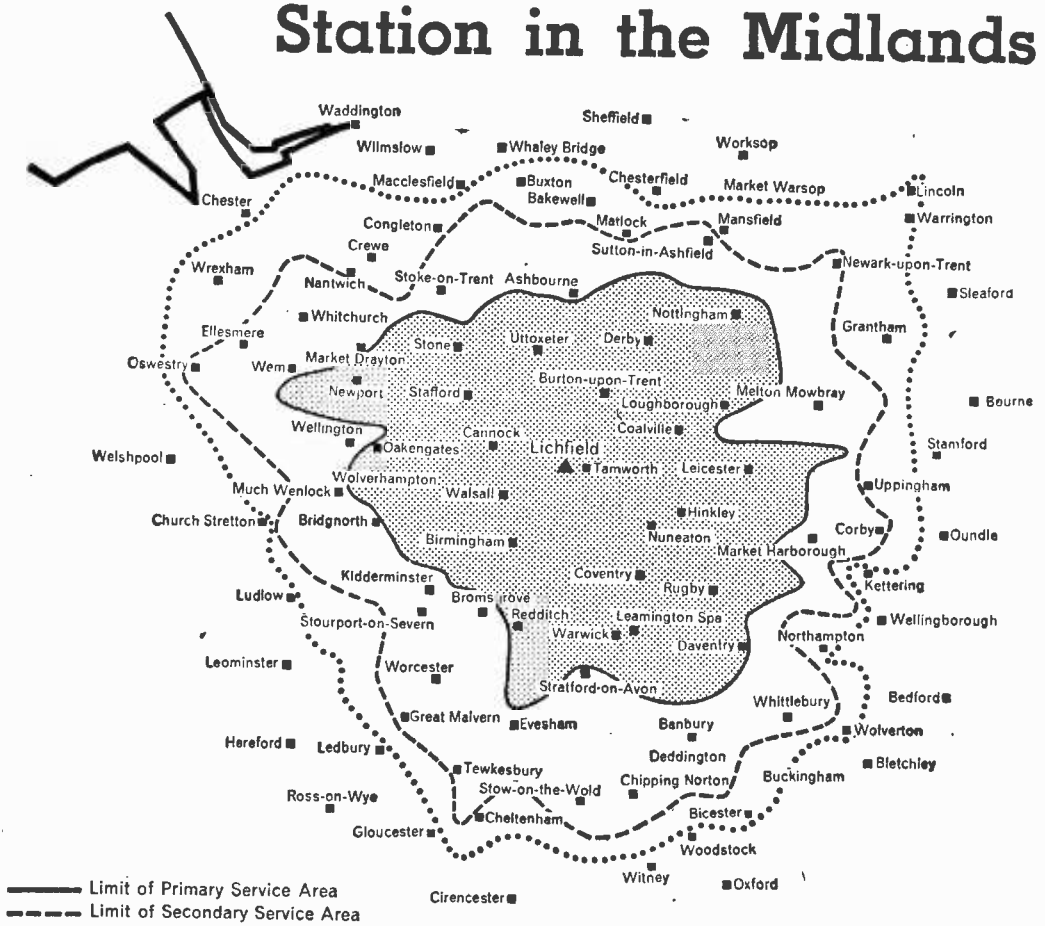
Newsreels

What a wonderful job the television newsreels do, both the BBC and ITA. The country is now literally covered with staff and "stringer" cameramen working for the BBC and Independent Television News. In addition, both services run their own local news supplements, which necessitates the installation of special equipment and the organisation of quite a complicated operation, involving the gathering of the latest news by telephone from reporters and correspondents, supplemented by visual news and interview stories sent in by "stringer" cameramen. Stringers, it should be explained, are freelance cameramen with their own equipment who are on the spot, probably miles away from headquarters.

Visual News

Naturally, the visual news is the most popular and the regional trend is to include as many filmed stories as possible, such as royal visits, sporting events, ship launchings, county shows and laying of foundation stones. In some regions, the faces and chains of office of local mayors must be becoming as familiar as film-star pin-ups!

A New Mast at the ITA's Lichfield Station in the Midlands



The estimated coverage of the new mast.

THIS month, transmissions from the Independent Television station at Lichfield will be radiated by a new 1000ft mast, which replaces the orignal 450ft mast. A directional aerial system also comes into operation, radiating a maximum power of 400kW to the South, 200kW to the North and West, and 100kW to the east. The effect of this will be to increase the total coverage of the station to 7·45 million, and reception will improve throughout the area.

Another improvement which has been recently introduced at Lichfield has been the addition of high-power amplifiers to the standby transmitter. Previously, if a fault occurred in the main transmitter, programme transmissions had to continue on reduced power. In future, if a fault should occur, programme transmission from the standby transmitter will continue, without reduction of power, while the fault on the main transmitter is being rectified.

The Lichfield station is 500ft above sea level, which gives the aerial a mean height of 1450ft. The vision frequency is 189·75Mc/s, and the sound frequency is 186·25Mc/s. The signal is vertically polarised and is received on channel 8.

Trade News

Aerials at Radio Show

AN extensive range of pre-assembled aerials will be exhibited by Aerialite Ltd., at this year's Radio Show. Aerials suitable for mounting in a room or on top of a television receiver will be on show, along with a range of loft-aerials.

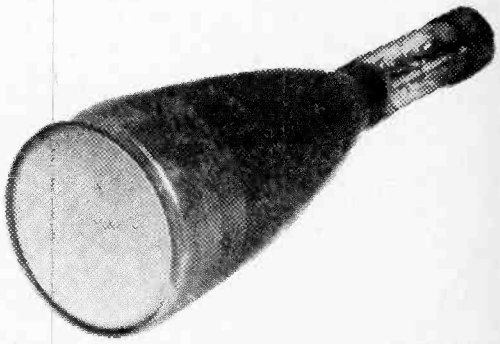
Many television accessories will be on view, including coaxial plugs and sockets, diplexers, triplexers, etc. A copper taped television relay cable, made by Aerialite Ltd., with improved lower attenuation figures, will be featured on their stand. All these items will be shown by *Aerialite Ltd., Aerial and Electronics Division, Hargreaves Works, Congleton, Cheshire.*

Remote Control Colour TV Camera

A NEW colour television camera is now available from EMI Electronics Ltd.

The main advantage of this camera is that it can be sited in positions that would not permit the use of ordinary cameras. It is also remotely-controlled. It can, for example, televise colour pictures from inside a steel furnace at the moment when a charge of metal reaches "white heat".

The camera uses three vidicon tubes and a novel optical system capable of producing good-quality pictures under difficult lighting conditions. It will operate on 405, 525 or 625 line standard. The camera is made by *EMI Electronics Ltd., Hayes, Middlesex.*



A new cathode ray tube, made by The M-O Valve Co. Ltd.

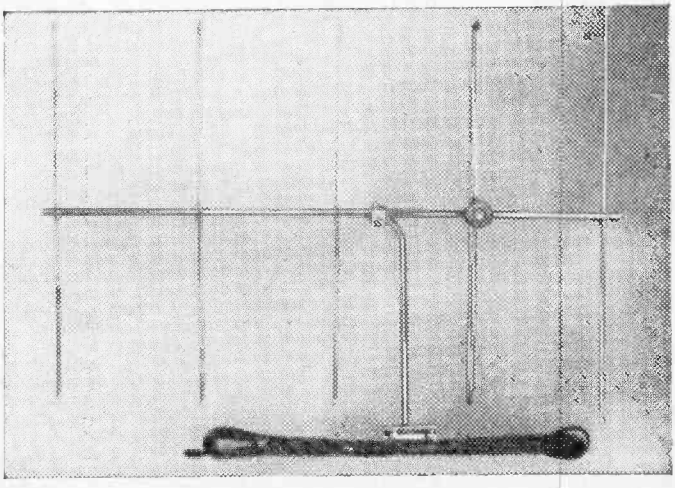
New TV Receiver

THE "Senator" (model 705T) is the first of a new range of television receivers, made by Ferguson.

The model 750T is a 19in. receiver incorporating a 110° picture tube. Push button control on the motor driven tuner, switches to either BBC or ITA, and the 13 channel tuner is easily pre-adjusted to the appropriate stations in the area where the receiver is to be used. The tuner unit also has provision for VHF coils, if and when new programmes start on Bands IV and V.

All of the main circuitry is on two printed boards, placed in easily accessible positions.

Available with this receiver at two guineas extra, is a remote control unit, which will operate the volume, on/off, and channel selector at some distance from the set. The "Senator" costs 68 guineas and is made by *Thorn Electrical Industries Ltd., Thorn House, Upper St. Martin's Lane, London, W.C.2.*



A complete Band III aerial which can be made from a Ben Nevis kit.

Spares Units for TV Cameras

A FEATURE of the Beulah range of closed circuit television cameras is the unit construction which they employ. This allows unskilled labour to be used to replace parts of the camera quickly and easily.

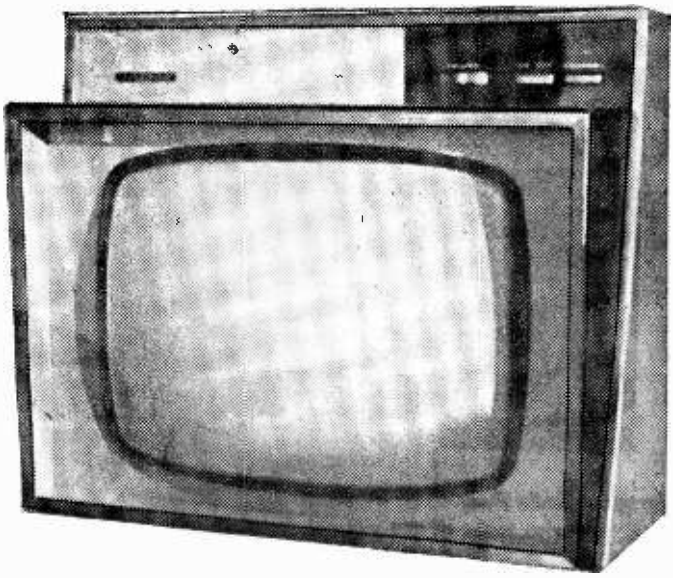
The makers of this camera Beulah Electronics, supply spare-part kits, which consist of a pulse unit, a video chassis,

scanning chassis and a power supply. Never more than nine connections are required in fitting any of these units. The Beulah D800 camera and spares kit are manufactured by *Beulah Electronics, 138 Lewisham Way, New Cross, London, S.E.14.*

Aerial Kit for Band III

ON display at the recent Scottish Council Exhibition, held in London, were several of the Ben Nevis range of aerials, including a kit which, when assembled, makes a complete Band III aerial, for either horizontal or vertical polarisation. These aerials are suitable for use anywhere in Britain and can be mounted on a mast, chimney or in a loft.

Complete with each kit comes 45ft of coaxial cable with a plug already fitted. Ben Nevis aerials are manufactured by *Andrew Sloss, Belmont Works, Belmont Site, Lewis Street, Stranraer, Scotland.*



The "Senator" television receiver, made by Ferguson, features a remote control unit.

New Cathode Ray Tube

THE LD603, a new 5in. instrument cathode ray tube by the M-O Valve Co. Ltd., is currently being prepared for production. By mounting a mesh about an inch behind the screen, this CRT eliminates the loss of deflection sensitivity and scanned area which occurs in existing post deflection accelerators; and the post deflection acceleration of this tube becomes 100per cent efficient.

In the LD603, this principle has been employed to reduce a tube possessing three times the deflection sensitivity of helical p.d.a. tubes, while maintaining a scanned area of 10cm x 6cm. An additional advantage of this method of p.d.a. is its greater freedom from pattern distortion and deflection defocusing. The LD603 has been developed by *The M-O Valve Co. Ltd., Brook Green, London, W.6.*

ADJUSTING TV TUNERS

(Continued from page 567)

This must be done with a thin non-metallic screwdriver inserted into the opening (to the rear of casing, on the V2 side) adjusting L7 for optimum sound. The location as indicated is on the left side, with the tuner in an upright position and viewed from the front. On no account must a larger tool than necessary be used and only very light pressure is required. Failure to observe this will result in damage to the oscillator coil and former.

Semi-Incremental Tuners

In recent years Sobell and McMichael receivers have been fitted with fourteen-position switched tuners of the above type. This tuner is larger than the "Fireball" and uses two rotating discs, one carrying the aerial coils and segments, the other the R.F. and oscillator.

The fine tuner, which is worm driven, is only fully contacted in the fourteenth position which is VHF/F.M. Its effect on Band I is therefore a little restricted and this tends to necessitate realignment of the Band I oscillator coil core occasionally.

Oscillator Tuning

This is carried out from the front of the tuner, this being exposed by removing the side knobs and panel. The selector is switched to the desired channel and the fine tuner is turned midway. Access to the oscillator cores is by three holes in the front of the tuner. When only one core is visible this should be set for *maximum sound.* When two cores are visible the core nearer to the fine tuner spindle should be adjusted for maximum sound.

Servicing

The unit is held by three 4B.A. screws. With these removed and the connecting leads unsoldered, it can normally be removed through the side of the chassis. Always ensure that the nylon lug engages the hole in the coupler unit on the fine tuner spindle, when refitting.

Resistor Check

The notes referring to the PCF80 triode section anode feed resistor mentioned in connection with the Fireball tuner should also be applied to the Sobell model. A single resistor R11 is used and the value is 10k. Weak Band III reception or no reception on one or all bands should direct attention to this resistor after the valves have been checked. ■

Letters to the Editor

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

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

TELEVISION AERIALS

SIR,—I have noted in the past that readers have asked questions concerning the reception of two or more stations; where they were able to pick these up. What is the position, however, where a viewer is able to receive two stations, one of which is vertically, and the other horizontally polarised? Does one have to rotate the aerial, or does it mean that yet another monstrosity has to be put on the roof. What with F.M., normal radio and the TV our houses will soon have to be specially designed to carry the aerials—or is there some way in which all of these, including right-angled polarisation, may be received on one aerial—perhaps of a type which has not yet been designed.—G. BATES (Northampton).

NOVEL AERIAL

SIR,—After reading the letter by N. A. S. Payn in the June issue, I thought perhaps he and other readers might be interested to know that I have been operating a receiver for a long while on little more than a yard of unscreened multistrand wire, and obtaining a very good picture.

The wire hangs from a picture rail and is connected to the centre pin of the aerial socket. However, a few weeks ago a new television was installed and when both new and old are on together (on BBC), the sound on the older model breaks through on to the vision. When the new receiver is switched off the interference stops. I assume that this is due to the simple aerial of the old television.—D. E. O'CONNOR (Wanstead).

CHANNEL CHANGING

SIR,—Of late the programme material has deteriorated on both channels so that it has become necessary for me to make more constant changes from one channel to another. Previously, I could tolerate one channel an evening, but I find that now I sometimes have to change five or six times in one evening, and I think that the modern tuner is unsuitable for this purpose. I have to go through eight unused channels before I obtain the new station, and I would have thought it would not have been beyond the capability of the manufacturers either to have made a tuner with wafers which could be arranged so that the viewer in any part of the country could re-position them so as to bring his alternatives next to each other, or to make tuners with just two switched positions (or three perhaps)—again with wafers to suit the locality. In the absence of such units, could not someone tell us how to modify the more popular tuners, i.e. Cyldon, Fireball, etc., so as to obtain this desirable feature?—F. R. OLIVANT (N.W.).

COLOUR TELEVISION

SIR,—It is very obvious that on many transmissions which are now radiated, the colour system is being used. No doubt this is for the benefit of certain sections of the BBC and ITV, but it is very hard on the poor viewer, who is not at the moment interested. If you look closely you can see there is a "walking" pattern over the picture, and the contrast is very much poorer than a standard black and white transmission. We are told that the colour system, when it is adopted, must be compatible, but it appears to be far from that at the moment. Another thing I would like to criticise is the way the producers play about with the lighting, doing clever tricks with light and shade. I suppose they call it arty-crafty, but unless you are prepared to keep adjusting your contrast control, you do not know whether your set is going wrong or they are just being clever. In the Black and White Minstrel shows, for instance, the faces are lost most of the time, and how often do we see singers in deep shadow, without the slightest details to help us to identify them? Could not the lighting be standardised so that we would know our sets were all right?—D. G. BEST (Watford).

SIR,—I noted in a recent press report that the tubes which are now being used in experimental commercial colour receivers are of American origin, and are actually imported under licence as no British manufacturer is allowed to manufacture them. This is surely a bottle-neck which must be broken! Are we to rely upon an imported item, without which the set will not function? It is to be hoped that sooner or later an alternative to this complicated system of colour television will be invented in which standard items will be used—or, at the very least, in which a much simplified form of tube may be employed. It would appear that there is still much to be said for the use of rotating glass filters which could be used with standard tubes. Did I not see, at an exhibition some time or another, a scheme in which three standard tubes, each with a separate coloured filter in front of it, were so placed as to be seen simultaneously through a single opening in the cabinet, and the combined image was in colour and indistinguishable from the orthodox colour picture as seen on a modern tube? Perhaps some reader has technical details of such a scheme or can remember the details and maker. —F. R. WESTBURY (Penge).

SIR,—I was most interested in your articles on colour in the last two issues, but this will not be of much use for receiving modern colour systems. Cannot something be published which will help us to construct units to add to our sets to pick up the experimental transmissions? I know that the tubes cannot be obtained, but is there anything which would show how the test was proceeding? I feel that there is a real need here for one of the service engineers on your staff to produce something for the home constructor as this will afford us a vast new field for experiment.—D. J. ATKINS (Gloucester).

AN UNUSUAL FAULT

SIR,—I recently experienced erratic effects on my TV set, and finally found a trouble which might occur to others and the experience might be of assistance to your readers. The frame kept collapsing, and operating the frame hold control would restore it only temporarily. I finally bought a new control, but the effect was still there. A substitute valve was to hand but gave no improvement. It was decided, as it happens, correctly, that the oscillator stage was responsible, and all parts in this stage were removed and tested on an R/C bridge, and apart from two resistors, tests were satisfactory. The resistors were replaced and all parts were put back and that evening the same trouble recurred. To cut a long story short, after much testing, the charging condenser in the oscillator stage was found faulty, in the form of an intermittent open circuit. When tested on the bridge it functioned correctly (no voltage across it?), but under use it broke down periodically. It would appear, therefore, that when testing condensers, the maximum voltage should be put across them, but perhaps peak voltages might be important also.—F. TRIMBLE (Lewisham).

MAINS FREQUENCY LOCKING

SIR,—A fault which I often see on friends' sets is false line lock, where a dark line appears across the middle of the screen, with the bottom of the picture at the top and vice versa. I believe this is due to the mains frequency triggering the frame timebase, but I am not sure of this. The frame frequency is 50c/s and this would appear to be due to the fact that the mains are, in fact, employed in the transmitting circuits to triggering, and if so, how can they prove stronger than a signal, or is there some more intricate reason for both the 50c/s frame frequency and the false line lock? I would be glad to see a discussion on this subject. —R. MEADOWS (Harrow).

LONG-DISTANCE RECEPTION

SIR,—I would like to know of anyone who has picked up television signals up to a hundred miles or more. I have done this at different times on channels 9, 10, 11, 1, 2 and 5. The signal strength varies. I have achieved this by juggling with the tuning coils at the back of the set, but am always able to put them back in their original places to receive normal channels 8 and 4. Channel 9 Granada television is the strongest of all the ITV channels; channel 2 is usually the strongest of all the BBC channels. Horizontal lines moving down the screen spoil the signals and, at times, the London ITV transmitter interferes with the signals coming in from the north on the same channel and helps to spoil the northern picture, which is always stronger. The aerial is an ordinary BBC dipole with a 5-element ITV combined. I am very interested in TV reception and would be very pleased to hear from anyone else who has picked up television signals from a transmitter that is 100 miles or more away from the receiving point with an aerial of the type I have mentioned.—R. FRANKLIN (105 Redditch Road, Studley, Warwickshire).

MANUFACTURERS' SURPLUS

SIR,—From time to time your pages carry advertisements from firms who deal in the supply of surplus items. Many of these look most attractive and seem, on the face of it, to be suitable for a particular purpose. However, one is rather doubtful about using them, and the manufacturers will not, naturally supply information about them. I remember some time ago you did a complete instrument built from such parts, but the difficulty is that stocks are limited. Would it not be a good idea for the firms dealing with such items to issue leaflets giving the most salient details so that those of us who are interested could try and make conversions where necessary or could adapt our equipment so as to make full use of them? I feel that there is a very good need for such information. —G. BANGAY (Lowestoft).

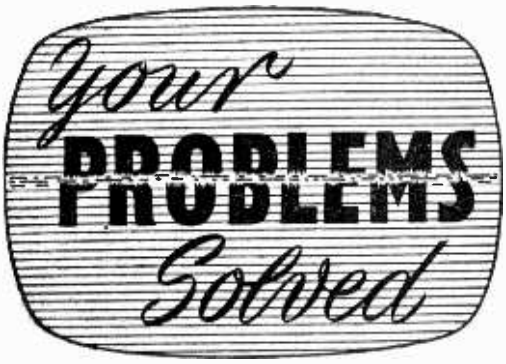
INDOOR AERIALS

SIR,—I would like to point out that many cases of unsatisfactory results with indoor aerials are due to pipes and similar items inside walls. I recently called on an acquaintance and he was sadly bemoaning money spent on a popular "V" type of indoor aerial. I told him I thought they were very good and he switched on and showed a very poor picture which no adjustment of the arms of the "V" would improve. I then moved the aerial a few yards to the side and he was astounded at the improvement (he thought the aerial had to stand on the set!) The trouble here was that there was a comprehensive run of hot and cold water pipes in the wall immediately behind the set and these screened most effectively the aerial from his particular local station. It was also found in this particular case that opening and closing the door made most remarkable variations in the brightness of the received signal.—R. BARRINGTON (Highbury).

PAY-AS-YOU-SEE TELEVISION

SIR,—In Canada, I believe, "Pay-as-you-see" TV is already past the experimental stage, and in one region, at least, is used by many of the viewing public. When, I wonder, will we see this development in Britain? Its advent will almost certainly draw as much attention as the long-discussed colour and line standard problems, and will probably give rise to even more controversy.

From what I have read about this system, the programmes are carried through wire to the receiver and not as transmitted signals. Is this the only possible means to obtain pay-TV, or can our present system be modified to give the same results? Surely an addition could be made to existing receivers so that the amount of television seen could be controlled in the same way that gas is used from a gas-meter. This would, I am sure, make a satisfactory arrangement.—K. AUSTIN (Pershore).



Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 583 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

DECCA 222

This set is for use with 200-250V 50c/s A.C. mains. The set receives BBC only. I should like your advice as to the most suitable converter to use, how much work is involved and the approximate cost of converting this set.—W. Lewis (Port Talbot).

The Decca 222 can be very easily converted by the use of a Cyldon P10L or Brayhead 10s turret tuner. If purchased at the retail price as advertised these have R.F. and mixer plugs which simply replace the V1 and V2 EF80 valves respectively. V1 is the rear right side EF80. V2 is to the right of the triangular tuner unit. You will require the unit, an aerial suitable for the area, and cable. The approximate cost is £10.

STELLA ST2717U

I have used this set in the Midlands for three years, and six months ago I came to North Wales and used the same attic aerials. I have had good results until recently, when I changed from ITV channel 9 to BBC channel 2. The picture narrowed on the screen, dark down the centre with a lighter picture on the sides, causing a double and treble picture. Would you enlighten me as to what is the cause? I followed the instruction booklet for the width control, but this does not have any effect.—T. Treadwell (Llandudno).

First try a replacement PL81 line oscillator/output valve. Then test the PY32 and ensure the ion trap magnet on the rear of the tube neck is correctly adjusted and that the controls are correctly set up; line hold, etc. The PL81 is the valve next to the PY81 on the right side as viewed from the rear (with top caps to each).

BAIRD P2017

The following faults have developed in my set: vertical lines broken; picture breaks up (this is not a complete break up, but takes the form of a horizontal bar varying in width in lower half of the screen).

The vertical lines are straightened if the contrast control is advanced to a point where there is hardly any difference between black and white, this also clears the bar effect. The bar is also cleared for a short time when the line hold control is turned to the right. (Altering volume control does not have any effect.) When the volume control is advanced operation of contrast control causes a scratching noise in the loudspeaker.—B. Morgan (Caerphilly).

There is a 5pF capacitor between pin 6 of the sync separator (frame oscillator) ECL80 (V9) and the line oscillator (frame output V10) ECL80, pin 1. Change this capacitor and check other sync separator components. Examine picture for ghost images and resite or redirect aerial if necessary to clear these.

VIDOR

I would like to change the valves in this set for new ones but the numbers have worn off and the dealers say they cannot test them without knowing the valve numbers. Also the picture has closed up into a line across the screen. Can you tell me the trouble? The sound is perfect and normally the picture is very good.—R. Franklin (Burton-on-Trent).

We would advise you not to replace the valves unnecessarily. You should replace the 6K25 (grey metallised valve on the left centre); first check the EL41 on the rear right side, and if necessary the 0·5μF capacitors under the chassis near the 6K25 valve base.

MARCONI V.T. 68DA

The fault on this set is short frame scan. This is about ¾in. top and bottom when the set is first switched on and will creep up and down equally to about 1in. top and bottom. There is also a fault in the tuner and I get white splashes going across the screen from right to left when the set is switched to BBC but the raster is correct when switched to the other channel. As this is an incremental tuner I notice that after a certain point is reached as I go from channel 10 to 3 I get the splashing effect.—J Blackshaw (Glasgow).

To cure the lack of height, replace the LN152 frame oscillator output valve. If there is no improvement, check associated resistors and capacitors. The splashing effect is likely to be due to poor contact on one of the tuner switch banks or the pressure of a component against a contact. Check by probing with an insulated tool. The effect could be caused by instability in the tuner or I.F. circuit: check decoupling capacitors.

DEFIANT TR1453T

Although I have been unable to obtain a service sheet for this set I have a service sheet for a Marconi V.T.63DA which looks the same. Can you tell me if they are the same?

By mistake I put a wrong valve, EF80, instead of ECL80, in V9. Smoke came from the set and PL81 now glows red hot inside, and there is now no line whistle and no EHT. Underneath the T5 transformer is a pile of wax, which seems to have melted from the transformer. I think T5 is a line blocking oscillator transformer, but when I sent it to a firm advertising in your magazine, they informed me that there is no line blocking

oscillator transformer in this model. All the numbers have been taken from the Marconi service sheet.—J. Bendle (Bishop Auckland).

The VT63DA is almost identical to the TR1453T and a line-blocking oscillator transformer is most certainly used. The transformer is probably burned out due to the fact that in an EF80 valve pins 1 and 3 are both cathode connections. This means that H.T. would be applied to pin 1 via the transformer and this direct to chassis through pin 3 of the V9 base.

REGENTONE

This is a second-hand model and although there is no number on it I believe it is a Big 12. I am having trouble with the sound which takes about 15 minutes to become audible, even then with the volume full on it can only just be heard. The valves in the set are 10F1, 30C1, 10C2, 2001, 20F2, ECL80, etc. From this information could you tell me what the trouble could be and the type number of the set?—B. Jones (Pontllanfraith).

Your letter suggests the receiver has a 12in. tube. The valve details given, however, do not substantiate this and the receiver is more likely to be a Big 15/5 or 15T with a 15in. CRM152B tube. In any case you will find the trouble is on the right hand side as viewed from the rear. Check the 10F1 and 10P13 valves and the base voltages, audio coupling capacitors, noise limiter, etc.

COLUMBIA C506

I wish to modify the receiver to receive UTV programmes as well as the BBC. I have unfortunately been unable to obtain a wiring circuit. Perhaps you could advise me regarding the I.F. frequency as I would like to fit either a G.E.C. or Cyldon tuner units advertised, by modifying the oscillator coil.—A. Gent (Co. Antrim).

The Columbia C506 is almost identical to the Sobell T144. The I.F. is 16-19·5Mc/s. A Cyldon P16H turret tuner is suitable. When fitting remember that V2 is an ECL80 (rear left) and that the anode pin of this is 6, not 7 as in the case of an EF80. The rear centre EF80 (V1) can be directly replaced by the R.F. plug.

INVICTA T120

A black line flickers every few seconds across the bottom half of the picture. It also appears to cramp slightly at the bottom. There was a black band at the bottom of the picture, but I have changed PL82 which has cured this, but the flickering and cramping still persist. The brilliance seems to be slightly unstable, especially on outside broadcasts.—A. Nichols (Liverpool).

Check C42 and C43 capacitors and ensure a good contact of the height and linearity controls. We are not sure of what is meant by unstable brilliance. Ensure the EF80 valves are seated properly in their holders. We will advise you further if necessary.

ALBA T321

The trouble is that the picture is stretched on the left. The horizontal form control has little effect on this side of the picture although it increases the width slightly.—K. Stone (Somerset).

You should check the 10k 5W resistor, wired across the horizontal form coil. If this is of the correct value, check the 3·3k 3W resistor to pin 8 of the PL81.

PHILIPS 1502U

The fault on the above set is as follows: hardly any sound is received: frame instability, receiving three horizontal pictures. The valves and electrolytics have been tested and are all in order. T3, a blocking transformer, was found to be open-circuited and was replaced, but the fault was still present. The H.T. was correct. Both faults appear together. The CRT and three electrolytics, C20, C57 and C75 were renewed 12 months ago.—G. Harris (Canvey Island).

Since you state that the valves and electrolytics are not at fault (we would have suspected electrolytic trouble) we can only suggest that you check the alignment with particular reference to the oscillator trimmer. If the alignment is in order, check the decoupling capacitors by shunting each in turn.

PAM 751

The picture is unobtainable when switching on without first adjusting horizontal hold. The setting required may be at any position of the control when the picture locks—usually a different position each time. Then the picture is perfect. After a time—sometimes an hour, sometimes a minute or two—the picture breaks up into a series of lines. By chance I noticed that by switching off and on the picture is often restored. This has happened before and the set has been in for repair on several occasions, usually with a bill for a PCF80 amongst other things. A new tube was put in in 1959, Mullard 36/44 and new PCF80 early 1960.—N. Allen (Norwich).

Your symptoms are usually caused by a faulty PCF80 as the line oscillator stage is a critical one in which only first-class valves will operate correctly. Later versions of the set use a modified line oscillator circuit, and this modification which virtually entails rebuilding the entire stage, can be fitted to your set and is well worth while. Pam dealers can obtain details and kits of parts from the manufacturers service organisation, where the modification is usually referred to as the "Green Spot" modification.

MURPHY V178C

Whilst servicing this set for a frame fault, I found that a black lead to tube cathode had come adrift. At 6F13 is video amplifier and the lead reaches to tag-board under this valve. I cannot find any clean copper showing on the tags, so could you tell me which tag I should reconnect to? —J. Ralph (Nottingham).

We cannot give you the precise tag to which the black wire is connected, but you will find it is at the end of the 4·7k video amplifier anode load, which is connected to the anode (pin 2) of the 6F13 video amplifier. We feel confident that you will be able to find the tag from this description, but if not, take the wire directly to the anode pin of the 6F13.

BUSH TV24C

Would you let me know the purpose of the magnet clipped round the line output valve (PL81)

of this set? Is the magnet position critical?—G. Byrne (Ilford).

Some line ouput valves have a tendency to self oscillation which gives rise to interference on the left side of the screen. The purpose of the magnet is to damp out any tendency of this in the PL81. It is more effective in doing this in one position than any other. If there is no sign of a ragged line down the left side there is no need to alter the magnet in any way.

K.B. MV50

This set has two distinct faults. On ITV there is severe line pulling (whites cause the picture to shift to the left) and sometimes a line appears about ½in.-1in. from the top, and the whole picture above this line is displaced to the left by about 1in. The picture does not bend, but shifts solidly and squarely, especially if the picture content is white. The width is just sufficient on the tube, but still fills the mask. A reasonable picture, without pulling, can be obtained by turning the fine tuner to its limit, but then there is no sound, only a loud hum.

The other fault is an intermittent BBC picture. On investigation it was found that the contact on the BBC coil set, in the tuner, was very worn. The contact in question is the fourth from the front on the channel set. Since I cannot find any marks identifying the tuner, I am unable to order the coil strip.—P. Bardos (London).

The effect you describe is most likely to be caused by "ghost" reflections (reflected signals) on the aerial. First try rotating the aerial a few degrees and if this does not help, resite the aerial or use a more directional type.

The correct BBC coil biscuit should be ordered from your K.B. dealer, specifying the channel required, and the model number of the receiver.

G.E.C. BTI746

There is sound-on-vision on ITV only, and this cannot be corrected by the tuner trimmers. Also the contrast control does not affect the picture as much as it should. Is there any way to omit the Barretter valve as this only short lived; can it be replaced by a resistor?—G. Wilson (Cheshire).

If the sound-on-vision is on ITV only and it cannot be corrected by the oscillator trimmer on the tuner unit, we suggest that too much signal input is being received on ITV. Attenuation or a different position for the aerial is the answer. The Barretter valve can be omitted and a 35Ω resistor put in its place; at least 10W.

PYE VT4

The picture recently broke up and could not be held by adjustment to the vertical and horizontal hold controls. Replacing the two ECL80s with two new ones and also two from a set working normally, would not cure the fault. The sound has also developed a hum. Whilst trying to adjust it I found positions when the picture remained still, momentarily, and it appeared normal at the bottom, but large and off the screen at the top and increased considerably in brilliance.—W. Cummins (Virginia Water).

Faulty main smoothing may well be the cause of your trouble. Check the 100μF and 200μF electrolytic condensers and also check for heater-cathode leakage on the frequency changer and R.F. amplifier valves.

EKCO TRC1124

This set develops a ½in. foldover at the bottom of the screen. I have changed several valves with little effect and would be grateful for any help you could give.—W. Young (Worcester).

Your trouble is centred around the SP61 which is in the centre of the row of three valves below the scan coils. Check for poor valveholder pin connections and a leaky 0·01μF condenser from the frame linearity control to height control.

FERGUSON 996T

I obtained this receiver quite recently. The sound is good though contrast is a little harsh and there is a series of bright perpendicular lines of varying intensity from the left hand side of the picture (maximum) to centre (minimum). I have tried a change of valves including PY81, PL81, PCF80s and EF80s in video and timebase circuits, but with little improvement.—L. Colledge (Abertillery).

Check the resistor and capacitor which are connected in parallel with the line linearity induction. Suspect a fracture in the core of the line output transformer.

FERRANTI 20T4

This projection set has the following fault. The raster is cut by a number of horizontal blanked out lines. These are spaced equally, about every tenth line, and they roll upwards. Otherwise the picture is satisfactory, apart from a general lack of brightness. The line hold control is working satisfactorily.—B. Harvey (Cardiff).

You should check the frame output valve and check the electrolytic capacitor (32μF) wired to pin 8 of V13 (ECL80), situated on the front left side. The 32μF is one of the sections of a 32 + 32 + 8μF can in the centre of the chassis.

STELLA ST1522U

The picture on my set rolls upwards and downwards and will not lock. Can you suggest a remedy?—T. Cox (Hull).

Check the electrolytic capacitors associated with the video amplifier (50μF and 5μF) which are of the white cardboard covered type. Then check the components associated with the UCH42 frame sync clipper.

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ALUMINIUM PANELS. 18 s.w.g. 12in. x 12in., 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3.

JASON F.M. TUNER COIL SET, 29/-. H.F. coil, aerial coil. Oscillator coil. Two I.F. trans. 10.7 Mc/s Ratio Detector and heater choke. Circuit book using four 6AM6. 2/6.
COMPLETE JASON F.M. KIT. FMTI, with set of 4 valves, etc., £6.5.0.

BBC TRANSISTOR RADIO. Med. and Long Wave. Two transistors and diode. Complete kit, 32/6, phones 7/6 extra. Deaf Aid Earpiece with Special Lead, 12/6. Details 6d.

465 Kc/s. SIGNAL GENERATOR. Total cost 15/-. Uses B.F.O. Unit ZA 30058 ready made. **POCKET SIZE** 2½ x 4½ x 1in. Slight modifications required, full Instructions supplied. Battery 7/6 extra 69 v. + 1½ v.

I.F. TRANSFORMERS 7/6 pair
465 Kc/s Slug Tuning Miniature Can. 1½ x ⅞ x ⅞in. High Q and good bandwidth. Data sheet supplied.

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4 Speed Autochangers, B.S.R., U.A.8	£6.15.0
4 Speed Autochangers, B.S.R., U.A.14	£7.10.0
Collaro Autochanger	£7.19.6
Garrard Model 210, GC8 Head	£10.10.0
4 speed Single Players, EMI	£6.5.0
Garrard TA Mk.II, GC8 Head	£8.0.0
Garrard Model 4SP GC8	£6.17.6
Garrard Stereo Head, £2 extra.	
Suitable player cabinets (except 4 H.F.)	49/6
Amplifier player cabinets (except 4 H.F.)	63/-
2-valve amplifier and 6in. speaker	79/8
3-valve amplifier and 6½in. speaker	95/-

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Volume Controls Long spindles. Guaranteed 1 year. 5K ohms to No Sw. 3/- Midget 2 Meg. D.P.Sw. 4/8 Linear or Log Tracks.

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COAX PLUGS ... 1/- **PANEL SOCKETS** 1/- **BALANCED TWIN FEEDER** yd. 6d. 80 or 300 ohms. **DITTO SCREENED** per yd. 1/6. 80 ohms only. **WIRE-WOUND POTS, 3 WATT.** Pre-set Min. TV Type. All value 25 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-). **WIRE-WOUND 4 WATT.** Pots Long Spindle Values. 50 ohms to 50 K., 6/6; 100 K., 7/6.
CONDENSERS. New Stock. 0.001 mfd., 7 kV. T.C.C., 5/6; Ditto, 20 kV., 9/6; 0.1 mfd., 7 kV., 9/6; Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1, 1/-; 0.25, 1/6; 0.5/500 v. 1/9; 0.1/350 v., 9d.; 0.01/2,000 v. 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6.
CERAMIC CONDS. 500 y.. 0.3 pF to 0.01 mfd., 9d. **SILVER MICA CONDENSERS.** 10% 5 pF to 500 pF, 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance (± 1 pF) 1.5 pF to 47 pF, 1/6. Ditto 1% 50 pF to 815 pF, 1/9; 1,000 pF to 5,000 pF, 2/-.

NEW ELECTROLYTICS. FAMOUS MAKES

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1/350v.	2/-	50/350v.	5/6	16/450v.	5/-
2/450v.	2/3	100/25v.	2/-	32/350v.	4/-
4/450v.	2/3	250/25v.	2/6	100/270v.	5/6
8/450v.	2/3	500/12v.	3/-	2,500/3v.	4/-
8/500v.	2/9	8+8/450v.	3/6	5,000/6v.	5/-
15/450v.	3/-	8+16/450v.	3/9	32+34/450v.	6/-
15/500v.	4/-	8+16/500v.	5/6	32+32+32/350v.	7/-
32/450v.	3/9	16+16/450v.	4/3	50+50/350v.	7/-
25/25v.	1/9	16+16/500v.	6/-	64+120/350v.	11/6
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CONTACT COOLED 250 v. 50 mA, 7/-; 60 mA, 8/6; 85 mA, 9/6; 200 mA, 21/-; 300 mA, 27/6.
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