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APRIL 1963

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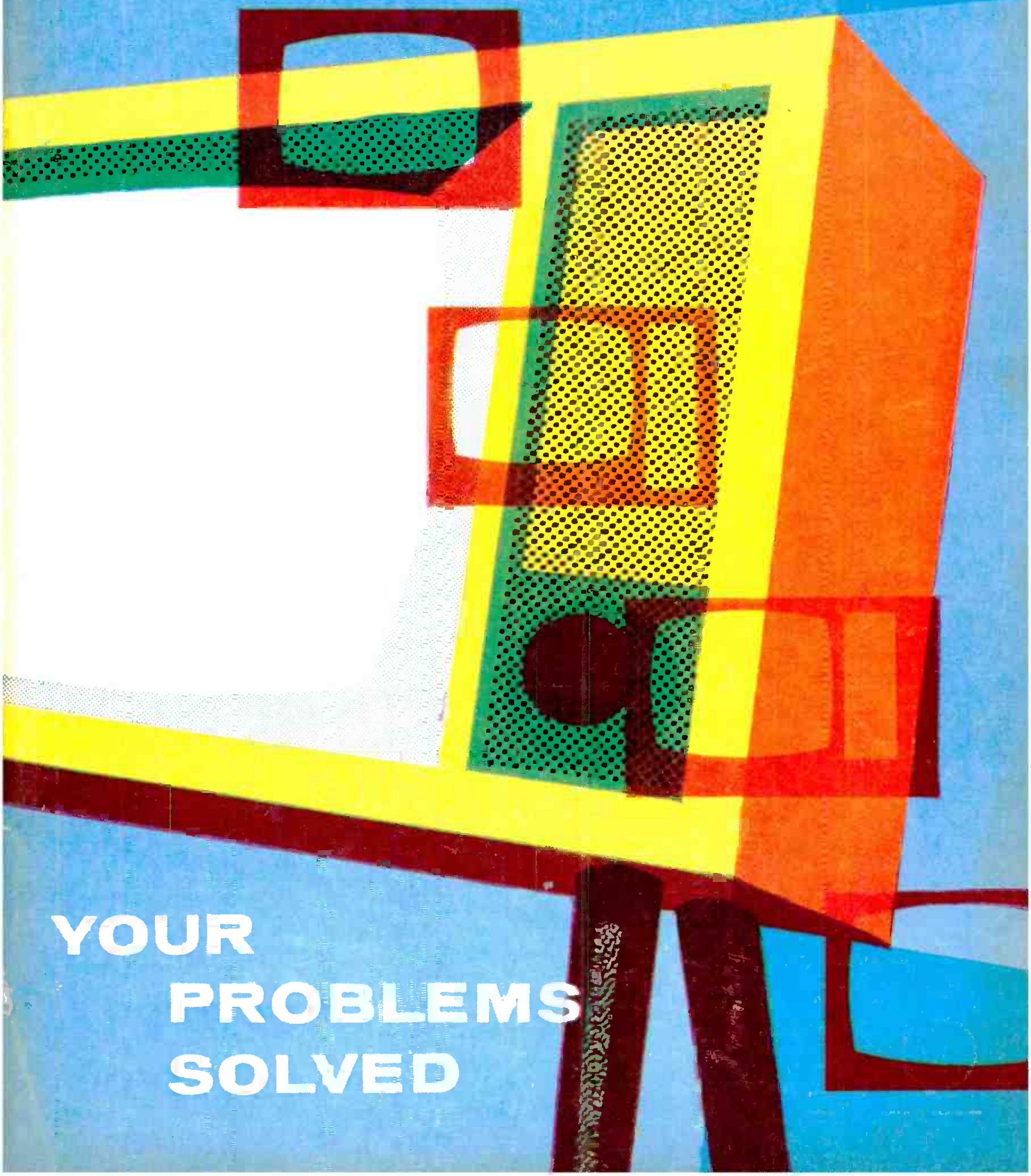

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6BW6	6/9	12AT6	6/6	9002	4/9	EF85	6/-	PL38	17/6	UY41	6/-
6BW7	5/-	12AT7	5/6	9003	5/9	EF86	7/6	PL81	8/3	UY85	6/-
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6C5	5/6	12AU7	6/-	AZ31	7/6	EF91	3/-	PL83	6/6	VP23	2/9
6C6	3/6	12AV6	6/9	AZ41	7/-	EF92	3/-	PL84	7/6	VP41	5/6
6C9	11/-	12AX7	6/6	B36	6/9	EF183	9/9	PL820	8/3	VR105	5/6
6CD6G	17/6	12BA6	7/-	C1C	8/-	EF184	9/6	PM84	9/6	VR150	5/-
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6D2	3/3	12BH7	8/9	CL33	9/-	EL32	3/9	PX25	9/-	W81	7/3
6D3	9/6	12C8	5/6	CY31	7/6	EL33	7/-	PY31	8/-	X61M	11/-
6D6	3/-	12E1	17/6	D77	3/3	EL34	11/6	PY32	10/-	X63	8/6
6F1	4/9	12H6	1/9	DA30	11/6	EL35	6/-	PY33	11/-	X65	11/-
6F6	7/6	12J5GT	3/3	DAC32	9/9	EL38	12/6	PY80	6/6	X66	7/9
6F6G	4/6	12J7GT	8/-	DAF91	4/6	EL41	8/-	PY81	6/3	X76M	11/-
6F13	4/9	12K7GT	4/6	DAF96	7/3	EL42	7/9	PY82	5/9	X78	21/-
6F14	9/6	12K8	9/9	DF33	8/9	EL81	8/9	PY83	6/9	X79	21/-
6F15	9/6	12K8GT	9/6	DF91	3/-	EL84	6/6	PY88	9/-	X81M	9/-
6F19	6/-	12Q7GT	4/6	DF96	7/3	EL85	9/9	PY800	9/-	Y63	6/-
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6F33	4/-	12SG7	4/6	DH63	5/6	EL95	6/6	R19	9/6	Z66	8/6
6H6	1/6	12SH7	3/6	DH76	4/6	EM34	8/6	RL18	11/-	*Transistors:*	
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6J5GT	4/3	12SN7GT	6/9	DK92	7/-	EM84	8/9	SU25	16/-	OC36	14/-
6J6	3/6	12SQ7	8/6	DK96	7/3	EM85	9/6	SU2150	4/6	OC44	5/6
6J7	8/6	13D3	5/6	DL33	7/6	EN31	16/-	T41	6/9	OC45	6/-
6J7G	4/9	14S7	14/6	DL35	7/6	EY51	7/6	TDD4	8/6	OC81	5/6
6J7GT	7/6	19AQ5	7/9	DL63	9/-	EY86	7/3	U14	7/6	OC81D	5/6
6K6GT	6/-	19BG6	14/-	DL75	6/-	EY88	9/6	U18	7/6	XB104	5/6

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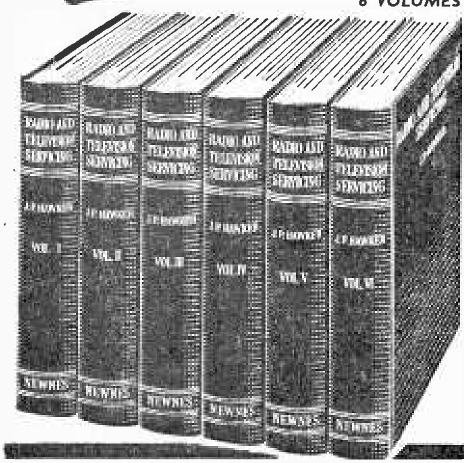

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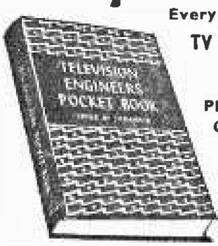

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Parent's Signature if you are under 21. ....*Mr., Mrs.* **(RV)533/66**

Practical Television

AND TELEVISION TIMES

VOL. 13, No. 151, APRIL, 1963

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PRACTICAL TELEVISION

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Contents

Problems Galore

IN the March 1951 issue of PRACTICAL TELEVISION, a new feature quietly appeared. It was an instant success and now, twelve years later, is firmly entrenched as a perennial favourite, as popular as ever.

YOUR PROBLEMS SOLVED is, in fact, a monthly sample of the correspondence from our free query service, the items published being carefully chosen for their interest and practical value to other readers.

Nobody in the office has found the time or the energy to flip through all the volumes for the years that the feature has been running, but a rough estimate shows that something like 3,500-4,000 items have been published. Perhaps some keen reader with all the volumes might like to run through for the fun of it?

We do know, however, exactly how many queries have been handled in those twelve years, simply by checking the file reference numbers.

This month, in actual fact, we have answered query number 100,000! And feeling that this was a milestone worth celebrating, our artists have honoured the occasion by designing a special front cover. An unusual treatment for an unusual event!

One hundred thousand! In any terms, that is a huge number of queries to deal with; in fact, we are now receiving literally hundreds every months, more than ever before. The trickle has become a deluge.

A few of the droplets in this stream, however, give rise to concern. A query coupon accompanied by requests for guidance on several problems connected with a number of different receivers is not only an attempted abuse of the query service but suggests that the sender is attempting to set himself up as a local freelance service engineer, a fact which is also sometimes apparent from single enquiries.

Our aim is to help readers in their personal TV problems and not to provide a trade service. And there are the ethical aspects to consider. The professional serviceman is a specialist with years of training behind him. For an untrained freelance to encroach on his livelihood is cheap and unfair—perhaps to the customers, too!

Although some service engineers claim that amateur freelances are good for business, on the grounds that the sets they handle ultimately end up in their workshops, they are probably being cynical.

Also, while many readers are capable of servicing their own TV set, it is painfully obvious that some have little practical expertise and theoretical know-how.

We hope, then, that readers about to tackle this sort of job will realise that there is more in repairing a set than a wet finger, neon screwdriver and blind faith—otherwise those sets might well end up on the professional engineer's bench!

Our next issue dated May, will be published on April 19th.

Telenews

Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of January, 1963, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London	2,038,880
Home Counties	1,738,271
Midland	1,819,503
North Eastern	1,947,909
North Western	1,625,257
South Western	1,062,161
Wales and Border Counties	736,117
Total England and Wales	10,968,100
Scotland	1,125,555
Northern Ireland	196,518
Grand Total	12,290,173

One-man Television system for the Philippines

FOLLOWING a three-week demonstration of a British educational television system in Hong Kong, an order has been placed with EMI Electronics Ltd. for similar equipment by the Republic Broadcasting Company of Manila, in the Philippines.

The equipment can be operated by one man, and remote control facilities for running film and for slide changes are provided for a commentator.

The Manila authorities have ordered the equipment for their latest broadcast station on the island of Cebu, which is situated centrally in the Philippine archipelago. As well as broadcasting film and slide programmes, the Manila Republic Broadcasting Company plans to transmit live programmes in due course.

Television Detector Cars

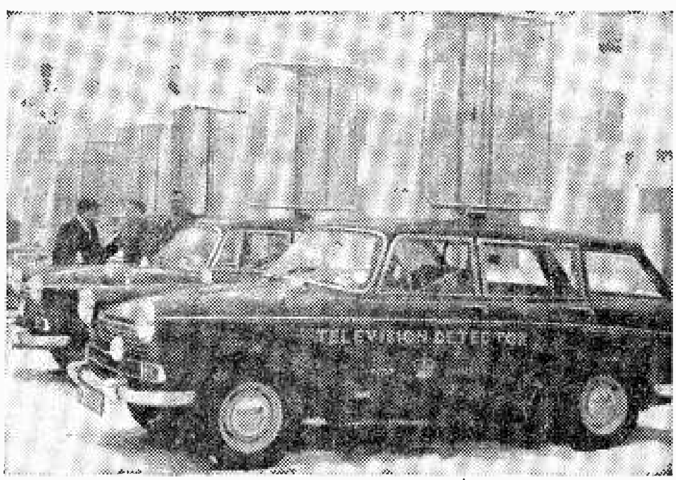
NINE new Post Office radio and television detector cars recently left London for other cities in England, Scotland, Wales and Northern Ireland. These cars have incorporated in their detecting equipment, several improvements which makes them more efficient than their predecessors in hunting for "pirate" users of radio and television receivers.

West and North Wales Coverage Complete

EARLY this year the Independent Television Authority announced that its coverage of West and North Wales was completed, when its Moel-y-Parc station began programme transmissions.

The main station of the West and North Wales chain is Prescelly, situated 1,100ft above sea level at Foel Dyrch, in the Prescelly mountains. The transmissions from this station, on Channel 8, are picked up across Cardigan Bay at the Arfon station. This latter small, automatic and unattended station rebroadcasts the signal on Channel 10 to serve its own area. The rebroadcast signal is also picked up at a receiving station at Nebo, on the island of Anglesey. From here it is passed on by a microwave link to the new transmitter at Moel-y-Parc, 1,115ft above sea level on the Clwydian Range of mountains. This dog-legged path, north from Arfon then east to Moel-y-Parc, is necessary to carry the signal round the Snowdon mountain range which blocks the direct transmission path.

The Moel-y-Parc station, operating on Channel 11 (vertically polarised), is designed to serve the north coast of Wales, from Conway to Prestatyn, and inland south to Llangollen. It employs a special directional aerial, with a semi-circular pattern, radiating 25kW from south-east to north-west but considerably reduced power to the north and east. The station serves a population of approximately 334,000 people, living in Flintshire and Denbighshire.



Some of the new Post Office radio and television detector cars about to start their journeys to all parts of the British Isles.

High-power 625-line Station Ordered

IN order to implement the conditions of the recent Government White Paper on Broadcasting, the British Broadcasting Corporation is inaugurating an extensive technical scheme for the provision of Bands IV and V television transmitting stations which will ultimately cover the entire country.

The Marconi Company has been awarded a contract to supply and install the transmitting equipment for six main high-power stations. These stations will be capable of radiating either black-and-white or compatible colour transmissions to 625-line standards.

TV Speeds Market Prices to Missouri Brokers

CLIENTS of Clayton Brokerage Co. at Clayton, Missouri, USA, now watch market quotations on large-screen television receivers as the information is received on ticker tapes.

This instantaneous information is made possible by a Fairbanks-Morse closed-circuit television system using a camera manufactured by EMI Electronics Ltd. It displays close-up pictures of the tapes as they move over tickers from the Chicago Board of Trade and the Chicago Mercantile exchanges. Clients and brokers making transactions can now watch latest market movements from both exchanges simultaneously.

Cameras for US Aircraft Carriers

INSTALLATION work has recently commenced on the first of ten new installations of the Ampex/Marconi Pilot Landing Aid Television (PLAT) systems on board United States aircraft carriers.

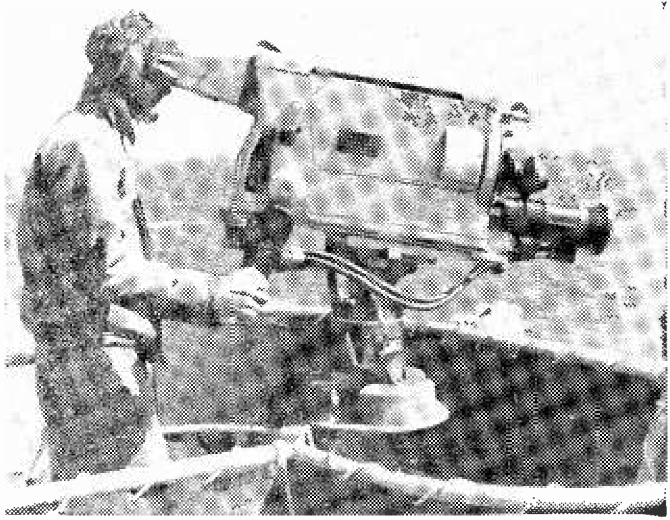
The PLAT system is a multi-channel television and sound monitoring and recording facility designed to improve the proficiency of pilots and landing control personnel and so to increase the safety of jet landings on aircraft carriers.

Four Marconi television cameras are used in the system—two being buried in modified lighting wells near to the touch-down point in the angled flight deck.

A third camera is located on the island bridge, some 40ft above the flight deck. This camera is manually controlled, and picks up the aircraft as it touches down and passes the two buried cameras.

The fourth camera, a miniature vidicon type, is permanently focused on a data display board in the control room to record the date, time, wind velocity, aircraft approach speed and the wave off signal.

After each operation is completed, pilots and landing control personnel can watch every detail of the complete landing within a matter of minutes and any errors of procedure or judgment can be assessed while the events are still fresh in their minds.



A U.S Navy cameraman, on a platform above the flight deck of an aircraft carrier, follows the landing of an aircraft with a Marconi Mark IV camera.

New Aerial for Northern Ireland

INDEPENDENT television programmes became available recently to a further quarter of a million people in Northern Ireland.

The television mast and aerial for the new Londonderry-Enniskillen ITA network, was supplied by EMI Electronics Ltd., and was erected on Koram Hill, near Strabane, 20 miles south of Londonderry. The full wave dipole aerial array which is vertically polarised, transmits on Channel 8.

Seventh 1,000ft TV Mast

THE firm of British Insulated Callender's Construction Co. Ltd. recently completed a contract for the design, supply and erection of a 1,000ft stayed steel mast for E.M.I. Electronics Ltd., main contractors to the Independent Television Authority. This is at Strabane, Co. Tyrone, from where programme transmissions to Londonderry, Armagh and other parts of West Ulster began in February.

The first 800ft of the mast is of 8ft 6in. triangular section with the top portion, which carries the aerial array, of 6ft 6in. triangular section.

This is the seventh 1,000ft mast BICC has supplied and installed for the ITA.

Colour Demonstration

THE independent television company of the Tyne-Tees area, Tyne-Tees Television, is going ahead with colourvision experiments.

Marconi colour cameras and Bush colour monitors were recently delivered to the company's Newcastle studios for "live" colour demonstrations on closed circuit. These were staged for engineers and officials of the company and leading potential advertisers in the area.

A spokesman for Tyne-Tees said: "We are keenly interested in colour television. Our engineers have been working with colour equipment for some time. The object of the present demonstration is to keep us all right on the ball."

PART 2

405-625

The New Dual Standard Television Sets

by S. F. R. KINGSFORD

CONTINUED FROM PAGE 257 OF THE MARCH ISSUE.

THIS month we first investigate the timebase circuits associated with the Pye V700D. The circuits of the frame timebase, interlace filter and sync separator are given in Fig. 6. Here is also shown the discriminator section associated with the line timebase.

The frame oscillator circuit is fairly conventional. This employs the triode section of a PCL85 (V18B) in a cathode-coupled frame blocking oscillator circuit, with T9 as the blocking oscillator transformer. Vertical hold is accomplished by virtue of the time-constant being adjustable by the vertical hold control R92, in the usual manner. The waveform at the anode of the oscillator is coupled by C82 and a linearising network to the control grid of the frame amplifier valve, which is the pentode section (V18A) of the PCL85.

Again, this is a reasonable conventional circuit, and the waveforms to be expected at various points in the circuit are illustrated as an aid to service. There are two frame linearity controls R101 and R95. The former controls the overall linearity while the latter the linearity mainly at the top of the picture.

SYNC SEPARATOR

The sync separator valve (V19B) receives signals at its control grid from the video amplifier stage, via C89, and the negative voltage developed in the control grid circuit is used as an a.g.c. bias for the vision section, see Fig. 4(a). The frame sync pulses at the anode are fed to the grid of the interlace filter triode (V19A), where they appear ideally shaped to lock the frame oscillator and provide excellent interlace. The shaped pulses are fed to the frame oscillator through C85.

The sync separator also "loads" the line sync pulses across the discriminator transformer T10. In addition to line sync pulses, the discriminator diodes (V20 A and B) receive line pulses direct from the line output transformer, via tags 59 and 56 (also see Fig. 7).

Now, when the line sync pulses are exactly in phase (e.g., in step) with the pulses from the line output transformer zero d.c. voltage exists at the junction of the diode loads R113 and R114. However, should the phase between the two signals differ either a positive or negative voltage will occur at the junction and at tags 57 and 62, and it is this voltage which is employed to control the frequency of the line oscillator.

It will be seen that there is no standard switching at all in the circuits of Fig. 6, as was intimated in Part 1 of this article.

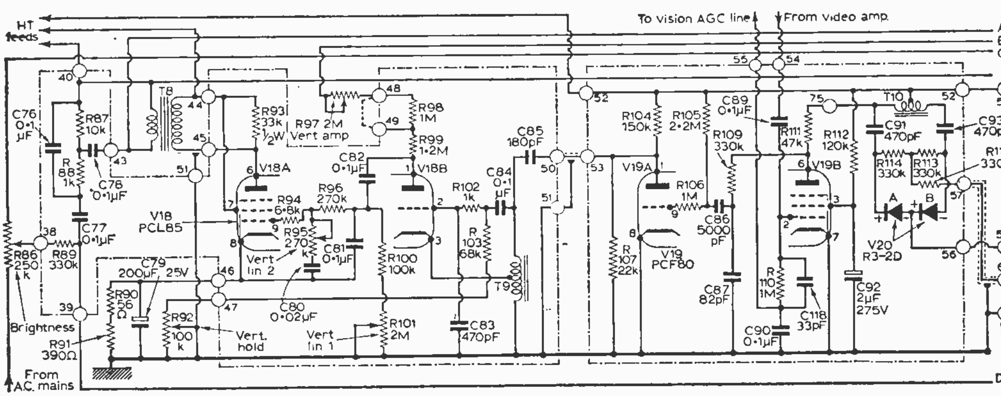


Fig. 6—The frame timebase, interlace filter, sync separator and line discriminator circuits of the new Pye V700D dual standard switchable receiver. Note that the circuit identifications A, B, C and D and 58, 59, 61 and 62 correspond to the circuit connections similarly identified in Fig. 7.

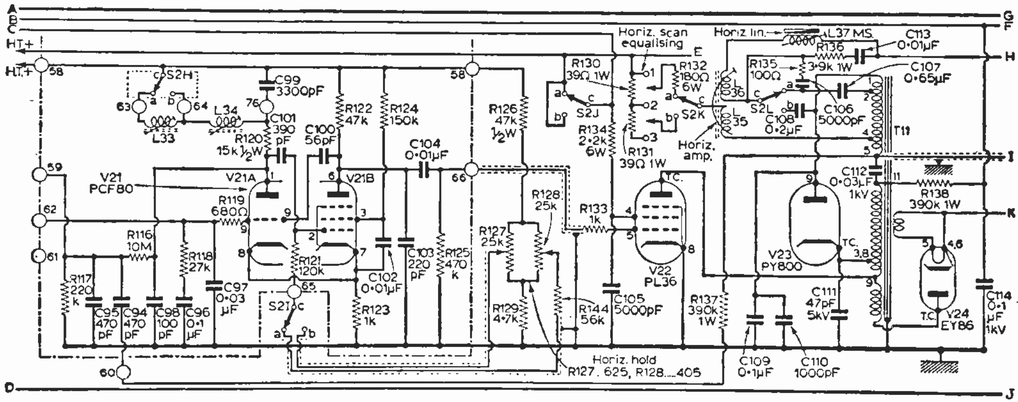


Fig. 7—The line timebase, efficiency diode and e.h.t. circuits of the Pye V700D. Note that the circuit identifications E to K inclusive correspond to the circuit connections similarly identified in Fig. 8.

LINE TIMEBASE

The line or horizontal oscillator is in the form of a multivibrator circuit, employing the triode and pentode section of a PCF80 valve (V21), as shown in Fig. 7. A "flywheel" effect is given to the circuit by inductors L33 and L34 in the triode anode circuit. To achieve such an effect the inductor or inductors has to resonate at the line frequency—so switching is demanded here.

It will be seen that standard switch S2H arranges for both inductors to be in series on 405 lines (10,125c/s), while on 625 lines (15,625c/s) inductor L33 is short-circuited, leaving only L34 in circuit. The time constant of the oscillator circuit is controlled by the horizontal hold controls and associated resistors. S21 not only alters the time constant so that the correct repetition frequency is secured on each standard, but it also introduces a separate and independent control for each standard. This means that optimum line hold can be established on each standard without affecting the other.

The repetition frequency of the oscillator is also controlled by the voltage derived from the discriminator and present in the control grid circuit of the triode section. If there is tendency for hunting or frequency drift a correction voltage is produced by the discriminator, as explained earlier, and the correct line oscillator frequency is restored (after first being set by the appropriate line hold control, of course). The control voltage appears at tag 62, while the pulse from the line output stage is fed first to tag 60, via R137, then through C94 to tag 59 (see Fig. 6).

EQUALISATION

The line output valve is the PL36 (V22). This receives line signals at its control grid, via R133, and there are various standard switching arrangements here to equalise the operation on each line frequency. The horizontal scan is equalised by suitable value resistors being introduced in series with the horizontal ampltitude inductor L35 by S2k. With the horizontal amplitude control within normal range flylead 4 is connected to tags 1, 2 or 3 to provide the correct width on 405 lines, while flylead 6 is similarly adjusted on 625 lines.

Switch S2L switches in the appropriate value capacitor to provide third harmonic tuning at each line frequency. For example, C107 is used on 405 lines and C108 on 625 lines. In this way the efficiency of the line output stage is maintained at both frequencies. Without such modifications there would be a considerable impairment in efficiency when switching to 625 lines if the circuit were optimised for 405-line working.

TUBE CIRCUITS

Signal is applied to the tube cathode from the contrast control direct (see Fig. 5), as shown in Fig. 8. The first anode potential is picked up from the boosted h.t. line—circuit F, and switch S2M switches in R142 and R141 as the lower arm of a potential-divider in the "625" position. As R142 is a preset, the boost voltage applied to the first anode can be adjusted on 625 lines so that it matches that present on 405-line operation.

The focus electrode (pin 4) of the tube is connected to a flylead and the correct focus is achieved by connecting this to the boost h.t., the normal h.t. or to chassis, via one of the three focus sockets provided. As the tube uses electrostatic focusing, a magnetic picture centring unit is fitted to the tube neck, and separate, small permanent magnets are disposed in proximity to the tube flare for correcting the geometry of the raster. L36A/B are the line scanning coils and L39A/B the frame scanning coils.

The control grid of the tube is connected via circuits J and D to the brightness control R86 (Fig. 6). The bottom end of this control, instead of being returned direct to chassis, is connected to the mains side of the pole of the on/off switch which itself is connected to chassis. Thus, with the receiver switched on and operating normally, the bottom end of the control is connected to chassis through the on/off switch, but when the set is switched off the earth is removed from the bottom of the brightness control.

This causes the grid to rise speedily and fairly heavily positive, and the resulting high beam-current almost immediately discharges the e.h.t. circuit and thereby avoids a lingering white spot on the screen of the tube.

V.H.F. TUNER UNIT

The incremental type of v.h.f. tuner used in the Pye V700D is shown in circuit form in Fig. 9. This follows conventional circuit practice, where a double-triode PCC89 (V1) is employed in a cascode r.f. amplifier and a triode-pentode PCF86 (V2) as the frequency changer, with the pentode as the mixer and the triode as the local oscillator.

The aerial, r.f. mixer and oscillator (from left to right across Fig. 9) circuits are switched from channel to channel by rotary switch wafers introducing small increments of inductance. C27 is the fine tuning control which allows each channel to be optimised in terms of picture quality and sound output.

The 405-line sound and vision "standard" i.f.'s are developed across L29 in the mixer anode circuit, and from here they are fed to the sound and vision i.f. stages in the receiver proper (see Fig. 2).

U.H.F. TUNER

Owing to the ultra-high frequencies associated with the channels in Bands IV and V, the conventional type of incremental or turret v.h.f. tuner is totally unsuitable for the new programmes, and an entirely different design has been established.

The u.h.f. tuner shown in Fig. 10 is attributable to Mullard Limited. This uses two frame grid triode valves, a PCC88 r.f. amplifier (V1) and a PC86 self-oscillating mixer (V2). Instead of ordinary inductors, this tuner and others like it employ "resonant lines"—sometimes called "lecher wires".

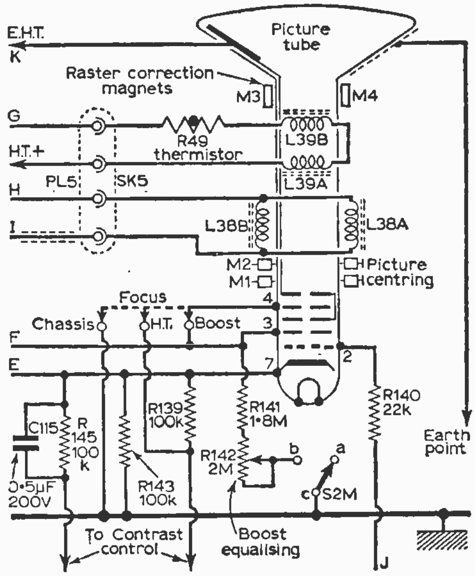


Fig. 8—The picture tube circuits of the Pye V700D.

These behave rather like half-wave dipoles in that the current and voltage distribution across them follows the same pattern as the voltage and current across a tuned dipole. For example, at the centre the current is at a maximum and the voltage at a minimum (low impedance), while at each end the current is at a minimum and the voltage at a maximum (high impedance).

The lines are partly tuned by the valve and circuit capacitances at one end and by sections of a variable tuning gang capacitor at the other end. Thus, the resonant frequency of the lines can be

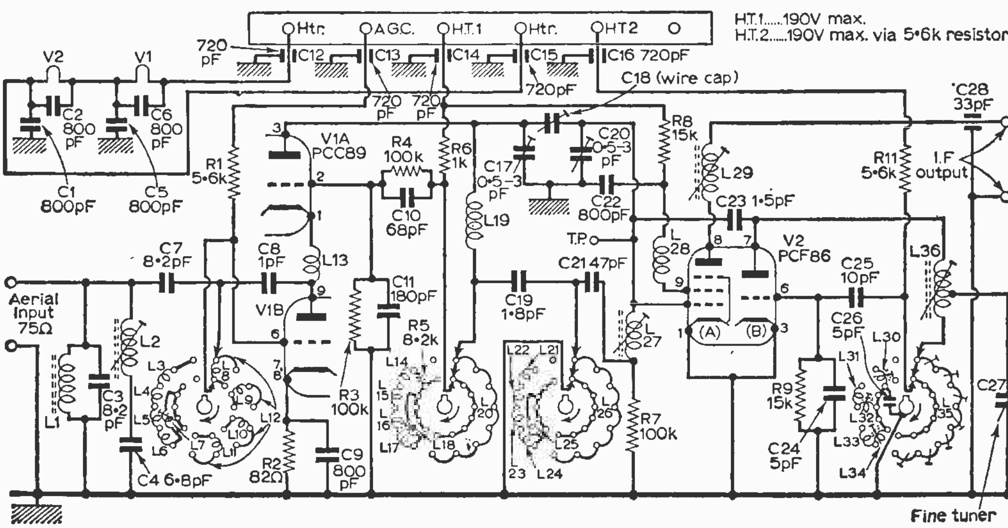


Fig. 9—The incremental v.h.f. tuner used for Bands I and III.

altered over a fairly wide range of frequencies by the ganged tuning capacitor—as in a radio set. In Fig. 10 the lines are represented by straight connections (e.g., L1, L2, L3, L4, L5 and L6). The coupling into L1 is inductive from the aerial circuit, and similarly between L1 and L2.

V1 is arranged in an earthed-grid circuit, with the signal applied at the cathode, across L2. L1 is interposed between the low impedance aerial input and the low impedance V1 cathode input in such a way that the impedance is relatively high. This means that L1 is not unduly damped and can be tuned by C1 section of the gang to enhance the overall selectivity of the tuner.

The r.f. anode line is tuned by C2 and this line L3 is coupled to L4 in a bandpass circuit, the latter being tuned by C3 section of the gang. This is an additional artifice to improve the selectivity, which is extremely important on the u.h.f. channels, where spurious responses at the image (second channel) frequencies could cause serious pattern interference.

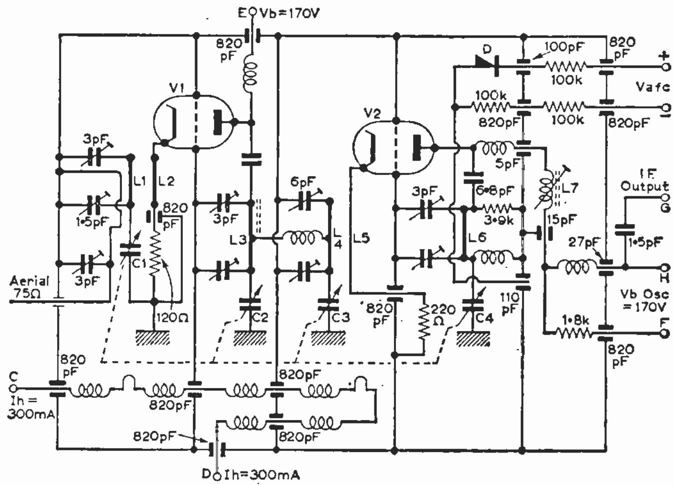


Fig. 10—Circuit diagram of a u.h.f. tuner (for Bands IV and V) designed by Mullard Limited.

V2 is arranged in the earthed-grid Colpitts mode, the oscillator feedback to cathode being a function of the ratio of the anode-to-cathode and grid-to-cathode capacitances of the triode. L6 is the oscillator resonant line, and is tuned by C4 section of the gang.

The 625-line i.f.'s are developed across the i.f. coil L7 in the anode circuit of V2 and are fed to the output socket through a low-pass filter which attenuates the oscillator and signal frequencies. In the tuner under discussion, diode D acts as a capacitance coupled to the oscillator circuit, the value of which depends upon the reverse bias.

This diode and associated components provide automatic frequency-correction, the a.f.c. voltage (Vafc) being derived from a discriminator circuit in the receiver proper, so that should the tuned frequency tend to drift a positive or negative control voltage is produced that alters the capacitance of the diode, and hence the oscillator frequency in such a way that the correct tuning is restored.

Not all u.h.f. tuners embody a.f.c., and none of them comes under the control of the receiver's a.g.c., since altering the r.f. valve bias to control the gain has an adverse effect on the overall response at u.h.f.

FINAL POINTS

The tracking of the u.h.f. resonant lines over the range of the tuning gang is accomplished by small trimmer capacitors connected to either end of the lines. The trimmer at one end tracks at the low-frequency end of the band, while that at the other end tracks at the high-frequency end of the band—these being akin to the padders and trimmers used in ordinary broadcast receivers.

The tuning spindle of the ganged capacitor is coupled to the channel selector control knob through a reduction gear to provide slow-motion tuning over the many u.h.f. channels. The knob itself is often calibrated in channel numbers, but on some models a tuning scale and pointer may be adopted, giving the tuner the appearance of a small radio set.

It should be noted that not all true switchable models yet incorporate a u.h.f. tuner unit, but when the new programmes are available in those areas in which the receivers are used (at present on 405 lines v.h.f.), it will be a very simple matter to have the tuner installed.

Convertible-to-switchable models, on the other hand, require—in addition to the u.h.f. tuner—circuit sections to endow the models with the characteristics fully discussed in this and the previous article. ■

The PRINCIPLES and PRACTICE of TELEVISION

By G. J. King

U.H.F. CHANNELS AND AERIALS

Continued from page 257 of the March issue

SO far we have seen how the 625-line signal differs from the 405-line signal and how a dual standard receiver needs to change over several circuits to accommodate the two signals. It will be recalled that the essential differences between the two signals are sound modulation (a.m. on 405 lines and f.m. on 625 lines), vision modulation (positive-going on 405 lines and negative-going on 625 lines) and channel width (5Mc/s on 405 lines and 8Mc/s on 625 lines).

In addition, of course, the 625-line signals are at present transmitted in the u.h.f. channels (note, however, that eventually the v.h.f. channels will also carry 8Mc/s 625-line channels) and that on this service the sound carrier frequency is above the vision carrier frequency, which is the reverse of the 405-line service. See also the article in the January, 1963 issue.

The change in the number of lines is arranged by increasing the 405-line timebase frequency of 10,125c/s to 15,625c/s for 625 lines. This change demands not only an alteration in the line oscillator circuit, but also a change of several conditions in the line output stage to ensure that optimum efficiency is maintained on both standards (see February, 1963 issue).

A dual standard receiver is only extraordinarily complicated because it has to work equally as well on two entirely different signals. A 625-line-only receiver is no more complicated—and in certain cases less complicated — than a 405-line-only receiver and, although it would be rather a feat for the experimenter to adapt a 405-line-only set to dual standard operation, such a receiver could be modified relatively easily for 625-line-only operation. It is hoped to reveal later in these pages how such modifications can be undertaken in relation to one of the surplus receivers of several years vintage which is readily available at small cost.

At the time of writing commercial u.h.f. tuners are not available to the experimenter, and unless the situation drastically alters it is proposed to offer a design for the home constructor.

In the meantime, however, there are probably many readers within range of the u.h.f. test transmissions from London who already have or are proposing to purchase dual standard models and who would like to try them out on the 625-line signals.

U.H.F. Tests

The u.h.f. tests have been commenced by the BBC to provide engineering statistics on signal shadow zones within the u.h.f. service area and on how two u.h.f. channels will react under conditions of co-siting. The tests will, of course, also yield early information on how the new "convertibles" and dual standard models really operate in practice.

The tests started on Channel 44 (vision 655·25Mc/s and sound 661·25Mc/s) with horizontal polarization and graduated to an effective radiated power (e.r.p.) of 160kW. These were followed by simultaneous transmissions on Channel 34 (vision 575·25Mc/s and sound 581·25Mc/s). It must be remembered, however, that these are only experimental channels and are not those which will eventually be employed in the London area when the BBC's second programme on 625 lines starts in 1964.

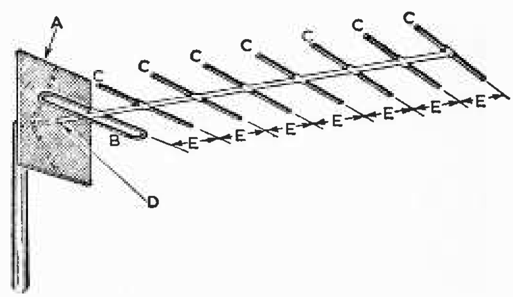


Fig. 29—Design for a nine-element u.h.f. aerial, employing a wire mesh reflector. See Table 2 for dimensions (page 300).

Channels for the four eventual London u.h.f. programmes are 23, 26, 30 and 33, having vision frequencies of 487·25Mc/s, 511·25Mc/s, 543·25Mc/s and 567·25Mc/s respectively, with the sound carrier placed 6Mc/s higher in each case. The permanent channels will eventually replace the test channels even for test transmissions, which are in both monochrome (e.g., black and white) and colour, using the American NTSC and French SECAM colour systems.

U.H.F. Aerials

U.H.F. aerials function in exactly the same manner as v.h.f. aerials (see October, 1962 issue), but owing to the higher frequencies involved the

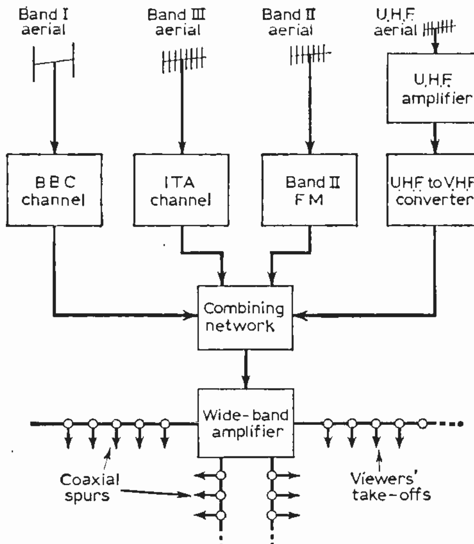


Fig. 30—Block diagram of a simple communal aerial system. The u.h.f. signals are converted to an unused v.h.f. channel before distribution through the coaxial cables to avoid excessive losses. The signals for viewers are extracted by an inductive or resistive take-off.

dimensions of the elements and the element spacings are considerably smaller. From first principles, this means that a nine-element u.h.f. aerial, for instance, will "capture" somewhat less signal than a nine-element v.h.f. aerial. This is because the amount of signal induced into an aerial is influenced by the total " mass " of the metal making up the array, including the directors and reflector as well as the dipole.

Look at it this way: the total length of all the elements of, say, a nine-element Band III v.h.f. aerial is approximately three times that of all the elements of a nine-element u.h.f. aerial of comparable design. Assuming equal field strengths, therefore, it follows that the v.h.f. aerial will pick up approximately three times as much signal on a v.h.f. channel as the u.h.f. aerial will pick up on a u.h.f. channel. There are other factors concerned, of course, but the foregoing gives a bird's eye view of the fundamental principle.

This is one of the reasons why a nine- or double-six-element array is often necessary to provide a signal on a Band III channel that is pretty well of the same strength as given by a two- or three-element aerial on a Band I channel, when the transmitters concerned are of approximately equal power and co-sited. So we get the same effect going from Band III to Band IV and from Band IV to Band V.

In addition, however, the losses tend to be greater as the signal frequency is raised, and this applies especially to the attenuation of the signal in the coaxial cable connecting the aerial to the receiver. Relative to Band I, the coaxial losses are approximately two times at Band III, a little over three times at Band IV and a little over four times at Band V.

This means, then, that ultra low-loss feeder is essential to feed u.h.f. signals to the u.h.f. tuner of a dual standard set. Note also that the propagation losses—e.g., the losses between the transmitting aerial and the receiving aerial—rise with increase in frequency, and the u.h.f. signals, particularly towards 900Mc/s, are often influenced by rain and mist over fringe area distances. We have already seen that the u.h.f. signals behave more like light than the v.h.f. signals (see article in November, 1962 issue). that they are less readily bent by the troposphere and that they are very prone to reflection, a factor which is responsible for multipath interference—e.g., " ghosting ".

At the present state of the art, filters are not available for combining a u.h.f. aerial system to a v.h.f. aerial system, and it is unlikely whether this sort of combining will ever be necessary, for it is probable that separate v.h.f. and u.h.f. tuners will always be used. This means that the Bands I and III aerials may be combined to a common feeder in some way or another, as they are at present, while the u.h.f. aerial will have its own independent circuit from the aerial direct to the u.h.f. tuner. This is highly desirable since it ensures the minimum of losses. Switching from v.h.f. to u.h.f., and vice versa, of course, is totally automatic at the receiver by reason of the " standard change " switch, thereby avoiding aerial switching arrangements.

Most aerial firms have available test aerials suitable for Channels 34 and 44, but it must be

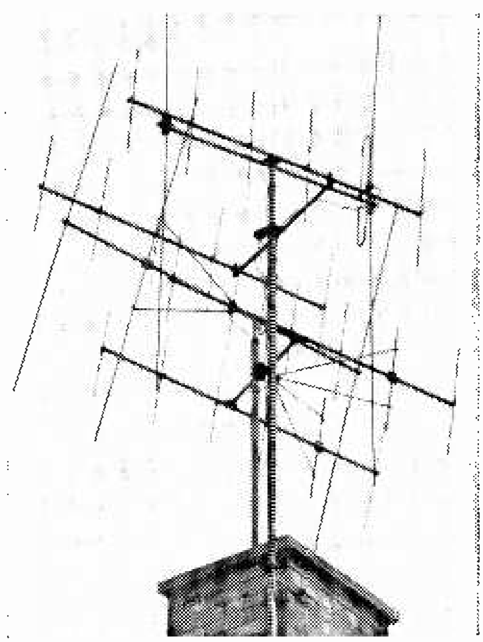


Fig. 31—It is becoming increasingly obvious that complex aerial systems of this nature on shared chimney stacks will be out of the question with the advent of u.h.f. broadcasting. Apart from the stresses to which the chimney stack is subjected during rough weather, the proximity of the various arrays detract from their individual performance.

remembered that these will be no good for the permanent channels for the London area, and if a test aerial is fitted today, then a model suitable for the channel range 23 to 33 will have to be fitted later.

Having in mind that the experimenter may wish to make up his own u.h.f. test aerial, we show a suitable design in Fig. 28. This uses a folded dipole, seven directors and a "mesh" reflector. Because of the small dimensions it is possible to support the array at the rear of the reflector; and under this condition the mast will have no effect on the performance of the aerial.

TABLE 2

Channel Range	Dimensions				
	A	B*	C	D	E
23–33	12" x 12"	10¼"	9"	6"	3⅜"
34–44	11½" x 11½"	9½"	8¼"	5¾"	3⅛"

** The length of the folded dipole is measured between the middle of each bend at the ends.*

The aerial can be optimised at the mean of Channels 34-44 or 23-33, the former for the tests and the latter for the permanent channels, and the dimensions in each case are given in Table 2.

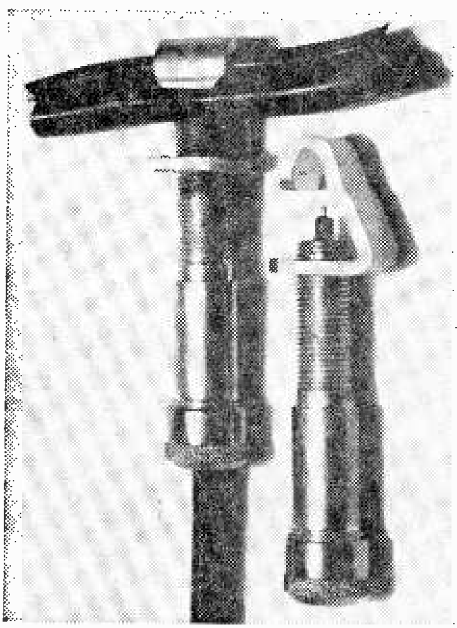


Fig. 32—A resistive type of take-off for a viewer. A special tool is used to drill a small hole in the spur cable, through which the wire end of the spring-loaded resistor is inserted until connection is made to the inner conductor. The flange on the metal housing gives the connection to the outer braid, and makes a water-proof connection.

The reflector should be made of ¼in. wire mesh which is strengthened at the edges with thick (14s.w.g.) copper wire. The boom should extend a few inches to the rear of the reflector to facilitate fixing to the mast and fixing the reflector to the boom by metal strip supports. The folded dipole and directors can be made of ¼in. alloy rods cut to exact size and supported by drilling and inserting into the boom. The folded dipole can be supported in the centre of the complete fold in the same way, while an insulator should be used to couple the gap in the other fold to give mechanical rigidity, while also providing a method of coupling the downlead to the dipole in the accepted manner.

Communal Aerial Systems

It is fast becoming obvious that the chimney stack of a semi-detached dwelling of conventional design will soon be unable to support all the required aerials. If we take the case of such a house located, say 30 to 35 miles from the transmitters outdoor aerials are really necessary since such a distance represents the edge of the service area. Indoor aerials may, of course, work in some cases of high signal field and little interference. but this is less probable at u.h.f. Thus, a semi-detached house may require on its shared chimney stack

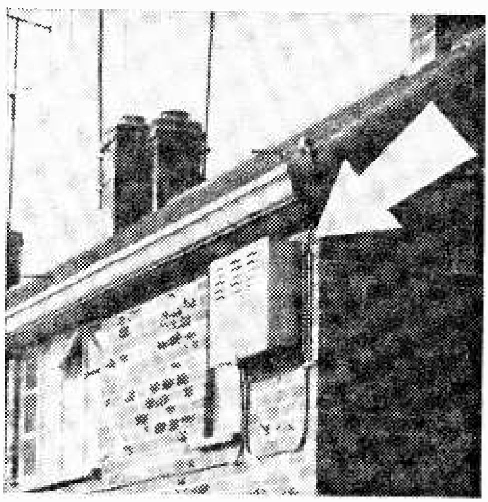


Fig. 33—A wideband repeater in position at the rear of a house, by EMI Limited.

eight aerials to provide the two dwellings with BBC, ITA, f.m. and u.h.f. The situation is stupid because the eight aerials may well be multiplied at each adjacent semi-detached house (see Fig. 29).

One way that this problem can be solved, and is being solved at the present time in certain parts of the country, is by the use of just one set of aerials arranged to feed neighbours' sets, a street, block of flats, whole housing estate or, indeed, a complete village or town. The master aerials as they are called are sited advantageously with regard to signal strength and interference and all the viewers on

—continued on page 309

SOME NOTES ON PICTURE FOCUS

BY T. L. MAY

A PICTURE on the screen of a television receiver is focused both optically and electronically. Actually it is focused optically once and electronically twice under normal direct viewing conditions. This three-fold focusing combination is one of the factors that sometimes makes it rather difficult for a person new to the arts to establish optimum focus on a closed-circuit television system with an r.f. output type camera used in conjunction with a domestic receiver—a popular combination these days.

Optical focusing is achieved in the way which is common to all cameras whereby a lens system brings the picture to a point of overall focus on a light-sensitive screen of some sort. With an ordinary camera the light-sensitive screen is the film, while with television camera tube it is the "photomosaic", the "photocathode" or the "photoconductor" in the orthicon, the image orthicon or the vidicon tube respectively.

Basically when a picture is projected on to the light-sensitive screen of a television camera tube, photoelectrons are liberated and are collected capacitively, leaving behind on the screen an "electrostatic charge image" which is a replica of the optical image. A low-velocity electron beam is caused to scan the screen and as each picture element is scanned so its corresponding charge is created and the synchronised "charge currents" are fed to the output of the camera tube and thence to a high-gain, low-noise video amplifier.

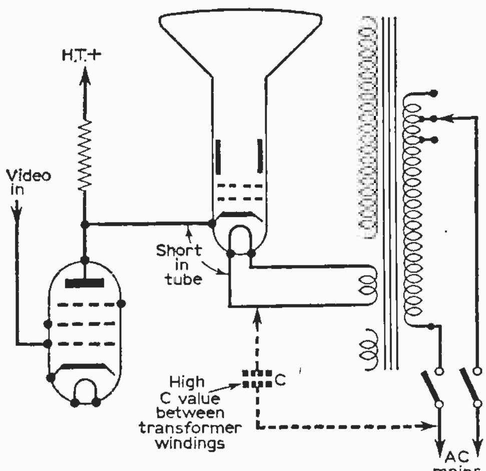


Fig. 1—Reduced video bandwidth with apparent defocusing can occur from a heater/cathode short in the picture tube when the tube heater is energised from an l.t. winding on the mains transformer. Here is clearly shown how the transformer capacitance C is shunted across the video signal at the tube cathode. The effect can be demonstrated by connecting a capacitance between tube cathode and the chassis of the set, as explained in the text.

For optimum focus at the camera, therefore, the optical image has to be perfectly in focus on the screen, while the electron beam also has to be at a point of focus as it scans the image over the whole of the screen. Scanning in a television camera, of course, is identical to that in a television picture tube, but while the electron beam in the former instigates a "charge pattern" corresponding to the instantaneous luminance of each picture element, in the latter it results in actual illumination of the scanning spot as it traces out 405 or 625 lines on the face of the tube.

Instantaneously the scanning spot takes on the luminance which matches that of the coinciding picture element on the camera tube screen (having in mind that the two electron beams are scanning in perfect synchronism). Thus the change is from black through grey to peak white over the monochrome range of the original image.

So much for focusing at the camera which, unless actively concerned with closed-circuit television or television transmission, is not of great interest to the average viewer and experimenter. Nevertheless it is just as well to have the basic principles in mind so as to be appreciative of possible shortcomings at the sending end of the chain.

Horizontal Definition

The optical and electronic focusing at the camera end is usually outside the control of the viewer and once the receiver has been adjusted to do full justice to the high quality of focus which is encoded in the signals sent from the transmitter the viewer can only sit back and appraise what he sees.

Pictures sometimes appear to be in better focus than at other times, though the overall depth of focus is nowadays far in advance of that of five years or so ago. However, old films tend to impair badly the focus performance which we have come to expect. Similarly some cameras tend to give the impression of poor focus under certain conditions, but here the trouble is immediately appreciated when a camera change is made, good definition being restored.

When the original camera is switched back the definition may again fall, but not always, as a correcting adjustment may have been made on a monitor prior to the camera being switched back on to the network.

Poor focus can be caused by a shortcoming in either the vertical or horizontal definition of a picture or both. The vertical definition is revealed chiefly by the horizontal scanning lines. If these are good and in clear-cut focus then poor definition or apparent defocusing is probably the result of trouble with the horizontal definition.

Consider a scanning spot travelling from the left to the right of the screen (during a single-line scan) so that the journey which is visible as illumination is completed in about 80μsec (one microsecond equals one millionth of a second). Now take a close look at the frequency gratings of Test Card C and imagine just how quickly the brightness of the spot must change to give the necessary contrast between the adjacent vertical lines of, say, the 2Mc/s pattern.

Ideally, of course, the brightness of the spot should change instantaneously, but this is impossible, for everything takes time to happen even though it may be in the microsecond range. Actually it is the *bandwidth* of the vision stages which governs the speed at which the scanning spot can change brightness. The wider the bandwidth the faster the spot can change in brightness. Misalignment of the vision i.f. stages, therefore, can suppress the vision channel bandwidth and in that way cause very poor horizontal definition as well as other adverse happenings.

The bandwidth of the vision channel can also be impaired by a large capacitive loading at the cathode of the picture tube or at the anode of the video amplifier valve such as can occur by a heater/cathode short in a picture tube whose heater is energised from the l.t. winding on the mains transformer (see Fig. 1). Most modern sets, however, use the a.c./d.c. technique, meaning that such a short would badly disturb the tube bias and cut off the picture completely.

However, it is a good instructive exercise to connect an 0·01μF capacitor between the tube cathode and the metal of the chassis to see just how much the picture is spoilt by bandwidth reduction. Note that on some sets 0·01μF may give too great a loading and 500pF or even less may be required for the demonstration. Too high a capacitance on some models may upset the line and frame holds.

This is the reason why a low-loss isolating transformer is called for to energise the heater when it is decided to retain the services of a picture tube which has developed a heater/cathode short or leak but is otherwise in good order. Such a transformer possesses a very low primary/secondary capacitance and thus greatly eases the capacitive loading at the tube cathode.

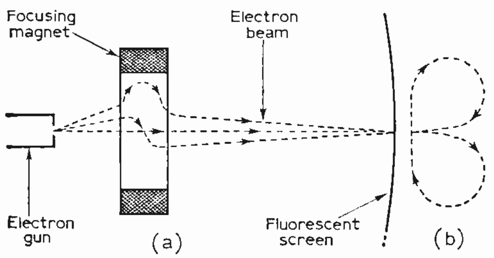


Fig. 2—Showing how the focusing magnet influences the electron beam as an optical lens influences rays of light—see Fig. 3. The diverging beam of electrons from the electron gun is brought to a point of sharp focus at the fluorescent screen due to the spiral path of the electrons through the magnetic field. At (b) is shown the end view of the electron path.

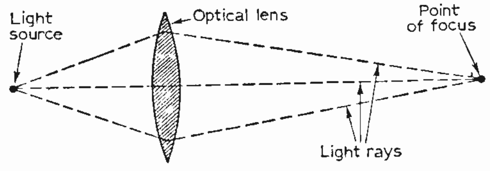


Fig. 3—Showing how a convex lens gives rise to the focus of a light source. Compare with Fig. 2.

The transformer should be mounted so as to avoid adding capacitance via the windings to the chassis of the set and this is best done by screwing it to the side of the cabinet and employing short, direct wires for its connection.

It is interesting to observe that the time taken by one black line and the adjacent white line together of the 1Mc/s frequency grating on Test Card C is 1μsec, while the total time or width of the frequency grating column proper is 3·5μsec.

Most 405-line sets are designed and aligned to give reasonable definition of the 2·5Mc/s (the vision bandwidth is around 2·7Mc/s) bars on Test Card C, while some better quality models make it possible to just about discern the 3Mc/s bars. Normally, however, if the 2·5Mc/s bars can be seen without difficulty the horizontal definition can be considered as satisfactory.

On 625 Lines

At 625 lines a line scan takes approximately 56μsec. This means that the brightness of the scanning spot must change even quicker than in the 405-line case to give comparable horizontal definition. Actually the video bandwidth of a 625-line set is approaching 5Mc/s and this generally enhances the horizontal definition over the 405-line case while in addition, of course, giving improved *vertical definition* as the result of the greater number of lines.

Spot Size

Apart from video bandwidth considerations early picture tubes were somewhat inhibited in terms of horizontal definition due to the size of the scanning spot. Of course to do full justice to a wide video bandwidth the scanning spot must be no larger than the smallest picture element to be defined. Modern tubes produce incredibly small scanning spots and there is no definition limitation from this aspect, not even on 625-line systems.

In the beginning picture tubes used electrostatic focusing. Then there was a change to magnetic focusing, using electromagnets on the necks, followed by neater, permanent magnets, and now there has been a change back to electrostatic focusing but of far better quality than the original electrostatic tubes.

Focusing in a picture tube refers to a means whereby the diverging stream of electrons emitted by the electron gun is brought to a sharp point of focus on the fluorescent screen (Fig. 2). As an optical lens brings light rays to a point of focus so does an "electronic" lens bring electrons to a point of focus.

Fig. 2 shows how a suitably placed magnetic field causes the electronic beam to travel in a spiral path from the magnetic "lens" to the screen so that it arrives at the latter at a point of optimum focus. This is compared with the focusing of a light source in Fig. 3.

Focusing Action

With an optical lens the focus is controlled by altering the distance of the lens from the screen and light source. It could also be controlled by altering the dimensions of the lens but, of course, this is usually out of the question. With an electronic lens the focus may also be controlled by altering the distance of the lens from the screen and electron source but mainly it is controlled by altering the strength of the magnetic or electrostatic field while leaving the lens system in one fixed position.

At the beginning of this decade the focusing unit was often a large electromagnet situated on the tube neck. The resulting magnetic field—and thus the focusing—was controlled by adjusting the current through the winding, a feat that was accomplished by the front-panel focus control.

The next move was a permanent magnet instead of an electromagnet. The field of the permanent magnet was controlled either by the movement of two ring magnets in relation to each other or by a metal sleeve being adjustable within the centre hole of the unit. Either a knob or a lever protruding from the rear cover was employed for focus adjustment.

With these systems the idea is to set the position of the focus unit along the neck of the tube for optimum focus with the control at the centre of its range, final adjustment then being carried out by the control itself.

With electrostatic focusing, which is now being adopted by almost all makers, the focus magnet and its problems of adjustment are abolished. In some cases a small preset slider-type potentiometer is wired so as to adjust the voltage applied to the tube focusing electrode.

The focusing potential, however, is rarely critical and the control can often be adjusted over its entire range without any apparent alteration in focus performance. For this reason some sets use only a flylead and sockets to establish the most desirable potential for the focusing electrode when the tube is installed, it then being necessary to readjust only when the tube is replaced.

This is because modern wide-angle electrostatically focused tubes provide almost fully automatic focusing and Fig. 4 shows the basic make-up of the electrostatic lens system within the tube itself.

Focusing Faults

The amount of focusing field demanded for optimum focus depends upon the velocity of the electron beam. For instance, the greater the velocity of the electrons in the beam the greater the effective "stiffness" of the beam and the greater the electrostatic or magnetic field required to establish a point of focus. This means, therefore, that an alteration in focus may be caused by trouble in the e.h.t. supply circuits as distinct from the focusing system proper. Typical causes of bad focus in this respect are low emission e.h.t. rectifier, low emission booster diode or line output valve and value reduction or open-circuit of the boost reservoir capacitor between the booster diode cathode circuit and the h.t. line.

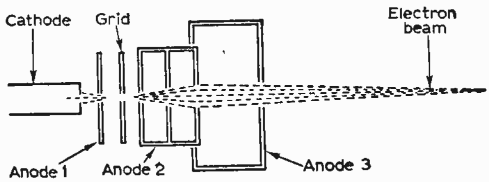


Fig. 4—The basic make-up of an electrostatically focused picture tube.

A fault under the above heading may, however, also result in the symptom of poor e.h.t. regulation where the picture tends to "blow up" and lose brightness as the brightness control is turned up beyond a certain point.

With tetrode and pentode picture tubes the first anode potential is rather important from the focusing aspect. If the voltage is low at this electrode the spot size invariably increases, so although the focus level or knob may cause the picture to go through a point of focus the focus may be so bad even at the optimum point that the horizontal scanning lines may not be visible.

Note that similar trouble can occur due to a fault in the permanent magnet focusing unit. Heavy grease on the sliding sleeve has been known to aggravate the trouble for some curious reason.

Astigmatism

To provide optimum definition both vertically and horizontally the scanning spot must be perfectly round. If the magnetic field is not truly concentric with the tube neck the spot may resolve elliptical in shape. Now as the focusing is adjusted not only will the spot size vary, as it should do, but the spot will also rotate—this is also normal.

Thus it is clear to visualise that while the focus will be optimum, say, vertically, giving clearly defined scanning lines, horizontally it will be poor owing to the major axis of the spot being horizontally disposed upon the screen.

If the focusing is adjusted for optimum horizontal definition, as determined by the resolution of the frequency gratings on Test Card C, for example, so the major axis of the spot will rotate towards the vertical, thereby virtually "killing" the scanning lines while greatly improving the horizontal definition.

Sometimes the trouble is caused by slight misalignment of the gun assembly within the tube neck but mainly it is caused by slight misplacement of the focusing unit. This should be carefully repositioned so that the axis of the tube neck passes through its exact centre parallel to the sides of the unit.

Adjustments are usually provided on the focus unit to allow its movement a little both vertically and horizontally and this should be done without initially paying too much attention to the picture position on the screen. Finally, of course, it will be necessary to adjust the shift controls on the focus unit to centre the picture when, in the majority of cases, it will be found that the astigmatism is cured. ■

SERVICING TELEVISION RECEIVERS

By L. Lawry-Johns

No. 88: PHILIPS 1796U and STELLA ST6917U

THESE receivers were developed from the 1786U and ST8617U series and the layout is very similar. The ST8917U and ST8921U were identical to the earlier models but were housed in a different cabinet.

The Philips 1792U and 2192U were based upon the 1786U but had f.m. facilities for v.h.f. radio reception. The 1796U, etc. models which form the subject of this article have flywheel line sync and mean level a.g.c. The tubes fitted are AW43-80 in the 17in. model and AW53-80 in the 21in.

The receivers have several interesting features, one of which is the ease of access to the tuner unit assembly. With the rear cover removed it will be seen that the cable forms terminate in two plugs. With these removed it is only necessary to rotate the two spring clips on the top inside of the panel to the horizontal position whereupon the unit hinges outwards and can be lifted from the bottom fixings complete.

Two types of tuner have been fitted, one with conventional coil biscuits which will be found on earlier models and the printed strip coils type which have a completely different method of tuning and contact making. There are also variations on this latter type and the tuners are not interchangeable. More will be said of these tuners later.

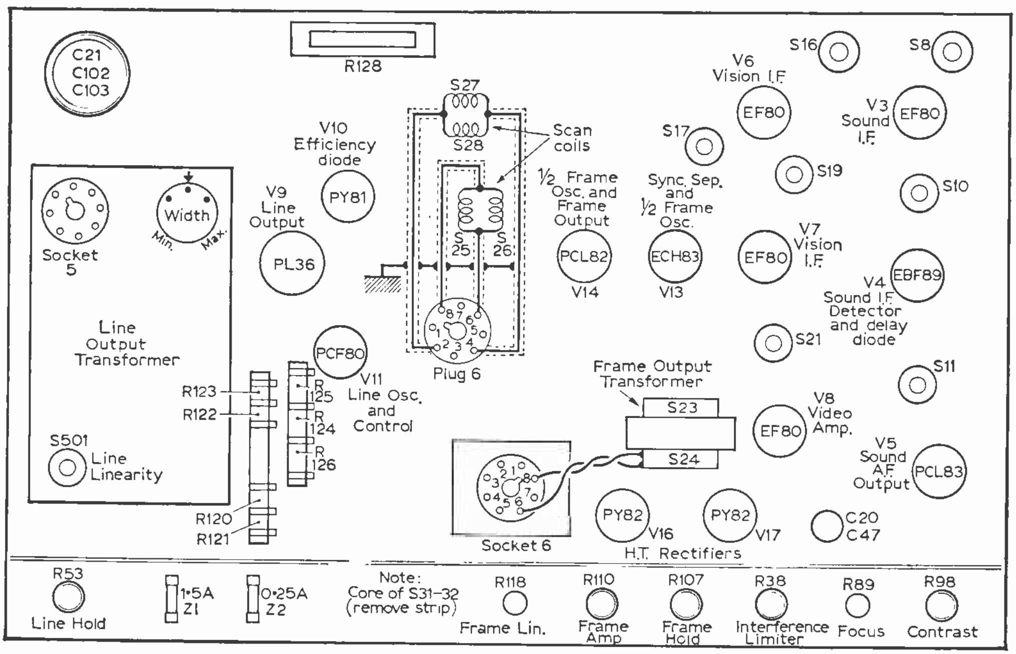


Fig. 1—The above-chassis layout of components.

Interference Limiting

Another interesting feature, this time of the circuit itself, is the method used for interference suppression on sound and vision.

Fig. 3 shows the sound audio amplifier circuit and it will be noted that the usual limiter diode is absent. It will also be noted that the R21 anode resistor of the PCL83 triode is taken to the boosted h.t. line.

Also the value of the resistor is unusually high (2·7MΩ). The purpose of this is to obtain a time constant between R21 and C23 which will attenuate the "spiky" waveform of interference pulses without distorting the normal sound modulation.

Since the use of such a high value resistor drops a considerable amount of voltage across it, it must connect to a source of voltage considerably higher than the h.t. line (which is only a little over 190V), hence its connection to the 450V boost line.

Thus a fault in the line output stage resulting in a drop of boost line voltage will cause loss of volume and some distortion, stressing of sibilants, etc.

The vision limiter operates by varying the voltage on the suppressor grid (pin 9) of the video amplifier. At one end of R38 the grid or electrode is at cathode potential and V8 operates at full gain with no limiting.

As the slider of R38 is turned towards the other end, an increasing negative voltage derived from the line timebase is applied to pin 9 via R39 resulting first in a clipping action which attenuates peak whites and then as the bias increases blocks V8 altogether causing loss of vision signals.

As the limiter knob is placed, perhaps unwisely, next to the contrast it can be seen that a complaint of loss of vision is not unusual when some knob twiddling has been taking place!

Chassis Removal

Remove the tuner unit as previously described, remove the bottom four fixing screws under the chassis and the cabinet screening plug and slide out the chassis and tube complete.

Access to the EY86

The e.h.t. rectifier valve is inverted inside the screened compartment on the left side of the chassis, on the line output transformer assembly. To gain access remove the e.h.t. connection to the side of the tube, the top caps of the PY81 and PL36 and the front left side plug. Remove the edge screws and lift out the complete assembly.

Fault Symptoms

When the receiver appears completely dead but the mains supply is known to be in order, check the supply up to the 1·5A fuse (left hand one of the two) with a meter or neon tester.

If this fuse is in order, but no valve heaters are alight, check the supply to the mains dropper R123-R124 etc. on the left centre of the chassis. Do not bother with the other fuse (Z2) as this is only in the h.t. supply line to the PY81 and does not effect the valve heaters.

If there is no supply to the mains droppers check the on/off switch, having ensured that the plugs to the tuner assembly are both properly connected. If the supply is present at one or more of the dropper tags but not at others shunt the defective section with a wire-wound resistor of the correct value and rating. For example the top section of the larger dropper is R123.

If this is o/c, shunt it with a 33Ω (15-20W) wire-wound resistor making good mechanical as well as soldered connections.

Assuming mains indication is obtained at all of the dropper tags, follow the circuit from the bottom of the smaller dropper (R126) to pin 4 of

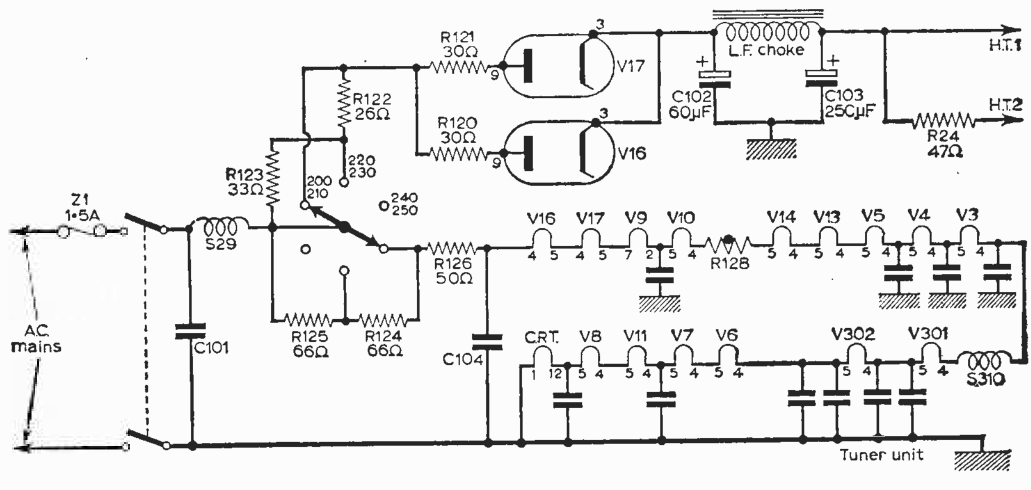


Fig. 2—The power supply circuit.

V16 (PY82). Then check through the heater chain e.g. pin 5, 4 and 5 of V17, 7 and 2 of V9, 5 and 4 of V10. This latter valve heater (PY81) is often to be found o/c, and to be the cause of the trouble.

From V10 the circuit is through the thermistor (VA1015) to pin 5 of V14 then through pin 4 and 5 of each valve base to the c.r.t. heater pin 12 with 1 to chassis. The c.r.t. heater would perhaps have been checked by most first! The neon (if used) should not light at pin 1 (chassis); if it does, reverse the mains connection.

If, however, it lights at pin 12 and the leads are properly connected, the sad conclusion is that the heater is o/c. Prove this by linking pins 1 and 12 together whereupon the valves will all light up if the tube is at fault.

Various methods of welding tube heaters have been presented in previous articles (December 1962 page 119), but a " safe " repair is usually only made by fitting a new tube.

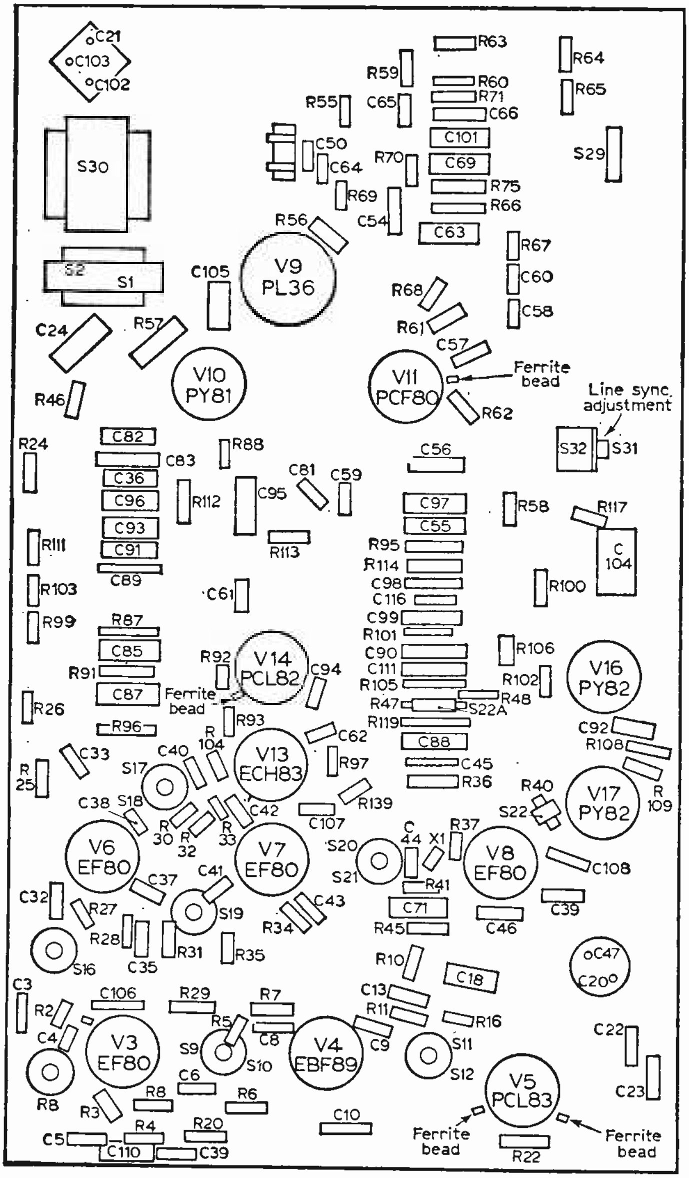


Fig. 3—An underchassis view.

Heaters Alight, No Sound or Vision

If a raster is displayed when the brilliance control is advanced and some hum or background noise can be heard from the loud-speaker. ensure the aerial is plugged in and that the plug is properly wired and making good contact.

Then, if there is no response on either channel, check the tuner unit valves PCC89 and PCF80 (early models PCC84 and PCF80) and the applied voltages.

As the output is split to separate sound and vision i.f. stages as it leaves the tuner it is safe to assume the fault is in the tuner or the aerial system.

If, however, there is no raster upon turning up the brilliance and no line timebase whistle or e.h.t., remember that the audio stage is fed from the boost line and check the PY81, and the 250mA fuse. This fuse does tend to tire and a small pulse is sufficient to cause it to fail. It can be replaced by a 500mA fuse with little chance of damage to the circuit.

Sound, No Vision

If the sound is present but there is no illumination of the screen when the brilliance is advanced, listen for the timebase whistle (we're still on 405!) and if this is present check for e.h.t. at the final anode (side connection) of the tube.

If the line timebase seems to be working normally but there is no e.h.t., or just an intermittent spark when the clip is advanced to chassis, the EY86 is usually at fault. The location of this valve has already been described.

If the line timebase whistle is absent and the sound a little weaker than usual, note whether the PL36 is overheating. It may

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1G6	17/6	6BA6	6/-	6LD20	15/7	20F2	25/11
1H5GT	10/6	6BE6	6/-	6P28	25/11	20L1	15/-
1L4	3/-	6BH6	8/-	6Q7G	6/-	20P1	25/11
1LD5	5/-	6BJ6	6/-	6Q7GT	11/-	20P3	22/8
1LN5	5/-	6BQ7A	22/6	6R7G	10/-	20P4	23/3
1N5GT	10/6	6BR7	9/-	6U5G	7/6	20P5	22/8
1R5	6/-	6BR8	16/4	6V6G	4/6	25Z4G	11/6
1S4	9/-	6BW6	10/6	6X4	4/6	27SU	25/11
1S5	5/-	6BW7	5/-	6X5GT	5/-	30C1	7/6
1T4	3/-	6C4	5/-	6/30L2	10/-	30C15	12/-
1U5	5/6	6C5	6/6	7B7	8/6	30F5	6/-
3A4	6/-	6C6	6/6	7C5	8/-	30FL1	9/6
3A5	10/6	6C9	13/6	7C6	8/-	30FL12	12/6
3B7	12/6	6C17	10/6	7H7	8/-	30L1	7/6
3D6	5/-	6CH6	7/6	7V7	12/6	30L15	9/-
3Q4	7/6	6CW4	24/-	7Y4	7/6	30P4	15/-
3Q5GT	9/6	6F1	10/-	9BW6	14/11	30P12	7/6
3S4	6/-	6F6G	7/-	10C1	12/6	30PL1	9/6
3V4	7/6	6F13	10/-	10C2	25/11	30PL13	10/6
5R4GY	17/6	6F23	10/6	10F1	10/-	30PL14	21/4
5U4G	4/6	6F24	9/6	10LD11	15/7	35L6GT	9/6
5V4G	10/-	6F33	7/6	10P13	15/-	35W4	7/6
5Y3	5/6	6J5G	5/-	10P14	18/9	35Z4GT	6/-
5Z3	19/5	6J6	3/-	12AC6	14/11	35Z5GT	9/-
5Z4G	9/-	6J7G	4/6	12AD6	16/10	50C5	10/-
6A7	10/6	6J7GT	10/6	12AE6	12/3	50L6GT	10/-
6A8	9/-	6K7G	2/-	12AH7	8/-	85A2	16/-
6AC7	4/-	6K7GT	6/-	12AH8	12/6	90AG	67/6
6AG5	5/6	6K8GT	10/6	12AT6	7/6	90AV	67/6

90C1	16/-	EA50	2/-	EF40	15/-	EM85	16/10
90CG	37/6	EABC80	9/-	EF41	8/-	EN31	71/-
90CV	42/-	EAF42	9/-	EF42	10/-	EY51	8/6
150B2	16/6	EB34	2/6	EF50(A)	7/-	EY83	16/2
807	6/-	EB41	8/6	EF50(E)	5/-	EY84	18/2
5763	7/6	EB91	4/-	EF73	10/6	EY86	7/6
7475	5/-	EBC41	8/-	EF80	5/-	EZ40	6/6
AZ31	10/-	EBC81	8/-	EF85	6/-	EZ41	7/-
AZ41	12/3	EBF80	8/-	EF86	9/-	EZ80	6/-
B36	9/-	EBF83	13/7	EF89	9/-	EZ81	6/-
BY100	8/-	EBF89	9/6	EF91	3/6	GZ30	9/-
CL33	18/9	EC70	12/6	EF92	4/6	GZ32	10/-
CY31	11/-	EC81	27/6	EF97	13/-	GZ34	14/-
DAC32	10/6	EC92	11/8	EF98	13/-	HN309	29/1
DAF91	5/-	ECC34	23/11	EF183	18/2	HVR2	10/-
DAF96	7/6	ECC35	8/6	EF184	9/6	KT33C	8/-
DD41	13/7	ECC40	17/6	EF804	22/8	KT36	32/4
DF33	10/6	ECC81	5/-	EK32	8/6	KT41	29/1
DF66	15/-	ECC82	5/-	EL32	5/-	KT44	12/6
DF91	3/-	ECC83	7/-	EL33	12/6	KT61	12/6
DF96	7/6	ECC84	9/-	EL34	15/-	KT63	7/-
DF97	9/-	ECC85	7/6	EL38	18/6	KT81	40/9
DH63	6/-	ECC88	21/-	EL41	9/-	KT88	43/6
DK32	12/-	ECF80	10/6	EL42	10/-	KTZ63	7/6
DK91	6/-	ECF82	10/6	EL81	16/2	L63	6/-
DK92	10/6	ECF86	19/5	EL83	19/5	MHLD6	12/6
DK96	8/6	ECF804	20/-	EL84	7/-	MU12/14	8/-
DL33	9/6	ECH21	22/8	EL85	10/6	N37	25/11
DL66	17/6	ECH35	6/6	EL86	16/10	N78	29/1
DL68	15/-	ECH42	9/6	EL91	5/-	N108	29/1
DL72	15/-	ECH81	7/6	EL95	10/6	N308	20/1
DL92	6/-	ECH83	13/7	EL820	18/2	N339	15/-
DL94	7/6	ECH84	16/2	EL821	25/11	P61	3/6
DL96	7/6	ECL80	9/-	EL822	19/6	PC86	14/7
DM70	7/6	ECL82	9/6	ELL80	20/5	PC88	16/2
DM71	9/9	ECL83	18/9	EM34	9/6	PC95	13/-
DY86	13/-	ECL86	14/7	EM71	22/8	PC97	11/8
E80F	30/-	EF36	4/-	EM80	9/-	PCC84	7/6
E83F	30/-	EF37A	8/-	EM81	9/6	PCC85	9/6
E180F	34/6	EF39	4/6	EM84	10/6	PCC88	18/-

PCC89	8/6	TY86F	13/-	UCL83	18/9	OA79	3/-
PCC189	19/5	U12/14	8/6	UF41	9/-	OA81	3/-
PCF80	7/6	U16	10/-	UF42	12/6	OA86	4/-
PCF82	10/6	U19	48/6	UF80	10/6	OA91	3/-
PCF84	16/2	U22	8/-	UF85	9/-	OA95	3/6
PCF86	9/6	U24	29/1	UF86	13/6	OA210	9/6
PCL82	9/-	U25	15/8	UF89	8/-	OA211	13/6
PCL83	9/6	U26	9/-	UL41	10/6	OC16W	35/-
PCL84	7/6	U31	11/6	UL44	25/11	OC19	25/-
PCL85	10/-	U33	29/1	UL46	14/6	OC22	23/-
PCL86	16/2	U35	29/1	UL84	8/6	OC26	25/-
PCL88	21/4	U37	32/4	UM4	17/9	OC28	17/6
PEN46	4/6	U45	15/6	UM34	16/10	OC29	27/6
PL33	18/9	U76	6/-	UM80	14/11	OC35	18/-
PL36	15/-	U191	14/7	UY1N	18/2	OC36	21/6
PL38	25/11	U201	16/2	UY21	16/2	OC41	9/-
PL81	10/6	U251	14/-	UY41	6/6	OC44	[illegible]
PL82	7/6	U281	19/5	UY85	6/-	OC45	9/-
PL83	9/-	U282	22/-	VP13C	7/-	OC65	22/6
PL84	11/1	U301	22/8	VR105	7/-	OC66	25/-
PM84	15/2	U329	14/-	VR150	7/-	OC70	6/6
PX4	10/6	U404	6/6	W107	20/5	OC71	6/6
PY32	13/6	U801	[illegible]	W729	19/5	OC72	8/-
PY33	17/6	UABC80	9/-	X41	15/-	OC73	16/-
PY80	7/6	UAF42	9/6	X66	12/6	OC74	8/-
PY81	7/6	UB41	12/-	X78	[illegible]	OC75	8/-
PY82	7/-	UBC41	8/6	X79	40/9	OC76	7/-
PY83	7/6	UBC81	11/-	X81M	29/1	OC77	12/-
PY88	13/-	UBF80	9/-	X109	29/1	OC78	8/-
PZ30	17/6	UBF89	9/6	Y63	7/6	OC81	8/-
R18	18/2	UCC84	14/3	Z66	9/6	OC82	10/-
R19	19/5	UCC85	7/6			OC83	6/-
SP41	3/6	UCF80	13/-	*Transistors*		OC84	8/6
SP61	3/6	UCH42	9/6	*and diodes*		OC170	9/6
SU25	27/2	UCH81	9/6	OA70	3/-	OC171	10/6
T41	9/-	UCL82	9/6	OA73	3/-	OCP71	17/6

Terms of business:—Cash with order or C.O.D. only. Orders value £3 or more sent post/packing free. Orders below £3 please add 6d. per valve. C.O.D. orders:—Minimum fee, including post and packing; 3/-. We are open for personal shoppers, Mon.-Fri. 8.30-5.30, Sats. 8.30-1 p.m.

We also require for prompt cash settlement all types of valves. Loose or boxed, but must be new.

All goods new, boxed, and subject to makers' full guarantee. We handle first grade goods only, and do not sell seconds, rejects, nor items stripped from new or used equipment. All orders despatched same day. Complete catalogue of modern and obsolete valves and components with terms of business, 6d.

be found that far from overheating it is not even lit up although all other valves are. If this is so it is because the glass envelope has cracked and the vacuum lost.

A replacement may restore normal conditions but pay particular attention to any signs of overheating which could have caused the original valve to fail. If the PL36 is overheating check the V11 PCF80 by replacement and check R57 1·8kΩ although being a 5W resistor this does not very often cause trouble.

Should the effect continue ensure that pin 5 of the valve base is making good contact in the base socket. We have encountered poor contact on a

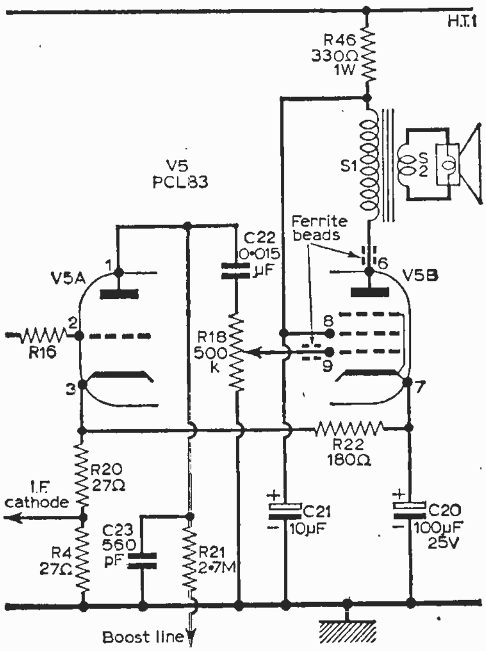


Fig. 4—The audio and output stages of the circuit.

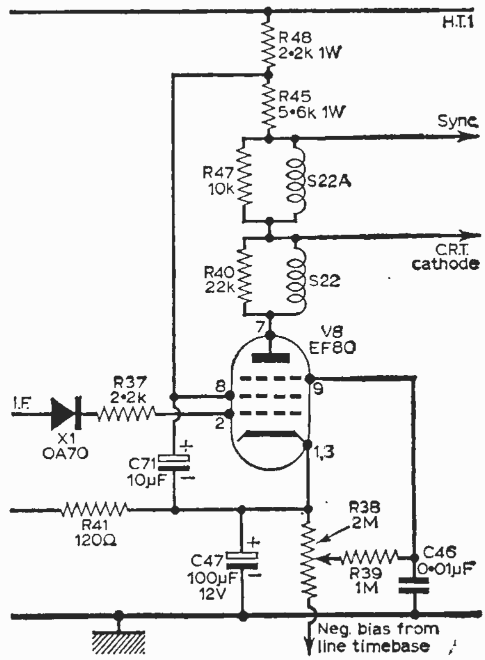


Fig. 5—The video amplifier stage of the circuit.

PL36 valve base (octal) on several occasions and the memory of the first merry chase lingers on, although this was actually on a Bush receiver.

It should be noted that an ECL80 was used in earlier models, not only in place of the PCF80 but also in place of the ECH83; this was the 1768U series. If the PCF80 and PL36 are in order check the PY81. If a slight line whistle is audible denoting that the oscillator is working and the above valves are in order check the 0·056µF boost line capacitor, C82.

TO BE CONTINUED

PRINCIPLES AND PRACTICE OF TELEVISION

—continued from page 300

the network thus have the advantage of an extra special aerial system without fear of the whole lot collapsing through their roofs.

The block diagram in Fig. 30 shows the basic conception for a small system. Here the u.h.f. signals are converted to an unused v.h.f. channel which, along with the BBC and ITA television signals and the v.h.f.-f.m. sound signals, are combined to a common cable. To make up for the losses in combining etc., all the signals together are amplified in a wideband amplifier, from whence they are fed from house to house through coaxial cable, called spurs.

The correct level of signal is extracted from the cable spurs through special inductive or resistive take-offs (see Fig. 31) and fed through downleads to the receivers. As the signals are thus weakened due to their travel through the coaxial cables and loading losses they are restored to their original levels by the connection of additional wideband amplifiers (or repeaters) at intervals throughout the cable network (see Fig. 32).

Systems of this nature are in operation in many parts of the country, and the big advantage of this kind of system, as distinct from the type that uses multi-conductors instead of coaxial cable, is that it is suitable for operating any type of domestic receiver, while the other type requires special sets or adaptors. The reason for converting the u.h.f. signals to the v.h.f. is that the coaxial losses at u.h.f. are prohibitive and would demand repeaters at very close intervals to maintain the correct level of signal.

It is understood that several manufacturers of dual standard receivers are arranging the switching so that on coaxial communal aerial and relay systems of the nature described, the u.h.f. programmes will be received on a pre-determined v.h.f. channel on the v.h.f. tuner at 625 lines.

LARGE-SCREEN AND PAY-TV WILL BE DEALT WITH NEXT MONTH

UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

BY ICONOS

THE music hall was at one time a great British institution, almost a part of the British Constitution. In the year 1912 there were no less than 72 music halls in the Greater London area, varying in size and clientele from the great variety theatres of the West End—the Coliseum, the Palladium and the Palace—to the smaller and rougher halls in Hoxton, Islington and South London. One of the smallest was the Granville, Walham Green, which seated only 777 people and was turned into a television studio some years ago by Associated Rediffusion. Chelsea Palace was acquired a year or so later by Granada, who adapted it for television. Granada also took over the Palace, Walthamstow, and the Metropolitan, Edgware Road, both large auditoria, which have been closed for development. ATV took over the Empire music halls at Hackney and Wood Green, both for television. It was the latter theatre-studio which was used by ATV for *Sing a Song for Sixpence*, John Betjeman's story of the English music halls, a series of the songs and reminiscences of their great days.

"Sing a Song for Sixpence"

As John Betjeman is one of my favourite storytellers and I have boyhood memories of the music halls of the twenties, I had hoped for a warm and nostalgic revival of the atmosphere of the period. Alas! It was not achieved on this occasion. John Betjeman addressed the viewers from a front seat in the empty circle of the Wood Green Empire; there was no audience reaction to the variety turns put on by a number of veteran artists, including Hetty King, Randolph Sutton, Billy Danvers and Dorothy Ward. The reminiscences of Marie Kendall and Ada Reeve were interpolated as though they were talking with one another instead of with Mr. Betjeman. Timing—always a most important factor in the old music hall—seemed notable by its absence, with artists late on their cues. Recordings of early phonograph cylinders and discs of Chirgwin, Albert Whelan, Robey and dozens of other stars naturally suffered in reproduction but did not seem to be as good as some of the early cylinders played on my own antique Edison Bell phonograph at home. This was a great pity. There seemed to be a lot of good material assembled which was wasted through under-rehearsal, absence of audience participation and a poorly shaped script. The show came to life when Hetty King gave her expertly timed act but trailed away sadly as the camera lens zoomed unsteadily away to a long shot and silence. The music hall may now be a museum but it deserves the slick, quick, brassy and brash treatment it got when Charles Gulliver, Oswald Stoll and Charles Morton used to pack 20 or so individual turns into each performance of a twice-nightly show!

"Television and the World"

The American Society of Motion Picture and Television Engineers added the word "Television" to its title some years ago and now devotes more than half its activities to the newer medium. The current position in America is that about 70% of American programmes are filmed and that Hollywood is once more a thriving picture-making centre, most of the output going to television all over the world apart from the 65,000,000 television receivers in the USA. These facts were brought out in an address given to the British Kinematograph Society by Richard Cawston on "Film and World Television". Mr. Cawston described the impact of television on the 22 countries he visited during the reconnaissance he made prior to making his BBC documentary film "Television and the World". His lecture was illustrated with excerpts from this film, one of the best documentaries ever made and winner of awards from the Television Society, Society of Film and Television Arts, the Screenwriters and the Italia Prize. The impact of television on backward countries in particular was almost terrifyingly illustrated in the scenes where crowds of illiterate natives in Nigeria were staring at TV receivers, fascinated by the scenes of white men shooting one another hour after hour in the continuous flow of Western films. Mr. Cawston explained that many of these viewers believed that what they were looking at was true, not make-believe, and that the trigger-happy cowboys of Roaring Gulch were a true representation of life in modern America.

Table d'Hote Westerns

Another extract of the film showed a big exterior lot in Hollywood with covered wagons, sheriff's office, saloon and all the usual scenery and props all ready for use, including waterfalls that could be turned on with a tap and an ancient steam locomotive and train at its depot. This was typical of one of the main sources of mechanised cowboy film factories which was capable of producing a half-hour Western film in two and a half days. Everything is laid on and at the ready. Speed is the essence of the whole TV film operation from script to final cut—and it must be admitted the result is a polished, mass-produced article which is a best-seller all over the world. It doesn't matter if the viewers can't understand the language. The Good man and the Bad man can be instantly recognised; the star-badged marshal, the doctor, the heroine and the parson are all familiar stock characters to these viewers whatever their nationality or level of intelligence.

Political TV

An amusing side issue of television in the West German and East German areas of Europe is the political propaganda battle which is daily fought on the air by each side.

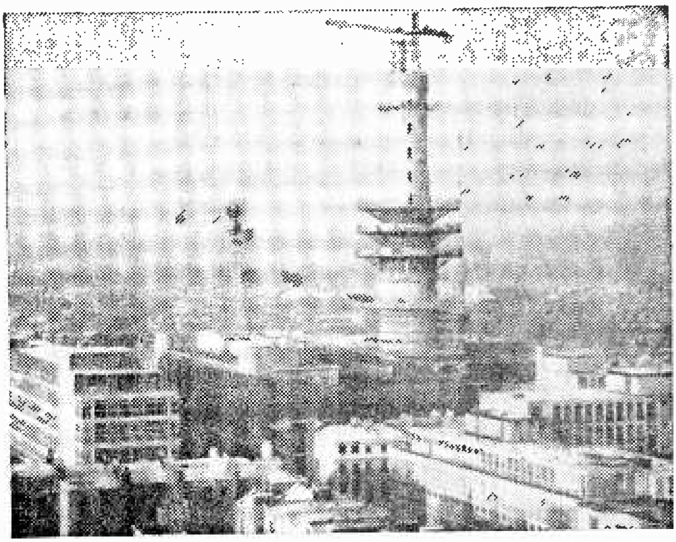
Mr. Cawston explained how the West Germans picked up the others' propaganda and videotaped it, added their own reply, commentary or supplementary picture, and then transmitted it back over the border. Naturally the East Germans and the Communists retaliate in like manner. As no holds are barred, venom is dubbed on to venom until viewers on both sides are bored to death by the childishness of the whole affair. How delightful it would be if the victims of the BBC's "TWTWTW" programme could answer back in like manner! Perhaps the ATV could produce a "That Was the Week Before That" show a week later, including a burlesque of the BBC sour pussies and a forum for the "TWTWTW" victims to hit back!

TV Writers

There is one point where the ITV and BBC programme arrangers always seem to think along the same lines. That is that to hold viewers week by week it is necessary to have series programmes which play off their half-hour or hour at the same time and on the same day or days of each week. This is not a new phenomenon, indeed it dates back to the early days of the BBC Savoy Hill sound radio when *Radio Radiance*, a musical sound revue with Tommy Handley, made its weekly Wednesday night transmission. This was the first show for which the BBC daringly engaged a troupe of six or seven chorus girls to sing and to tap out the rhythms on tap mats. *Coronation Street, Steptoe and Son, 77 Sunset Strip* all have their regular times to which we have become accustomed. This trend continues and the more successful series carry on and on —and on. Of course the script writer of the original "pilot" episode of a series soon gets to the end of his powers of invention with one particular set of characters and has to have a break to recover. In the meantime a team of two or three writers have been studying the characterisation, style and writing. They move in and carry on the never-ending plot while the original author clears his head and gets his second wind. Ultimately the three or four authors make quite a career out of the original idea. It becomes a highly professional routine job; workmanlike but skilled, competent but well finished, like an expertly removed appendix. The real creative job was done at the start of the series and everything written later is limited to the exploitation of the traits of the characters that are already familiar to viewers. The same rules apply to nearly all the long TV series whether filmed, live or tape, whether about hospitals, department stores, detectives or what-have-you. The American Western script writer teams have long ago worked out the 14 basic cowboy plots and are now well on with the thousands of permutations and combinations of the actions of the ever-popular cardboard characters.

"Laughter, USA"

All American television shows are not routine weekly opiates or sedatives. Many of the top-line musical shows are brilliant, their world affairs commentaries are as astringent and well informed as they are superbly written and presented. Their documentary films are brilliantly edited, backed by careful research, whatever the subject. BBC-TV recently transmitted a fine example of a documentary film titled *Laughter, USA*, one of the NBC's Project 20 series. With a racy commentary by George Burns the programme surveyed 50 years of humour in American entertainment: books, vaudeville, plays, films and radio. The major part was devoted to films and included some well-selected extracts of early films of Charles Chaplin, Laurel and Hardy and Buster Keaton. Keystone comics were well to the fore and there were one or two delightful glimpses of W. C. Fields, one of the funniest of all comics who, like Stan Laurel, rose to fame in the English music hall. It made one wish to see in complete form some of these early movie laughter classics. There was a warmth about the gags which is absent from the sick humour favoured by the angry young producers of the BBC of today.



The rapidly growing Post Office radio and television tower in London's Howland Street, photographed from the top of Mullard House.

continental tv

LONG DISTANCE TEL

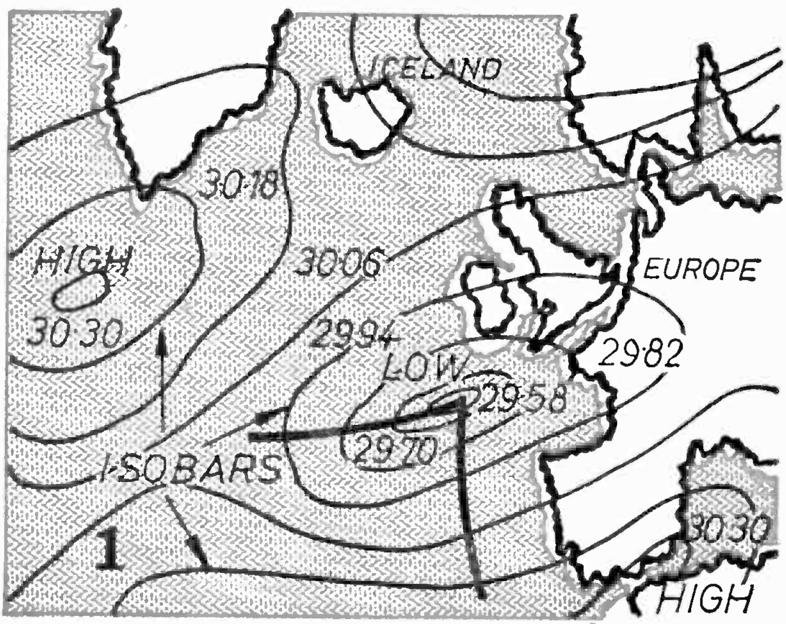
BY
IAN C. EWENS

RECEIVING DX SIGNALS ON DUAL-STANDARD SETS

WITH the advent of dual standard 405/625 line television sets it has become very much easier for the enthusiast to interest himself in chasing the DX television picture. The aim of this article is to explain how long distance v.h.f. propagation takes place, and how to prepare the more modern sets to receive Continental stations.

Weather Conditions

The most common cause of long distance television reception is a particular weather condition known as an anticyclone. This is the meteorologists' term for an area of high atmospheric pressure, and when such a system exists in a favourable position, some sort of reception will be obtained from transmitters of 150 miles distant or more, and on suitable days within this period stations well over 750 miles away will quite likely be observed.



VISION RECEPTION

Anticyclones are associated with long spells of settled weather, this being in itself a guide as to when the right conditions exist for more-than-ordinary propagation—especially in our climate of usual variance. But the safest and surest method is to combine the readings of a barometer with the position as indicated in the weather maps published daily in the National Press; these maps are quite easy to read, and the only important thing to remember is the difference between an anticyclone and its opposite the Depression.

Figs. 1 and 2 indicate this difference, and Fig. 2 also shows a typical situation for long distance TV reception in this country. In fact on this particular day, stations transmitting in Italy, Hungary, Denmark and Holland were received by the author in South East England.

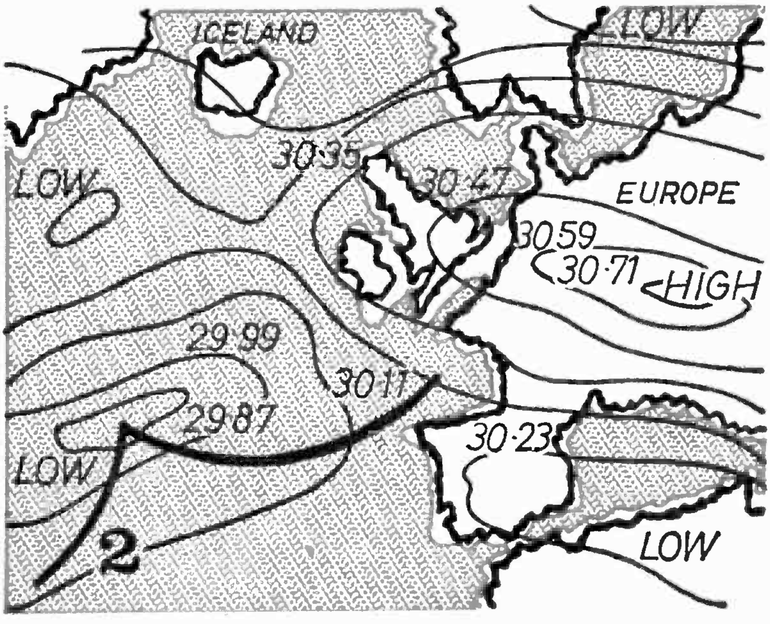
It is not the province of this article to explain *why* these unusual distances can be covered by v.h.f. radio waves; the BBC for instance is still carrying out research on the subject. If it is due, as believed, to layers of air of different temperatures and density it seems odd that barometric pressure need be so high for this to happen.

Sunspot Maxima

V.H.F. radio waves may also be reflected by the ionised layers of the atmosphere, though usually they pass straight through and are lost in space. This rarity only occurs in years of intense sunspot activity and there is little guide as to when it can be expected even in years of sunspot maxima. It is worth while to note, however, that by this phenomena no distance is too great for the television signal to travel!

Only one or two very minor modifications are needed to enable the new dual-standard receivers to accept and resolve Continental transmissions. Let us consider first of all the receiver in which a u.h.f. tuner has not been fitted. In this case the h.t. feeding the unit is merely removed when the 625-

continued over



Two examples of typical weather maps, the study of which can give an indication of expected long distance reception. Fig. 1 shows a Depression and Fig. 2 an Anticyclone.

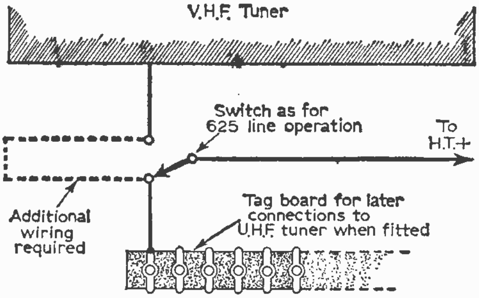


Fig. 3—H.T. switching for a dual standard set without a v.h.f. tuner fitted.

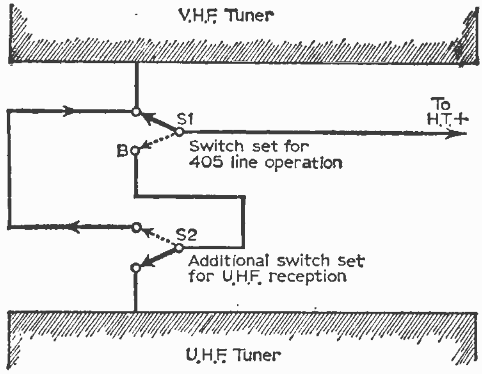


Fig. 4—Circuit alteration needed where a u.h.f. tuner is already fitted.

line circuits are switched into operation, and all that need be done is to restore it as shown in Fig. 3.

Where a u.h.f. tuner unit is already in circuit, Fig. 4 shows the circuit alteration needed. It is of course essential to ensure that both tuners are not fully operative together.

Sound reception of Continental programmes is not possible without major retuning of the inter-carrier sound circuits, but at least the set is now prepared to receive the negatively modulated pictures from the Continent.

Tuning in these transmissions poses the only other problem, and this is carried out very easily by alteration of the oscillator frequency through movement of the oscillator coils core, access to which is often obtained by removal of the knobs operating the channel tuner. It can then be adjusted from the front of the set.

Some Continental channels more or less coincide with our own and no detuning is necessary. The accompanying table gives an accurate guide to the frequency difference between British and Continental channels.

Band I	British	Continental	French	Russian
Channel 1	46·00	41·25 42·25	46·00	—
Channel 2	51·75	48·25 49·75	52·40	49·75
Channel 3	56·75	55·25	56·15	—
Channel 4	61·75	62·25	—	59·25
Channel 5	66·75	—	65·55	—
Band 3				
Channel 6	179·75	—	177·15	—
Channel 7	184·75	182·25	185·25	183·25
Channel 8	189·75	189·25	190·30	—
Channel 9	194·75	192·25	—	191·25
Channel 10	199·75	196·25	199·70	199·25
Channel 11	204·75	203·25	203·45	—
Channel 12	209·75	210·25	—	207·25
Channel 13	214·75	—	212·85	215·25

Vision frequencies (Mc/s) showing European channels receivable by use of the fine tuner or adjustment of the oscillator frequency.

Aerials

As far as aerials are concerned, the better the array the better the signal, but the X aerial takes some beating, being neither strictly horizontal or vertical in its polarisation. However signals which originated in Spain have been resolved on Channel 2 on a simple Band III aerial lined up in almost the opposite direction. Of course, the ideal arrangement is a multiple array with provision for remote rotation.

It is possible to take some very good pictures off the cathode ray tube, Fig. 5 shows the 625-line positively modulated transmitter at Ruislede. Belgium resolved twice at a line speed of just over 8,000c/s. The receiver was switched to 405-line operation and with the line hold control at the very end of its travel. ■

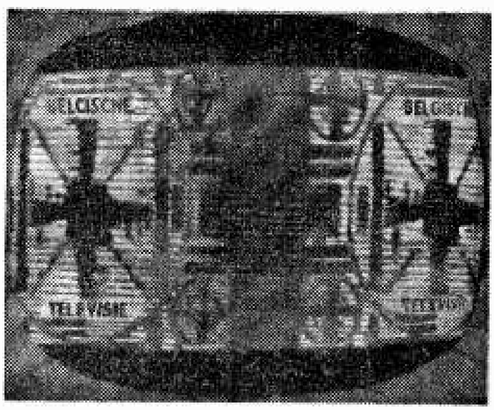


Fig. 5—A photograph from the screen of a receiver showing a Belgian test card.

MAKING AND USING ATTENUATORS

by D. Elliott

AN attenuator is one of the most important single passive networks employed in television engineering, and at some time or other the experimenter will require one either for cutting down signal level or for matching purposes—or both. A well-known attenuator application is for the reduction of signal level from a television aerial to a television receiver to avoid overloading troubles.

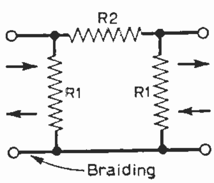
Overloading due to too strong an aerial signal exhibits bad sound-on-vision and vision-on-sound because of intermodulation of the sound and vision signal in the overloaded stages. This trouble is not so bad as it used to be because modern receivers have adequate automatic gain control circuits which adjust the sensitivity of the amplifying stages to suit the signal strength.

Nevertheless, new stations are going up all over the country and the local signal strength is progressively rising and there is a limit to the strength of signal that can be handled even by the most elaborate a.g.c. system.

The sound and vision interferences caused by intermodulation, of course, cannot be cleared by internal receiver adjustment or realignment, and the only cure for the hiatus is to cut down the signal applied to the set. This must be done, however, without upsetting the match between the aerial downlead and the set. A simple, single resistor connected in series with the inner conductor of the downlead would undoubtedly cut down the signal all right, but at the same time it would badly unmatch the aerial and the set and probably cause the latter to go into oscillation—a condition which is worse than intermodulation.

Simple Attenuators

In Fig. 1 is given the circuit of a simple attenuator for use with coaxial cable. This differs slightly when the circuit is balanced, such as when twin feeder is used instead of coaxial, as shown



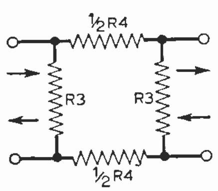
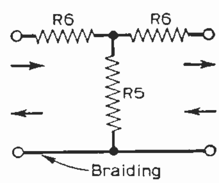


Fig. 1 (left)—A pi unbalanced attenuator for coaxial cable.

Fig. 2 (right)—A pi balanced attenuator for twin feeder.

in Fig. 2. The attenuators shown are called pi-type (π). Another well-known type, however (T type), can also be made for coaxial (unbalanced) or twin (balanced) feeders, as shown in Figs. 3 and 4 respectively. Note that π and T types for unbalanced coaxial each use three resistors, while for balanced feeders the former uses four resistors and the latter five resistors.

The π-type attenuator is the most popular for television applications because, for one thing, the resistor values for the higher attenuation values are easily obtainable, which is not so with the T type (see Table 1).



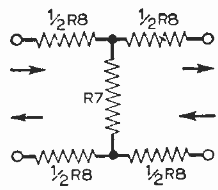


Fig. 3 (left)—A T unbalanced attenuator for coaxial cable.

Fig. 4 (right)—A T balanced attenuator for twin feeder.

Degree of Attenuation

The amount of attenuation required in the simple cases will depend upon the strength of the aerial signal and the sensitivity of the receiver. A good indication that signal attenuation is required is when it is impossible to eliminate sound-on-vision even with careful adjustment to the fine tuning control, when a slight buzz accompanies sound-on-vision, when the picture has that "soot-and-whitewash" appearance even at minimum contrast and when the screen goes peak white with background patterns as the contrast control is turned up.

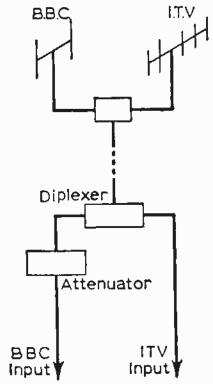
An attenuator reduces the signal by a given ratio, dependent upon the value of the resistors chosen for the network. Exactly how much reduction ratio will need to be applied to the signal to avoid the effects of overloading is best established on a trial and error basis. Switched attenuators can, of course, be made up, but these are rather costly if capacitive effects are to be minimised and the matching to be maintained over all the switched values.

From the experimenter's point of view, it is desirable to make up a series of popular values, for these can easily be connected in cascade in any combination to provide the required overall ratio. Ratios of attenuation or loss (as with ratios of gain) are usually given in terms of decibels (dB). For example, engineers would most likely say that an attenuator has a loss of 6dB or 20dB rather than a loss of two-to-one or ten-to-one.

However, for convenience, both the ratios and decibel equivalents are given in Table 1. Conversion from ratio into decibels is simple enough, and only involves multiplying the logarithm of the loss or gain *voltage* ratio by 20.

Note carefully that we are dealing with *voltage* or *current* ratios across or in impedances which are equal at the input and at the output of the attenuator. The conversion exercise is slightly different with both *power* ratios and with attenuators where the input and output impedances differ.

It is also important to remember that the overall attenuation given by a number of *matched* attenuator networks connected in cascade is the *multiple* of the individual *ratios* or the *sum* of the individual decibel values. This means that three 6dB attenuators connected in series would give an overall value of 18dB, which is the same as an eight-to-one voltage ratio. As a 6dB attenuator has a voltage ratio of two-to-one when three are connected in series we get the same answer—eight-to-one (e.g., 2×2×2=8).



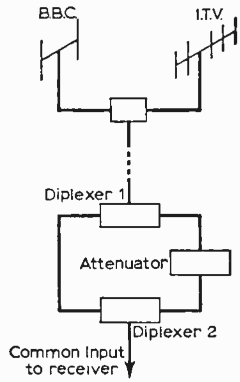


Fig. 5 (above, left)—An attenuator in the Band I feed from a diplexer to the receiver, for use with separate aerial inputs.

Fig. 6 (above, right)—Two diplexers used so that the balanced signals following the first diplexer may be combined to a common cable for receivers with common aerial input.

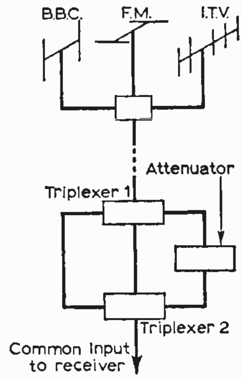


Fig. 7 (right)—Similar to Fig. 6 but using triplexers for carrying f.m. as well as TV.

Channel Attenuation

It often happens that only one television channel needs to be attenuated. The BBC, for example, may be overloading the receiver while the ITV, which is coming in on the same downlead, may be just about the right level for the best picture. Thus, if an attenuator is connected in the common downlead, the ITV as well as the BBC would be attenuated.

This is a bad thing, for if a receiver does not obtain a signal of sufficient level the picture will appear grainy, and will in bad cases exhibit the well-known "snow storm" symptom. To avoid introducing a snow storm on one channel at the cost of clearing overloading on the other channel, the attenuator can be used in conjunction with diplexers or triplexers. The basic idea is revealed in Fig. 5 where the set features separate inputs for the BBC and ITV signals.

These days, however, the set invariably has a "common" input socket, thereby calling for two diplexers, the first to split the signals for individual channel attenuation and the second to recombine them to a common input cable, as shown in Fig. 6.

Fig. 7 shows a similar arrangement for use when the aerial downlead carries the v.h.f.-f.m. signals as well as the television signals. Here, of course, triplexers are used instead of diplexers, and in all the examples given it is assumed that combined or masthead-coupled aerials are employed.

Shared Aerials

Attenuators must also be used when a single aerial system is employed to operate more than one television receiver simultaneously. The

dB	Ratio	Outlets	R1	R2	R3	R4	R5	R6	R7	R8	R9
6	2 : 1	2	216	54	240	60	96	24	107	27	22
9	3 : 1	3	144	96	160	107	54	36	60	40	33
14	5 : 1	5	108	173	120	192	30	48	33	53	56
20	10 : 1	10	88	356	98	396	15	59	16	65	—
26	20 : 1	20	80	718	88	798	7	65	8	72	—
34	50 : 1	50	75	1,800	83	2,000	3	69	3	77	—

TABLE 1

Ratios, dB equivalents and resistor values in ohms for elements of attenuators. The resistor numbers refer to those shown in the various networks figured.

attenuator this time serves as a matching device and, unfortunately, attenuation is the cost of correct matching.

Two such arrangements for coaxial cable are shown in Figs. 8 and 9, the former for feeding two receivers and the latter for three receivers. These are called "star" networks for obvious reasons and are symmetrical, the resistors being of equal value in each particular network.

For two outlets (Fig. 8) and for 70Ω coaxial cable R9 is equal to 22Ω, while for three outlets (Fig. 9) R9 is equal to 33Ω (nearest preferred value in each case). The values for other numbers of outlets can be computed (see Appendix), but it must be remembered that the loss ratio from the aerial to *each* receiver is equal to the number of outlets. Thus, two outlets give a two-to-one loss, three outlets a three-to-one loss and so on.

The decibel loss from the aerial to each receiver can be discovered by multiplying the common logarithm of the number of outlets by 20, and is, for example, 6dB for two outlets, 12dB for four outlets, 18dB for eight outlets, 20dB for ten outlets and so on. Clearly, then, the aerial signal must be strong enough for splitting over the required number of outlets to avoid each receiver from exhibiting bad grain effects.

If the aerial signal is insufficiently strong it is in order to amplify it between the aerial and the input to the star network. For zero loss between the aerial and each outlet the amplifier must have a gain in decibels equal to the decibel loss of the star network from the input to one outlet.

This is when the desirability of working in decibels, as distinct from ratios, is fully realised, for as we have already seen decibels can simply be added and subtracted while ratios require more complicated multiplication and division.

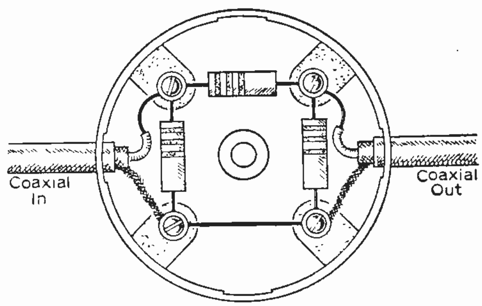
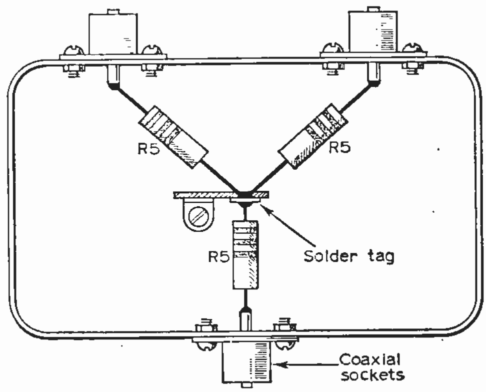


Fig. 10 (above)—Showing how a simple pi attentuator may be built into an electrical junction box.

Fig. 11 (below)—A small tin box can also be used to house attenuator networks; that shown incorporates the circuit of Fig. 8.

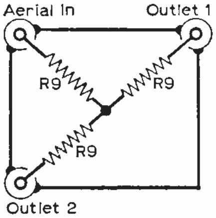


Unit Construction

For ordinary work of the nature detailed in this article, attenuator construction need not be unduly critical, but for instrument and very accurate applications extreme care must be taken to avoid unwanted capacitive and inductive couplings and impedance discontinuities.

Two suggested methods for the construction of simple attenuators are given in Figs. 10 and 11. The first shows how neatly a π-type attenuator may be built within a plastic or metal electric junction box, while the second shows how a small tin can be used to house the components of a two-outlet star network (see Fig. 8).

In all cases the resistors should be of the insulated carbon type which are non-inductive. If exact values as required are not available, the next lowest value can be used and the carbon very carefully filed away in the form of a groove until the resistor reads as required. In most instances it requires only the removal of a small amount of carbon in this way. Excessive filing to provide relatively large changes in value should be avoided.



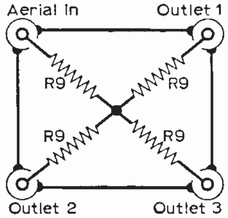


Fig. 8 (left)—A two-outlet star network for feeding two sets from a common aerial.

Fig. 9 (right)—A three-star network for feeding three sets from a common aerial. If all the outlets are not connected to sets, those not in use must be terminated with a 70-80 ohms resistor.

Appendix

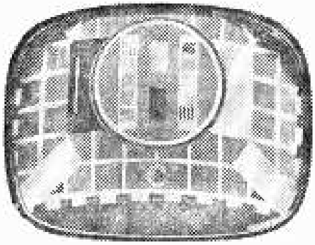
Resistor values for any value of attenuation and impedance may be calculated as follows:

For the π network (Figs. 1 and 2) R1 and R3 $=Z(A+1/A-1)\Omega$ and R2 and R4$=Z(A^2-1/2A)\Omega$. For the T network (Figs. 3 and 4) R5 and R7$=Z(2A/A^2-1)\Omega$ and R6 and R8$=Z(A-1/A+1)\Omega$. For the star network (Figs. 8 and 9) R9$=Z(n-1/n+1)\Omega$, where Z is the characteristic impedance of the cable, A the attenuation ration (e.g., the ratio of input to output voltage required) and n the number of outlets.

Note that the resistors in Table 1 were calculated for 72Ω coaxial and 80Ω twin feeder. The nearest preferred value resistors should be used in each case. ■

Picture Adjustments

by T. S. Smith



Part 2 UNDERSTANDING AND USING YOUR VARIABLE CONTROLS

CONTINUED FROM PAGE 267 OF THE MARCH ISSUE

LAST month we dealt with the basic principles of the picture tube, with the associated parts that help to make up the raster upon which the picture is built and with several picture adjustments that are directly related to the tube and its ancillary fitments.

It will be recalled that to facilitate picture centring some method is available for shifting the picture complete with its raster both vertically and horizontally. This is usually achieved by rotatable discs of metal on the pole face of the focusing unit.

At this juncture it should be noted that on some receivers (specifically those with flywheel line sync) it is possible to shift the picture horizontally *within* the raster. That is, the raster remains still and only the picture moves. This is not classified as horizontal shift, but is a factor of phasing and will be considered later.

On more recent receivers electrostatic focusing is adopted in the electron gun assembly of the tube proper and an external focusing magnet is not required. This means, however, that a separate unit specifically for picture centring must be included, on the neck of such a tube.

PICTURE SHIFT UNIT

There are several designs of this type of unit—one looking rather like a miniature focusing assembly and another having the appearance of an overgrown ion trap magnet upon which is a small control knob. An idea of what the former type looks like can be gleaned from the picture in Fig. 9. The unit is mounted between the tube base and scanning coils and carries two rotatable discs, one for vertical shift and the other for horizontal shift, as already described.

With the other kind of unit, a shift in one direction is usually provided by the control knob, while rotation of the entire unit on the neck of the tube moves the picture on the other axis. The position of the shift unit on the neck of the electrostatic tube is, of course, rather important, and if it is way out of adjustment it will be found impossible to centre the picture correctly and corner shadowing may also be present.

ION TRAP MAGNET

Early picture tubes often showed a dark disc 2in. or so in diameter in the centre of the screen towards the end of the life (or before) of the tube. This was the result of the emission of negative ions—as well as electrons—from the cathode, and these being relatively heavy were neither focused properly by the "magnetic lens" nor deflected and consequently bombarded the central regions of the screen, thereby destroying the fluorescent property.

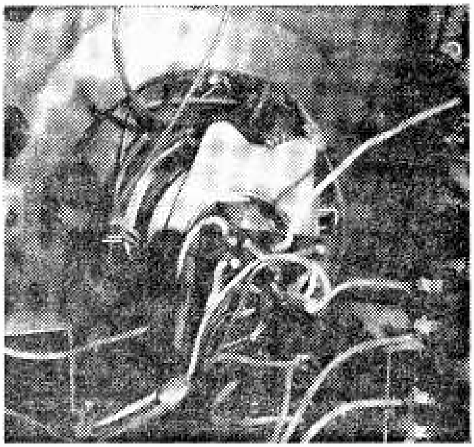


Fig. 9—This picture shows the picture centring unit on the neck of an electrostatically focused picture tube. Also note the small rod beam correction magnet on the left-hand side of the scanning coils, near the flare of the tube.

Note that negative ions, while barely influenced by a magnetic field, are deflected in almost the same way as electrons by an electrostatic field. It is for that reason that very early all-electrostatic tubes were never troubled with ion burns—as the electrons and *ions* were focused and scanned by the electrostatic fields. Recent electrostatically focused tubes would for the same reason exhibit a small intense burn in the centre of the screen, since here the ions are brought to a sharp point of focus but fail to be deflected by the magnetic scanning—that is, of course, if steps were not taken to eliminate the burn.

Fig. 10 shows three types of ion trap gun assembly as used in picture tubes. That at (a) is called the bent gun, and the electrons plus the ions travel down the gun to the bend. The field from a correctly positioned ion trap magnet deflects the electron beam so that it travels round the bend and out of the gun to the screen, while the ions are not deflected by this field and thus end their days by hitting the end of the electrode.

The assemblies at (b) and (c) employ the "slant lens" principle, the difference between the two being that (b) uses a so-called "tilted gun". They both operate in a manner similar to that described, whereby an ion trap magnet is used to restore the

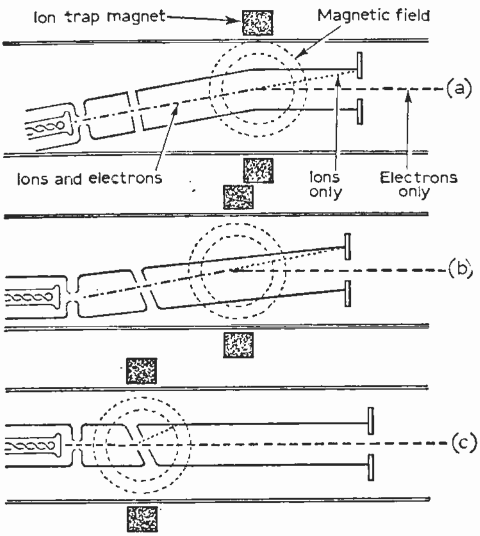


Fig. 10—Three typical ion trap assemblies. These are called the bent gun (a); the tilted gun with slant lens (b) and the slant lens (c). The assemblies are arranged so that both ions and electrons set off in the direction that will result in their impact with a special electrode or with the side of the anode cylinder, but as the ions fail to be deflected by a magnetic field they exhaust their energy by impact as intimated. The electrons, on the other hand, are deflected by the ion trap magnet field and are thus restored to the normal axis of the tube. In that way, therefore, only the electrons reach the screen.

electrons on to the axis of the gun after being bent by the slanted lens system, while the ions continue on the original path and exhaust their energy by striking the side of the anode electrode.

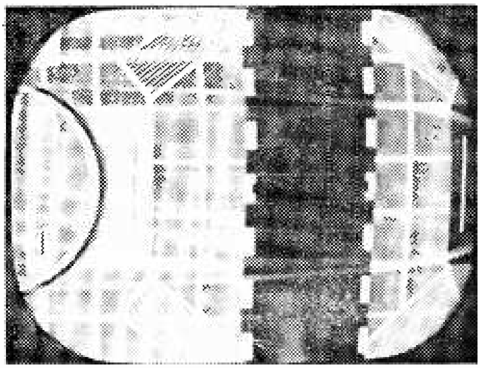


Fig. 11—This illustration shows the effect of the phasing maladjustment on a flywheel line sync model. Incorrect adjustment of the line lock control may also give a similar effect (see text).

ION TRAP ADJUSTMENTS

Having knowledge as to how ion trapping works, one can now understand the importance of ensuring that the ion trap magnet is accurately adjusted. Incorrect adjustment will pull the electrons from the axis of the gun assembly (one cause of corner shadowing), cause the electrons to strike the side of the anode aperture (one cause of tube failure and astigmatism), and reduce the density of the beam (resulting in a dim picture).

OPTIMUM BRIGHTNESS

To secure optimum brightness of the picture or raster—which is the "drill" which must always be undertaken to establish the correct position for the magnet —the ion trap magnet must be rotated and moved along the neck. On some tubes a line is marked on the neck, the idea being to rotate the magnet until the arrow which is marked on it is directly over the line and pointing towards the screen. Note that on some models, for mechanical reasons, the magnet may be fitted with the arrow pointing away from the screen. In such cases, it must be positioned so that the arrow is diametrically *opposite* the line on the tube neck.

The brightness control should be turned approximately half on and the magnet adjusted as described for the brightest possible picture, taking no notice of centring or focusing at this time—adjust simply for maximum illumination. Check the setting at various positions of the brightness control, preferably using Test Card C.

POOR E.H.T. REGULATION

Always remember that there will be no illumination at all if the magnet is well out of adjustment, while slight misadjustment may cause dark shading at the bottom or top of the picture, and as the brightness control is turned up the picture may tend to brighten unevenly—that is, from the bottom up or from the top down. Another symptom is poor e.h.t. regulation that is, the illumination or picture disappearing completely as the brightness control is turned towards maximum. In this event, turn the brightness control well up—almost to disappearing point—and then adjust the magnet for maximum brightness. When adjusting the magnet initially to secure the first signs of illumination, never turn the brightness control up to maximum as this may ruin the tube on the one hand and cause a collapse of e.h.t. voltage on the other, thereby making it impossible to obtain illumination even should the setting of the magnet be correct!

BEAM CORRECTING MAGNETS

So much for ion traps. Some tubes, although not endowed with an ion trap gun assembly, use a small magnet on their necks for beam correction. This magnet should be adjusted on a Test Card for optimum geometry of the picture.

On wide-angle tubes small rod magnets may be located on pieces of soft non-magnetic metal towards the flare of the tube (such a magnet can be seen in Fig. 9, on the left-hand side of the scanning coils). Again, these are for correction of the beam and raster at the full extent of the scans. If necessary, adjustment should be made by bending the metal supporting the magnet until the raster distortion is minimised, as revealed on a Test Card.

ASTIGMATISM

Astigmatism was considered last month, and on Test Card C it can show up like poor vision bandwidth, that is, with the higher frequency gratings failing to resolve. If by adjusting the focusing control or unit the frequency bars resolve with improved horizontal definition but at the expense of defocusing of the scanning lines, then here we would have the classic symptom of astigmatism. The picture tube could be responsible due to misalignment of its gun assembly or—more likely—the focusing unit could be out of alignment with respect to the axis of the tube.

In the latter event, the picture would initially have deen displaced on the screen as a result of the misalignment and then centred by a "hard-over" adjustment to the shift controls. This is the usual cause of the trouble, particularly after the replacement of the picture tube. To correct it, the focusing unit proper should first be accurately aligned so that the neck of the tube passes linearly through the exact centre of the hole in the focus unit, taking no notice of picture centring at this time. Once the correct alignment has been established, the picture should be centred in the usual way by the shift controls, and now they should be well within their range and not at the extreme end.

PICTURE PHASING

On receivers with flywheel line sync it is possible to shift the picture horizontally by means of (a) the line lock control and (b) the "phasing" control or preset (or core in the discriminator transformer). Actually, here the horizontal shift effect differs from that produced by the normal shift controls in that the picture shifts within the raster. That is, the raster remains still, while for normal shift both it and the picture are moved.

The "Telefault" in Fig. 11 shows the symptom of incorrect phasing. Here the picture has shifted so far horizontally within the raster that the picture is split, and drifting, light shadows occur across the black vertical band which represents the line sync pulse region. Now, by adjusting the line lock control (or the phasing control) the picture would move horizontally in a direction as determined by the direction of rotation of the control, and the Telefault photograph in Fig. 12 shows the picture almost completely centred within the raster.

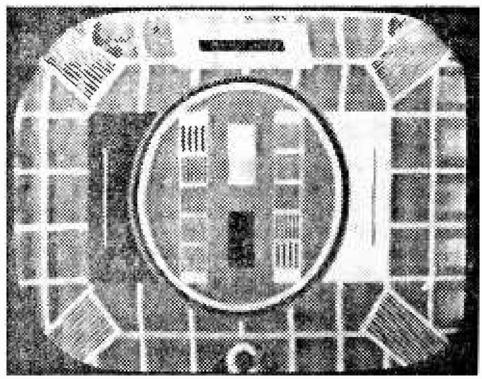


Fig. 12—Here the phasing and/or line lock adjustment is almost correct but not quite as the suppression of the right-hand edge of the picture shows.

Actually, there is still suppression of a part of the right-hand edge of the picture, and the idea would be to adjust the controls until both vertical edges are properly formed.

LINE LOCK CONTROL

Firstly, however, on such receivers it is necessary to establish the correct setting for the line lock control before attending to the phasing, and this is achieved either by removing the line sync pulses (on some models this can be done by pressing a button or the control knob itself) and then adjusting the line lock control until the picture holds lightly in the centre of the screen or by adjusting the control while removing and reconnecting the aerial alternately until the position is established where the picture immediately jumps into line lock on connecting the aerial.

Now, if the picture is displaced from the centre of the raster (assuming that the raster is centred in the screen by the normal shift adjustments), the phasing control or trimmer should be adjusted to give the correct picture position. The adjustment can be facilitated by reducing the picture width a little so that both vertical edges of the raster are visible. When the phasing has been adjusted so that both vertical edges of the picture are fully formed, it may be necessary to check again on the line lock adjustment, as described earlier.

If it is found that the correct line lock position falls towards one end of the range of the line lock control, it is possible on most flywheel sync models to adjust the oscillator frequency—with the control at range centre—by means of a preset trimmer or core. ■

Trade News

One of the EMI type 10667M vidicon cameras.

Remote Controlled Tele-cine Unit

NEW from Beulah Electronics is a completely remote controlled tele-cine unit. With this equipment it is possible to televise, over a closed-circuit network, either silent or sound films or continuous loop films of up to six minutes' duration. As many as 12 receiving locations may be used and, as the equipment needs no projector operator, it can be housed wherever it is most convenient.

An automatic control is incorporated so that the equipment is switched off when a continuous loop film comes to an end and a built-in 24-hour time switch controls the complete equipment, including the receivers. A safety device comes into operation if the film breaks, when everything is switched off and a red indicator light shows.

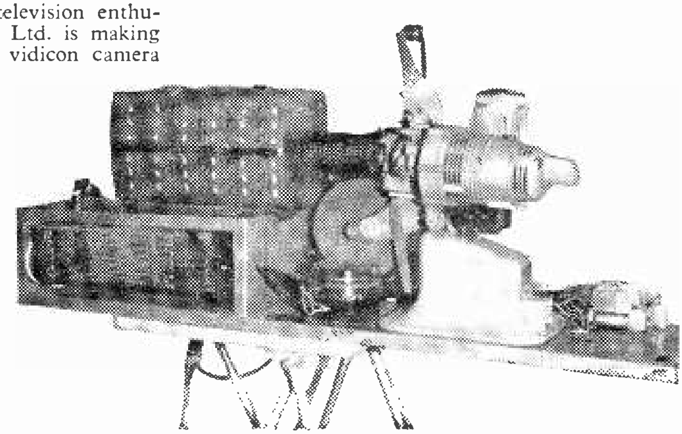
The complete system is known as "Telefilm" and is manufactured by *Beulah Electronics, 138 Lewisham Way, New Cross, London, S.E.14.*

Low-price Camera Tubes

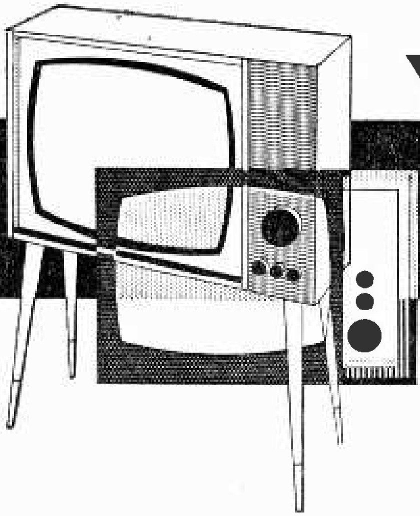
SOME good news for amateur television enthusiasts is that EMI Electronics Ltd. is making available their type 10667M 1in. vidicon camera tubes at the greatly reduced price of £12. Although these tubes are substandard because of minor blemishes they are extremely suitable for amateur-built television cameras. Other uses include setting up and maintenance work on vidicon television cameras which might damage or cause excessive use of a similar expensive high-grade tube.

The tubes employ a high sensitivity photoconductive target. Typical signal current at an illumination of 2ft candles on the target and a dark current of 0·01μA is 0·16μA for peak white illumination. The heater is the standard 600mA type.

The manufacturers of this tube are *EMI Electronics Ltd., Hayes, Middlesex.*



The Beulah remote controlled tele-cine unit.



Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 328 must be attached to all Queries, and a stamped and addressed envelope must be enclosed.

FERGUSON 454T

I have found it impossible to make a permanent correction, on this set, for the lengthening of the picture which occurs at the top of the screen. Adjustment of the two frame hold linearity controls rights the picture only for a short period of time. —C. F. W. Mangold (Liphook, Hampshire).

Alteration in characteristics of the frame timebase valve with increase in temperature can cause this symptom, as also can incorrect adjustment on the mains voltage selector. Note, however, that the height and two frame linearity controls should not be adjusted for optimum geometry of Test Card C until after at least 10 minutes from switching the receiver on.

FERRANTI T1425

If possible, I would like to incorporate the ITV tuner from this set in a Ferguson 992 receiver. I believe that the i.f. is the same for both sets and I wonder if you could let me know of any alterations that would enable me to carry this conversion out?—A. Hills (Crewe).

Although the i.f.'s are the same in the two models mentioned, the tuner is designed specifically for the Ferranti and it is not of general application. It could undoubtedly be used in the Ferguson, but several modifications would have to be made to the frequency changer section.

The EF80 r.f. valve should be removed and the heater current for the tuner should be picked up from across the heater pins on the valveholder (4 and 5) thereby maintaining heater chain continuity. The ECC81 oscillator triode section should be disconnected (V2 frequency changer) while the bypass capacitor on the mixer section cathode should be removed and the tuner signal should be applied, via an 0·001μF capacitor, across the cathode resistor. H.T. should be picked up from the receiver's h.t. line.

EKCO T231

There is a distinct lack of volume on the BBC channel which has not been rectified by replacing the sound output valve, a 10P13. The sound on the ITA channel is still good.—D. Ridsdale (Port Talbot, Glamorganshire).

You should check the setting of the local oscillator coil core on the BBC channel, and also make sure that the PCC84 r.f. amplifier is working satisfactorily.

FERGUSON 992T

This set has recently been fitted with a new mains dropping resistor which appears to have caused the sound to become distorted. The picture is perfect.

I have fitted a new ECL80 sound output valve, and also an EB91 sound and vision interference limiter, but there is no improvement.—A. Murphy (Belfast 14).

Check the 5pF capacitor connected between the control grid and the anode of the pentode section of the ECL80 sound output valve. Also the 0·003μF coupling capacitor on the control grid of the pentode of the same valve. If the trouble persists, suspect a value increase or open-circuit of the 3·3MΩ resistor connected to the anode of the EB91 suppressor.

K-B LVT30

The frame hold control is inoperative and the height control has little or no effect when operated. The frame jumps at regular intervals, rising to 3 or 4in. and immediately collapsing to a line.

The line and frame hold controls have been very critical for some time prior to this fault becoming evident, and now the contrast is also inoperative. When the brightness is increased beyond a certain point, the screen becomes blank.

I have checked voltages and the values of components in the sync separator and frame timebase stages and have also substituted a number of valves, but nothing as yet provides indication of where the fault might lie.—P. Stonelake (Torquay, Devon).

The trouble lies in the frame timebase, and the frame blocking oscillator transformer is the most likely culprit. The picture fade with brightness increase could be caused by a low emission line output valve or booster diode, a low emission e.h.t. rectifier, maladjustment of the ion trap magnet on the tube neck, or a defective picture tube.

FERGUSON 506T

This set has recently developed a thin bright vertical line down the centre of the screen. The sound and picture otherwise remain satisfactory.

I would be pleased if you could give me some advice regarding this fault.—J. C. Piercy (Stromness, Orkney).

While the cause of this symptom could lie in the line stabilising circuit, it is also often caused by low emission either of the PY81 booster diode or the PL81 line amplifier. Have these valves checked for emission before delving too deeply into the line circuits.

SOBELL T171

The top $\frac{1}{4}$in. of the picture on this set has folded over, giving rise to a brighter image which is also inverted. I have checked by substitution V13 (PCL83) and V6 (PCF80) and have substituted the cathode bypass capacitor (C68, 100μF) to V13b, but with no improvement to the picture. —H. F. S. Addicott (London, S.E.18).

This is, of course, frame timebase trouble and is symptomatic of a slow frame retrace. Check in particular, in the anode circuit of the frame amplifier valve and suspect shorting turns or poor insulation in the frame output transformer.

INVICTA 540

The fault on this set started with the picture continually rolling downwards and only being temporarily corrected by the frame hold control. After a week of this the frame collapsed into a horizontal white band in the centre of the screen. The valve PCL82 was replaced which restored the picture but left the uncontrollable rolling fault. —W. Wilson (Hucknall, Nottinghamshire).

It would appear that the 10MΩ grid leak resistor of the PCL82 triode control grid has "gone high" or open-circuited completely. This resistor is associated with a 1MΩ resistor and a 5,000pF capacitor. Check this capacitor and the 470pF to chassis if the resistor is in order.

SOBELL TPS147

For much of the time the picture is clear and sharp, but occasionally there occurs severe fading of both picture and sound. As this is a fringe area for reception, it could be caused by signal fading, but as this fault has only recently become evident it seems likely that something is wrong with the receiver.—P. McLoughlin (Northampton).

The trouble could, of course, lie in the aerial system and may be due to loose connections between the feeder and the dipole or insecure elements. Check these possibilities and also that the first three valves are firmly seated in their holders.

COSSOR 947

The fault on this set is cramping at the top and bottom of the picture. Apart from this the picture is very good.

I have changed the PCL82 frame blocking oscillator and output valve and have tested a number of the components associated with it but without improving the picture.—R. A. Williams (Pontypool, Monmouthshire).

Replace the 250μF capacitor decoupling the pin 2 cathode resistor of the PCL82 frame output valve

DECCA DM4C

The picture has become very dark and the images appear to be defocused. Also the picture fails to fill out to the full width of the screen by about $1\frac{1}{4}$in. either side. The EY86 and the ECL80's have been replaced and the PL81, the PY81 and PY82's have all been checked and found in order.—T. S. Clements (Haddenham, Buckinghamshire).

We would advise you to check the 4·4kΩ resistor to pin 8 of the PL81. This can be replaced with a wire-wound resistor of 5W rating for greater stability. The exact value is not critical.

FERGUSON 989T

After this set has been on for about 5 minutes, crackling noises can be heard and eventually the sound goes completely and the picture grows darker.

I have replaced the EY51 and EB91 but the fault persists.—C. H. Parkinson (New Brighton).

The trouble here would appear to lie either in the h.t. circuit or in the first three stages which are common to both the sound and vision signals.

BUSH TUG34

When the set is correctly adjusted for contrast and brightness, fly-back lines become prominent. Any attempt to remove these lines by adjustment to the contrast and brilliance controls results in the picture becoming too dark for viewing.—D. E. Skinner (Leicester).

These symptoms could well be those of low tube emission, but if the overall brilliance is good, we would advise you to check the front right side PL83 on the lower deck, which is the video amplifier, and the anode load resistor on the rear right side panel.

INVICTA 120T

The trouble with this set is in the sound section. As the volume is increased the sound becomes distorted and muffled, although, up to a certain point, it remains quite clear.

I have replaced V14 (ECL80), C68, C67, R123 and T9; also I have tried a substitute loudspeaker, but with no improvement in the sound quality. —W. Shearman (Exeter, Devon).

You may well find that C66 is shorted. Check C65, R85 and R86 if necessary. R87 sometimes "goes high" but the distortion thus caused would not be affected by the volume control as it is in the control grid of the pentode section. Try a 22kΩ grid stopper to pin 9 if necessary.

VIDOR CN4231

The volume of this receiver has gradually faded until now the fine tuner has to be set at a point where the picture distorts, in order to make the sound audible. All the valves in the sound section have been replaced, but with no better results.

There is also bad interference on the vision, which appears in the form of white spots which cover the screen from top to bottom. This is only prevalent on the BBC channel, and the PCF80 and PCC84 valves are both new.—W. Minchin (Bridgwater, Somerset).

Regarding the weak sound, you should check the audio response by a hum test at the volume control. If the hum is weak, check R48 (220kΩ) anode resistor to pin 1 of the ECL80. If the audio response is normal, check the limiter diode OA71 and its load resistor 6·8MΩ. Check the OA70 detector and i.f. valve base voltages if necessary.

The white spots on the BBC vision may only be due to external interference, possibly from a defective lamp or fitting.

COLUMBIA C506

When I first bought this receiver the picture was very poor. I boosted the tube with a transformer and received a good picture for about three hours but then the screen gradually became darker until the picture had completely gone. After replacing the EY51 and the PL81 a very weak picture returned for about an hour but then the screen once again went dark. I still get a spark at the tube connector to the EY51 but the proper line whistle is not present.—G. W. Aird (Southport, Lancashire).

There is little doubt that the tube itself is defective and will have to be replaced. This usually happens when a tube which has given good service over a number of years is suddenly subjected to an increase of heater boost.

KB PVP20

I have recently fitted a new tube in this set. Now when I increase the brightness all the symptoms of a low emission e.h.t. rectifier (i.e. the picture size increases all round and finally disappears) become evident.

I have changed the e.h.t. rectifier and also the line output valve (PL36) and boost diode (PY83) but with no improvement.—J. Watson (Southsea, Hampshire).

Low h.t. voltage is another cause of the symptoms described in your letter, but also ensure that the mains adjustment is set accurately to suit the applied mains voltage, as this is important on this model.

DECCA DM45

Two weeks ago I lost both sound and vision on this set. I replaced the PCC84 and PFC84 valves in the tuner and everything once again appeared normal. However, when I next switched on to the ITV channel 9 only sound was present and the screen was brightly lit but with no picture. —J. Hayward (Liverpool 24).

You should switch to channel 9, set the fine tuner midway, remove the knobs and insert a non-metallic trimming tool—such as a shaped knitting needle—to retune the oscillator coil core, which appears through a hole just to the right of the tuner spindle.

REGENTONE BIG 12

There is acute cramping of the picture at the bottom of the screen, which usually affects about 1½in. of the screen, and also at the sides but to a lesser degree.—I. Allen (Codsall, Staffordshire).

We would advise you to replace the 6L18 frame output valve, have the EL38 tested and if this is in order, change the 14A100 metal rectifier.

PHILIPS 1768U

The frame hold on this set will not lock in any position of the control, the picture constantly rolling upwards, unless the interference limiter control is advanced until the picture is verging on negative.

This trouble begins about half-an-hour after switching on.—D. E. Williams (London, S.W.6).

You should change the 3·3MΩ resistor which is in series with the hold control. Check the right-centre ECL80 and PCL82 valves if necessary.

BUSH TV53

The top third of the picture remains black unless the height control is fully advanced, when a poor picture is obtained. Then the line structure

is very prominent and the picture is distorted. The bottom part of the picture is very bright and the brilliance control, when adjusted to cure this, also affects the height of the picture.

I have substituted all the valves in the line section but the situation remained the same. I have changed the frame output valve with no improvement, and I had the ECC83 tested and found to be in order.—A. E. Ainsworth (Runcorn, Cheshire).

First try the effect of reversing the mains plug at the back of the receiver. If this results in the top being bright and the bottom dark, check the rear left side PCF80 video amplifier. If the areas of shading remain the same, the fault is likely to be in the frame timebase, particularly in view of your statement that the height has to be fully advanced to get any picture at all.

We presume that the picture fault is that the bottom scanning lines are close together to give a bright area and the top lines far apart, giving a darker area. If this is so and the PCL83 is in order, check the 100μF cathode capacitor, which may be shorted, and the linearity circuit components C17, C37, TC1, R23 and R24.

BUSH TV52

The picture has become distorted and shakes across the screen. This can be corrected for a matter of a few minutes by adjusting the line hold control, but recently this has become very critical. —L. Thomas (Port Talbot, Glamorganshire).

You should replace the 1MΩ preset line hold control and if necessary, replace the right side ECC82 valve.

DEFIANT 1403

I am having trouble with interference on sound and I am unable to locate the cause. The sound is perfect when the brilliance control is turned down, but when it is advanced to normal picture brilliance, an interference, which is very much like mains ripple, appears on the sound. This interference can be eliminated by turning the volume full on, but of course, it is then much too loud for comfortable listening.—R. Dean (Wellington, Shropshire).

Check the metal body of the brilliance/volume control to ensure that all parts are properly bonded to the chassis. Then check the screening of the leads making sure that the screening goes direct to chassis.

PAM 500C

I have recently had a new tube fitted to this receiver and on ITA the test card appears near perfect. On BBC, however, the circle of the test card becomes an oval, which can be adjusted by the linearity control, but this results in the ITA picture lacking in height.—G. O. Davies (Warwick).

Try a replacement PCL82 (rear right side) and if the fault persists, change the 100μF+200μF main smoothing electrolytic.

ALBA T655

After the set has been on for about one hour the picture starts to "jump". This can be stopped by adjusting the vertical-hold control but this also distorts the top of the picture.

After another 20 minutes it begins to "jump" again and cannot be stopped by adjustment to the control.

I have had the two ECL80's and the PL82 tested, and found to be in working order.—L. Clifford (Newton Abbot, Devon).

You should replace the PCL82, V11. Also change R52 (330Ω) and check R48 and C42 if necessary.

H.M.V. 1854

I would like to replace the metal rectifier in this set with silicon rectifiers. Could you give me details of the wiring necessary and also the type of components to use.

Also I recently replaced the volume and brightness control with a Clarostat potentiometer instead of the Morganite fitted by the makers. The volume control now works in reverse (e.g. anti-clockwise instead of clockwise). I have tried altering the wiring but I cannot correct this fault.—J. Walsh (Sheffield).

The existing metal rectifier is wired with the a.c. input to the centre plate and the d.c. output is taken from the strapped end plates. The silicon diode (Mullard BY100 or equivalent) should be wired with the a.c. end (blue dot) to the centre plate and the output to one end plate. Once this is fitted, the mains plug C must always be kept in position 6 irrespective of the mains voltage. Wire an 0·05μF 750V capacitor from one end plate to chassis. This is to protect the diode from peak reflected voltages such as those created by a sudden discharge of e.h.t.

The wiring of the volume control is quite straightforward. As the setting is reduced, the spindle is rotated anti-clockwise and the wiper is brought toward the tag wired to chassis. The inner of the screened cable from the 0·03μF capacitor goes to the other end tag and the inner of the other (to 10kΩ) goes to the centre.

COSSOR 950

The picture suddenly began to slip downwards and the vertical hold control was at the end of its travel. I have replaced the ECC82 and ECL80 valves and can now get a steady picture but at only one position of the vertical hold control.

I would like to know the value of this control and also that of the sound interference limiter control.—D. M. Renty (London, S.E.1).

The vertical hold has a value of 100Ω.

Recheck the ECC82 valve. Also check the 180kΩ resistor (R38) in series with the slider of the hold control.

The limiter control has a value of 250kΩ.

PETO SCOTT 1419T

Could you please tell me the values of the two surge limiters used in this receiver? One is in the frame coils and the other in the heater chain. —F. Morley (London, S.E.14).

The frame coils thermistor is a Mullard VA1033 and that in series with the heater chain is a VA1015.

PYE VT17

Recently the picture has deteriorated as regards brightness, and on ITA it is necessary to switch off all the room lights to view properly. I have tried adjusting the ion trap magnet but this makes very little difference.

If the tube is at fault, would you advise boost-

ing it, and if so by what method?—F. Holborn (Chesterfield, Derbyshire).

Before boosting your tube, check the PCC84 r.f. amplifier valve.

To fit a boost transformer, remove the base and join together the existing heater wires, and connect the 6·3V boosted secondary to the blank heater pins. Mains for the transformer can be taken from the set side of the on/off switch.

QUERIES COUPON

This coupon is available until APRIL 22nd, 1963, and must accompany all Queries sent in accordance with the notice on page 322.

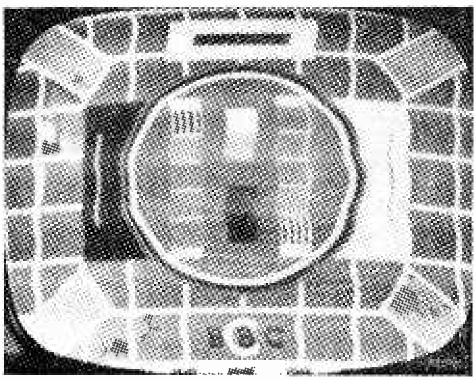
PRACTICAL TELEVISION, APRIL, 1963

TEST CASE -5

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

? *A receiver featuring line flywheel synchronising is prone to develop a waviness on certain transmissions (see illustration) and when the horizontal line lock control is critically adjusted. This is the symptom of "hunting". How is it caused and how can it be cured?*

See next month's PRACTICAL TELEVISION for the solution.



The effect on a TV screen of "hunting."

SOLUTION TO TEST CASE—4

(Page 283, last month)

The frame or vertical scan commences at the top of the screen and finishes at the bottom, and the vertical geometry of the picture is totally dependent upon how well the speed of the scanning spot is maintained during its downward journey. The picture will be perfectly linear in vertical form only when the speed of the scanning spot is constant from the start to the finish of the frame scan, but if there is any change in speed during the scan then there will be vertical distortion or non-linearity as it is called.

Compression or cramping at the bottom of the picture with normal linearity at the top means that the speed of the spot is correct to start with and that it reduces towards the finish of the scan. If there is a gap at the bottom of the screen some fault is preventing the scanning spot from being deflected downwards to its full extent.

The scanning spot is deflected downwards due to a changing magnetic field in the frame scanning coils on the neck of the picture tube, the changing field being produced by a changing current in the anode circuit of the frame output valve. The current starts from a low value when the spot is at the top of the screen and increases progressively as the spot is deflected downwards so that the anode current of the valve is at a maximum when the spot is at the bottom of the screen.

This means, of course, that any shortcoming in the valve or associated network will show up at the bottom of the picture as a gap or compression due to the inability of the valve and circuit to provide the full current necessary to deflect the spot at a "linear" speed right to the bottom of the screen.

Thus, one major cause of the symptom illustrated last month is low emission of the frame output valve, and it is a simple matter to prove this either by having the valve tested for emission or by substituting with a valve known to be in good order.

Another cause is open-circuit or low value of the electrolytic capacitor connected in parallel with the cathode resistor of the frame output valve. This requires to have a relatively low impedance at 50c/s frame frequency to prevent the sensitivity of the stage from being impaired due to negative current feedback, for which reason its value is often in the region of 100μF or more.

Most receivers have one or two frame linearity controls to adjust the overall and top linearity, on a test card, in conjunction with the height control. Either of the faults mentioned above would almost certainly make it impossible to achieve full height and correct linearity by control adjustment, though varying degrees of correction would be possible depending upon the characteristics of the frame circuits. It should be noted that cramping at the *top* of the picture is most likely to be caused by a fault in the linearity correcting network, in the frame coils or in the frame output transformer.

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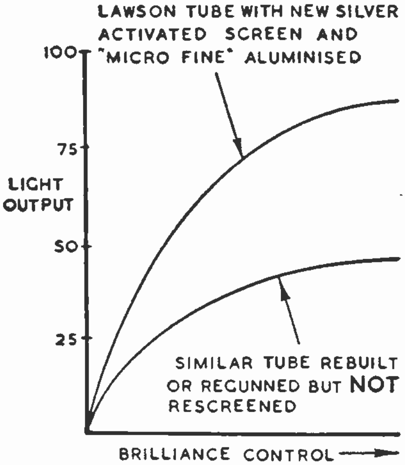

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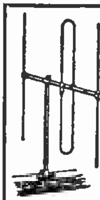

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Letters to the Editor

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.

ACTION PLEASE

SIR,—Several months ago everyone was relieved, if not pleased, to hear of the publication of the long-awaited Pilkington Report. Later in the same year the Government announced its intentions with regards to the Report and once again everyone was pleased to note that some progress was being made. Since then, however, it appears as though things have been allowed to stagnate or else the public is being kept very poorly informed of any action that is being taken by the Corporation or the Authority to put into effect the changes decided upon.

Hardly a whisper of new developments escapes from the BBC and the 625-line test transmissions from Crystal Palace do not give one's mind much opportunity to imagine the great changes most people were expecting taking shape. *Please* may we hear of some positive action soon, so that we may all know where we stand.—L. N. MUNROE (Kenilworth, Warwickshire).

SERVICE WITH A SMILE

SIR,—Much adverse criticism is levelled at television service engineers and so I am glad to be able to tell of the excellent service given by the local radio and television retailers were I purchased my receiver. Being old age pensioners, my wife and I find the television an invaluable form of entertainment and therefore it came as a serious blow when, during the recent spell of very cold weather, I found that my technical knowledge was not sufficient to enable me to repair a fault which suddenly developed in the set.

The young man who came from the shop in answer to my telephone call for assistance was both pleasant and efficient. After changing a valve in the tuner unit we were once more able to view without the annoying fault in the contrast of the picture which had been present. I would add that at the time of the serviceman's visit it was snowing heavily and that the fee settled for was the price of the valve and a cup of tea.—A. H. HERBERT (Guildford, Surrey).

UNUSUAL C.R.T. FAULT

SIR,—I recently had a television receiver brought into my workshop for repair; the customer complained of "switching-on" difficulties. The picture would appear normally, but some seconds later all modulation vanished abruptly, leaving only a raster. This then proceeded to go dark in the form of a diffuse circular region in the middle, which expanded until the entire screen was dark.

Switching the set off and then on again a few seconds later restored a perfect picture, which then proceeded to vanish by the same procedure some seconds later. After repeating this sequence several times, a permanent picture could ultimately be produced, which then invariably remained faultless for the rest of the evening. The customer stated that this fault had been in existence for many months.

My examination revealed a collapse of the boost voltage during all phases of the fault condition, to about half of the normal value, coupled with almost double the h.t. current drain in the line output stage and brilliant blue fluorescence in the e.h.t. rectifier. The symptoms were clearly those of a total short-circuit on the e.h.t. during the fault.

It was also observed that the brilliance control could not reach sufficient darkness, even when the main fault was absent. A check of the grid and cathode circuitry of the c.r.t. revealed absolutely normal voltages and control ranges of voltage, whether or not the fault was present.

Replacement of the c.r.t. removed all fault conditions, and restored normal behaviour of the brilliance control. The defective c.r.t. was examined in a physical laboratory, and showed spasmodic outbursts of gas from the fluorescent screen and inner coatings during switching on, which were generally gradually absorbed again, especially if the cathode was allowed to cool momentarily.

In the presence of e.h.t. voltage the gas was ionised, the positive ions going to the grid until this caused a cumulative increase of beam current through neutralisation of bias, and locked the grid to roughly cathode potential, preventing video-modulation from asserting itself. The blacking-out of the raster from the middle outwards seemed to be due to charge-build-up on the screen due to excessively low e.h.t. during the fault-build-up.—A. TAYLOR (Croydon, Surrey).

VISION FOR STEREOPHONIC SOUND TRANSMISSIONS

SIR,—I understand that the BBC are, at the moment, continuing their experiments in stereophonic sound broadcasting, and of course the results of these experiments, especially if it is decided to introduce regular transmissions, will be of interest to everyone. But I would like to see these experiments carried a step further by using a vision channel, as well as the television sound channel which is already used, so that a film, synchronised with the sound, could be shown. The whole effect would then be more realistic than ever.

I may be wrong, but I cannot imagine any technical difficulty in this operation and for the listener who is also watching a film which is relevant to the sound, concentration on the sound must come easier than when having only a lifeless radiogram or a blank wall to stare at.—T. T. PLEACE (Liverpool).

PIRATE VIEWERS

SIR,—The recently launched fleet of television detector vans undoubtedly represents a technical achievement in the development of ingenious receiving and direction-finding equipment. But should this really be necessary? As a nation, can we be proud of the fact that in our midst are many thousands of pirate viewers.

Such parasites should be brought to book through the application of a new and rigidly enforced licencing system!—K. H. WILSON (Brighton).

SOME PROBLEMS SOLVED

SIR,—Please accept my thanks for your answer to my query about a K-B QV70. I replaced the metal rectifier as you suggested and this has resulted in a full-size normal picture.

Once again many thanks.—W. J. SMITH (Hornchurch, Essex).

SIR,—Following your advice I completely cured the fault on my Alba T655. Thanking you very much.—S. HUDSON (Selby, Yorkshire).

SIR,—Once again I have successfully located and cured the fault on my Invicta receiver by following the excellent advice of your experts. A quick check showed the faulty component to be exactly where you said; and so many thanks.—R. J. IBBOTSON (Leeds).

SIR,—Many thanks for your letter. Your diagnosis of the fault was correct—the coupling capacitor was shorted.

Thanks again for your help.—R. LOWE (Sheffield 13).

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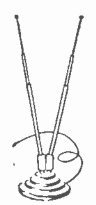

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