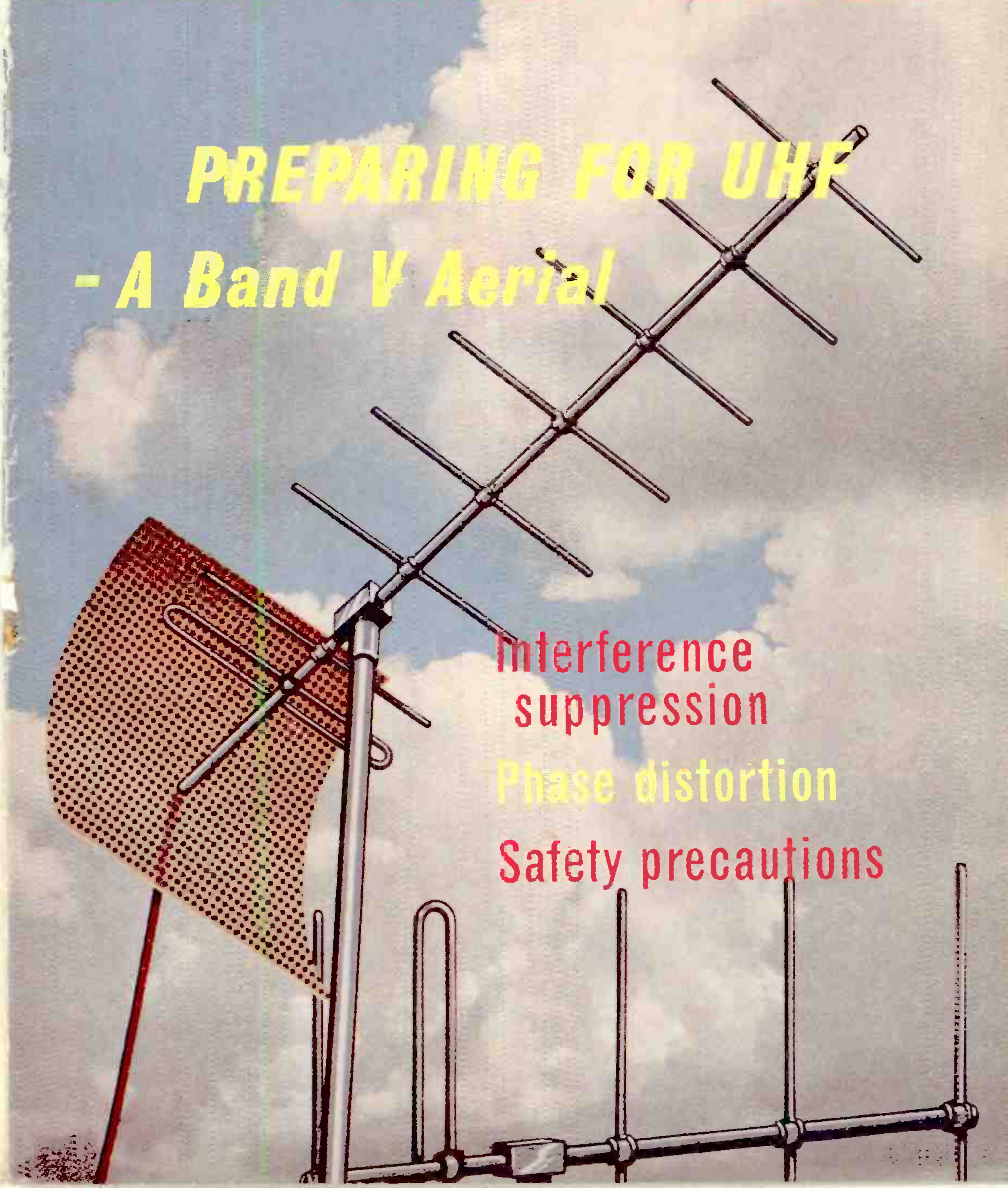
Practical TELEVISION

DECEMBER 1961

1/9



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Practical Television

AND TELEVISION TIMES

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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.

Bands IV and V

IT seems safe to assume that any extensions or developments in television techniques or programmes will take place on frequencies other than those at present in use, in order that existing receivers will not be rendered obsolete. This, of course, takes into account colour or any line definition modification which may be advised when the report of the Pilkington Committee is published. As readers will know, two frequency bands may come into use when any such changes are made; these are Bands IV and V. The former extends from 470Mc/s to 585Mc/s and the latter from 610Mc/s to 960Mc/s. These two bands are part of what is now known as the ultra high frequency band which covers from 300Mc/s to 3,000Mc/s, and, from these figures, it is obvious that special techniques will have to be employed in receiver construction. Those readers who saw the introduction of the ITV transmission on Band III will remember how great was the change from the Band I transmissions which were then standard, but the advent of transmissions on Band IV and Band V may introduce much greater difficulties, and those who are anxious to build equipment for receiving new transmissions will no doubt wish to start carrying out experiments and thus follow developments as they are made. We have already published constructional details of a Band V Signal Generator (in the October 1959 issue), but, now, reception of actual transmissions or experimental tests will be necessary. First a reliable aerial must be constructed and full details of a high gain array are given on pages 136-139.

We shall, of course, be introducing designs and details of apparatus from time to time as the UHF bands come into general use, and, next month, we shall be describing the construction of a Band V sound receiver in great detail; this design has been developed to enable circuit changes to be made easily so that future changes in transmission standards may be accommodated.

OUR QUERY SERVICE

ONCE again we must remind our readers of the rules of our Free Query Service. The following points should be carefully noted:

(i) We cannot undertake to answer technical queries over the telephone

(ii) All queries must be accompanied by the query coupon from the current issue

(iii) If a postal reply is required a stamped and addressed envelope must be enclosed with the query.

We must also point out that we cannot design circuits to readers' specific requirements. Nevertheless we shall continue to help readers as far as possible but it should be remembered that all information necessary for answering the query should be sent to us.

Our next issue, dated January, will be published on December 22nd.

Telenews

Television Receiving Licences

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

Region	*Total*
London	1,949,253
Home Counties	1,608,605
Midland	1,738,256
North Eastern	1,848,765
North Western	1,510,304
South Western	985,352
Wales and Border Counties	697,859
Total England and Wales	10 338,394
Scotland	1,044,836
Northern Ireland	169,425
Grand Total	11,552,655

A New Transmitter

THE Independent Television Authority's new transmitter at Caldbeck, near Carlisle, commenced programme transmissions on Friday, September 1st, 1961.

This transmitter broadcasts the programmes provided to the Authority by Border Television Ltd. It stands on a site 940ft above sea level and has a mast 1,000ft high.

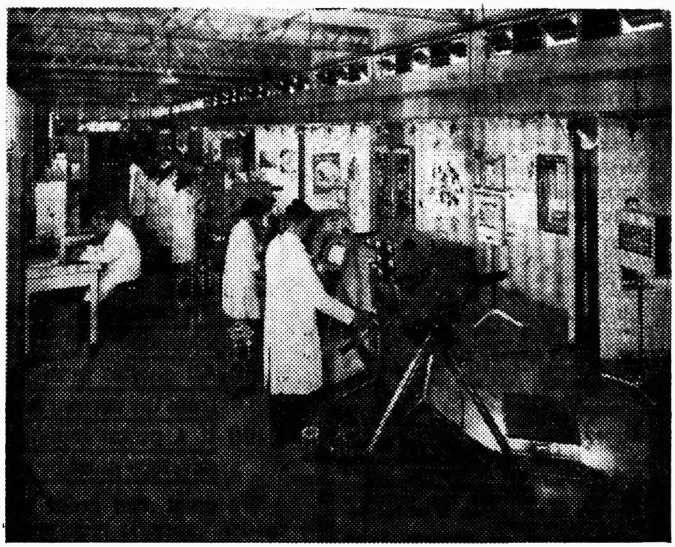
The station is equipped with two 5kW Marconi vision transmitters and two 1.25kW Marconi sound transmitters.

A New Ultra-Violet TV Camera Tube

THE direct observation of fundamental processes in living cells has been the aim of biologists for many years. This has been brought a step nearer by the development of an ultra-violet-sensitive vidicon television camera tube. Experiments in ultra-violet microscopy have recently been carried out by Dr. R. Barer, at the Department of Human Anatomy, Oxford University, using an EMI Electronics closed-circuit TV camera fitted with this new-type EMI tube.

Normally, the method of using an ultra-violet microscope—which can observe details in cells of animals or plants not visible to the human eye—is to take a large number of photographs for different settings of the controls, in order to ensure that some of them will be in focus. But high intensity ultra-violet radiation quickly kills the cells. Another disadvantage is that it takes time to develop and print the photographs, and some of those taken at vital stages of the activity may be so much out of focus as to be unusable.

The new EMI ultra-violet tube is so sensitive that the amount of ultra-violet radiation can be reduced to a level which does not kill the cells for a considerable time. And the observation is immediate and continuous. So a specimen can be examined for interesting features in breadth, width and depth by moving the specimen stage and by focusing the microscope through the depth of the specimen as easily as in ordinary light microscopy. Using the EMI television camera, a large number of specimens were thus inspected in one hour which would otherwise have taken several months



The test studio of the Photoelectric Tubes Division, English Electric Valve Co., Ltd., where Image Orthicon and Vidicon television pick-up tubes are tested. The pick-up tubes receive a thorough electrical test to stringent specifications and an optical test under studio conditions in a television camera.

Observation of cell division on a television microscope is a very stringent test as the cells are very sensitive to ultra-violet radiation. If there is sufficient sensitivity in the tube, the ultra-violet intensity can be kept low enough for the cell division to be observed.

There is reason to believe that the cost of an ultra-violet microscope installation can be considerably reduced by the use of a closed-circuit television camera equipped with this tube.

Closed-Circuit TV at Computer Exhibition

SO many executives have applied to attend the Electronic Data Processing Symposium—to be held in conjunction with the Electronic Computer Exhibition in the National Hall, Olympia, next week—that EMI Electronics Ltd. have been asked to supply a closed-circuit television system to bring a close-up view of the speakers to those sitting at the back of the room.

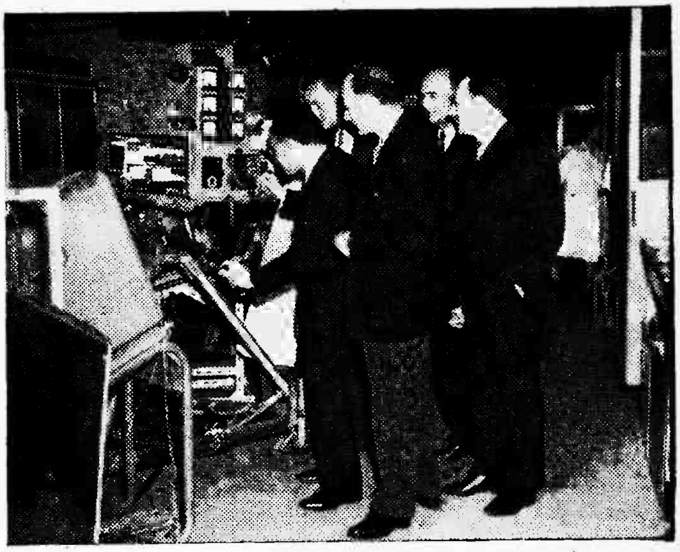
The Symposium will be held in the Apex Restaurant—adjoining the National Hall—where several large pillars limit the size of audience which can have a direct view of the speakers' platform. But six closed-circuit TV receivers, placed behind the pillars, will enable the whole audience to see the speakers and any diagrams shown.

Closed-circuit television will also be used on the EMI stand in the National Hall, where a picture of the printed output from the EMIDEC 1100 computer will be displayed on a TV screen mounted high up on the stand.

TV for Nigerian Schools

OVER 150 schools in Western Nigeria and the Federal territory of Lagos began watching WNTV television for schools this month when the third term of Schools TV got under way.

WNTV is the first commercial and educational television network in Africa, launched in October 1959 as a partnership project between the Western Nigerian Government and Overseas Rediffusion Ltd of London. Transmitters are located in Ibadan, capital of Western Nigeria, and at Abafon, some 18 miles from Lagos. Since its inception the television service has provided schools programmes.



At a recent visit to the English Electric Valve Company Limited, representatives from leading French television and electronic organisations, who for a considerable time have been users of the Company's image orthicons, gathered to discuss and evaluate the award-winning English Electric 4½in. and the 3in. image orthicons.

Live shows to be seen this term include an experimental programme on Infant Nutrition; Nature Study; and the popular "News and You", in which a team of experts from the Western Nigerian Ministry of Education discuss current events and their background.

Television at USA University

EXPERIMENTS with a Marconi 4½in. image orthicon TV camera have been so successful at the University of California at Berkeley, USA, that the College has planned large-scale television facilities for the coming academic year.

An 80-seat classroom has been set aside as a television teaching laboratory; in addition, a number of lecture courses at the college will be video-taped for subsequent playback. These are two of the facilities being made available through the use of television as a teaching aid.

Fair in Yugoslavia

AN Image Orthicon Camera channel, type 203/6, was the highlight of EMI Electronics Ltd's exhibits at the Ljubljana Fair, Yugoslavia (October 21st to 29th). Although in the past EMI has had a number of business dealings in Yugoslavia this was the first time that EMI Electronics Ltd. equipment has been exhibited at a Yugoslav Trade Fair.

A scale model layout of an EMIDEC 1100 computing system illustrated one of their range of fully-transistorised electronic computers.

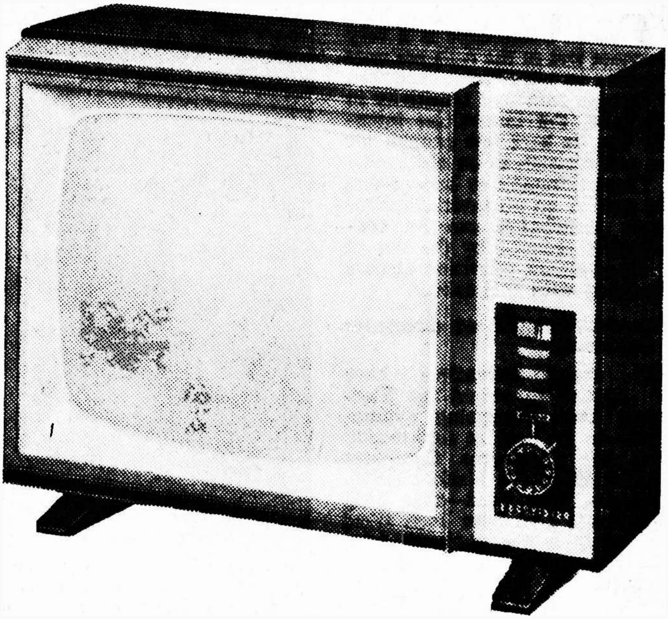
Other units shown included a display of the company's special electronic valves; tape recorders; electronic instruments, including a range of nuclear health equipment; and a wide selection of the company's industrial electronic products.

Television Cameras for Poland and Denmark

FOLLOWING a successful demonstration of equipment in Warsaw earlier this year, two EMI vidicon camera channels have been ordered on behalf of Polskie Radio, Poland.

These channels comprise camera, camera control unit, remote control panel and four-position lens turret. Also Denmark's Radio—the Danish State broadcasting service—has placed an order with EMI Electronics Ltd. to supply four 4½in. image orthicon camera channels for use in the Copenhagen studios.

405 or 625?



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

The "Lines" Battle

THE TRUTH BEHIND THE PRESENT CONTROVERSY

(Continued from page 69 of the November issue)

By J. Harwood

EVERY new requirement of a new system brings added complications. All these added complications and the lack of material information on future standards make it impossible for any manufacturer to produce a set with a switched conversion system which he would be sure would be suitable for the future while satisfying today's requirements. There are, nevertheless, designs and prototypes of dual standard television receivers for the British and CCIR systems.

Towards Conversion

Manufacturers have tackled the problem in such a way that their new receivers are designed towards conversion at some future date. This does not necessarily mean that the receivers will be able to be switched over the two systems although, on the other hand, it may mean that a future conversion may, in fact, change an existing new model to a truly dual standard model. Whether or not this would be economically and technically feasible will depend mainly on two factors: firstly, the extent of change over to the new standard as governed by the type of system eventually adopted, and secondly, when the new system becomes available. There is, of course, the possibility that even today's new models will be worn out before a new system is launched.

It would appear that truly dual standard models will not be produced until some definite ruling has been given by the Government, but in the meantime manufacturers must satisfy the demands of their customers—and their customers demand that any new receiver that they may buy today will also be suitable for tomorrow. There is no doubt about this, of course!

The "convertibility" features of the new models range from switched timebases and a UHF position on the tuner to elaborate "plug-on" conversion units. Most models now have a UHF position which simply opens up the tuner to the I.F. channel. A separate UHF tuner would thus be plugged in and this would be brought into operation by switching the ordinary tuner to UHF. The Cyldon PC80 tuner, for example, has a switched injection point at the grid of the mixer for the introduction of the output for a separate UHF tuner.

(Continued on page 147)

Television Filters

By T. Kemp

THE FIRST OF A SERIES OF ARTICLES ON THIS SUBJECT

TELEVISION filters serve two basic requirements. One, they either block or short out unwanted signals; or two, they produce a specific passband allowing signals of certain frequencies to pass with very little attenuation while signals (outside the passband) are heavily attenuated.

Such filters are built either in the receiver circuits or in units external to the receiver. In the former case, typical examples are adjacent channel and sound rejectors, while falling in the latter category are low-pass, high-pass and band-pass filters, diplexers and triplexers and certain kinds of frequency-selective attenuators, all of which may be connected in the aerial downlead.

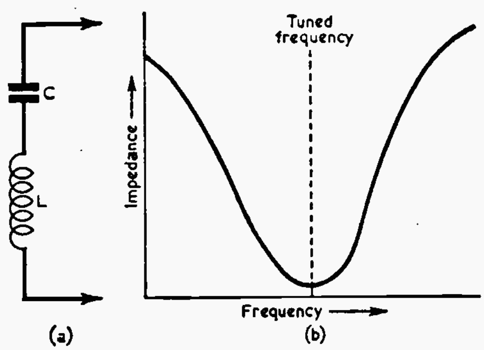


Fig. 1 (above)—The series-tuned circuit (a), has minimum impedance at resonance (b).

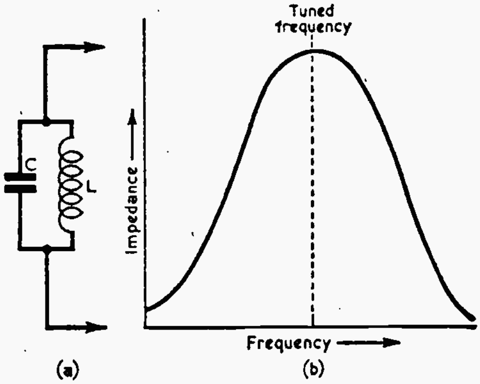


Fig. 2—The parallel-tuned circuit (a), has maximum impedance at resonance (b).

In this short series of articles it is proposed to describe the various types solely from a practical plane with the minimum of mathematics. However, as filters are essentially mathematical in their conception, one or two slight ambiguities may be observed by those well versed in the arts, but it is hoped that these will be overlooked by the purist in the interests of simplicity of presentation.

Classification of Filters

The simplest filters consist of either a series or parallel resonant circuit. With the series arrangement, the impedance offered to signals at the frequency to which the filter is tuned is at a minimum, while either side of resonance the impedance increases, as shown in Fig. 1. With the

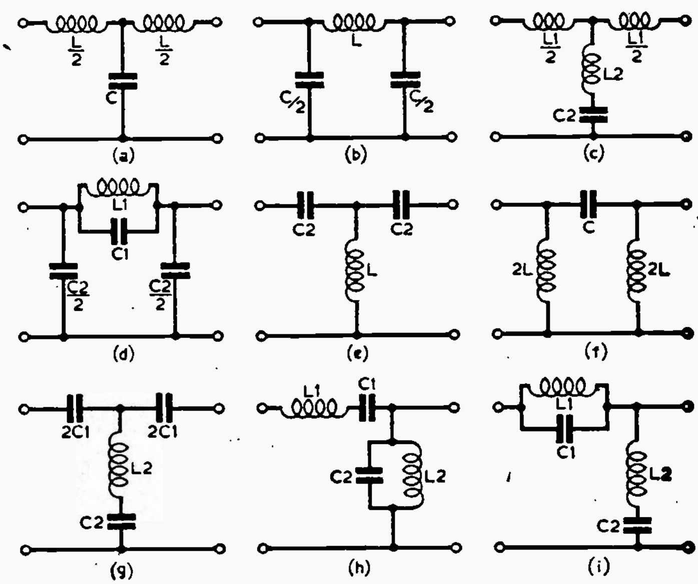


Fig. 3 (right)—Examples of four-terminal filters.

—(a) low-pass T-section;

—(b) low-pass π-section;

—(c) low-pass series-derived T-section;

—(d) low-pass shunt-derived π-section;

—(e) high-pass T-section;

—(f) high-pass π-section;

—(g) high-pass series-derived T-section;

—(h) band-pass;

—(i) band elimination.

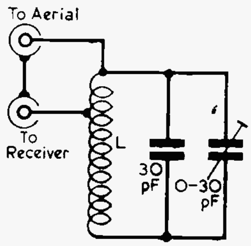
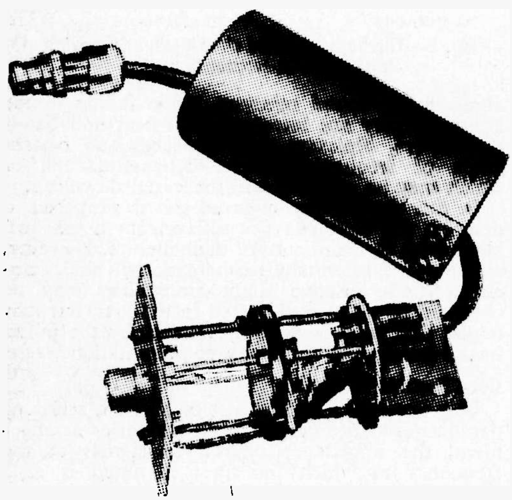


Fig. 4 (right)—A Parallel-tuned rejector. The resonant frequency is equal to $\frac{1}{2}\pi\sqrt{(L.C)}$ where L is the inductance and C is the total capacitance.

Fig. 5 (below)—The construction of the rejector in Fig. 4.



parallel arrangement the impedance is at a maximum at resonance, as shown in Fig. 2. These are known as " resonant circuits " and in some applications are called " rejectors " or " traps ".

Four Terminal Filters

Of slightly more complicated structure are the four-terminal filters, so-called because they have two input terminals and two output terminals. These come under four primary classifications: " low-pass ", which pass all frequencies below a critical frequency; "high-pass", which pass all frequencies above a critical frequency; "bandpass", which pass all frequencies between two critical frequencies; and " band-elimination ", which pass all frequencies outside two critical frequencies.

Examples of such filters are given in Fig. 3. It will be seen that they are all composed of inductance and capacitance. The values of these elements are computed to provide the required critical frequency and terminal impedance, for in the latter respect it must be remembered that a filter has to work into and out of impedances governed by the circuit in which it is connected. For example, a filter which is required to be connected in series with an aerial downlead must have an impedance on the input side equal to the aerial and an impedance on the output side equal to the aerial input of the set. In this particular case, of course, the input and output impedances would have similar or identical values.

Tuned Rejector Circuit

The simple tuned rejector circuit can be very useful for certain external applications, especially

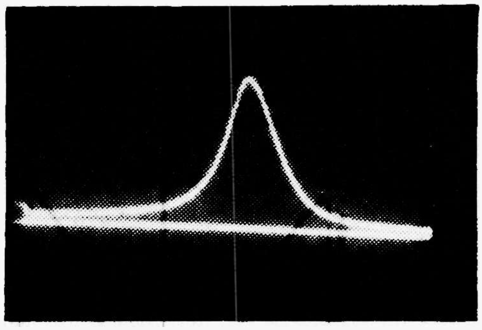


Fig. 6—The response curve of the parallel-tuned rejector as displayed on the screen of an oscilloscope.

in cases where an interfering R.F. signal falls towards the edge of the vision passband. A typical example in this respect is when it is required to receive a distant station on a channel adjacent to that used by a powerful local station.

Although the set itself is designed to possess reasonable adjacent channel selectivity, the aerial signal of the adjacent channel station may be of sufficient strength to force its way into the set and cause breakthrough and pattern interference.

When that happens a parallel-tuned rejector can

(Continued on page 152)

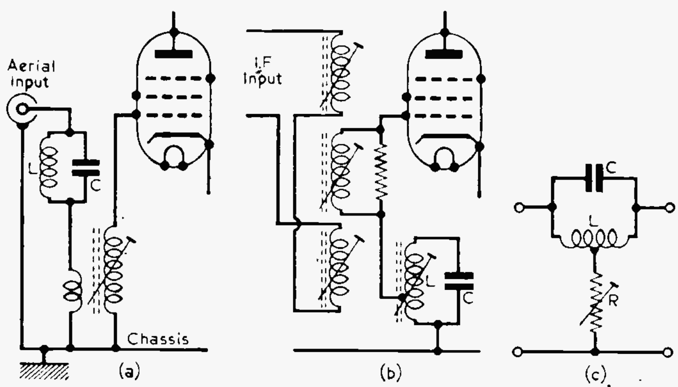


Fig. 7—Simple parallel rejectors; (a) the rejector is inserted in the signal input circuit, (b) the circuit forms an "absorption" sound rejector, (c) is a "bridged-T" rejector.

" . . . a television receiver, by virtue of the fact that it is permanently connected to the public power supply is a potentially dangerous device, if handled incorrectly".

TV Safety Precautions

By F. C. Adams

THIS article relates mainly to the safety aspect of television receivers not only from the experimenters' and service technicians' points of view but also so far as the viewer himself is concerned.

Dangers

Modern sets are not dangerous from the EHT angle, as were old sets in which the EHT was derived from the mains transformer, though, nevertheless, a severe electric shock can be experienced

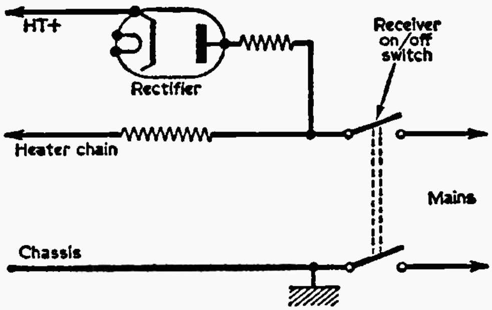


Fig. 1—A connection between one side of the power supply and chassis is made on all A.C./D.C. equipment; the chassis being connected to neutral.

by touching the final anode connection of the CRT or the EHT feed circuit, even after the set has been switched off for a while. Under normal conditions, there is not enough power in a line flyback EHT system to feed a lethal current to anyone who contacts the wiring, but sets with large tubes are particularly dangerous especially to anyone with a weak heart. A very unpleasant burn is, however, possible by touching the high pulse voltage points, in particular the anode of the EHT rectifier valve, the anode of the line output valve and the cathode of the efficiency diode. Indeed, the power at these points is sufficient to set fire to the set. An ideal condition for this to happen is set up by a collapse of the insulation at the high pulse voltage points, such as on the line output transformer. Severe arcing begins and the insulation progressively becomes more conductive, resulting in an even greater arc and finally fire.

Dangers from the Mains

On most modern sets, one side of the mains supply is fed straight to the chassis and the other to the anode of the H.T. rectifier and the heater chain, as shown in Fig. 1. This can represent the greatest danger to both the viewer and the experimenter or technician, because the side of the mains connected direct to chassis may be the " live " side. At the generator or sub-station the neutral side of the supply is connected very efficiently to earth and the live side is highly insulated from earth. If, at the receiver, the live side is connected to chassis, and contact is made with a hand or other part of the body to the chassis, an electric current will flow from the earth at the generator back through the body and via the chassis to the live side. There is, in fact, a complete circuit.

How much current flows will depend on how good the connections are at the body. If, for example, the hand is slighly moist and pressed hard against the chassis and there is very little insulation between the feet and a good earth, then a large current will flow, possibly with fatal results. If, on the other hand, one is standing on a dry, wooden floor, or is wearing rubber shoes, there will only be a very small current and it may not even be felt. An extremely dangerous condition exists if one happens to be leaning against an earthed object, such as an electric radiator, while touching a live chassis with the other hand and similarly, if one is standing on a concrete or stone floor and wearing leather shoes.

Testing for Live Chassis

Conditions for an electric shock of this nature only exist, of course, when the chassis or object being touched is connected to the live side of the mains supply. If it is connected to neutral, all is well, as there is very little potential difference between the neutral side of the mains and a local earth.

There are several ways of determining which mains wire is the live one. A small neon tester of the type found in some screwdrivers will glow when the blade is connected to the live terminal. An ordinary household bulb can be used by connecting one side to a good earth and the other side in turn to the two terminals. The bulb will light —though possibly not at full brilliance — when connected to the live terminal. The largest diameter socket on three-point outlets is itself connected to a local earth (or should be). When looking at the rear of the plug or the front of the socket with the earth point at the top, the neutral side, labelled N, is on the left and the live side, labelled L, is on the right. It often pays to check this on the outlet points fitted in new houses! However, do not keep a bulb operating between the live wire and earth for any length of time.

Correct Connection Always Advisable

When servicing a set or making internal adjustments the precaution of checking for a live chassis is highly recommended. Indeed, it is advisable always to ensure that the chassis is connected to the neutral and not the live wire, even when the set is operating normally in its cabinet. There are several reasons for this; on some older sets the control knobs are secured by grub screws against the metal spindles of the controls and a chassis connection may thus be accessible from the outside of the cabinet and an electric shock may be sustained by a viewer operating the controls. This type of control knob is no longer allowed, but they still exist on certain old sets. The grub screw hole should be filled with wax after the screw is tightened. Secondly, the metal speaker grille may become bent after years of use and touch the chassis. This is highly dangerous if the chassis is live, for then there is a large live area on the front of the set. A child was killed some years ago due to a defect of a smaller nature. He was touching an earthed electric fire with one hand when the other hand made contact with the metal speaker grille. Regulations prevent this from happening on modern sets, but it is as well to bear in mind when dealing with old sets and home constructed models.

Live Aerial Danger

Another danger of a live chassis is that the aerial itself may become live. Theoretically, the braid of a coaxial downlead should be earthed and on some sets an earthed terminal is provided for thus purpose. It is rarely used, however, and the downlead is nearly always isolated from earth. The downlead must be in R.F. connection with the receiver chassis and this is accomplished by a capacitor, shown by C in Fig. 2.

This effectively isolates the aerial from the chassis so far as the mains frequency is concerned but connects it to chassis at VHF. The value is around 0·001μF so it lets through very little current at 50c/s. However, if the chassis is live, almost the full mains voltage develops across the capacitor, especially when the aerial is partially earthed as it usually is, particularly when it is raining. The capacitor may eventually become short-circuited. This will not affect the performance and will blow neither the set fuse (if fitted) nor the household fuse because the aerial and downlead are not properly earthed. There is usually not the slightest indication that the isolation has failed.

We now have a very dangerous condition where the aerial and downlead are connected to the live side of the mains. This may go on for quite a long time without anyone being aware of the condition. If the aerial is removed from the set and reconnected there would be a tell-tale spark—quite a big one if it were raining. Even with isolation there would be a small spark with a live chassis because the capacitor lets through a little of the 50c/s current. This symptom, therefore, should lead to a thorough investigation of the isolating capacitor and a reversal of the mains leads. An aerial rigger was killed recently because of a live aerial—not so much as the direct result of electric shock, but because the shock caused him to fall off his ladder.

All receivers should be installed with the chassis connected to the neutral of the mains—this stipulation is sometimes made in the instruction booklet issued by the manufacturer. If a dealer makes the

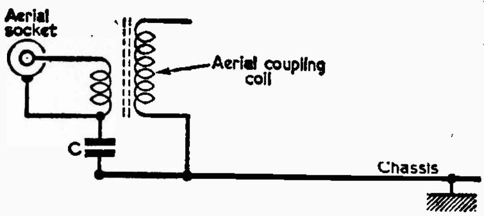


Fig. 2—Capacitor C isolates the aerial from the chassis. If this breaks down on a live chassis the aerial will become live.

installation then he should attend to this, also when re-installing after a repair. If the viewer makes the installation, then it is his full responsibility to ensure that all is correct. With modern receivers, it is almost impossible to receive an electric shock, even when the chassis is connected to the live side of the mains.

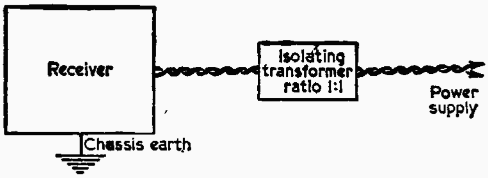


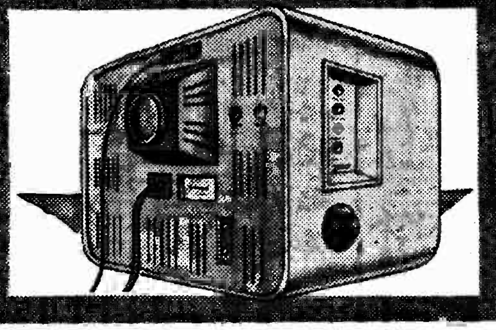
Fig. 3—If external equipment is to be connected to an A.C./D.C. receiver, a 1 : 1 ratio isolating transformer should be used.

External Connections

Manufacturers do not recommend that any external equipment should be connected to their receivers, apart from that which they themselves authorise. If, for example, an extension speaker, tape recorder or pair of headphones, is connected, then this must be at the owner's own risk. Such connections are highly dangerous on A.C./D.C. equipment of the type under discussion. There is only one really safe way that this can be accomplished and that is to connect the set to the power supply through a 1-to-1 ratio isolating transformer, as shown in Fig. 3. The receiver chassis may then be connected to an efficient earth point and external equipment may be connected without danger of electric shock from the mains supply. If running a tape recorder or pick-up, this " earthed " arrangement makes it relatively easy to remove hum, which is virtually impossible to achieve on A.C./D.C. equipment with capacitor isolation. *On no account, however, should an earth be connected to a receiver of this type without transformer isolation.*

Isolating transformers can be obtained from most dealers at various wattage ratings. A very substantial 200W transformer costs about £6. The transformer must have a 1-to-1 ratio so that the output voltage is the same as the voltage applied from the power supply. ■

Servicing Television Receivers



No. 74—THE ENGLISH ELECTRIC 16T11D AND SERIES

By L. Lawry-Johns

(Continued from page 67 of the November issue.)

HAVING considered the EHT system and its usual faults (last month), we now discuss the line timebase in greater detail.

Line Hold

Quite a common complaint is loss of line hold, the control being at one end of its travel. A 1W resistor of 220k (red, red, yellow) is connected from pin 2 of V13 to the hold control and this (R251) sometimes goes a little high, sufficiently to put the control out of range. The resistor R250, 470k does not often change in value but when it does go high in value, lack of line drive results producing insufficient width, poor EHT regulation and (owing to underdriving the output stage) early failure of the PL81.

Complete loss of EHT, line whistle etc., is often caused by R255 4·7k 3W becoming o.c. This is a wire-wound resistor and the element fails on occasions, resulting of course in no screen voltage on pin 8 of the PL81 and consequently rendering the valve inoperative. If the timebase is dead, the thermal overload is not tripped and the valves are in order, a glance at the PL81 will show whether it is overheating or not. If it is not overheating check the pin 8 voltage and R255. If the PL81 is overheating check C251 (0·1μF) and the V13 stage.

Oscillator

Overheating may well be caused by an overload, in the EHT circuit for example, and it should be remembered that V13 cannot oscillate on its own. It depends upon a feedback waveform from the output transformer. Thus if an overload is present the oscillations will fail and the PL81 will be overheated. Such conditions will also obtain if C259 is leaky.

If the timebase starts operating soon after switch-on but fails after a few seconds, C254 (0·5μF-500VW) should be suspected after the essential preliminary valve check. Valve V15 (PY81) is occasionally responsible for an inoperative line timebase.

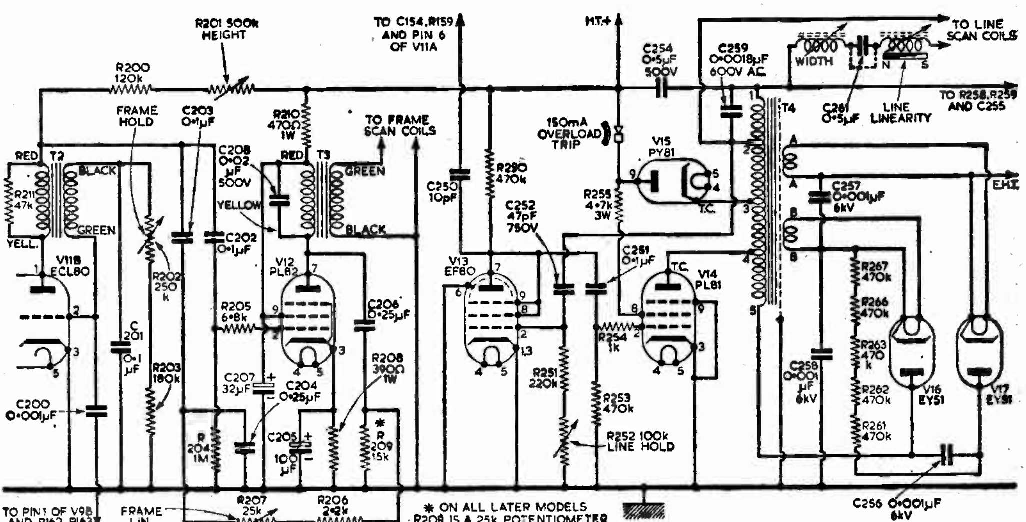


Fig. 4—Circuit of the frame and line timebases.

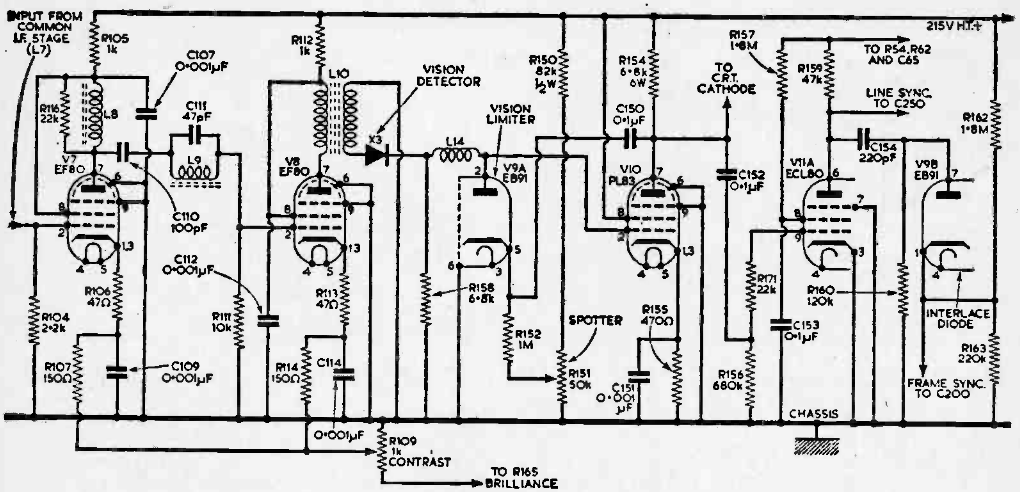


Fig. 5—The vision I.F., detector and sync separator circuits.

The Frame Timebase

A blocking oscillator (V11B) is used to drive an output pentode V12. The oscillator which is the triode section of an ECL80 is conventional, the driving waveform being developed across R200 (120k) and R201 (500k height). This is coupled to the control grid of the PL82 via C202 (0·1μF). Linearity of the frame scan is obtained by a feed-

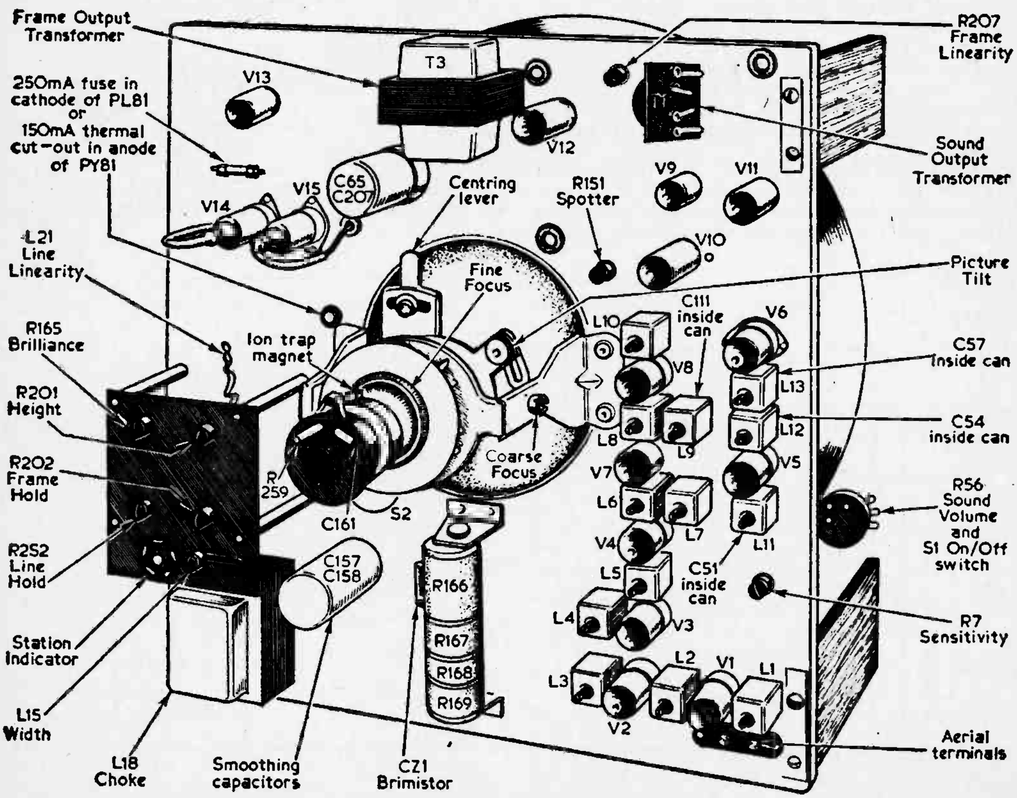


Fig. 6—Rear view of the chassis.

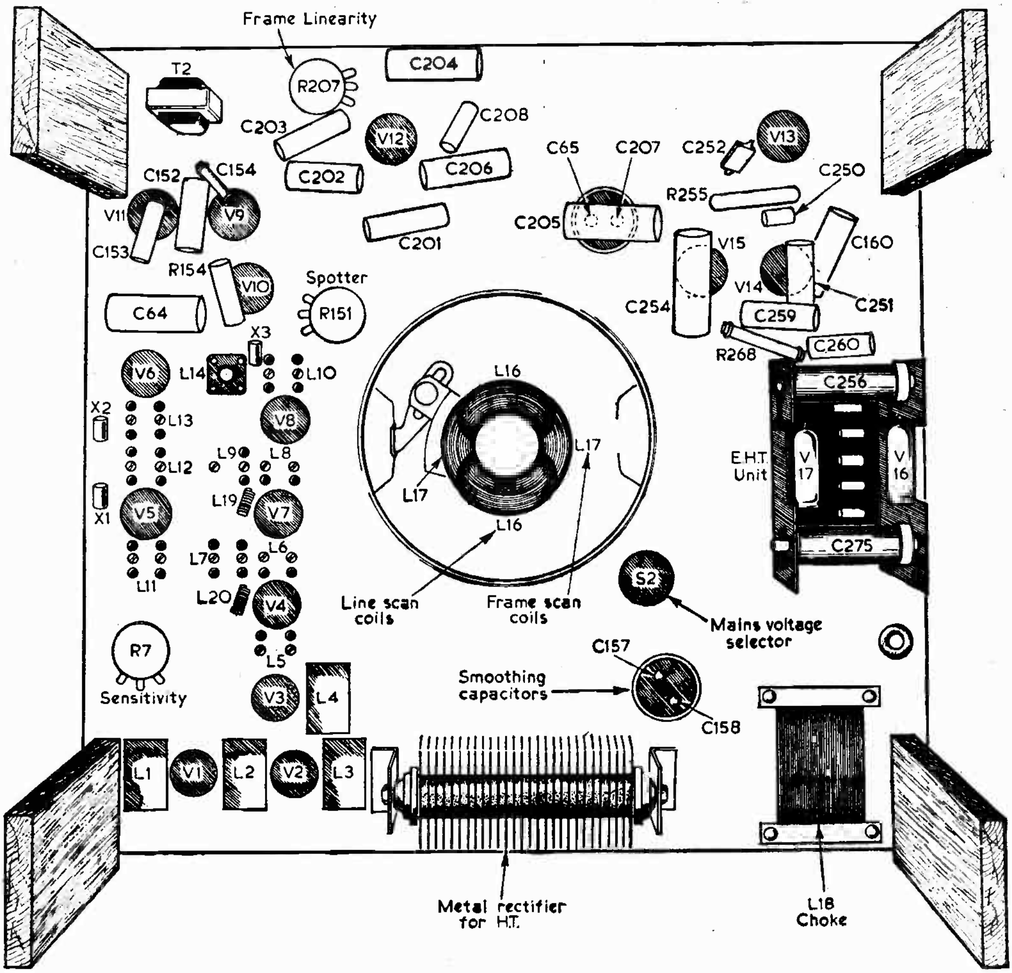


Fig. 7—A simplified front view of the chassis.

back loop using rather high valued capacitors (C206-C203-C204).

No Frame Scan

A white line across the centre of the screen denotes trouble in the V11B-V12 stages. The output stage (V12) is easily checked by connecting a small capacitor (say 0·01μF) from pin 4 of the PL82 to pin 2. If this results in some sort of raster being obtained the V11B stage should be checked. V11 could be defective, but, if a replacement fails to cure the fault, check the voltages at pins 1 and 2. Over 80V should be present at pin 1 and about (−40)V at pin 2 when the stage is working correctly. Check T2 by disconnecting R211 (47k) and noting the effect upon a voltage reading at pin 1 or make a "cold" continuity check between the red and yellow leads. If the stage is oscillating, bridge C202 with a known good 0·1μF capacitor as this can go o.c.

If the V12 stage is inoperative, check the voltages at pins 7 and 9 of the PL82 base. If the voltage is absent from both, suspect R210 (470Ω)—probably o.c. and check C207 (32μF) which may be shorted. If H.T. is present at pin 9 but not at pin 7 check the continuity of T3, red-yellow winding.

If the picture revolves and the hold control is at one end of its travel check R203 (180k) and if necessary C201; R202 (hold control 250k).

Reduced Height

Even gap top and bottom; check R200 which sometimes goes high. If the bottom is compressed, and the top stretched; check V12 (PL82), C205 (100μF) and linearity capacitors (C203, 204, 206).

If both timebases are difficult to lock perhaps one more than the other, for example, the line hold may be critical, but the frame hold just rolls up or down with no locking point, check V11 and R157 (1·8M). If these are in order, check C152 (0·1μF). If the

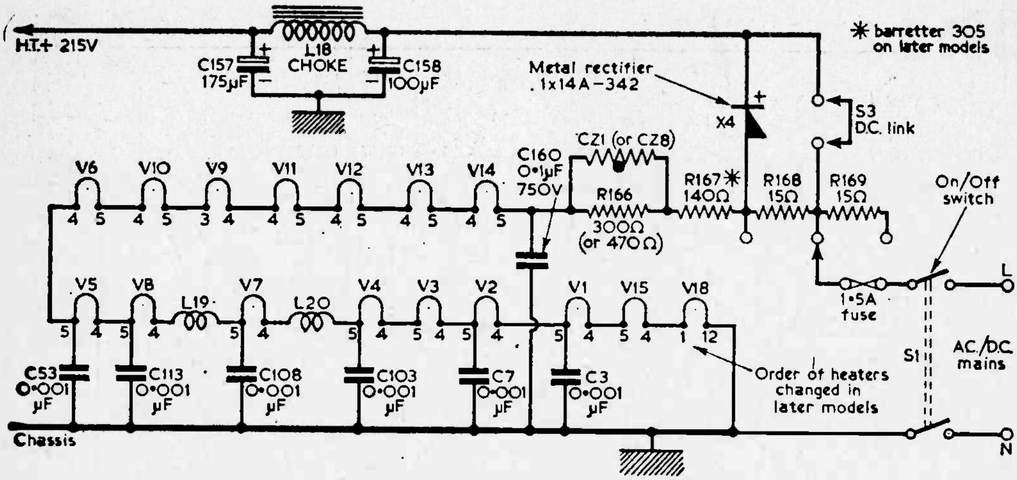


Fig. 8—Circuit of the heater chain and power pack.

line hold is not impaired at all, check V9 and the components connected with pins 7 and 1 e.g., C154, R160, R162, R163, 200. If the line sync is poor although the frame locks well, check C152 but bear in mind the effect of reflected signals on the aerial. As well as producing "ghosts", these can cause severe line displacement whereby sections of the picture move horizontally on black and white picture content, particularly as the white content nears the right-hand side (see page 505, July issue).

Sound Stages

Low and distorted sound, check V5 and V6. If in order check R54 (10M), X1 and X2. A loud howl may be caused by C64 becoming o.c. thus promoting positive feedback from V6 output pentode to the triode section.

(To be continued)

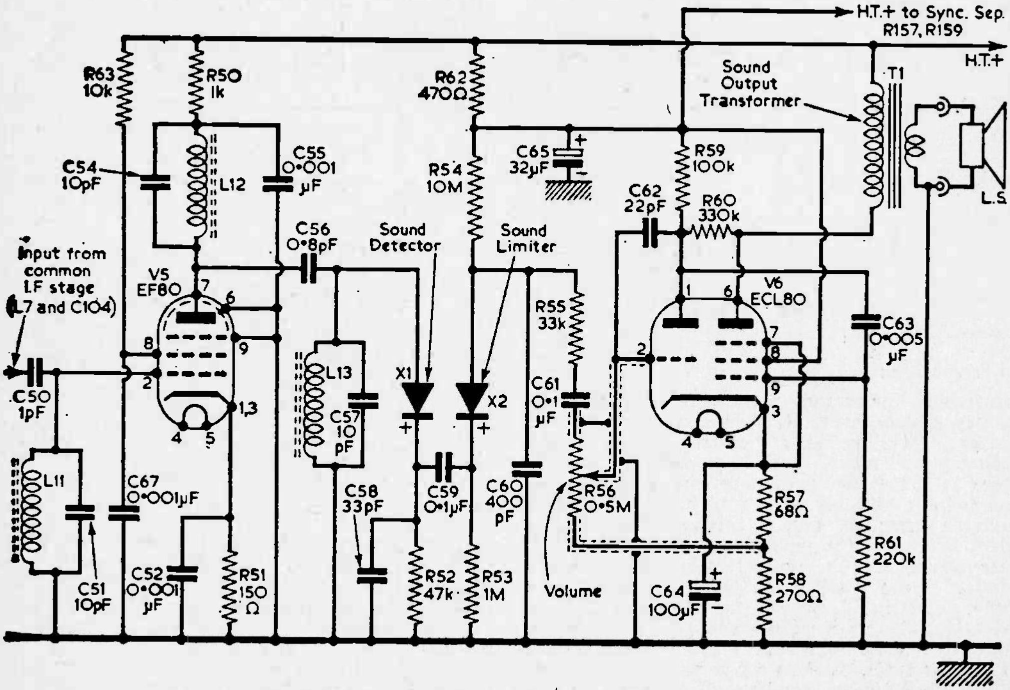


Fig. 9—The sound I.F., detector and output stages.

phase DISTORTION

By T. W. Carreyett

A KNOWLEDGE OF PHASE SHIFT AND PHASE DISTORTION IS ESSENTIAL FOR ALL TV ENTHUSIASTS

MAINLY because of developments during the last ten years in wide band equipment, pulse techniques, television equipment, wide band recording equipment and the like, interest in phase shift, and the correction of phase distortions has become necessary. By means of a square wave, phase distortion can quickly and easily be found. In an ideally perfect amplifier, the response would be linear and would possess a phase shift characteristic proportional to frequency and the output therefore could produce a perfect square wave.

A.F. Testing by Square Wave and Sine Wave

When applied to A.F. amplifier testing, it should be mentioned that the square wave test has one big disadvantage—a square wave output expresses the combined output of the phase and frequency response at all frequencies incorporated in the square wave. At low frequencies in an A.F. amplifier, the phase response may be poor, so producing a poor square wave output and this may, to an inexperienced eye, be thought to represent a poor amplifier. Fortunately, since the ear can tolerate a large quantity of phase distortion at low frequencies, this does not matter, so the distorted low frequency square wave, although telling a true story, tells one that may be neglected. Because of this, it is not on the whole advisable to test A.F. amplifiers with a square wave frequency below 1kc/s.

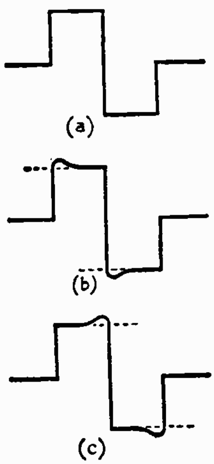


Fig. 1 (a)—A square waveform for testing; (b) an example of phase advance, generally known as "overshoot"; (c) an example of phase lag, known as "undershoot".

In testing of an audio system, it is often sufficient to "squeak" the equipment with an oscillator with reference to a zero level frequency point (zero dB or 1mW developed in 600Ω at 1kc/s). Providing that the losses at the top and the bottom of the audio frequency spectrum are within some specified tolerance, all may be assumed to be well. It is found, however, that when wider bands of frequencies are involved, a spot frequency test of a system does not represent a true picture, for although the frequency response can sometimes be adjusted to a satisfactory result, trouble may now be encountered with the phase response. Within an audio system, the phase response can, on the whole, be neglected, although for the enthusiast "hi-fi" this would never do, for he would quickly explain that a poor phase response would ruin the transient response and would give a lack of "presence". Let us now consider the a lack of "presence".

Wide Band Response

In a wide band system, with careful design, phase distortion in equipment can be kept to a small value. One thing that cannot be controlled so easily is the number of links or lines connecting equipment in the system, and it is here, by equalisation with frequency correction that one may run into phase distortion. One typical example of phase distortion which most people with a television set will have experienced at some time or another, is the effect on the picture when an aeroplane flies around the district. The bright, fuzzy picture illustrates phase distortion owing to the sum and difference paths introduced by the original signal path and the new path from the aeroplane.

Let us now see how this effect can be caused by circuitry instead of the aeroplane. Apart from

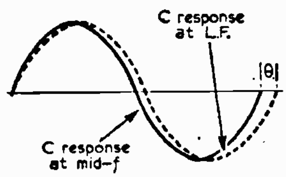


Fig. 2—How phase distortion will affect an L.F. signal.

valves the main circuit elements are resistance, capacitance and inductance. If these three components are connected in series it will be found that the current across the resistance will be in phase with the applied current; across the capacitance it will have a 90° phase lead, and across the inductance it will have a 90° phase lag. Now, since all circuitry can be broken down by network theorems to an equivalent circuit of L, C, and R, it seems reasonable to suppose that phase distortion will be introduced only by the reactive components X_L and X_C. So, from this deduction it appears that in order to control the phase response of a system a very careful control of X_L and X_C must be maintained. From a general inspection of equipment, and a little thought, it can be seen that the values of X_L on the whole can be fairly well controlled, but values of X_C cannot be. Here, X_L and X_C are total values including all stray sources.

Stray Sources

Stray inductances likely to take effect are mainly such things as long leads, induction and the effects of cans around transformers, and some screening and shielding—all these effects can be taken into account in design.

Stray capacitance however cannot always be compensated in a design; for example, the disturbance of a grid lead, or the use of a non-standard high capacity coaxial cable for a link. It appears, therefore, that the main culprit involving phase distortion is capacitance, stray or otherwise.

Waveforms

In Fig. 1(a) is shown the square wave test waveform, in (b) is seen an example of phase advance, known generally as "overshoot" and in (c) is shown an example of phase lag, or phase retard, which is known as "undershoot". Now, if these distortions are mainly the work of the condenser, it would be worth while to look at its physical properties and see how they will affect a wide band signal. Let the signal be split into three bands one of medium frequency for minimum distortion as a reference, one of high frequency, and one of low frequency.

The Low Frequency Case

A condenser is basically formed by two plates separated by an insulator, and in most signal paths, the function of the condenser is mainly one of charging and discharging. From basic theory it is found that the capacity seen by the signal is dictated by $C=Q/V$ and since $Q=It$, $C=(I/V)t$. Therefore, the charging of a condenser is governed by time, and this can also be read as meaning that in order for the plates of the condenser to reach the value of the applied EMF, the dielectric must have been charged to a value of It or must have accepted a current for a given time t. From this reasoning, we can see how phase delay can be introduced, because in order for the condenser to pass the low frequency signal without distortion, its plates must rise to a voltage equal to the source EMF, and since it will take a given time to acquire this voltage, a delay will be introduced. Fig. 2 shows how this phase distortion will affect an L.F. wave. The delay is shown as θ. This is a rather exaggerated case, but it does serve to show the effect of phase distortion at L.F. The cause of this type of distortion is also known as dielectric hysteresis, because of the time required to "soak" the dielectric with a charge. A distortionless output calls for a phase shift proportional to frequency as shown in Fig. 3(a), at low frequencies; for the case considered, a shape of Fig. 3(b) would be likely.

The High Frequency Case

At high frequencies another state of affairs is added to that existing in the L.F. case. Let us consider a very high frequency charge applied to a condenser. This time the charge varies so quickly that it is impossible for the dielectric to derive any form of soak charge. This can be imagined, for no sooner has a positive charge been applied when a negative charge follows very quickly after it. The dielectric can therefore never be fully charged, and only the surface layer of the dielectric can be working at all. This means that at H.F., the dielectric constant has been lowered with respect to its mid-frequency value, thus lowering the effective capacity. However, at H.F., stray capacities will start to take effect, working in parallel with the signal source to produce additive phase losses. The net result will therefore produce frequency and phase distortion. As frequency is raised still higher, so the phase losses will increase because of the dielectric hysteresis, as more time is going to be demanded to charge the more predominant stray capacities. The H.F. phase response will therefore be similar to that shown in Fig. 3(b).

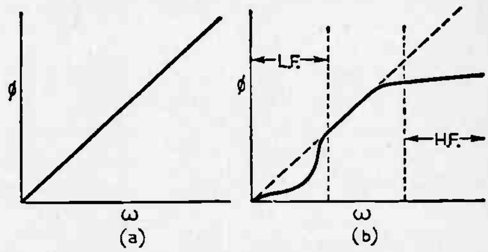


Fig. 3 (a)—A distortionless output needs a phase shift proportional to frequency; (b) shows the distortions considered.

Analogy of Low and High Frequency Cases

At low frequencies an analogy of the condenser charging can be found in filling a container with a gas. For the container to possess the same pressure as the applied pressure, then it must firstly have stored a full quantity of gas. At high frequencies the effect on the dielectric can be simulated to a deep fast flowing river, where the surface layer may move very quickly but the bottom layer has relatively no movement. This action at H.F. in the condenser is therefore known as dielectric viscosity.

Conclusions and Cures

This discussion has presented in a very general way the causes of phase distortion. It can however be reduced by means of phase equalisers and special techniques such as derivative amplifiers, or in some cases coaxial chokes. But, the correction of phase distortion is a rather delicate and gentle matter, because, in its correction, no other non-linearities must be introduced which may upset the frequency or amplitude response. For example, the introduction of phase equalisers may at a given point correct phase distortion, but also result in severe ringing on the square wave output. This in effect is only trading one evil for another and is still leaving trouble. However, introduced in the right place, successful correction can occur, the right place being one where impedance uniformity can be obtained between source and phase equaliser. As this uniformity is likely to be disturbed over a wide frequency range, it may have to be obtained by masking the phase corrector into a valve amplifier stage as is found in derivative amplifiers. This method of correction will work, but, unfortunately, it is not very economical, but at times this form of correction may be favoured instead of using many small corrections. It can therefore be seen that phase distortion over a wide band system is something that must be reckoned with, but with thoughtful design it can be kept down to quite small values. ■

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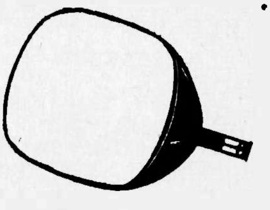

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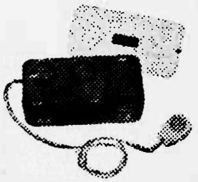

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A Precision Wobbulator

By N. Mears

(Continued from page 83 of the November issue)

USING THE INSTRUMENT

LAST month the 200c/s multivibrator and the 20c/s multivibrator and sawtooth generator were aligned; the sawtooth linearity must now be adjusted and the oscillator aligned before the method of using the wobbulator can be explained.

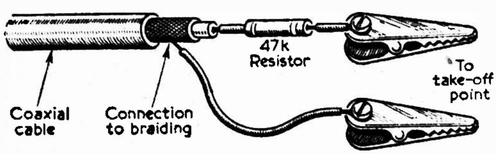
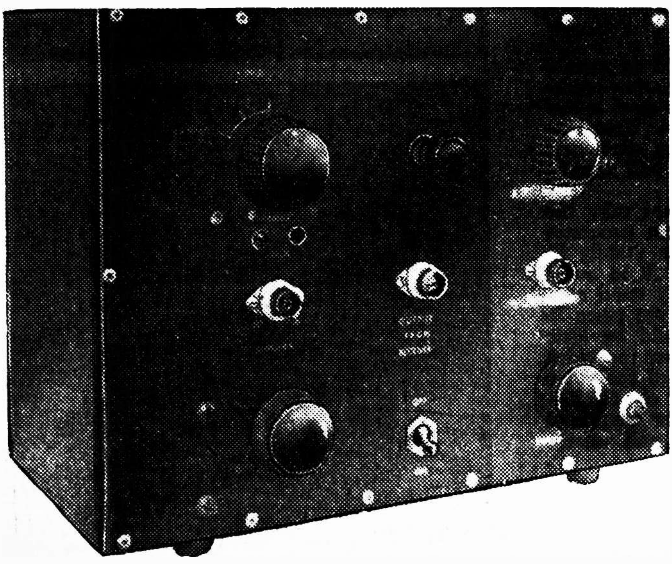


Fig. 16—Terminating the cable for attachment to the receiver take-off point.



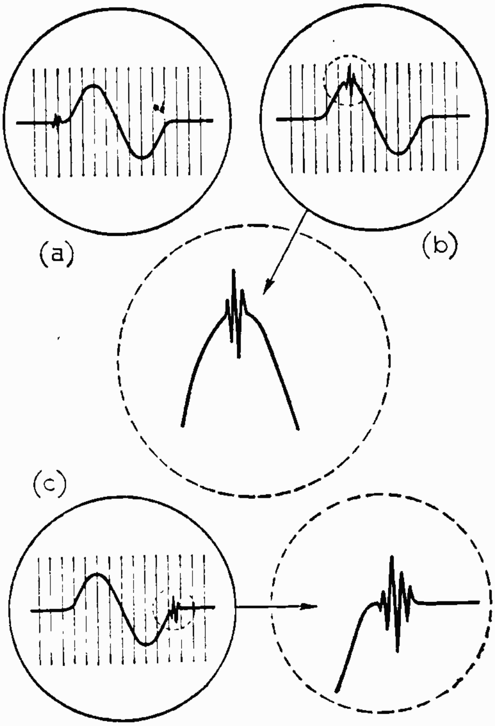


Fig. 17—The calibration of the sweep (see text).

3. *Adjustment of sawtooth linearity*
(a) Connect the Y-amplifier lead of the 'scope to the cathode of the ECC82 and R29.
(b) Set VR4 at its maximum setting.
(c) Check the shape of the sawtooth wave. If it is still too linear, increase the value of R29 a little, say to 2·2k.

The linearity should be such that the exponential shape of the wave is just noticeable—a linear sweep is not wanted, but too distorted a wave is not required either. The ideal shape is such that the sloping portion — the sweep—becomes nearly horizontal just at the very end of the sweep. The shape is not very critical, as long as extremes are avoided.

4. *Alignment of Oscillator*
(a) Attach 6in. of wire to the R.F. output socket to act as a short aerial. Set the R.F. control (VR6) to maximum.
(b) Tune the receiver well away from any station, and turn up the volume control.
(c) Set the "sweep" control (VR4) to about $\frac{1}{5}$ of its range.

(d) Rotate the core of the coil until reception is obtained.

(e) Check that I.F. is now generated by reducing VR4 setting to zero, and test for a heterodyne whistle on all stations.

It may well be that the R.F. output gives too little output, even at maximum, for a well-screened receiver, when stray pick-up is used. If so, connect the R.F. socket direct to the aerial terminal of the receiver via the usual coaxial lead, and adjust the R.F. control for a suitable output. If this fails, connect the coaxial cable direct to the grid of the frequency changer.

The wobbulator is now ready for use.

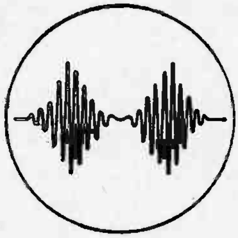
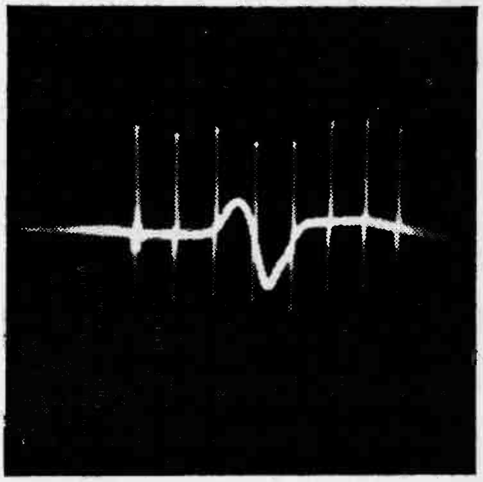


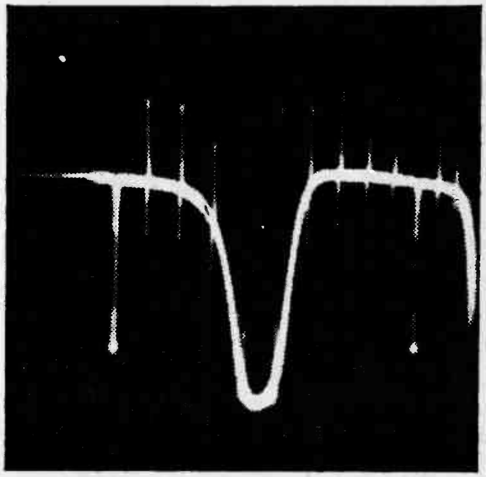
Fig. 18—If an amplitude modulated signal is used to produce a marker pip, the pip is of the form shown above.



(A)*—Discriminator curve for a VHF F.M. transistor portable.*

Method of Use

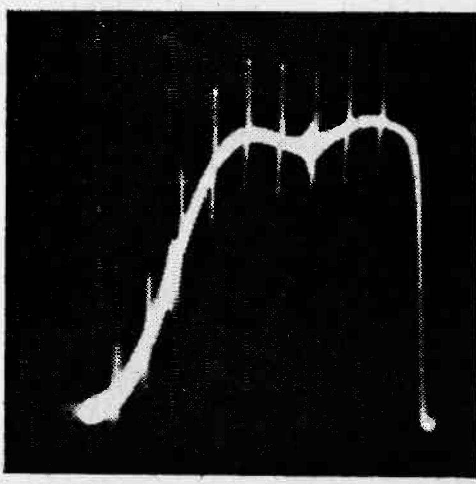
To avoid any instability, an audio point in the receiver would be best for connecting to the "output from receiver" socket of the wobbulator. To avoid hum pick-up the signal should be taken from as early a point as possible, best of all from the detector load resistor; this however tends to cause instability by introducing unwanted feedback. To avoid this, a coaxial lead should be terminated by a resistor of value 47k, as shown in Fig. 16.



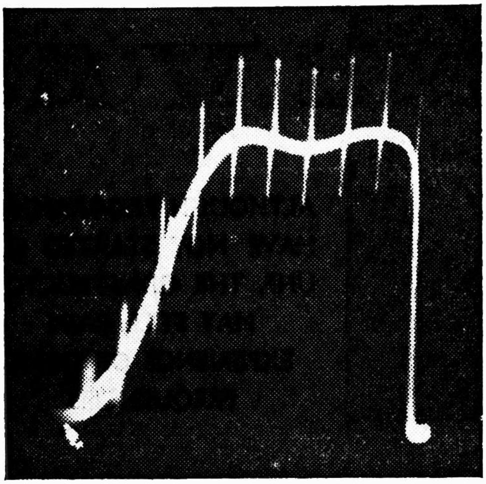
(B)*—Response curve for an M.W. transistor portable.*

Crocodile clips afford a secure method of attachment; for VHF and TV use, the miniature crocodile clips are best, and the writer has used ladies' hair clips (cut-down) with good effect. Since the detector output is not very great, the usefulness of the built-in pre-amplifier mixer V4 will now be apparent.

If hum pick-up is found to interfere with the displayed response curve, the waveform generator can be made to run at 250c/s (flat on middle C) and 25c/s respectively. Hum is difficult to avoid with mains receivers, but if thoroughly good connections are ensured, and precautions are taken in layout during construction, there should be little interference found. With a TV receiver the video output should be taken from the grid of the video valve, *not from the cathode or grid of the CRT*—the latter is more accessible, but the extra trouble of reaching the earlier take-off point is well worthwhile.



(C)*—Response curve of a TV receiver—note the calibration pip.*



(D)—The same response curve as in (C) without the calibration pip.

Calibration of Sweep (Fig. 17)

For this process, an external calibrated signal generator is required. The connections are made between wobbulator, oscilloscope and TV receiver, and the signal generator is provided with a short "aerial" at its "high-output" socket. When the response curve is displayed, set VR4 for maximum sweep and centralise the response curve by adjusting the D.C. control VR5. Adjust so that a recognisable point on the curve coincides with a marker.

Marker Pips

Using an unmodulated output, tune the signal generator slowly through the I.F. listening for the sound output (unless the TV vision curve is being displayed!) and watch the response curve closely. A small "pip" will become visible when the receiver begins to respond to the signal generator output (see Fig. 17(a)).

As the pip approaches the I.F. its amplitude will become larger; when it passes through the peak response position it may well obscure the response curve altogether, and as it passes out of the I.F. range it will become smaller and finally disappear. It should be clearly visible for several markers. Note the number of markers covering the range of the pip's visibility. From this, the total sweep can be calculated, because the signal generator frequency difference between the pip's appearance and final disappearance is known.

A.M. Signal

When an "amplitude-modulated" signal is displayed, at the central point the "pip" will appear similar to that shown in Fig. 18—the "pip" splits into two halves. If the pip blots out the curve altogether, the signal generator output is too high; reduce it by the control provided or by shortening the "aerial".

Owing to lack of space, it has been found necessary to hold over until next month "How TV Sets Work" and "Tracing TV Faults"

The calibrations are not the same on all ranges, but once found, they are quite stable and the markers thus have a definite meaning although the meaning is different for each range. The writer's instrument has the following calibrations:

465kc/s—the markers are at 8kc/s intervals.
10·7Mc/s—the markers are at 200kc/s intervals.
34-38Mc/s—the markers are at 500kc/s intervals.

The accompanying illustrations show the response of the following receivers:

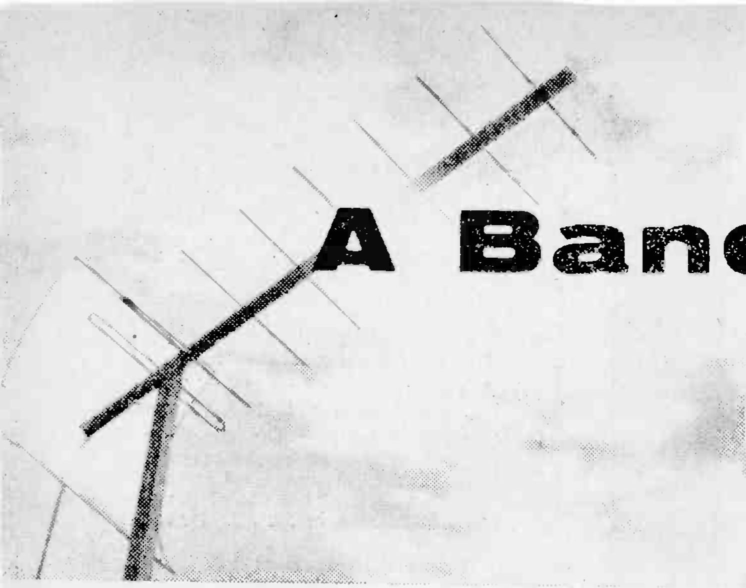
(A) A VHF transistor portable, with interfering I.F. signal from a short-wave transmitter.

(B) Transistor receiver for broadcast wavelengths. The long markers represent the ends of the sweep. This came out the "wrong way up" because of the particular diode connection in the detector stage.

(C) A commercial television receiver—the calibrating pip is in the centre of the response curve.

(D) The same as (B) above without the calibration pip.

In using the wobbulator care must be taken not to arrange matters so that the D.C. control sets the standing bias on the diode at less than two volts or so. The optimum setting is about 6 or 7V, corresponding to about 3/4 maximum, when full sweep is used. The best setting can readily be found by experiment, and the control can then be used to shift the trace a little each way as needed. This is about the only precaution needed in use; the operation of the instrument is very simple and has proved to be virtually trouble-free. ■



A Band V Aer

ALTHOUGH PROGRAMMES HAVE NOT STARTED ON UHF, THE CONSTRUCTOR MAY STILL GAIN EXPERIENCE OF THESE FREQUENCIES

FROM time to time during the past two years the writer has passed on to the home constructor some of his results in experimenting with frequencies in the region of 650Mc/s. In June 1959 an experimental Band V converter was described, and in October and November 1959 a signal generator circuit was published in this journal. The exhibition by the BBC of colour television at the Radio Show this year has no doubt stimulated the interest of many. If the Pilkington Committee does eventually recommend to the Government that colour transmission should be started it will doubtless go out on Band V. The BBC intends to radiate high-power transmissions in 1962 and is currently operating low-power experimental broadcasts from Crystal Palace.

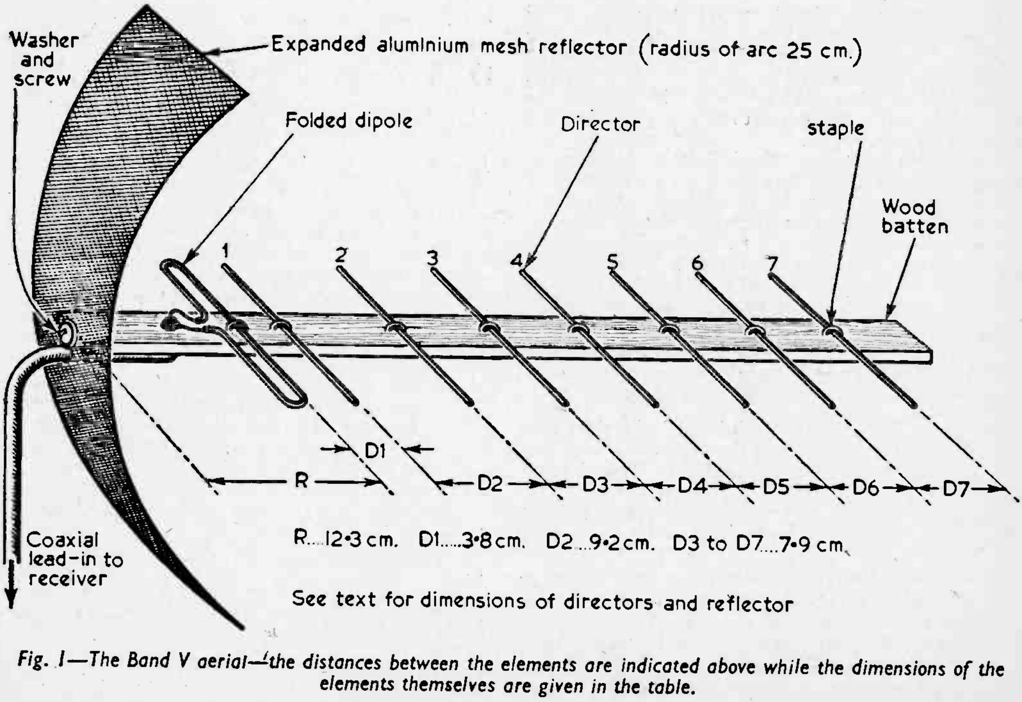


Fig. 1—The Band V aerial—the distances between the elements are indicated above while the dimensions of the elements themselves are given in the table.

rial

By R. B. Archer

Preparation

Those living within range will doubtless be interested to attempt reception of these experimental broadcasts, and others who would be able to receive the high-powered transmissions in due course will wish to prepare their equipment in good time. In this article a suitable aerial array is described, while in future issues details of a fully tunable receiver will be given.

Design Considerations

At such frequencies it is important to consider the type of aerial in relation to the type of receiver likely to be used. Until valves or transistors definitely designed for the UHF bands are generally available the experimenter will tend to use what devices can be obtained. This requirement will, in general, rule out an R.F. stage in the receiver, and the "front end" will thus consist of a silicon crystal and local oscillator. These will be associated with a band-pass input filter, partly because there will be little protection against oscillator radiation. To minimise further the nuisance of oscillator radiation the aerial must have not only sharp directional properties but a very high "back-to-front ratio," together with an absence of side lobes. Thus, any oscillator radiation will be directed chiefly back toward the transmitter, where it does negligible harm.

TABLE OF TUBULAR LENGTHS (See Fig. 1)

Directors:

No. 1 20·5cm	No. 5 19·7cm
No. 2 20·3cm	No. 6 19·5cm
No. 3 20·1cm	No. 7 19·3cm
No. 4 19·9cm	

Dipole according to the bending diagram.
Reflector 12·3cm behind.

TABLE OF DIRECTOR DISTANCES
(measured from the reference member of the folded dipole)

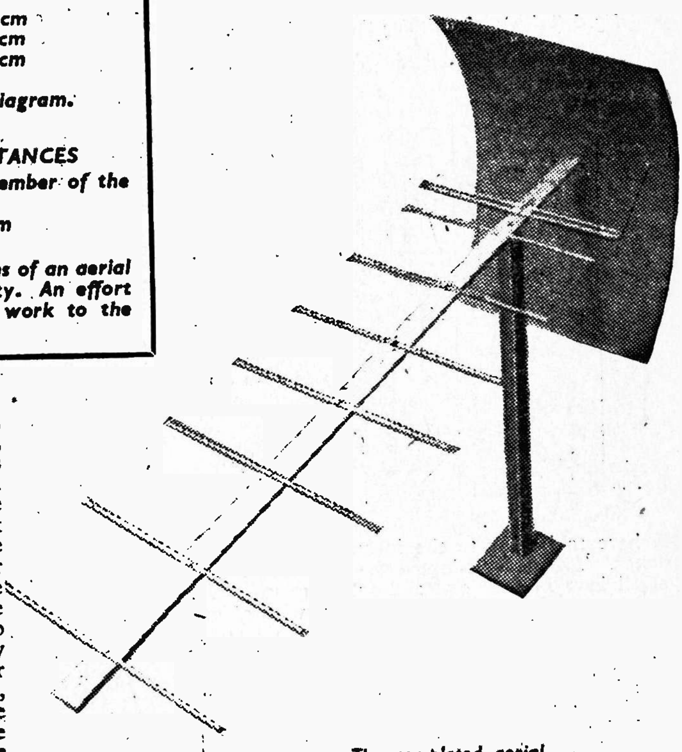
No. 1 3·8cm No. 2 13cm
and the rest spaced 7·9 cm apart.

Note.—The smaller the dimensions of an aerial the poorer is its reproducibility. An effort should therefore be made to work to the nearest millimetre.

The normal Yagi array suffers from the disadvantage of having an appreciable response if facing directly away from the transmitter. This defect can be removed by replacing the conventional rod reflector by a parabolic cylindrical reflector—which in practice can be a plain cylindrical reflector, since the difference between circular and parabolic sections is not large for the portion of the cylinder actually used. At lower frequencies this is not practicable for home installations because of its size and weight—and in any case is much less necessary.

Construction

The materials required for this aerial are very modest — they are as follows: one piece of expanded aluminium, similar to that used for loudspeaker grilles; measuring 40cm x 23cm, is required for the reflector. The dipole and directors



The completed aerial

are all of ⅛in o.d. copper tubing (from a garage), and 6ft of this will be needed or a little over. A wooden batten 1in. x ½in. and 2ft 6in. long is also needed, together with enough wood to make a stand about 2ft high on a firm base. Small galvanised iron staples are also needed and brass screws as necessary.

As bought the copper tubing is unrolled from a coil and cut off by the garage storekeeper. It is never straight enough for use and the first thing to do is to straighten it out. This is done by pulling it until it stretches, and here something

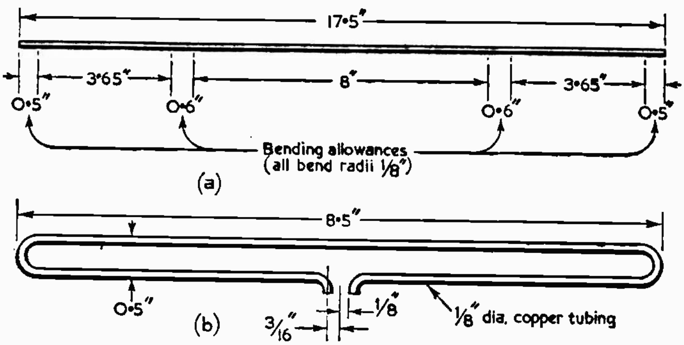
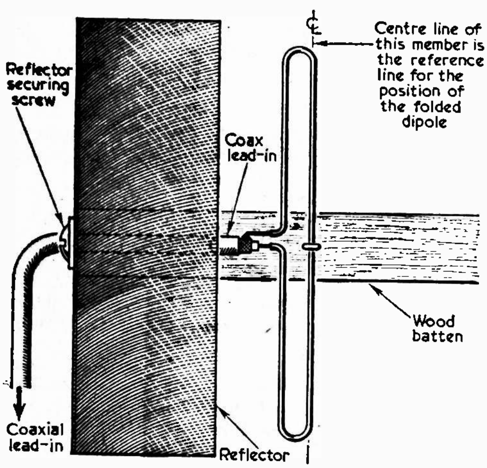


Fig. 2a—The dimensions of the copper tube from which the folded dipole is formed.

Fig. 2b—The completed folded dipole.

Fig. 3 (below).—Positioning the folded dipole.



will have to be left to the ingenuity of the constructor. The writer adopted the device of making a small loop in each end and soldering up. One loop was attached by a stout fencing wire of galvanised iron—about ⅛in in diameter—to a main roof beam of his garage. The other loop was similarly attached to the front bumper of his car, which had been run into position and jacked up 6in. When the jack was lowered the tubing stretched very nicely and controllably. However, with such methods one needs to give careful thought to the robustness of the garage structure, to say nothing of the strength of the bumper of the car, and to do nothing rashly.

Preparing the Elements

When the tubing has been stretched it is laid flat on a bench and cut into the required lengths. Each piece is carefully cleaned with metal polish and is dropped into really hot detergent solution and scrubbed clean ready for silver-plating.

In the past the writer has found that the silver-plating is rendered much more durable and the surface much less likely to lift or "blister" if, before putting it into the electrolyte bath, the copper is given a very light coating of mercury. This is applied in the following way:

Mercury Layer

The least possible quantity of mercuric chloride is bought from the local chemists. (Not remembering anything from his schooldays about penny-weights or grains, the writer persuaded the local chemist to sell him five grams, which proved to represent about five years' needs.) Mercuric chloride is very poisonous and the usual precautions must be taken with it, both in solid state and in solution. It is dissolved in a good quantity of water and some sodium cyanide solution added to it. The mixture is then applied to a clean swab of cotton wool and, holding the copper tubing with a rag soaked in detergent solution (to keep away any grease from the fingers), the tube is rubbed briskly until it assumes a uniform silvery appearance. After treatment the tube is then silver-plated in the usual way. If any appreciable time is to elapse between mercury treatment and silver-plating the tube can be kept under cold water. However, the exposed mercury surface deteriorates in time and the aim should be to plate straight away; no more than ten to 15 minutes' delay should be allowed.

After plating heavily, the surface of the tubes should be polished with plate polish (not metal polish, which removes too much silver).

Effects of Constructional Change

If silverplating is not carried out the aerial will require different design. At the frequencies concerned the material and type of surface has a noticeable effect on the spacing of the directors as well as on the properties of the finished aerial. The reason for this is not obvious and it has not been investigated theoretically by the writer, who records his findings without attempting an explanation.

The reflector is next made up by cutting the expanded metal to size and bending to the necessary radius. This may be done well by using a cake tin from the pantry as a bending bar. Such tins often have a diameter of about 15in, so one can hardly wrap the metal round the tin and leave it at that. However, by judicious pulling a creditable bend can be made and the reflector can easily be checked against a circle of 10in radius chalked out on a suitable surface. Fortunately, the accuracy required here is not especially high.

A dead central hole will already have been marked out to take the retaining screw, together with a ¼in. diameter hole through which the coaxial cable will be led.

Folded Dipole

All that now remains to be done is to mark out and bend the folded dipole. Actually this is probably best done before silver-plating; although polishing the bends is not too easy, the ready-made dipole is easier to handle in the plating bath than the straight tube from which it is fashioned.

The wooden batten is now marked with the positions which the rods will occupy, and it should be noted that the position of the folded dipole is referred to the centre line of its continuous member. The sides connected to the coaxial cable are turned inwards toward the reflector. Fine holes are drilled in the wood each side of these positions so that when the staples are knocked in, securing the aerial elements, the wood does not split.

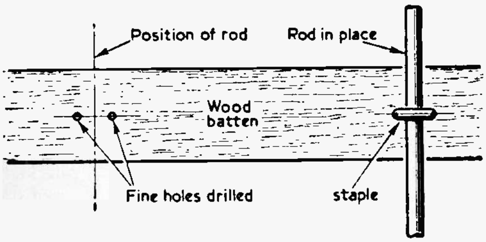


Fig. 4—The method of securing the elements of the aerial.

Connecting the Cable

When all the elements have been secured to the batten, the coaxial cable (which should be of the low-loss type) is pushed through the hole in the reflector, along the underside of the batten, through a hole drilled in the batten, and is brought up so that the conductors can be connected to the free ends of the aerial. The outer insulating layer of the cable should have been removed as far back as the reflector so that the reflector can make contact with the outer braiding. The edges of the hole are now pushed down hard upon the braiding so as to make a good contact. Finally the aerial is mounted on its stand and the job is done.

Outdoor Aerial

It will be seen that this construction is not intended for out-of-doors use. If it is intended to work it permanently on a mast additional precautions must be taken as follows . . . The reflector will have to be supported in some way. This can be done by adding bracing across the aperture with strips of polystyrene or Perspex secured to the batten. The batten itself will preferably be made of Perspex or paxolin as wood may warp badly in wet weather and acquire a permanent set. Two staples instead of only one should be used to secure the directors, or preferably the rods should be made a force fit with holes drilled through the batten. All conducting surfaces should be coated thinly with polystyrene varnish or epoxy resin to avoid atmospheric contamination of the polished silver surfaces. Paint is, of course, no use, and probably the best protective coating would be a few millionths of an inch of gold, plated direct on to the silver.

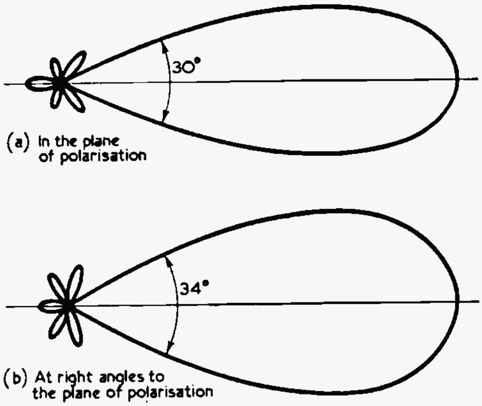


Fig. 5—Polar diagrams of the Band V aerial in the plane of polarisation and at right-angles to it.

Performance

The performance of the aerial is as follows: Centre frequency, 660Mc/s; power gain, greater than 100; back-to-front ratio, about 1/60; band width, 14Mc/s; beam-width in the plane of the elements, 30° approximately; beam width at right-angles to the elements, 34° approximately. The polar diagrams for this aerial are shown in Figs. 5(a) and 5(b).

Transmission Schedule

The BBC has kindly afforded the following information about the transmissions now being made.

Times: Daily (including Sundays), 9 a.m. to 10 p.m. (except when the channel is required for outside broadcast links). Carrier frequency: 659·75Mc/s. Power: Peak 2·8kW, mean 1·4kW. Modulation: Square wave, pulse repetition frequency 1,000c/s (amplitude modulation). Identification: 3sec silence every 60sec. Polarisation: Horizontal.

It is probable that when high-power transmissions are resumed the frequency will be close to the above, since major retuning of the transmitting klystrons would otherwise be necessary. Meanwhile the experimenter can obtain experience either with these transmissions or with the signal generator referred to at the beginning of this article.

There is one practical point of importance in the setting up of the aerial for use with transmissions. That is, care should be taken to erect the aerial with accuracy. Since the beam width is quite narrow, alignment on a compass bearing alone may result in poor reception. The need to apply corrections for magnetic variation and local compass deviation is stressed if the compass is used. It is probable that the most accurate method is to use the sun, which is always due south at noon GMT, or the Pole star as the reference. ■

INTERFERENCE SUPPRESSION

By T. S. Ferriers

CAUSES AND CURES OF TVI

THE best way of proving whether or not an electric tool or other domestic electrical appliance is a source of radio or television interference is to set up the appliance as it would normally be used and observe the effect on one's own receiver. Before the appliance is switched on, however, the receiver should be tried to ensure that it is free from interference and then it will be conclusively evident that any interference from the speaker or on the screen is caused entirely by the appliance under test.

Wear and Vibration

Almost all recently made tools and electric motors are suppressed for both radio and television, but, even with this type of equipment, there is always the possibility that wear on the motor brushes or commutator rotor will eventually cause interference. Continuous vibration may also loosen the internal suppression components causing random bursts of very heavy interference when the appliance is in use.

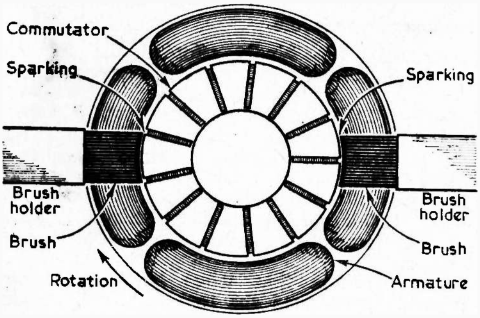


Fig. 1—Interference can be caused by sparking occurring between the brushes and commutator of armature type electric motors. The trouble is aggravated by wear on the brushes or commutor. Induction motors, which do not use brushes, are free from interference.

What is Reasonable Suppression?

It should be understood that perfect interference suppression is virtually impossible to achieve. This would necessitate costly anti-interference precautions at both the receiver and source of interference. Interference precautions at the source are, therefore, based on the assumption that the receiver itself is installed with due regard to interference pick-up. For example, if "reasonable" suppression is undertaken on the appliance and yet a nearby neighbour suffers interference because his aerial is mounted, say, in the roof-space close to the mains wiring, then it becomes the responsibility of the neighbour—viewer or listener—to improve his installation before making a complaint to the Post Office. A radio dealer would advise on such a problem and, if necessary, the dealer himself may consult the Post Office.

The Effect of Signal Strength

How much interference is seen on a picture or heard from a loudspeaker depends not only on how much interference the appliance is radiating but also on how much signal the set is receiving. If the wanted signal is weak, the interference may be equal to or above the wanted signal, in which case it would override the picture and sound and cause extremely disturbing noises and flashes. On the other hand, if the wanted signal is much stronger than the interference, then it may be almost totally masked by the wanted signal and hardly show up at all.

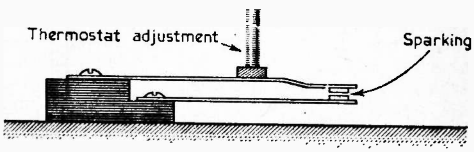


Fig. 2—Interference can also be caused by sparking and arcing between the contacts of thermostats. The arcing may be prolonged on 'switch-off' if the thermostat tension springs are weak.

Clearly, then, in areas where the signals are strong (close to a transmitter), a far greater level of radiated interference can be tolerated than in areas where the wanted signals are weak. This means that "reasonable" suppression in a strong signal area may be looked upon as "poor" suppression in a weak signal area.

Manufacturers of electrical appliances usually design their suppression circuits on the assumption that there will be an average signal level at the receiver, of a level, for instance, that would work a television set adequately from an H-type aerial. Such suppression would, therefore, be almost perfect in areas close to a powerful station, but may be below "reasonable" in areas where the signal strength is very weak.

Radiation from Appliance

Interference to television reception is almost entirely radiated direct from the appliance and connecting cable. The appliance and cable, in fact, act rather like a transmitting aerial and, the closer the appliance to the receiver, the stronger will be the interference. Thus, when an appliance is checked on one's own receiver some small interference effect will almost certainly be observed. This test should, of course, be made with the set receiving a signal, for in the event of there being no programme, the receiver would be highly sensitive to even the smallest amount of interference.

If the interference effect appears to be excessive on the nearby receiver, it often pays to visit neighbours to see whether their reception is being affected. If the interference is highly disturbing, steps should be taken to improve the suppression of the appliance.

Cause of Interference

Interference of the nature under discussion is caused entirely by sparking taking place within the appliance. Whenever there is a make or break in an electrical circuit, sparking takes place. This happens even when an ordinary electric light switch is operated and may cause a small click on sound and an instantaneous flash on vision. Such interference is so short-lived that it is not troublesome. However, when sparking is prolonged the resulting interference can be very disturbing.

Prolonged Sparking

Prolonged sparking takes place between the brushes and the commutator of electric motors having armatures as shown in Fig. 1. As the armature and commutator rotate, so the current is disconnected and connected very rapidly and the sparking is almost continuous. This produces a continuous buzz on sound and bright, horizontal lines across the picture. The amount of interference radiated is almost proportional to the size of the spark, which means that on a motor with worn brushes or commutator the interference is likely to be very high indeed.

Similar sparking occurs between the contacts of a thermostat, as shown in Fig. 2. This happens only when the control comes into or goes out of operation. With a faulty thermostat, however, the sparking on disconnection can be prolonged due to arcing between the contacts, so instead of short-lived interference, prolonged buzzing and flashing may well be produced. Electric irons and electric blankets cause this type of interference, but immersion heater thermostats are often sufficiently well screened by the earthed water jacket which surrounds them, although they also may cause interference.

The Cure

If the appliance is obviously defective in itself, then this should be attended to before suppression or additional suppression is contemplated. It should be noted that there are two basic suppression arrangements—one for radio and the other for television—and it does not necessarily follow that radio suppression will have been achieved after dealing with an appliance for television, and vice versa. Where an appliance is affecting both radio and television sets, it is necessary to combine the suppression arrangements recommended for each.

Suppressing TV Interference

When suppressing a motor for television interference, it is essential that the suppression components be mounted as close as possible to the part of the motor concerned. For example, if a choke is to be connected to the brushes, then it *must* be mounted inside the motor housing adjacent to the terminal of the brush holder. This does not follow to such an extent with radio suppression, for such interference is mostly mains-borne, and the principle in this case is to prevent the interfering currents from travelling out of the appliance into the mains wiring. We have already seen that with television interference, direct radiation is the important factor.

Suppressing Radio Interference

Small chokes and capacitors have been developed by various firms specialising in suppression equipment, for inclusion inside the motor housing, but, even so, ingenuity is often necessary in order to

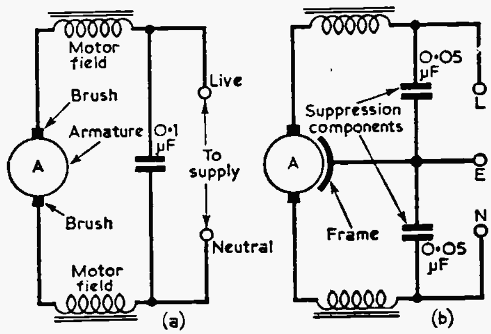
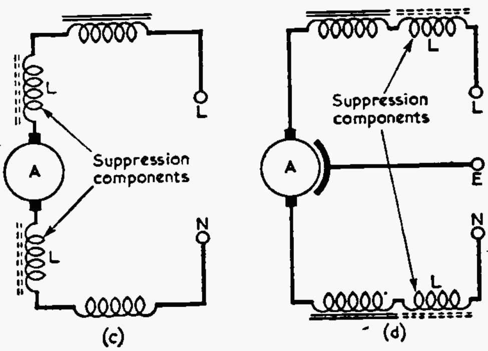


Fig. 3—These suppression circuits are designed for use on small appliances in areas of reasonably good signal strength and moderate interference: (a) and (b) (above) are for radio and (c) and (d) (below) are for television.



accommodate a complex suppression arrangement inside a portable appliance. If radio as well as television suppression is required, it may be necessary to fix the radio suppression components outside the housing.

With this in mind, Belling & Lee have designed a series of suppression units that can quickly be fitted to the flex lead within about 12in. of the appliance. Similar arrangements in the form of adaptors for plugging in at the power output sockets are also available from radio dealers. The

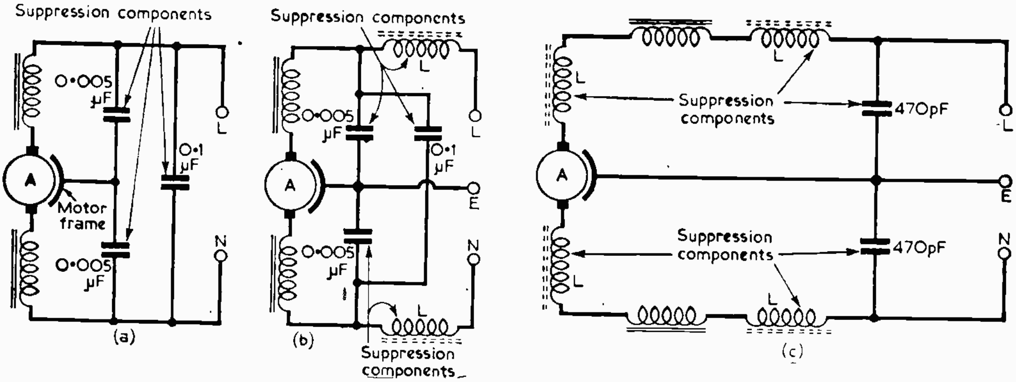


Fig. 4—These circuits are also for small appliances but have a better performance than those of Fig. 3 (a) and (b) (above) are for radio and (c) (top-right) is for television.

latter type are ineffective on television, but the flex lead type are also suitable for television when moderate suppression is required provided they are connected close up to the offending appliance.

Moderate Suppression

In Fig. 3 are given four circuits for moderate suppression of portable appliances. At (a) is the simplest of radio suppression circuits and takes the form of a capacitor across the mains input terminals. If the appliance uses three-core cable (e.g., with a green earth wire), the arrangement at (b) should be used. Special capacitors for this purpose are available.

Similarly, at (c) is shown the simplest of television suppression circuits which uses a pair of television chokes connected close to the brushes. At (d) is the arrangement for a three-cored appliance, but here it may be better to include the chokes L as in (b), depending on results. When checking the success of suppression, it is essential to reassemble the motor housing and run the unit in the normal way with all the screws properly tightened.

Excessive Suppression

In weak signal areas, suppression circuits after the style of those in Fig. 4 (a), (b) and (c) are often called for. Fig. 4 (a) is for radio and could be used on a two or three terminal appliance, but if only two conductors are used, it is still necessary to take the junction of the two 0·005μF capacitors to the motor frame. Connection should be made to a soldering tag clamp beneath one of the motor securing screws.

The circuit at (b) is also for radio and gives even better performance than (a). This is due mainly to the two R.F. chokes L, which in this circuit should have an inductance of about 1·5mH.

The arrangement at (c) is for television only, and the improved performance is given by the use of four television chokes and the two 470pF capacitors. As already pointed out, it is essential that all these components are mounted as close as possible to the motor unit, preferably in the housing.

Suppression Components

For television suppression of small appliances there are two basic components, small chokes wound on dust-iron cores and small 470pF ceramic capacitors. The chokes are rated at 1A or 2A, according to the current requirements of the appliances, and the capacitors must be rated at 300VW A.C., at least.

Capacitors for radio suppression should have a rating of 250VW A.C. and delta-connected units containing three capacitor elements, as in Fig. 4(b) are available in values of 0·1μF+0·005μF+0·005μF and 0·1μF+0·01μF+0·01μF. Chokes for radio suppression are somewhat larger than their television counterparts, depending upon inductance and power rating, but are also available in 1A and 2A ratings.

Fitting Suppressors

When fitting, extreme care should be taken to avoid the possibility of internal short-circuits and adequate insulation should be adopted throughout. The components should be mechanically rigid and wired in a sound electrical manner. Capacitors greater than 0·05μF should never be connected to the frame of an unearthed appliance, but this should not be taken to mean that it is safe to run an appliance without an earth. All appliances featuring an earth conductor *must for safety reasons be connected to an efficient earth point*, such as to the earth pin of a three-pin plug. ■

Underneath the Dipole

A MONTHLY COMMENTARY

By Iconos

FEATURE cinema films, especially old ones, are said to be unpopular with viewers these days. Maybe some of them are rather bad and dated, but just now and again we see on television a film from the cinemas which is neither ancient nor bad. The ITV programme companies have had a few good vintage films but recently it has been the BBC which has scored the successes. One of these was "Cast A Dark Shadow", a modern mystery starring Dirk Bogarde and Margaret Lockwood, which had been adapted from a stage play "Murder Mistaken" which I had seen performed by a West-end company in London and also by a repertory company at Aldershot several years ago. "Cast A Dark Shadow" was a "who-done-it", with light comedy and strong drama mixed in the usual two-to-three proportions but, in this case, including a few novel twists. The story concerned the activities of a plausible young man who made a habit of marrying wealthy women and then murdering them, in order to inherit their riches.

This basic plot sounds bald enough, but the initial script characterisation had been elaborated by London and repertory interpretations and additional "business" by the players, all of which contributed to the meatiness of the film.

The first wife-victim in the film story, a weak drink-sodden woman (who was assumed to have gassed herself) was followed by an ex-barmaid, of the hard and brassy type, who had inherited a fortune and was all set to be the next victim.

In the repertory version, the parts of both wives was played by Hermione Baddeley, whose appearance in both parts was effectively changed by make-up, wig, clothes, and, of course, expert character acting. This, perhaps was the best performance of both parts!

The BBC film cast Margaret Lockwood in the part of the brassy barmaid wife who was nearly murdered, which role she played with great skill, especially in the production of an authentic Cockney accent.

This was the type of film in which television reaped the benefit of prior stage production and yet was not restricted by limitations of two or three settings and no exteriors.

I remember it as a good, but not great, stage play and a gripping film; but on television it seemed to gain something in presentation. Perhaps this was by comparison with some of the puzzling modern kitchen-sink epics recently put before us on television. If it wasn't vintage drama, it was first-class entertainment with Dirk Bogarde and Margaret Lockwood at their best, and with Robert Fleming as the solicitor who solves the mystery. Since he played in this film he has become a reliable solicitor-character on many TV features.

Vintage Tapes

Dramatic, comedy and documentary films are not the only vintage entertainment put before viewers. Now we are able to see vintage video tape shows, and there are no pieces of old tape more welcome to our screens than those which record the diverting adventures of Tony Hancock. The earlier series in which Sidney James was foil to Tony is ever welcome; and now the BBC has reissued, after only four months, the later series in which Tony Hancock is the central figure. Alan Simpson and Ray Galton evolved a new formula for displaying the virtuosity of Hancock, and a second viewing confirms that it is first-class, and suitable for many more showings.

The episode in which he considers matrimony in turn with June Whitfield, Myrtle Reed and Gwenda Ewen, three young women with highly differing characteristics, provided even

This is an interior view, looking upwards, of the 250ft mast at Llandrindod Wells, central Wales, for which EMI Electronics Ltd. have supplied a turnstile aerial array to the British Broadcasting Corporation. This is one of five new stations which the BBC is building to extend its television and sound services and to improve reception in the fringe areas.

more laughs on its second viewing. Let us hope that the BBC repeat these Hancock video tapes regularly, just as they do the five-year-old Hancock sound tapes on radio—they are all classics.

Comedy Classics

Comedy classics of the cinema are not very often seen on television. I can't remember having seen a Chaplin film though I hear that this great comedian has permitted a section of one of his last films, "Limelight" to be shown by Scottish Television.

The antics of Laurel and Hardy used to be regularly shown on BBC TV at one time, and might once more be brought out of the film vaults and given an airing on television. A new generation of viewers has grown up and may never have seen these amusing buffoons.

Other comedy classics which might (or might not) make the grade, are the real vintage silent comedies of Harold Lloyd, and the slapstick adventures of Will Hay and George Formby jnr.

Sound Levels

One of the advantages BBC television has over the ITV programme companies is its unified policy as regards sound quality and volume. The result is that in all regions the BBC programmes keep reasonably even in volume and quality, uninterrupted by fortissimo commercials. The ITV companies, on the other hand, are not all of the same mind on policies which may affect the uniformity of sound. Advertisers who feel that their wares are best pushed home by sheer force of volume, have their actors declaim the merits of the product loudly and the recording reinforced by electronic compression of sound. Occasionally, this bangs the "message" home to viewers and also to the people living next door, if the volume knob is not turned down quickly! But it often makes the next item on the programme sound rather thin and feeble by comparison.

There is now a tendency for ITV companies to make use of electronic sound compression on various items which depend upon clarity of diction—so often missing these days in so-called plays of realism.

I.T. News uses compression, for instance, without losing quality and certainly with a gain in intelligibility. Electronic sound compression mainly affects the peaks of modulation, reducing the top 15 or 20dB into 10dB, thus allowing a higher level of volume without overshooting. By its use, whispered or throw-away lines become audible instead of being lost. This is an important factor when the viewer has a television set with a loudspeaker at the side, operating towards the wall or curtains in a room.

Programme Papers

The BBC also has uniform presentation of its programmes in its weekly journal in all regions. ITV companies have very different ideas from one another on the right and proper way of producing a television programme journal.

The London companies, Southern, Midland and Anglia have their own regional versions of the 'TV Times', a magazine publication somewhat like the BBC's journal in shape, but a little easier in which to find the night's programme. Ulster, Scottish Television and TWW have 'The TV Post', 'TV Guide' and 'Television Weekly' respectively, which are all large-page publications, more like newspapers. Tyne-Tees and Westward produce 'The Viewer' and 'Look Westward' for their respective regions, very fully illustrated with photographs and cartoons, but otherwise, in the rather more handy size and shape of the 'Radio Times'.

All of these publications line up with the style of the film-fan magazines of twenty years ago, but with the benefit of more modern printing techniques. None of them carry technical information of any weight but all are bright and informative in a popular picture paper style, with readable articles. British viewers are better served with their regional programme magazines than any other country in the world.

The Roaring Twenties

It—or rather—they, had to come. First the gay nineties, then the plushy 1900's, and now the roaring twenties. I don't know whether the new craze was triggered off by the authentic jazzy sounds of the Temperance Seven, but the days of the Charleston, the Black Bottom, the Savoy Orpheans and Red Nicholls are with us again.

The Warner Brothers television series, "The Roaring Twenties" seems to have appeared at just the right moment with American speakeasies, straw-boaters and tuxedos as a background to gangster melodrama in its most elementary and—it must be admitted—entertaining form. At any rate, the TAM rating indicates that it kept quite a lot of people awake at a late Saturday night spot on several of the ITA network stations.

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.

ANTI-FLUTTER CIRCUITS

SIR,—I have tried most of the commercial circuits of the above type but cannot yet completely remove the flutter caused by aircraft passing overhead. Surely it is not beyond the bounds of possibility that a very efficient type of AVC circuit could be developed which would hold a picture steady except perhaps under the most extreme conditions. Living on a " run " to London Airport, I think we have about the worst position in the country, and I would like to avoid the very intense fade and glare which results from the big planes passing over the house.—E. LEESON (Kenton).

AN EKCO FAULT

SIR,—In your September issue in a reply to a Mr. A. Phillips concerning a fault in his Ekco T161, you have hit the right nail on the head. You suggest that his trouble may be due to a weak signal. I recently had two sets giving a similar trouble and after much searching found that the decoupling condenser in the I.F. stage had gone open circuit. This occurred on both sets and after only a short period of use. The voltage rating is correct, but presumably the condenser had developed a fault and although replaced by similar components the trouble has not recurred. — G. BRETTENDEN (Harringay).

LINE SLIP

SIR,—I would suggest to Mr Humberstone that the washers were not originally in his set (September issue). They must have been dropped there after the set had been installed, as they were presumably of steel and had been magnetised. The magnetic field on the coils is negligible, and they were probably lodged where they were found as a result of the pull of the focussing magnet, and when the set had cooled down they should have fallen away. Is he sure they were not part of the actual scanning yoke assembly and had not in fact become loose and if they are not replaced the coil assembly may later give trouble. — D. GROVES (Leamington).

RE-GUNNED TUBES

SIR,—I wonder if anyone has had experience with the remade tubes to the extent that they could suggest a possible cause for the trouble which I have experienced with these items. I have had several tubes from time to time, and from different firms, but in nearly every case the tubes have become erratic after a period of use. The fault does not take the form of the standard failing tube symptom, but rather resembles that found in an area of weak signal strength, where the signal fades. The picture *suddenly* drops in intensity, to return after a few minutes in a rather dim manner. Full black and white are not obtained, but in other respects the results are normal. No adjustment of controls has any effect on the screen, and when the tube is next used it appears perfectly normal. The sudden drop in brightness (contrast?) does not occur every night and only after an hour's use or so. I feel convinced that it is the tube and that in some manner the re-gunning process has this effect. I did once try a replacement, but it takes so long to change the tube that a comparison is not practicable, and by the time the new tube is in, if there has been any fault in the circuit itself, it would have cleared itself.—G. BORHAM (Kidderminster).

THE "LINES" BATTLE *(Continued from page 120)*

UHF Tuners

There are several UHF tuners and typical in this respect is the Cyldon Type UT. This has continuous tuning over Bands IV and V through a 5-to-1 gear drive which may be further modified through the manual tuning and indicator drive built into the set. An earthed grid self oscillating mixer is used and tuning is accomplished by Lecher lines and a three-ganged capacitor.

Another idea, adopted by Ferguson and others, is simply an additional segment clipped into the existing tuner. This produces double mixing and multiples of the oscillator frequency (usually the third or fourth) are generated by a crystal circuit, as shown in Fig. 1 (last month). The harmonics are mixed with the incoming UHF signal by a second crystal and so produce a first I.F., which is fed into the mixer section of the standard tuner in the ordinary way and changed into the I.F. of the receiver.

Ferguson also have available a comprehensive conversion unit that is designed for the Senator Phase II models. This is in the form of a sub-chassis and contains the I.F. stages, video amplifier and flywheel sync circuits. When the unit is installed it can be brought into operation by a 405/625 control knob which, although fitted on some models, is at the present time disconnected. It would, of course, be linked to the conversion chassis and, with the addition of a UHF tuner or adaptor, the receiver would be a switchable dual standard model. The design of the conversion chassis cannot be finalised until the standards are fixed, but a completely converted model has been demonstrated on the true CCIR system.

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. 152 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

FERGUSON 406T

I have a Ferguson 406T which has been used for two years on 250V without the voltage adjustment link for 200V being removed. A number of condensers have been replaced and the remainder checked by shunting. Valves 6, 5, 11, 12 and 13 have been replaced. When switched on the picture is short top and bottom, split into two parts and the screen is covered by numerous white lines. After approximately 15 minutes the picture flickers and fills the screen, but it remains divided into two parts. Movement of the frame hold then produces a normal picture. I have just replaced the OA81 interlace filter and would appreciate any suggestions as to what to do next. C. Violett (Hemel Hempstead).

Carefully check the printed wiring associated with V5 and V12. Check the height, vertical lock and frame linearity control are in good order. It would seem from your description that there is a minute crack in one of the printed wires.

K.B. OV30

My receiver is a 17in. K.B. New Queen Special OV30. Could you please help me with two faults? Firstly, when the brightness control is altered the picture blows up and goes out of focus. The second fault appears to be with the vertical hold control. The picture is subject to intermittent rolling. Once the picture starts rolling it takes very careful handling of the vertical control to stop it.—W. Gregg (Belfast).

You should first ensure that ion trap magnet on the rear of the tube neck (if fitted) is adjusted for maximum brilliance. If the effect continues, change the R19 EHT rectifier, mounted on the front of the line output transformer, inside the screened section. With reference to the frame hold fault, check the 12AX7 valve situated on the right side near printed panel.

RGD Deep 17

Perhaps you would be able to help me on the following points regarding the above receiver. On replacement of V11 (EF80 sound I.F. amplifier), which developed a fault, the sound kept clicking on and off after about five minutes warming up. I found the sound, particularly on ITV, was not as loud as it had been. I have since tried two more EF80's in this position, but with no better results. Could you please suggest a possible solution? With regard to your July 1961 issue—Servicing Television Receivers, page 519, about PY32 failure—I have recently fitted a new PY32 and am puzzled about the paragraph stating that pins 3 and 5 should be strapped together. Should the resistors 90A and B be taken out of circuit when you do this, or left as they are? Also if the above modification is not done, what detriment is there to the set—will the PY32 function properly, or will it have a shorter life, etc.?—J. Wormald (Leeds).

Original valves of the PY32 type, used a twin anode construction, each anode brought out to a separate pin i.e. one to 3, one to 5. Recent PY32 valves have a single anode brought out to pin 5. As this passes the whole H.T. current, not half as before, the series resistor will drop twice the voltage. To avoid this it is only necessary to connect pin 3 and pin 5 together to place both resistors in parallel, thus halving the voltage drop which would occur across one. Check the 0·001μF capacitor from pin 8 to chassis and that from pins 1 and 3 to chassis by replacement. Check the alignment of L22-23-24, and, if necessary, the feed resistor R88. If sound is intermittent, restored by a pulse, check C70 (0·1μF), C72 (0·01μF) and C74 (0·005μF).

MARCONI VT53

Could you please help me with the following fault. Adjustment of the contrast control gives a picture at one end of its travel with no sound, and sound with no picture at the other end. Also the picture will not lock. R40 is correct. I did disconnect C32 from pin 3 of V10, but it made no difference to the picture. I would have thought that disconnection at this point would remove the picture and so I reconnected again as it was before. Also V5—the vision amplifier—has 70V on the anode, the control grid, pin 1, has 12V D.C. and the cathode 10V. The current through this valve is from 30 to 40mA. The cathode voltage on the CRT is only 30 because of the heavy fault current through V5. Could you tell me how a 12V positive appears on the control grid at all? —T. M. Lloyd (London, S.E.17).

The video section is in a state of oscillation, possibly due to L14 being partially open circuited (note the effect of replacing this with another choke) or to incorrect vision R.F. alignment. Check security of screening cans and realign L10-L7, etc. Maladjustment of T.C. (sound rejector) could cause the effect but this should not be altered unless absolutely necessary. If the fault persists, check V6 and the decoupling capacitors C11, C9 and C13.

SOBELL T192

Although I live within 20 miles of both BBC and ITV transmitters, owing to surrounding hills, reception is reduced to fringe area conditions. The

(Continued on page 151)

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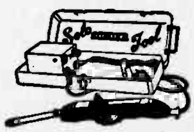

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(Continued from page 148)

ITV transmitter (Band III, Channel 11, Caldbeck) has only recently commenced and at present is on daily test transmission. I have tried receiving this station, using a BBC aerial only, but the picture obtained is extremely indistinct. Do you think a proper Band III aerial would improve reception to any great extent? The BBC picture received is quite good, but with a certain amount of horizontal " tearing " which is quite noticeable on the test card, but not so noticeable on an actual programme transmission. Also the background, especially when light, flickers a great deal. I was wondering if a pre-amplifier would be worthwhile for this Band. The advertisement I obtained re pre-amplifiers also refers to diplexers and triplexers. Can you advise me about diplexers and triplexers please?—J. Hornbrook (Keswick).

If you are receiving an indistinct picture from the ITV transmitter using a BBC aerial, we think it is quite likely that a good picture will be received using an efficient Band III aerial, such as a double 4 or double 5 array. The interference on BBC is not due to a weak signal but to reflected " ghost " signals. A diplexer is necessary to combine two aerial leads to a common downlead. A triplexer takes three inputs—Band I, Band III and VHF radio on Band II—to a common downlead. In your situation efficient aerials are the correct solution.

AMBASSADOR TV 15CC

There are three faults on this set: no raster, no whistle from the line timebase, and no white flashes when the channel switch is rotated. Upon switching the set on there is immediately a flash in the neck of the tube, and thereafter it lights up normally. The sound is perfect. The valves line-up in the set is U301, 20P4, 6K25, 10P14, 10LD11 and 10F1. The U301, 20P4 and 10LD11 are faulty, but before replacing them I wish to be assured that the flash in the tube is nothing serious, which may result in the new valves being blown. —G. Harrison (Swinton).

Either or both the 20P4 and the V301 may be causing the trouble referred to. The flash in the tube neck is of little or no importance. The 6K25 is the frame generator and this affects the height and vertical hold aspects of the picture only. Being a gas-filled triode with a " flash point ", a valve tester cannot apply a satisfactory set of conditions to make a worthwhile test.

FERRANTI 14T6

I would like some information on the following fault on a Ferranti 14T6. On advancing the brightness control, the picture swells. I suspect low EHT so the EY86 was changed, to no avail. The same effect occurs if the contrast is advanced, and also if the iron trap is moved carefully. The PL81 and PY82 were changed without improving things. The grid voltage on the tube is 0·50V, and the video anode voltage is 140V. The CRT tube is an electrostatic type. Do you think it is the tube? The H.T. D.C. voltage seems correct, as does the sound.—T. V. Byrne (Farnborough).

You do not say whether the EY86 heater is glowing normally or not at low brilliance. If the heater glow is clearly visible and remains so while the brilliance is advanced and the picture swells and fades, the new EY86 is at fault. If the glow is subdued or hardly visible at all times, the line timebase circuit must be carefully checked. If the glow is clear when brilliance is low but fades as the brilliance is advanced, although the picture does not come in from the sides, the ion trap magnet is inefficient or wrongly positioned, or the tube is passing excess current. Try wiring a 1M resistor from pin 10 to pin 1 of the tube base socket.

INVICTA 126

I am having trouble with this receiver, the difficulty being that the valve heaters do not light up. I have checked all the valves, fuses and switches, but have made no progress, and would be pleased if you could help me in this matter. —Frank M. Lever, R.M.R. (Netherfield).

You will almost certainly find that one section of the left side mains dropper has fractured. Observe the position of the voltage selector plugs; connecting to these are the sections of the mains dropper. Carefully check these windings. If a break is found, repair it or clean the end, unwind a turn or two and wrap firmly around the nearest connecting post. If the receiver does not have two PY82 valves on the upper right side, remove the chassis and check the single wire-wound resistor, mounted on the lower part. A black mark on the body normally denotes a fracture which necessitates a new resistor—130Ω 10W.

ALBA T644

The following fault has occurred on this set. There is no picture or sound. All the valves light up except the EY86, which I have changed with no results. Also there is no spark at the EHT clip on the side of the tube. The set was working all right when switched off the previous night but would not work when switched on again. Could you please explain how to boost a fading tube? —M. Evans (Gateshead-on-Tyne).

It would appear that the A.C. supply to pin 9 of the PY82 is absent. Check the three sections of the dropper—35Ω-30Ω-30Ω—which supply pin 9 according to the setting of the mains plug. The PY82 itself could of course be defective. To boost the tube wire a 5k 10W resistor from the mains dropper to pin 12 of the base. If the emission is not improved, remove it from pin 12 and connect to pin 1. This applies to the T644 only.

EKCO T221

I have an Ekco T221 television which does not give full volume. I have changed all the valves and checked the voltages. I have found that connecting the AVC line to earth increases the volume.—J. Bullock (Horley).

Your trouble is likely to be caused by an unstable sound I.F. strip and this is frequently caused by defective 0·003μF decoupling condensers. If replacement of these does not improve matters, a 47k damping resistor across the grid winding of the middle sound I.F.T. will stabilise the strip.

PYE V.T.4

The frame on above receiver collapsed to a single horizontal line. The frame oscillator and

frame output valves were replaced, as was the frame output transformer. Can you suggest what else I can try to cure the fault, as the above changes have not had any effect at all.—F. Crowley (Hatch End, Middlesex).

We suggest that you isolate your fault to either the oscillator or output stage. This can be done by applying 6·3V A.C., from a suitable source (CRT "live" heater pin), via a 0·1μF condenser to the grid of the PL82. This should produce a distorted picture some 6in. tall if the stage is satisfactory. Frequent causes of your symptoms are: an open circuit frame hold control, broken scancoil leads, and faulty coupling condensers in the ECC82 stage.

DECCA DM4/C

My receiver has recently developed the following faults. The picture is quite good but is spoilt by very predominant scan lines, also the picture flickers. The volume is quite loud, but on ITV and VHF it has rather a rasping qual·· whilst on BBC it emits a high pitched hum. _ should be very grateful for any assistance you can give me in curing these faults.—W Gibson (Pudsey).

On the right of the centre screened section, as viewed from the rear, are three valves (all ECL80). We would advise you to check the second and third by replacement. The harsh quality of the sound seems to suggest incorrect sound I.F. alignment whilst the hum could be due to incorrect BBC oscillator core adjustment or possibly excessive input signal. The oscillator coil core is adjusted from the front; the channel selected, the fine tuner set to midway, the knobs removed, and a long non-metallic tool is inserted to the right of the spindle to adjust the coil core.

Television Filters

(Continued from page 122)

be fitted in the aerial downlead and tuned to the frequency of the offending station. Fig. 2 reveals how the arrangement works. At the frequency of the unwanted transmission, a high impedance is offered by the rejector, while at frequencies either side the impedance is relatively small and so the wanted signals pass through without trouble while the unwanted signal is considerably reduced in strength at the set input.

The success of this method depends very much on the "efficiency" of the rejector. The circuit should have a high Q so that the sloping sides of the response are as steep as possible to prevent them from embracing the frequency of the wanted signals and to provide maximum rejection.

A circuit which has been proved for this work is shown in Fig. 4 and its construction is shown in Fig. 5. The coil is self-supporting in 18 s.w.g. wire and is tapped at a quarter turn to provide the correct impedance match and to avoid damping the tuned circuit by the low impedance of the coaxial cable. Tuning is by means of a low-loss air-dielectric trimmer. For Band I operation, the coil consists of two turns with a ¾in. diameter and the turns spaced by the diameter of the wire. A fixed 30pF capacitor puts the circuit on Band I and the 0-30pF trimmer allows tuning from Channel 1 to Channel 5. A picture of the response of such a circuit is shown in Fig. 6, from which it will be seen that the insertion loss is quite small (compared with the datum line) while the rejection is quite high and peaky.

This arrangement is suitable for suppressing interfering R.F. signals at almost any frequency, but, with very high frequencies, difficulty is encountered in maintaining a sufficiently high Q.

Internal Rejectors

The circuits in Fig. 7 (a) and (b) show how simple parallel rejectors are used in the circuits of a receiver. At (a), L and C form the rejector in series with the aerial input. In this application, the rejector is usually tuned to the I.F. of the set or to the image frequency.

At (b) is shown a similar type of rejector comprising L and C, but when this is found in the vision I.F. channel, as shown, it usually serves as a sound rejector or adjacent channel sound rejector. A similar arrangement may sometimes be found in the cathode circuit of the vision I.F. amplifier valve. At the tuned frequency, the circuit impedance is largest and purely resistive so that heavy negative feedback occurs and reduces the gain of the stage at the rejection frequency. Off frequency the feedback falls and thus restores the stage gain to normal. The cathode lead is usually tapped into the rejector coil to reduce the load on the circuit by the valve cathode.

At Fig. 7 (c) is shown a four-terminal filter network which is sometimes incorporated as a sound rejector or adjacent channel rejector. This is called a "bridged-T" rejector because the action of the circuit is rather like that of a bridge. In effect, when R is adjusted for maximum attenuation the bridge is in balance and the "resistive" losses of the tuned circuit are cancelled out. In this way the circuit exhibits a very high Q resulting in extremely high rejection ratios.

(To be continued)

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PRACTICAL TELEVISION, DECEMBER, 1961.

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(continued)

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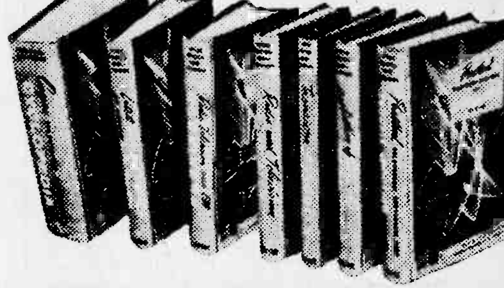

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5Y3	**7/6**	6V6G	**6/6**	ECH42	**10/6**	PCL82	**11/6**
5Z4	**9/6**	6X4	**7/6**	ECL82	**10/6**	PEN25	**6/6**
6AM6	**5/-**	6X5	**6/6**	EF39	**5/6**	PL82	**10/6**
6B8	**5/-**	12AT7	**8/-**	EF41	**9/6**	PY80	**7/6**
6BE6	**7/6**	12AU7	**8/-**	EF50	**5/6**	PY81	**9/6**
6BH6	**9/6**	12AX7	**8/-**	EF80	**8/-**	PY82	**7/6**
6BW6	**9/6**	12BE6	**8/6**	EF86	**12/6**	SP61	**3/6**
6D6	**6/-**	12K7	**6/6**	EF91	**5/-**	UBC41	**9/6**
6F6G	**7/6**	12Q7	**6/6**	EF92	**5/6**	ECH42	**9/6**
6H6	**3/6**	35L6	**9/6**	EL32	**5/6**	UF41	**9/6**
6J5	**5/6**	35Z4	**7/6**	EL84	**8/6**	UL41	**9/6**
6J6	**5/6**	80	**9/6**	EM81	**9/6**	UY41	**8/6**
6J7G	**6/6**	807	**5/6**	EZ40	**7/6**	U22	**8/6**
6K6GT	**6/6**	954	**1/6**	EZ80	**7/6**	VR105	**9/6**
6K7G	**5/6**	EA50	**1/6**	E1148	**1/6**	VR150	**9/6**

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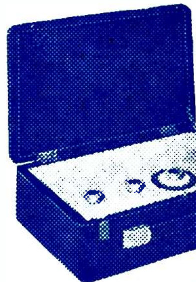

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