Practical TELEVISION

NOVEMBER 1961 1/9

THE 'LINES' BATTLE

The truth behind the present controversy.

HOW TV SETS WORK

The tuner circuitry is explained in this first article of a new series.

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Making a cabinet and calibrating this latest Practical Television design.

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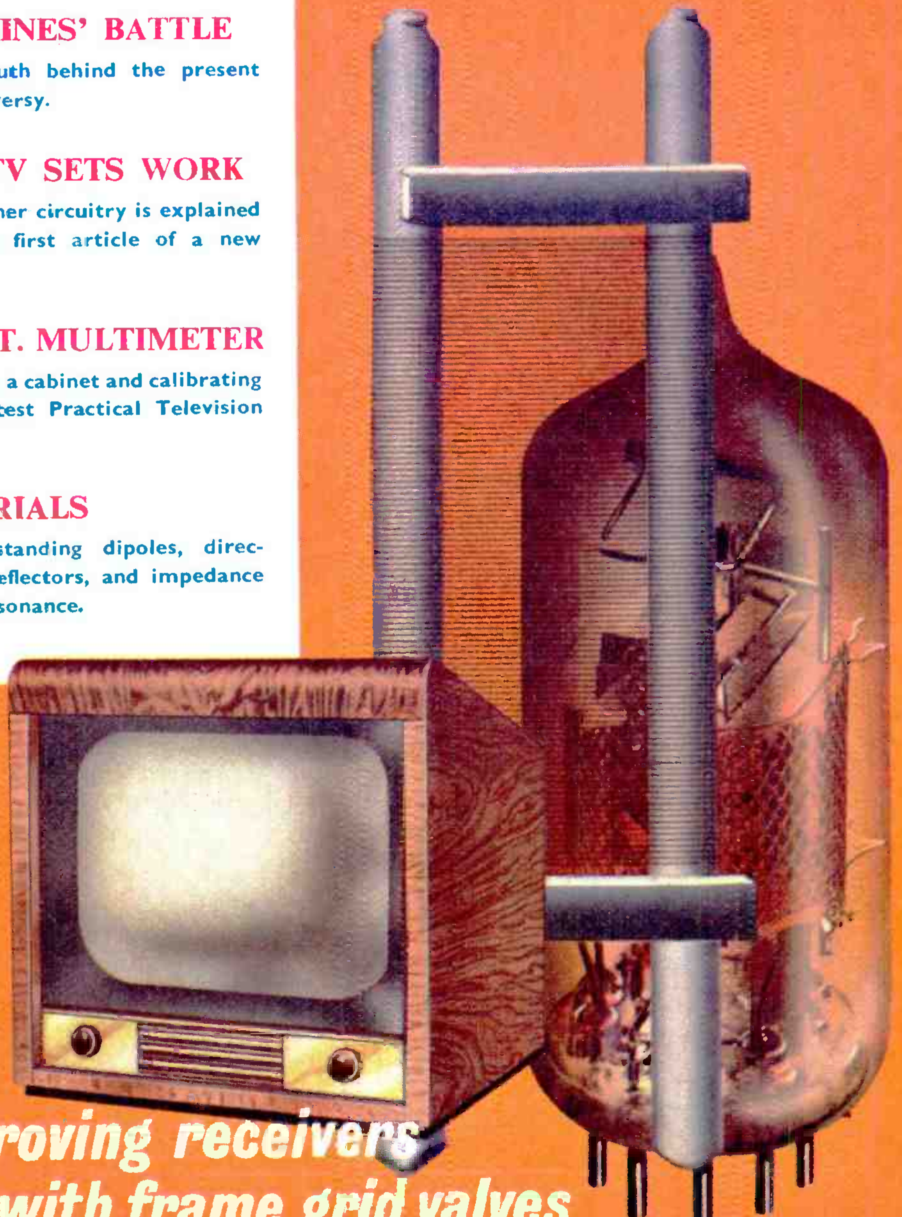
Understanding dipoles, directors, reflectors, and impedance and resonance.



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Pocket Size Taylormeter 127a

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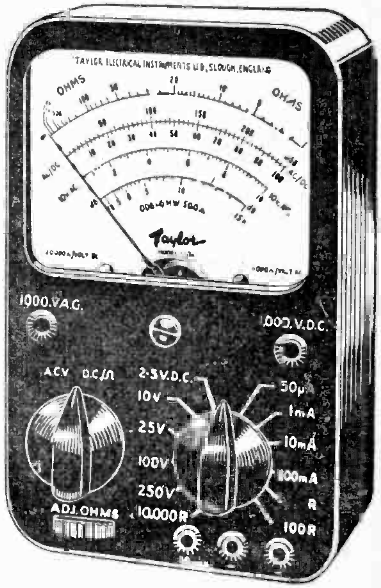

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6D6	6/6	10P14	19/9		37/5	DL33	9/6	EF41	9/-		19/9	PL820	19/1	UBC41	8/6	XSG(1.5)	6/6	XB104	7/-
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1A5GT	5/-	6AG5	3/6	6J5	4/3	6V6GT	8/-	12E1	16/6	42	7/6	DAF96	7/3	ECC35	6/-	EL42	9/-	N108	16/-		4/6	UF41	8/6
1A7GT	11/3	6AG7	7/-	6J5G	2/9	6X2	6/6	12J5GT	3/6	43	7/6	DF33	9/9	ECC81	5/6	EL84	7/-	N152	8/9	T41	7/-	UF42	5/6
1C5GT	8/6	6AK5	5/-	6J5GT	3/9	6X4	6/-	12K7GT	4/9	50C5	7/6	DF91	3/6	ECC82	6/-	EL91	4/6	P41	4/6	TDD4	7/6	UF80	7/6
1D5	8/6	6AL5	3/6	6J6	4/-	6X5G	5/-	12K8GT	11/-	50L6GT	9/-	DF96	7/3	ECC83	6/9	EM34	8/6	P61	2/3	U14	8/-	UF85	8/9
1D6	9/9	6AM6	8/-	6J7	7/9	6X5GT	5/6	12K8	12/-	52KU	10/6	DH63	6/3	ECC84	7/-	EM80	7/9	PABC80	11/-	U18	8/-	UF86	14/6
1H5GT	9/9	6AQ5	6/-	6J7G	5/-	6Y6G	7/9	12Q7GT	5/-	53KU	10/6	DH76	5/-	ECC85	7/9	EM81	8/9	PCC84	7/-	U22	6/9	UF89	7/-
1L4	3/6	6AT6	5/-	6J7GT	7/6	7B5	12/6	12SG7	6/-	54KU	8/9	DH77	5/-	ECF80	8/6	EM84	8/9	PCC85	7/3	U24	15/-	UL41	7/-
1LD5	3/6	6AU6	7/6	6J8	8/6	7B6	9/-	12SJ7	5/6	61SPT	11/-	DK32	11/8	ECF82	8/6	EM84	9/9	PCC88	19/-	U25	12/6	UL44	11/-
1LN5	4/6	6B7	8/6	6K6GT	6/6	7B7	7/3	12SK7	4/-	75	8/-	DK91	5/6	ECH21	12/6	EM85	10/6	PCC89	13/6	U26	9/9	UL46	9/9
1N5GT	9/9	6B8G	3/6	6K7	5/9	7C5	7/-	12SN7GT	8/6	77	6/6	DK92	7/6	ECH35	9/6	EN31	16/-	PCF80	7/-	U31	7/9	UL84	7/6
1R5	6/-	6BA6	6/-	6K7G	2/3	7C6	7/3	12Z5	9/-	78	6/6	DK96	7/3	ECH42	7/9	EY51		PCF82	7/3	U35	11/-	UM80	9/6
1S4	8/-	6BE6	5/9	6K7GT	4/9	7H7	7/3	14S7	22/6	80	5/9	DL33	8/6	ECH81	7/9	Small	8/-	PCL82	7/3	U37	26/-	UU6	19/-
1S5	4/9	6BG6G	12/6	6K8GT	8/9	7K7	9/6	19AQ5	7/6	83	9/6	DL35	9/6	ECL80	7/-	EY86	8/-	PCL83	10/6	U43	8/-	UU7	9/6
1T4	3/9	6BH6	6/-	6L1	12/6	7Q7	7/6	19BG6G	15/-	185BT	18/-	DL82	9/-	ECL82	8/9	EZ35	6/-	PCL84	7/6	U50	5/9	UU8	17/-
2A3	7/9	6BJ6	6/-	6L6	9/9	7S7	9/-	20D1	8/6	807(A)	5/6	DL91	8/-	ECL83	12/-	EZ40	6/6	PEN25	4/6	U52	4/9	UY1N	11/-
2D21	4/6	6BR7	9/3	6L6G	6/9	7V7	6/-	20F2	8/6	807(E)	3/9	DL92	6/-	EF22	7/-	EZ41	7/-	PEN45	7/3	U76	5/6	UY21	11/-
3A4	4/9	6BW6	7/9	6L18	8/6	7Y4	6/3	20L1	16/-	808	15/-	DL94	6/-	EF36	3/3	EZ80	6/-	PEN46	5/3	U78	5/-	UY41	6/-
3A5	9/-	6BW7	5/9	6L19	12/6	7Z4	6/6	20P1	9/9	954	2/-	DL96	7/3	EF39	4/3	EZ81	6/6	PL33	8/3	U191	11/-	UY85	6/6
3D6	4/6	6BX6	4/9	6LD3	8/-	8D3	3/-	20P3	12/6	955	3/9	EA50	9d.	EF40	13/6	GZ32	8/9	PL36	10/6	U281	9/6	VR105/30	
3Q4	7/-	604	3/6	6LD12	7/6	10C1	11/-	20P4	17/-	956	2/6	EABC80	7/6	EF41	8/-	HL41DD	7/9	PL38	16/6	U282	15/-		6/3
3Q5GT	8/6	6C5	6/6	6LD20	8/6	10C14	8/6	20P5	15/-	5763	10/-	EAC91	4/6	EF42	7/6	HVR2	7/6	PL81	8/-	U309	7/-	VR150/30	
3S4	5/6	6C6	4/9	6N7	6/6	10F1	5/9	25A6G	8/-	9001	4/-	EAF42	8/6	EF50-BR		KL35	7/6	PL82	6/9	U329	7/-		6/9
3V4	6/9	6C9	8/9	6P1	14/-	10L14	7/9	25L6G	6/9	9002	4/9	EB34	1/6		2/-	KT32	6/9	PL83	6/9	U339	11/-	W61M	11/-
5R4G	9/6	6CD6G	21/-	6P25	8/6	10LD3	7/9	25L6GT	9/-	9003	4/-	EB41	7/-	EF50-USA		KT33C	4/9	PL84	9/-	U404	6/-	W76	5/-
5T4	8/9	6CH6	8/3	6P28	12/6	10LD11	13/9	25Y5G	9/-	ATP4	2/9	EB91	8/6		3/-	KT36	9/-	PL84	11/-	U801	23/-	W81	7/6
5U4G	4/9	6D1	9d.	6Q7G	6/-	10LD12	8/6	25Z4G	7/3	AZ31	8/-	EB3C3	9/-	EF54	3/3	KT44	6/3	PX25	11/6	UABC80	8/6	X61M	11/-
5V4G	8/9	6D2	3/6	6Q7GT	8/9	10P13	9/-	25Z5	8/-	B36	8/6	EBC33	4/9	EF80	4/9	KT45	8/6	PY31	7/9	UAF42	8/-	X63	9/6
5Y3G	5/9	6D3	12/6	6R7G	6/-	10P14	9/-	25Z6	12/-	B65	4/6	EBC41	7/9	EF85	6/6	KT61	8/6	PY32	10/-	UB41	8/-	X65	11/-
5Y3GT	6/-	6D6	4/9	6SA7	5/9	10P18	7/6	27SU	25/-	CIC	7/6	EBC81	7/9	EF86	9/-	KT63	6/3	PY80	7/-	UBC41	7/9	X66	11/-
5Y4G	11/-	6F1	4/9	6SG7	4/9	12A6	5/-	30C1	7/6	CBL31	21/-	EBF80	7/9	EF89	6/9	KT66	12/6	PY81	6/-	UBC81	10/-	X76M	12/-
5Z3	8/3	6F6G	5/9	6SH7	4/6	12AH7	6/9	30F5	6/9	CCH35	14/-	EBF89	8/6	EF91	3/-	KT76	8/6	PY82	6/3	UBF89	7/9	X78	14/6
5Z4	11/-	6F6M	7/-	6SJ7	4/6	12AH8	9/9	30FL1	9/6	CL33	11/9	EBL21	12/6	EF92	4/6	KTW61	5/9	PY83	7/6	UBL21	14/6	X79	16/6
5Z4G	8/6	6F8G	6/8	6SK7	5/3	12AT6	7/6	30L1	7/-	CY31	7/6	EBL31	21/-	EF95	6/6	KTW63	5/9	PZ30	9/6	UCC84	14/6	X81M	9/-
5Z4GT	11/-	6F12	3/6	6SL7GT	6/-	12AT7	5/6	30P4	12/6	D63	1/6	EC52	3/6	EK32	7/-	KTZ63	5/6	R18	11/-	UCC85	7/9	Y63	6/3
6A6	7/6	6F13	6/9	6SN7GT	4/9	12AU7	6/-	30P12	3/-	D77	3/6	EC90	3/6	EL32	3/9	L63	5/6	R19	11/-	UCF80	16/-	Z63	5/-
6A7	10/-	6F14	9/6	6SQ7	6/-	12AX7	6/9	30P16	6/9	D152	5/9	EC91	4/6	EL33	8/-	LN152	7/-	SD6	8/6			Z66	9/6
6A8G	9/6	6F15	9/6	6SS7	4/6	12BA6	8/-	35L6GT	9/-	DA30	12/6	ECC31	9/6	EL35	7/-	LZ319	7/-	SP6	3/6	UCH21	12/6	Z77	3/-
6A8GT	13/-	6F16	8/6	6U4GT	10/6	12BE6	8/6	35W4	6/9	DA90	2/6	ECC32	4/-	EL37	11/6	MU14	8/-	SP41	2/6	UCH42	7/6	Z152	4/9
6AB8	7/-	6F33	6/6	6U5G	6/3	12BH7	10/6	35Z4GT	5/3	DAC32	9/9	ECC33	4/6	EL38	12/6	N37	11/-	SP61	2/6	UCH41	8/6	Z719	4/9

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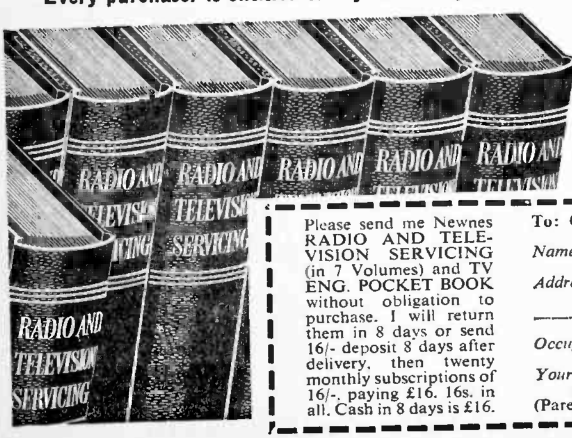

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Practical Television

AND TELEVISION TIMES

VOL. 12, No. 134, NOVEMBER, 1961

Editorial and Advertisement Offices:

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Contents

New Standards

THE repercussions of the many claims made at this year's Radio Show regarding sets which were supposed to be convertible, have now made themselves felt. As we expected, many of the public were confused by the various claims, and so much doubt seems to have arisen that we include in this issue a detailed account of the many problems involved, and their possible solution. There did not seem to be a single manufacturer at the Show who mentioned the fact that any convertible receiver will have to be fed from a new aerial system. The higher definition cannot be obtained using the present frequencies, and, as stated in our article "The 'Lines' Battle", any improvement will have to be in Bands IV or V, and this will entail a new aerial system, in addition to the tuner and modified circuitry. We feel sure that many prospective purchasers of these convertible receivers, whilst not unwilling to purchase at a later date a tuner for the receiver, would be unwilling to put up another aerial. This latter fact should, we feel, have received more emphasis in the various manufacturers' advertisements and receiver details as we are sure that it is a very important point so far as the house-owner is concerned. An enthusiastic listener and viewer will already have Band I, Band II and Band III aerials, and the addition of yet another may present difficulties, not so much from its size, as it will in its simplest form be quite a small assembly, but in its actual location to avoid interaction between other aerials. In fringe areas, the difficulty will become most pronounced unless some new type of aerial, equally efficient on all bands, can be developed. Some of the novel aerials from America may make their appearance here, as some (not all) appear to offer some relief from the mass of aluminium tubing which is seen on some houses in certain parts of this country.

However, as no definite progress can be made in the direction of a new line standard, or with colour, until the report of the Pilkington Committee is issued, we feel that it is once more necessary to recommend that some sort of interim report should be issued as soon as possible, not only in the interests of the manufacturer, but also in the interests of the viewer.

A FILM SHOW

ANOTHER film show has been arranged in collaboration with Mullard Ltd. It will be held at Caxton Hall, Westminster, and readers are invited to send for their free tickets which are now available from these offices. The films will be shown on Friday, February 2nd, 1962, and the programme will begin at 7.30 p.m. When applying for tickets, enclose a stamped addressed envelope (at least 3½in. x 6in.). Mark your envelope "Caxton Hall" in the top left-hand corner.

Our next issue, dated December, 1961, will be published on November 22nd

Telenews

Television Receiving Licences

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

Region	*Total*
London	1,950,384
Home Counties	1,601,539
Midland	1,729,134
North Eastern	1,845,892
North Western	1,507,521
South Western	982,867
Wales and Border Counties	694,776
Total England and Wales	10,312,113
Scotland	1,040,916
Northern Ireland	169,025
Grand Total	11,522,054

Czechoslovakian Trade Fair

AS part of their stand at the Brno International Trade Fair, Czechoslovakia, from September 10th to 24th, EMI demonstrated their Image Orthicon television camera channel type 203/6. This camera was mounted on a remotely controlled pan and tilt head and fitted with a remotely controlled zoom lens. The equipment also included a shot selection box which enables a series of pre-selected shots to be put into sequence merely by pressing buttons.

EMI also exhibited tape recorders, electronic computers, instruments, etc.

TV at Bingo Sessions

WEEKLY Bingo sessions are televised for thousands of players as they sit checking their numbers in bars and restaurants all over the stadium at Clapton dog track.

As winning numbers are called they are shown on a board in the middle of the track. But because this board is out of sight for many of the players, a Marconi closed circuit camera is being used to show it simultaneously on over a dozen TV receivers in different parts of the stadium.

International Control Room at the Television Centre

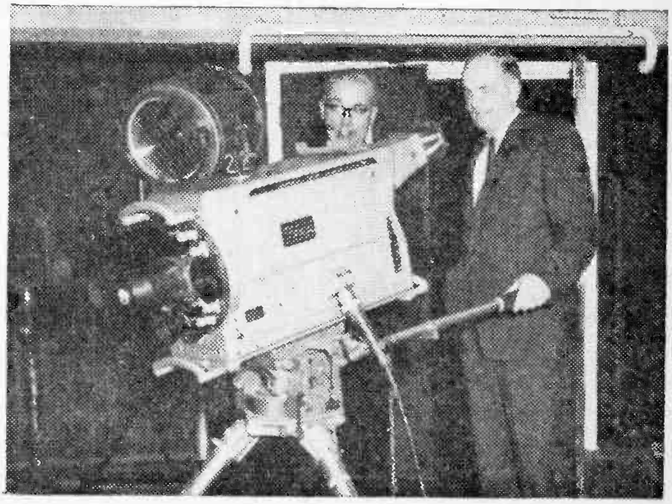
THE BBC has recently brought into operation a new Television International Control Room at its Television Centre in London. The Control Room replaces the Continental Control Point at Broadcasting House and marks a further stage in the concentration of the BBC's main television activities in London at a single centre.

The BBC's technical and programme control in vision and sound is carried out in the new Control Room in which are now centred the operations involved in contributing programmes, often with commentaries in many foreign languages, to the Eurovision network, and in receiving programmes from it.

Positions are provided at a control desk for the senior television engineer, vision engineer, presentation assistant, and sound engineer. Facing the inner side of the desk, and remotely controlled from it, are six 21in. multi-standard picture monitors, below each of which is a visual indication of the source of programme. The room also contains apparatus bays and the area is fully equipped with test apparatus.

Television for New Liner

THE new passenger liner "Northern Star", of the Shaw Savill Line, will be fitted with a television system providing



Among recent visitors from overseas to Marconi's was Mr. G. Stringer, assistant director to broadcasting, New Zealand Broadcasting Services. he is pictured here (right) examining a Marconi Mark IV Image Orthicon television camera at the company's television laboratories near Chelmsford. Marconi's have supplied a number of transmitters and a quantity of studio equipment, including Mark IV cameras, for New Zealand's new television service.

a completely co-ordinated internal and off-air service all over the world This is to be supplied and installed by Marconi's Wireless Telegraph Co. Ltd.

Passengers on the " Northern Star " will be able to receive local television programmes at ports of call, and will also have the added facility of closed-circuit telecine and live television programmes while the liner is at sea.

Surgeons See Operation on Colour TV

TWO thousand surgeons from all over the world were able to see colour television pictures of delicate surgical operations on an 8ft by 6ft screen, whilst attending meetings of the International Society of Surgery and the International Cardio-Vascular Society, in Dublin, from September 6th to 9th.

EMI Electronics Ltd.'s colour television cameras, controlled from the EMI colour TV mobile unit, televised the operations at St. Vincent Hospital, and the colour pictures were transmitted by microwave link to the Coffey Memorial Hall of Dublin's University College.

TV Cameras for ITN

THREE of the four Marconi Mark IV television cameras ordered by Independent Television News are now in use at the ITN headquarters in Television House, Kingsway, London. By November all four cameras will be fully operational in a new studio which is being built on the eighth floor of Television House. This is part of a general re-equipment of ITN's facilities to enable them to carry out more ambitious programmes. When the new installation is completed the main studio will have three Mark IV cameras with provision for a fourth, if required, in a small interview studio on the seventh floor.

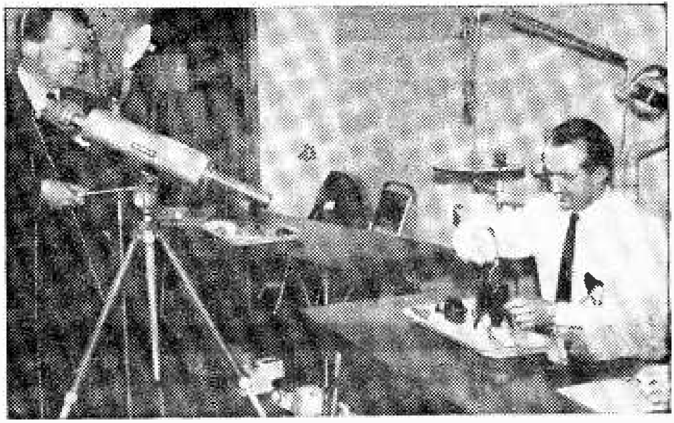
ITV for Wales

SOME 738,000 people in the South-Western and North-Western areas of Wales will be able to watch Independent Television programmes for the first time by the end of 1962. The Independent Television Authority has placed contracts with EMI Electronics Ltd. to supply and erect aerials and masts in Carmarthen and Caernarvon, which are scheduled to be completed by next July.

On the Prescelly Mountains in Carmarthen, a 40ft aerial array on a 750ft mast will transmit Channel 8 programmes at good strength to South-West Wales.

A 1,000ft mast in Caernarvonshire will carry a 60ft aerial array which will supply Channel 10 programmes to North-West Wales. The programme contractor for both stations will be the Wales Television Association.

Both aerials will be horizontally polarized.



Closed circuit television by Marconi played an important part in the 16th Australian Dental Congress, held recently in Sydney. Delegates to the Congress were able to see the newest techniques and equipment developments demonstrated by leading Australian and overseas experts. This picture shows one of the practical clinics in progress. In an adjoining hall a large audience is watching the demonstration on the screens of the viewing monitor.

TV Aerials for Liners

TWO broadband aerial arrays designed by Belling-Lee are used on board the 45,270 ton " Canberra " owned by P. & O. Orient Lines. These aerials enable the ship to pick up programmes on all possible channels of the world's television. The 42,000 ton " Oriana ", is equipped with similar aerials and television systems.

The television installation provides for the reception of television broadcasts employing the 405-line system used in Britain, the 625-line system used in Australia and the greater part of Europe, and the 525-line system used in the United states, Canada, Japan and some South American countries.

Where alternative programmes are available, viewers can change from one channel to another by using the normal channel selector on the receiver.

The " Canberra " carries more than 3,200 passengers and crew, and has fifty television receivers installed with provision for a further three hundred.

Sound Equipment for TV Centre

A NEW 24-channel sound mixing system is to be supplied under an order placed by Tyne Tees Television with Pye T.V.T. Ltd., of Cambridge. This system will be used for Studio One in the Television Centre, Newcastle Upon Tyne.

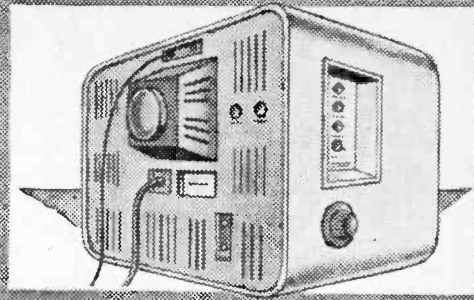
The use of transistors throughout has meant a considerable reduction in the size of the amplifiers over conventional valve types; and there is easy access to all components for servicing.

The equipment, which will replace the existing 14-channel sound installation in TTT's Studio One, will give the sound department many more facilities than they have had in the past. The equipment will be delivered and installed in the summer of 1962.

TV Aerial System on Bognor Estate

FOR the 800 bungalows and flats of Bognor Regis' Westmeads Estate, a wired television system has been installed with the gas, water and electricity. This is to preserve the amenities of the estate against disfigurement of unsightly aerial arrays.

Servicing Television Receivers



No. 73—THE ENGLISH ELECTRIC 16T11D AND SERIES

By L. Lawry-Johns

THE other receivers in this series are the 16T18 and the 16C19D, the former a table model as is the 16T11D, the latter a console. The fringe versions 16T11F, 16T18F and 16C19F use a much modified circuit with an extra I.F. stage and flywheel line sync. Also, the EF80 line oscillator is removed, its place being taken by two ECC81 valves, an extra stage of vision and sound I.F. employs the EF80.

Tube

These receivers use a 16in. circular metal cone tube, English Electric type T901A or T901B, the direct Mullard equivalent being the MW41-1. Details have been given in past issues of *Practical Television* for fitting 17in. rectangular tubes, modifying the front cradle and EHT connection.

Points of interest are the two R.F. stages before the frequency changer and the use of a voltage doubler system for EHT. The stage gain is not as great as might be expected from the number of valves employed and this is almost certainly due to the type of I.F. coupling. High-Q band-pass coils would no doubt have provided a much enhanced performance. For this reason it is best to modify V3 to an extra I.F. amplifier when fitting one of the conventional turret tuners. Whilst plugging the mixer plug or adaptor into the V3 socket is a much simpler method this is unlikely to give the performance required except in strong signal areas. The writer would suggest the V3 stage be modified as follows. Wire a 0·005μF capacitor from pin 8 to chassis. Remove L3 from V2 anode circuit and connect this from pin 2 (V3) to chassis, removing C11 and R14. Disconnect pins 1 and 3 (V3) from chassis and connect to pins 1 and 3 of the V2 base. Connect a 0·005μF condenser from pins 1 and 3 (V3) to chassis. Valves V1 and V2 are removed, pins 4 and 5 used as heater supply for the tuner on one base and shorted on the other. The H.T. for the tuner is taken from pin 7 of the V1 base. The I.F. output of the tuner connect to pin 2 of V3 with L3, screening to chassis of course. L3 is tuned down to about 37Mc/s by screwing in the iron-dust core. The gain of V3 is then pre-set with sensitivity control to the required level; note that the tuning of L3 is slightly upset by the sensitivity setting.

EHT System

The EHT system is worthy of close study since trouble is almost bound to be experienced in this section, usually due to one or more of the 0·001μF 6kV capacitors becoming leaky. This results in a

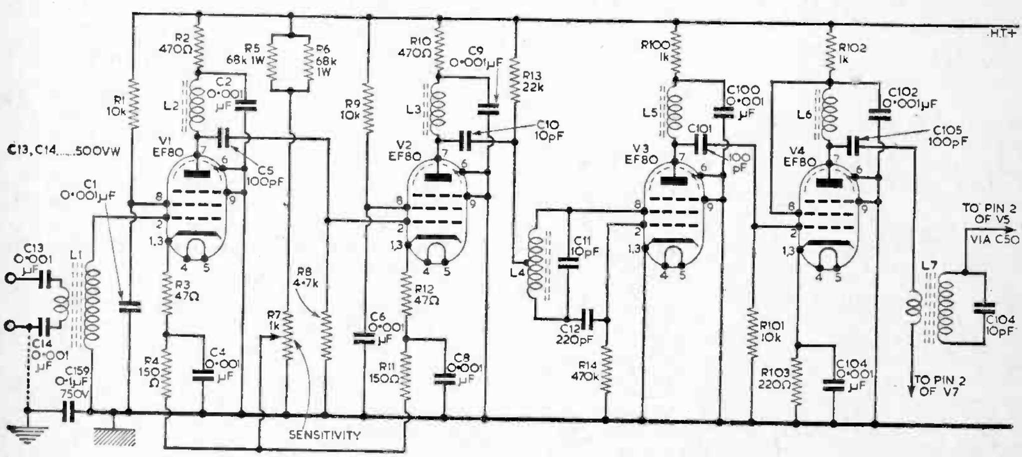


Fig. 1.—The circuit of the R.F. frequency-changer and vision I.F. stages.

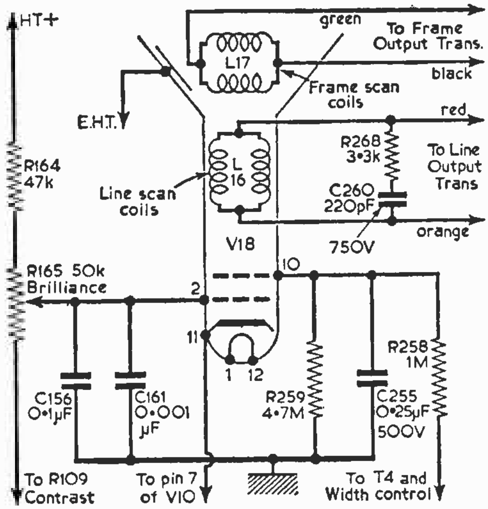


Fig. 2.—The CRT base and scan coil connections.

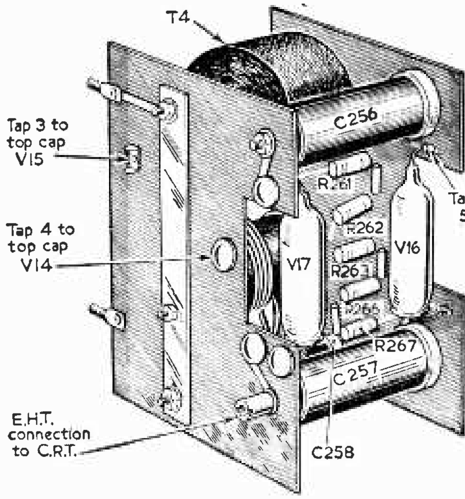


Fig. 3.—The EHT Unit.

severe overload on one or both of the EY51 valves and this is reflected back to the line output stage. Slight leakage may only cause loss of focus and an enlarged picture but normally the leakage rapidly becomes more severe and complete EHT failure results with perhaps one of the EY51 rectifiers having a red hot anode. A couple of spare capacitors of the 6kV 0·001μF type (C256-7-8) should always be held in reserve since this trouble is to be expected. Higher voltage capacitors of a different type may be used for greater reliability and there is plenty of room for these to be fitted with very slight modification.

The Line Timebase

Apart from the EHT system, the line oscillator and output stages are fairly conventional and relatively trouble free. The PL81 is liable to fail, of course, low emission giving lack of width before final collapse which of course results in no picture, no EHT and no line timebase whistle. The EF80 (V13) is fairly trouble free and if a valve is at fault it is usually the PL81.

(To be continued)

INDEPENDENT TELEVISION IN NORTH-EAST SCOTLAND

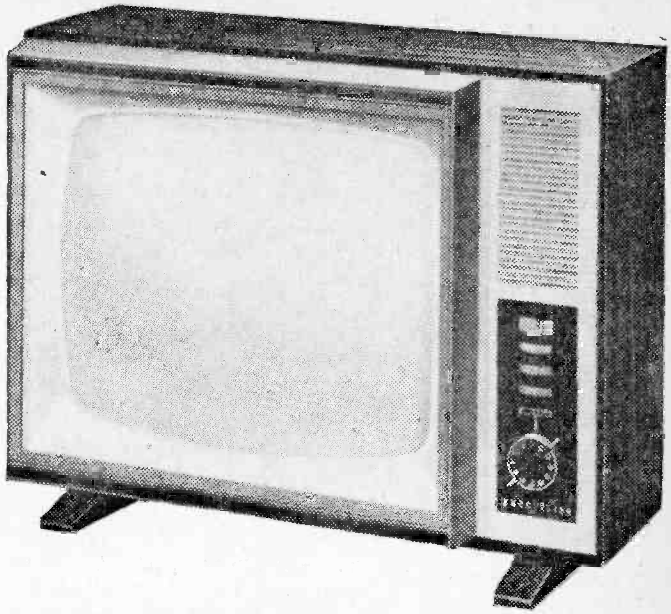
The Independent Television Authority announces that programme transmissions commenced simultaneously from its Durris and Mounteagle stations on Saturday, 30th September.

Construction of the Mounteagle station, near Inverness, started some months after the beginning of work at Durris, and it was initially thought unlikely that a simultaneous opening of the two stations could be achieved. However, great efforts by all concerned resulted in remarkably rapid progress, and, after a week of trade test transmissions, Mounteagle will be ready to transmit the programmes of Grampion Television Ltd. simultaneously with its sister station at Durris.

The signal of the Durris station is on Channel 9, horizontally polarized, and the directional aerial system has a maximum effective radiated power of 400kW.

The Mounteagle station radiates on Channel 12, horizontally polarized, and its maximum effective radiated power, from a directional aerial system, is 50kW.

405 or 625?



(Above).—*This receiver may be used on the present 405-line standard, but may be adapted for 625-line transmissions should this become necessary.*

The "Lines" Battle

THE TRUTH BEHIND THE PRESENT CONTROVERSY

By J. Harwood

EVEN though there will not be a final decision on the future of television broadcasting for some time, most manufacturers have recently launched so-called "convertible" receivers. In essence, these operate normally on the existing 405-line standards and are designed towards the possibility of conversion to 625 lines.

Switched Design Not Possible

At the outset, one must fully appreciate that it is impossible for any manufacturer to launch a set on the British market which may be switched from 405 to 625 lines, and vice versa, for the simple reason that no decision has yet been given on the type of transmission standards that would be used should, in fact, the Pilkington Committee eventually recommend a change to 625 lines.

Basically, a change from 405 lines to 625 lines is not difficult in itself. Basically, it means that the line timebase would have to be switched from 10kc/s to 15kc/s. With a frame timebase frequency of 50c/s, as it is at present, and the correct signal applied to the set, then a picture of either 405 lines or 625 lines could be produced by the turn of a switch.

However, to give a 625-line picture on an existing receiver so adapted, the characteristics of the picture signal, apart from the sync pulses, of course, would need to be identical to those of the 405-line signals. That is to say, the signals would have to operate in the existing Band I and Band III channels; the spacing between the sound and vision carriers would have to be 3·5Mc/s; the vision bandwidth would have to be the same as at present; the vision modulation would have to be positive; the existing sound/vision frequency relationship (i.e., vision 3·5Mc/s above sound) would have to be maintained, and also the existing A.M. sound system would have to be retained. With all these factors constant on both services, then 405/625 switching could be accomplished in the line timebase alone.

405-line system to be retained for some years to come

The Government has promised that even in the event of a change of television standards, 405-line transmissions would continue in parallel with the new system for a number of years. One can be sure, therefore, that 405-line sets purchased today will still be suitable for reception in this country for, at least, five years, and most likely for double this time, even though they are not "switchable" or "convertible".

Now, since the existing standards are to be maintained it is impossible to launch a second 625-line service in Bands I and III because almost all the channels in those bands are already occupied by the existing services. This means, then, that any new service will have to operate in new bands, and the two which are available are Bands IV and V. These bands, in fact, have already been set aside for the development of the television service and embrace frequencies from 470-585Mc/s and 610-960Mc/s respectively.

The upper part of Band V is at present being used for work on tropospheric scatter, but when the whole of this band is available for television, no less than 92 separate television channels could be accommodated in the two bands with the existing channel bandwidth (i.e., 5Mc/s).

Conversion Also Requires UHF Tuners

Clearly, it is not enough simply to switch the line timebase, even assuming that the fundamental transmission standards are maintained, for it will be necessary also to have some sort of VHF/UHF switching. Some of the new convertible sets provide both for timebase switching and UHF switching, but the UHF tuner is not usually installed, as it is envisaged that this will be an entirely separate unit, possibly reminiscent of the Band III Converter days.

The CCIR System

There would be many more complications if it were eventually decided to adopt the CCIR 625-line sytem, for the standards of this system differ considerably from those at present used in Great Britain. Apart from the number of lines, the essential differences between the two systems are a channel width of 7Mc/s (British 5Mc/s), resulting in 5·5Mc/s spacing between the sound and vision carriers compared with the British 3·5Mc/s; a reversal of the positions of the sound and vision carriers (the sound is "high" on the CCIR system); F.M. sound instead of A.M. and negative vision modulation against the positive modulation of the British system. In the CCIR system this means that peak white is represented by zero modulation and that the sync pulses are 100% modulation—exactly the opposite of the British standard.

The CCIR system is used in most of Western Europe, excluding France. The French system uses 819 lines and has other differences in channel width, spacing, etc., but uses A.M. for sound. There are other standards, including a 625-line system used in Russia, East Germany, Hungary, Czechoslovakia and Poland, and the 525-line FCC system is used in the U.S.A., Canada, Iran, Japan, Thailand and certain Latin American countries. The Russian system is almost the same as the CCIR system, but the channel width is 8Mc/s and the channel spacing 6·5Mc/s.

UHF Standards

It was agreed at a CCIR Conference on frequency allocation that a standard of 8Mc/s channel spacing with 6Mc/s vision bandwidth be adopted in Bands IV and V in the event of a British 625-line system being launched in these bands. Even with such a wide spacing, 57 channels could still be accommodated in the two UHF bands.

It will now be understood that if the slightly modified CCIR system is finally adopted in Great Britain, set conversion will represent considerably more than a mere change of line frequency coupled with facilities for UHF reception. Indeed, in some cases, the term "convertibility" could well mean a complete change of chassis or, at least, the inclusion of a entirely new vision strip and UHF tuner.

Flywheel Sync

Since the sync pulses in the CCIR system are positive-going, they are more susceptible to interference and noise than are the negative-going pulses of the British system, and for this reason it has been found almost essential to include flywheel line sync in sets operating on a negative-going picture signal to avoid "line tearing".

It will be recalled that flywheel sync was very popular in Great Britain some years ago, but with improved signal coverage its popularity has waned somewhat. Although impulsive interference may not be very troublesome at UHF, first stage noise may well be sufficient to cause "ragged verticals", particularly since there is likely to be a large number of fringe areas when the service is first launched.

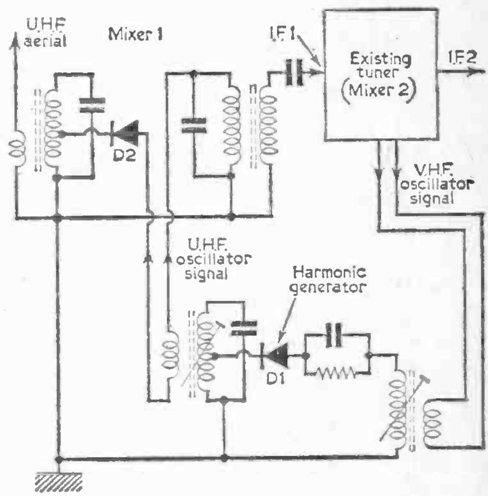


Fig. 1.—The components of this UHF segment are mounted on a biscuit moulding. The oscillator signal is increased in frequency by D1, and this is mixed with the UHF signal in D2 to give I.F.1.

Intercarrier Sound

There is also the possibility that intercarrier sound will be used on the new system. This arrangement is used in America and the sound I.F. is taken right through the video amplifier, where it is extracted by beating it against the vision I.F. and then detecting it in the usual F.M. manner.

(To be continued)

TV AERIALS

By J. Jenkins

FROM the theoretical aspect, one usually looks upon an aerial as a radiator of signal energy rather than a receptor. This is of no consequence, however, since basically an aerial is the same whether it is transmitting or receiving.

The simplest aerial is the so-called "long wire" type, and this is sometimes looked upon as being of infinite length and connected to a signal source through a coupling transformer with one end of the coupling winding connected to the long wire and the other end to earth, as shown in Fig. 1.

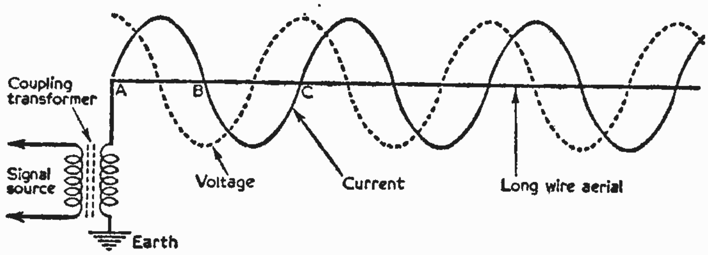


Fig. 1.—The current and voltage distribution in a long-wire aerial.

Delay

A signal applied at the start of the wire will not simultaneously appear at the end (indeed, it will never reach the end of an infinitely long wire), but will take time and will travel along the wire in the form of a sine wave.

Actually, the signal is composed of two sine waves, a current sine wave and a voltage sine wave the peaks of which occur at the points of the greatest rate of change of the current wave. Conversely, the points of zero voltage occur at the points of zero current *change*, at the peaks of the current wave. This is made clear in Fig. 1.

It will be seen, therefore, that the voltage is out of phase with the current by 90°. That is to say the current leads the voltage by 90°. This goes on all the way along the wire, relative to earth, and the current waves produce magnetic fields, while the voltage waves produce electrostatic fields.

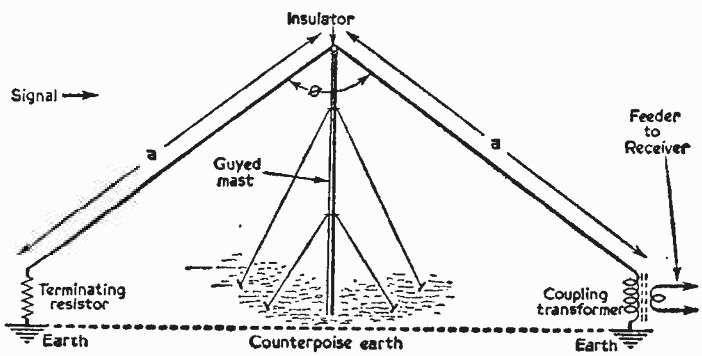


Fig. 2.—A practical vertical half-rhombic aerial for television reception.

Radiation

These two fields combine to form self-supporting waves of energy which are radiated into space. In the case of a receiving aerial, the waves of energy are picked up by the wire where they produce current and voltage waves, exactly the same as in Fig. 1, and re-form as signal across the coupling transformer.

In a practical long wire aerial of finite length, some signal is present at the end of the wire and, unless this is fully absorbed in a suitable terminating resistor, it will start travelling back again along the wire and produce fields in opposition to those required for normal radiation. If the aerial is not properly loaded there will be a reduction in efficiency which will be greater with relatively short aerials than long ones.

Half-rhombic Aerial

Forms of long wire aerials have been used for television reception, which are sometimes termed "tilted wire", "half-rhombic" etc. The general idea of a vertical half-rhombic aerial is shown in Fig. 2. This requires rather a lot of space to erect, since it does not give a great deal of improvement over a dipole unless the sides 'a' are several wavelengths long.

The terminating resistor should be around 300Ω or 400Ω and the coupling transformer should be designed to match this value to the type of feeder used, usually 75Ω coaxial cable. A coaxial transformer consisting of a quarter-wave matching section of 170Ω impedance could be used for coupling to 75Ω coaxial, in which case the terminating resistor should be 400Ω. A typical arrangement would be sides of 51ft and a mast of 32ft. This would give the aerial a total length along the ground of approximately 80ft.

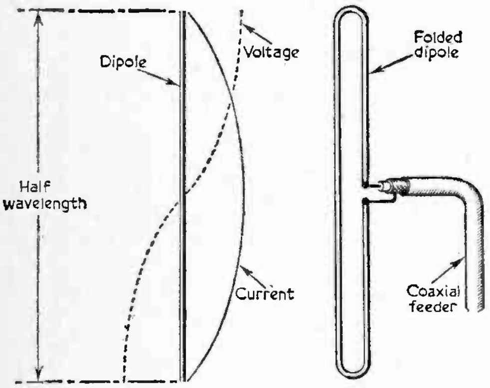


Fig. 3 (left).—The current and voltage distribution in a tuned half-wave aerial.

Fig. 5 (right).—A dipole is folded in the manner shown to bring the centre impedance to a reasonably high value. (When parasitic elements are added to a dipole, the centre impedance is considerably reduced; folding the dipole quadruples this value of impedance and the final value is generally suitable for matching to standard cable.)

High Gain

The actual characteristics depend essentially on the length of the sides, and on the angle θ which, of course, is governed by the height of the mast. A well designed array of this kind is capable of giving a gain approaching 20dB over quite a wide band and with very useful directivity, but, since the other half of the rhombic is provided by the earth, the ground conductivity at the site is of some importance. This can be enhanced at poor sites, however, by the use of a counterpoise earth consisting of several copper conductors stretched along the whole length of the base of the aerial, as shown in Fig. 2.

Resonant Aerials

Any aerial will act as a resonant aerial provided that it satisfies two conditions at the working frequency. These are that the length is an exact multiple of quarter wavelengths and that the length is greater than one quarter wavelength. This means, then, that the shortest possible resonant aerial is one half wavelength. The physical length, of course, depends upon the frequency at which it is to operate.

A complete cycle of the current or voltage wave in Fig. 1 (from A to C of the current wave, for example) occupies a distance along the wire approximately equal to one wavelength of the signal frequency. If the wave were propagated in free space instead of along a wire, then the distance would be exactly equal to one wavelength of the signal frequency, and if the frequency were, say, 200Mc/s the distance would be 1·5m, or 59in. The half wavelength in free space would thus be 29·5in. A half-wave dipole tuned to 200Mc/s is slightly shorter than this because the signal does not travel at quite the same speed down a conductor as it does in free space. The length of a half-wave dipole for Channel 11, which is very close to 200Mc/s, is about 27½in.

Frequency (f) / Wavelength (λ) Relationship

The product of the frequency and the wavelength is equal to the velocity of propagation of wireless waves in free space (which is the same as the velocity of light). For example (λ in metres) x (f in kc/s)=300,000. Thus, knowing either the wavelength or the frequency, the unknown can be found from (λ in metres)=300/(f in Mc/s) or, (f in Mc/s)=300/(λ in metres).

The retarding effect on the signal owing to the conductor is called the "velocity factor", and this is fairly high in R.F. cables, such as coaxial, and long wire aerials. As an example, the natural wavelength of an aerial is approximately 4·5 times its electrical length, bearing in mind that the aerial resonates at its half wavelength. With coaxial cable with a velocity factor of 0·66, which is a common value, the physical length of a resonant cable is 33% shorter than the electrical wavelength.

Dipole aerials for television are mostly cut to one half wavelength corresponding to the mean of the channel on which it is to operate. Some designers favour cutting more towards the vision carrier frequency while others may, in fact, tune slightly in favour of the sound carrier, and it is for this reason that small discrepancies occur between aerials of different design and manufacture.

Half-wave Dipole

In Fig. 3 is shown the voltage and current distribution in a tuned half-wave dipole, which is exactly the same as the distribution over the first half wavelength of the long wire aerial. The most important facts about this are that the voltage is at a minimum at the centre and maximum at the ends, and the current is at a maximum at the centre and minimum at the ends. This state of affairs continues as long as the aerial is receiving or radiating signal energy.

The impedance of the dipole is, therefore, at a minimum at the centre and at a maximum at the ends, and intermediate positions down the aerial correspond to intermediate impedances. It is usual to feed the dipole at a low impedance point, and to facilitate this, the dipole is generally cut into two quarter-wave limbs at the centre point. The two points are held about an eighth of an inch apart by an insulator, which also serves to hold the dipole rigid.

When the dipole is cut in this way, the impedance between the two adjacent ends is around 70Ω, which represents a very close match to 70Ω coaxial feeder. Indeed, this is one of the reasons why feeders are manufactured with impedances around that value.

Effects of Mismatch

The impedance of a coaxial cable results from the distributed inductance throughout the length of the conductors and the distributed capacitance between them. These combine to give a specific impedance value, usually called the "characteristic impedance". Maximum transfer of energy will take place only when the two ends of the coaxial cable are loaded to impedances which equal the characteristic impedance. If, for example, 70Ω feeder were connected to a point on the aerial where the impedance were, say, 200Ω, some of the signal in the aerial would make its way down the cable, but a proportion of it would be reflected back into the aerial. Similarly, if there is a mismatch at the set end, all the signal in the cable will not be absorbed by the set, but some of it will be reflected back up the cable and will be lost. It may undergo a second reflection at the aerial connection, in which case a reflected signal will be received by the set a little later than the direct signal, and if the feeder is long this could result in a ghost image or impair the picture definition.

Mismatching of this nature produces "standing waves" on the cable the amplitude of which is proportional to the degree of mismatch. Standing waves represent a total loss of energy and should not be confused with the useful signal which travels along the feeder. Mismatching also makes the cable itself susceptible to signal pick-up and radiation. From a receiving point of view, this means that excessive interference from cars may be caused by pick-up on the downlead which is closer to the source than the aerial itself.

The Addition of a Reflector

An ordinary vertical dipole has what is called an omnidirectional polar diagram, and gives all-round reception and transmission, as shown in Fig. 4(a). This pattern is highly desirable for mobile radio services where the aim is to cover the widest possible area, but for point-to-point television reception a directional arrangement is favoured, since then there is less possibility of interference from signals arriving from different directions.

Moreover, the gain or pick-up sensitivity of a directional aerial is automatically increased over a dipole in the forward direction. Single dipoles are employed mainly in areas of very high signal strength, where the strength of the wanted signal far outweighs that of unwanted signals.

An aerial is made directive by adding a reflector. This simply consists of a single conductor about 5% longer than the dipole and spaced from the dipole by a quarter wave-length. Since it is inductively coupled to the dipole it has induced into it a signal from the dipole, and thus itself radiates. However, there is a phase alteration of 90° due to

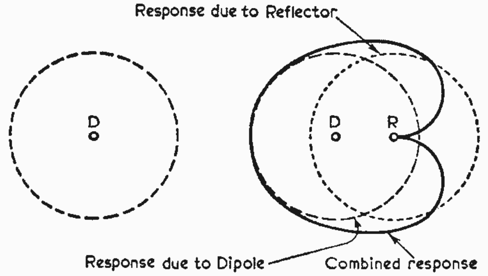


Fig. 4(a).—The polar response of a simple dipole, and (b), the directional response produced by adding a reflector, Further directivity and gain is produced by adding directors.

the coupling, and there is a further alteration of 90° due to the signal passing back again from the reflector to the dipole. This means that the dipole now receives two signals, the direct signal and that reflected back at anti-phase from the reflector. The reflected signal tends to cancel the response pattern at the rear and enhance it at the front, and the combined effect is the production of a polar diagram as shown in Fig. 4(b).

The Addition of Directors

Even greater directivity is secured by mounting parasitic elements in front of the dipole. These are called directors and are cut slightly shorter than the dipole so that they resonant at a slightly higher frequency. They have the effect of reinforcing the signal in the forward direction by several artifices closely related to phase and spacing.

Up to a limit, as more directors are added so the polar response is continually narrowed, but there comes a point, after about seven or eight directors, where there is hardly any improvement in gain or directivity. As a general guide, directors diminish progressively in length in relation to the dipole at a rate of approximately 5% per director and eighth-wave spacing is often used, though these factors depend to a large degree on the exact design of the array.

Folded Dipole

Although a reflector does not have a large effect on the centre impedance of a dipole, there is a marked reduction in impedance when directors are added. This makes it almost impossible to match direct to 70Ω coaxial cable. There are various ways of correcting this, and the most popular is to "fold" the dipole (Fig. 5 page 71). The signal pick-up of a folded dipole is approximately equal to that of a simple dipole, but owing to the effect of the signal current being divided between the two sections, the impedance is increased by a factor equal to the square of the impedance of a simple dipole.

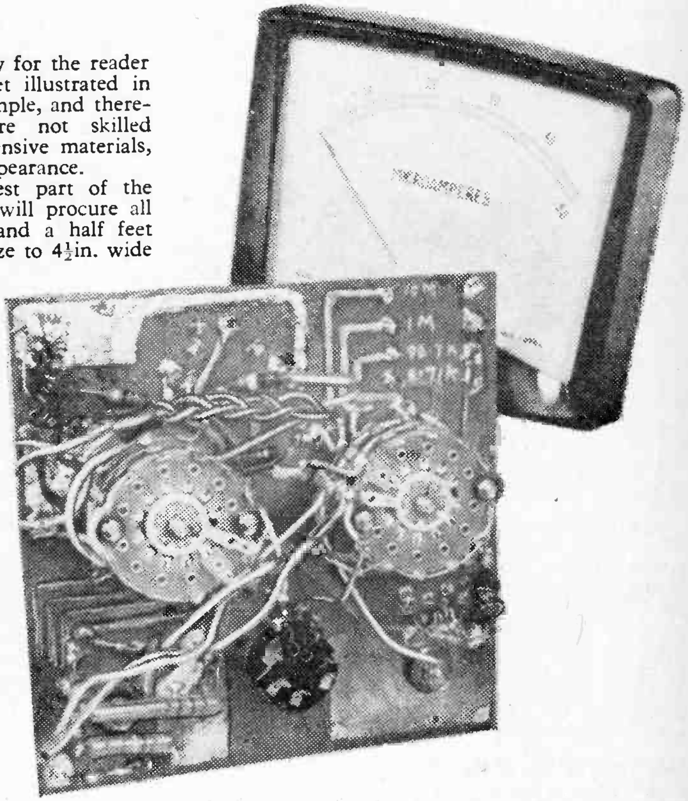
Thus, if the centre impedance of a simple dipole falls, say, to 8Ω due to the addition of a reflector and a number of directors, and this is a common value, the impedance is raised to about 64Ω by folding the dipole, and it then represents a reasonable match to 70Ω coaxial cable. ■

Practical Television MULTIMETER

(*Continued from page 51 of the October issue*)

THERE is no absolute necessity for the reader to follow the details of the cabinet illustrated in Figs. 2 and 3, but this design is simple, and therefore suitable for those who are not skilled carpenters. It is made from inexpensive materials, but is nevertheless attractive in appearance.

Soft wood constitutes the largest part of the materials needed. A few shillings will procure all the timber necessary; about two and a half feet of $\frac{3}{8}$in. wood of the nearest stock size to $4\frac{1}{2}$in. wide will be required, or some off-cuts from the local wood shop merchant will prove even cheaper.



Sides

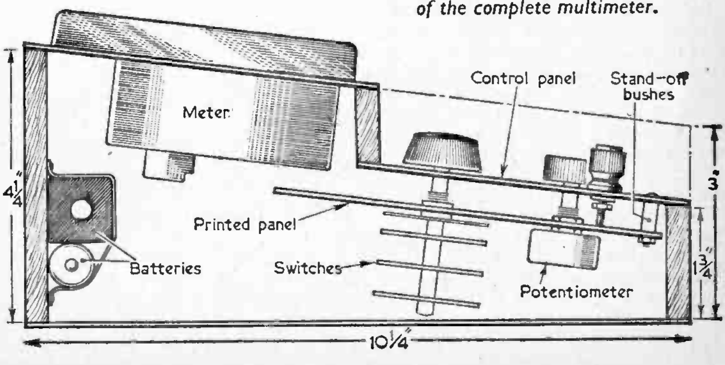
The first pieces to be sawn to size are the two side pieces. It would perhaps be best to make a cardboard template for these parts, taking the measurements given in Figs. 2 and 3; i.e., $9\frac{1}{2}$in. long at the base and slightly less than $4\frac{1}{4}$in. wide at one end and slightly more than $1\frac{3}{4}$in. wide at the other (this takes into account the fact that the two Perspex panels slope from one end to the other, thus giving rise to slight differences from the measurements given for the extreme ends (see Fig. 3).

The back of the cabinet is a piece of soft wood $6\frac{7}{8}$in. x $4\frac{1}{4}$in., the top edge of which must be planed or otherwise shaped to conform to the slope of the meter panel. The front portion of the cabinet is a piece $6\frac{7}{8}$in. x $1\frac{3}{4}$in. similarly planed to suit. There is one other piece to be cut, and that is the centre panel (see Fig. 3), which is $6\frac{7}{8}$in. x $1\frac{1}{8}$in. This last piece has to be planed along both edges to meet the meter and control panels.

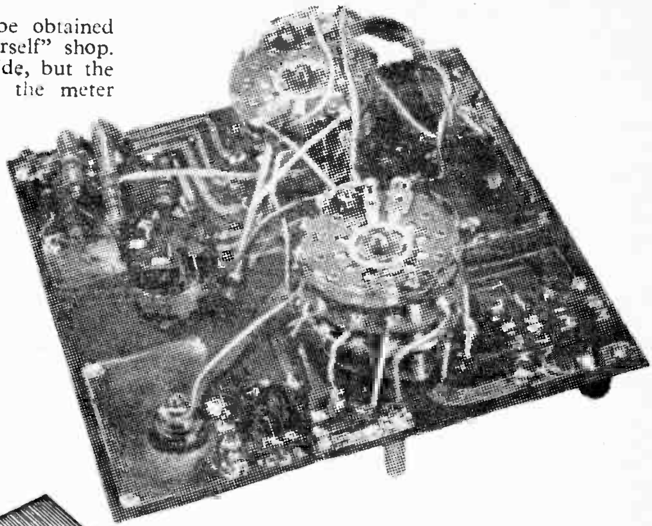
The base of the cabinet is simply a piece of $\frac{1}{8}$in. hardboard, which may easily be obtained from a wood merchant already sawn to the correct size; $10\frac{1}{4}$in. x $6\frac{7}{8}$in.

The two black Perspex panels, one supporting the meter and one the controls

Fig. 2 (below).—Side view of the case of the complete multimeter.



and printed circuit board, can best be obtained new, or as off-cuts, from a "do-it-yourself" shop. They are both $\frac{1}{8}$in. thick and $6\frac{7}{8}$in. wide, but the control panel is $5\frac{1}{4}$in. in length and the meter panel $5\frac{1}{2}$in. in length.

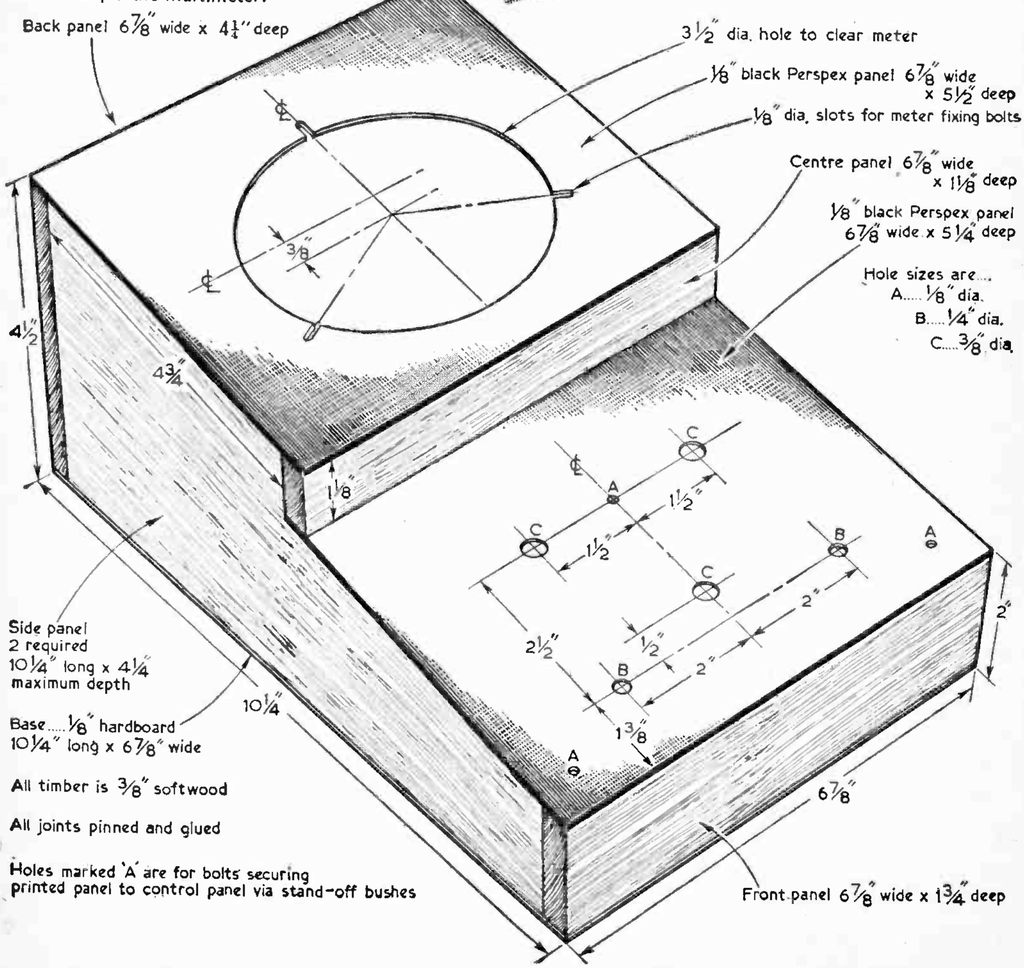


Perspex is almost as easy to handle and tool as wood, and with care will not crack, break or splinter. All the edges should be lightly filed to give a better finish than the raw saw cut, and the holes which are drilled should also be finished with a half round file. All the holes in the control panel are drilled to the measurements given in Fig. 3.

Meter Mounting

The hole for the meter can be cut with a fret saw starting from a small hole drilled somewhere towards the centre of the final circle. The three slots placed at 120° intervals round the

Fig. 3 (below).—The dimensions of the case for the multimeter.



circumference of the circle are best made from a saw-cut, widened with a small file.

The printed circuit board is fixed to the Perspex panel by three bolts through the holes marked " A " in Fig. 3. The two situated at the corners of the cabinet are drilled to correspond to those shown on the printed circuit on the Blueprint. The third hole is positioned as shown in the diagram and to receive the bolt a corresponding hole must be drilled in the printed circuit board, and it will be found that this will conveniently be on a piece of the board free from copper; *on no account must this fixing bolt come into contact with the copper on the printed circuit board.*

Stand-off bushes are used on all three fixing bolts to keep the board at a suitable distance from the Perspex panel. The shanks of the two switches and the potentiometer must be sawn off to the correct length and knobs fitted on them. The two terminals are mounted on the front panel and *not* on the printed board, so that the shanks pass through the two holes left for them on the board. The sides, back and front of the cabinet should now be placed together to ensure that all the sides

line up and then, by using one of the modern contact adhesives and panel-pins, the four pieces may be permanently joined. The meter and control panels may now be placed in position and glued with a suitable adhesive.

Switch Wiring

At this point in the construction, the two terminals, the shanks of which pass through the printed circuit board as explained earlier, are connected with 16s.w.g. tinned copper wire to the two switches. Refer to the blueprint—Terminal Y is connected to tag Y on S2A. Terminal Z is connected to tag Z on S1A. The meter movement may now be connected as shown on the Blueprint.

The 9V battery and 1·5V cell are now strapped to the back of the cabinet as shown in Fig. 2. Strips of plastic or leather held by drawing pins are all that is needed. The two batteries are, in effect, wired in series, the junction of the two forming the " 0V " connection (the positive tag of the 9V battery is connected to the negative tag of the 1·5V cell). The 9V battery (negative end) is connected to R18 and the 1·5V cell (positive end) is connected to tag 10 on S2C.

The base may now be screwed into position—and lettering can be put round the switches, terminals and potentiometer, either by hand-painting or by the use of transfers, to correspond to the ranges given.

Calibration

The procedure necessary for the calibration of the meter was given in detail last month and it should be found relatively easy to achieve the required degree of accuracy. The main difficulty will consist of transferring the results of the various calibration exercises to the meter so that direct readings are possible. If desired, the calibration could be carried out in the form of various graphs, one for each scale or set of scales, but this method, while accurate, makes the taking of readings tedious and unnecessarily complicated. What is needed is the ability to take readings directly on all ranges. In order to help the constructor, a sample set of scales is printed in Fig. 4 below and shows the type of professional layout which it is possible to achieve. The amateur could well draw out similar scales when calibrating his meter and, if the scales are drawn on thick card, then the card can finally be cut to fit above the glass of the meter so that readings can be taken easily. Of course, although this method avoids the necessity of tampering with the meter and attempting to mount the scale on top of the existing scale, great care must be taken to avoid parallax error — the eye must be kept directly above the meter needle or the reading taken will be too high or too low. The scales shown above are suitable for direct use on the home constructed meter and can be mounted on card and used as described above; the accuracy obtained should be at least 5% on A.C. ranges, provided full scale reading is adjusted to be correct. Voltage readings, using the proper value of series multiplier, will be equally accurate without such adjustment. With current ranges, however, accuracy depends only on the resistance of switch contacts so that for the higher current ranges (50mA and over) this needs to be taken into account. Consequently, for the higher current ranges (on both A.C. and D.C.) scales are only correct if the full-scale reading is adjusted to be correct. ■

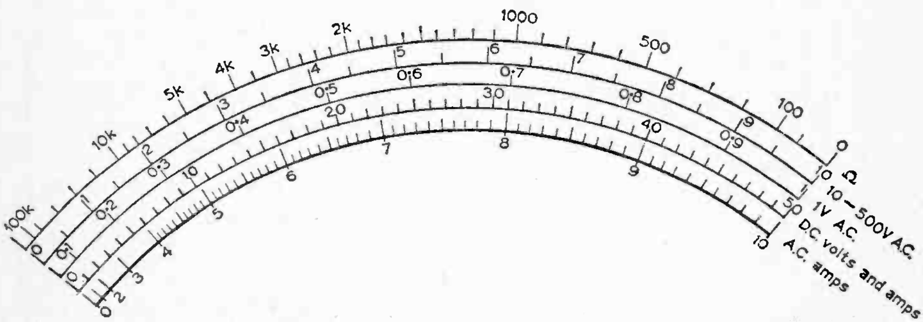
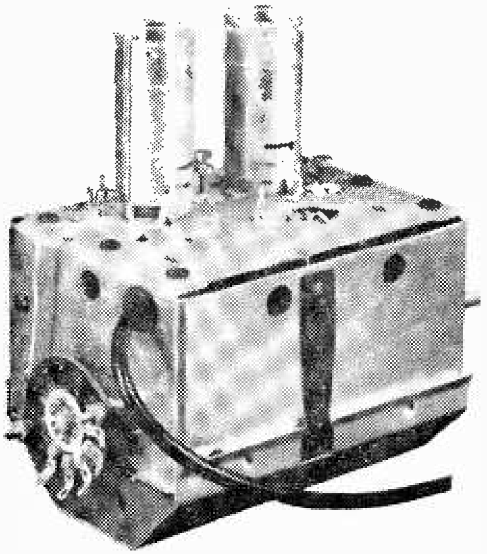


Fig. 4.—An example of the type of scale produced in calibrating the multimeter—in fact, this scale may be used on the completed instrument.

IT is the purpose of this series of articles to describe in a practical manner the function of each particular component making up a television receiver. Details will also be given where appropriate of the likely effect on receiver performance should the component under discussion be in any particular way defective.



HOW TV SETS WORK - 1: The tuner

By K. James

To start the series, a typical turret tuner will be considered, the circuit of which is shown in Fig. 1. Although tuner circuits differ slightly between models, the basic make-up is fairly standard, even with switch tuners and modern turrets. There are usually two valves, a double-triode (V1) arranged in a cascode R.F. amplifier circuit and a triode-pentode arranged in a frequency changer circuit (V2), with the triode acting as local oscillator and the pentode as mixer.

Aerial Isolation

The aerial downlead is connected to a coaxial input socket and fed to the aerial coupling transformer L1/L2 through capacitors C1 and C2. These isolate the mains-connected chassis of the receiver from the aerial, and may have a value between 470pF and 1,000pF. It is unwise to replace these with components of greater value, as then the capacitive reactance at 50c/s may be increased sufficiently to cause a person touching the aerial system to suffer serious electric shock if the chassis of the set happens to be connected to the "live" side of the mains supply. Replacement components should also have a rating around 1,750V (1·75kV).

Resistors R1 and R2 connected in parallel with the isolating capacitors provide a discharge path between the aerial system and receiver chassis, and thus avoid the build up of a large static potential which would cause interference to the reception and, under certain conditions, also cause the aerial to charge up to a dangerous voltage.

Section A of the double-triode V1 is connected as a neutralised triode, the signal from the coupling transformer being applied to the grid. The pre-set capacitor C3 and the capacitor C4 are the neutralising elements which cancel out the effects of the anode-to-grid capacitances of V1A. In conjunction with the valve capacitances, C3 and C4 form a bridge circuit, and, by careful adjustment to C3, the stage is effectively neutralised.

Critical Adjustment

Neutralisation is necessary to prevent the triode from oscillating and to maintain the lowest possible noise factor for the first stage. C3 is adjusted at the factory, and, as very small values of capacitance are involved, the adjustment is critical.

The cathode resistor R4 provides a part of the grid bias for V1A, depending on the setting of the gain control R103. When R103 is at maximum gain, the voltage drop across R4 gives all the fixed bias, but, when R103 is turned towards minimum gain, V1A receives an increased bias which effectively decreases the mutual conductance of the valve and hence the gain of the stage.

Resistor R4 is decoupled by C7 to prevent negative feedback from unnecessarily reducing the gain. Similar decoupling is provided by C6 in relation to the gain control circuit. R103 is connected between chassis and H.T. positive in a potential divider arrangement. Thus, as the gain control is turned down, so the cathode of V1A becomes progressively more positive with respect to the grid. As this is the same as the grid becoming progressively more negative with respect to cathode, a wide control of stage gain is provided.

Automatic Gain Control

In addition to the fixed bias and that provided by the gain control, bias is also applied to V1A from the AGC line, via R3. This negative bias increases with increase in signal strength and thereby automatically adjusts the gain of the stage to accommodate a range of input signals.

In poor signal areas, the gain control should always be set at maximum, and the general gain of the receiver adjusted by the contrast control. This ensures that the first stage is providing the best noise performance. This can be demonstrated by in very strong signal areas, where sound-on-vision and vision-on-sound might occur. Open-circuit of R3 would result in modulated hum bars on the picture and hum on sound.

The Other Half of the R.F. Stage

Section B of V1 is an earthed-grid R.F. stage which receives the amplified signals at V1A anode in its cathode circuit. These signals are applied through inductor L3, which is sometimes called a coupling or peaking coil. This coil is made to resonate just below Channel 13 and, since the Q is low owing to the input impedance of V1B, it preserves the stage gain at high frequencies in a similar manner as the "peaking coil" in video amplifier stages.

The grid of V1B is maintained at chassis potential (so far as the signals are concerned) by C8. Bias

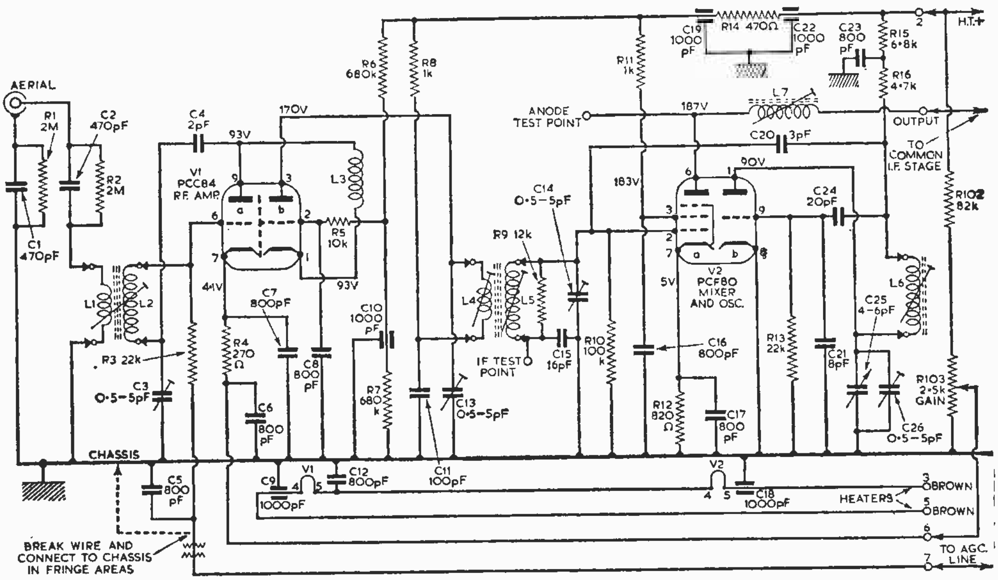


Fig. 1.—The circuit diagram of a typical turret tuner. The components making up this tuner are described in detail in the text.

turning down the gain control and turning up the contrast control to compensate. In areas where the signal is not too strong, this practice will result in a picture which is very noisy (i.e. covered with grain). The reason for this is that the noise from the R.F. stage increases as its gain is decreased.

For optimum results in fringe areas it sometimes pays to disconnect the AGC to the tuner, by breaking the AGC wire (the C5 end) and connect it direct to chassis, as shown in Fig. 1. This ensures that the stage performance is not impaired by unnecessary bias when the aerial signal is very weak.

Biasing Faults

Open-circuiting of R4 would cause complete failure of V1A and lack of sound and vision signals. A short in C6 or C7 would be revealed by R103 not operating. Open-circuiting of R102 would seriously limit the range of gain control, while a short across C5 would hardly be noticed other than for V1B is fixed by means of the potential divider, R6 and R7, and from the D.C. point of view, V1B appears as a cathode-follower. Further decoupling of the grid circuit is provided by R5 and C10.

It sometimes happens that the "lead-through" condenser C10 develops a short-circuit. This destroys the bias of V1B and, in certain tuners, causes R6 to overheat and burn out. In some cases, the tuner may continue working with very low efficiency.

The two sections, V1A and V1B, form the well-known cascode circuit, in which the amplified signals are developed across the anode coil L4 and the coupled coil L5, which together form a band-pass coupling to the mixer. The anode circuit is decoupled by R8 and C11 and the anode coil is tuned by its slug and the trimmer C13. C13 is adjusted at the factory to provide the best compromise over all the channels, and improvement can never be obtained by altering this setting.

Mixer Section

The pentode section of V2, V2A, receives at its control grid the amplified R.F. signals across L5. This inductor is tuned by the slug in its former and by the pre-set C14, which should not normally be adjusted. Resistor R9 is included to set the Q of L5 for the required passband characteristics, while C15 gives a coupling for the " I.F. test point ". Such a test point is made available on most tuners to allow easy connection of an I.F. signal for alignment purposes.

A grid return for the pentode is provided by R10, and the stage is biased by the cathode resistor R12 and grid current in R10 as the result of the applied heterodyne signal from the local oscillator. R11 is the screen feed resistor and C16 and C17 are decoupling capacitors.

Local Oscillator

The triode V2B is arranged in a simple oscillator circuit of modified Colpitts form. The H.T. feed to the anode is via R16, and the oscillator coil is L6. The oscillator is tuned by the slug in the coil, by the fixed capacitor C21, by the fine tuner C25 and by the trimmer C26. The latter, again, is a pre-set which is adjusted for optimum results on all channels at the factory. As these components are chosen in terms of temperature co-efficient to compensate for capacitance changes with temperature, it is essential, if oscillator drift is to be avoided, to make any necessary replacements with components of the original characteristics. This also applies to the oscillator coupling capacitor C24 and the heterodyne feed capacitor C20.

As a fairly high R.F. voltage exists across the oscillator feed resistor R16, this is returned not direct to H.T. line, but to an H.T. decoupling network comprising R15 and C23. Further decoupling for the remainder of the tuner is provided by R14 and C19.

Excessive frequency drift should lead to a check of the fine tuner and associated capacitors, after first proving that the frequency changer valve is not responsible, preferably by substitution.

Excessive oscillator radiation, as may be picked up on a nearby set as pattern interference, could be caused by a fault in R15 or C23.

Intermediate Frequency

Grid bias for V2B is provided by the grid current in R13 which is produced by the oscillatory condition of the valve. The oscillator voltage is fed to the control grid of the mixer section through C20. In most tuners, the oscillator frequency is the signal-frequency plus the intermediate-frequency, which gives sound and vision I.F.'s in the I.F. coil L7 such that the sound I.F. is *above* the vision I.F. in frequency. In tuners with the oscillator at the I.F. below the signal-frequency, the sound I.F. falls *below* the vision I.F.—a point worth remembering.

The " lead-through " capacitors in tuners appear vulnerable to short-circuiting or intermittent breakdown—these are indicated on the circuit by two lines, one either side of the circuit wire, such as C19, C22, C10, etc. Should the faulty capacitor happen to be decoupling an H.T. circuit, then the associated resistor will nearly always burn out, but the capacitor, when later checked with an ohm-meter, may not show a short. To be on the safe side it pays to replace the capacitor if there is any doubt at all. For example, should C19 short, a very high H.T. line current will flow in R14 and cause it to burn out.

The I.F. coil L7, should be adjusted for the best overall response of both sound and vision. In the event of instruments not being available, the coil slug should be adjusted to give the best reproduction of Test Card C, consistent with good sound.

Heater Circuit

Most modern tuners feature a series-connected heater chain, as shown in Fig. 1. The heater line is decoupled to R.F. by C9, C12 and C18. It is rare for these capacitors to fail, but if they do, pattern interference effects may be present on the picture at certain critical points of the fine tuning control owing to the injection of spurious R.F. and oscillator signals into the heater circuits of other valves in the set. The tuner heater chain is usually introduced into the main heater chain between the picture tube heater and the other valves, the other side of the picture tube heater, of course, being connected to chassis.

(To be continued)

WIRED TV SYSTEM

A CONTRACT has been placed by the Independent Television Authority with EMI Electronics Ltd. for the installation of a wired TV and sound system at their new headquarters in Brompton Road, London.

Work is already being carried out on this installation which, when complete, will provide ITV Channel 9 and BBC Channel 1 television programmes and BBC VHF sound programmes in most of the offices in the new headquarters.

A modulator will permit pictures from other TV programmes—supplied by cable from the Museum telephone exchange—to be displayed.

Aerials will be fitted to a 30ft tower on the roof.

COLOUR TV FOR SOUTH AFRICA

A LARGE screen colour television projector developed by Marconi's was recently demonstrated in South Africa, when the Smith Kline and French medical colour TV unit visited hospitals and medical centres in the Republic.

The mobile unit, manned by Marconi engineers, gave demonstrations at the 43rd South African Medical Congress in Cape Town in September. Also in use was a new colour television projector.

The Smith Kline and French medical colour TV unit has given demonstrations to doctors, hospital staff and medical students all over the world and last year carried out a successful tour of Australia.

In South Africa, after leaving Cape Town, it will give demonstations in Johannesburg and Durban before returning to England late in October.

TV CONFERENCE IN BUDAPEST

MORE than 100 foreign guests besides official delegates are expected in Budapest next summer for the conference of the International Radio and Television Organisation.

Observers will be attending from Iraq, the United Arab Republic and a number of Asian and African countries.

The meeting will discuss, among other things, exchanges of documentary and feature films for television, and exchange of radio programmes.

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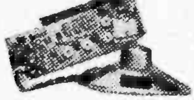

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DL96	9/-	PCF80	9/6
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RESISTORS—FULL RANGE 10 ohms—10 megohms 20% ⅛ w. and ¼ w., 3d.; ½ w., 5d.; (Midget type modern rating), 1 w., 6d.; 2 w., 9d.; 10% Hi-Stab. ½ w., 5d.; ¼ w., 7d.; 5% ½ w., 9d.; 1% Hi-Stab, ½ w., 1/6.

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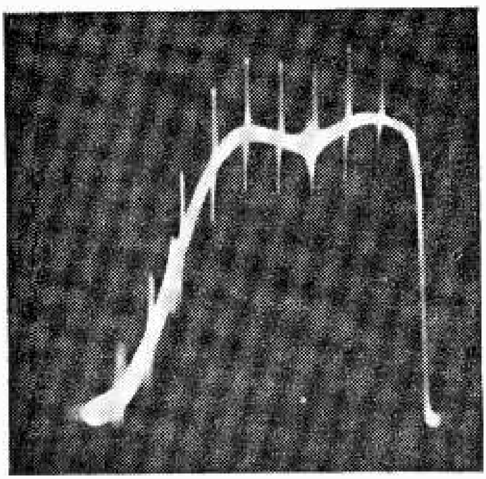
A Precision Wobbulator

By N. Mears

(Continued from page 27 of the October issue)

THIS VERSATILE WIDE RANGE INSTRUMENT WAS DEVELOPED AROUND A MODERN SEMICONDUCTOR JUNCTION DIODE

SCREENING for the wobbulator was described in last month's issue, and a means of decoupling the mains leads was also explained. Thus the only leakage of R.F. field is from the centre spigot of the coaxial connector and the ¼in. holes in the front panel.



TV receiver response: note the marker pip.

The former is by far the larger leakage except when a metal screwdriver is used to trim the coil cores—the use of an insulated tool is therefore recommended. The 465kc/s coil is aligned before the can is screwed over the oscillator assembly, and no external trimming hole is needed.

Control of Output

It is important for the R.F. output control—or 1000Ω variable resistor—to have zero resistance at its minimum. If it does not, R.F. output will not

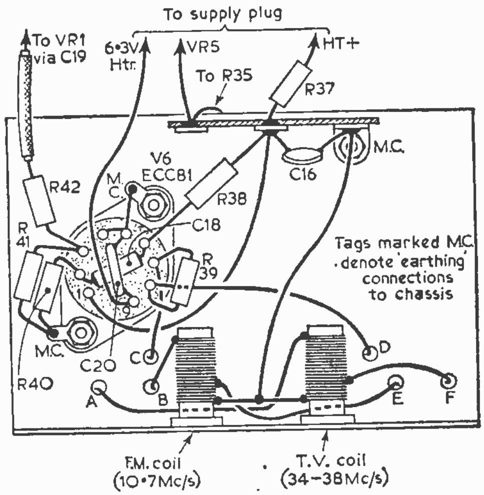


Fig. 10.—The wiring details of the oscillator circuit.

reduce to a sufficiently low value at the minimum setting of the control. The earth connection must also be of very low impedance. Several wires in parallel, or thick copper braid, must be used and the length of this connection must be kept to the minimum. A wire-wound potentiometer is quite unsuitable, as its inductance is very appreciable. A similar low value of minimum resistance must be obtained in the sweep control, or it will be impossible to achieve an unmodulated R.F. output. It is difficult to find a commercial component with a low enough resistance and the writer found that an ex-Government wire-wound component proved most successful, giving at its lowest setting only 5kc/s sweep. It should be noted that the SVC1 diode, at moderate D.C. potentials, is relatively very sensitive to a small A.C. input.

Components

Apart from the foregoing simple precaution, there are no special difficulties about the circuit. All resistors are ¼W; the oscillator capacitors of 100pF or less are silver-mica; all the 1000pF capacitors are disc-ceramic types, while the remainder may be of tubular or ceramic type. Layout is not critical in any respect, although of course in the oscillator circuit, stray capacitances must be kept to the minimum by careful wiring.

Alignment

1. *Aligning the 200c/s multivibrator*
   (a) Attach phones via 0·01μF capacitor between R7 and chassis.

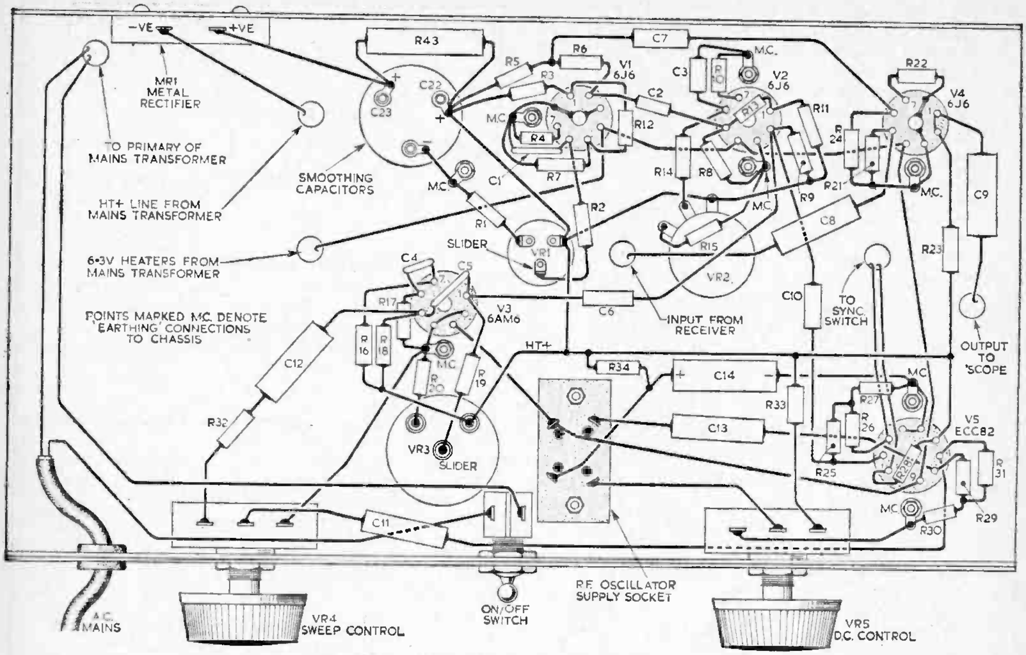


Fig. 11.—The underchassis wiring diagram.

(b) Rotate VR1, until the note is flat on A below middle C and a little sharp on F below middle C. If an audio generator is available, adjust to 200c/s.

The above gives " near enough " alignment.

2. *Aligning the 20/cs multivibrator and saw-tooth generator*

(a) Attach phones between R10 and chassis.

(b) Rotate VR2 until a rapid flutter is heard —not really recognisable as a note.

(c) Insert 4-6in. of bare wire in the " input from receiver socket, to pick up hum.

(d) Connect Y-amplifier output to oscilloscope, and adjust trace to about 10 sweeps/sec.

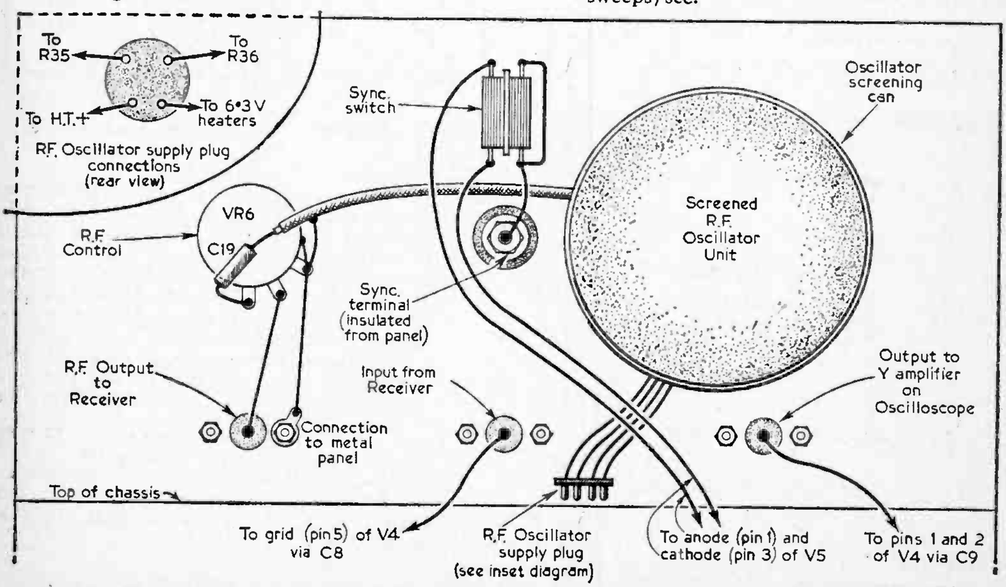


Fig. 12.—The connections to the rear of the front panel (inset: the plug connections for the R.F. oscillator).

(d) An A.C. waveform should now be visible on the scope. Keep it as steady as possible without sync, and adjust to show 4 or 5 traces.

(e) Correct the adjustment of the 200c/s multivibrator by rotating VR1 until each A.C. wave shows 4 markers exactly (see illustration on page 613 of the September issue).

(f) Remove the plug from the "Y-amplifier" socket on the wobbulator and connect the lead instead to the "sync" terminal on wobbulator. Rotate VR2 until over 5 A.C. waves are displayed, 2 pulses are visible and steady.

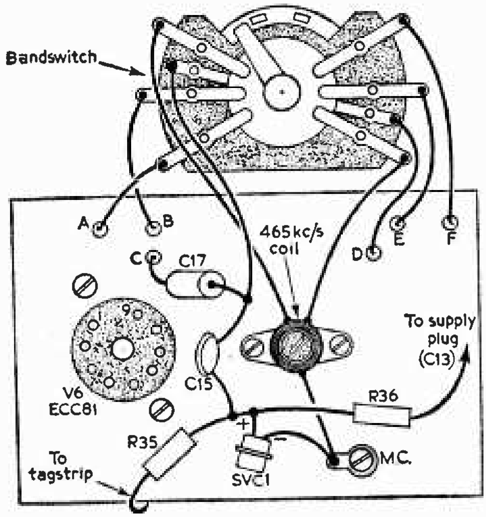
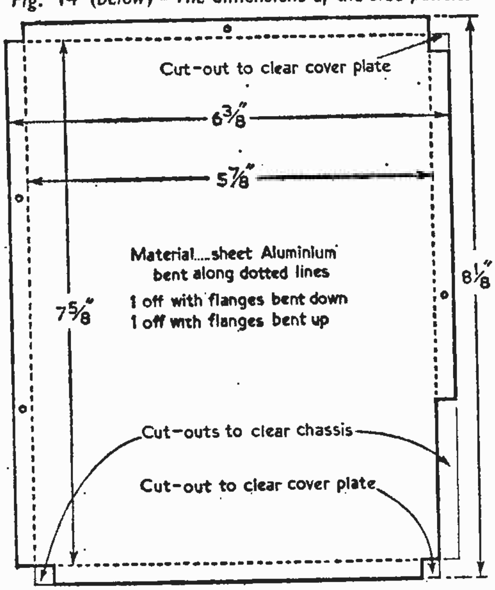


Fig. 13 (above)—R.F. oscillator coil switching.

Fig. 14 (below)—The dimensions of the side panels.



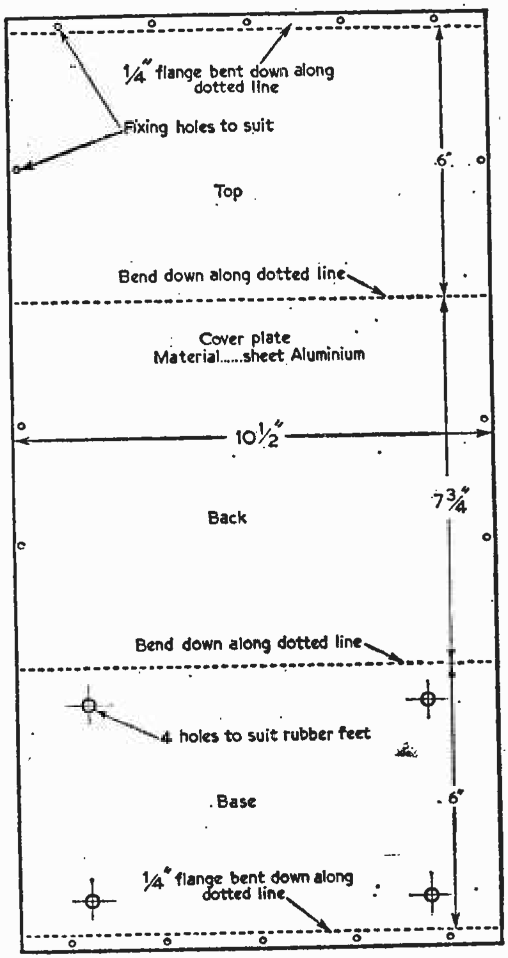


Fig. 15.—Construction details of the wrap-round case.

(g) Disconnect the lead to the oscilloscope from the sync terminal and attach it to the anode of the 6AM6. Disconnect the length of pick-up wire from the "output from receiver" socket; rotate VR3 until 2 perfect sawtooths appear. These should be somewhat "exponential" in shape, negative-going, as shown in Fig. 6 (last month). If they are too linear, try connecting a 1M or 500k resistor between the grid of the 6AM6 and its anode, but this need not be tried just yet.

(h) Connect the oscilloscope "external sync" terminal to the wobbulator "sync" terminal, and adjust the oscilloscope trace to 20c/s; use as little sync as possible. The trace should now lock, displaying one sawtooth only.

(To be continued)

THERE are times when a little extra sound and vision gain would make the difference between tolerable reception and good reception. In past pages of this magazine various methods have been discussed for improving the overall gain, especially of the older type "service area" television receiver, by the use of a pre-amplifier, an extra I.F. amplifier stage, decreasing bandwidth and similar dodges. Most of these have their own particular appeal to the experimenter.

Low-noise Input Stage

A pre-amplifier, for example, is simple to fit and rarely calls for modifications to the receiver. By using a preamplifier with an ultra-low-noise input stage (see, for example, "A Nuvistor Band III Preamplifier" by R. E. F. Street, PRACTICAL TELEVISION July, 1961) an improvement in noise performance over that of the receiver's first stage is often accomplished. This is highly desirable in those areas where the aerial signal is notoriously weak, for it lifts the overall sound and vision gain without introducing extra noise in the form of "snow" on the picture and "hiss" on the sound.

However, quite a few of the more recent receivers using multi-channel tuners with a double-triode cascode R.F. amplifier already possess a reasonably good noise performance, and it is often difficult to improve on this by adding a similar type of preamplifier. Indeed, if the pre-amplifier is of poor design or construction the receiver's noise performance may be impaired instead of improved and, although a "brighter" picture may be obtained, the snow effect may be so bad as to make viewing virtually impossible on all but strong signals.

The sensitivity of a receiver is given in terms of so much signal voltage required to produce a given peak white picture signal at the cathode of the picture tube. Vintage receivers require approaching 100µV to give about 2V at the cathode of the tube. Modern receivers give about the same cathode voltage for around 10-20µV of aerial signal.

This is only one factor, however, for it is the maximum *usable* sensitivity that is most important, and this is governed by the noise factor of the R.F. amplifier or pre-amplifier. It would be pointless to say:—"my set is highly sensitive, it only requires 10µV aerial signal to give a peak white picture"—if, in fact, the set requires about 100µV to outweigh the noise of the first stage or pre-amplifier!

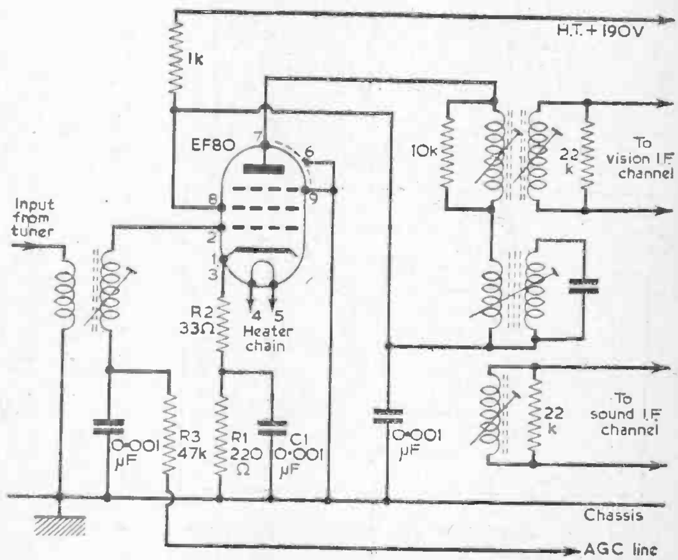


Fig. 1.—A conventional common I.F. amplifier stage, using an EF80, working at a maximum gm of about 6mA/V.

An extra I.F. amplifier stage, if common to both sound and vision, would give considerably improved sensitivity and would have no effect on the noise performance. The noise performance would, in fact, remain almost exactly the same as the original conditions. An extra stage of this kind requires to be built on the receiver chassis, and requires extra components, including coils.

Reducing the vision bandwidth to achieve a greater overall vision gain was the vogue among experimenters in days gone past. Test Card C was usually used as the signal source and the various vision channel cores were judiciously adjusted one at a time to produce a brighter picture whilst retaining as much bandwidth as possible, as revealed by the frequency gratings on the Test

IMPROVING RECEIVERS WITH FRAME GRID VA

Card. Invariably the whole process used to go out of control and the experimenter was left with a grossly misaligned receiver and with poorer pictures (and sound) than when he started the exercise.

Frame Grid Valves

With the advent of frame grid valves the problem has been considerably simplified. In essence, the frame grid valve has a far higher slope or mutual-conductance (gm) than its conventional counterpart, and since the gain of an amplifier stage is equal to gm × Zp, where Zp is the impedance of the anode circuit of the valve, it follows that the higher the gm the higher the stage gain.

Slope or gm is dependent on the distance between the cathode and grid of the valve—the smaller the spacing the higher the slope. The higher slope of frame grid valves results, therefore, from the use of finer, closely spaced grid wires. The diameter of the grid wire is no more than 10 microns, and the grid-cathode spacing is 50 microns. These are small distances when it is realised that an average human hair is about 75 microns in diameter and that it would not be possible to insert a piece of it between the cathode and grid, and the diameter of the grid wire itself is about seven times *smaller* than a hair! (A micron is one ten-thousandth of a centimetre, and there are approximately two and a half centimetres to the inch.)

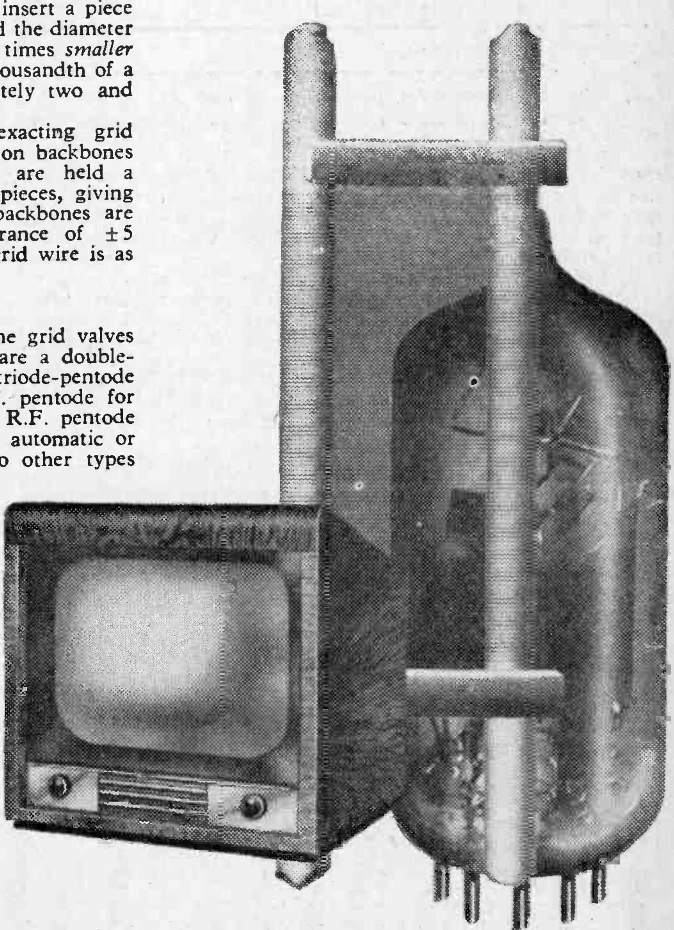
In order to produce such an exacting grid assembly, the grid wires are wound on backbones of rigid molybdenum rods, which are held a determined distance apart by cross pieces, giving the frame grid construction. The backbones are drawn to size within a close tolerance of ±5 microns, while the tolerance of the grid wire is as small as ±0·2 microns.

Available Valves

There are four main types of frame grid valves for use in signal ciruits, and these are a double-triode for cascode R.F. amplifiers; a triode-pentode frequency changer; a variable-μ R.F. pentode for AGC I.F. amplifiers; and a straight R.F. pentode for I.F. amplifiers using little or no automatic or manual gain control. There are also other types being launched and coming into full scale production.

It should be understood that increased gain cannot usually be achieved simply by replacing the conventional valves in a receiver with frame grid specimens. When a designer decides to use frame grid valves, then he develops the circuit to take full advantage of the attributes of the new valves. From the point of view of set design, frame grid valves mean that a given gain can be accomplished by the use of fewer stages or that improved sensitivity can be achieved by using the same number of valves as in a conventional receiver but using combination of frame grid and conventional valves.

Sets are now being made with frame grid valves in the tuner (e.g., Mullard PCC89 and PCF86) and a frame grid common I.F. amplifier (EF183). If the sound and vision I.F. amplifiers each use a conventional EF80, the sensitivity on Band III for a 2V vision signal at the tube cathode is about 10μV (less on Band I). Similar sensitivity figures are achieved by the use of a PCC89 R.F. amplifier, PCF80 (conventional valve) and frame grid I.F.



BY MODIFYING CERTAIN STAGES IN A TELEVISION RECEIVER, VISION AND SOUND GAIN CAN BE INCREASED.

ALVES

By D. B. Chappell

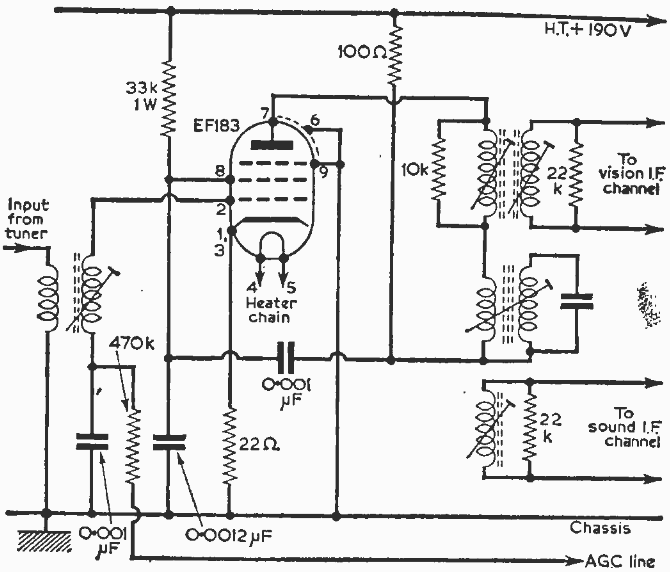


Fig. 2.—The circuit of Fig. 1 rearranged for use with an EF183 frame grid variable-mu pentode. This circuit gives an effective gm of about 12mA/V.

amplifiers—e.g., EF183 common, EF183 sound I.F. and EF184 vision I.F. The EF183 is a variable-μ type and the EF184 a straight pentode, and compare with the lower slope EF85 and EF80 valves respectively.

The gain advantage of the frame grid type valves in comparison with conventional types is of interest and is detailed below:—

PCC84 to PCC89—5—7dB
PCF80 to PCF86—6dB
EF85 to EF183—6—8dB
EF80 to EF184—6—8dB

These figures show that a receiver can be made approximately twice as sensitive by replacing a conventional valve with a frame grid counterpart—6dB being a 2:1 step up in voltage gain, which is brought about by a gm of a frame grid valve being approximately twice that of the conventional counterpart.

It should be understood, of course, that twice the gain in a single stage would mean four times the gain in two stages, eight times the gain in three stages, sixteen times the gain in four stages and so on, but in practice a receiver is rarely designed to exploit a valve to its very maximum.

Lower Noise

The total gain that can be obtained in a tuner by the use of two frame grid valves (e.g., PC89 and PCF86) is in the region of 60dB (1,000 times), and this can be accomplished without any impairment in noise performance. Indeed, by sacrificing just a little of this gain, and paying extra special attention to the design of the tuner, the noise performance can be enhanced.

It must be stressed, however, that this is not possible simply by replacing the tuner valves; the circuit has to be carefully engineered to suit the valves. Experimental work is in hand to adapt old-style tuners to work with the new valves, and details of this work will be given in a later issue of PRACTICAL TELEVISION.

The PCC89 can also handle about five times more signal than its conventional counterpart before intermodulation becomes troublesome. This means that sound-on-vision and vision-on-sound interference does not occur so quickly when the aerial signal is increased. In older sets, it will be recalled, it was often necessary to introduce external attenuators in areas of high signal strength to eliminate intermodulation effects. Sets using the new valves can handle a far greater signal range for a given intermodulation factor.

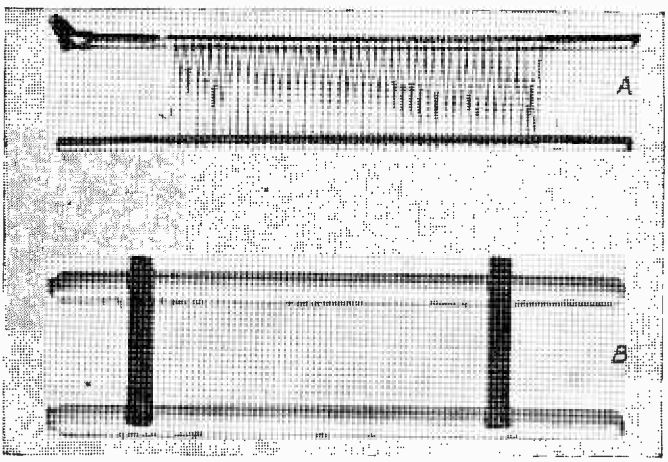


Fig. 3.—"A" illustrates a conventional grid, and "B" is a frame grid. Both are shown magnified.

The EF183 as Common I.F. Amplifier

In Fig. 1 is shown a fairly conventional common I.F. amplifier stage using an EF80 R.F. amplifier. This employs cathode biasing (R1) and is decoupled to R.F. by C1. The unbypassed 33Ω resistor is to prevent detuning of the amplifier by the AGC voltage which is applied to the control grid through R3. Without R2, the input capacitance of the valve would alter sufficiently with changes in bias to cause detuning of the grid circuit. This is avoided by the negative feedback resulting from the un-

(Continued on page 99)

TRACING TV FAULTS

(Continued from page 22 of the October issue)

By G. J. King

THIS month the tuner will be dealt with fully (stage 3 in Fig. 1 in the September issue) as will the Common I.F. stage (stage 4).

Blank Raster (No Sound or Vision)

Because a raster (illumination on the whole of the screen) is present, one can conclude immediately that the H.T. circuits are working, that both timebases are working, that EHT voltage is present on the picture tube and, if the brightness control turns the raster brightness up and down correctly, that the video amplifier and tube biasing circuits are in order.

It would now be a good idea to turn to Fig. 1 again. Since there is neither sound nor vision, the trouble is almost certain to lie somewhere in those stages common to both the sound and vision signals. If the symptom occurs only on one channel, say, the BBC channel, then the most likely cause would be a break in the connections between the BBC aerial (1A—Fig. 1) and the diplexer—2.

The aerial could be all right, of course, in which case the fault would lie in the tuner. In turret tuners, in particular, it sometimes happens that a connection on one of the coil biscuits breaks or that the biscuit falls out of position preventing its contact studs from making good connection with the spring contacts connected to the tuner circuits.

When this kind of trouble is responsible, the raster is perfectly clear when the tuner is switched to the offending channel. There is no grain, not even with the contrast control turned right up, and there is only a very slight trace of a hiss on sound. However, if a broken aerial connection is responsible, the raster will be full of grain (snow effect) and there will be an appreciable hiss from loudspeaker, and possibly very slight sound in the background.

Failure in a Common Stage

We must now assume that the raster is clear of grain on both channels and that there is virtually no hiss from the loudspeaker. In this event, a fault in a stage common to both the vision and sound signals is most likely. The symptoms could be caused by separate failures in individual sound and vision stages, but this is extremely unlikely.

We have cleared stages 1A, 1B and 2 (Fig. 1), and all the other stages, of course, except the common ones, 3 and 4. Thus, the exercise starts with the examination of these.

The best thing to do first of all is to eliminate the tuner. This is a simple matter if one is in possession of a signal generator tunable over the I.F. bands, for then a signal may be injected at the control grid of the common I.F. stage, and the modulated signal tuned first to the sound I.F. and then to the vision I.F. If the common stage is working, the modulation will be heard from the loudspeaker and horizontal bar patterns, due to the modulation, will appear on the raster. If the stage is "dead" neither of these things will happen, and it would be concluded that the trouble is in the common stage, thereby clearing the tuner itself.

Long-wire Aerial (see Fig. 4)

Without a signal generator, things may not be quite so conclusive. Nevertheless, it is usually possible to glean some idea of the condition of the stage by connecting a long-wire aerial to the control grid of the common I.F. valve. The receiver's contrast, volume and sensitivity (if fitted) controls should be turned full on and the brightness control adjusted to give a raster of normal brightness.

When the long-wire aerial is connected a distinct crackle should be heard from the speaker and, under certain conditions, sound programmes of Continental origin will also be heard. On the raster, moving, dark, horizontal bands will appear due to the modulation of the sound signals (falling within the vision I.F. spectrum) which are amplified by the common I.F. stage and the vision I.F. stage.

Another way of injecting a signal, if stations do not happen to be radiating within the I.F. bands, is to direct the long-wire aerial close to a domestic electrical appliance, such as a vacuum cleaner or hair dryer. The interference from the appliance as picked up by the aerial will cause severe interference effects on the raster and typical interference disturbance on sound or from the speaker.

Circuit

In Fig. 4 is given the circuit of a turret tuner and common I.F. stage. and the point at which the long-wire aerial should be connected is also shown.

If signals cannot be directed through the common stage then this should be examined in some detail. There is really not a lot in the circuit, and observation will show whether the valve heater is intact. A finger test of temperature will indicate whether H.T. current is passing through the valve, and the envelope temperature should be comparable to that of a correctly working I.F. stage, as already dealt with. If the valve is only just warm. an emission test at a dealer's shop would pay. If the valve is in good order, attention should be given to the anode and screen grid feed resistors and their associated decoupling capacitors, such as R27 and C33 in Fig. 4. An open-circuited cathode resistor (R24 or R25) would destroy normal operation, and a voltmeter test at the cathode (pins 3 and 1) would show almost full H.T. voltage between that point and chassis in that event. If a meter is not available, a quick test could be made by connecting a 180Ω resistor between cathode and chassis. Shorting decoupling capacitors would be revealed by the associated decoupling or feed resistor being burnt and possibly cracked.

Checking the Tuner

Assuming now that the common I.F. stage is without fault, then the trouble must lie somewhere in the tuner. Unfortunately, the tuner is rather a tricky item to test without instruments; indeed, even with instruments, it can present a problem, since the components are soldered in circuit with very short leads close to the base of the valveholders, which are usually deep down in the tuner chassis, beneath the switch or turret mechanism.

It is recommended that if the fault is proved to be in the tuner, and the valves check normal, the repair should be handed to a person fully experienced in the art of television servicing. Even dealers' service engineers sometimes return defective tuners to the manufacturer for service—and some manufacturers, in fact, recommended this procedure.

Critical Circuits

Apart from the mechanical difficulties involved, tuner circuits are highly critical as they have to handle very-high-frequency (VHF) signals. They also have to be in perfect balance so that the overall response remains identical on all channels. Unskilled servicing can quickly destroy the balance and, although the tuner may eventually be made to work again, it is always debatable whether it is working efficiently or not. The tuner is really the most important part of the set, for it is here that the aerial signals are developed into noise-free I.F. signals for subsequent amplification. Poor servicing may well increase the "noise factor" of the tuner and make it almost unsuitable for use in poor reception areas, especially on Band III—the ITV band.

There are one or two consistent faults which occur in tuners and result in failure of sound and vision. These are: a short developing in C18 or C21 causing burn-out of R12 or R14 (see Fig. 4) and sometimes the main H.T. decoupling capacitor (C24), which is often a feed-through type, becomes short-circuited and the tuner H.T. feed resistor (R18) then burns out. Burn-outs of this nature can usually be seen by carefully examining the likely components.

Before finally deciding to remove the tuner for repair or to have the local dealer service the set, attention should be given to the various leads and cables coupling the tuner to the main chassis, for the symptom under discussion has been known to be caused by a fracture of the inner conductor of the coaxial cable linking the tuner to the main chassis. This cable may also become hot owing to incorrect routing near a valve or hot resistor, and when this happens there is a likelihood of the polythene melting and the inner conductor making connection with the outer braid. Similar trouble may occur owing to the soldering iron being left in contact with the conductors too long when soldering the ends. The short may not occur immediately, but may only develop after the set has been in service for some time.

(Continued on page 91)

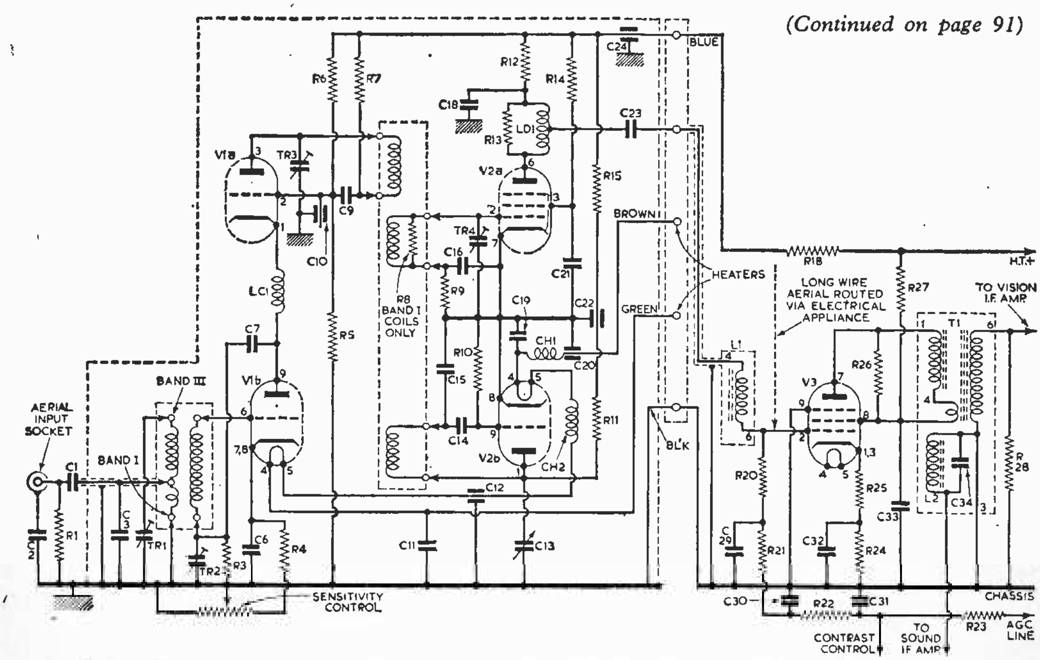


Fig. 4.—The tuner and common I.F. stages (stages 3 and 4 in Fig. 1 on page 616 of the September issue).

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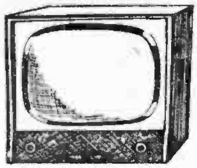

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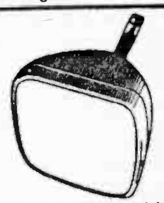

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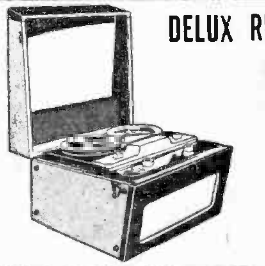

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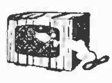

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(Continued from page 88)

Blank Raster (Sound Normal)

The fact that the sound is normal would indicate that the fault resulting in this symptom lies somewhere in the vision I.F. amplifier, vision detector or video amplifier stage (stages 5B, 6B or 7B Fig. 1). There is also a possibility that the tube is responsible, but this will show up by making a few control knob adjustments.

The first clue lies in the behaviour of the brightness control; if this has no effect on the brightness of the raster, then we can conclude that the tube biasing is faulty and that it is not being varied, as it should be, by the brightness control. In nine cases out of ten, this is caused by a heater-to-cathode short in the picture tube.

Bias Arrangements

If the brightness control does work in a limited manner, in that it is necessary to turn the control *fully* anti-clockwise to black out the raster, then, if this is not normal when the set is working properly, the loss of picture has also resulted in a disturbance to the tube biasing conditions. Generally. the tube cathode is in direct connection with the video amplifier anode (see Fig. 5). The cathode is thus at a positive potential, and the correct bias is produced by the grid also being positive, but to a smaller degree, as set by the brightness control. In effect, the grid is negative with respect to the cathode, even in the position of maximum brightness, and the negative voltage at the grid rises as the brightness control is turned down.

Faulty Valve

Now, if it is necessary to turn the brightness control fully down to black out the screen, it would follow that the cathode has gone less positive than it should, and this would be caused by a short-circuit within the video amplifier valve itself.

If the emission of the video amplifier valve fails, the anode voltage (and hence the tube cathode voltage) will rise and produce the opposite effect on the brightness control—the control would need to be turned up fully to obtain any illumination. Thus, the operation of the brightness control has provided a key clue.

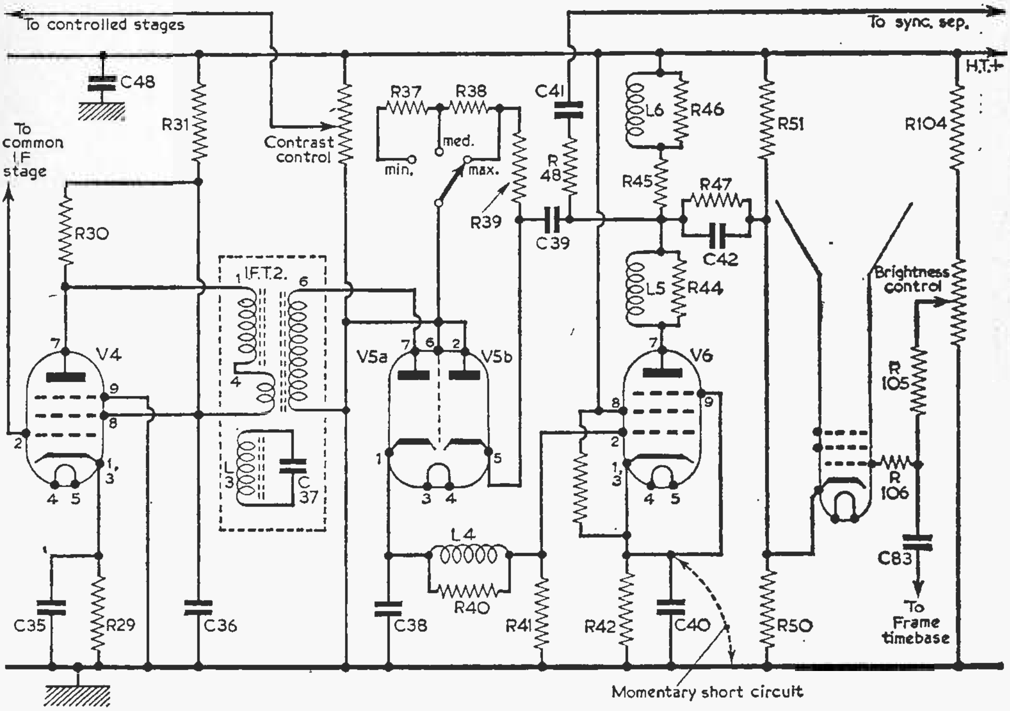


Fig. 5.—The vision I.F., detector, vision amplifier, and picture tube biasing circuit.

Let us now assume that the brightness control operates normally on the raster. We can be fairly certain that the video amplifier stage is *not* responsible; however, to be absolutely sure, all we need to do is put a momentary short-circuit across the cathode resistor (R42 in Fig. 5). If the video amplifier is working correctly, this will produce a change in the brightness of the raster. At that point the video amplifier stage can be eliminated.

If the cathode resistor short has no effect on the brightness (without altering the brightness control), then the trouble is undoubtedly in the video amplifier stage. In the latter event, close examination of the components associated with stage V6 should be undertaken. In Fig. 5 is shown a circuit of the vision I.F. stage, the vision detector and noise limiter, the video amplifier and the picture tube biasing arrangements.

(To be continued)

Trade News

Closed Circuit TV Trade Service

A LARGE stock of closed circuit equipment is now available to dealers, public address operators, and other similar organisations for use at conferences and exhibitions either with or without technical and production teams, from Audio and Video Rentals Ltd. The equipment, which includes cameras, tripods, lighting, sound system, cables, etc., is available by the day, or week.

The Trade Hire Service for Closed Circuit Television Equipment, as this new promotion is called, is operated by *Audio and Video Rentals Ltd., Video House, 27-29 Whitfield Street, London W.1.*

Two New Receivers

TWO new TV receivers have been released by Stella under the name Stellascope.

Both the 19in. model (ST.1029U) and the 23in. model (ST.1023U) have pre-set stops on the channel selector combined with pre-set automatic fine tuning. Both receivers have cabinets with African walnut veneer finish and polyester protective gloss.

The 23in. model costs 74 guineas and the 19in. model costs 64 guineas.

Stella Radio and Television Co. Ltd., Astra House, 121-123 Shaftesbury Avenue, London W.C.2.

Closed Circuit TV Camera

A CLOSED circuit television camera is available which can be connected to the aerial socket of a normal domestic receiver and produce a good picture in normal room lighting. This camera is the Beulah D.800 and costs 225 guineas.

Beulah Electronics, 138 Lewisham Way, New Cross, London S.E.14.

TV Aerials at the Radio Show

THE "Monitor" aerial is the latest addition to the Belling-Lee range of set-top aerials. In addition to the adjustable telescopic elements, a fine tuner is incorporated, enabling the user to obtain the optimum adjustment. The change from one band to another is effected simply by means of a push-button switch. Provision has been included for future use on Bands IV and V, in anticipation of the requirements of a colour television service.

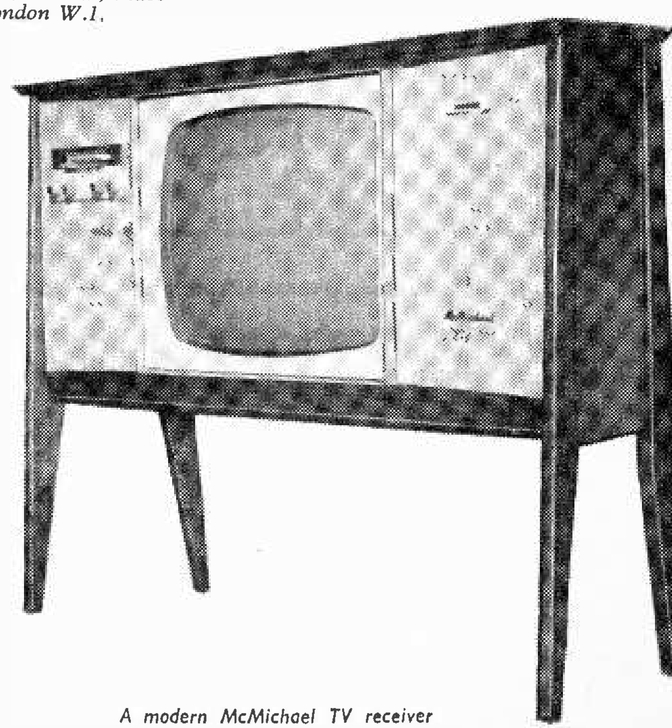
Another new aerial for use in the same room as the receiver is the Envoy. It functions as a compressed dipole in Band I, the length of the elements being compensated electrically by means of an internal loading coil according to the channel required, at the same time being correctly matched in Band III.

For the outer regions of the primary service areas a new collapsible attic aerial has been introduced, employing tubular elements which snap positively into position on erection. All these aerials are made by *Belling and Lee Ltd., Great Cambridge Road, Enfield, Middlesex.*

405/625 Line TV Receivers

THE Model T398 Ekco receiver, has a 19in. screen and provides for reception of existing 405-line transmissions and also 625-line programmes should they be introduced. All that will be required is a UHF tuner, which will be fitted by Ekco dealers at minimum cost when details of any new transmissions are available.

The price of this set is 73 guineas. It is made by *Ekco Radio and Television Ltd., Southend-on-Sea, Essex.*



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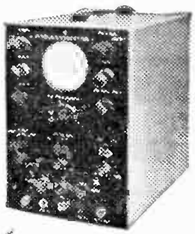

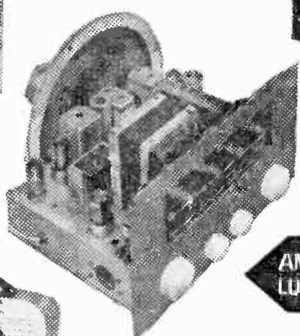

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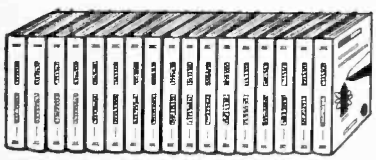

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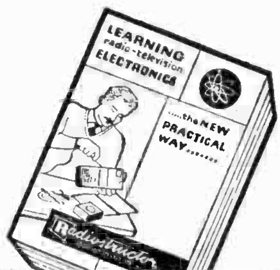

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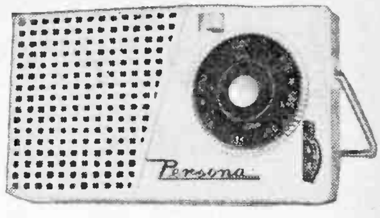

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6F6G	6/6	12Z3	7/6	DL96	7/6	EM34	6/9	PY81	7/-	UY41	6/6
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6F14	16/6	20F2	17/6	EAF42	8/6	EM81	8/6	PY83	7/9	VP4B	9/6
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6K8G	6/3	25A6G	8/-	EBC41	8/-	EY86	7/9	U24	17/6	W76	5/3
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Underneath the Dipole

A MONTHLY COMMENTARY

By Iconos

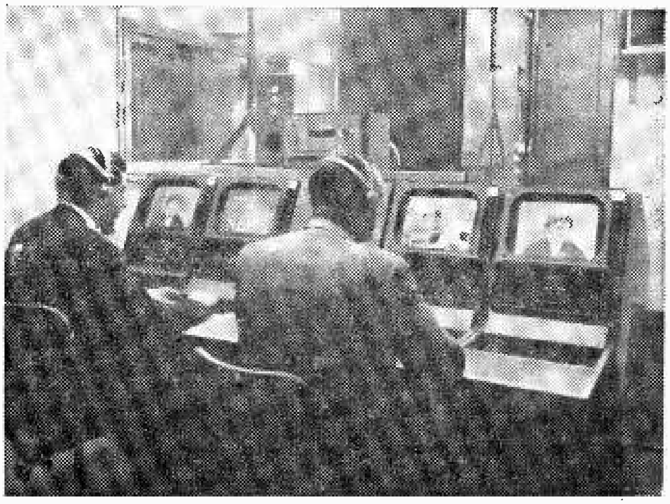
THERE are many different shades and varieties of comedy, from the robust traditional slapstick romps of the circus clowns to the delicate nuances of the high comedies of words and wit. And yet the widely contrasted comedy offerings of Groc, Charlie Cairoli, Dan Leno, Chaplin, Wilde, Marx Brothers and Noel Coward have a common denominator: a storyline of some kind, culminating in a tag which might be a smart or witty speech on the one hand or the squish of a custard pie on the other.

Spike Milligan

When the BBC announced the reappearance of Spike Milligan on television they took the precaution of warning viewers by the title, " A Series of Unrelated Incidents at Current Market Value," that the traditional story background or continuity links would be missing. Even the comic incidents in this feature had no particular shape excepting when they were terminated by a well-aimed custard pie. Many excellent ideas, utilising the special effects facilities of the modern TV studio, were harnessed by the producer, G. B. Lupino, in this nightmarish Milligan production. The singing of a ballad by Spike Milligan in front of a most inappropriate film background (Hitler's troops goosestepping, etc.), the use of background slides and other technical tricks were brilliantly carried out. Goon shows are an acquired taste and I like to see them. But " A Series of Unrelated Incidents "—etc., was a little too unrelated for the tastes of most viewers and smacked rather of an end-of-term rag than of a professional presentation of unconventional twists of modern comedy or topical revue. Spike Milligan is a comic anarchist, unable to conform to the established forms of the comic art, whose extraordinary sense of humour and gifted clowning are often ruined by his queer mumblings. A little more audibility and clarity of speech would be less wearing upon the ears of Milligan enthusiasts, especially those whose receiving sets are not very good for sound! It was significant that the biggest laughs in this show were scored by the impassive " straight man ", Valentine Dyall, when receiving a custard pie squarely on the face!

Lighting

Just how important is the art or technique of lighting in television production? The final result depends upon how well the average receiver is adjusted, otherwise subtleties will be lost. Film studio lighting started from the all-glass daylight studios, progressed to mercury vapour tubes and enclosed violet-coloured carbon arcs, and later to the tungsten bulb. Carbon arcs are still used, particularly for colour cinematography. Television studios started by making use of film studio types of tungsten lamps and housings. Several makers have competed in developing a wide range of lightweight spotlights, floods, skypans and so forth, apart from special effect lanterns capable of producing the hard shadow effects hitherto obtainable only with arc lamps. Carbon arcs are not normally used in TV studios, though fluorescent tubes, high-pressure mercury lamps and zenon arcs have received attention from time to time, with varying success. Mole Richardson, G.E.C. and Strand Electric are three British firms which are now making lamp-housings for the individual telescopic support (as used by Granada, TWW and Westward) or the tubular barrel support (as used at BBC's TV Centre, Riverside Studios and AR's Studio 5 at



The first of four Marconi Mark IV television cameras ordered by Independent Television News is now in use at the I.T.N. headquarters in London. By November all four cameras will be fully operational in a new studio which is being built on the seventh floor. This picture shows the I.T.N. control room, with the control desk for the cameras.

Wembley). The BBC had rather special lighting problems at Lime Grove Studios when several different types of camera were in use, each requiring its own particular key-light and filler-light intensities.

Photogenic Faces

Lighting for television is not easy. The lighting man, who should preferably have had some experience of camera control units or racks together with some knowledge of portraiture, has a constant battle with directors, set designers, wardrobe, make up and even the casting department. Possibly the last mentioned—casting—is one of the most important factors. The faces have to be photogenic. The TV lighting man hasn't the time or facilities to give individual attention to each camera set-up, like the film studio cameraman. Once set for a show, his lamps are fixed for all scenes and shots, excepting for the measure of control afforded him by a dimmer-switchboard to vary the intensity of individual lamps. Actors with deep set eyes and overhanging eyebrows, large noses, wobbling Adam's apples and shady hats all present him with problems, mainly by creating ugly shadows. His lighting units are all overhead, for it must be remembered that the studio floor must be kept clear of all cables excepting those to the television cameras. Nevertheless, I feel that many of these unpleasant shadows could be softened, reduced or eliminated by the use of a small lamp fitted on top of the camera. One or two TV companies are already adopting this system, notably Southern Television. It certainly enables viewers to see the most important part of an actor (or actress)—the eyes.

Horse Racing O.B.s

Ever since the first hazy long-shots of races at an Alexandra Park meeting were put out many years ago by the BBC, race meeting outside broadcasts have been one of the most popular items in the afternoon programmes. Competition between the BBC and ITV companies is pretty strong for covering the wide choice of courses and horses all over the country. The degree of expert handling of the number one camera (and especially of its zoom lens) can make or mar these racing O.B.s, and the most skilled and experienced men are always allocated to these jobs. Some courses are technically well suited for television, with ready-made camera positions on the top of grandstands, commanding a view of the whole course. This gives great opportunities for the dramatic use of the new long focus zoom lens made by the two British firms of Watson and Taylor, Taylor, Hobson. Sandown Park, for instance, is an ideal course for television, with the sun in the right position, a ready-made camera platform and a handy parking place for the O.B. truck and the microwave link for sending the picture back to the network. At Epsom, complete coverage of the Derby requires the erection of a high tubular steel tower, sometimes shared with cinema newsreel cameramen. This naturally requires the hauling up of cameras and equipment on tackle, a hazardous operation on a windy day. Screen time actually devoted to racing is short, however, and producers, commentators and cameramen are busily occupied in capturing the atmosphere of the racecourse, from the Royal Enclosure to the silver ring, the paddock, the bookies and the tipsters—and in long discourses by the commentator on the antecedents and the present form of the contestants for the next race. It is all good exciting television material, though not so continuous in entertainment value as spectacular equestrian jumping shows, such as the Horse of the Year and similar amateur events. A tremendous lot of preparatory work goes into O.B.s at race meetings, including the setting up and testing of several microwave "hops" for those race courses far removed from television centres. This can involve technical and production crews numbering anything from fifteen to forty people.

Border Television

The opening of yet another ITV programme company, Border Television, at Carlisle, brings the commercial programmes to another 500,000 viewers and adds two more television studios to the long list. A recent survey made by a television equipment company revealed that there are now no less than ninety-three TV studio stages in Great Britain which are more than 500 square feet each in area. This figure, therefore, does not take into account the dozens of small announcers, presentation or continuity studios with fixed cameras.

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.

RECEIVER ALIGNMENT

SIR,—I recently had to align a television set and would like to pass on a tip to any other reader who is not too familiar with this aspect but who may have to do such a job. The majority of modern sets are A.C./D.C. and the signal generator will probably be A.C. only. The connection of one of the generator padder leads to the chassis of the receiver will render this "live" so a really good condenser should be used in each of the leads from the terminating padder or outlet from the generator. To preserve a balance both condensers should be of the same value. Various false readings can be obtained by the omission of these condensers. I also found, incidentally, that the C.R. tube made a very much better alignment aid than the customary meter in the particular set under test, keeping a modulated signal on for vision alignment and adjusting brilliance to keep the lines on the tube just visible. In this way more accurate changes were observed than the movement of a meter needle in the video valve anode circuit. —G. H. BRANDON (Norfolk).

CONTINENTAL BROADCASTS

SIR,—I wonder if any of your readers living on the coast could pass on any hints for the adjustment of a commercial set so as to enable me to pick up one or more of the Continental broadcasts. As the systems are different, and as I understand that many people pick up these transmissions (especially in the Folkestone area), I should like to try my hand with the unused channels on my set. I do not want to go to a lot of trouble and alteration, and the stations may be out of range, but I should like to try and pick up one or more. I have managed to see a very weak picture on Channels 3 and 2 at various times, but not consistently. Probably the aerial is an important factor in the reception of signals on other channels than that for which the aerial and set are normally used, but there must be some way in which this could be adjusted.—F. T. WAITE (Hatfield).

[*We hope to publish an article on this subject in the near future.*—ED.]

SERVICING TV RECEIVERS

SIR,—I follow very closely the series you run on the above, and would like to add a note which is not too often given in these articles. When a fault develops, it is nice to have such an article to refer to, but I would like to emphasise that the first thing to do is to check normal H.T. at all available points. (Not the EHT). One must, of course, have a service manual, but a check of H.T. will find the majority of faults, as these are nearly always caused by a faulty resistance or condenser, and the resultant change of current in the circuit will nearly always reveal itself by a change in an H.T. voltage.—P. SELWAY (N.W.5).

AN INDUCTANCE TESTER

SIR,—Your recent article on a Capacity-Resistance bridge interested me greatly, but I have seen similar articles before in your pages. There is, however, one form of tester which is not often described and which I think would be found very acceptable by most amateurs. I refer to an inductance tester, which would measure inductance values. Correction chokes, etc., are often needed in TV, and a simple instrument which would enable one to check a home-made coil would be most valuable. I have been unable to find such an instrument in any of your back numbers, either wireless or television.—G. BLAKE (Perth).

IMPROVING RECEIVERS WITH FRAME GRID VALVES

(*Continued from page* 86)

bypassed resistor. However, an attendant effect is a small loss in gm, and the stage as shown is operating with an effective or dynamic gm of about 6mA/V, although the gm of the valve is 7·4mA/V.

In Fig. 2 is shown that same stage altered for the best performance of an EF183. The cathode bias has been eliminated, and grid current bias has been adopted by increasing the grid resistor (R3 in Fig. 1) from 47k to 470k. The unbypassed cathode resistor has been reduced from 33Ω to 22Ω and slight alterations have been made to the screen and anode H.T. feed and decoupling arrangements.

Screen Feed

The screen grid is now fed from a 33k resistor from the 190V H.T. line, while the anode is fed through a 100Ω resistor. The 0·0012μF screen decoupling capacitor in conjunction with the 0·001μF anode decoupling capacitor and 100Ω anode feed resistor provides a degree of neutralisation.

In this arrangement, a small percentage of the I.F. Signal is introduced into the grid circuit in the opposite phase from that introduced via the capacitance between the anode and grid one of the valve. The out of phase component is introduced via the capacitance between the screen grid and the control grid (grid one) of the valve by virtue of the decoupling components.

The stage as set up provides an effective gm better than 12mA/V, and thus in comparison with the circuit in Fig. 1 gives a two-to-one stage gain, which can be extremely useful if a service area type receiver is operating under fringe area conditions. ■

metal rectifiers

(Continued from page 14 of the October issue)

One of the most popular applications of the point-contact diode is for sound or vision detector. Fig. 7 shows a typical vision detector circuit suitable for an I.F. around 30Mc/s. The diode should have a low forward resistance and a relatively high reverse resistance, which is typified in the Mullard OA70 or equivalent.

A sound detector circuit is very similar, but would normally use a load resistor in the region of 47,000Ω and a 30pF reservoir capacitor. The OA70 has an inverse resistance of 100k, while the OA71 has a value of 1M which, depending on the peak inverse voltage in the circuit, may be considered more suitable as sound detector with a higher load resistance.

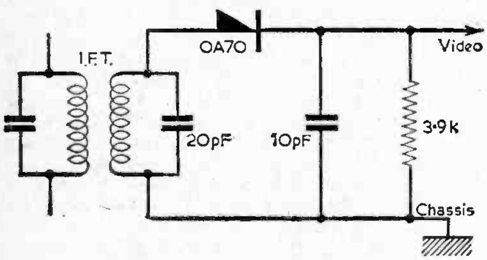


Fig. 7—A vision detector circuit, using a medium impedance diode.

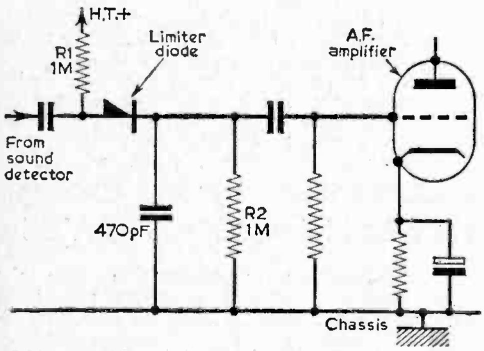


Fig. 8.—A germanium diode used in a sound noise limiter circuit.

DETECTOR CIRCUITS

Sound Noise Limiter

Germanium diodes are also extensively used in limiter circuits, a typical application being sound noise limiter in a circuit such as Fig. 8. The limiter diode should have a high reverse resistance, and the diode is held in its conducting region by resistors R1 and R2 across the H.T. supply. Under normal conditions, therefore, the diode, being in series with the A.F. signal, provides a path for the signals from the detector to the A.F. amplifier. The occurrence of impulse interference, such as produced by car ignition systems and domestic electrical appliances, drives the diode into its reverse current region where the high reverse resistance virtually open-circuits the signal path.

AGC Applications

In television receivers especially, crystal diodes are often used not only to produce a negative bias for AGC but also to ensure that the AGC line does not go positive in the absence of a signal. This could happen in some circuits and the resulting positive bias could cause the controlled valves to exceed their anode current rating and thus reduce their life.

In Fig. 9 is shown a circuit of an AGC clamping diode; under normal conditions, forward current will flow through the rectifier and a negative voltage will appear at the junction of R1 and R2 of an amount governed by their values. The negative voltage from the AGC source will, of course, be added to the standing bias produced by the voltage drop across the diode.

(Continued on page 107)

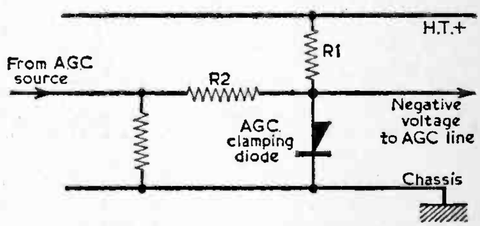


Fig. 9.—A diode clamping circuit which may also be used to provide AGC delay to one or more controlled stages.

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MURPHY VU21OC

When first switched on, the picture is enlarged and out of focus. After it has been working for ten minutes or so, the picture is normal, and stays normal, except that black parts of the picture are not as black as before. The EHT rectifier is an EY51, but I am told that it should be a U25.—F. C. Bennett (Edgware).

The basic symptoms indicate a faulty C.R. tube, but may be due to other causes. The EHT rectifier is given as a U25, but some replacement line output transformers are fitted with an EY51. The correct valve type is usually stamped on the black bakelite, near to or below the valve.

SOBELL T274T

The height decreased and I remedied this by wiring another resistor of the same value across the one in series with the height control; but, a few days later, the picture started to roll, sometimes up, sometimes down, and now I have to adjust the frame hold every few minutes. I have checked the ECL80's by substitution with no improvement.—J. Wilson (Newport).

If the ECL80 valves are in order, check the 0·01μF capacitors wired around the frame sync separator/sync gate ECL80; particularly the one from pin 1 to pin 2 of the oscillator ECL80. Check resistors if necessary, but usually if the valves are in order, one of the capacitors is o.c.

ULTRA 84L

I wish to change the old tube for a new one. How do I proceed?—A. S. Deadman (Eastbourne).

If the chassis is removed from the cabinet it is only necessary to remove the EHT cap from the side of the tube, release the front clamping band and slacken the rubber-lined clamp on the neck of the tube. Remove the base socket and ease the tube forward taking all the weight at the front, carefully withdrawing the neck through the focus magnet clamp at the same time supporting the scanning coils so as to impose no strain. Reverse this procedure when fitting the new tube.

GEC BT6145

The picture is poor and there is no horizontal hold. The voltage setting has to be at 210V instead of 230V to obtain a picture. I have changed the metal rectifier (RM4) with no effect.—D. J. Williams (Port Talbot).

Probably V14—L63—is intermittent, but also suspect the KT36, U25 and U239. The heater transformer may have developed a fault, giving low output.

PORTADYNE 517

The lines on the screen are much wider at the top of the picture than at the bottom, and this is distorting the picture for about 2in. from the top.—A. Stokes (Edmonton).

You should change the 100μF (25VW) condenser wired from pin 3 of the frame output ECL80 to chassis.

DECCA DM3/C

There is a 3in. black margin down each side of the screen. The width control does not remedy the defect but just brightens and dims the picture. The brightness control enlarges the picture. I have changed valves and condensers but have not found any fault. I do not have a meter—only a service sheet. The picture is also out of focus. —R. Andrews (Creggan).

You do not say which valves you have changed. Two versions of the DM3/C are in current use. That version which uses serial numbers up to 50,000 employs a chassis similar to the DM2/C and DM4/C, but if the serial number is over 50,000, a revised chassis is fitted using PCL82 and ECC82 valves in the timebase and sound sections. You should check the PL81 valve and the resistor to pin 8 of this valve. Early versions used a 4·4k 2W, later versions a 2·7k 2W resistor in this position.

AMBASSADOR TV2

This is a 12in. table set, BBC only. The set has gone completely dead. On switching on, one fuse blows and there is a blue flash in the V801 valve. —T. Allen (West Bromwich).

You should replace the V801 valve and check each of the four 47Ω resistors to the valve base.

VIDOR CN4225

The picture is of very poor quality and, on advancing the brightness, the picture goes grey in colour and expanded vertically. I replaced valves SU61 and PY81. My picture is now very good as to detail etc. but I cannot obtain full width on advancing the control to maximum. It is approximately 1in. short on either side. The focus lever is over to maximum on one side also. I do not have a service sheet or any instruments to make tests. This set is BBC only and is fitted with a convertor.—J. Collins (Heckmondwike).

You should check the PL81 valve and the resistors etc.; associated with it. These are 1·5k to pin 8, 100Ω to pin 3 and 50μF capacitor across it. Check 1·2M resistor to pin 1 of the ECL80 valve base if necessary.

McMICHAEL TM54F

On switching on the set there is very low sound and no picture, although the raster is there. After waiting a few minutes and then switching the set on and off several times the sound comes up to its normal level and the picture comes on with a lot of noise through the speaker and interference on the screen. I have changed the PCF80's the PCC84, and also the PY81. Once the picture is on, it will stay until being switched off again. The picture quality is good.—G. Cooper (Rotherham).

The trouble appears to be in the tuner unit and the connections should be checked. The suspect resistor is the 6·8k 1W to pin 1 of the PCF80 valve base (first spring contact).

PHILCO 1019

I would like to receive Midlands ITV from Birmingham on this set. I do not think I could receive a picture, but surely I may receive the sound if I alter the coils on channel 8 of my turret tuner. Could you please advise me on the coil to put in and any minor alteration. I can receive Granada ITV but should also like to receive Birmingham. Is this possible?—A. Burns (Liverpool 17).

To receive the Midlands ITV transmission you should have an aerial directed suitably and if necessary retrim the channel 8 oscillator coil core. No alterations are necessary.

INVICTA 138

When the set is switched on, the sound is fine and the picture eventually appears but only fills the screen from the top to half way down. The picture gradually fills up but leaves a 2½in. black band along the bottom. Altering the controls, or adjusting the ion trap or picture shift, will not fill the screen.—M. Kemp (Birmingham).

You should replace the rear right side PCL82 frame output valve. If necessary check the 330Ω bias resistor which is to the left of the valve and further to the front (as viewed from the rear).

G.E.C. BT.5144

I have recently moved from London to Bristol and wish to know the procedure for altering this set to receive the local BBC programmes. I do not have a service sheet to follow.—L Godding (Bristol).

This set is a single sideband TRF made only for receiving London or Midlands stations. To receive any other channel a complete change of coils would be necessary and then re-alignment.

COSSOR 938

A few weeks ago the picture began to fade and at present it is a dull grey. No amount of adjustment of the brightness and contrast has any effect. It takes about 15 minutes for even a very faint picture to show.—H. Dunn (Leeds 7).

If the faint picture is full size and in focus, the cathode ray tube is at fault. It may possibly have an open-circuit cathode, but the ion trap magnet around the tube neck should be checked first of all as it may have slipped. If the picture is defocused and lacks width, suspect the 21A6 line output valve and its associated circuits.

MARCONIPHONE VT150

The trouble with the above set is that the picture continues to slip with a jump unless the height control is reduced until the picture is at least 1½in. from the bottom of the screen. Adjusting the other controls does not stop this.—W. Coleman (Co. Durham).

There is a 1·5M resistor (brown, green, green) wired from the hold control to the black lead connection of the oscillator transformer. It is one of a group of three resistors between the 0·022μF capacitors under the chassis near one of the U154 (PY82) valve bases. Check by substitution.

FERGUSON 991T

Can a K.B. adaptor, serial number 27485, be fitted to the above set or a Pye V4—W. Smith (Umberleigh).

Only the type D K.B. adaptor is suitable for use with the V4 or 991T. This adaptor uses series heated PCC84 (6AN7) and PCF80 (PLF82-8A8 or 9U8) valves.

H.M.V. 2806

I am unable to purchase a circuit diagram for this set and it has developed the following fault. A new tube has been fitted as the old one had an o.c. heater. Now, all I can obtain is a very fine vertical line and other lines across the screen but nothing else at all. I have changed the line output valve with no success.—C. Fisk (Eye).

The 1806 uses a similar chassis to the H.M.V. 1805 and 1851. Marconi models VT52A, VC52A, VRC52 etc. You should check the line oscillator valve next to the KT44 (or KT45) which is a Z66 and the line blacking oscillator transformer which is associated with the Z66. If the transformer is at fault, no H.T. will be applied to pin 4 of the Z66 valve base. If the line output transformer is at fault no H.T. will be applied to the top cap of the KT44 (KT45).

REGENTONE BIG 12

The screen will not light up although the tube heater does. The sound is perfect. I have replaced the EL80 valve, also the condenser between line output transformer and final anode on the tube. Also, I replaced the EY51 with a new one and this does not light up.—J. Howard (Manchester 11).

We presume the valve referred to as EL80 is actually the EL38 and that th·; has been changed. You should check the resistor to pin 4 of this valve base (6·8k wire-wound) and the continuity of the controls (line hold and linearity). It would then appear to be necessary to change the line output transformer.

SOBELL PORTABLE TPS180

The above set has been in use for approximately 12 months. During the last few weeks, the tuning position for both BBC and ITV have slowly crept upwards on the tuning scale until it is now only just possible to tune in the BBC when the pointer is at the very top of the scale. I have checked that this trouble is not caused by the pointer changing

(Continued on page 107)

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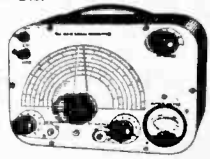

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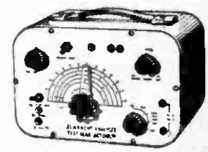

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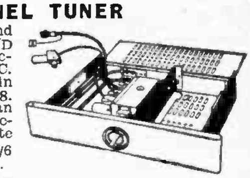

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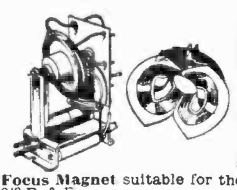

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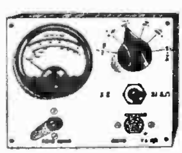

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(Continued from page 104)

its position on the cord connecting it with the tuning condenser pulley, but the original position on the scale can almost be regained if the screening-can of the PCF80 valve is pressed downwards so that it is not centrally situated on the valve. just below and to the right of the same valve is a long brass screw with a square head and I have tried adjusting this on the assumption that it might be a trimmer for that particular valve. However, such adjustment has no effect that I can detect and I have therefore left it in its original position. How can the trouble be rectified please?—G. Mott (Nottingham).

You should change the PCF80 valve. If the tuning is still out remove the side panel (over the controls—remove the switch knob etc., and unclip the panel inside) to expose the oscillator coil cores near the fine tuner spindle. Switch to channel required and tune core with the fine tuner spindle mid-way.

BUSH TV83

This set is 14 months old and works satisfactorily except when it is switched off. After a few seconds have elapsed a spot appears on the centre of the screen starting as a pinpoint and enlarging to ⅛in. diameter and closing to a pinpoint. This takes about 12 seconds and the spot is very brilliant.—R Christian (Wembley).

The appearance of the spot does not indicate a fault. There is no circuit incorporated in the TV83 to discharge the EHT at switch off and therefore the spot must be regarded as normal. It will not burn the screen.

ULTRA V8-15

This is no EHT. The line output transformer has been completely renewed including the U25 rectifying valve. Valves 20P4 and U329 have also been renewed. The U25 heater does not light up.—W. Shawcross (Leeds).

We presume the complete line output transformer included the EHT smoothing capacitor. It now remains to check the supplies to the 20P4 and the 0·5μF boost line capacitor, the screen feed to pin 4 of the 20P4 (3k 4W) and the 20L1 (also components to pins 5 and 6).

PYE V14

There is a raster on all channels but no picture or sound. There is a hissing noise which appears to be coming from underneath the EHT box.—R. Hardy (Sunderland).

The hiss that you can hear is EHT "brushing" and will probably disappear when the picture is restored. Check the tuner, especially the PCF80 local oscillator and its associated circuits including the sensitivity control and make sure that none of the lead-out wires from the tuner has come adrift.

PHILIPS 1446U

Would you please tell me what make of turret tuner I require for this set. The number is M.61799.—S Edwards (Birkenhead).

We would suggest you fit a Cyldon P101 or Brayhead 10s. tuner unit. These have R.F. and mixer (or adaptor) plugs which replace V1 and V2 EF80 valves respectively. State the channels required when ordering.

METAL RECTIFIERS AND CRYSTAL DIODES

(Continued from page 100)

Such an arrangement is sometimes used to provide a delay on one of the controlled valves, usually the R.F. valve, for, in the interest of noise performance, the R.F. amplifier should not be biased on weak aerial signals. Thus, if a delay of the kind shown in Fig. 9 were applied, extra control bias would only influence the stage when the AGC bias is greater than the standing bias of the diode, and the I.F. stages will, therefore, first come under control.

Voltage Stabilising

Voltage stabilising is also being accomplished by rectifiers of various types, and typical in this application is the zener diode; this is a silicon diode but one with a reverse characteristic in which the current rises very quickly at the reverse turnover voltage point.

The diode, in fact, functions in this part of its negative curve and the design is such that it can withstand relatively large reverse currents without ill effect. One application is in the cathode circuit of a valve amplifier, such as a video amplifier of a television receiver, where it serves to stabilise the cathode voltage whilst having virtually no effect on the signal component.

Used in this condition, the reverse resistance of the diode biases the valve in the usual manner and holds the cathode voltage constant. As the A.C. resistance of the diode is very small, there is no undue loss of signal owing to negative feedback and cathode decoupling is unnecessary.

Selenium rectifiers may also be found connected in this manner, but with the opposite polarity to a zener diode. That is to say, the negative terminal of a selenium rectifier would be connected to the cathode of the valve concerned.

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PRACTICAL TELEVISION, NOVEMBER, 1961.

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(continued)

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DF91	2/6
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6BX6	2/6
6C6	2/6
6D2	2/6
6D3	2/6
6D6	2/6
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6F13	1/3
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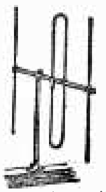

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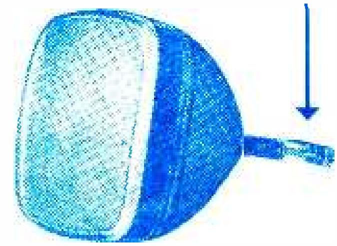

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