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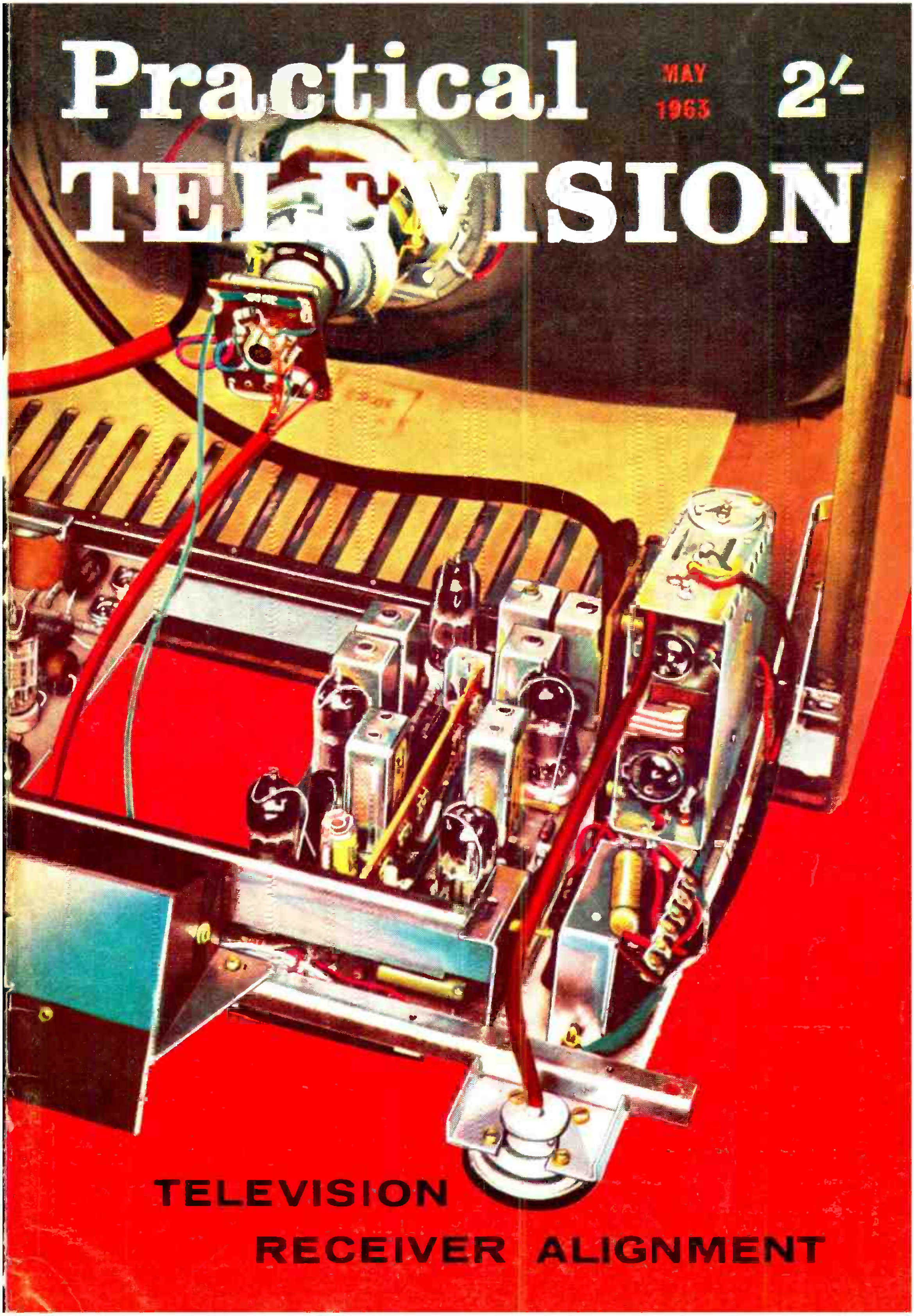

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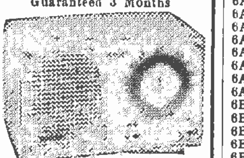

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6F6G	4/6	12J7GT	8/-	DAF91	4/6	EL41	8/-	PY81	6/3	X76M	11/-
6F13	4/9	12K7GT	4/6	DAF96	7/3	EL42	7/9	PY82	5/9	X78	21/-
6F14	9/6	12K8	9/9	DF33	8/9	EL81	8/9	PY83	6/9	X79	21/-
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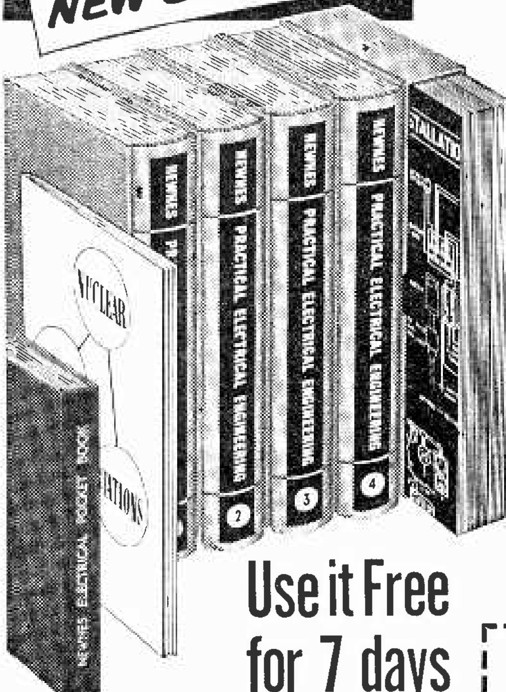

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Practical Television

AND TELEVISION TIMES

VOL. 13, No. 152, MAY, 1963

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Contents

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Television". Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for the manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed to The Editor, "Practical Television", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2

Owing to the rapid progress in the design of radio and television apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Victims of Progress

THERE was a time, not so very many years ago, when thousands of amateur enthusiasts were busily occupied in making their own television receivers. Today, there are comparatively few.

In the immediate post-war years, of course, there was the tremendous stimulus of the sheer novelty, and with the relatively high cost of commercial receivers it was an attractive proposition to adapt the convenient (and plentiful) war surplus units into inexpensive TV sets.

Admittedly, the green picture displayed on the 6in. screen of a VCR97 c.r.t. was not the ultimate in luxury viewing, but in the days when few people owned a receiver, and particularly when embellished with the refinement of a magnifying lens, these surplus-unit conversions were almost a status symbol!

This activity set the stage for a widespread interest in home constructed TV and soon many designs appeared using conventional 9 and 12in. tubes. At one time it seemed that practically everybody was building some kind of TV set.

Even starting from scratch, it was still financially worthwhile. Useful valves, such as the famed EF50, were obtainable at low prices on the surplus market and were included in published designs. Also, of course, enthusiasts already had an accumulation of valves and components left over from their earlier conversion activities.

Since those halcyon days, there has been a steady and significant decline of activity on the homebuilt TV front. This seems directly related to three factors.

Firstly, as technology advanced, circuitry inevitably became more complex, thus requiring more experience to produce reasonable results.

Secondly, with an increasing potential market, manufacturers began to mass produce receivers to a high specification at a highly competitive price.

Thirdly, and related to the above, the novelty interest declined with the spread of the medium.

Thus, it can be said that the building of a receiver is no longer the economic proposition it was a few years ago, nor is the spur of experimenting in an unknown field; and a high standard of constructional ability is required. In other words, the amateur TV enthusiast is a victim of progress.

There are, of course, still many who build their own sets, but those capable of doing so can generally devise their own circuitry. Fortunately, all sections of electronics are in a continual state of development and new ideas suggest new approaches and new lines of investigation.

For while the keen practical man can devote his time to experimenting with new TV circuitry, to repair work, to building test instruments (and even, if sufficiently advanced, to TV transmitting experiments) another line of approach is opening out. This is closed circuit TV. We are aware of the increasing interest in this and will have more to say on the subject next month.

Our next issue dated June, will be published on May 22nd.

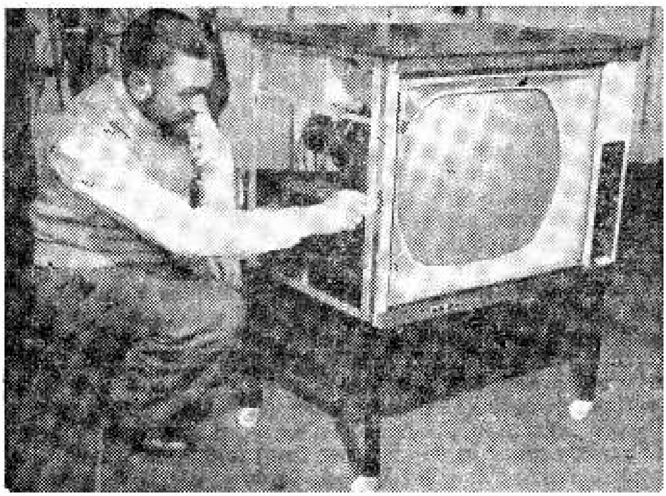
TELETOPICS

U.H.F. "Secam" Receiver

A 21in. u.h.f. colour television receiver was recently completed at G.E.C.'s laboratories, at North Wembley, for installation at the BBC Engineering Designs Department. It was supplied for use in monitoring tests on the 625-line "Secam" system.

The European Broadcasting Union is conducting comparative studies to determine whether this—the Secam—system, which is French in origin, or the American N.T.S.C. system, shall be recommended for adoption by member countries, as development of colour television for public use can go ahead only when a decision on the choice of systems has been reached.

Final adjustment being made to G.E.C.'s "Secam" colour receiver.



NEW BAND IV/V TRANSMITTER

A CONTRACT has recently been placed by the BBC, for 12 new transmitters which the Marconi Company has introduced for operation on Bands IV and V.

This equipment, which consists of a 100W/12W vision and sound driving transmitter and a 25kW/5kW vision and sound amplifier, is equally suitable for the radiation of black and white transmissions or colour.

The vision equipment is amplitude modulated and the sound equipment is frequency modulated. Among the new technical features embodied in the new transmitter, is the incorporation of high-power, water-cooled klystrons in the vision and sound output stages in preference to the conventional tetrodes.

TELEVISION FOR SINGAPORE

SINGAPORE is to have a Marconi-equipped television service, and the Broadcasting Division of the Singapore Government's Ministry of Culture ("Radio Singapore") has decided to provide a comprehensive service for the whole island.

Initially there will be one programme channel, radiated via a pair of vision and sound transmitters, with a second pair acting as standby.

The cameras employed for the main studios will be Marconi Mark IV image orthicons, whilst for telecine work Mark IV vidicon camera channels will be used.

A pilot programme service came into operation on February 15th, with the station operating in Band III to 625-line C.C.I.R. standards.

Radar Teaching Aid for Norway

A MONOCHROME television projector has recently been installed at the Oslo School of Navigation for Seamen, Norway, by Rank Cintel. This Oslo school teaches radar techniques to new students and also provides refresher courses for more advanced maritime navigators.

In the past it has been very difficult to demonstrate synthetic radar displays to classes exceeding five in number, but by the use of a back projected picture on to a four foot square screen from a Rank Cintel projector, it is possible to demonstrate a single display to as many as fifty students at one time.

PREDICTION OF TELEVISION COVERAGE

FOR some years the Marconi Research Laboratory has provided a consultative service to television authorities to enable them to plan new services in the most economical manner. The Laboratory has accumulated a large amount of propagation data from radio surveys and this helps to produce a coverage prediction of a high degree of accuracy.

When a practical measurement survey is required to confirm a given prediction, the Propagation Field Studies Section of Marconi's uses specially equipped vehicles. These vehicles have incorporated into their design, a telescopic aerial mast which extends the broad-band "dis-cone" dipole to the recommended height of 10 metres during field surveys.

One of the specially equipped vans used by Marconi's Propagation Field Studies Section.

TV Equipment for Jamaica

TELEVISION will come to nearly 700,000 Jamaicans within a short time of the opening of the newly-built Jamaican Broadcasting Corporation's Studios at Kingston next summer.

Thomson Television (International) Ltd., main purchasing agents and advisers for the Corporation, have placed an order for studio equipment with EMI Electronics Ltd.

Equipment in the two new studios will consist of four 4½in. image orthicon camera systems with all ancillary equipment. Included in this order are two vision mixers, a ten-channel sound mixer and a five-channel sound mixer, and all requisite talk-back facilities. All lighting and nearly all the control consoles will also be suppied by EMI.

Colour Equipment for Italy

AN order for a colour slide scanner and a colour monitor, value £10,000, has been received by Rank Cintel, a division of The Rank Organisation, from Radio Televisione Italiana.

The equipment is to be installed in Turin where it will be used in a research programme to determine the future of colour television transmissions in Italy.

NEW TELEVISION STATION FOR SCOTLAND

THE BBC's new television station to serve Ballachulish, Argyllshire, was brought into service on Monday, 18th March, this year. Transmissions are on channel 2 (vision 51·75Mc/s, sound 48·25Mc/s) with vertical polarisation, which means that receiving aerials should be of the vertically mounted type.

The Ballachulish station is a small relay station which receives its programmes for retransmission via a radio link from the new station at Fort William, which is now in full service.

SLIDE SCANNERS FOR COLOUR RESEARCH

THE Ferguson Radio Corporation have ordered a Monochrome slide scanner and a colour slide scanner, total value £9,500, from Rank Cintel. This equipment will be used in a research programme concerned with the development of colour television equipment which is to be completed in time for the commencement of colour television transmissions.

Camera Sales in the U.S.A.

THE AMPEX Corporation of America has placed another order with the Marconi Company —this time for the supply of 28 Mark IV 4½in. image orthicon camera channels, complete with English Electric Valve Co. camera pick-up tubes. The new contract brings the total number of sales of these cameras in the Americas to 323, of which 184 have been ordered for use in the USA, not only by various broadcasting authorities but also by the United Nations, the US Navy and the US Army.

IMPROVING TV SOUND

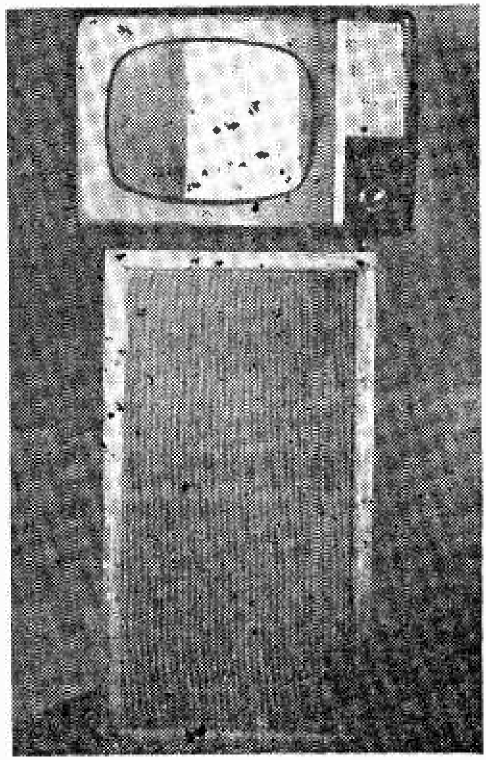
HOW TO OBTAIN BETTER AUDIO RECEPTION

By T. L. May

TELEVISION is first and foremost an optical system and as such it is natural that more attention is directed towards the picture side of the receiver than towards the sound side. This is not to imply, however, that the sound is always poor, for this is often far from true. Indeed, some sets give sparkling reproduction while others may give a comparatively poor rendering.

Provided the sound channel is without fault, television sound should always be better than that on medium-frequency radio and it should approach the quality made possible by the v.h.f.-f.m. sound system. A television set with comparatively *poor* sound, therefore, should give better reproduction than is possible from an ordinary radio set. The whole point here, then, is that television sound has a natural hi-fi potential.

Funnily enough, some of the older, console-cabinet receivers often seem to give far better sound than their more recent, wide-angle counterparts. This is forcibly revealed when an old model is replaced with the latest table model on legs. The sound quality difference is at first very striking, but is often soon forgotten in the light of the very-much-improved picture—thereby proving the first statement!



The author's arrangement to achieve better quality sound from his set.

Hi-fi Potential

There is a murmuring among enthusiasts and experimenters, and many of those who are hi-fi prone are taking steps to improve the sound on their television sets. Even magazines dealing with audio matters are turning their attention to the sound of television. What is more, the Third Programme of the BBC has taken up the theme and one Sunday afternoon gave out basic information on how to improve TV sound! (Donald Aldous, Technical Editor of the Audio and Record Review, in the BBC's Network Three "Sound" programme).

The spectrum of any television sound channel is sufficiently wide to accommodate a.m. sidebands extending well into the upper regions of audibility without the slightest suppression. This is possible on television because adjacent stations do not impose any response limitations.

Provided that the sound channel response does not spill into the vision channel, all is well and this gives at least 50kc/s of bandwidth—far more than required for even the best of high-quality sound circuits. Moreover, an extended sound channel response in the set is desirable to ensure that the sound interference limiter circuit works properly.

Why, then, if there exists this hi-fi potential do not the set makers take full advantage of it? The chief reason is that of economics in a very competitive field. Most of the money in a popular model goes towards the picture side and only the smallest amount possible to the sound side. On the more expensive models, of course, this is not the case. It would not be possible to combine good quality vision with hi-fi sound in a 60-odd guinea table model, for example.

When one thinks about it, modern television sets are remarkably inexpensive (taking away purchase tax), and this low price has been brought about by great economies in both design and production. The loudspeaker, for instance, in a table model may

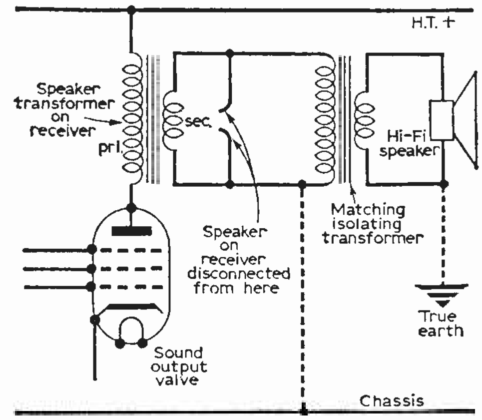


Fig. 1—Showing how a transformer is used between the set's speaker transformer and the extension speaker for matching and isolation (see text).

well be extremely small and relatively inefficient; the audio section generally, including the loudspeaker transformer, is produced simply to *add* sound to vision and not to do reasonable justice to it; and the loudspeaker may be mounted on the side of the cabinet and radiate its sound into a wall.

Although none of these things is conducive to hi-fi sound it is nevertheless surprising how good the sound is under these conditions; they do show, though, where improvements to the average set can be made.

So far as the programme authorities themselves are concerned, they usually transmit very high quality sound, often equal to that applied to v.h.f.-f.m. transmitters. Thus, all round there is hi-fi potential and the experimenter is in an excellent position to exploit it. Let us see what can be done.

Better Loudspeaker

The most elementary exercise is to employ a better class loudspeaker than that contained in the receiver. Unfortunately, space inside a table cabinet is at a premium and it is not usually possible to fit in a larger loudspeaker unit. If one of greater efficiency is employed, however, a small increase in sound quality will often result since the required level of sound is then obtained at a lower setting on the volume control, where the total distortion of the audio section is lower.

The next step up the quality ladder is to employ a really good quality loudspeaker unit loaded in a reflex or other type of enclosure as an entirely separate item. When this idea is adopted, however, care must be taken to see that the set is not too far away from the loudspeaker otherwise the disconcerting effect of sound disembodied from vision will result.

It is often possible to place the set on top of the enclosure or loudspeaker cabinet, as shown in the photograph.

Isolation

Most modern television receivers use the so-called a.c./d.c. technique where the mains supply is connected direct to the metal chassis of the receiver without the isolating properties of a transformer. This arrangement has much to commend it economically and it is perfectly safe provided external extension circuits are not connected to the set.

An extension loudspeaker is an external circuit and as it needs to be connected to the inside of the set it can, under certain conditions, represent a danger.

To avoid this, transformer isolation is essential. There are two ways of achieving this. One is by connecting an isolating transformer between the mains and the set and the other is by connecting a transformer between the output stage and the extension loudspeaker system.

The most inexpensive method is to use a transformer in the loudspeaker circuit. In any case, a hi-fi or better class of loudspeaker system usually has an impedance of 15Ω as opposed to the 3Ω loudspeaker of the set. Some arrangement for matching the 15Ω extension to the 3Ω circuit of the set is thus required for the best results.

A matching transformer with two separate and fully insulated windings (as distinct from an auto-transformer with a single tapped winding) can also serve to isolate the loudspeaker from the set.

Transformers of this kind are readily available, and one which is ideal for the purpose is the "Universal Speaker Isolating Transformer" marketed by Radiospares Limited and obtainable from most radio and television dealers anywhere in the country. This sells for about 13s. 6d., can match 3, 7 and 15Ω to any load, is rated at 5W, is double-wound and tested to the safety requirements of BS415.

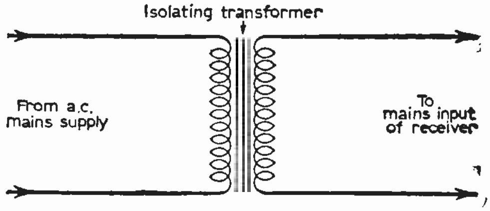


Fig. 2—The use of a mains isolating transformer. This method is necessary for the feed of Fig. 4 when the set is a.c./d.c. See text. The transformer should withstand the power loading of the set.

It is simply connected as shown in Fig. 1 with the primary and secondary taps adjusted to give the best match between the set and loudspeaker. It is sometimes thought that the primary/secondary insulation of the set's loudspeaker transformer is adequate for safety. This may well be in certain transformers, but unless specific information is at hand on this important parameter it is always best to play safe and fit a transformer with known insulation characteristics—it is usually necessary to interpose a matching device anyway.

Should it be decided to rely upon the insulation of the set's transformer after all and not bother about optimum matching, any chassis connection to the secondary of the transformer must be removed—as shown by the dotted line connection in Fig. 1.

The chassis connection must *not* be broken, however, should it be in any way related to a negative feedback loop, for if this is broken the audio section may go unstable; the gain will rise in any case, as also will the level of hum and distortion. Very few television sets in the popular price-group feature negative feedback from the loudspeaker secondary, but if yours does, then a matching/isolating transformer is essential.

When employing a good quality extension loudspeaker system as a sound quality aid, it pays to disconnect the set's loudspeaker. If it remains in circuit along with the extension, its relatively low efficiency consumes extra and unnecessary power from the audio section without producing more noise, thereby making it necessary to turn up the volume control more than would otherwise be required for a given level of "domestic" sound; and the higher the volume control setting, the greater the total distortion. This is rather an important fact to remember.

The other method of achieving total isolation is by a 1:1 ratio isolating transformer between the mains supply and the set (Fig. 2). The transformer must be sufficiently large to handle the full power of the set without overheating or voltage loss. Typical examples of this type of transformer are the "Heavy Duty" 200W version (sells about £6 6s.) and the "Standard" 75W version (sells about £2 16s.) both by Radiospares Limited and obtainable through a radio or television dealer (or from our advertisers).

Mains isolation means that the whole inside of the set is adequately isolated from the mains supply and it then becomes feasible to extract the audio from across the volume control and apply it to the "radio" input sockets of a hi-fi amplifier, or to a tape recorder if TV tape records are required (Fig. 3).

New Audio Circuit

It is not suggested that the domestic set is used as a guinea-pig, but if a second set or set which is used for experiment is available, the circuit shown in Fig. 4 may prove interesting. This shows how the new Mullard PCL86 triode-pentode audio valve may be used to replace the ECL80 type of valve used in the audio section in the majority of sets.

The PCL86 has a high amplification factor triode and a high mutual-conductance (slope) pentode, thereby permitting the application of liberal degree of negative feedbacks while still achieving full output from the signal present across the sound detector load.

If this circuit is employed the factors of isolation still apply, and here it is not possible to rely upon

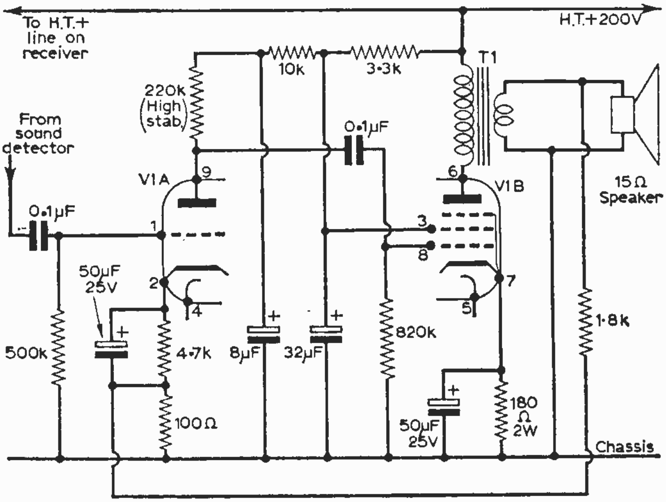


Fig. 4—Experimental audio stage for giving improved sound in conjunction with a good quality extension speaker system. V1 Mullard PCL86; T1 primary impedance 7kΩ. primary inductance 10H, primary resistance 350Ω. All resistors ¼W and capacitors 300V working unless otherwise stated. Extension loudspeaker isolation must be adopted as described in the text.

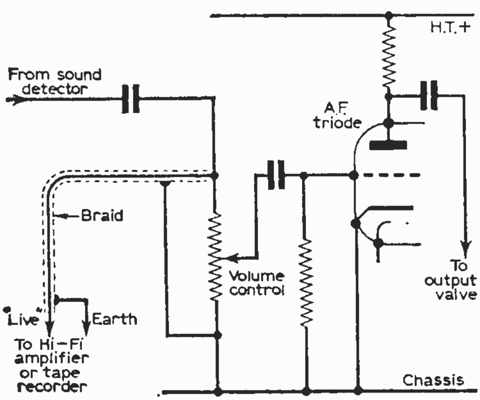


Fig. 3—A method for extracting good quality sound from across the volume control to drive a hi-fi amplifier or for recording. Mains isolation must be used if set of the a.c./d.c. type.

the insulation of the loudspeaker transformer T1 since the secondary winding has to be connected to chassis to obtain the negative feedback loop.

There would not be a lot of point in employing the circuit with a small internal loudspeaker. Optimum results are possible only when the circuit is used in conjunction with a good quality extension speaker system or if a 12in. unit can be fitted into the cabinet, which may be possible with an old-fashioned console cabinet of substantial construction —there are still some of these about.

If hum or frame breakthrough is troublesome in the enhanced sound channel, the main smoothing electrolytic should be increased in value. A solution is to connect an extra 100µF unit in parallel with the existing one; but make sure that the working voltage and ripple rating matches the original.

It is really surprising just how much the sound can be improved by the methods prescribed, and the author would not now go back to the 2½in. internal loudspeaker embodied in his set—not after operating the set on the high quality loudspeaker system depicted in the photograph. ■

TV ALIGNMENT

by H. W. Hellyer

PART 1: SPOT FREQUENCY METHOD

This two part article is intended to supplement the series of articles "Test Gear Techniques" currently appearing in Practical Wireless, *in which the author describes the types, specifications, and applications of test instruments. For more specific details of the instruments mentioned, see* Practical Wireless, *Jan. 1963, The Basic Meter; Feb. 1963, Multimeters; March, 1963, Valve-Voltmeters; and April, 1963, A.M. Signal Generators. Further notes on signal generators, oscilloscopes and other test instruments will appear in subsequent issues.*

THIS is the hey-day of the " second set ". The Post-Pilkington era, if you like. Many householders have had brand-new television receivers installed, even those for whom the u.h.f. transmissions are several revolutions of a licence date away. The old faithful TV has been relegated to lumber room or attic, as a stand-by against the dreaded day when a breakdown may occur.

In addition, many sets have been bought at bargain prices, as the result of trade-in transactions. These may be no more than middle-aged, needing only a modicum of tickling-up to bring them back to fair condition.

The time is ripe for the enthusiast to undertake a few of those jobs he could not—or dare not—tackle before. When the set being operated upon does not have to be back in its corner before " Emergency Ward 10 " begins, there is some incentive for the man of the house to take on the more ambitious repairs. Like aligning the tuned circuits—obtaining peak performance.

PROCEED WITH CAUTION

It should be stated at the outset, that re-alignment is not necessary in half the cases where it is attempted! The professional serviceman is sadly aware that a panacea for all manner of TV complaints has been the ill-considered " twiddle of a slug ". Tuned circuits do not normally go out of alignment.

There are occasions when the changing of a valve may make a difference to circuit characteristics—but tolerances are such that in any set made in the past five years very little difference will be noted to the tuning if a valve is replaced—except, of course in the high frequency circuits of the tuner unit.

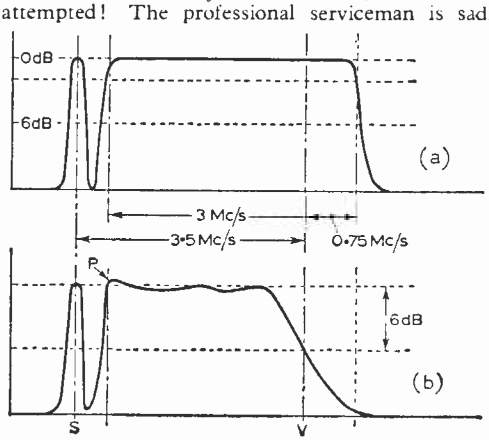
But, allowing for the fact that some other fellow may have had a go at the tuning, let us consider how the response, gain, bandwidth and sensitivity can be checked on our " middle-aged " receiver.

The instruments used can vary from a keen ear and the broadcast Test Card to a crystal-controlled sweep generator with marker and output level monitor, plus accurate oscilloscope and check meters.

I.F. CHARACTERISTICS

We shall deal first with the adjustment of the intermediate-frequency tuned circuits.

As can be seen in Fig. 1, the " shape " of the response curve of a television receiver, important if we are to retain all the transmitted frequencies,



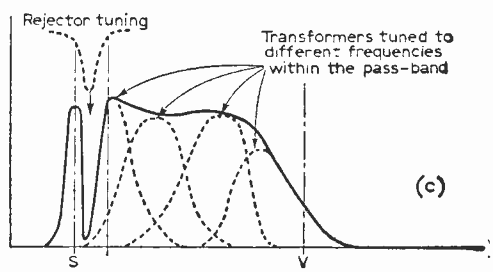


Fig. 1—Vision receiver i.f. response characteristics, as discussed in the text.

can only be obtained by "stagger-tuning", or some comparable method of broadening the pass-band.

Fig. 1(a) shows the transmitted curve of a lower-sideband system, with the vision carrier at frequency V, the sound carrier at frequency S, and the bandwidth distributed so that the top of the vision curve is practically flat for 3Mc/s below and 0·75Mc/s above the vision carrier.

This suppressed upper sideband is known as the vestigial sideband, and the steepness of the falling away of the curve is carefully determined at the transmitter. At the receiver, some compromise has to be effected, and a practical curve, such as would be displayed on an oscilloscope, is shown in (b). Here, we have the sound and vision carriers received at S and V, with a 3·5Mc/s separation as before, and the top of the curve fairly flat.

Note that the dip between the sound curve and the 3Mc/s lower limit of the vision pass-band is quite sharply pronounced, and the slope of the fall-off at the upper end is such that there is a 6dB (2:1) drop in response from the top of the curve to the carrier frequency.

This is only possible by accurate tuning of the intermediate frequency transformers—and to obtain the sharp dip, the sound rejectors.

SOUND REJECTORS

Before attempting alignment of a set for which no data is available, these sound rejectors must be identified. They are not always obvious, and if it is suspected that tuned circuits have been altered, a detailed analysis of the circuit may be needed.

As a guide, the skeleton circuits of Fig. 2, show some of the methods by which various manufacturers achieved the end of preventing the vision intermediate frequencies from entering the sound channel, and trapping the sound i.f. from the vision circuits.

The efficiency of these circuits, and their number, often result in an accentuation of the vision response curve, a peaking at the point marked P in Fig. 1(b), but more often the curve will be found to shoulder off more gently as shown dotted in the same diagram.

An important part of the i.f. circuitry in any set is the sound take-off, which may be capacitive, as in Fig. 2(a), or inductive, 2(b), at a point just after the mixer. This, in practice, is usually the output from the tuner unit.

If the signal generator is connected to the mixer grid, at a test point that is generally to be found adjacent to the frequency changer valve, and a meter connected in the output of the vision channel, by one of the methods suggested in Fig. 3, these rejector and take-off circuits should be tuned as follows.

CAPACITIVE TAKE-OFF

Inject a signal at the sound frequency, strong enough to give a reading on the output meter. Tune L1 for the minimum reading. Two dips are possible: one of these is that giving the maximum sound output, the other, while giving increased sound response, should give the correct rejection of sound frequencies from the vision channel. The latter is the required tuning point. L2 is then tuned for maximum output at the *vision* frequency.

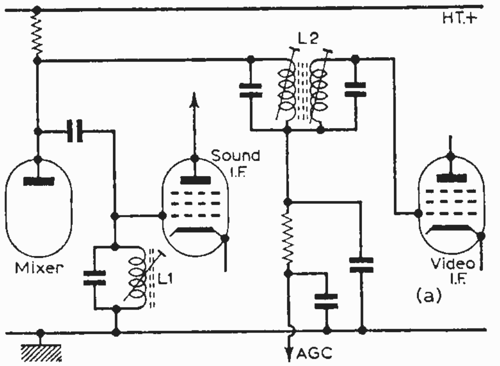
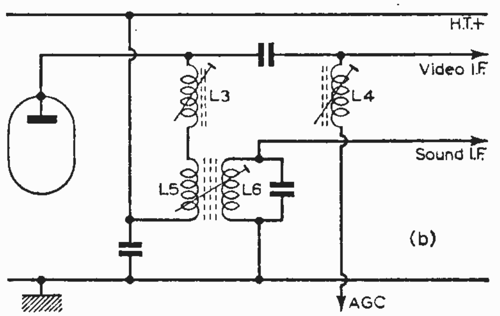


Fig. 2a (above)—Capacitive sound take-off circuit.

Fig. 2b (below)—Inductive sound take-off circuit.



INDUCTIVE TAKE-OFF

The second circuit (b), is rather more complicated, though basically the same in principle. L3 is the coupling coil, which should be tuned for minimum response on the vision channel output meter *at the sound frequency*. L4 is the vision coupling coil, which tunes to a frequency toward the upper end of the vision pass-band, and L5 and L6 are the sound input circuit, tuned to maximum sound output at the sound frequency.

Absorption circuits may be found consisting of a "closed loop" which absorbs energy at the required rejector frequency Fig. 2(d).

The take-off may be at a later stage as in (c), where the coupling to the sound stages is between two vision i.f. valves and requires a double-tuned transformer flanked by two tuned coils. The coils are tuned to vision frequencies, but L7 is tuned to give minimum output at the sound frequency whereas L8 is tuned for maximum sound.

It is often difficult to identify these windings, without recourse to a circuit diagram and continuity tests, but if the correct tuning is not made, it is almost impossible to eliminate sound-on-vision.

In the foregoing notes, reference has been made to the "vision" and "sound" frequencies. These are, of course, the intermediate frequencies determined by the setting of the local oscillator with relation to the incoming carrier frequency.

It is not proposed to go into great detail here on this subject, and the reader is referred to the *Practical Television* Data Chart, given free with the October 1962 issue, reprints of which are available for 7s. 6d. Among a host of useful data, there will be found a table of channel frequencies, and other tables giving relevant information on all television stations.

STANDARD I.F.

Intermediate frequencies are a different problem, for over the years there have been many variations by manufacturers, although a " standard " has now been agreed upon, 38·15Mc/s for sound and 34·65Mc/s for vision.

The local oscillator is above the carrier frequency in both cases.

If there is any doubt as to the i.f. employed on a particular receiver, first connect the signal generator to the frequency changer grid—or couple it to the mixer valve by a coil made from three or four turns of stiff wire wound around the valve envelope—and inject a modulated signal at the suspected sound i.f., sweeping the generator tuning over the scale until maximum response is heard from the loudspeaker.

Note the frequency reading, then subtract 3·5Mc/s from this and inject the new frequency, but this time note the modulation of the c.r.t. screen or take a meter reading as in Fig. 3. Even if the receiver has been badly misaligned, it should be obvious whether the vision frequency is above or below the sound.

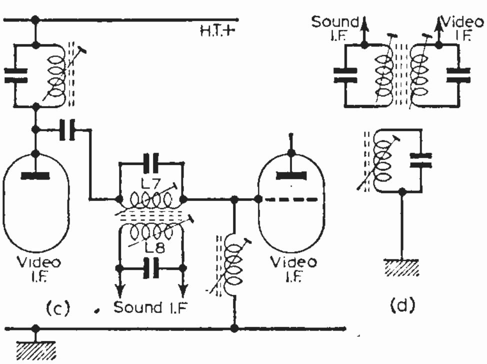
Patient probing in this manner can tell the operator a lot—even about a receiver completely unknown to him.

CONNECTING THE GENERATOR

The usual precautions regarding safety must be taken when connecting these instruments. No direct earth connections must be made to the chassis of an a.c.-d.c. set. The signal generator should be connected via isolating capacitors, which can be 0·001μF paper, or ceramic, and of at least 350V working.

If an isolating transformer is employed for mains supply, a direct chassis connection from the screened outer of the signal generator lead can be used, but it is still advisable to retain the coupling capacitor in the " hot " lead. A dummy aerial is not required for i.f. alignment; output impedance of the signal generator is normally 75Ω.

The input signal may need to be fairly high at



Figs. 2c and d—Absorption sound take-off circuits.

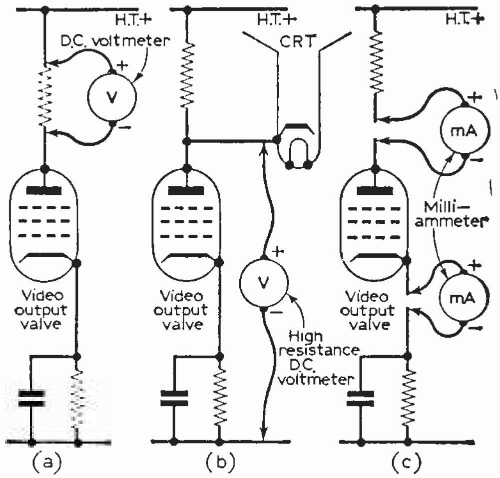


Fig. 3—Alternative methods of obtaining video output indications.

first, in order to force a signal through the misaligned circuits, but as meter readings are obtained, reduce the input signal level to as low a value as is consistent with accurate indications on the meter scale, to prevent the a.g.c. circuits from coming into operation.

A.G.C. INOPERATIVE

The effect of the a.g.c. circuit is to damp down the response, allowing considerable mis-tuning, and an overall decrease in vision channel gain. It is therefore advisable to render the a.g.c. inoperative, either by disconnection (and shunting with a similar load), in the case of mean-level a.g.c. systems, or by applying a " backing-off voltage " where gated or keyed systems have been incorporated.

A backing-off voltage is obtained by fitting a couple of wander leads and clips to a suitable battery and then applying the negative lead to the chassis and the positive to that part of a.g.c. circuit nearest the last point of coupling, say at the lower end of the grid isolating resistor of a vision i.f. amplifier.

An indication of the voltage required can be gained by injecting a strong signal and measuring the negative voltage at this point, then arranging a suitable external *positive* source to counteract it.

The output meter for vision response can be connected across the video load, as at Fig. 3(a), when a reading of about 20V would indicate peak white, this reading being the d.c. variation increasing with the signal level.

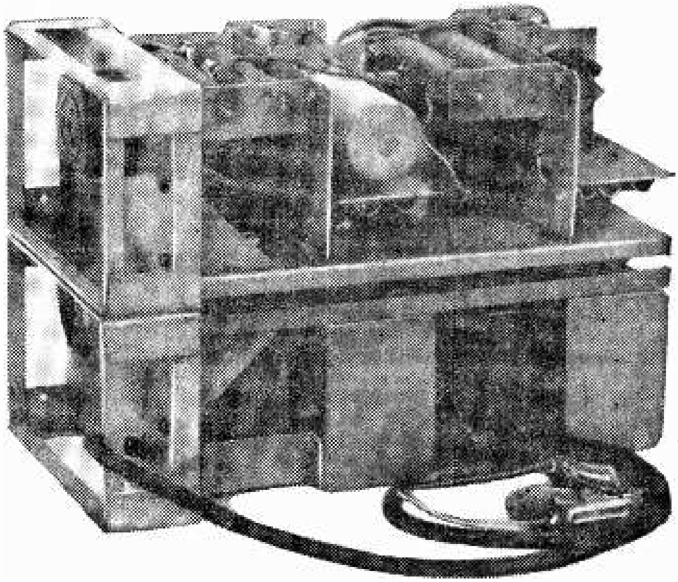
Alternatively, where a cathode modulated c.r.t. system is employed the output meter can be coupled to give a direct indication of cathode voltage at the tube base.

This is a convenient point of connection, but it should be remembered that an increase in vision signal will produce a *decrease* in cathode voltage. Care must be taken not to damp the video circuits, and therefore a high resistance voltmeter is imperative and short connecting leads should be used. This connection is shown in Fig. 3(b).

—continued on page 369

CONVERTING TO BATTERY OPERATION

The following article describes the conversion of two specific television receivers to operate from 12V batteries. Other receivers could be converted, using the same basic principles.



by

J. C. Boylan

TO those who have not access to a mains electricity supply, a battery operated television receiver has certain attractions. The successful conversion of a mains receiver to run from 12V batteries presents an interesting problem, which the writer attempted, working on Bush TV22 and TV24C receivers. The following notes apply specifically to these two sets, but the general principles could be applied to most receivers.

The essential object was to achieve a low consumption, not only to give longer viewing per charge and to give more even performance during viewing, but to conserve the batteries. As a general rule, a lead acid battery should be discharged at a ten hour rate; a 40A hour battery should discharge at about 4A. Mains operated receivers use upwards of 120W, which would require more than a 10A consumption with 100% conversion from a 12V supply.

The direct conversion of 12V to mains voltage was considered uneconomic. Two approaches were made in tackling the work, the heater supply for the valves, and a matched h.t. power supply.

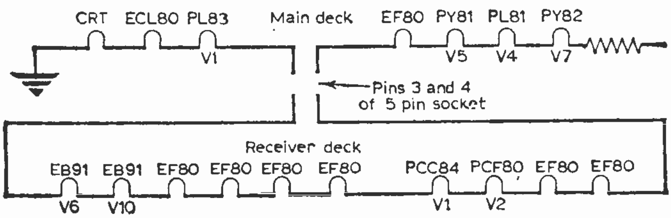
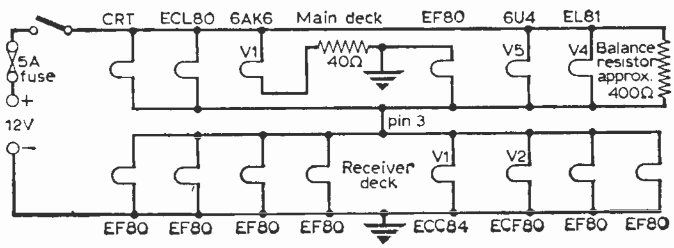


Fig. 1a (left)—The heater system of the TV24C before conversion in a series chain. Valves requiring replacement are given their original circuit reference. The rectifier V7 (PY82) is removed.

Fig. 1b (right)—The revised heater system using a series-parallel arrangement. V1, V5, V4 (main deck) and V1, V2 (receiver deck) are substitute types. Two extra resistors are used—one in series with the 6AK6 and one to balance the two sections of the heater system.



Valve Heater Supply

On a Bush model TV24C, the removal, replacement and substitution of the series wired valves was made as shown in the table. Eight valves and the tube remained, the remainder being changed to 6V valves if required.

Receiver Deck

V1 PCC84 replaced by ECC84 Same base.
V2 PCF80 replaced by ECF80 Same base.
V6, V10 EB91 replaced by four OA81 germanium diodes. Same bases (see text).

Main Deck

V1 PL83 replaced by 6AK6 B7G base.
V4 PL81 replaced by EL81 Same base.
V5 PY81 replaced by 6U4 I.O. base.
V7 PY82 removed.

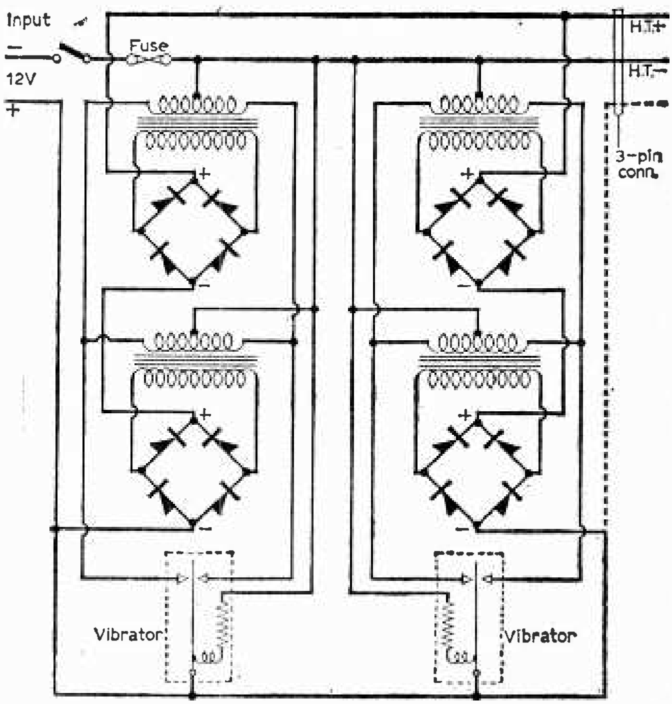


Fig. 2—12V vibratory power unit—part of ZA21531, Power Supply and Amplifier Unit No. 1. The chokes and capacitors are not shown. A photograph of the converted unit is shown in the heading.

Valve heaters on the receiver deck were wired in parallel, one side being earthed to the chassis, the other to pin 3 of the 5-pin socket. The current requirement for these valves is (ECC84) 0·335A, (ECF80) 0·43A, (EF80) 6×0·3A, a total of 2·565A.

The main deck valve and tube heaters, with the exception of the EF80 and 6AK6, were also wired in parallel, one side being connected to the switch, the other to the 5-pin socket (pin 3). These valves take (ECL80) 0·3A, (EL81) 1·05A, (6U4) 1·2A, and the tube 0·3A, a total of 2·85A.

The EF80 valve was wired between pin 3 and earth, so that the receiver deck load is increased by 0·3A to 2·865. By putting 12V across the heater supply the two halves of the circuit were accurately matched. In theory, a 400Ω resistor is indicated but, due to tolerances in the valves the trial-and-error method was more practical.

The 6AK6 valve was wired in series with a 40Ω resistor across the 12V supply.

The valveholder used as a replacement for the original PY81 was of the best quality, and was mounted on a light alloy bridge over the old valveholder cut-out to minimise the risk of an h.t. short. The negative lead of the 12V heater supply, which should be as heavy and as short as possible to reduce voltage drop, is connected to the chassis of the receiver. The positive lead, to which also is joined the negative lead from the power pack, is taken through a 5A fuse and one set of points in the volume control switch to the main deck heaters.

The crystal diodes were simply fitted by turning back and twisting the wire ends and inserting them into sockets 1 (Red), 1 and 5 (Red), 2 of the two valveholders from which the EB91 (V10) had been removed.

It is emphasised that the correct balancing of the two halves of the heater circuit is essential. The only trouble experienced in this part of the conversion was either low signal input or loss of e.h.t. and resultant picture, depending on which half of the heater circuit was low.

H.T. Power Supply

Two types of "surplus" power packs were available at the time the conversion was attempted, a small 12V vibrator unit fitted as part of ZA21531, Power Supply and Amplifier Unit No. 1, and a larger and more robust pack ZA29770 Vibratory Power Unit No. 9 for the PCR3.

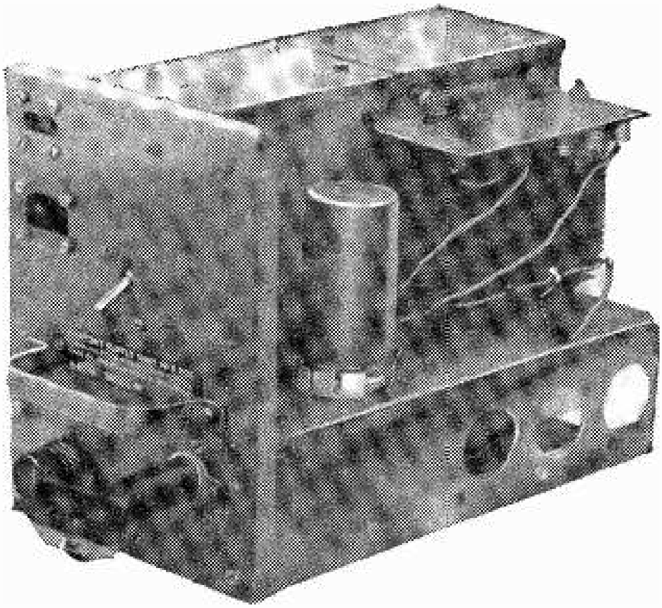
The first has an output of about 110V 60mA, and by careful fitting the two units were accommodated in the one case, with the outputs series connected. Four units in two cases were sufficient to operate the receiver. The arrangement is shown in Fig. 2.

It was later found that the current taken by the power pack was considerably reduced by feeding the two transformers in the one case from the one vibrator. The output chokes were removed as unnecessary; with an input of 3-4A, the h.t. was found to be satisfactory.

The positive of the 12V supply to the power pack was connected to the power pack chassis, while the negative was taken to the power pack switch, and to the receiver chassis. The h.t. negative was connected to the power pack chassis, the h.t.

positive going to the original smoothing section on the receiver. Tests showed that the resistors were not required and the supply was taken direct to the smoothing capacitor.

The No. 9 power pack presented a different problem in that the output was excessive and the battery drain consequently too high. An immediate but uneconomic solution was the fitting of a dropping resistance in the supply lead.



The vibratory power unit No. 9 after modification, showing the fitting of the additional transformer and rectifier.

Second Transformer

A more satisfactory but involved method was the installation of a second transformer and rectifying bridge to work with the single vibrator. This entailed the removal of the cover to the transformer, the identification of the primary centre tap, which consisted of two twisted leads, and the separation and insulation of them. The judicious use of a small blow lamp and much patience was necessary for this work.

In this power pack, both the input and output chokes were found to be redundant. The second transformer and rectifier just fitted within the case. The final arrangement is shown in Fig. 3. The two leads from the primary of the first transformer were connected to the split centre tap of the second transformer, while the primary ends of this were connected to the vibrator points, from which the first leads were removed.

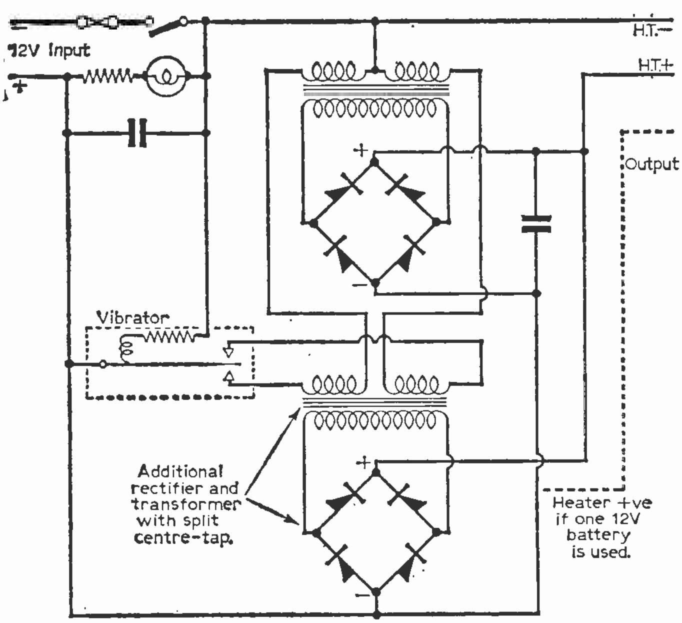


Fig. 3—The modification of a Type No. 9 vibratory power unit by the addition of an extra transformer and rectifier.

The secondaries of the transformers were connected to their individual rectifiers, the outputs being paralleled. The negative h.t. was wired to the chassis which, like the previous pack is at positive supply potential, the negative supply going to the switch and receiver.

The fact that the power pack chassis and the receiver chassis are at a 12V potential difference should be borne in mind when installing the units.

Total Consumption

The heater supply takes less than 3A while the power packs of either type take 3-4A; this maximum total of 7A represents a power dissipation of 84W, which is two thirds of that at which the receivers are rated. With average batteries this should give viewing up to seven hours. Nor is it necessary to use two batteries. A large capacity nickel iron battery with 12 cells, can be conected direct to the power pack (positive chassis) and an extra lead run from the chassis to the heater supply connection on the

—*continued on page 354*

"quick-testing" the EF80

THIS INSTRUMENT WILL QUICKLY GRADE THE QUALITY OF THIS UBIQUITOUS VALVE

BY J. B. WILLMOTT

THE simple piece of apparatus about to be described, was assembled by the author as a result of the need quickly to check the performance of a number of EF80 valves. These valves are very widely used in the r.f. and i.f. stages of television receivers, and also as sync separators, oscillators, etc., in both commercial and home constructed designs.

Being widely obtainable from advertisers in this magazine, both as "new surplus" and "ex equipment" at attractive prices, EF80 valves are in constant demand as replacements or for new construction purposes. Naturally valves obtained on the surplus market, or from the stripping of old receivers, may vary very considerably in performance, and some means of sorting out the "good", "fair" and "reject" specimens is extremely valuable to the enthusiast.

The "goodness" of a valve is best determined by its "slope" (gm) in terms of mA/V under actual working conditions.

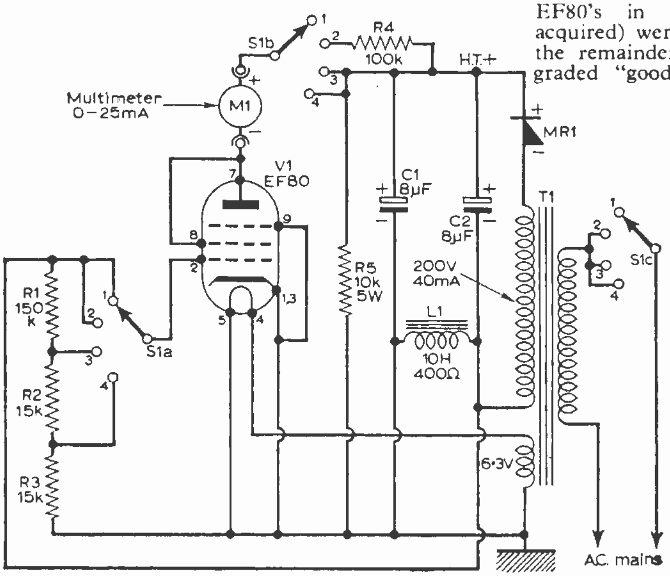


Fig. 1—The circuit diagram of the unit. The switch S1 is shown in the "off" position.

For the benefit of the beginner to whom the above statement may be meaningless, it can be briefly said that the efficiency of a valve as an amplifier is determined by the amount of change in anode current resulting from a given change in grid bias voltage, usually expressed in terms of "milliamps per volt". This is, of course, the principle under which the elaborate and highly accurate (and expensive!) commercial valve testers work; these instruments must of course cater for an innumerable number of valves types, with their multiplicity of valveholders and different requirements in respect of heater voltages, etc.

Description of the Tester

All that was required by the author was a means of quick comparison between various EF80 valves, an actual reading of "gm" in terms of "mA/V" not being necessary. The readings obtained from a brand new valve were recorded and used as a standard for comparison purposes, the other EF80's in the spares box (or subsequently acquired) were then graded "good" or "fair", and the remainder consigned to the dustbin. Valves graded "good" were then reserved for use as

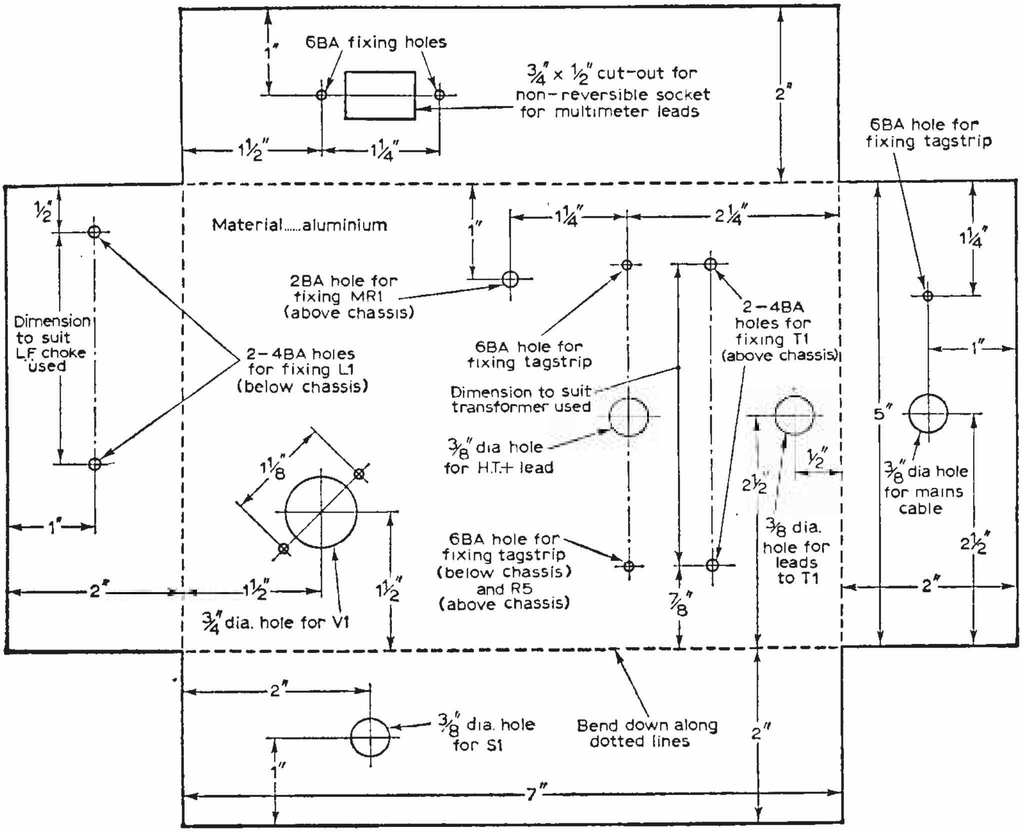


Fig. 2—The chassis drilling.

frequency changer r.f. or vision i.f. or video output stages. Those graded "fair" can then be used in positions where a slight loss in efficiency can be tolerated, such as sound i.f. or sync separator stages.

The requirements of the instrument to be constructed are therefore a comparative reading of the change in combined anode and screen grid current resulting from a change in grid bias voltage by a predetermined amount (within the normal working limits of the valve type in question). The workshop multimeter, set to a suitable range (e.g. 0 — 25mA), is connected to a socket at the rear of the instrument, and thus the cost of a "built-in" indicating meter is avoided.

Naturally, if a suitable spare milliammeter is available, together with the necessary shunt resistor to enable the desired range to be covered, its incorporation would make the unit self-contained. A further refinement would be the fitting of a suitable scale engraved "good", "fair" or "reject" once these readings had been established as a result of testing a number of valves. However, in the interests of keeping cost to a minimum, the use of the normal bench multimeter is perfectly satisfactory, and a small card showing the readings to be expected from each "category" of EF80 can be compiled and kept with the instrument for reference as required.

The Circuit Explained

Possibly the most interesting feature of the circuit employed (see Fig. 1) is the action of the function switch S1 (a/b/c). This is a 3-pole 4-way rotary switch, and is so wired that the following sequence of operations takes place as a result of clockwise rotation:

Position 1. "OFF." The mains supply to primary of T1 is broken, and also the h.t. supply line to the anode of the valve under test, while the control grid of the valve is connected to the top of R1. Thus in this position the valve is near anode current cut-off point by reason of full grid bias (some 12V on the prototype) when h.t. current is applied on turning switch to position 2.

Position 2. "WARM UP AND CHECK." Mains supply switched on to primary of T1 and h.t. circuit made to anode and screen grid via limiting resistor R4. As soon as the valve heater reaches operating temperature, a small anode current flow will be registered on the meter, this will be some 5mA or less.

Should the valve have internal electrode shorts, between grid and cathode or suppressor grid and screen grid for example, a very heavy current would flow through the indicating meter (with risk of damage to the movement) were it not for the preliminary "check" made in this position with

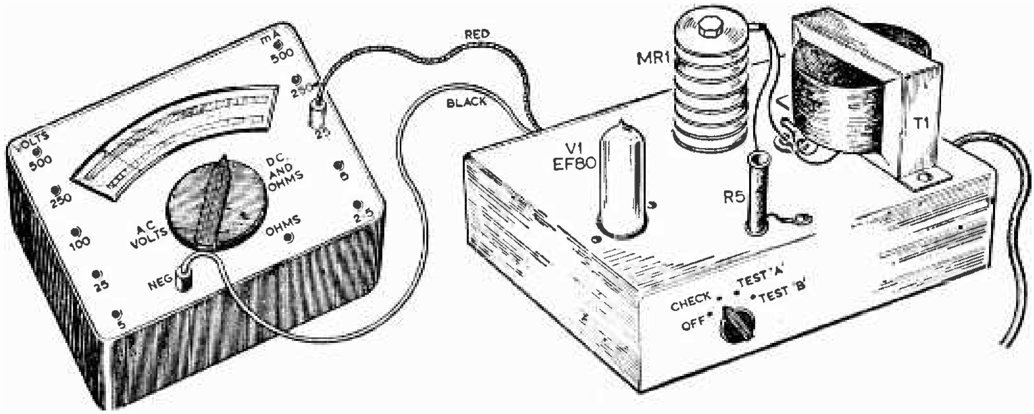


Fig. 3—The above-chassis layout.

maximum bias and anode current limiting resistor in circuit. If all is well, switch is then turned to position 3.

Position 3. "TEST A." Grid bias now reduced to approximately 3V, and the anode and screen grid are now connected direct to the h.t. supply. The meter reading will rise to about 20mA for a good valve.

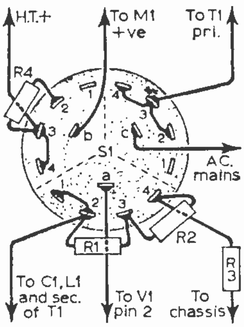


Fig. 4—Connections to the "function-switch."

Position 4. "TEST B." Grid bias is now further reduced to approximately 1·5V, and the meter reading will rise to about 25mA for a good valve.

The difference between readings "Test A" and "Test B" then represent an indication of the "goodness" of the valve under test.

In order to maintain the h.t. voltage, and the total bias voltage developed across the smoothing choke L1, which is placed in the h.t. negative return for this purpose, within reasonably stable limits, a bleeder resistor R5 of 10kΩ 5W (a wirewound component) is connected across the h.t. supply. As this component dissipates a certain amount of heat, it is best mounted above the chassis. In the prototype, this was done by passing a long 6B.A. bolt down the hollow centre of the resistor, and securing the component vertically above the chassis as shown in the plan view Fig. 3.

Building the Tester

Actual construction of the unit is extremely

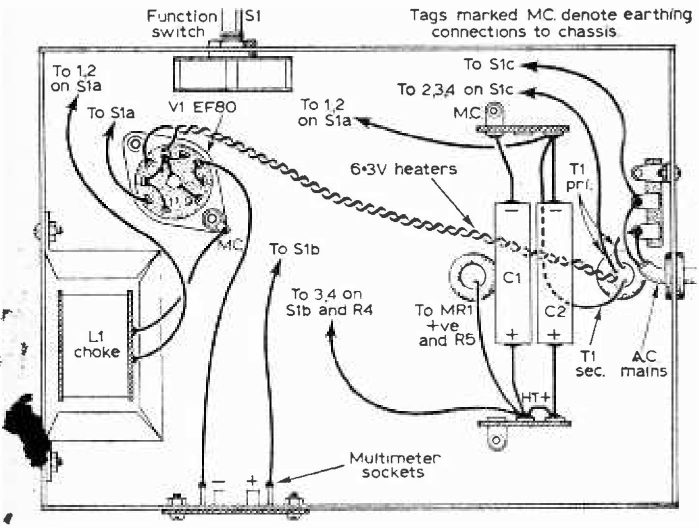


Fig. 5—The underchassis wiring diagram and component layout.

COMPONENTS LIST

Resistors:

R1 150kΩ 5% ½W
R2 15kΩ 5% ½W
R3 15kΩ 5% ½W
R4 100kΩ 1W
R5 10kΩ 5W wire-wound

Capacitors:

C1 8μF electrolytic 350V
C2 8μF electrolytic 350V

Other Components:

L1 Smoothing choke 10H 400Ω
M1 See text
MR1 Metal rectifier 250V 40mA
S1 3-pole, 4-way rotary switch
T1 Mains transformer. Miniature type with 230V 40mA and 6·3V 1A secondaries

Miscellaneous:

One B9A valveholder. Non-reversible 2-pin plug and socket. Wander plugs or spade terminals. Three 3-way tagstrips. Pointer type control knob. Rubber grommets. Nuts and bolts, solder tags, sleeving, etc. Chassis 7in. x 5in. x 2in. approximately.

simple, and considerable latitude in layout or choice of actual components is permissible; a small mains transformer giving approximately 230V at 40mA, plus 6·3V at 0·3A at least meets the requirements for T1. The choke L1 should have a rating of 40mA and a d.c. resistance of about 400 ohms. The metal rectifier MR1 should have a rating of not less than 250V 40mA. The two filter capacitors C1 and C2 must be separate tubular type electrolytics of at least 350V working. A dual 8 + 8 component cannot be used, as separate negative connections are essential for this circuit. R1, R2 and R3 should be high stability close tolerance resistors (5% or better), otherwise considerable "drift" in readings will be experienced during the tests, which will render such readings meaningless.

Fig 2. shows the drilling plan used in the original, and the under-chassis layout is given in Fig. 5. Full connection data for the function switch is given in Fig. 4.

Note the connections to the "thick" and "thin" sockets of the meter connecting panel on the rear chassis runner, and to its corresponding plug. To avoid any danger of wrong connections to the external indicating meter, the lead which goes to the thick plug should be of red flex (and be connected to meter positive), and that to the thin plug should be of black flex (and therefore connected to meter negative).

The use of tagstrips to form anchorage for the incoming mains supply lead, and for the terminations of the capacitors C1 and C2 should be noted. Apart from the foregoing, the only points to be observed in assembly and wiring are the usual instructions to keep wiring as short and direct as possible, and to ensure that the leads carrying the a.c. valve heater supply are pressed close down to the chassis surface, and as far away as possible from connections to the control grid (pin 2) of the valveholder. ■

Converting to Battery Operation

—continued from page 350

receiver. The additional voltage available from the battery compensates for the voltage drop which occurs due to the power pack. A 12V lead acid battery could also be used, more especially if the leads are kept short and an independent supply is taken direct from the battery to the receiver heater supply.

To compensate for the undoubted underrunning of the receiver and the consequental lower sensitivity and gain, it is most important that the best possible aerial should be used.

Converting the TV22 Receiver

The conversion of the Bush TV22 was performed along similar lines to those already described for the TV24C.

In the case of the TV22, the receiver deck had seven EF80/91 valves in parallel requiring 2·1A in all, while the main deck current amounted to two ECL80 at 0·3A, one EL38 (replacement for the PL38) at 1·4A and the c.r.t. at 0·3A; a total consumption of 2·3A.

A push-pull transistor amplifier was fitted in the place of the PL33, and a silicon rectifier with ballast resistor as substitute for the efficiency diode half of the PZ30, the other of this valve the h.t. rectifier no longer being required.

This receiver, with its reduced consumption, could comfortably operate from a 12V battery, and by the addition of an ITV tuner, of the type now being advertised at a give-away price, fitted with PCC84 and PCF80 valves with series resistors in the heater supply, which for further economy could be switched off when on Band I—makes a more convenient and attractive set for the caravan user. ■

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OB2	17/6	6AK5	8/-	6K25	19/5	12BH7	18/8	90CG	37/6	EAF42	9/-	EF40	15/-	EM85	16/10	PCC89	8/6	TY86F	13/-	UCL83	16/11	OA81	3/-
OZ4	5/-	6AL5	4/-	6L1	15/-	12E1	17/6	90CV	42/-	EB34	2/6	EF41	8/-	EN31	71/-	PCC189	19/5	U12 14	8/6	UF41	9/-	OA86	4/-
1A5	6/-	6AM6	3/6	6L6G	7/6	12K5	17/6	150B2	16/6	EB41	8/6	EF42	10/-	EY51	7/6	PCF80	7/6	U16	10/-	UF42	12/6	OA91	3/-
1A7GT	12/-	6AQ5	7/6	6L7GT	7/6	19AQ5	10/6	807	6/-	EB91	4/-	EF50(A)	7/-	EY83	14/7	PCF82	7/-	U19	48/6	UF80	10/6	OA95	3/6
1C5	12/6	6AT6	5/6	6L17	9/-	19H1	10/-	5763	7/6	EBC33	5/-	EF50(E)	5/-	EY84	18/2	PCF84	16/2	U22	8/-	UF85	9/-	OA210	9/6
1D6	9/6	6AU6	10/-	6L18	13/-	20D1	14/11	7475	5/-	EBC41	8/-	EF73	10/6	EY86	7/-	PCF86	9/6	U24	29/1	UF86	13/6	OA211	13/6
1G6	6/-	6BA6	6/-	6LD20	15/7	20F2	15/-	AZ31	10/-	EBC81	8/-	EF80	5/-	EZ40	6/6	PCL82	8/-	U25	15/9	UF89	8/-	OC16W	35/-
1H5GT	10/6	6BE6	6/-	6P28	25/11	20L1	15/-	AZ41	12/3	EBF80	8/-	EF85	6/-	EZ41	7/-	PCL83	9/6	U26	9/-	UL41	10/6	OC19	25/-
1L4	3/-	6BH6	8/-	6Q7G	6/-	20P1	25/11	B36	9/-	EBF83	13/7	EF86	7/6	EZ80	6/-	PCL84	7/6	U31	11/6	UL44	25/11	OC22	23/-
1LD5	5/-	6BJ6	6/-	6R7G	10/-	20P3	22/8	CL33	18/9	EBF89	9/6	EF89	9/-	EZ81	6/-	PCL85	10/-	U33	29/1	UL46	14/6	OC26	25/-
1LN5	5/-	6BQ7A	22/6	6SJ7	5/-	20P4	23/3	CY31	11/-	EC70	12/6	EF91	3/6	GZ30	9/-	PCL86	16/2	U35	29/1	UL84	8/6	OC28	17/6
1N5GT	10/6	6BR7	9/-	6U5G	7/6	20P5	22/8	DAC32	10/6	EC81	27/6	EF92	3/6	GZ32	10/-	PCL88	21/4	U37	32/4	UM4	17/9	OC29	27/6
1R5	5/6	6BR8	16/4	6V6G	4/6	25Z4G	11/6	DAF91	4/6	EC92	11/8	EF97	13/-	GZ34	14/-	PEN46	4/6	U45	15/6	UM34	16/10	OC35	18/-
1S4	9/-	6BW6	10/6	6X4	4/6	27SU	25/11	DAF96	7/-	ECC34	23/11	EF98	13/-	HN309	29/1	PL33	18/9	U76	6/-	UM80	14/11	OC36	21/6
1S5	4/6	6BW7	5/-	6X5GT	5/-	30C1	7/6	DD41	13/7	ECC35	8/6	EF183	18/2	HVR2	10/-	PL36	10/-	U191	14/7	UY1N	18/2	OC41	9/-
1T4	3/-	6C4	5/-	6/30L2	10/-	30C15	12/-	DF33	10/6	ECC40	17/6	EF184	9/6	KT33C	8/-	PL38	25/11	U201	16/2	UY21	16/2	OC44	9/3
1U5	5/6	6C5	6/6	7B7	8/6	30F5	6/-	DF66	15/-	ECC81	5/-	EF804	22/8	KT36	32/4	PL81	8/6	U251	14/-	UY41	6/6	OC45	9/-
3A4	6/-	6C6	6/6	7C5	8/-	30FL1	9/6	DF91	3/-	ECC82	5/-	EK32	8/6	KT41	29/1	PL82	7/6	U281	19/5	UY85	6/-	OC65	22/6
3A5	10/6	6C9	13/6	7C6	8/-	30FL12	12/6	DF96	7/6	ECC83	6/6	EL32	5/-	KT44	12/6	PL83	9/-	U282	22/-	VP13C	7/-	OC66	25/-
3B7	12/6	6C17	10/6	7H7	8/-	30L1	7/-	DF97	9/-	ECC84	7/6	EL33	12/6	KT61	12/6	PL84	11/1	U301	22/8	VR105	7/-	OC70	6/6
3D6	5/-	6CH6	7/6	7Y4	7/6	30L15	9/-	DH63	6/-	ECC85	7/6	EL34	15/-	KT63	7/-	PM84	15/2	U329	14/-	VR150	7/-	OC71	6/6
3Q4	7/6	6CW4	24/-	9BW6	14/11	30P4	15/-	DK32	12/-	ECC88	21/-	EL38	17/-	KT66	15/-	PX4	10/6	U404	6/6	W107	20/5	OC72	8/-
3Q5GT	9/6	6F1	10/-	10C1	12/6	30P12	7/6	DK91	5/6	ECC807	25/-	EL41	9/-	KT81	40/9	PY32	10/6	U801	26/2	W729	19/5	OC73	16/-
3S4	6/-	6F6G	7/-	10C2	25/11	30PL1	9/6	DK92	8/6	ECF80	10/6	EL42	10/-	KT88	43/6	PY33	10/6	UABC80	9/-	X41	15/-	OC74	8/-
3V4	7/6	6F13	10/-	10F1	10/-	30PL13	10/6	DK96	8/6	ECF82	10/6	EL81	16/2	L63	6/-	PY80	6/-	UAF42	9/6	X66	12/6	OC75	8/-
5R4GY	17/6	6F23	10/6	10LD11	15/7	30PL14	21/4	DL33	9/6	ECF86	19/5	EL83	19/5	MHLD6	12/6	PY81	6/6	UB41	12/-	X78	26/2	OC76	7/-
5U4G	4/6	6F24	9/6	10P13	15/-	35L6GT	9/6	DL66	17/6	ECF804	20/-	EL84	6/6	MU12/14	8/-	PY82	6/-	UBC41	8/6	X79	40/9	OC77	12/-
5V4G	10/-	6F33	7/6	10P14	18/9	35W4	7/6	DL68	15/-	ECH21	22/8	EL85	10/6	N37	25/11	PY83	7/6	UBC81	11/-	X81M	29/1	OC78	8/-
5Y3	5/6	6J5G	5/-	12AC6	14/11	35Z4GT	6/-	DL72	15/-	ECH35	6/6	EL86	16/10	N78	29/1	PY88	13/-	UBF80	9/-	X109	29/1	OC81	8/-
5Z3	19/5	6J6	3/-	12AD6	16/10	35Z5GT	9/-	DL92	6/-	ECH42	9/6	EL91	4/-	N108	29/1	PZ30	17/6	UBF89	9/6	Y63	7/6	OC82	10/-
5Z4G	9/-	6J7G	4/6	12AE6	12/3	50C5	10/-	DL94	7/6	ECH81	7/6	EL95	10/6	N308	18/1	R18	18/2	UCC84	14/3	Z66	9/6	OC83	6/-
6A7	10/6	6J7GT	10/6	12AH7	8/-	50L6GT	10/-	DL96	7/-	ECH83	13/7	EL820	18/2	N339	15/-	R19	19/5	UCC85	7/6	*Transistors*		OC84	8/6
6A8	9/-	6K7G	2/-	12AH8	12/6	85A2	16/-	DM70	7/6	ECH84	14/7	EL821	25/11	P61	3/6	SP41	3/6	UCF80	13/-	*and diodes*		OC170	9/6
6AC7	4/-	6K7GT	6/-	12AT6	7/6	90AG	67/6	DM71	9/9	ECL80	7/-	EL822	19/6	PC86	14/7	SP61	3/6	UCH42	9/6	OA70	3/-	OC171	10/6
6AG5	5/6	6K8GT	10/6	12BA6	8/-	90AV	67/6	DY86	13/-	ECL82	9/6	ELL80	20/5	PC88	16/2	SU25	27/2	UCH81	9/6	OA73	3/-	OCP71	17/6
								E80F	30/-	ECL83	16/1	EM34	9/6	PC95	13/-								
								E83F	30/-	ECL86	14/7	EM71	22/8	PC97	11/8								
								E180F	34/6	EF36	4/-	EM80	9/-	PCC84	7/-								
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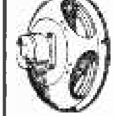

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TV MICROPHONY

CAUSES • EFFECTS • CURES

by O. M. Devonshire

A BAD case of picture judder in sympathy with the sound accompaniment, which disappears completely when the volume control is turned right down, is a typical symptom of television microphony.

The basic effect, of course, is sound-on-vision interference but the fact that it goes off when the sound is turned down signifies conclusively that misalignment of the sound rejectors is not responsible. It is important to remember this.

A resounding "clang" from the loudspeaker when the channel selector knob on the tuner is operated or when the chassis of the tuner or set is struck with the handle of a screwdriver is another symptom of microphony. Still another takes the form of a "howl" from the loudspeaker when the fine tuning control is adjusted accurately to the sound carrier (i.e., for maximum sound).

Cause of Microphony

The essential cause is that vibrations from the speaker or cabinet are picked up by a component in a "sensitive" part of the circuit and that due to the component responding in some way to the vibrations, a feedback path is established between the component and loudspeaker.

A typical feedback path is revealed in Fig. 1. Although this is not directly connected with television it at least serves to illustrate basic microphony. To an ordinary audio amplifier input is connected a microphone and to the output a loudspeaker. The microphone and loudspeaker are orientated so that sound from the loudspeaker is picked up by the microphone.

At low volume level on the amplifier this set-up may behave normally; but as soon as the volume control is advanced beyond a critical point, depending upon the power of the amplifier and the spacing and acoustical conditions between the microphone and loudspeaker, a feedback circuit occurs which is partly acoustical and partly electrical.

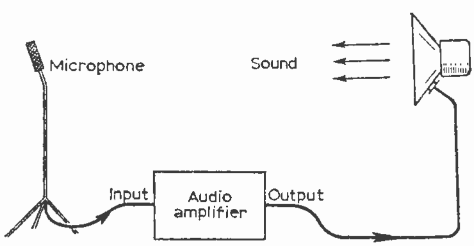


Fig. 1—Showing basic microphony. A feedback path is established partly acoustically from microphone to loudspeaker and partly electrically from the input to the output of the amplifier.

Conversion

Sound from the loudspeaker picked up by the microphone is converted into electrical signal and applied to the input of the amplifier. After amplification this is fed back into the loudspeaker and the original sound is endowed with multiple echoes. Now if the gain of the amplifier is increased or the microphone moved closer to the loudspeaker the whole system starts to oscillate on its own.

Since the feedback is partly acoustical, a howl will develop in the loudspeaker, the tone of which is governed by the response characteristics of the audio system as a whole and by the acoustics of the room. If an oscilloscope is connected across the amplifier signal circuits, oscillatory signals would also be observed here.

This, then, is the fundamental microphony concept—often called acoustic feedback or "feedback howl" by sound engineers and is well known by those who have had dealings with public address amplifiers and equipment.

Valve Microphony

From this stepping stone we can now see why microphony in a television set causes the symptom of sound-on-vision interference. Instead of a microphone—which is designed to respond to sound and to convert it into electrical signal—a valve often acts in the same way.

All valves are a little "microphonic", although extra special care is now being taken during manufacture to keep the microphony to the lowest possible level, but sometimes a fault develops—either in the circuit or in the valve—which makes the valve much more microphonic than normal.

This is not to mean that a valve could be put to work as a microphone on an audio system, since the response to sound vibrations even of the most microphonic of valves is many thousands of times less than that of a microphone. Nevertheless just a small response to sound vibrations is sometimes sufficient to cause trouble in certain circuits.

Changes in characteristics in sympathy with the sound or vibrations occur in a microphonic valve, and although these in themselves do not produce a corresponding signal voltage, a signal is, nevertheless, produced due to the effect of the changes on the circuit.

For example, vibrations of the electrode structure can cause alterations of mutual conductance, anode current and inter-electrode capacitances. These alterations are fundamental to the working of the *circuit*, which means that amplified signals—at the vibration frequency—are created in the output circuits. Microphony may thus be considered as the production of an interference signal arising from mechanical vibration. As the basic effect is similar to that of a microphone the term "microphony" is used.

To get back to the case of sound-on-vision interference due to a microphonic valve. The frame amplifier valve is usually responsible, possibly because this has a fairly high value of mutual conductance and features a rather heavy electrode assembly. Also, the valve is invariably in line with, and close to the loudspeaker, so that it is subject to maximum vibration (Fig. 2).

The resulting changes in characteristics cause a small compression and expansion of the picture in sympathy with the sound, and on the picture the effect is rather like ordinary sound-on-vision (Fig. 3).

Locating Faulty Valve

The most conclusive check for valve microphony of this nature is to remove the aerial, turn up the brightness until a raster is clearly visible on the screen and then tap the suspect vision valves with the handle of a screwdriver, keeping the hand well clear of high-voltage points. The microphonic valve will be revealed by the production of horizontal black bars across the raster when the defective one is tapped.

A form of interference similar to that shown in

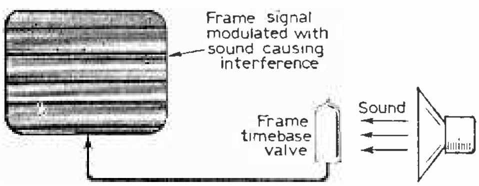


Fig. 2—Showing how the sound-on-vision interference symptom is produced by a microphonic frame timebase valve.

Fig. 3 can also be caused by "intensity modulation" of the electron beam in the picture tube. Apart from picture tube microphony, which can be proved by gently tapping the tube neck with the handle of a screwdriver while observing the effect on the picture, interference from this cause can result from microphony in one of the r.f., video or vision i.f. valves or even from sympathetic changes in the frequency of the local oscillator due to sound or other vibrations.

As an example, the symptom can sometimes be exhibited by subjecting the fine tuning control on

Fig. 3—Microphony of the frame amplifier valve produces this symptom of dark, horizontal lines across the picture.

the turret to a sharp tap when it is adjusted for optimum results on sound *and* vision.

To locate the faulty valve here requires the receiver to be passing a signal in the usual manner. The interference shows up best on a plain, unmodulated raster, however, such as the kind that is held in lock by the transmission of line and frame sync pulses and a little white level, as distinct from actual picture signal. Such transmissions are often radiated just after or before a programme sequence.

Vision valves under suspicion should be tapped as before, and the valve responsible will produce dark and bright horizontal bars across the raster. It should be noted that a vision amplifier valve which exhibits microphony may work perfectly satisfactory in another part of the circuit—in the sync separator stage, for instance. It thus pays to interchange a vision channel microphonic valve with one in a less susceptible circuit. This can save money.

If the valve is associated also with the sound channel, apart from the picture symptom a howl or ringing noise may also occur on the sound when the valve is tapped. Microphony in a valve concerned only with the sound signal, of course, will produce only the sound symptom, leaving the vision completely clear.

Tuner Microphony

Some old-style turret tuners are prone to microphonic disturbances, and in some cases the valves may not be responsible, even though they may appear to be excessively microphonic when a signal is tuned in. Actually, it will be found that the whole of the tuner develops a state of microphony (only when the tuner is correctly adjusted to a transmission) and lines on the picture and ringing on sound will result by tapping the tuner—or the receiver chassis near to it—at almost any point.

The first move here is to establish that the valves are free from the trouble; if they are not, then special attention should be given to the mounting of the tuner on the cabinet or chassis. On some sets the tuner is buffered by rubber grommets and, when these get hard or perish, vibrations are easily transmitted to the tuner with bad results. The cure, of course, is to replace the grommets; they are readily available.

The frequency changer—triode-pentode—valve or stage is the most affected by microphonic troubles. This is because the local oscillator signal often becomes modulated with the vibration and thus sends the disturbance through the rest of the set to be amplified and detected as if it were a normal signal. Apart from the modulation taking place in the oscillator section of the valve, vibration of a component—usually a capacitor—associated with the local oscillator can create almost exactly the same conditions (Fig. 4).

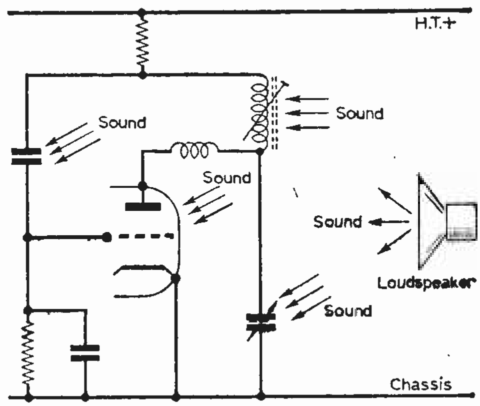


Fig. 4—Microphony symptoms can arise from the exciting vibrations modulating the local oscillator in the tuner. This occurs mainly from the sound causing a change in one of the components used for frequency control of the oscillator in the tuner, as this diagram shows.

Frequency Change

The sound vibrations on one of the components which control the oscillator frequency causes the frequency to change in sympathy with the sound. This, in effect, frequency-modulates the oscillator, so that after amplification and detection, there is superimposed upon the wanted sound signal the original vibrations.

If the feedback from the loudspeaker to the responsive component is large enough, conditions may exist for sustained feedback, thereby giving rise to a microphonic howl due to exactly the same conditions as illustrated in Fig. 1.

A component which has developed microphonic tendencies can be located by tapping with the end of the handle of an insulated electrician's screwdriver, keeping the hand as far away from the circuit as possible to minimise hand capacitances effects which could suppress the trouble. Note that microphony of this kind will only show up when the set is tuned dead-on to a carrier—sound or vision, whichever the case may be—and for this reason some service technicians favour tracing microphony with an unmodulated signal applied to the set from a signal generator, for then the degree of microphony can often be varied to suit the test conditions just by altering the level of the applied r.f. signal.

Microphonic Joints

A certain section of the receiver can be afflicted by microphonic symptoms as the result of a dry joint or bad soldering. The defective area can usually be traced by systematic and controlled tapping with the handle of a screwdriver. The effect of the microphony will vary as the chassis and circuits are explored in this manner and when the tapping is very close to the defect even the very lightest of taps will excite the symptom in great vigour and often cause sustained microphony.

It is thus a matter of reducing the fault area by this mechanical means, leading eventually to the trial replacement of suspect components or the resoldering of suspect joints. Unfortunately there is no simpler method yet evolved of tracing and clearing trouble of this kind.

Remember that a screwdriver with an insulated handle must be used as the tapping medium, for tapping the chassis with metal would cause clicks and crackles which would over-ride the microphony effect. Also, some microphony symptoms show up only when the set is passing signal.

Timebase Troubles

Line timebase circuits and valves may also become microphonic (especially those related to flywheel line sync circuits) and the symptom is then a horizontal displacement of the picture. The maximum displacement of the picture due to this cause is given as approximately 1mm on a 19in. picture tube.

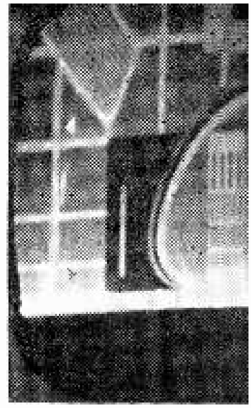
The vertical displacement due to similar trouble in the frame timebase should not exceed one line space for vibration frequencies up to 1kc/s.

There are various artifices in current application for the prevention or reduction of television microphony, and these include such things as anti-microphonic valves (where the electrode structure is firmly fixed and the natural frequencies of the electrodes are made as high as practicable), positioning a susceptible valve on a "quiet" part of the chassis, isolating the susceptible valve or component from vibration by means of resilient mountings or acoustical screening, damping to limit the vibration at resonant frequences and increasing the natural frequency of vibration of the chassis or cabinet by local strengthening.

Replacement

The experimenter and service technician should always have these things in mind if some unusual mounting arrangement is encountered, while if the trouble occurs on home-made equipment attention as above should be considered. Early valves gave quite a bit of trouble from microphony but most modern ones are designed to be anti-microphonic and, where the symptoms have been tolerated for years, replacement with a modern valve may well clear the trouble at last! ■

VALVE TROUBLES



BY D.

IT has been estimated that eight out of ten television breakdowns arise wholly or partly from valve trouble. Such breakdowns may affect sound or vision or both, while the symptom may be total failure or some spurious effect superimposed upon the sound and/or picture.

This article reveals to the owner/viewer enthusiast the various methods practised by professional service technicians to determine whether any particular fault symptom is caused by valve trouble. Although television generally is a highly technical subject, the majority of receiver faults can be cleared satisfactorily with nothing more than a basic knowledge of receiver circuits coupled with a good idea of the stage-to-stage chassis layout and the valve line-up of the receiver under repair.

This must not be taken to mean that one can expect to become a professional service man almost overnight, since an intimate knowledge of many hundreds of different models plus much more than just a basic understanding of television theory are ingredients essential to money-making servicing.

The " bench " professional man, of course, must be able to correct even the most complex fault on every make and model in double-quick time. Such a high degree of proficiency is cultivated from years of experience, and this *is* a case where experience is at least equally as important as knowledge. The field service technician does not usually require such a high degree of " skill ", for the bench man takes over if the job looks like being somewhat more complicated than a valve change.

Nevertheless, there is no reason at all why readers of this magazine—who are conversant, at least, with the basic elements of television receivers—should not be able to maintain their own receivers: and know, for instance, when the time has come to replace a specific valve.

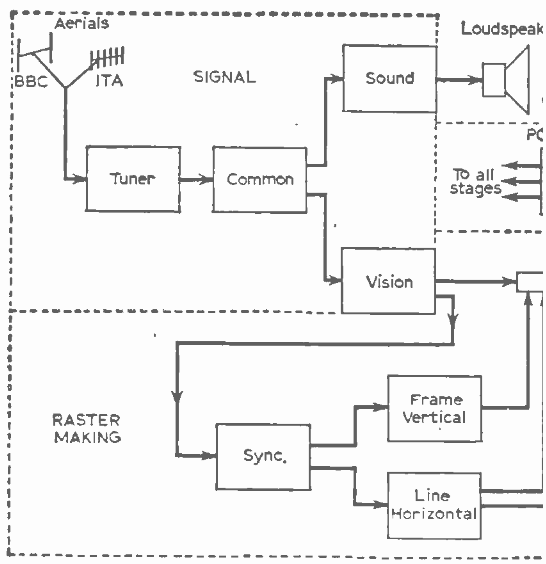
Stage-by-Stage Layout

The first thing to do is to get to know your television set even though there may not yet be anything wrong with it. All models can be divided into three basic sections or departments, each section comprises certain stages and each stage usually contains at least one valve or semiconductor (e.g., metal rectifier, diode or rectifier or transistor).

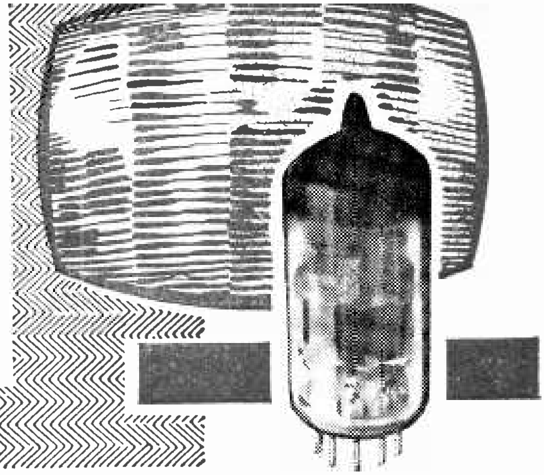
Firstly, there is the section which deals essentially with the signals proper as fed to the set from the aerials (see Fig. 1). This section is made up of the aerials, the coupling diplexer (if fitted), the tuner, the common i.f. stage, the sound stages and the vision stages. The sound stages feed the loudspeaker while the vision stages feed the picture tube.

Secondly, there is the raster making section. The raster, of course, is that " lined " background upon which the picture is built. The picture tube comes into this, as also does the h.t. and l.t. power stage. In addition, the section comprises the frame timebase, the line timebase, the sync stage which locks the timebases to the picture and the extra high-voltage (e.h.t.) stage which supplies the picture tube with 14,000V or so.

Thirdly, there is the power supply section itself. This has the h.t. rectifier stage and smoothing circuits which supply high-tension to the various other stages and valves. In a.c.-only receivers this section also features a mains transformer with windings for low-tension (heater supply) as well as h.t.



Tracing Television Valve Faults



ELLIOTT

In a.c./d.c. sets a mains transformer is not used and the h.t. rectifier is fed direct from the mains supply, while the valve and picture tube heaters are all wired in series and then connected to the mains in series with a large resistor, known as the mains dropper. This ensures that the heaters pass the correct current to give the rated voltage drop across each one, and is the way that l.t. is produced in so-called "universal" models.

Valve Line-up

The next thing to do is to identify the three sections or departments and the various stages in terms of valves in one's own receiver. In Fig. 2 is shown a typical layout (Ferranti Model 14T3) which will do as an illustration. Check the stages in conjunction with the block diagram of Fig. 1.

In the tuner we have V1 and V2, which are the r.f. and mixer stages. The common i.f. is V3, while V4, V5, V7 and the picture tube represent the vision stages, and V6, a part of V9 and V10 the sound stages. All the above, including the aerial, are in the *signal* department.

The *raster making* department contains V8 the sync separator, part of V9 and V11 in the frame, V12 and V13 in the line and V15 in the e.h.t. stage.

Finally is left the power department, and this is looked after by the solitary h.t. rectifier V14. Some sets have two valve rectifiers for h.t. or one or more metal rectifiers, depending upon the type and design.

There are, of course, many more components relating to these stages; in fact, an average television receiver has about 3,000 parts, but as this article is concerned about valves we have no need to bother about the other components.

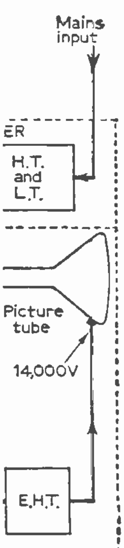


Fig. 1—The basic stages of a television receiver which can be divided into three sections: signal; comprising tuner, common sound and vision; power, comprising the h.t. and l.t. circuits; and raster making, comprising the sync, frame, line and e.h.t. stages.

The points to note on the stage and valve identification exercise are that the sound and vision interference suppression stages are included in the *signal* department and the efficiency diode (sometimes called boost or recovery diode) is included in the raster-making department.

On most models the tuner looks into a single valve, which is the common i.f. amplifier, and then this splits two ways—one way going into the sound stages and the other way into the vision stages. On certain receivers there is no common i.f. stage, and the tuner stages feed two ways into the sound and vision stages.

Readers who are really keen to maintain their own sets should make a special effort to obtain a service manual or service sheet. This gives the circuit diagram of the receiver as well as the layout of the valves, from which the three departments referred to above can easily be established. It must be stressed that a knowledge of the layout of the receiver is essential before any useful maintenance work can possibly be undertaken.

Trouble in the Power Department

If anything goes wrong with the h.t. rectifier valve (or metal unit) pretty well the whole of the set is affected. If this valve is totally defunct, then there is neither sound nor vision, since there is no h.t. voltage. Note, however, that the heater of a defective valve may remain alight—a glowing heater is definitely *not* a conclusive indication that the valve is good.

The first indication that this valve is failing is that the width of the picture is reduced and that the width control (if fitted) is hard over to maximum. In some instances, the valve may tend to glow a purple-blue colour, showing that its vacuum is poor. At other times sparks may be seen flashing over between the electrodes, indicating that the cathode is breaking up. Take care here, though, for a short on the h.t. line could aggravate this trouble.

When the rectifier is badly gone, the height and brightness of the picture, as well as the width, will be affected. The sound may also go weak and a ripple may be heard in the background (note that a low value smoothing electrolytic capacitor could give a similar symptom).

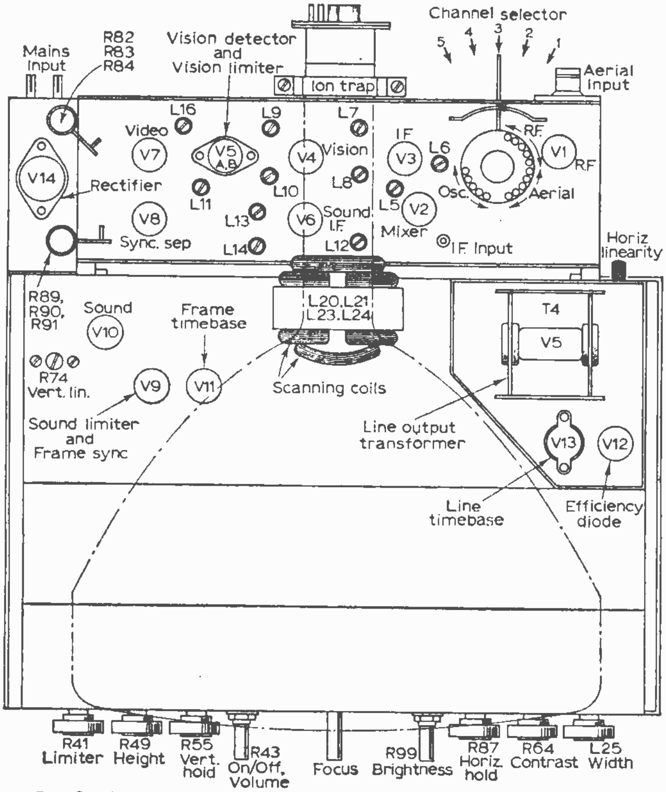


Fig. 2—An example of stage and valve layout (Ferranti 14T3 series).

Raster Making Valve Troubles

Total failure of a frame valve will cut off vertical deflection on the screen of the tube and result in a bright, horizontal line, while low emission will cause cramping at the bottom of the picture, as shown in Fig. 3. A loose electrode in the valve may cause the picture to dance up and down when the valve is tapped or in time with the sound when the volume control is turned up high.

If the oscillator section of the valve is faulty (a triode-pentode is often used in which the triode is the oscillator —or part of—while the pentode is the amplifier), similar symptoms could result, but on the other hand the picture may be steady for a while when the frame hold control is turned hard against one stop. It may then roll intermittently or it may continue to roll over and over or lock halfway, as shown in Fig. 4.

Another symptom of a faulty frame oscillator valve is shown in Fig. 5. Here the picture is folded over upon itself vertical, and cannot be increased to normal height.

Total failure of the line timebase oscillator or output valve, the booster diode and e.h.t. rectifier would cut off the screen illumination completely. Apart from the e.h.t. rectifier, the other valves of this section would also prevent the normal scan, but this fault would not be seen because it is the line timebase which usually drives the e.h.t. circuit and lack of line scanning power also means lack of e.h.t. voltage.

If the line whistle can be heard (try adjusting the line hold control to reduce the pitch of the whistle), then one can be sure that the line oscillator valve is functional. If the whistle is present but the e.h.t. rectifier heater is out, the rectifier heater could be open-circuit or there could be trouble in the line output valve or booster diode. If a nice ¼in. arc can be drawn from the anode of the e.h.t rectifier from the tip of a screwdriver *(held, of course, with an adequately insulated handle)*, the e.h.t. rectifier is almost definitely bad.

Suspect the line output valve if this is badly overheating when there is no raster and when there is

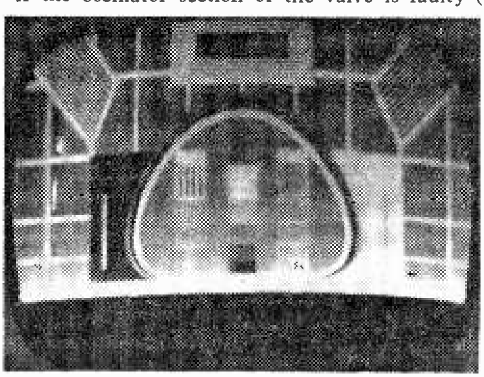


Fig. 3—Compression at the bottom of the picture like this indicates that the frame amplifier valve is weak.

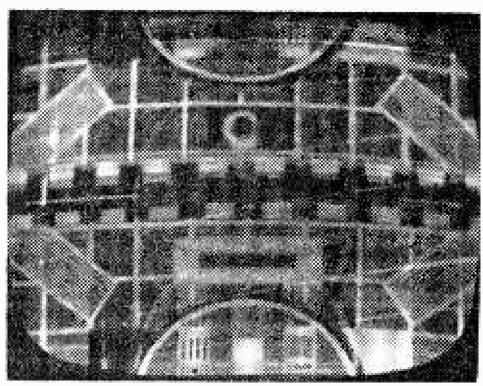


Fig. 4—If the vertical hold control will not clear this effect, the frame oscillator valve may be low emission.

no e.h.t. pulse at the anode of the e.h.t rectifier, but provided the line whistle is present.

Low emission of the line amplifier would give reduced picture width, while with the boost diode a vertical, bright line or band may appear towards the centre of the picture. A weak e.h.t. rectifier valve gives a dim picture which tends to "blow up" and disappear from the screen as the brightness control is adjusted. The same symptom may occur due to low emission of the line output valve or boost diode, in addition to the other symptoms mentioned.

An ageing line oscillator valve could fail to bring in line lock within the range of the line hold control, thereby giving the symptom as shown in

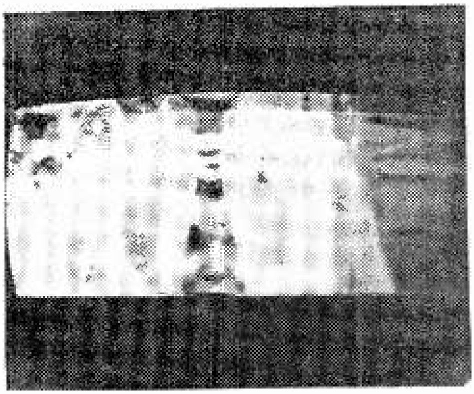


Fig. 5—This is another symptom of a weak frame oscillator valve.

Fig. 6; or the line may just lock right at the end of the travel of the line control, and break up intermittently on programme change.

Trouble in the sync separator valve shows up as weak frame and line locks, even though the correct locking point in each case is towards the centre of rotation of the control. Total failure of this valve prevents even the weakest lock on both the frame and line, and the whole picture zigzags completely out of control—rolling and tearing simultaneously.

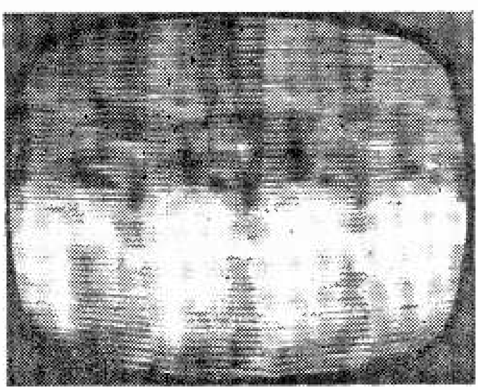


Fig. 6—Lines like these indicate that the horizontal oscillator stage is operating at the wrong frequency. If the horizontal hold control fails to clear the trouble, suspect the line oscillator valve.

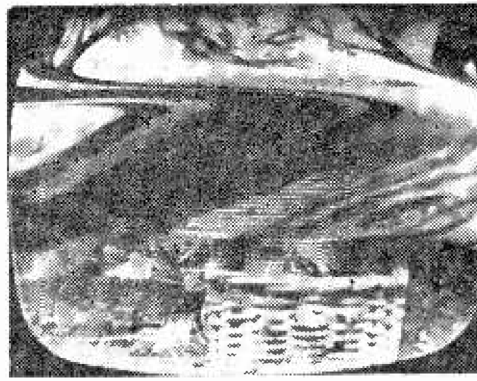


Fig. 7—The symptom was caused by a heater/cathode leak in the video amplifier valve.

Trouble in the Signal Department

Neither sound nor picture would be expected by complete failure of a valve in the tuner or common i.f. amplifier stage. A worn r.f. tuner valve, however, would give a lot of picture "snow" and possibly a hiss on sound, particularly on the independent programmes.

Similarly symptoms may occur with a worn frequency changer tuner valve, but in addition the fine tuning may drift as the set warms up or it may

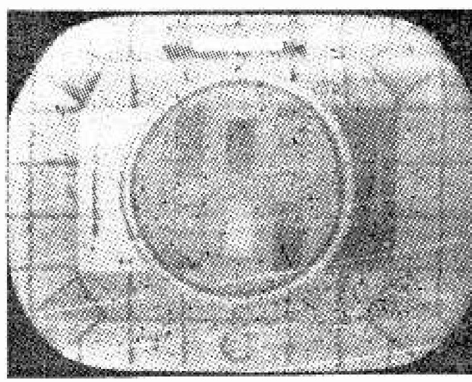


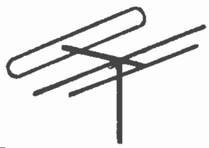
Fig. 8—A negative picture of this kind can be caused by a worn picture tube or video amplifier valve. Also check the vision interference limiter control.

be impossible to get the best picture and sound within the range of the fine tuning control.

An ageing common i.f. amplifier valve would not provide picture "snow" or sound hiss, but it would give a weak picture and sound. For example, a washed-out looking picture even at full contrast.

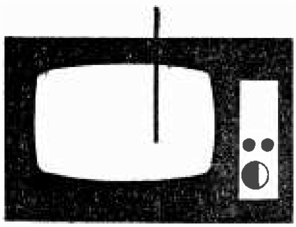
Total failure of any valve in the sound stages would cut off sound altogether, while the picture would be likewise cut off due to failure of a vision stage valve. In the latter case, however, a raster (screen illumination) would be obtainable by turning up the brightness control except (possibly) in the event of the video amplifier valve being to blame.

—continued on page 379



A MONTHLY COMMENTARY

Underneath the Dipole



BY ICONOS

THE wide differences in programme policy between the BBC and ITA become more obvious as the weeks go by. They seem to have exchanged hats. BBC producers now appear to have the freedom to put on to television more or less what they like, artistically or politically, with little thought of the consequences. On the other hand, "Auntie" ITA has become much more cautious, directing, inspecting and even banning programmes. One of the results of the Pilkington Report which has taken effect has been the gradual elimination of the Advertising Magazine programmes of the "Jim's Inn" type. I have always thought that these programmes were fairly innocuous, quite well presented and, in a way, usefully instructional. The details of how to operate a new type of vacuum cleaner or kitchen gadget have been appreciated by housewives, some of whom have said they were far more useful in a practical sense than the routine advertising commercials.

Admags and Politics

I appreciate the argument that some viewers of less sophisticated type might think that an "admag" is a genuine documentary item, the authenticity of which was endorsed by some unnamed and invisible consumers committee. The same argument could be used about many other programmes, as seen by certain sections of the viewing public. Most people, especially foreigners, still look upon the BBC as being a semi-official government department, and are puzzled when individuals on television utter opinions which are critical of the monarchy, the church, the government or the constitution of this or any other country. That is why the clever "scoop" that the BBC achieved in securing a filmed interview of M. Bidault misfired—or rather, backfired.

Co-ordination

There has been an outcry about the lack of programme co-ordination between the BBC and ITA, which was climaxed during the debate in the House of Commons on the Television Bill. At one time, this debate became a sort of extension of a typical railway compartment discussion on the 8.20 a.m. train to town. Mr. Philip Goodhart, M.P. for Beckenham, a devotee of Westerns, bemoaned the overlapping of "Laramie" on one channel with "Bonanza" on the other. M.P.'s swapped opinions about "Juke Box Jury", "TWTWTW", "Z Cars", "Coronation Street", "Monitor" and "Dateline", with all the abandonment of critical commuters, during the debate on the second reading, which lasted from 3.30 until ten o'clock. The Parliamentary Debates (Hansard) report of the occasion reveals the wide field covered, including many valuable technical points touched on by an ex-Post-Master-General, Mr. Ness Edwards. It was a good debate, marred only, I thought, by unnecessary and undeserved attacks on certain high executives of the ITA. Memories seem to be short, because these same executives had to fight battles, talk persuasively and act quickly to induce the original programme companies to take the plunge and risk a considerable amount of capital. As everyone knows, a lot of money was lost in the first couple of years of Independent Television, before the tide turned. The technical problems of the turn-over from 405 to 625 lines and colour were fully realised by many M.P.'s, especially the difficulties of networking dual transmissions on the two lines standards, which will be necessary for many years. Just think of the tasks that lie ahead for both BBC and ITA. Line standards converters from 625 lines down to 405 and vice versa will have to be temporarily located in various spots all over the network, so that in some areas, the quality of transmission may for a time deteriorate slightly until the higher standard can be sent direct all over the country on modified co-axial cable links or by microwave "hops". Transmission of 625-line programmes may be from new u.h.f. masts in many areas, to be shared by both BBC and ITA, and a great deal of technical co-ordination will have to be undertaken.

"Auntie ITA"

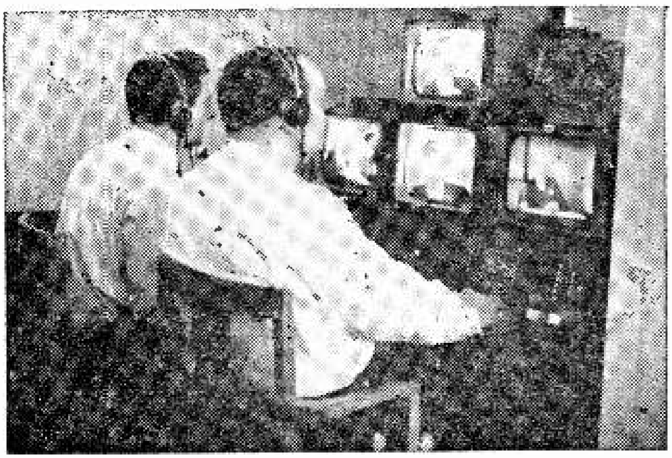
On the other hand, the ITA are said to have taken quick action in the case of a Granada programme *The World in Action*, which contained an item critical of government spending on defence, and was banned on the grounds that it did not preserve political impartiality. The ITA no doubt remember the storm which arose some years ago when a political debate in a Granada programme *Under Fire* got out of hand. That was in the days before programmes could be video-taped. Now regional officers of ITA frequently request pre-viewings of taped programmes of films, if they suspect propaganda, violence or any other undesirable ingredient. Clips of current films showing at cinemas are often seen in regional ITV programmes, and if these are in the "X" category, the local ITA officer usually likes to have a preview for approval, particularly if the film concerned is being transmitted before 9.00 p.m. This is as it should be.

A sequel to *The World in Action* defence film situation was the transmission by the BBC of this item, banned by ATV. Here was a new principle, the immediate outcome of the unlimited licence recently adopted by the BBC. That there should be one law for both is obvious. That both should be given a freedom that can be used with irresponsibility is indeed doubtful.

The Drum Beat

As to programme co-ordination between the BBC and the ITA, it is a liaison that will not be easy to achieve. It is difficult enough to arrange complete co-ordination within the framework of the ITA programmes, with their differing centres of production origination. Just how far should co-ordination go? Take the case of a recent Sunday programme, which included " Sunday Night At The London Palladium", in which the orchestra was conducted by Jack Parnell. This was followed by Leon Griffiths' satirical comedy on a secret agent theme *A Love of Treason*, for which Jack Parnell provided and played stylised drum rolls as a "tension" musical background, and most effective they were, too. Immediately after this ATV production, came the ABC series *The Avengers*, with almost identical tension music on the drums, provided this time by Johnny Dankworth. It was quite an evening of percussion, a coincidence which is difficult to avoid now and again.

Both of these dramatic offerings were cloak - and - dagger affairs about the secret service and espionage. *A Love of Treason* was a well directed story set in a seedy London hotel used as a hide-out for a spy or counter-spy, who is surprisingly communicative to the owner and his wife. The confident and sophisticated secret agent was smoothly played by Ian Bannen, and the gullible hotel owner by Bernard Cribbens. Mr. Cribbens is an actor to watch—he always gets the utmost from any character part he has to play. As for the idea of a satire on secret agents: well, it didn't quite come off, notwithstanding good direction and acting. Still, one left the switch on for the second dose of secret agent drama in one evening, to watch Patrick Macnee and Julie Stevens prowl around a fairground in search of an alleged corpse. This was in an instalment of *The Avengers*. The camera technique in this play called for many close-ups, using a style in which the lens followed the actors around. This was rather a restless method, particularly if long-focus lenses are used and the camera is wobbled. I found it trying to the eyes.



The control console of the Rank mobile TV unit, which was installed in a London hotel recently to show a new product of Johnson's Wax to over a hundred salesmen. Six receivers showed live pictures from a complete studio which had been set up in under two hours in an adjoining room.

Pretentious Trivialities

The Avengers has achieved the distinction of being criticised in Parliament as being of trivial character. When do plays become non-trivial? When they have a message, I suppose. One of the greatest of film producers, Sam Goldwyn, once said " If I have a message—I'll send it by Western Union telegraph, not on film!". The ATV play *Exits and Entrances* was one of those modern plays with no beginning and no ending, and so far as I was concerned, not much middle either. There was a tedious scene between a young art student and a neglected wife, in which the writing was so muddled that it made one wonder who had okayed the script!

Modern playwrights seem to overcome the problem of leading up to a denouement by the simple process of omitting it altogether, leaving this to be supplied by the imagination of the TV audience—that is, if the weary viewers haven't already switched over to the other channel.

Triviality De-Luxe

I am determined this month to end my notes in a trivial manner by writing about a trivial play which must have pleased the large proportion of viewers who are escapists. I refer to *My Lords, Ladies and Gentlemen*, a comedy written by John Whitney and Geoffrey Bellman, and directed by Dennis Vance. Here was an old theme developed along new lines about a barber who attended to the tonsorial requirements of the Chancellor of the Exchequer in Downing Street. Dennis Price gave a beautifully polished and amusing performance as the barber, well balanced by Avis Bunnage's portrait of his nagging wife, and Emrys Jones as the sly lodger. Dennis Vance's direction was first class, and his use of the " Barber of Seville " music was expertly timed and added to the fun. This was played in a most unusual manner for TV plays —on the set in the studio instead of being taken from a disc or tape. *My Lords, Ladies and Gentlemen* was a really first-class piece of triviality which deserves a repeat. Encore!

The PRINCIPLES and PRACTICE of TELEVISION

By G. J. King

LARGE-SCREEN AND PAY TV, AND SHARED AERIAL SYSTEMS

CONTINUED FROM PAGE 309 OF THE APRIL ISSUE

LAST month we dealt mainly with the design and basic construction of u.h.f. aerials and also looked in at the "communal" or "shared" aerial system. As the number of communal systems and viewers taking their signals from them is progressively rising, a little more information about them is warrented.

Fault Masking

Some fault queries from readers who are working from a communal aerial system signify conclusively that the chief trouble lies not in the receiver but in the system itself. Unfortunately, a fault on the system can often be partially masked—sufficient in some cases to provide a just-about-acceptable picture—by putting the set a little out of adjustment either in terms of video balance or tuned circuit alignment.

At the outset it must be stressed that this is a very bad thing to do or let be done. Communal systems using coaxial cable as the network medium should always be designed in such a manner that they provide signals which do not differ in basic characteristics from those which are obtained direct from an aerial. Indeed, as its name implies, a shared aerial system (or the same thing with any other name) is, in fact, an aerial which is shared by a number of viewers.

It is nothing more exciting than that, but it can bristle with problems and make life difficult for both the operator and his subscribers if it has been badly designed and installed in the first place. Although the majority of systems are good ones, there are, unfortunately, still some bad ones, which cause some trouble to local television dealers.

Communal systems may be large or small—ranging from the town or city system to the flat or estate system. Town systems are really outside the providence of the experimenter and service technician as they are usually operated by some big relay company or by a group of local traders.

Specialised Make-up

These systems are somewhat specialised in make-up and feature a very elaborate master aerial, which is invariably hill-sited in a high signal field well away from interference. This is where coaxial relay systems can be of considerable advantage to the fringe area viewer, for the master aerial is a very costly affair and if the network system is designed properly, then each and every viewer on the system is in effect using an aerial which has cost many hundreds of pounds to erect.

Moreover, each viewer has the advantage of the height of the master aerial coupled with its interference-free location. A coaxial relay viewer, therefore, is often able to obtain several more programmes—some distant channels—than his neighbour who is using an ordinary chimney-mounted aerial.

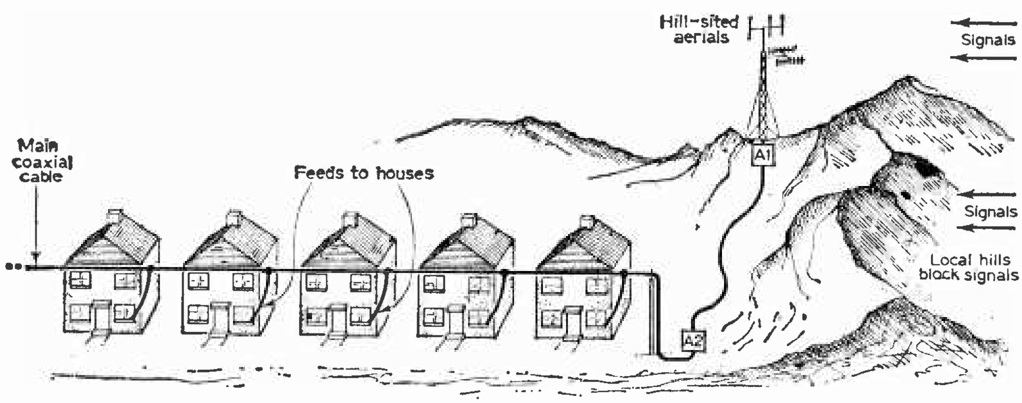


Fig. 34—Small shared aerial system. Signals picked up by the hill-sited aerials are fed into the shielded area through coaxial cable after first being amplified at the aerial by A1 and by A2 at the start of distribution. Feeds to houses are taken through resistive taps as described last month.

Channel Changing

On large systems the Band III channels are sometimes changed to unused Band I channels to avoid unnecessary signal loss in the cable at Band III frequencies, bearing in mind that the cable loss on Band III is almost double the loss on Band I. The signals are not always converted to Band I channels, however, and some recent systems even pass the signals through the coaxial network at Band III frequencies, as well as at frequencies in Bands I and II.

Such systems thus carry, in addition to television, programmes in Band II. It is not unusual for a town system to pick up Radio Luxembourg at the master aerial station and use the audio signal to frequency modulate a specially produced carrier corresponding to a spare Band II channel, thereby permitting subscribers on the system to obtain Radio Luxembourg at f.m. on their ordinary v.h.f.-f.m. sets or on the f.m. radio side of their television sets!

Pay-TV and Large-screen Programmes

Systems working in Bands I, II and III will become commonplace as television in the u.h.f. bands (Bands IV and V) develops throughout the country. This, of course, is because there is insufficient "radio space" in Band I only to accommodate all eventual programmes, including pay-TV programmes, which have now been authorised by the Government—in its second White Paper on the Future of Broadcasting—on an experimental basis.

This White Paper also gave the go-ahead for large-screen, cinema-type closed-circuit television programmes. These will probably be screened at cinemas in colour and will include programmes of local interest such as sport and plays. Again, the coaxial relay system may well be called upon to help with the distribution of this kind of local programme material.

Flat Systems

Small local systems, on the other hand, are far less complex than the town system. Many experimenters and service technicians have been responsible for bringing good reception to nearby neighbours by mounting a common aerial system on a local hill and feeding the signals to a group of would-be viewers—who are otherwise cut off from the signals due to screening by the local hill—through coaxial cable (Fig. 34).

Exactly the same idea is employed in a block of flats and for this reason the small system is often called the flat system (Fig. 35). This smaller kind of system does not usually convert to Band I channels for distribution but puts out the Band III programmes at their original frequencies.

Neither is it necessary to feature network automatic gain-control on small systems, though it is required in most of the larger systems to combat the change in attenuation of the main cable as its temperature varies throughout the day and night, summer and winter.

Full design considerations for a small local communal aerial system are given in Fig. 36 and this should be of considerable assistance to the experimenter who feels that he would like to help his neighbours obtain better reception while also improving his own. The plan is for three television programmes plus the f.m. sound programmes in Band II.

All conditions cannot, of course, be represented, but once the basic principles are understood the plan is easily alterable to suit any particular set of conditions. The television programmes are the BBC in Band I, the second BBC in Band IV or V and the ITA in Band III.

Owing to the high cable loss at ultra-high frequencies (approximately five times the lost at 50Mc/s at 1,000Mc/s in Band V) the second BBC programme is translated (converted) down to an unused channel in Band I (or in Band III). The Band I BBC programme is put over at its natural frequencies, as also is the Band III ITV programme.

In areas of weak signal field it is necessary to step up signals actually at the aerials to values suitable for working the main distribution amplifiers. Where the signals are strong, however, aerial amplifiers are not necessary, the aerial then being coupled direct to the main amplifier.

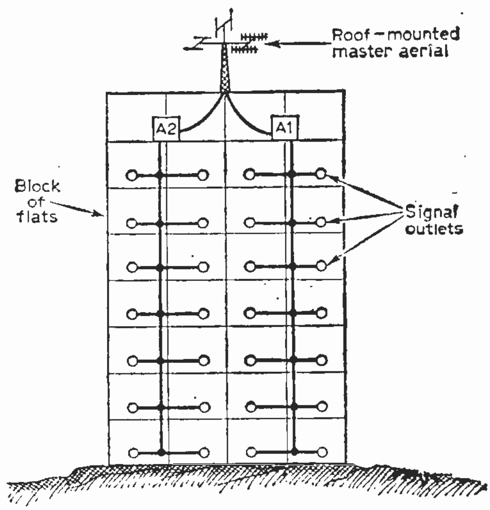


Fig. 35—Flat system. Here the master aerials are mounted on the roof and the signals are divided between two amplifiers A1 and A2. Each amplifier feeds its own main cable which is tapped for signal at each dwelling. In some systems a single amplifier system is used and the two main cables are then fed through a circuit splitter (see Fig. 36).

The object of the exercise is to ensure that the most distant viewer gets a signal of approximately 1,000μV on each vision channel (with the sound signal approximately 6dB down—half the vision signal). Now as the maximum cable attenuation occurs on the Band III channel the calculations are usually based on the losses at the corresponding frequencies and the gains of the Band I amplifiers are reduced by about 6dB to equalise the signals in all channels at the end of the line.

On the plan in Fig. 36 the Band III aerial signal is 250μV. This is stepped up eight times (18dB) by the aerial amplifier so that the main Band III amplifier receives 2,000μV (e.g., 2mV) of signal. The main amplifier steps up the signal by a further hundred times (40dB) so that a signal of 200mV is produced at the output.

The signal is cut by half (6dB total—note that decibels add) by the combining filter and splitter together so that each main cable starts off with 100mV of signal. Now as the signal travels along the cable so it is weakened and the amount that it is weakened depends upon the length of the cable, frequency and the number of viewers tapped off the cable.

Each subscriber tap extracts the required amount of signal from the main cable to give 1mV of signal at the top channel and because the signal level falls progressively along the cable it follows that taps with graded values must be used from the start to the finish of the line.

The greater the loading given by the tap the greater is the loss that reflects into the main cable. Thus we have the cable loss *plus* the loss (overall) introduced by the taps. In the plan we have supposed that each main cable with its tap loadings drops the signal ten times (20dB) from the start to the finish.

This means that the 100mV of launching signal is down to 10mV at the end of each cable. A further 20dB is introduced by the final tap, meaning that the final subscriber on each cable gets 1mV vision on the top channel, which is what we set out to achieve in the first place.

Exactly the same things happen on the other programmes but the lower Band I frequencies mean that the cable loss is less so, depending upon the actual aerial signal on the other programmes, the main amplifiers usually require a smaller gain setting than that used on Band III.

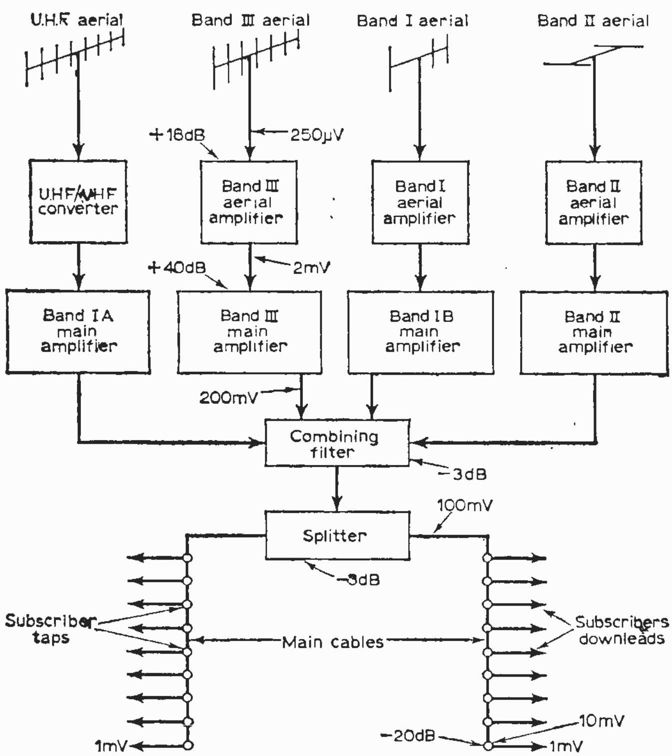


Fig. 36—Plan of small shared aerial system. The new programmes in the u.h.f. bands are converted to a suitable Band I channel. The Band III signal is distributed at natural frequencies, as are the Band I and Band II signals. All the signals are combined in the combining filter and then fed to two main cables through a splitter. The system is best designed for the highest frequency channel to be distributed (since the cable losses are greatest at that frequency) and then the gains of the other amplifiers can be adjusted accordingly to give a desirable balance of signal on all channels at the end subscribers. On Band III we have 250μV of aerial signal (vision) which is stepped up to 2mV by an 18dB aerial amplifier. This is then fed to the main Band III amplifier whose 40dB gain lifts the signal to 200mV. This drops to 100mV by the combined losses of the splitter and filter. The loaded cable accounts for 20dB loss and the last tap for 20dB loss, thereby leaving 1mV of signal at the last subscriber.

On simple communal aerial systems the signal for viewers is often extracted from the spur or main cable via a resistive take-off as shown in Fig. 37. The value of R governs the amount of signal taken from the cable and the amount of signal extracted governs the degree of loading loss due to the tap. Taps are readily available from all the firms dealing with equipment for coaxial relay and communal aerial systems.

Such firms as Belling and Lee, Teleng, Aerialite and others also have a full range of suitable amplifiers for use in the smallest to the largest of systems. It should be noted that a Post Office relay licence is required to operate a largish coaxial relay system (coupling two or three dwellings from a shared aerial does not usually attract a licence, however) and before such a licence is issued the system has to conform to certain technical standards.

Inter-modulation

One of the single biggest problems of coaxial relay systems is inter-modulation (sometimes called cross-modulation). The symptoms are a ghost image of an adjacent channel station drifting to and fro across the wanted picture and vision buzz on the sound. This effect may occur in varying degrees depending upon how far the viewer is away from the master aerial, the number of programmes carried on the system, how well the system is engineered and so on.

Coaxial systems should give pictures at least as good—and with less interference—as those obtainable from elaborate domestic-type aerials. The inter-modulation effects described should not be noticeable on a normal picture and sound. If there are troubles here then it in the interests of all the other connected viewers that a complaint is put in to the company or firm running the system.

U.H.F. Tests

To end this article on aerials and signals it is interesting to hear of tests carried out by Messrs. Aerialite at relatively large distances from the u.h.f. station. At the time of the tests the station was operating at an e.r.p. of 160kW and the aerial employed was an Aerialite 45/11 Yagi array with folded dipole and mesh reflector mounted at a height of 30ft for reception.

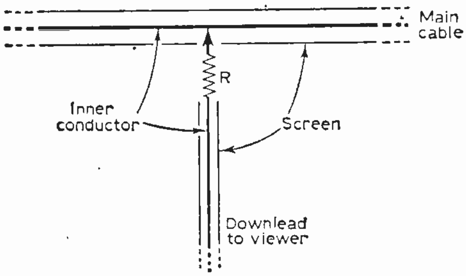


Fig. 37—Simple resistive tap for signal take-off from coaxial spur or main cable. The value of R determines the amount of signal taken from the line and the amount of loss introduced to it. Practical values range from about 180Ω to 2700Ω.

The tests confirmed particularly that coverage on the u.h.f. bands is not likely to be restricted to line-of-sight paths—as was first thought—nor to locations situated within a radius of 10-20 miles from the stations. In general the tests revealed that the pattern of u.h.f. reception follows that of reception on Channel 9 in Band III but often being of better quality and less subject to interference. In some screened sites signals were proportionately below the Channel 9 level, but this condition was rare.

Good pictures and no interference were obtained at a distance of 52 miles from the transmitter at an elevation of 200ft above sea level—actually in the Didcot area. The tests confirmed, however, that aerial placement and orientation are much more critical than at Bands I and III. Large variations in signal level were observed by moving the array less than a foot in locations of standing wave conditions.

It would thus appear that site probing will be essential at locations towards the edge of the service area to really secure the best possible signal/noise ratios. But the extra distance per transmitter angle looks like being advantageous and may mean that in several years' time more than just one u.h.f. station may well be receivable in any given local area!

(Editorial Note: A full report of the Aerialite tests was published in our March issue.)

CONTINUED NEXT MONTH

TV ALIGNMENT

—continued from page 347

A third method is to obtain a reading of the video current, as in Fig. 3(c), by breaking either the anode or cathode circuit of the video amplifier and inserting a milliammeter. Again, an increase in signal will produce a peak. The range switch of the meter should be set so that the maximum deflection accuracy is obtained, i.e. the peak or dip should be arranged to fall within the middle third of the scale.

When applying the signal to the vision circuits, switch off the signal generator modulation, to avoid spurious readings. Keep the generator tuned to the required frequency for the tests being made—it is extremely difficult to reset the generator scale with the accuracy necessary for correct alignment.

Thus, when adjusting the sound rejectors, select the sound i.f., inject the unmodulated signal and adjust for minimum reading of the vision output meter, then, without altering the generator setting, switch on the modulation and tune the sound circuits for maximum output.

MONITORING SOUND OUTPUT

The sound channel can be metered by the normal radio receiver practice of connecting an a.c. voltmeter (low range) across the secondary of the output transformer, or by switching to a higher d.c. range and then connecting the meter to the anode of the sound output valve via a 0·1μF capacitor.

Trusting to one's ear is not suitable for television alignment, as the tuned circuits need to be accurate to prevent spreading of the pass band, with the resultant buzz of vision-on-sound.

Remember to allow for drift of both the receiver oscillator and the signal generator by letting both warm up at least ten minutes before commencing operations. When tuning over-coupled transformers, as are often found in vision channels, it is desirable to damp the secondary of the transformer when tuning the primary, and vice versa.

Although the manufacturer will recommend particular damping circuits, a useful test procedure is to make up a shunt consisting of a 470Ω resistor with small crocodile clips attached, keeping the leads as short as possible.

When adjusting i.f. circuits, switch the receiver to an unused Band I channel, unless the maker's data advises an alternative procedure.

No information is given here on tuner alignment, as this is a specialised subject; it is not advisable to interfere with the maker's setting of preset tuner unit components.

REJECTOR CIRCUITS

Aerial injection and the setting of trap circuits follows the normal procedure. There will be found a number of second-channel rejectors and intermediate frequency trap circuits, varying between models. Final setting of these rejectors is always best done on the test card or transmitted signal, to allow for local conditions. More will be said about this in the final part of this article, when we deal with visual alignment, with the aid of the sweep generator and oscilloscope.

PART TWO FOLLOWS NEXT MONTH

SERVICING TELEVISION RECEIVERS

By L. Lawry-Johns

No. 89: PHILIPS 1796U and STELLA ST6917U

WITH reference to Fig. 6, an ECL80 was used in earlier models, not only in place of the PCF80 but also in place of the ECH83; this was the 1768U series. If the PCF80 and PL36 are in order check the PY81. If a slight line whistle is audible denoting that the oscillator is working and the above valves are in order check the 0·056μF boost line capacitor, C82.

With the cabinet on its side, line output uppermost, tuner to the bench, C82 is the top component on the left (front) tag strip. C83 (0·027μF) is immediately below this and although it is not concerned in the fault of no picture it is often responsible for lack of height and low volume (when the two are experienced together).

It shorts to the h.t. line thereby dropping the available voltage for the height control, focus, first anode and audio stage severely. The focus and brilliance of the picture are not as severely affected as may be thought.

Still on the absence of e.h.t., however, if C82 and the valves are in order check C503 (50pF 4kV) and C502 (100pF 4kV) which sometimes break down. These are in the line transformer housing.

If all these points are in order it is reasonable to suspect shorted turns in the line output transformer itself.

Line Hold

If the line hold is at the end of its travel check R60 (220kΩ) which is the second resistor from the top with the underside viewed as previously described, behind the hold control.

Then set the hold control midway, remove the strip from the rear centre of the chassis and adjust the core of S31-S32 for a locked picture.

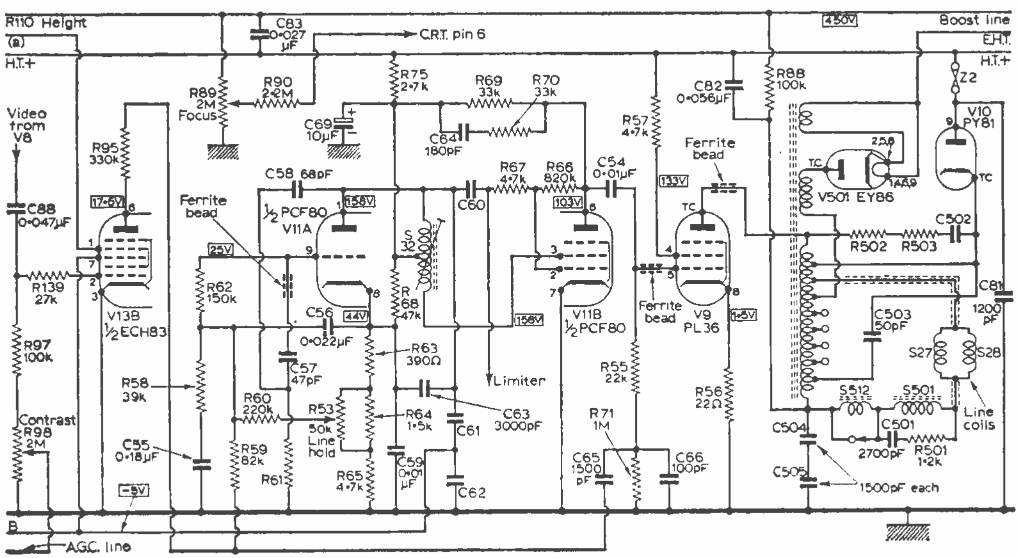


Fig. 6—The line timebase circuit.

Frame Hold

If this control is at the end of its travel, check R109 (2·2MΩ) which sometimes goes high. Check R108 (3·3MΩ) if necessary which forms with R109 a potential divider between h.t. and chassis, the hold control being taken from the junction. Check V13 ECH83 and V14 PCL82 if necessary.

Lack of Height

This symptom has previously been referred to but if the boost line voltage is normal check R111 680kΩ from pin 9 of the PCL82 to the height control.

Picture Normal, No Sound

Most often this is caused by V5 PCL83 failing and a replacement usually restores normal conditions. The sound may not fail completely but may still be available but extremely weak.

The rule is to check the PCL83 first. If the fault is illusive, the output stage may be checked by making a hum test at the volume control, which is fairly accessible. If there is no response at all and the PCL83 has been checked, take a voltage reading at pins 8 and 6 of the valve base.

If h.t. is at 8 but not at 6, the sound output transformer winding is probably o/c. If there is no voltage at pin 8 check R46 (330Ω) and if this is charred check C21 for shorts.

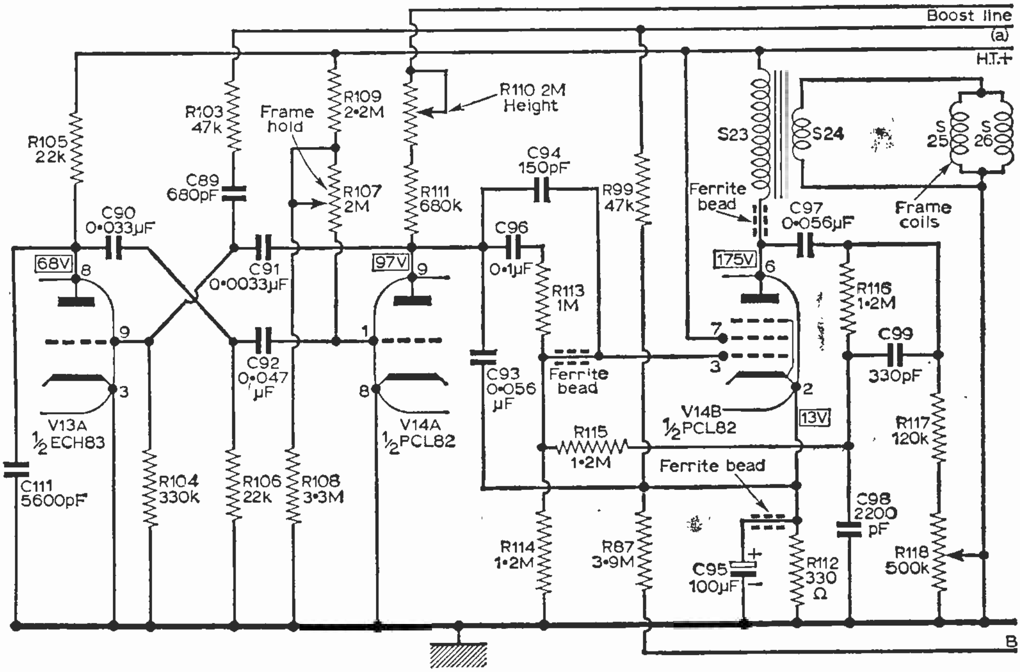


Fig. 7—The frame timebase stage.

Bottom Compression

This is usually due to the PCL82 failing in emission or C95 (100µF 25V) becoming o/c. In these receivers the bias resistor is of a higher wattage rating than is sometimes found in other receivers and does not change value so readily.

Sound Normal, Picture Weak

With a normal raster display, but a very weak picture with poor sync, attention is directed to C47 (100µF, 12V), which decouples the video amplifier cathode, and the OA70 vision detector diode (X1).

Also check the tuner unit valves, all three vision strips (V6, 7 and 8) EF80 valves and their supply voltages. H.T. should be recorded at pins 7 and 8 and cathode bias at 1 and 3.

Also check R311 which is a 6·8kΩ 1W high stability resistor in the tuner to pin 1 of the PCF80 base, via the contact strip.

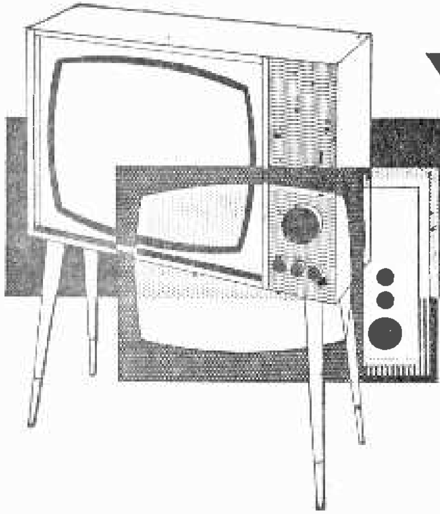
If the output is in order check the response from pin 2 of the PCL83 base. This should give a loud response when touched but if the response is distorted check R21, which can, and does, go high causing excessive limiting action and distortion on strong signals.

If the response is normal, however, check V4, EBF89 and V3, EF80 and their voltage supplies. A loud howl is sometimes experienced which worsens as the volume is advanced. This is invariably due to C20 (100µF 25V) becoming o/c.

No Sound or Vision Signals

When the raster is displayed on the screen but no sound or vision is received, although the aerial is known to be in order and the channel selector is properly set to either local channel, check the tuner

—continued on page 380



Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 376 must be attached to all Queries, and a stamped and addressed envelope must be enclosed.

EKCO T 415

Could you please tell me if there is any adjustment for linearity on this set. About a quarter of the picture is slightly extended at the bottom, but otherwise both line and frame linearity are good.

I have had the valves tested and found them to be in order.—L. Welldon (Greenford, Middlesex).

The frame linearity controls are the pre-set resistors, RV10 and RV11 on the upper half of the timebase printed panel.

PYE CTM 17F

When first switched on the picture appears at normal size, but after several minutes the picture gradually gets smaller, until is only about 10in. in width.—R. E. Webb (Chepstow, Monmouthshire).

Suspect a faulty PL81 line output valve, or change of value of its 4·7kΩ screen grid feed resistor. Also check that the FC31 metal h.t. rectifier has not become low in output.

FERGUSON 306T

Is it possible to increase the emission of the c.r.t. on this set, and if so, what is the correct procedure?—G. F. Comley (Trowbridge, Wiltshire).

It is quite in order to increase the tube current by means of a 5kΩ, 10W resistor wired from the mains dropper or voltage adjustment panel to the c.r.t. base, as is the case of all a.c./d.c. receivers, with the tube heater connected one side to chassis.

SOBELL T191

On first switching on, the BBC sound (channel 5) is very weak, while on channel 11 it is quite normal. After a few minutes the sound on channel 5 comes on suddenly at normal strength.

Also, the BBC sound is always slightly distorted. B. W. Sansam (Peterborough, Northamptonshire).

To correct the weak sound, set the channel selector to channel 5 and adjust the finer tuner control to its mid-way position. Remove the side panel and retune the oscillator coil core, near the spindle.

With regards the distortion, check the 3·3MΩ resistor, R86 to the OA81 sound noise limiter diode on the lower left side.

DECCA DM/14

I understand that I can change the 14in. c.r.t. in this set for a 17in. tube. Can you confirm this?

The e.h.t. is 15kV and the width control seems to be effective enough to give plenty of width. —H. R. Pascoe (Plymouth, Devon).

It is quite true that a 17in. c.r.t. may be fitted to this set, e.g. the MW 43-64 or MW 43-69, if the cabinet and mounting difficulties can be overcome. The scanning angle is the same and no electrical modifications are necessary; merely ensure that pin 7 of the c.r.t. base is connected to pin 11 or to pin 10.

PHILIPS 1768U

This fault is not permanent, but comes and goes and sometimes lasts for a few hours. When the fault is present, two black lines appear across the screen. They are both horizontal and

about ⅛in. in width. One is positioned in the centre of the screen, while the other is about 4in. lower.—R. Phillips (Llanharan, Glamorganshire).

The trouble could be due to a faulty PCL82 in the centre of the chassis, a dry joint associated with the base or a poor contact in the height or frame linearity control.

EKCO T164

The frame hold adjustment seems to be very critical and requires frequent adjustment to correct frame slipping.

I have substituted V12 (the sync separator valve) but without any effect. I have also replaced R63, R66 and R71 as their values had altered. I have checked the values of C64, C65, C68, C70, C72 and C79, all of which appear to be correct.—W. Bateman (Horsted Keynes, Sussex).

Check the Q3/4 interlace diode, which should be found on the underside of the set near the frame oscillator transformer.

FERRANTI TC1063

Occasionally, after first switching on, the sound will come up some five minutes after the picture. It then comes on very slowly as though a valve was just warming up.—J. W. Whitfield (St. Albans, Hertfordshire).

Indeed, the trouble described could, in fact, be caused by a "lazy" valve in the sound channel. Look in at the valves just after switching on, making sure that they all light. If one of the sound channel valves remains cold for the period that the sound is off, then that valve should be replaced. Otherwise, we would suggest that you have the valves tested by a dealer and replaced if weak.

FERGUSON 992T

Basically the picture is perfect, but whenever there is any sound, flashes of light cross the screen. These flashes increase in number and intensity as the sound gets louder.—G. Byrne (Gourock, Renfrewshire).

Remove the rear cover, and with the set working, adjust the tuning knob in the rear right-hand corner of the chassis for the best picture and minimum sound interference on the picture.

PYE VT17

Present on the screen of this set is a vertical white line, about ⅛in. wide, and 3in. from the left-hand side of the screen. This only appears on channel 9. Its position can be changed by altering the line linearity control, but this also results in bad cramping of the picture. The line hold and width controls have no effect on the fault, nor does reducing contrast.

I have changed the following valves with no effect; PL81, PY81, PCF80 (line oscillator) and PCF80 (frequency changer).—E. J. Sibley (London, S.E.4).

You should change the 0·05μF efficiency diode capacitor. This is mounted on the line output transformer, just behind the PY81.

DECCA 101

I wish to fit a CRM 123 c.r.t. in place of the CRM 92 tube in this set. Can you please tell me what alterations I shall have to make?—J. Eldridge (Enfield, Middlesex).

Electrically there is no difference in tube circuitry, but the 12in. tube will not give a very bright picture, as it has an aluminised screen and the Decca produces only about 7kV of e.h.t.—the 12in. tube requiring about 9kV for full brightness.

KB MV30

The picture on this set is extended at the top and slightly cramped at the bottom. Adjustment of the frame linearity control has no effect on this.—R. Mills (Bilston, Midlothian).

If the frame linearity control has no effect at all, then suspect the control and/or associated components for a fault. If, however, there is some change of linearity when the control is adjusted the trouble could still be alteration in value of associated component, but most likely low emission of the frame output valve is responsible. Check this valve and replace if low.

McMICHAEL CR317

The picture and sound will fade simultaneously, but both can be made to return to normal by switching on and off any other light or appliance in the house, either on the lighting or power circuit.—T. C. Bush (Merthyr Tydfil, Glamorganshire).

If the receiver is still in its original condition (i.e. BBC only) you should check V1, V2 and V3 (all EF80's) on the right side and see that these and V4 (EF80) are secure in their sockets. Clean the pins if necessary and check the associated capacitors and feed resistors.

It is only necessary to check the aerial input and up to the common i.f. stage (V4).

PHILIPS 1758U

The sound seems normal on this receiver, but the picture has a tendency to pull to the left. The line hold control has most effect on this in its mid-way position.

All the valves have been checked by substitution but without throwing any light on to possible faulty component.—J. Donaghy (Dungannon, Co. Tyrone).

The fault may well be due to reflected signals received by the aerial. If there is a light bar down the left side there is evidence of ghosting, and the picture mainly pulls when there is white content on the right, then the aerial should receive attention and should be resited.

If there is no evidence of ghosting, check the 47pF line sync feed capacitor to the PL81 valve base.

SOBELL T171

When first switched on, the picture comes up split vertically, and no adjustment of the horizontal control will remedy this. After a short while, however, the picture moves over to fill the screen, and stays perfect for the rest of the time it is on.

The ECL80 has been replaced, as have the resistors R58 and R59, but with no success. Lately the time the fault takes to correct itself has increased.—T. E. Smith (Atherton, Lancashire).

We would advise you to check the 6·8kΩ screen resistor to pin 8 of the PL81 and the PL81 itself.

ULTRA VT8-14

The picture suddenly collapsed to a horizontal line, about ⅛in. in width and positioned about half way down the screen.—E. G. Dixon (Salisbury, Wiltshire).

What you describe is a failure in the frame timebase. You should check the front right side 6K25 and 20P3 valves, the 0·5μF capacitor between the valve bases, the anode 2·8kΩ 10W resistor of the 20P3 and the 40μF capacitor in series with the frame scanning coils.

ENGLISH ELECTRIC 16T11D

Could you explain why this set suffers from lines on vision on ITA but not on BBC? I can reduce the effect of these lines slightly by careful adjustment of the gain and fine tuner, but this is never permanent.—H. Kirby (London, N.3).

The 16T11D was originally a BBC-only model. If an external converter is used for ITA reception, the patterning is due to BBC breakthrough, either being picked up on the converter to receiver coaxial stub, or by the r.f. stages of the receiver. As the BBC usually finishes transmissions before the ITA, note whether the effect stops at this time.

EKCO TC 220/1

The U191 runs red hot when the set is on, but it appears normal when the top cap is removed. This valve has been changed, but the fault remains. I have also changed the line output transformer and the 30P4.—W. H. Newcombe (Swansea, Glamorganshire).

Suspect a faulty line linearity coil or width coil. The linearity coil frequently slides down its core and shorts to chassis, and is often repairable.

BUSH TV43

This set had been giving very good service, until recently, when on switching on, I found that I could receive sound only, the screen being blank except for white lines across the centre.

I have tested the PY81 and PL81 valves, but without finding the fault.—J. Cooper (South Shields, Co. Durham).

You should check the ECL80 valve in the right side and if necessary, check the associated controls and transformer.

The fault is one of frame timebase failure. The ECL80 is the frame oscillator output valve.

KB OV30

I recently replaced the tube in this set and since have found the picture to be vertically elongated, leaving a black band visible down each side of the screen.—P. Bell (Greenford, Middlesex).

We presume the horizontal linearity control, the width and the mains voltage adjustments are correctly set. If so, check the 50CD6G and the 12kΩ screen dropping resistor to pin 8 of this valve. Check the h.t. voltage and if this is much under 200V, change the RM4 metal rectifier.

SOBELL SC24

Recently, my aerial fell from its fixing on to a metal roof. I presume that this was the cause of the set's fuse blowing. I replaced the fuse, after re-assembling the aerial in the attic, but there is now no trace of a signal, neither sound or vision on BBC. ITA, however, is perfect. I have replaced the tuner valves, but still there is nothing on BBC.—I. Davies (Southport, Lancashire).

We presume that when the aerial fell, the set was switched to BBC. In the first place, the fact that the aerial fell should not have blown the fuses. The fact that it did means that the aerial isolating capacitors (470pF) have shorted (at least one of them). Check these (on the aerial panel) and the BBC coils on the tuner, ensuring that the coils' ends have not been blown away from their soldered connections.

FERGUSON 206T

I would like to replace the PCC84 r.f. amplifier valve with a 30L15. Can this easily be done? —G. R. Huges (Bangor, Caernarvonshire).

Replacing the cascode valve with a frame grid specimen usually demands circuit alterations, however, you can try such a substitution and adjust the aerial and r.f. coil slugs for the best signal/noise ratio and sensitivity.

QUERIES COUPON

This coupon is available until MAY 22nd, 1963, and must accompany all Queries sent in accordance with the notice on page 372.

PRACTICAL TELEVISION, MAY, 1963

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TEST CASE -6

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

? *After several years' use a receiver started producing the symptom as shown in the diagram (Fig. 1). Here the illumination gradually spreads across the screen with uneven edges—rather like water dispersing on a greasy plate—as the set warms up.*

What is the cause of this trouble and what steps can be taken—if any—to clear it?

See next month's PRACTICAL TELEVISION for the solution.

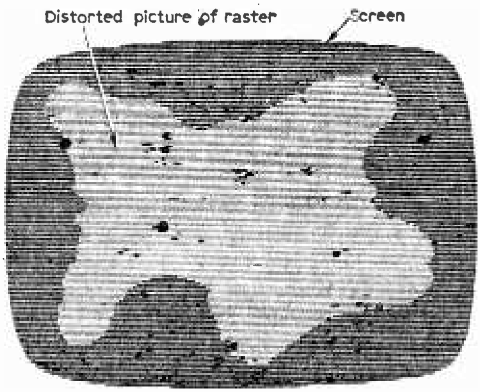

Fig. 1—See text

SOLUTION TO TEST CASE—5
(*Page 328, last month*)

Some receivers featuring flywheel line sync circuits employ a reactance valve across the line oscillator frequency-governing elements. The reactance valve "looks" to the oscillator as a capacitance and thus to some extent governs the frequency of oscillation.

The value of the effective capacitance of the reactance valve is varied by altering the grid bias voltage about a mean negative value. With the normal standing bias the capacitance is such that the oscillator frequency is for correct line lock with the line control at range centre. As the line lock control is adjusted either side of optimum, so the bias applied to the reactance valve is decreased or increased, thereby resulting in a manual variation of the line frequency.

The circuit also features a phase discriminator employing two diodes, and is fed with the line sync pulses and pulses from the line output stage. Now when the output stage pulses are perfectly in step with the sync pulses, zero voltage is produced by the discriminator. However, should the pulses tend to drift out of step, a negative or positive voltage is created by the discriminator. The voltage is fed back as grid bias to the reactance valve in such a way that any drift in the frequency of the oscillator is automatically corrected in terms of the effective capacitance across the tuned elements being altered accordingly.

The most susceptible part of the circuit is the grid circuit of the reactance valve, for any spurious signal here will result in random alterations of capacitance across the oscillator tuned circuit. Damping is thus employed, and this often takes the form of a resistor in series with a capacitor being connected between the grid and chassis.

If the resistor increases in value or the capacitor goes open-circuit, "hunting" of the nature described last month, is almost sure to take place. In circuits using a pentode reactance valve, the electrolytic capacitor decoupling the screen grid can also cause the effect if open-circuit or low in value.

VALVE TROUBLES

—continued from page 363

If a sound stage valve is low emission the sound will be weak and probably distorted as well, depending upon which valve is responsible, but the picture would not normally be troubled. Conversely, a bad vision stage valve would give a weak picture while the sound remains normal.

Poor insulation between the heater and the cathode of a vision stage valve may give the effect as shown in Fig. 7. This, in fact, was produced by a heater/cathode leak in the video amplifier valve. In the sound channel, the symptom would be a rough ripple and possibly distortion accompanying the sound.

A weak picture tube or video amplifier valve often gives a negative picture, as shown in Fig. 8. But remember that this fault can also be caused by a badly adjusted vision interference limiter control.

Heater Faults

Always bear in mind that failure of the heater of just one valve or the picture tube will cause all the heaters to go out in a.c./d.c. receivers (but not, of course, in a.c.-only models which have a winding on the mains transformer to energise the *parallel-connected* heaters).

A heater/cathode short in certain valves of such a set will bypass a section of the series-connected heater chain and cause the valves so bypassed to go out while causing those remaining in circuit to glow extra bright. ■

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.

PIRATE VIEWERS

SIR,—Many readers will surely share the indignation of your correspondent Mr. K. H. Wilson (April issue) who wrote to you on the subject of pirate television viewers.

The fact that many otherwise respectable persons are guilty of this mean offence and can apparently sit back night after night enjoying entertainment without any qualms, throws light on the extent to which the development of social conscience lags behind the advancement of material and technological standards.

The weakness of the present system, it seems to me, is in relying (in the first instance) on the individual to apply for a licence when a receiver is first installed in his home. I suggest the solution here is to make it compulsory for manufacturers to provide a registration card with each new receiver (radio or television). This would be an official "post paid card" and could quite conveniently be in the form of a tear-off section of the normal instruction card or booklet. Upon the sale of a receiver the retailer would fill in the model and serial number together with the name and address of the purchaser, complete the address on the other side by adding the name of the local town and then put the card in the post. The retailer's duty and responsibility would finish here. In the event of no licence being taken out within, say, the next seven to 14 days, the local post office could initiate their own enquiries.

I appreciate that this suggestion will meet with opposition from the retail trade—and one can sympathize to some extent with the view that this is solely the affair of the Post Office and that private business people should not have to act (or appear to act) as agents of a government department. Nevertheless, the above proposition has, I believe, distinct advantages and should be perfectly simple and straight-forward to operate.

This system would, of course, apply also to receivers supplied upon a rental or hire basis, and the local post office could arrange for retailers to be kept supplied with additional registration cards to cover the sale of second-hand receivers.

It would seem reasonable to expect the administration cost of such a system to be more than offset by the saving effected due to the abolition of the Detector Van organisation, while the redeployment of the skilled personnel now engaged upon this work would not, I venture to suggest, embarrass their employer in this age of great technological expansion.—L. P. BUTTERWORTH (Bath, Somerset).

FREAK RECEPTION

SIR,—I was very interested in a reader's letter in the March issue concerning freak television reception and I thought that the following notes might be of interest.

My house is situated in a valley, with hills on three sides, but in spite of this, first-class pictures can be received on channel 9 (Stockland Hill, ITA), channel 10 (St. Hilary, ITA) and channel 5 (Wenvoe, BBC) at all times of transmission. Also slightly grainy pictures, though still very acceptable, are received on channel 11 (Chillerton Down, ITA), channel 2 (North Hessary Tor, BBC), channel 3 (Rowbridge, BBC) and channel 4 (Hastings, BBC). All these stations have been checked when the appropriate test cards were being transmitted.—R. G. WIDGER (Beaminster, Dorset).

SERVICING TELEVISION RECEIVERS

— *continued from page 371*

unit valves as previously described and then make a more detailed examination of the tuner.

Check R311 in particular and ensure that all the contacts are making. Some types of tuners have a row of contacts which are engaged by pegs on the channel strips where these are of the printed type.

Quite often one of the pegs is found broken away and although this would only affect that particular channel, it may have been forced through the contacts, distorting them in doing so and thereby rendering the other channels inoperative.

On this type of tuner individual oscillator core adjustment is not available and the tuning is set up on channels 4 and 11, the fine tuner range then covering the correct tuning for each channel as selected.

Earlier models used normal coil biscuits which enabled each oscillator coil core to be separately aligned. This is done by selecting the desired channel, removing the centre brass ornamental screw and then the cover knob. Using a thin plastic knitting needle with a shaped end, insert into the hole at the 5 o'clock position and tune for maximum sound.

If the needle won't go in, rotate the fine tuner until it can. There is no need to remove the tuner unit assembly to do this operation.

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3V4	6/9	7B6	9/-	CY1	12/6	ECH81	7/3	PCC84	7/-	UBF80	7/9
5U4G	4/6	7B7	8/-	CY31	8/6	ECL80	7/3	PCC85	8/-	UBF89	7/3
5V4G	8/-	7C5	7/9	DAC32	9/-	ECL82	9/-	PCC88	12/6	UBL21	14/6
5Y3GT	6/-	7C6	7/6	DAF91	4/9	EF37A	6/9	PCC89	8/-	UCC84	11/6
5Z4G	8/9	7H7	5/9	DAF96	7/3	EF39	4/6	PCF80	6/9	UCC85	7/-
6AL5	3/9	7S7	9/-	DCC90	9/-	EF40	11/6	PCF82	7/-	UCF80	12/-
6AM6	3/6	7Y4	6/-	DF33	9/-	EF41	7/9	PCF86	8/6	UCH21	13/6
6AQ5	6/3	10C1	12/-	DF91	3/-	EF42	7/-	PCL82	8/6	UCH42	8/-
6AT6	5/3	10C2	16/6	DF96	7/3	EF80	4/9	PCL83	9/6	UCH81	7/6
6BA6	5/9	10LD11	11/6	DH76	4/9	EF85	5/-	PCL84	6/-	UCL82	9/3
6BE6	5/9	12AT6	7/-	DH77	5/3	EF86	7/-	PCL85	8/6	UCL83	13/3
6BG6G	13/6	12AT7	4/9	DK32	10/6	EF89	6/3	PEN36C	8/-	UF41	7/6
6BH6	6/-	12AU7	4/9	DK91	5/6	EF91	3/6	PL36	10/-	UF89	6/3
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6BW6	8/-	12K7GT	4/9	DK96	7/3	EF184	10/3	PL82	7/-	UL44	10/6
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6K7G	1/11	20L1	17/6	DL96	7/6	EM34	7/3	PY32	11/-	UY21	11/-
6K7GT	5/-	20P4	19/-	EABC80	4/9	EM80	8/-	PY80	6/6	UY41	5/9
6K8G	4/9	20P5	15/9	EAF42	8/6	EM81	8/-	PY81	7/-	UY85	5/9
6K8GT	9/-	25L6GT	7/-	EB91	3/9	EM84	9/-	PY82	6/-	VP4B	9/6
6K25	10/6	25Z4G	7/6	EBC33	5/-	EM85	9/9	PY83	7/-	VP41	5/-
6L6G	6/6	27SU	17/6	EBC41	7/9	EY51	7/-	TH21C	15/-	W76	4/9
6L19	10/-	30L15	10/3	EBF80	7/9	EY86	6/6	U24	15/6	W77	3/9
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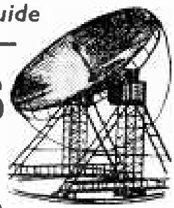

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