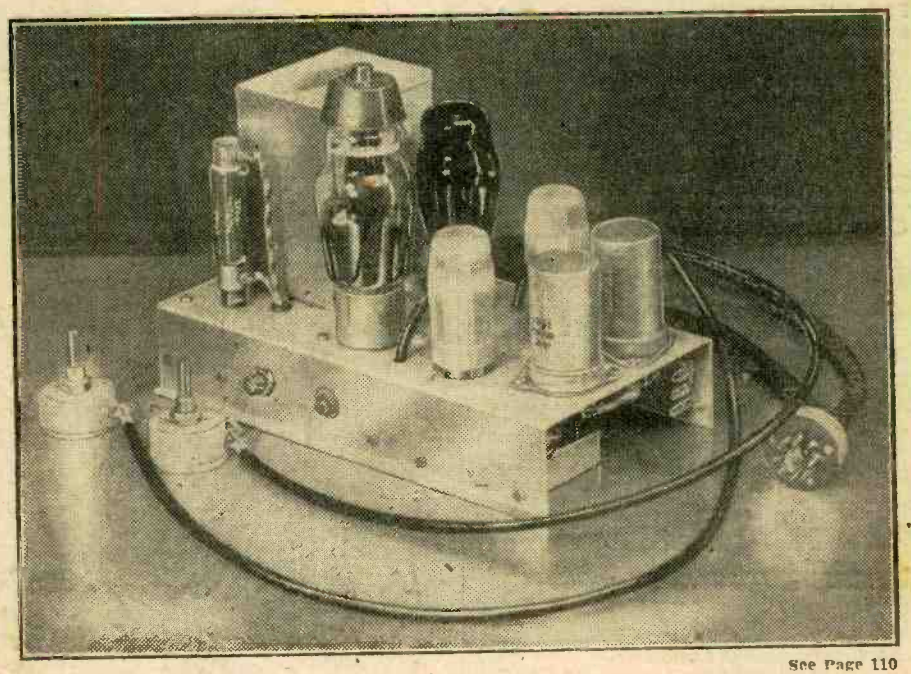
Practical Wireless

9d. EVERY MONTH

AND PRACTICAL TELEVISION

Vol. 25. No. 512. || Editor: F. J. CAMM || MARCH, 1949



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PRINCIPAL CONTENTS

Practical Wireless and PRACTICAL TELEVISION
17th YEAR OF ISSUE
EVERY MONTH
VOL. XXV. No. 512 MARCH, 1949
Editor F. J. CAMM

COMMENTS OF THE MONTH — BY THE EDITOR

The Wireless Telegraphy Bill

THE Radio Industries Council has sent to all Members of Parliament a memorandum explaining the causes of electrical interference with radio and television services, so that those concerned with the new Wireless Telegraphy Bill may appreciate the importance of dealing with the problem now.

It is noted that no reference is made to the very serious trouble caused by public service vehicles, and we challenge the Radio Industries Council's original statement that 90 per cent. of interference with television is caused by car ignition systems. We do not think that they have any justification for such an "estimate," and we suggest that it is just a wild guess.

Public service vehicles, electrically propelled, cause very serious interference. Why has this not been mentioned in the memorandum? This states that many kinds of industrial and domestic electrical equipment produce, inadvertently, when operating quite normally, signals at radio wavelengths in much the same way as the B.B.C. radiate programmes. They give as examples of equipment which produce such signals, certain types of electric motors, electric vacuum cleaners, electric razors, certain types of electric water-heaters, irons, bed-warmers and refrigerators, motor vehicle ignition systems, and electro-medical and industrial H.F. heating equipment.

Unlike radio signals, which can be controlled, the signals radiated by this equipment are uncontrolled, and instead of being confined to one fixed wavelength are transmitted over a wide band of wavelengths.

As an example, consider two signals being radiated simultaneously, one a B.B.C. programme, and the other a signal produced by a vacuum cleaner. When the receiver is tuned in to the B.B.C. programme it is received at a fixed point on the dial, but the other can be received anywhere on the dial, and so the signal from the vacuum cleaner will also be heard as an unwanted and interfering signal.

This interfering signal may travel through the ether and along electric cables, wires, pipes and other metal objects. Not every piece of electrical equipment causes interference; only those which produce signals at radio wavelengths.

The memorandum goes on to suggest how interference can be suppressed. It can be suppressed on the receiving apparatus, by means of internal screening and by the use of a special aerial which must be very high so as to be outside the range of interference. This is, however, expensive, and not generally practicable for the ordinary public.

In cases when the interfering signal occurs on the same wavelength as the wanted signal, which it does in most cases, it is not possible to suppress it in the receiver. The practicable method, therefore, is to suppress interference on the apparatus which causes it and, as we have pointed out before, this can be effected by means of a simple device fitted to the equipment. The device is cheap and easily fitted.

Increasing use is being made of radio and radar as navigational aids, and the vital importance of preventing interference with these services, where safety of life is involved will be fully appreciated. There is no reason why one user of electrical apparatus should be favoured at the expense of any other, but we concur in the view that it is desirable that full use should be made of scientific knowledge and technical experience to ensure that all electrical appliances and radio services work efficiently for the good of the public. If measures are taken to ensure that equipment producing interference is properly suppressed, the public will derive the fullest enjoyment from the large sums of money spent by the B.B.C. to give the best in radio and television entertainment.

Editorial and Advertisement Offices: "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone': Temple Bar 4363.
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Wireless." 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 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: The Editor, "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of wireless 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.

Practical Television

ELSEWHERE in this issue readers will notice that we have re-introduced the Practical Television Supplement. In this feature, which will appear monthly, we shall give the latest television news, reviews of television receivers, and constructional details of apparatus.

Readers interested in the subject will appreciate the grouping of television subjects within the pages of the supplement.

ROUND THE WORLD OF WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended 30th November, 1948.

Region	*Number*
London Postal	2,121,000
Home Counties	1,496,000
Midland	1,627,000
North Eastern	1,771,000
North Western	1,482,000
South Western	1,004,000
Welsh and Border	660,000
Total England and Wales..	10,161,000
Scotland	1,075,000
Northern Ireland	186,000
	11,422,000

British Railways to Test Radio

BRITISH RAILWAYS are to carry out tests with radio to ascertain whether it would facilitate any traffic or engineering operations.

Announcing this, the Railway Executive report that in addition to fixed radio stations, tests will be carried out with transportable equipment, portable sets, for use on vehicles and by staff on the ground.

The tests envisaged will, for example, determine the possible value of wireless for :

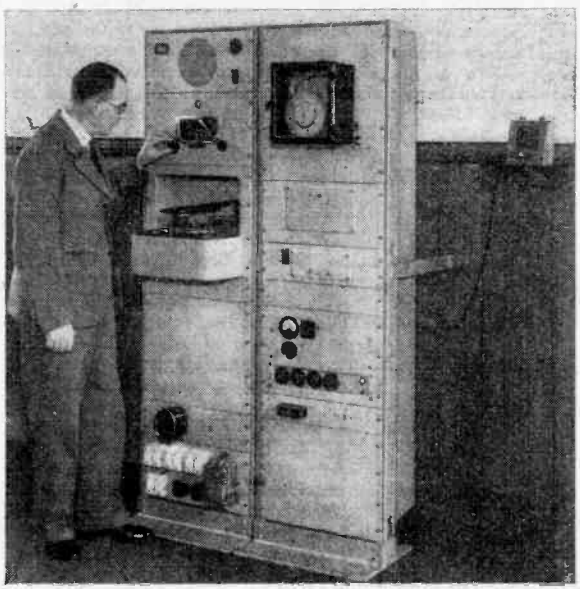
Communication between shunting-engine drivers, ground staff and control towers in marshalling yards.

Communication between staff during extensive engineering operations.

Communication from a central depot to road cartage collection and delivery vans.

Working trials will take place as soon as the radio equipment now on order becomes available.

Tests are also in hand, using ultra-high-frequency to determine the possibility of providing radio communication through tunnels, to facilitate engineering operations in these difficult locations.



Main Equipment Rack at the Institution for the Blind. The radio receiver and record player are immediately below the loudspeaker grille, with the "programme" timeswitch at top of the right-hand rack. A microphone for local announcements can be seen on the wall.

Additional Frequency Bands for Amateurs

THE Postmaster General announces that as from the 1st January, 1949, holders of amateur wireless station licences may, subject to the conditions of their licences, use in addition to the frequencies they already use, frequencies within the bands 5,650 to 5,850 Mc/s and 10,000 to 10,500 Mc/s and, on a non-interference basis, the frequencies 144 to 145 Mc/s, and 1,215 to 1,300 Mc/s. Only amplitude modulation may be used with frequencies in the 144 to 146 Mc/s band but in the other new bands frequency modulation or amplitude modulation may be used. Amateurs who hold licences which restrict them to using telegraphy or a maximum power of 10 watts will be required to observe the same restrictions when using the new bands and the 145 to 146 Mc/s and 420 to 460 Mc/s bands released earlier, but other amateurs will be allowed to use any of these frequencies for telegraphy and telephony at powers not exceeding 25 watts. Licences will be formally amended by a notice in the London Gazette. The continued use by amateurs of frequencies in the 58.5 to 60 Mc/s band will be permitted until a date not later than the 31st March, 1949, which will be announced in due course.

Radiotelephone Service With R.M.S. "Caronia"

THE Postmaster General announces that telephone service is now available with the R.M.S. *Caronia*.

The charges for calls to the *Caronia* are the same as those for calls to other liners.

The British Institution of Radio Engineers

THE London Section held a meeting at the London School of Hygiene and Tropical Medicine recently when a paper was read by J. B. Birks, B.A., on "The Physical

Applications of Microwaves." Mr. Birks is the lecturer in Natural Philosophy at the University of Glasgow and made a special journey from Scotland in order to give this paper.

A major part of the physicist's knowledge of the structure of matter has been derived from the study of the interactions between electromagnetic radiations and matter. The major war advances in microwave experimental technique and apparatus have provided the physicist with important new research tools, and have encouraged fresh investigations of the properties of matter in the centimetre wave region. The paper reviewed the progress made in such physical applications of microwaves.

Big Ekco Development in India

E. K. COLE, LTD., announce the successful conclusion of negotiations with the great Tata organisation of India for the manufacture and distribution of radio receivers in India, in the following statement:

"E. K. Cole, Limited, and National Radio and Engineering Company, Limited, of Bombay (a Tata affiliated company) announce that they have entered into an agreement for the establishment and development of radio manufacture and distribution in India. This will embrace radio receivers, components and electronic devices generally. Plans are well advanced for the production of a range of radio receivers, the first of which it is expected will appear shortly."

Radio Relay Installation at Institution for the Blind

AN automatic time signal and radio relay system of a flexible character has recently been made and installed by the G.E.C. for the Royal Dundee Institution for the Blind.

The assembly illustrated houses a radio receiver, gramophone with automatic record changer and microphone input panel, as well as the main 60-watt amplifier and power supply equipment.

The apparatus is intended chiefly for the relaying of radio and gramophone programmes but microphones are available to enable announcements to be made. There is also provision for locally-generated time signals to announce the beginning and ending of work periods.

The entire equipment is switched on and off automatically and provision is made for music to be reinstated automatically after time signals or microphone announcements have been made.

"Electric Eye" Banishes Smoke

IT is reported that an "electric eye" for the control of the smoke nuisance is in use in Australia. It controls fuel supply and regulates smoke volume automatically. Hospitals and factories in Melbourne, Victoria, are installing it and the inventor claims that it is capable of dealing with the smoke nuisance from municipal power stations.

Picture Transmission

ULTRAFAX, a new method for high-speed transmission of pictorial or printed material, was demonstrated to the public for the first time last month, according to *Radio Electronics*. Feature of the demonstration was the sending in just two minutes and 21 seconds of the complete text of "Gone With the Wind," the famous 1,047-page novel.

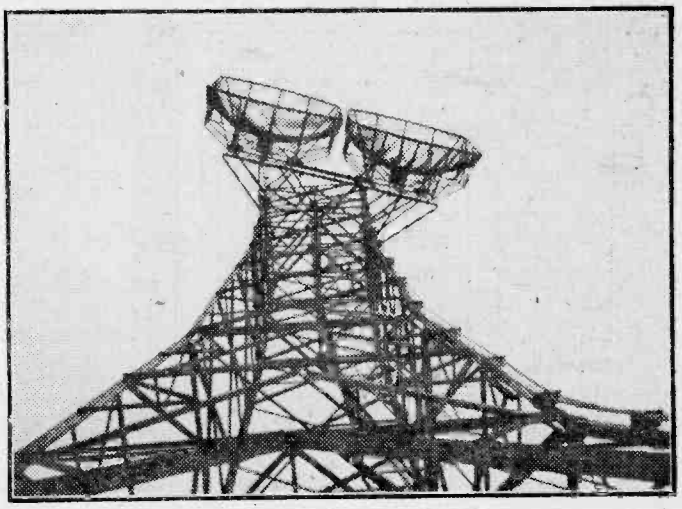
A picture of each page is transmitted via television to a TV receiver and is copied on microfilm. Thirty of these pictures per second are sent. A war-developed system of high-speed photography delivers film ready for printing or projecting in 45 seconds.

Television Points to the North-west

ONE hundred feet above the heads of passers-by, on the roof of the old Museum telephone exchange in Cleveland Street, off Tottenham Court Road, workmen are erecting a giant television transmission aerial. The aerial is the first part of the B.B.C. project to bring television to the many people who live outside the range of the London transmitters, and is the London link to relay programmes to the new television station at Sutton Coldfield, for re-transmission to the Midlands and the North. A cable will carry the programmes from Alexandra Palace to Cleveland Street.

"Detector" Medical Aid

A NEW device for the detection of metal is designed to locate foreign objects in animals. A bit of baling wire swallowed by a cow or a bullet accidentally fired into a farm animal or pet may be located by passing the detector over the animal's body. Developed by the U.S. Army Medical Department, the device is awaiting final clinical tests.



The new Relay Aerials in London. Note that the reflectors are made from strips instead of being solid—in order to reduce wind resistance.

Compact Three-band Superhet

A 4-valve Battery Receiver of Simple Design Built From Standard Parts

By R. V. LUMBARD

A BATTERY receiver capable of receiving both short-wave and home stations was recently needed. Such a receiver was to be compact, at the same time using standard components to the fullest extent. Since the set might frequently be used with a 20ft. throw-out aerial, sensitivity adequate to receive the more powerful short-wave stations was required.

The four-valve superhet circuit was decided on, as giving a good overall performance. Simplicity of operation is ensured by reducing controls to a minimum. The 4in. P.M. loudspeaker provides volume and quality sufficient for usual needs with this class of receiver. Limiting the number of valves to four assists in battery economy.

Since the set was designed as a semi-portable, an earth is not used. The addition of an earth on medium waves does make a marked difference to signal strength, although sensitivity is adequate without. Overall size is approximately 13in. by 8¼in. by 8¼in. deep. Broad details of construction are given, all minor points of receiver assembly and construction being left to personal discretion.

Two-volt valves are used. First, a triode-hexode frequency changer to maintain a good short-wave performance. A four-pin variable-mu H.F. pentode follows as I.F. Then a double-diode-triode for detection, A.V.C. and audio-frequency amplification. Finally, an output tetrode of moderate slope, to give a favourable compromise between sensitivity and quality.

There are only two connections to the 120-volt H.T. bias, for the output valve is automatic, resulting from the volts-drop across R13. The resistor R7 was connected across the volume control R14 to reduce the diode D.C. load, since the value of the available 1-megohm volume control on its own was considered too high. The A.V.C. voltage is taken from the primary circuit of the second I.F. transformer, full A.V.C. being fed to frequency changer and I.F. valves.

The choice of coil unit used is left to the constructor. A large section of the chassis is removed to allow the coil unit to be fitted. If necessary, the unit can project above the level of the chassis. There is ample clearance below the two-gang condenser. The space will readily accommodate the average three-waveband unit, or, if preferred, the constructor's own coils, together with wave-change switch, trimmers and padders. The writer's present coils are of the "P" type, covering 12-35, 35-100 and 200-550 metres. An alternative is to use the three-waveband iron-dust core coils to cover long, medium and short, and these, besides covering the worthwhile short-wave broadcasts, will enable the 1,500 metres Light programme to be heard.

The Circuit

The complete theoretical diagram of the coils and switching is shown in Fig. 3 (a). Values of trimmers and padders are omitted, since they depend on coils used and wave ranges covered. An alternative oscillator-anode circuit can be tried, and is shown in Fig. 3 (b). It was found in the writer's receiver (a) gave best performance on the lowest wavelengths. Excessive oscillation on any one waveband can be cured by artificial damping on the coil concerned. The inclusion of a series resistor of 200-1,000 ohms between the anode winding of the coil and the switch contact will stabilise things. A further resistor of

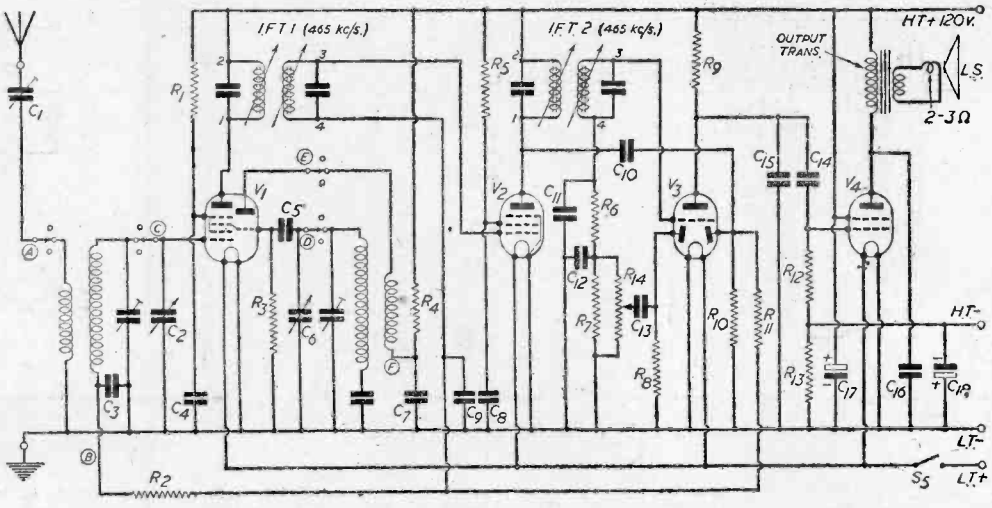


Fig. 1.—Theoretical circuit diagram complete with basic coil unit components for single waveband.

30,000-100,000 ohms, connected across the tuned winding, should cure any remaining instability.

It is possible to arrange that an additional resistor is switched into the oscillator-anode circuit when not on short waves. This makes for greater H.T. economy, without seriously affecting sensitivity.

The size of the steel front panel is 12¾in. by 8in. The main apertures to be made are for the speaker, tuning dial, volume and wave-change controls, and insulated aerial terminal. Other holes to be drilled are for speaker fixing, and 2 B.A. for attaching chassis to panel ; and, finally, holes for screw-fixing the panel to front of cabinet.

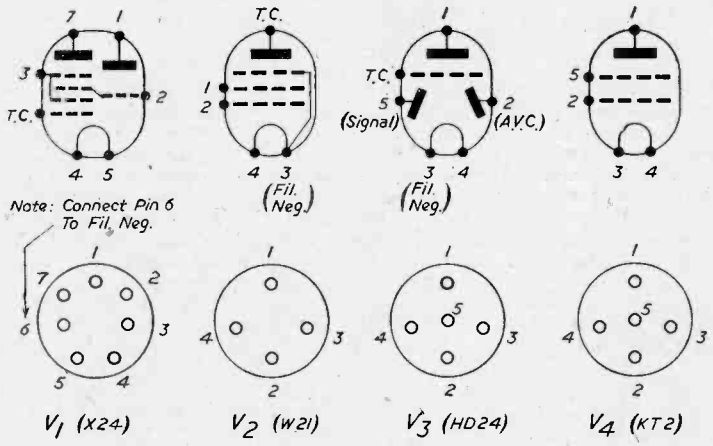


Fig. 2.—Valve base data.

The steel chassis is made separately, being joined to the panel by four 2 B.A. bolts. The outside dimensions are 11¾in. by 5¼in. deep. The chassis height is 2¼in., there being a clearance of ¼in. between the bottom of the chassis and the bottom of the front panel. This permits chassis and panel, when assembled complete, to be slipped bodily into the cabinet.

Large sections of the chassis top and front must be cut away. The main sections are for the coil-unit and base of the speaker ; also volume-control/on-off switch. Next come the holes for valveholders and I.F. transformers. Finally, the 2 B.A. bolt holes to line up with panel, the aerial terminal holes, and fixing holes for the two-gang condenser bracket, valveholders and I.F. transformers. All fixed condensers and resistors are supported in the wiring, so no holes are needed.

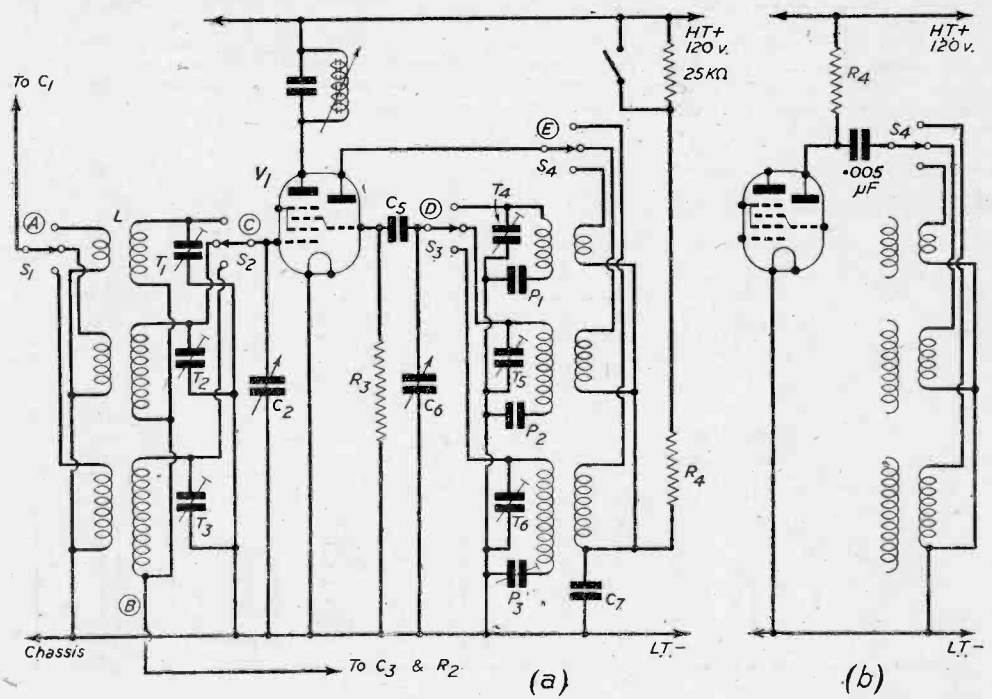


Fig. 3.—On the left is a diagram of a three-band coil unit with additional switched resistor inserted on normal broadcast (not S.W.) band. On the right is an alternative oscillator-anode circuit.

The Cabinet

The construction of a suitable cabinet should not be difficult. Either five-ply or ¾in. wood is suitable. There is only a top, bottom, and two sides. Two runners are screwed underneath. The carrying handle is a matter for personal choice. With the cabinet complete, both chassis and panel can be bolted together and checked for fit by sliding into the cabinet.

The assembly of valveholders, I.F. transformers, coil-unit, volume-control, tuning condenser, dial, loudspeaker, etc., is followed by wiring. A guide to the relative positions of components is given in Fig. 4. In the writer's receiver it was not necessary to screen any of the grid or anode leads. Wiring of all but the battery leads is best kept as short and direct as possible. Doubts may be felt about the leakage current through C17 when the set was switched off. But with a good reliable make of condenser the leakage is negligible. A three-point or double-pole on-off switch will remove any leakage when the set is off, but volume-controls with either are more difficult to get.

Before connecting batteries, the wiring should be checked for obvious faults, safeguarding valves against possible damage. The H.T. and L.T. can then be plugged in and alignment commenced. To avoid any headaches, it is best to get the I.F.T.s lined to 465 kc/s at the beginning, using a signal

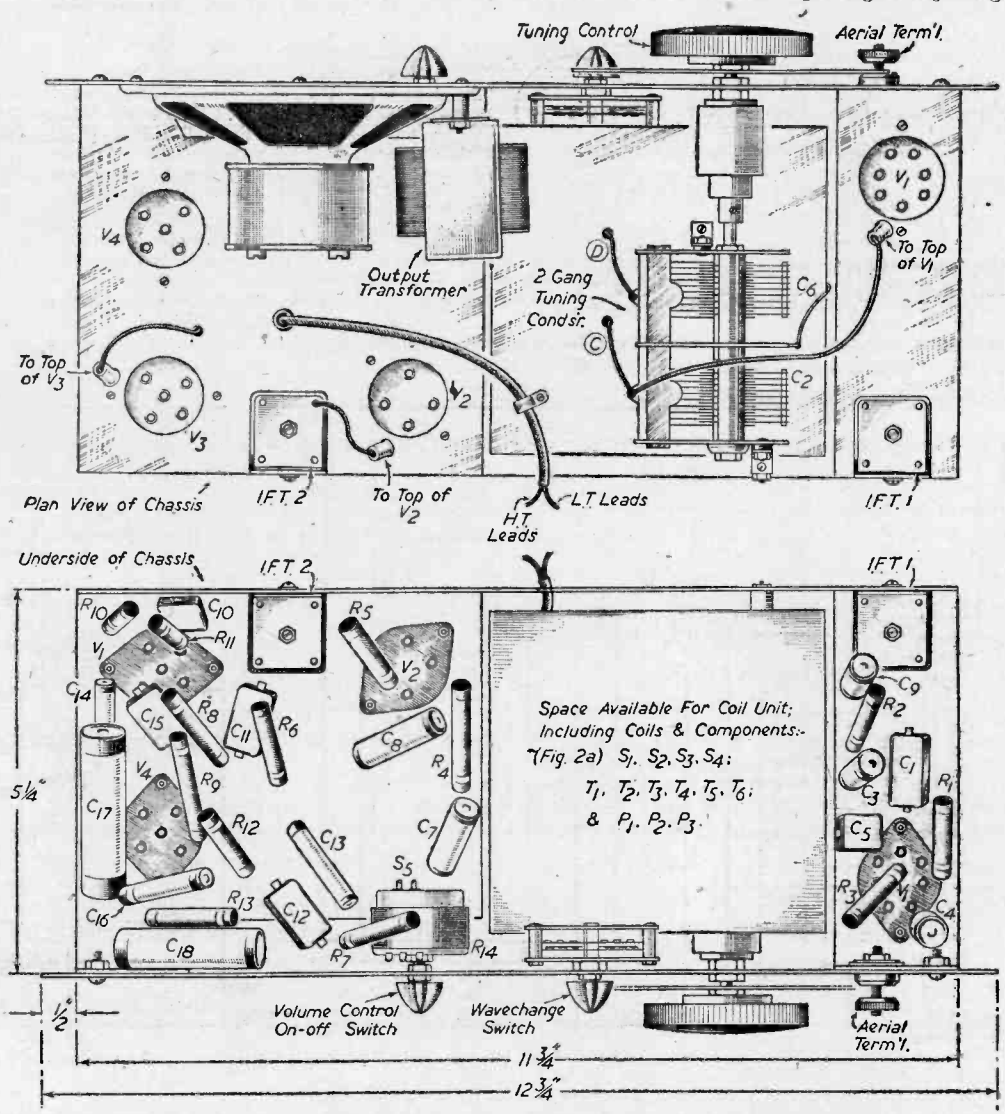


Fig. 4.—Practical above- and below-chassis diagrams showing layout and positions of all components.

generator. Aligning can be done by "hit-and-miss," but the procedure is as tedious as it is long; even then one is not certain of proper alignment. The use of a signal generator is also a great asset for trimming and padding the signal and oscillator circuits of the frequency changer.

LIST OF COMPONENTS

CONDENSERS

C1 .0002μF Trimmer (Ceramic)
C2 and C6 Two-gang .0005μF variable
C3 .05μF Tubular
C4 .1μF Tubular
C5 .0001μF Mica
C7 .05μF Tubular
C8 .1μF Tubular
C9 .05μF Tubular
C10, C11, C12 .0001μF Mica
C13 .01μF Tubular
C14 .05μF Tubular
C15 .0001μF Mica
C16 .005μF Tubular
C17 8μF Tubular Electrolytic
C18 25μF Tubular Electrolytic

RESISTORS

R1 40,000 ohms
R2 .1 megohm
R3 50,000 ohms
R4 10,000 ohms
R5 25,000 ohms
R6 20,000 ohms
R7 .5 megohm
R8 2 megohms
R9 .1 megohm
R10, R11 1 megohm
R12 .5 megohm
R13 300 ohms
R14 1-megohm volume control

VALVES

V1 Triode-hexode (Marconi/Osram X24)
V2 V.M. Pentode (4-pin) (Marconi/Osram W21)
V3 D.D. Triode (5-pin) (Marconi/Osram HD24)
V4 Output Tetrode (Marconi/Osram KT2)

5in. P.M. loudspeaker of 2-3 ohms.
O.T. small output transformer, ratio about 70 : 1.
Precision slow-motion dial, complete with reduction drive and 2½in. knob.
I.F.T.1. and I.F.T.2 small type 465 kc/s intermediate frequency transformers with adjustable iron-dust cores.
Three-waveband coil-unit to constructor's own requirements, complete with trimmers and padders, also necessary switches.
Valveholders : 7-pin, one ; 4-pin, one ; 5-pin, two.
Batteries : 120-volt high-tension (standard capacity) ; 2-volt dry accumulator.

New Home Battery Charger

THE possession of a home battery charger can no longer be considered a luxury. In fact, it is true to say that the present system of petrol rationing, with its attendant mileage restrictions, puts the battery charger amongst the indispensable items of garage equipment for motorists. For without it no motorist can to-day guarantee that his battery will be correctly maintained.

With the arrival of winter this difficulty is considerably worsened. Not only is the battery called upon to provide ignition facilities for the engine, but it has also to cope with the prolonged burning of side, tail and head lamps, together with the additional burden of cold starting. Thus, the need for an efficient home battery charger becomes imperative. The listener who relies upon battery equipment, but who has mains facilities available, will also find a good battery charger a valuable adjunct.

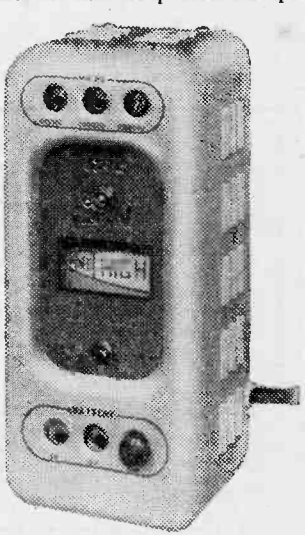
Such an instrument is now marketed by The General Electric Co., Ltd. Costing only £5 12s. this new G.E.C. charger is simple to operate and is suitable for use on A.C. (single-phase supplies) with frequencies between 40 and 100 cycles, and can be adjusted easily by the user for 100/110, 200/220 or 230/250 volt circuits. Movement of a single screw plug enables a 2-, 6- or 12-volt battery to be charged as desired.

A novelty incorporated in the charger is a thermally operated combined cut-out and indicator. This device protects the transformer and rectifier unit against excessive overload or accidental short-circuiting of the output leads, while the pointer, which passes over a scale reading "LOW," "MED" and "HIGH," indicates the relative output of the charger. The state of the battery automatically controls the rate of charge.

When the battery is in a discharged condition, the charger will deliver its full output of 2 amps. but as the charge in the battery builds up, so the rate of charge decreases.

Further protection for the transformer is given by the provision of double-pole fuses on the primary side. Operating costs are negligible, as the unit only consumes approximately the same current as the average domestic electric lamp.

Enclosed in an attractive, cream-finished case with red pilot lamp, and supplied with electrical leads, battery clips and instruction leaflet, the G.E.C. home battery charger can be relied upon.



The G.E.C. charger which provides 2-, 6- or 12-volt outputs.

Civilian Walkie-talkies

Advance Details of a New American Midget Transmitter-receiver

THE first portable radio transceivers for public use between homes, cars, offices, plants, farms and many other person-to-person radio-telephone applications are now in pilot plant production, according to Al Gross of the Citizens Radio Corporation, which has received the first F.C.C. type approval for equipment to be used on the 465 megacycle band allocated for civilian use.

The equipment, according to Gross, is one fourth the size of the famous wartime walkie-talkie and is the result of more than two years of research and engineering in which many new techniques, including sub-miniature tubes and the use of silver-on-ceramic circuits, have been perfected for practical push-button, person-to-person radio communication for public use.

Experimental units, he said, have been given exhaustive field tests between car and home; home and office; boats and shore; 'planes and ground; and person-to-person on city streets. They have also been tested for communication between cemetery ground keepers; hunters; mountain climbers; farm and field; and surveyors. He also predicted that this revolutionary type of personal two-way radio will soon become a standard means of eye-witness reporting of sports and spot-news events to radio and television audiences and newspapers.

The transceiver, two of which are required for person-to-person air contact, is housed in a tiny case measuring only 6in. by 2⅞in. by 1¾in., topped by a small folding aerial. This pocket-sized radio station includes all necessary equipment except a tiny headphone and batteries carried in a separate case about the size of a miniature camera.

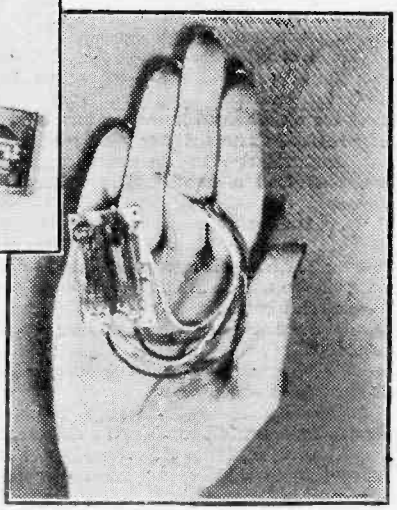
As may be seen in the centre of the control panel, there are only two controls, that on the left being for volume and that on the right for tuning. They are of the edge-operated type.

The cut-out grille on the lower portion carrying the letters "R.C." is, in fact, the opening over the microphone, and the ornamental panel is thus a protective cover as well as carrying out a useful function.

Development of the citizen's radio, Gross said, was made possible largely through the availability of sub-miniature tubes manufactured by Sylvania Electric Products Inc. and the co-operation of Sylvania's advanced development laboratories. However, he admitted that many practical design problems, without which F.C.C. type approval CR-401 could not have been obtained, were solved in the laboratories of the Citizens Radio Corporation.

He described the model 100-B citizen's radio as a transceiver for Class B stations only; operating at 465 Mc/s, tolerance 0.4, input 3 watts, emission A-3 with 30 per cent. maximum modulation. The transmitting section uses a Sylvania 6K4 sub-miniature oscillator and the receiver is a super-regenerative using three Sylvania 1V5 sub-miniature tubes. The transceiver weighs only 11 ounces including aerial, and total station equipment including batteries is only two-and-one-half pounds.

At the moment the apparatus is available only on the American market and we are unable to give any further details of the equipment. If and when it becomes available in this country an announcement will be made in these pages.



The transmitter and receiver, seen above, includes microphone, aerial and four sub-miniature valves for oscillator and super-regenerative receiver. On the left the equipment is seen in use, and on the right is the audio section.

New Developments in Broadcasting–2

Concluding the Precis of the Presidential Address Delivered Recently at the Junior Institution of Engineers by SIR NOEL ASHBRIDGE, F.K.C., B.Sc.(Eng.), M.I.C.E., M.I.E.E., F.I.R.E.

Ultra-short-wave Broadcasting

THE other major development which I wish to speak about is ultra-high-frequency, or ultra-short-wave broadcasting. Almost everyone knows, of course, that home broadcasting is carried out on what are known as long and medium waves. Such waves have one main disadvantage: in darkness they are reflected from the ionosphere, which not only gives rise to the well-known distortion due to fading but causes severe interference between stations using the same wavelength at very considerable distances. It is true that this also makes long-distance reception possible, but for a high-quality home broadcasting service such reception cannot be regarded as satisfactory. The existence of indirect ray transmission means in effect that, generally speaking, high-power stations, say, on the Continent of Europe, cannot normally satisfactorily share the same channel unless they are separated by well over 1,000 miles.

This naturally gives rise to the very serious overcrowding of the available frequency bands and to the necessity of allowing only 9 kc/s spacing between channels, which is not sufficient for really high-quality reception except when the received strength from the wanted station is high.

If the tendency to increase the number and power of broadcasting stations throughout Europe continues it may even be necessary still further to reduce the spacing to secure an internationally agreed wavelength plan, without which a condition of chaos would almost certainly develop. Thus, at the recent European Regional Broadcast Wavelength Conference at Copenhagen there was at first strong pressure to adopt a 10 kc/s separation between channels, but in the end, in order to secure agreement, it became necessary to adopt 9 kc/s as the standard spacing. Even so, it was necessary to space a few of the channels at the high-frequency end of the medium-frequency band at 8 kc/s in order to fit in the very large number of stations which had to be accommodated.

In these circumstances it may well be asked what are the prospects of good broadcasting in the future. Fortunately, the answer in this case is favourable; without much doubt the future to a large extent depends on the development of broadcasting on ultra-high frequencies. Since, however, the shortage of channels has existed for more than 20 years, with steadily increasing severity, the question naturally arises, why has this expedient not been adopted before?

Increasing the Range

The answer is that prior to the introduction of television on carrier frequencies as high as 45 Mc/s, as a matter of necessity, to accommodate the very wide modulation frequency band, it was thought that these very high-frequency waves would be limited in range to "line of sight" transmission and would be subject to masking and shadow effects from hills, large buildings, and other obstructions. In fact some doubts were expressed as to whether such frequencies were really practicable for a broadcasting service at all.

To an extent these fears are realised in practice, but certainly not to the serious extent anticipated. Moreover, it has been found that by siting stations on carefully chosen high ground—and I might mention here that the choice is not necessarily the same as it would be for a medium or a long wavelength station—and by placing the radiating system at the top of the highest mast it is practicable to build, these limitations in coverage can be very greatly reduced.

Again, the radiating system for these frequencies can be designed to concentrate the energy in the required direction in the vertical plane to such an extent as to give the effect of several times the apparent power. The result is that the maximum effective range of a 25 kW sound broadcasting station working on say 90 Mc/s may prove to be roughly equal to that of a similar station on, say, 1,000 kc/s. But this is perhaps rather a broad statement and the exact nature of the terrain to be covered must be taken into account. For example, the general coverage of a mountainous district would in the ordinary way not be feasible, although the technique of using a number of low-power stations of this type in populated mountainous areas may be found quite satisfactory. Again, there may be, and almost certainly will be, some strictly local difficulties in cities with tall buildings. It is anticipated, however, that these effects will not be important enough to prevent the development of broadcasting on these frequencies. The band which is at present earmarked for the purpose in this country is 87.5 Mc/s to 95 Mc/s.

Benefits of Frequency Modulation

Many people refer to this kind of broadcasting in a general way as F.M., which, of course, means frequency modulation. Many millions of words have been written on this method of modulation, both extolling the advantages and pointing out the difficulties. When a transmitter is frequency modulated it means that the carrier wave is modulated by the audio frequency programme input by varying its frequency instead of its amplitude, which is normal for broadcast transmitters. The advantages of the former method, put very briefly, are that it reduces to a considerable extent parasitic interference of most kinds, giving a remarkably silent background even when the field strength is comparatively low. It is this fact which makes it possible to adopt a lower field strength

as the working limit and so obtain a range comparable with that obtained on lower frequencies where the rate of attenuation is much less. The main disadvantage is that to get the full advantage from a F.M. transmitter, the modulation bandwidth—that is the overall frequency swing of the carrier—must be of the order of 150 kc/s, whereas the highest possible quality of sound transmission using amplitude modulation requires, say, 30 kc/s channel width overall. Frequency modulation, therefore, cannot be used on medium or long waves because of the wide band necessary if it is to be effective.

It is thought by many people that the time will soon be reached when the ultra-high-frequency bands are as congested as are the medium- and low-frequency bands at the present time. This, however, is unlikely, unless it is found that in practice interference between stations at a distance, due to tropospheric propagation which is liable to occur on these frequencies, is more severe than is anticipated at present. It should be explained that by tropospheric propagation is meant reflection or refraction, at much lower levels than the ionosphere, caused by sharp variations in atmospheric temperature and humidity with height. Nevertheless, the fact that frequency modulation uses five times the band width necessary for amplitude modulation might conceivably cause a set-off to its main advantage, namely that good reception can be obtained at a much lower field strength.

Perhaps it should be made clear that were there no such thing as frequency modulation it would still be possible to develop the use of ultra-high frequencies for broadcasting, using amplitude modulation, although at the moment general, if not quite universal, opinion is in favour of exploiting ultra-high-frequency broadcasting using a frequency-modulated carrier.

The advantages of frequency modulation for high-frequency broadcasting began to be realised in the U.S.A. at about the beginning of the late war and it was developed there to a limited extent during the war years. It has now obtained a firm hold in America and expansion is extremely rapid both with regard to transmitters and receivers.

Present Experiments

So far as broadcasting was concerned it was not possible to do any practical work on this development during the war in this country, but as soon as the end was in sight the B.B.C. started experimental work, using two or three low-powered stations in areas which were chosen to give typical conditions which would have to be met in practice. Valuable, but not complete, data has been obtained, and before committing a very large sum for development on a country-wide basis it was decided to construct a high-power station near London which would be regarded to a considerable extent as experimental.

This station will have two transmitters, each with a power of about 25 kW. (which is somewhat higher than is commonly used in America) and the maximum height of mast allowed by the Air Authorities, 500ft. It has been constructed in such a way as to facilitate comparative experiments between two transmitters working under different modulation conditions and with the object of making measurements on which it would be reasonable to base a scheme for general coverage. Its experimental nature does not, however, imply that there is any real doubt as to the feasibility and importance of ultra-high-frequency broadcasting generally, and, in fact, the station at Wrotham, Kent, will be the first of a chain of such stations throughout the country.

Ultimately it will, of course, be necessary for listeners to provide themselves with new receivers, or possibly adaptors, and with this in view close liaison with industry is being maintained. It is hoped that suitable receivers will be produced at the right time which will cover the low-, medium-, and ultra-high-frequency bands.

It is always dangerous to make forecasts concerning the distant future, especially when the relative data is incomplete. However, it can be said that it is not anticipated that ultra-high-frequency broadcasting will, in the foreseeable future, entirely replace the use of medium and low frequencies, at any rate in this country. In a consistently flat country this might well be feasible, assuming, of course, that listeners had provided themselves with suitable receivers. However, where mountainous or very broken country is to be covered, serious difficulties may well be encountered and the ultra-high-frequency development should be regarded more as an extremely welcome auxiliary to the existing services, rather than as a replacement of them. Above all, their use can fortunately be regarded as a solution in the future to the steadily increasing international difficulties with regard to the sharing out of channels which arise from the limitations of the low- and medium-frequency bands. At the same time the new bands would, in general, make possible improved reception, giving greater artistic possibilities for the future.

The New Wavelength Plan

As already mentioned, a conference of European countries has just succeeded in producing a new wave plan to which a large majority of the countries present have agreed. It is to be applied in March, 1950, and normally there should be five or six years before this plan would come up for revision. However, taking into account the extreme difficulty of obtaining an agreement at this conference and the fact that broadcasting, especially in certain countries, is now being rapidly developed for the first time on a basis of high-power stations, the prospects of obtaining future agreement would not be at all promising were it not for the fact that in future some of the development should be absorbed by the use of wavebands not so far taken into use.

Thus it is most satisfactory that we can, quite apart from television, look forward to the further development of sound broadcasting, a possibility which even 10 years ago appeared to be rapidly disappearing.

ON YOUR WAVELENGTH

By THERMION

Crooning—80 Years Ago

CROONING does not appear to be a modern disease, for Charles Reade had something to say about it in "The Cloister and the Hearth," written in the year 1860, and I am indebted to Mr. A. J. Sweeney, of Gloucester, for drawing my attention to it. This is what Reade says:

"Those whining slurs, now sold so dearly by Italian songsters; yet every jackal in India delivers them gratis to his customers all night. Frequently gets shot for them and always deserves it."

"Sound and Fury"

LAST month I reviewed "Cæsar's Mistress," a book extremely critical of the B.B.C., and this month I review Maurice Gorham's book "Sound and Fury," which is a record of his 21 years' service with the B.B.C., that is to say, the period from 1926 to 1947, when he left.

In 1926 the B.B.C. was a company owned by the radio manufacturers and chiefly run by the wireless pioneers. Gorham saw the change-over to a public corporation, the growing bohemianism of Savoy Hill, the return to ultra-respectability in new Broadcasting House, the great work which the B.B.C. did during the war, and its gradual reversion to iconoclastic aloofness once the charter had been renewed.

Maurice Gorham should be a reliable recorder of facts, for he worked under five director-generals, edited *The Radio Times*, ran the B.B.C's wartime broadcast to America, started the A.E.F. programmes for the troops, the Light Programme, and finally the post-war television service. Towards the latter end of his career he was in the inner councils of the B.B.C. In this book, which is a fair exposition of his experience, he deals with the men who control the B.B.C. and the reasons which led him to resign.

Although one feels that he left under a genuine grievance, this does not unduly obtrude. It is impossible to come to any other conclusion after reading the book than that Gorham thinks the departure of Reith from the B.B.C. was a good thing for broadcasting.

Here are a few extracts: "The B.B.C. had never been so pompous, self-righteous, and aloof. . . . The B.B.C. considered nobody's opinion but its own. . . . Reith professed not to read the newspapers. . . . What the Press thinks is not the final test, it is what we ourselves round this table think of our work. . . . Administration was a stumbling block because Reith and Carpendale made it unduly strong. . . . They thought that everybody doing a productive job was childish and irresponsible and needed controlling by somebody who was concerned only with In-and-Out trays. . . . I do not think of Reith as a great organiser. By the time he left in 1938 the B.B.C. was getting musclebound. . . . The direction of the Corporation lacked common sense. . . . Reith suffered increasingly from a sub-conscious horror less the listener should have too good a time. Giving pleasure to the ungodly was not amongst his objectives for the B.B.C. If they liked it too much it could not be doing its job. Listener research came at last, but not until Reith had gone. . . . Reith still disapproves of this."

The fact has to be admitted that Reith was not popular either in the B.B.C., outside the B.B.C., nor with the Press.

As one of the earliest of the radio journalists I came into contact with the B.B.C. from its beginning, and from personal knowledge I can support much of what Gorham has written. The criticism of those who ruled the B.B.C. never ceased, and it is noteworthy that it is a happier organisation altogether to-day. I recommend every reader to purchase a copy of Maurice Gorham's book, which, apart from criticisms and comments, gives a great deal of history hitherto unpublished. He deals with life among the artists, and interesting facts about the stuffed shirt era, *The Radio Times*, programme arrangement, the inner circle, Alexandra Palace—in fact, the whole history of the B.B.C.

Gorham is fair in his comments, and gives praise where it is due.

A Survey of Noise in British Homes

NOISE in homes has been the subject of complaint for about a hundred years. The noise problem occurred with flats to an even greater extent than with houses, and the inadequacy of party walls as a protection against noise was a particular subject of complaint. Although it could fairly be assumed that such a large history of complaints had a foundation in hard fact, there was no data on which to work. There was no basis, other than personal experience or complaints registered in the Press, on which an appraisal could be made of the extent and severity of the noise nuisance.

An opportunity was therefore taken to include several questions on noise in a survey carried out during the war by the Government Social Survey, and the answers to these questions are now made available.

While the interpretation of the results of such a survey is in itself a matter requiring some skill, the survey figures do give a first real measure of the problem, at least for the purpose of comparing different sources of noise and different buildings.

Among the interesting points shown by the replies is the fact that the noise of radio, though "noticed" by the largest proportion of people, was considered much less troublesome than what was called "banging of doors"; and in the comparison of buildings, noise was found to trouble about one person in four in houses, one person in three in old-fashioned flats, and two people in three in flats of modern construction.

Remote-control of Your Receiver

Making the Extension Listening Point More Efficient

By J. R. DAVIES

VERY often in the average household there occurs the need to use the radio receiver in a room other than that in which it is installed. Sometimes this requirement is met by the provision of an extension speaker. This, however, has its disadvantages in so far as it is necessary to keep returning to the set to change the station or the volume level, or to switch it on and off.

Various commercial firms have introduced methods of remote control of the receiver, some expensive and some cheap. To the constructor, however, is opened an engrossing field of experiment and design in which he may make all the equipment necessary to control the functions of his set from a distance. There is something fascinating in the realisation that, by pressing a button in, say, one's bedroom, a slave circuit in the living-room follows one's requirements instantaneously and reliably.

In this series, the writer will review the various means that may be adopted in controlling the receiver remotely, bearing in mind the reliability, economy and suitability of the methods.

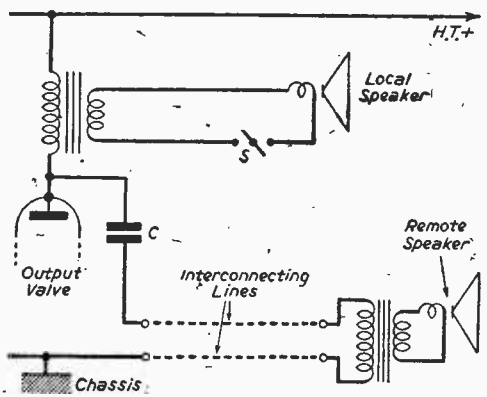


Fig. 1(a).—Showing method of connecting extension loudspeaker, using a high-impedance output from the receiver.

Connecting the Remote Speaker

First things first! Before fitting in any system, it is obvious that we must consider the best method of connecting the extension speaker.

Some years ago, and particularly when high-impedance moving-iron loudspeakers were still in use, the usual method of connecting the external speaker was that shown in Fig. 1(a), in which the connection is made via the condenser C and earth. If the speaker in the set needed to be silenced the switch S was opened, the primary of the output transformer in the set acting as an anode choke, and the output impedance being developed across the remote speaker. The condenser C should be a paper component having a capacity of at least 4μF to permit full reproduction of bass.

Nowadays, it is the custom to use a low-impedance outlet to the external speaker as shown in Fig. 1(b). This saves both a condenser at the receiver and a transformer at the distant speaker. The internal speaker may be silenced by the switch S if desired. The impedance of the speech coil at the distant speaker should be approximately that of the local one to avoid any serious mismatching. The connection of one of the leads to earth or chassis (as shown in Fig. 1(b)), is not necessary, but occasionally tends to remove any chance of instability, particularly in a T.R.F. set, where the extension speaker leads may run close to the aerial. The use of the earthed connection also assists in the wiring of the other control circuits, as it may be utilised as a common return lead, thereby reducing the number of wires between the receiver and the remote point.

Both methods of connection have their disadvantages. In the high-impedance method of Fig. 1(a), the resistance of the wires is not of great importance

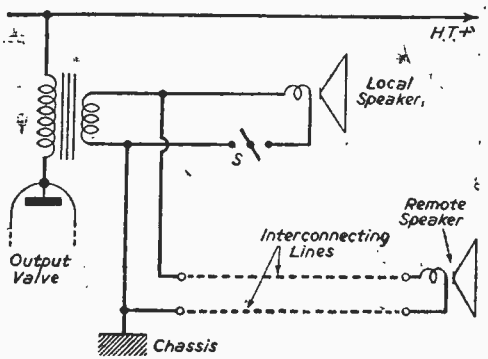


Fig. 1(b).—Low-impedance speaker connections.

and ordinary bell wire may be used quite satisfactorily. The capacity between the lines, however, may prove troublesome if long runs are used, and will tend to attenuate the higher frequencies. The condenser C has surprisingly high voltages impressed on it during loud passages of music, particularly if there are any resonances in either of the speakers, and should have a working voltage of twice the H.T. voltage of the set. The low-impedance method of Fig. 1(b), whilst saving the cost of the condenser and speaker transformer, introduces an extra expense, in so far as the wire between the two speakers has to have as low a resistance as possible. If really good quality reproduction is desired, the connecting link should consist of, at least, 5-amp. lighting flex or similar wire.

Controlling the Volume Remotely.

A remote control of volume is the next require ment. This may be done at the speaker itself, and various methods are used. Fig. 2(a) shows a good practical method in which the impedance presented

to the set and to the speaker remains constant at all positions, thereby eliminating the chance of distortion due to mismatching. Looking at this diagram, it will be seen that a three-gang six-position switch is used giving six positions of volume. The direction of the arrows alongside the sliding arms indicates the direction in which they move to reduce the volume. The values given at each resistance indicate its resistance in ohms; the impedance between A and B and between C and D always remaining constant at 3 ohms.

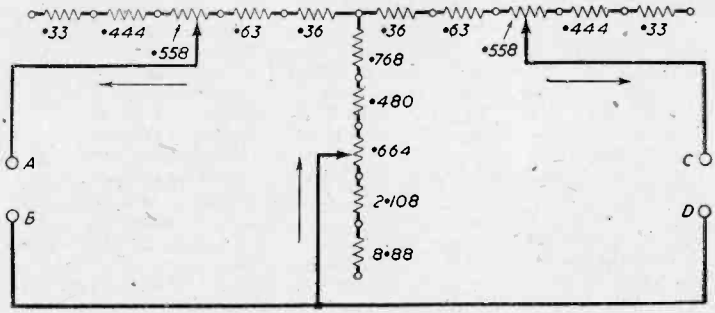


Fig. 2(a).—Circuit of a constant-impedance volume control. The figures indicate resistance values in ohms. The impedance between A and B and between C and D both equal 3 ohms.

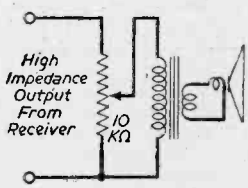


Fig. 2(b).—Simple potentiometer volume control for a high-impedance extension speaker.

Fig. 2(b) shows a potentiometer circuit which may be used with high-impedance outlets, as in Fig. 1(a). This method of connection cannot always ensure consistently good quality, however, owing to the inevitable mismatching which will result.

An alternative method of volume control may be utilised by controlling the gain of one of the receiver valves from the remote point. This can be done quite simply and with the addition of only one interconnecting wire. Fig. 3(a) shows the grid circuit of an H.F. valve in a T.R.F. (or non-A.V.C.-controlled superhet). If the valve is of the vari-mu type, its amplification factor can be controlled by the simple process of varying the bias voltage on its grid. Fig. 3(b) and (c) show two simple methods of doing this. The resistance R and the condenser C in these two diagrams are for decoupling the lines and preventing any hum picked up on them from affecting reception. The condenser C in Fig. 3(b) is used also to complete the tuned circuit. The batteries used for varying the bias are kept at the remote control point. The current taken from them by the volume potentiometer is almost negligible, but it is advisable to switch them off when not in use by the switch S. This switch may be ganged with the remote switch used to switch the set on and off, and which is discussed later. Another method of controlling the bias, particularly when a mains valve is used, is shown in Fig. 3(d). This system is applicable to mains-type valves only and has the advantage of not needing the batteries required in Figs. 3(b) and (c). The interconnecting wire used for the circuit of Fig. 3(d) should have a fairly low resistance, whilst that used in Figs. 3(b) and (c) should be well insulated from earth, its resistance not being so important a factor.

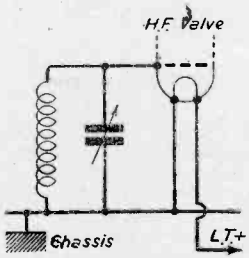


Fig. 3(a).—Normal grid circuit of battery H.F. valve.

If the set in use is a superhet. with A.V.C., it is not very practicable to control the volume by altering the bias on an R.F. valve. The control will have to be effected in the A.F. circuits after detection. Fig. 4 shows one way of doing this. An octode frequency-changer, such as the Mullard EK32, is used as an A.F. amplifier in place of the usual triode after the double-diode. The A.F. voltage is applied to the signal grid, whilst the biasing voltage is applied to the oscillator grid. The values of screen resistor, etc., are shown in the diagram. The valve should be connected immediately after the double-diode so that the biasing circuit will have the greatest control. Some

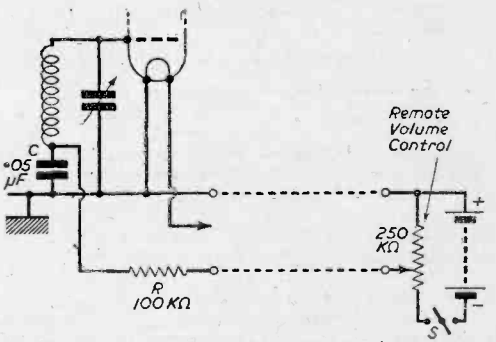


Fig. 3 (b)—One method of applying bias to the valve of Fig. 3(a), so that its amplification factor may be varied remotely.

experimenting may be necessary to find the value of bias battery voltage which gives best results.

Control of Tone

A tone control of the top-cut variety may easily be fitted at the remote speaker. If the connection

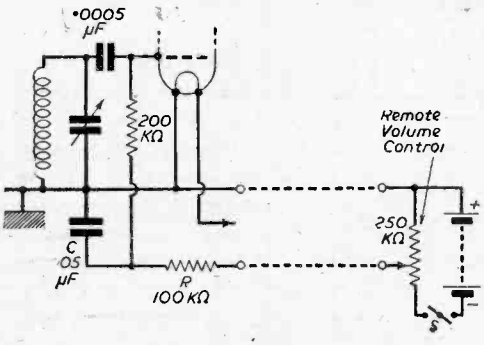


Fig. 3(c).—Another method of controlling bias remotely.

is of the high impedance type shown in Fig. 1(a), a circuit as shown in Fig. 5(a) will meet the requirements, the switch in this diagram connecting the various capacities (or no capacity at all) across the transformer primary and giving varying degrees of high note attenuation. The capacities suggested in the figure will meet most needs, but if additional cut-off is required a larger condenser may be

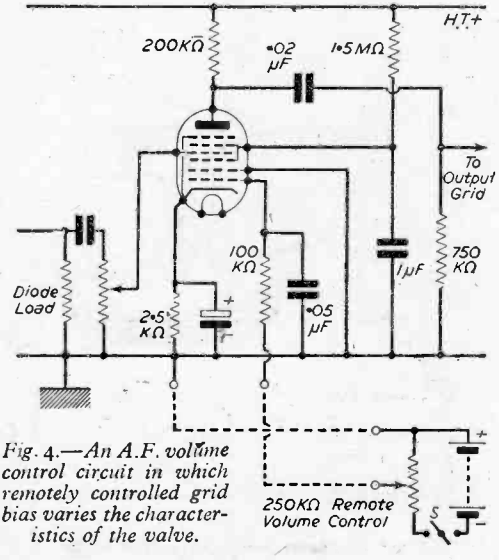


Fig. 4.—An A.F. volume control circuit in which remotely controlled grid bias varies the characteristics of the valve.

fitted in place of the .05μF. condenser, its value being found by experiment.

If a low impedance circuit (see Fig. 1(b)) is used the tone control presents a slightly harder problem. It is not advisable to connect condensers across the speech coil, and the best solution is to fit another speaker transformer at the extension speaker, as shown in Fig. 5(b). This presents a high impedance at the condenser network, the various degrees of attenuation being "reflected" to the speech coil.

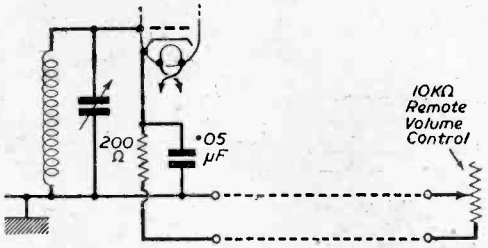


Fig. 3(d).—An alternative method of volume control. As the external volume control puts more resistance in circuit so the cathode becomes more positive, thus increasing the relative negative bias on the grid.

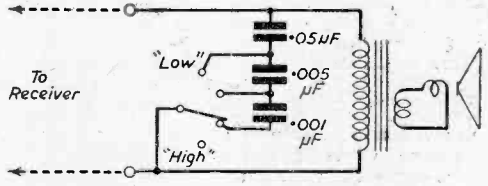


Fig. 5(a).—A tone control circuit that may be connected at the remote loudspeaker.

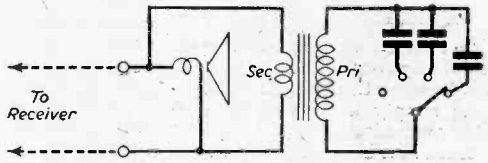


Fig. 5(b).—How the tone control may be connected if a low-impedance outlet from the receiver is used.

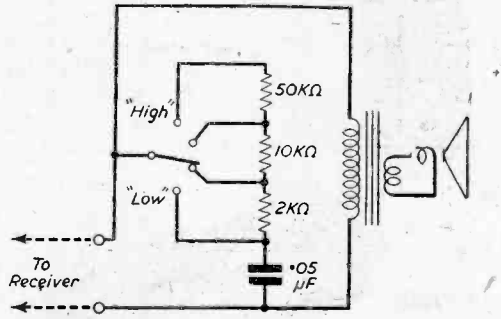


Fig. 5(c). An alternative to the arrangement shown in Fig. 5(a).

An alternative to the condenser switching circuit is shown in Fig. 5(c). In this circuit, various resistors are switched to limit the effect of the single .05μF. condenser.

(To be continued.)

D.C. Oscillograph Amplifier

A Two-valve Unit With Stabilised Power Supply

By B. F. WALKER

A D.C. coupled amplifier has many advantages, namely :

(1) No distortion of low-frequency square waves due to the time constants of coupling resistances and condensers.

(2) No phase shift at low frequencies.

(3) Instantaneous shift control, since there is no delay in waiting for coupling condensers to charge as in an A.C. coupled amplifier.

In addition it may be used as a rough D.C. and A.C. valve voltmeter for frequencies up to about 100 kc/s.

The Circuit

As shown, the input goes via S, which inserts a 2 μF condenser when it is necessary to block any D.C. present when examining say the signal on the anode of a valve. There is a 20/1 attenuator operated by S2, and the small trimming condenser over the 2 MΩ resistor is used to compensate for the loss of high-frequencies due to the unevenly distributed capacities over the attenuator. The 1 MΩ potentiometer P1 is the fine gain control feeding into the 6J5 cathode follower. This has its anode strapped to the screen of the 6J7 and they are both supplied from +130 volt stabilised supply from a Cossor S130 stabiliser. The cathode of the 6J5 is joined to 25 kΩ potentiometer, P2, which acts as the shift control by varying the bias on the 6J7 and hence the anode voltage. The anode is attached directly to one of the plates of the cathode-ray tube, therefore any variation in anode voltage moves the spot on the screen. The 500 kΩ pre-set potentiometer is adjusted so that the spot is central on the screen when the shift potentiometer is about midway in its travel.

The 1 kΩ cathode resistance of the 6J7 provides negative feedback at low frequencies, and it is shunted by a condenser "C" which reduces the feedback at high frequencies and hence improves the H.F. response. An approximate value for this is .0025 μF, but, if possible, it should be adjusted by applying a few thousand cycles/sec. square wave to the input and finding the value which gives the best waveform.

The anode of the 6J7 is coupled to the cathode-ray tube plates by a 100 kΩ resistor. If desired a smoothing choke, Ch1, may be inserted between the resistor and H.T., but it is questionable if this gives any great improvement in H.F. response. Anyway the H.F. response is limited to about 100 kc/s by the varying capacitance of the slider of the gain control to earth, which shunts high frequencies to earth.

The amplifier is not push-pull, the other C.R.T. plate being fed from a potentiometer of two .25 MΩ resistors across the H.T. line, but I have used the amplifier in an oscillograph for some time now and find that trapezium distortion and astigmatism are very slight with both the VCR135 (Mullard ECR35) and VCR97 (Mullard ECR60).

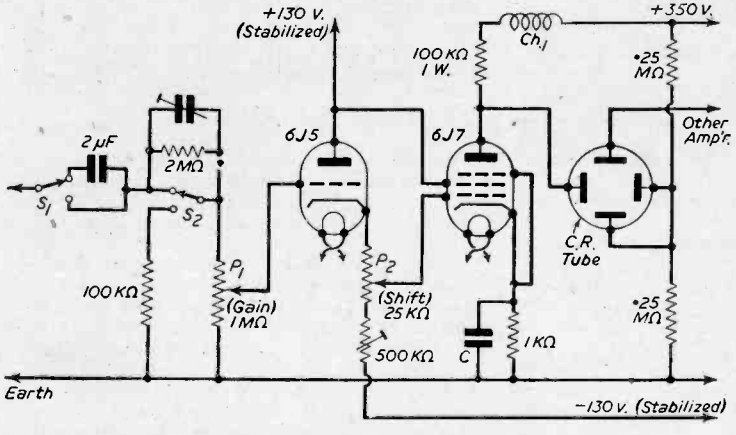


Fig. 1—Theoretical circuit of the amplifier.

Expanded Trace

With the values shown five screen diameters shift are obtainable on a VCR138 using 1,000 volts on the final anode. There are identical X and Y amplifiers and I have adjusted the output from the time-base (a Phantastron) so that I can use the gain control to expand the trace to five screen diameters.

This is a great convenience when examining a waveform, as the trace can be expanded to five screen diameters and any part brought on to the screen for detailed examination.

On the Y plates the spot can be swept from one edge of the screen to the other by the application of 1.5 volts (from a torch battery) to the input terminals. The same happens on the X plates by the application of 3 volts, since the Y plates have twice the sensitivity of the X plates.

The power supplies for cathode-ray tube (−1,000 volts), time-base (+350 volts) and amplifiers (+ 350 volts, + 130 volts, −130 volts), are all taken from one 350–0–350 volt 60 mA. transformer. There is a 4 volt 1 amp. winding for the C.R.T. This requires high insulation and I obtained an old 400-cycle transformer (ex R.A.F.) cheaply and had the core re-wound to my specification. There

are many firms who undertake rewinds. Alternatively a small high-insulation heater transformer could be used.

Transformer Windings

A voltage of 6.3 at 3 amps should be sufficient for amplifiers and time base and another winding is needed for the rectifier, which could be a 5Z4 or similar valve. The smoothing condensers (8+32 μF) were a Hunts 8+16+16 μF 450 volt can with the two 16 μF sections in parallel. A 10 kΩ, 5 watt resistor feeds a Cossor S130 neon stabiliser which supplies the 130 volt positive for the amplifiers. The stabiliser is shunted by a .1 μF condenser to bypass H.F. currents. A small metal rectifier over half the H.T. winding supplies 130 volts negative bias for the amplifiers. The only smoothing necessary is an 8 μF condenser on the rectifier side of the 20 kΩ 5W resistor. However, if any trouble is experienced a 2 μF condenser on the other side of the resistor should suffice.

The 1,000 volt negative for the C.R.T. is obtained by means of a circuit similar to that described in these pages early last year. A 1 μF 2,000 volt working condenser is put across the 350–0–350 volt winding in series with a C.R.T. metal rectifier, and another rectifier is attached to the junction, and the output is taken from the other side of this. The smoothing is accomplished by a .25 MΩ resistor and two .1 μF 2,000 volt condensers. It is important that the metal rectifiers used for supplying the 1,000 volts for the C.R.T. are capable of handling the voltage, so they must be television types or several receiving types in series.

I find the H.T. drain of the whole oscilloscope to be only 30 mA. and thus a small transformer can be used.

There is also no appreciable interaction between amplifiers and time-base if a 32 μF condenser is used for smoothing, as shown.

It is not necessary to use Cossor S130s. Most common stabilisers will do if the burning voltage is over 90 volts.

Adjustment

To adjust the amplifiers, the 500 kΩ preset potentiometers should be set at maximum and the shift controls midway in their travel. One set of plates can be shorted to the final anode, and a good voltmeter connected to measure the H.T. on the other valve anode. The 500 kΩ preset is then adjusted till the voltage is the same as that on the tapping of the potentiometer of two .25 MΩ resistors, from which the other plate is fed. This should be about 170 volts. The spot should then be visible on the screen. The same procedure is then repeated for the other amplifier.

The condenser "C" over the cathode resistor of the 6J7 should be adjusted by means of a square wave generator, if available, otherwise .002 μF or .003 μF should be satisfactory. The same applies for the trimmer over the 2 MΩ input potentiometer. This should be a 60 pF trimmer.

After the first few minutes when it has warmed up the amplifier is quite stable and does not drift with mains fluctuations. The frequency response

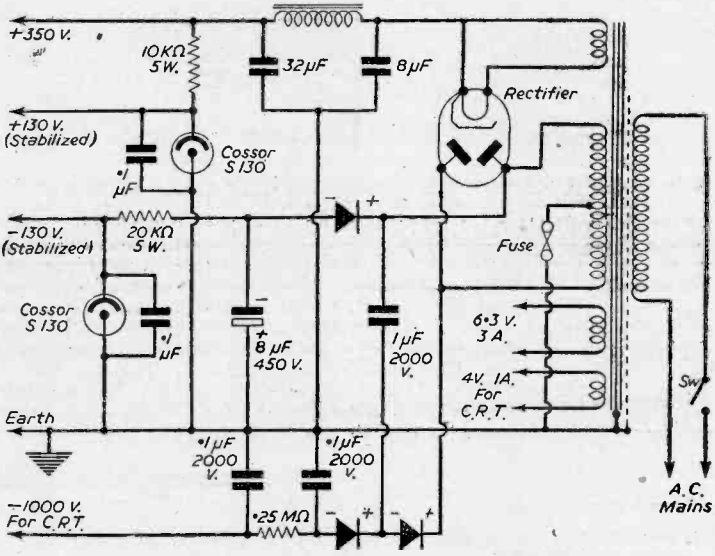


Fig. 2—Circuit of the power pack with values marked.

is reasonably linear from D.C. to 100 kc/s and hence it is admirably suited for all audio frequency work and gives a good enough response for pulse examination. The gain falls appreciably beyond 400 kc/s.

Another device I have found useful is a neon tube synchronising circuit for the time-base.

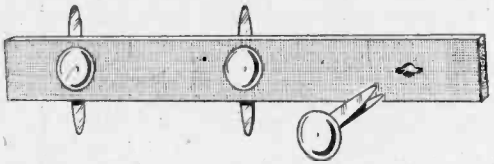
A small neon lamp (it need not be a stabiliser) is connected over half the 350 volt winding in series with a 1 MΩ resistor. There is a difference of about 20 volts between the striking and burning voltages of the neon, and thus there are alternate +ve and −ve pulses every one-hundredth of a second. This provides good synchronising on large multiples and sub-multiples of 50 cycles where a sine wave would not work well and would cause erratic synchronising.

Practical Hints

A Quickly-made Tag Board

FOR this device you will require a strip of red fibre or other insulation material about 1/16in. thick, and some brass paper clips. The length and width of the strip depend upon the number of tags and the size of paper clips.

Scribe a line down the centre of the length of strip, divide into number of tags required, leaving a small space between each. At each position drill a small hole right on the centre line, and slightly smaller in diameter than the width of the legs of the paper clips. Using the centre line already scribed as a guide, cut, with a Swiss file or fretsaw, a very small slot, each side of the hole dead on the centre line, of such a depth as to allow the paper clip to be pushed in the hole and slots each side of the hole. The slots will prevent the clip from turning.



Mr. Percy's idea for home-made tag-boards.

Pull the clips tightly into the holes, and bend back the legs, one up, one down, on the back of the strip.

By fitting two small brass angle brackets, one each end of the strip, first, and drilling through these brackets as well as the strip, the first and last tags may be earthed to the chassis through the brackets. In this case one leg is bent down as before, the other is bent up and soldered to the bracket or clamped under it.—H. L. PERCY (Cowes, I.O.W.).

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay half-a-guinea for every hint published on this page. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be original. Mark envelopes "Practical Hints."

SPECIAL NOTICE

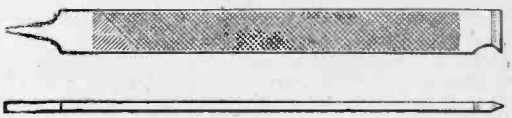
All hints must be accompanied by the coupon cut from page iii of cover.

Cutting Sheet Aluminium

CUTTING out an aluminium chassis with a small pair of shears is not a satisfactory method, as the metal has to be bent to clear the hinge of the shears. There is also the risk of cut hands when operating the shears between the two sharp edges one has cut.

The writer has found that a much neater job can be done with the tool shown below. It was made from a 6in. flat file, the end of which was ground smooth and shaped, as in the drawing, on a small hand grindstone.

In use the tool is drawn several times along a straight edge until the aluminium is cut nearly through. Then it is bent backwards and forwards a few times until severed. The edge is afterwards trimmed with a file.

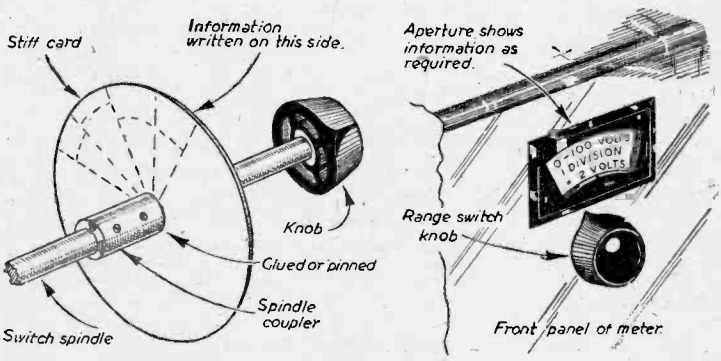


A useful tool for "cutting" aluminium.

Switch Indicator

I HAVE no doubt that many readers have made up a multi-range meter using an ex-Government instrument. Many of these meters have "awkward" scales for calibration, and it is usually found that each scale division represents a different value on the various ranges. Here is an idea I am using, and I find it minimises error due to faulty readings.

A piece of stiff card is cut into a circle and a ¼in. hole made in the centre. This is now glued or pinned to an ordinary spindle coupler, with their holes corresponding. It is then slipped over the range switch spindle and tightened up. A small window and a spindle hole are now made to correspond with the card and switch spindle respectively. The switch itself can be mounted on a suitable bracket. Now the required information can be written on the card for the various ranges in the different positions. Such information might be: 0-100 volts. 1 division=2 volts, and thus it will always be seen on any particular range what calculation to make. If desired a small piece of glass can be placed behind the window to make a "finish."—G. D. RUDRAM (Lancing).



How an indicating dial may be made up and fitted to a rotary type of switch in a multi-range meter, to provide a "scale" for each setting.

Building a Tele

This Month Constructional Data on the Sy

By S.

Theoretical Details

WE now turn to the unit which, apart from the vision chassis, is probably the most important part of a complete television receiver, namely, the time-base chassis, shown in theoretical form in Fig. 1.

The unit in the present receiver is a six-valve section, V11 to V16 inclusive, the first pair of valves constituting the synchronising separator and limiter stages. V13 is the line discharger valve with V14 as line amplifier, and V15 is the frame discharger valve with V16 as frame amplifier. The amplifier valves feed the deflector coils with correctly-shaped pulses to build up the raster on the screen of the cathode-ray tube.

Turning to details, V11, which is an EF50 (VR 91) strapped screen to anode, operates as the synchronising separator proper by working with a very low anode voltage which brings the working point of the characteristic on to the bend of the curve. The vision signal which is applied from the anode of the phase-splitter V10 in the vision unit is negative-going in sign, with the result that only the synchronising pulses carry the valve into the conducting regions of the characteristic, and the output from the anode thus consists only of negative-going synchronising pulses freed from the vision signal itself. Fig. 2 (a) shows the actual oscillogram on the anode of V11. This output is applied to the grid of V12 through the normal RC network of C2 and R4, and V12 itself functions as a straightforward amplifier and inverter, producing at the screen and anode positive going sync. pulses for triggering the line and frame thyratron discharger valves.

The output from the anode is applied to a short time-constant differentiating stage consisting of C7 and R11. C7 is a home-made component and is illustrated in Fig. 3. The construction is in no way critical, and with care can be made in a couple of minutes. Good insulation is the main item of importance. R11 is 270kΩ. in value, and in conjunction with C7 splits up the positive sync. pulse of Fig. 2 (b) into a series of alternate positive- and negative-going spikes of extremely short duration. The positive spike is used to trigger the line thyratron V13, and so synchronise the picture with the transmitter. (Fig. 2 (c)).

The line thyratron valve is the Mazda T41, a reliable and popular discharger for this sort of work, and in the unsynchronised condition i.e., in the absence of a signal, is a free-running sawtooth oscillator working at a frequency between 9 and 11 kc/s. C8 is the actual charging condenser which charges through R13 from the H.T. line, and VR2 is used to control the frequency by the simple method of adjusting the cathode resistance. The synchronising pulses from C7 when applied lock the frequency very firmly to that of the transmitter (10,125 cycles per second), and so ensure a steady picture on the screen.

The saw-tooth output at line frequency from V13 is fed to the line amplifier valve, a power tetrode type 807, chosen on account of its reliability and the fact that it has a top-cap anode connection. This latter is almost a necessary condition in line amplifiers in view of the very high voltage appearing at the anode during the line fly-back. In single-ended valves spark-over troubles are almost inevitable if used as line amplifiers. The gain of the stage, and thus the width of the picture, is controlled by VR1, which is a pre-set control of 250Ω value and functions by virtue of varying the negative feedback on the stage. This form of control tends to improve linearity, for which reason R14 is also included in series with the charging condenser. The output from the anode is shown in Fig. 2 (d) and although this looks terrifying it is quite suitable for feeding the line deflector coils which modify it through

LIST OF COMPONENTS

R0, R12, R24—3.3 kΩ.
R1, R4, R17—1MΩ.
R2—27kΩ.
R3—110kΩ.
R5, R23—470kΩ.
R6, R8—47kΩ.
R7, R9—25kΩ.
R10—4.7kΩ.
R11—270kΩ.
R13, R25—220kΩ.
R14—470Ω.
R15—2.5kΩ.
R16, R29—1kΩ.
R18—160Ω.
R19—47Ω.
R20—200kΩ.
R21, R22—100kΩ.
R26—1.5kΩ.
R27—0.5MΩ.
R28—200Ω.
R30—3.5kΩ.

Erie Ceramic, etc.

(All resistors ½ watt type except R15 which is 1 watt and R30 which is 15 watts.)

C1—4μF.
C2, C12, C14—.1μF.
C3, C4, C13—.5μF.
C5—25μF. (25v. working).
C6—.005μF.
C7—See text.
C8—.002μF.
C9—.01μF.
C10, C11—.001μF.
C15—.0005μF.
C16—16μF. Electrolytic (500v. working).

T.C.C. mica, etc.

(All condensers above 0.005μF should be of the 500 volt working type, except where otherwise stated, and those of 0.005μF and below are of mica.)

VR1 (Width)—250Ω.
VR2 (Line hold)—2.5kΩ.
VR3 (Frame hold)—2.5kΩ.
VR4 (Height)—0.5MΩ.
Valveholders—2 Mazda Octal, paxolin; 2 Belling-Lee, B9G; 1 International Octal; 1 5-pin U.X. type.
Valves—2 EF50 (V.R.91); 2 T41 Mazda; 1 807; 1 EL33.
Line Transformer—4.5 to 1. (Midco Radio, Wellingborough.)
Chassis—12in. x 6in. x 2in.
Wire, sleeving, nuts and bolts, tag strips.

sion Receiver—2

nising Separator and Time-base are Given

NIGHT

their self-inductance. T1 is the line transformer, a very important component. This has a ratio of 4.5 to 1 and is made so that the connection to the top-cap of V14 is direct and well insulated. It is specially matched to the deflector coils to be specified later on, and so *any* type just won't do.

Going back now to V12, at the screen the sync. pulses (similar to those appearing at the anode) are fed to a frame integrator network consisting of R20, R21, C10 and C11. This layout works in a manner opposite to that of the differentiator circuit, in that it "bunches" the frame pulses at the end of each half-frame into one long pulse, at the same time destroying completely the high-frequency line pulses. The frame discharger valve V15, which otherwise functions in exactly the same way as V13, is thus only triggered at the end of the half-frames, with the result that the generated saw-tooth has a frequency of 25 cycles per second. When the stage is free-running in the absence of a signal, the frequency is variable by VR3 and may be anything between 20 and 100 cycles per second, the charging condenser in this case being C13. When the stage is synchronised the saw-tooth output is locked to the transmitter just as the line thyratron is locked by the line pulses.

The output at frame frequency from V15 is fed to the frame amplifier through C14, and a correcting network C15 and R27, and the gain of the amplifier V16 (EL33), is adjusted by VR4, which thus varies the height of the picture. The cathode resistance R28 is unbypassed to assist linearity, and the output appearing across R30 (a 15-watt resistance), is passed through C16, a 16 μF. electrolytic, to the frame deflector coils. These coils, together with the line coils, are, of course, located in the tube unit, and will be described later in the series.

There are two heater inputs to this unit, one of 6.3 volts at 3 to 4 amps., and one of 4 volts at 3 amps. The other side of all heaters returns directly to chassis.

Construction

The photograph shows the general appearance of the finished unit, which is small and neat. The

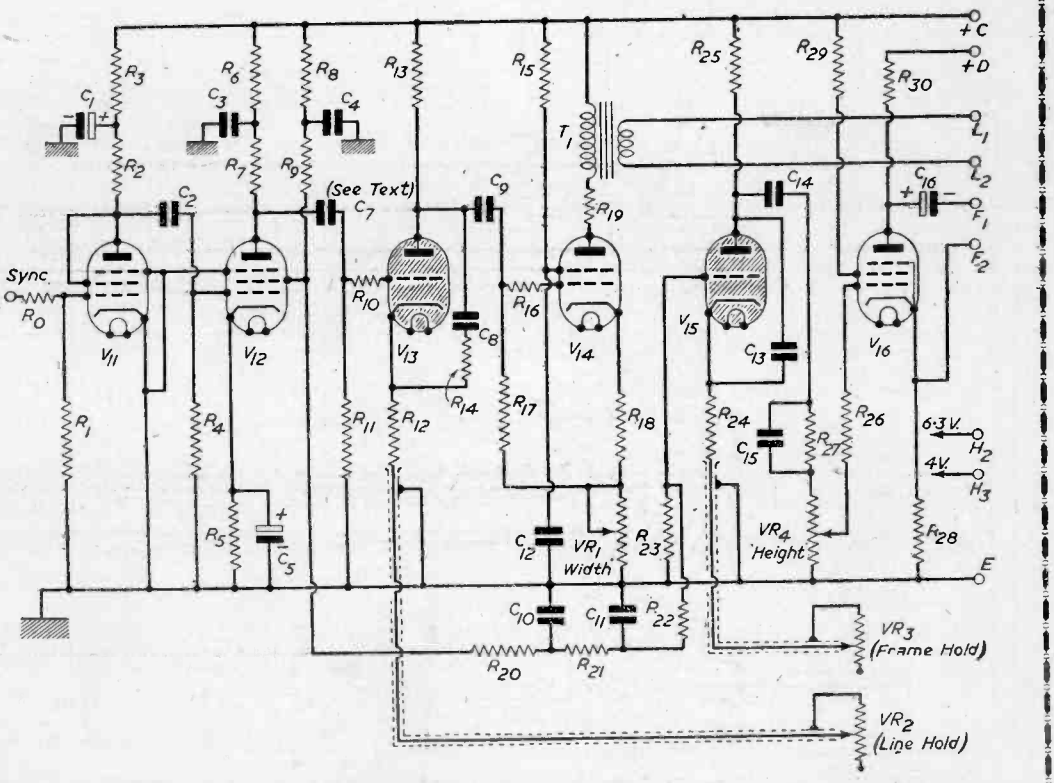


Fig. 1.—Theoretical circuit of the synchronising separator and time-bases. The illustration on our cover shows the completed unit.

chassis size is 12in. by 6in. by 2in. deep, and is made from heavy gauge aluminium. A larger chassis size may, of course, be used if one is conveniently to hand, provided the general layout remains the same. Fig. 4 shows the underchassis layout of components; tag strips are used wherever junctions have to be made, otherwise resistances and condensers are wired directly from pin to pin. There is nothing particularly critical about the actual building of this unit, but good separation of line and frame input pulses to the thyratrons should be aimed at (physical separation, that is) to avoid any unwanted interaction.

VR1 and VR4, respectively the "Width" and "Height" controls, are presets and are mounted at the side of the chassis as seen in the photograph. Once set during test they need be touched no more. VR2 and VR3 on the other hand are respectively the "Line Hold" and "Frame Hold" controls and must be made available for setting up at the beginning of each programme. They are accordingly brought away from the main chassis through about 18in. lengths of screened lead (the thin type of coaxial cable is admirable), as the photograph shows. Later, if and when the whole set is fitted into a cabinet, these controls can be conveniently mounted on to the front panel. The self-capacity of the lead is not critical, and the screening is used as the earth return.

The anode resistance of the frame amplifier, R30, is a 15-watt resistance of value 3,500Ω. This is mounted above chassis next to the line transformer, and the photograph shows this clearly. No heat is thus generated unnecessarily below chassis. The line amplifier also has a high-voltage protective top connector included, in which is the 47Ω stopper resistance, though such a connector is not absolutely necessary. It is, however, advisable, in view of the flyback voltage developed at this point.

The line and frame outputs are brought out through a four-way cable to an eight-pin Octal plug, alternate pins being those used. The cable length depends on how far away the tube unit is going to be, but 18in. should prove adequate for most cases. The heater and H.T. inputs are brought through a similar length of five-way cable, fairly heavy leads being used for the earth and heaters. All leads, both those going to the deflector coils (L1, L2 and F1, F2), and those coming from the power supply +C, +D, E, H2 and H3), connect to the main chassis on tag strips mounted along the far edge.

The only other points of importance are: all earth connections should be short and well made, components should be rigidly mounted, and a substantial gauge of aluminium used for the chassis itself.

All resistances are rated half-watt except R15 which is 1 watt and R30 which, as previously

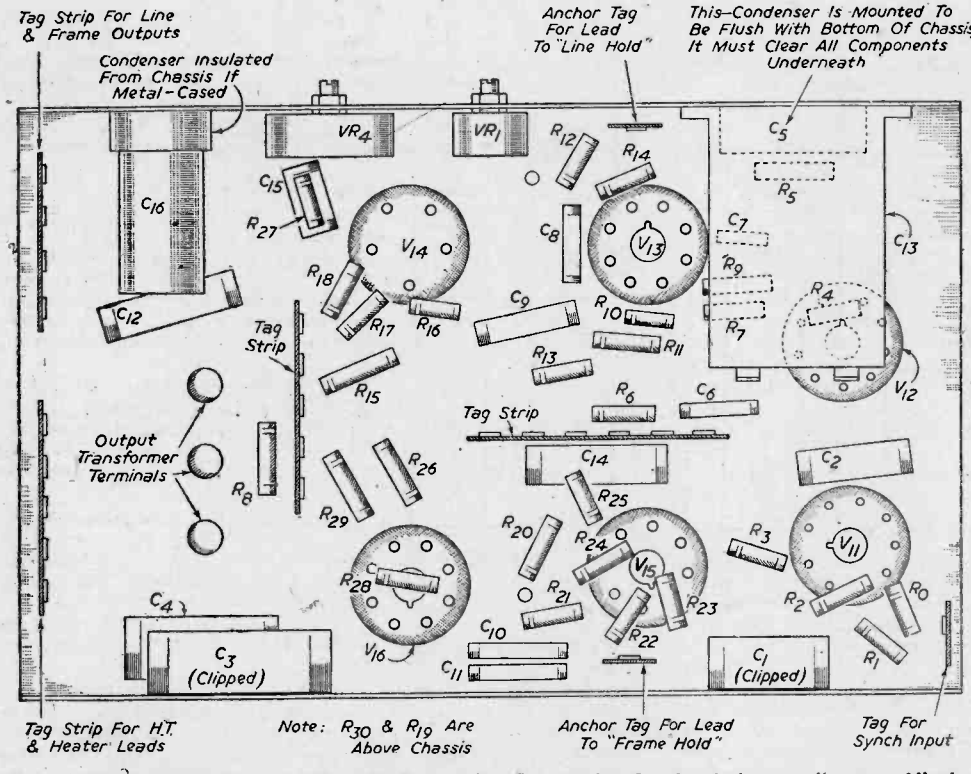


Fig. 4.—Underchassis layout of the time-base unit. In practice the chassis is more "cramped" than appears here, and some slight differences in position are permissible.

mentioned is 15-watt. Note carefully that C16 is an electrolytic (500 volt working), and that if a metal cased component is used it *must* be carefully

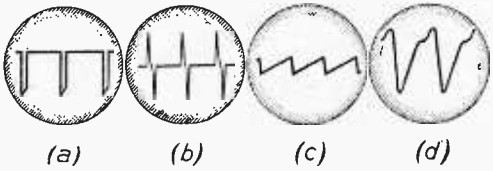


Fig. 2.—Typical traces obtained on the oscilloscope at various points in the time-base.

and adequately insulated from the chassis. A few turns of insulating and Empire tape between the can and the clip are essential, and insulation should be checked before H.T. is applied to the unit. The positive terminal goes to the valve anode.

All condensers must be rated with regard to working voltage depending upon their position in the unit; C1, C2, C3, C4, C6, C8, C9, C12, C13, C14, should all be 500 volt types, with those of value below 0.005μF. of the mica type. Other condensers not listed above should be of the mica

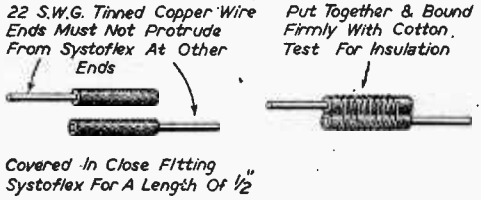


Fig. 3.—Stages in the making of a low-capacity for the line differentiator.

type, except C5, which is an ordinary 25-volt bias electrolytic.

This completes the time-base unit, and the next section to be described will be the sound receiver—a five-valve chassis.

(To be continued.)

Trade Notes

Taylor Tester

TAYLOR ELECTRICAL INSTRUMENTS, LTD., are in the very near future introducing a modified version of the popular Taylor Model 70A. This model will be known as No. 70B. The object has been, by means of mass-production methods, to produce an instrument approximately to first-grade standard and available at a popular price.

Model 70B will have a total of 50 ranges available and fitted with a Taylor Moving-coil Meter. A mirror scale and knife-edge pointer will be fitted and the sensitivity on both A.C. and D.C. volt ranges will be 1,000 ohms per volt. Provision is made for six decibel ranges and a self-contained buzzer is incorporated for quick continuity tests. The price of this instrument will be £14 14s.

A radio-frequency measuring instrument, mains operated, for frequency measurements in all amateur bands up to 60 Mc/s with an accuracy of better than ±0.1 per cent., is also announced.

The equipment comprises a stable variable frequency oscillator calibrated from 1.6 to 2.0 Mc/s, a 100 kc/s crystal-controlled oscillator, a detector valve to enable beats to be heard in headphones, and power supply.

The variable frequency oscillator is inherently stable and has ceramic insulation throughout. Its calibration can be checked against harmonics of the crystal oscillator and small corrections made by a panel trimmer. A set of tuned circuits is provided, each pre-tuned to the centre of an amateur band, so that by selecting any one the harmonics over that band are greatly intensified. On the 10 and 6 metre bands, where several harmonics can be heard, a simple chart enables positive and instantaneous harmonic identification without calculations.

The instrument may be used to measure transmitter frequency; to calibrate receivers over the amateur bands; to monitor transmissions; and to measure frequency drift of transmitters and receivers.

The instrument is 12in. by 8in. by 6in., and the mains consumption approximately 8 watts.

Carlton Coils and Transformers

MANY amateurs have been converting ex-government equipment to amateur use, and for some considerable time the Carlton Coilwinding Co., of Birkenhead, have been manufacturing chokes, coils and transformers for the conversion of ex-government equipment to A.C. mains operation, with the minimum amount of alteration to internal wiring.

The transformer for the B.C.348 has a 26-volt filament winding and is of such a physical size that it can be mounted, together with their standard choke, type CLF/100 and the rectifier valve, on the platform which is normally occupied by the dynamotor.

Transformer type CBC/453 has two filament windings, together with the usual H.T. and rectifier filament windings. One of the L.T. windings is 25 volts at .45 Amp. for use with the B.C.453, 454 or 455, and the other, 6.3 volts at 3 Amps. is intended to heat the filaments of a converter such as R.F.26 or R.F.27 when used in conjunction with the B.C.455.

Of special interest to the amateur wishing to build a cheap broadcast reception set is the medium-wave coil unit type CMW/453 to convert the B.C.453 receiver for operation on medium waveband. These are supplied complete with connecting data and retail at 10s. each.

Using Metal Rectifiers

Hints on Replacing a Valve in Certain Circuits

By F. G. RAYER

IN some circuits metal rectifiers can be used with advantage, types being available which may be used for detection, A.V.C. and mains rectification. They may also be used for accumulator charging, and for adding A.C. ranges to D.C. meters, but as these particular aspects do not come into the design of receivers, they are not dealt with here.

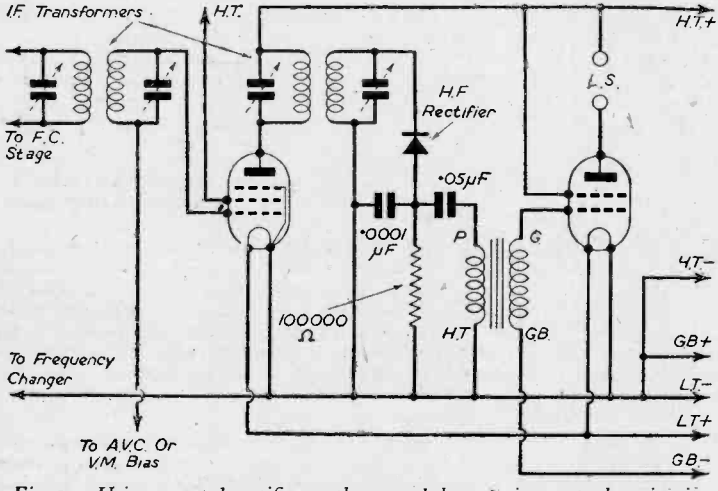


Fig. 1.—Using a metal rectifier as the second detector in a superhet circuit.

Rectifiers for Detection

Fig. 1 shows a suitable circuit for a superhet, only the last I.F., detector, and output stage being shown. For a simple receiver this avoids having to use an extra valve for the detector, or a multiple valve. It gives good results because the rectifier is preceded by a fair degree of amplification.

In this circuit, the 100,000 ohms resistor is the rectifier load, and it is by-passed by a .0001 μF condenser to allow proper rectification. The .05 μF condenser couples the rectifier to the primary of the transformer, and is followed by a low-frequency amplifier in the usual way.

It is usual to wire the rectifier so that the positive end is connected to the I.F. transformer secondary (or tuning coil in the case of T.R.F. receivers).

In Fig. 2 a T.R.F. or "straight" circuit is shown. Here the rectifier has been connected directly to the primary of the transformer. This causes no appreciable loss of efficiency if the component is a good quality one with a high primary impedance. Usually the self-capacity of the primary is sufficient to enable rectification to be achieved, but if necessary a condenser of about .0001 μF may be shunted across it.

The rectifier may be taken to a tapping on the tuning coil to lessen damping on the second tuned circuit. This is also possible with the circuit in Fig. 1, if a centre-tapped I.F. transformer is used.

Other parts of the circuit follow normal lines and other forms of coupling between H.F. and rectifier, and rectifier and L.F. stages, may be used.

Mains Rectification

Fig. 3 shows a circuit quite satisfactory where only moderate H.T. voltages are needed, such as in an H.T. battery eliminator. It may also be used for an all-mains receiver, the valve heaters being fed from a small transformer, or connected in series with a suitable dropper resistor.

The resistor in series with the smoothing choke (which should be capable of carrying the necessary current, and of 20 to 40 henrys inductance) is only needed when H.T. is being supplied to battery-operated valves. (The maximum anode voltage for these usually being

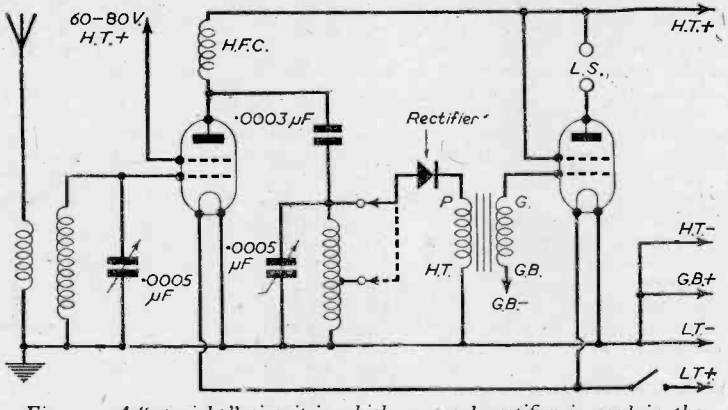


Fig. 2.—A "straight" circuit in which a metal rectifier is used in the detector stage.

150 volts.) If further low-voltage tappings are required, additional resistors may be wired as shown. The value may be determined from Ohm's Law, or from the following table:

Current Flowing	Voltage to Drop	Resistor Required
1 mA.	100	100,000 ohms
1 mA.	50	50,000 ohms
1 mA.	25	25,000 ohms
2 mA.	100	50,000 ohms
2 mA.	50	25,000 ohms
2 mA.	25	12,500 ohms
5 mA.	100	20,000 ohms
5 mA.	50	10,000 ohms
10 mA.	100	10,000 ohms
10 mA.	50	5,000 ohms
10 mA.	25	2,500 ohms

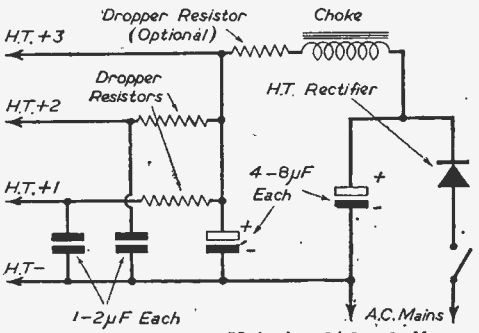


Fig. 3.—A simple H.T. Unit, in which a half-wave rectifier is used.

Voltage-doubling

Where higher voltages are required, the circuit shown in Fig. 4 may be used. It has the advantage over the circuit in Fig. 3 that H.T. minus is not connected directly to one mains lead.

The 4 μF condenser connected between H.T. plus and H.T. minus may be an electrolytic component. Note that both the other 4 μF condensers are not returned to H.T. minus, so that if metal-cased components are used they should not be bolted to a metal chassis unless the condenser casing is "dead."

Various rectifiers are available, depending upon the voltage and current required. The type H.T.16 will provide 300 volts at 60 mA., which is ample for most mains receivers.

Bias with H.F. Rectifiers

Sensitivity to weak signals may be increased by applying a small bias, as shown in the simple circuit in Fig. 5. The polarity depends upon the way the rectifier is wired, and connections to the battery may be reversed to obtain the desired result. The best voltage should be found by trial.

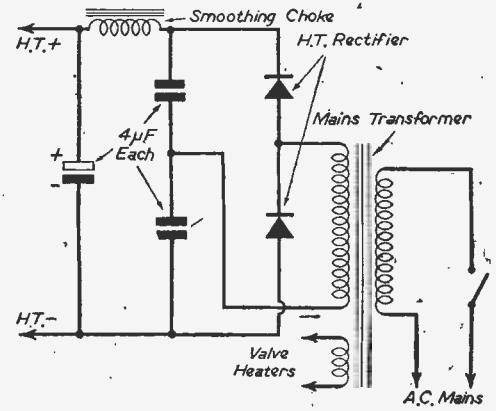


Fig. 4.—In this mains unit, two half-wave rectifiers are connected to provide full-wave rectification.

For use in a receiver with little or no H.F. amplification the type WX6 is most suitable. Where the rectified current may exceed .12 mA. type W6 may be used, the maximum rectified current for this component being .28 mA. Because of this type W6 is used in receivers with more than two stages of pre-detector amplification.

For A.V.C.

A portion of the signal may be rectified to provide A.V.C., as shown in Fig. 6. Here it is important the rectifier be connected in the correct polarity so that a negative bias is obtained. The bias

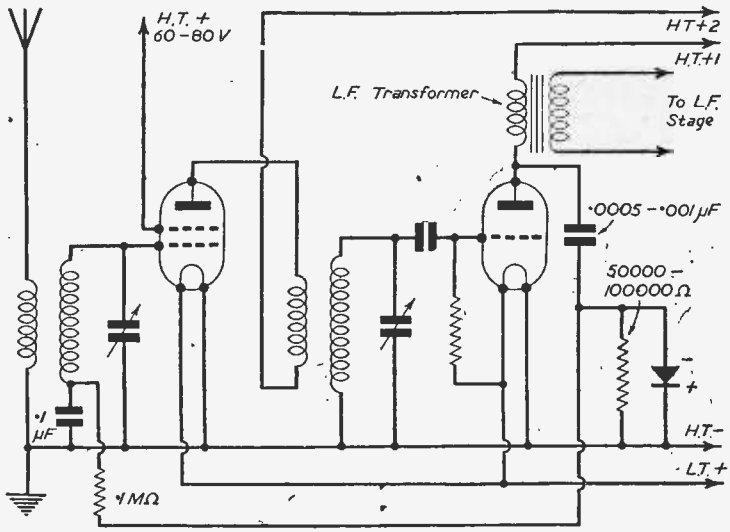


Fig. 6.—In this circuit a voltage for A.V.C. purposes is obtained from a half-wave rectifier.

is developed across the 100,000 ohms resistor and by varying the value of this, and the capacity of the associated fixed condenser, some control over the A.V.C. action is possible.

The degree of control will not be large with only one H.F. stage, but the same circuit may be used with superhets, or straight receivers where two or more valves may be controlled. As will be seen, the necessary addition may be made to an existing receiver quite simply.

Each controlled H.F. stage should, of course, be decoupled as shown by a .1 μF condenser and a .1 MΩ resistor.

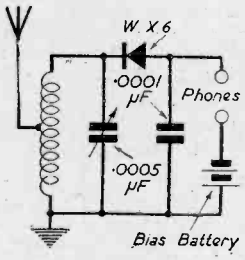


Fig. 5.—A simple receiver circuit in which an H.F. metal rectifier takes the place of the usual crystal detector.

Radio Communication for Aircraft

IN anticipation of legislation regarding "communication facilities" in civil aircraft, E. K. Cole, Limited, have developed a complete twin-channel ground and air installation which meets the recommendations of the International Civil Aviation Organisation now in course of implementation by the Ministry of Civil Aviation. Many owner pilots, flying clubs and aerodrome operators have been waiting for just such equipment as Ekco now offer.

The company promise delivery in approximately three months from the date of order, and their own engineering department will undertake the initial installation. A complete and immediate service of replacements has been planned at the Ekco Works, Southend-on-Sea. The company are organising a nation-wide coverage for installation and maintenance which aims to provide air charter companies, flying clubs and aerodrome operators, wherever they may be located, with the personal attention of E. K. Cole engineers. All orders and enquiries will be handled by the Radio Sales Division, Aircraft Radio Section, Southend-on-Sea.

In marketing this new equipment, E. K. Cole, Limited, are prepared to extend a full and detailed advisory service to all enquirers, and their organisation assures that users of the equipment will at all times have behind them the immediate and ready assistance of the manufacturers in maintaining their installation at full efficiency.

Complete Equipment

The Ekco Aircraft Communication Equipment consists of:—

(1) Crystal controlled twin channel aircraft transmitter-receivers of the V.H.F. type, with selector switch control, weighing approximately 12 lbs.

(2) An aerodrome installation comprising two transmitters and two high gain receivers covering, for example, the Universal Guard frequency, and the frequency of the local aerodrome, or any two frequencies in the 118/128 megacycles V.H.F. band.

Ekco have also developed, in conjunction with the Communication Equipment, a complete D.F. installation which can be immediately and automatically tuned to the frequencies on which the main transmitters and receivers are working.

Aircraft Equipment

The equipment is a lightweight Transmitter/Receiver, suitable for installation in private and club-type aircraft. It is self-contained and operates from a 12 volt battery (other voltages can be covered if required), and has a power consumption of 3.75 amps at 12 volts.

Provision has been made for transmitting and receiving on two crystal controlled frequencies, one of which would normally be set to the Civil Aviation Guard frequency of 118.1 Mc/s, whilst the other would usually be set to the frequency allotted to the local aerodrome from which the aircraft operates and within the band 118-128 Mc/s.

Circuit

The set contains sixteen valves, plus rectifier and is divided into two crystal multiplier chains, two R.F. and frequency changing chains, and a common I.F., detector, L.F. and modulator chain.

Controls

The two frequencies are pre-set and crystal controlled and the only manual controls necessary are:

(a) Channel frequency selection switch.
(b) Send/Receive switch.
(c) On/Off switch.

making for extreme ease of operation.

The above switches are all mounted in the small Control Unit, which can be installed on the dashboard or any other convenient position.

Provision is made for the use of two sets of microphone and headphone attachments from the Junction Box.

The Junction Box is fitted with an additional supply socket to enable overriding transmitter switch operation, and this may be used as remote control by either pilot or passenger.

Programme Pointers

In This Month's Article MAURICE REEVE Looks at Television, the Symphony Concerts and the Brains Trust

MUCH ink is spilled and breath used up in telling of what is wrong with wireless, the films, art, and, in fact, the world in general. *A* thinks it is this and *B* that, whilst *C* is certain he knows the remedy. But radio was so quick to solidify into its present conglomerate mass—quicker, even, than the films, from which it derived so much that was both good and bad—that, like the body politic itself, change must in the nature of things be slow.

A point of similarity, with a difference, that I seldom see mentioned is one which, I think, contains the gravamen of the problem, to wit, that whereas both cinema and radio quickly made themselves non-stop shows covering many hours, the radio cannot keep repeating itself like its sister amusement does. Where a film show is practically always good or always bad, four times a day, according to the programmes being shown, the wireless is constantly alternating from the sublime to the ridiculous, and midway between, for short snippets of time the whole clock round, said snippets being chucked at us from all points of the compass.

No wonder much of it is bad, or, to put it more mildly, stupid, inane, mildly amusing or mildly instructive, as the case may be. And so long as it remains a twenty-four hour a day service, which, I suppose, will be for ever, so long must we expect a service which never seems quite so good as it might be. I do not think it was ever meant to be such, and the result is what it was bound to be: best summed up in the classic story of the housewife who "always turns the wireless on but seldom listens to it."

I am sure the quality of both programmes and listening would go up if we hadn't quite so much of a good thing. The fact seems to remain that, in spite of the inclusion of the present host of outside broadcasts, the broadcasting of films, church services, darts matches, repetitions, etc. etc., there is still not nearly enough first-class material to see the day through. Also, certain regular features like Music Hall and the Brains Trust, have sadly deteriorated. Ought, therefore, the B.B.C. to decide, even if regretfully, that in the interests of the quality of their programmes, they intend to sacrifice quantity and limit the number of broadcasting hours. Or should they, in fact, preach *laissez faire* and say, "We'll give you all of the best that's going, and if you don't like the rest, then we're afraid we can do nowt abaht it!" To expect two programmes, each of about eighteen hours' length, with a third of about six hours, plus the rest of the world, everlastingly packed with first-class material whenever we turn the knob is, of course, to ask for the impossible.

Television in the Future

Surprising things happen in the course of evolution: things never intended at the commencement and not wanted in development. But when they are quick to take root, as the cinema and the wireless, they willy nilly become our masters. So who knows whether, during the next generation, the perfect television system may not solve everyone's troubles. By combining perfect listening with perfect vision, television could, at one blow, kill either the cinema or the wireless. If it became the public entertainment of the future, room would be made for the restoration, with modern improvements, of the better features of the old family life which set up such nostalgic memories in the breasts of those who remember them. Whilst, should it supersede wireless in the home, it would probably leave the theatre and the concert free to regain their pristine glories, which the film and the radio so gravely damaged. In fact, everything in the garden may be perfect, with only an atom bomb to guard against.

The Symphony Concerts

Of the three B.B.C. symphony concerts from the Albert Hall, conducted by Barbirolli, Beecham and Kubelik respectively, I preferred Beecham's. The orchestra always seems to play with just that little bit more intensity and snap for Sir Thomas than for most others. His Sibelius No. 7 and Delius's "Song of the High Hills" were magnificent, whilst Tortellier, in Dvorak's gorgeous 'cello concerto, beautifully accompanied, proved him only a little behind the irreplaceable Casals. Kubelik's Ninth Schubert was fiery virtuosity, but though the great music swept on with ever-increasing surge, there was not quite the cohesion and balance of the former concert. The Italian violinist, Gioconda de Vito—a name to conjure with in its own right, if ever there was one—played Mozart superbly, but with abominable cadenzas. The applause savoured of the Highbury Stadium and the winning Arsenal goal. Barbirolli's Fourth Brahms was a noble effort, and he also revealed the likeable brilliance of Bartok's Concerto for orchestra to an extraordinary degree.

There was some lovely eighteenth century chamber music on the Third by Pergolesi, Gluck, and others, given by the London Harpsichord Society—the third of six programmes. I also liked the Trout Quintet by the Bayrilli combination, plus the irrepressible Peter Stadlen.

Brains Trust

I cannot quite agree with my *Radio Times* colleague *apropos* the Brains Trust. In the issue of November 25 he says that "after a disappointing start, they have settled down and, in doing so, have mellowed." I presume he is complimenting them, and that is why I differ. As, later in his article, he also says "... I was astonished last week to hear him (the chairman) rap out the precise opposite to the jury's verdict on a question regarding the purchase of clothes," one wonders what they are exactly meant to be these days. To

me they have become extremely stuffy, boring and dull, completely lacking their former wit and sparkle, and, for the most part, discussing fatuous and naïve questions.

In this repetitious age, the making of broadcast dramas from film sound tracks had to come. As they are usually and understandably the good films which are thus treated, it is an odd pastime to listen for an hour to a film which you have either already seen at your local celluloid tabernacle, or thoroughly intend to in the very near future. Films without the films. Betty Grable minus Betty Grable! If a lot of opening and shutting of doors and commentary in place of visual action can create any excitement comparable to the real thing, then "Call Northside 777" was very good, and just the right type of film which can be divorced from its better half without undue grief or shedding of tears. With all respect to the excellent Mr. James Stewart, none of the scenery was vitally missed. It made a good number for Picture Parade. But I saw the film and found it vastly superior in tenseness and realism.

After the weekly reminder, December 11, that "Music Hall" is rapidly becoming one of the most banal and hackneyed of features, Saturday Night Theatre presented a powerful stimulus to one's dormant brain with R. and M. Pertwee's "The Paragon," adapted for radio by M. Pertwee. The story, not everyone's meat, of how a doting father is going to honour the memory of his worthless son, announced killed in the war, until the son turns up, a deserter and blackmailer, was well played by all, and dramatically produced by Archie Campbell. Edward Chapman was particularly good as the blind father, and his change of mood from silent worship (he intends spending half a million pounds on memorials to his memory) to a full realisation of having been deceived by an utter and complete cad, was convincingly portrayed. We also felt the inherent cowardliness and worthlessness of the son, by Hugh Burden.

News from the Clubs

LOTHIANS RADIO SOCIETY

Hon. Sec.: I. Mackenzie, 41, Easter Drylaw Drive, Edinburgh.

THE next regular monthly meeting will be on February 24th, 7.30 p.m., at the Chamber of Commerce Rooms, Charolette Square, Edinburgh.

Mr. W. R. Eadie (GM4JO) will deliver a lecture. Subject: "Aerial Theory and Practice, with particular application to Multi-Element V.H.F. Beams."

READING AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: L. Watts, G6WO, 817, Oxford Road, Reading.

THERE was only one meeting of the society during the month of December. The programme at this meeting consisted of a Brains Trust.

On February 12th, Mr. J. Dee, G3BJE, will give a talk on oscilloscopes.

THE WEST MIDDLESEX AMATEUR RADIO CLUB

Hon. Sec.: C. Alabaster, 34, Lothian Avenue, Hayes, Middlesex.

THE club continues to be very much alive in all aspects of radio and electronics. Recent meetings were concerned with the electron microscope, the stroboflash, a junk sale and lectures on interference, the latter being particularly timely in view of the new Wireless Telegraphy Bill.

The future programme includes lectures on valves, amplifiers and V.H.F. equipment.

Meetings are held on the second and fourth Wednesdays of every month at the Labour Hall, Uxbridge Road, Southall, Middlesex, at 7.30 p.m.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. A. Higgins, 35, John Street, Brierley Hill, Staffs.

A MEETING of the above society was held at King Edward's School, Stourbridge, on Tuesday, December 7th, 1948. Mr. B. Whitehouse (G6WF) was in the chair. Following general business, in which the secretary gave details of future meetings, Mr. K. H. Varney (G3DMV), of G.E.C., Ltd., gave a most interesting talk on the "Photo Electric Cell and its Application in Industry." The talk was illustrated with lantern slides and a display of apparatus. Members were shown how the photo cell was used for burglar alarms, counting and sorting, automatic door and gate opening, and testing smoke density. Mr. Varney was accorded a hearty vote of thanks for an excellent talk.

Further particulars may be obtained from the secretary.

ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: D. Coppendale (G3BNI), 9, Morden Road, Chadwell Heath, Essex.

AFTER 12 years as secretary to the Romford and District Amateur Radio Society, G3FT, his wife and family have left for Canada, complete with 10-metre transmitter, and hope to be working back to local "Gs" in the near future.

The position of secretary has been taken over by G3BNI, to whom all matters concerning the R.A.D.A.R.S. should be addressed.

Two nights a week are devoted now to radio—Tuesday, normal radio lectures, demonstrations, junk sales, etc., whilst Wednesday nights one can learn about television. The Wednesday evening meeting is proving very successful and shortly it is hoped to have a TV of our own.

NOTTINGHAM SHORT WAVE CLUB

Hon. Sec.: N. W. Adcock, "Bryn-Gates," Harlaxton Drive, Long Eaton, Nottingham.

THE club now has a new secretary as above, and new premises have been found owing to increased membership. Meetings are held every Monday evening at 7.15 p.m. at "The Old Boys' Club," Middle Street, Beeston, Notts. The club Tx, G3EKW, was officially opened on Monday, December 6th, by Mr. F. R. Sharp, Radio Editor of the *Nottingham Evening Post*. The Tx is situated at Chilwell, Notts, and is active at present [on 1-7 Mc/s only. New members are always sure of a welcome, either personally or by contacting the secretary. Morse tuition is available as well as technical theory and practice in relation to the A.R.E.

SOLIHULL AMATEUR RADIO SOCIETY

Hon. Sec.: G. Flaving, 121, Bradbury Road, Olton, Birmingham.

THE A.G.M. of this society was held on January 12th, and marked the election of new officers, these being: Hon. sec., G. Flaving, G3EQL; hon. treas., J. Tucker, G5TU; pres.: M. Filgate, and a committee of five.

The programme committee outlined their future programme, which began on January 26th with a lecture on radar by Mr. Smith, G6FK.

Future lectures include "V.H.F.," by G5BJ, "The Radio Valve," by G5TU, and many more by members of the society. It is hoped in the future to deal more with the constructional side, as younger members have suggested. Meetings are held on alternate Wednesdays at 7.30 p.m. at the Manor House, High Street, Solihull, and visitors and new members will be welcomed.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: F. C. Ward, G2CVV, 5, Uplands Avenue, Littleover, Derby.

THE society's first annual dinner and social will be held on Wednesday, February 9th, at the Grandstand Hotel, Racecourse, Nottingham Road, Derby.

Future meetings will be held on February 2nd and 16th respectively in the Club Room, 67b, London Road, Derby.

THE HOUNSLOW AND DISTRICT RADIO SOCIETY

Hon. Sec.: A. Pottle, B.Sc., 11, Abinger Gardens, Isleworth, Middlesex.

PLANS for 1949 were fully discussed at a recent meeting. Future activities will be concentrated upon transmitting, receiving and television. The society's transmitter has now been completed and will operate under the callsign G3FHD. Prospective members should contact Mr. A. Pottle, whose address is given above.

Impressions on the Wax

Review of the Latest Gramophone Records

OUTSTANDING among the recent releases is a recording of Schubert's "Great" Symphony played by the Vienna Philharmonic Orchestra conducted by Herbert Von Karajan on *Columbia LX*1138-43. There are many points in this last and greatest symphony of Schubert's that compel admiration. The general conception is splendid, and it is magnificently handled by Herbert Von Karajan, who is especially successful with the big driving theme in the finale. It was not until seven years after Schubert's death that this symphony saw the light of public performance, and then only the last movement was given. These six records are sold with a booklet of analytical notes, and are a welcome addition to the Columbia Masterwork Series.

Another highlight is a recording of Handel's Organ Concerto No. 9 in B Flat, Op. 7, No. 3, on five sides of three 12in. records played by George Thalben-Ball accompanied by the Philharmonia Orchestra conducted by Walter Susskind—*H.M.V. C*3814-6. The records supply lively and vital music in the best Georgian tradition. On the reverse side of *H.M.V. C*3816, George Thalben-Ball plays his own arrangement of Allegro Moderato from Concerto No. 6 in B Flat Major.

Ida Haendel, who has recently signed a three-year contract with H.M.V., makes her second recording under the contract with Brahms Hungarian Dance, No. 17, arranged by Kreisler. This violin solo is coupled with Wieniawski's Polonaise Brillante in D Major, Op. 4, on *H.M.V. C*3818. She is accompanied on the piano by Gerald Moore in both recordings.

Walter Gieseking, the distinguished pianist, makes a welcome return to Columbia with a recording of Danse and La plus que lente, both by Debussy, on *Columbia LX*1146. This is his first recording since the war, and for a long time he has been the most important pianist in Germany and has given recitals under the auspices of the Allied authorities in recent years.

Popular Sadler's Wells Opera

The production of Verdi's Simone Boccanegra, which was undertaken by Sadler's Wells in October last, was the first performance of the work to be given in England. An English translation of the Italian libretto was made by Norman Tucker, chairman of the Sadler's Wells Directorate. These two records—*H.M.V. C*3824-5—are important additions to the repertory of opera in English, and the artists concerned in these excerpts are all members of the Sadler's Wells Opera. Simone Boccanegra is not given frequently even in Italy, and the Sadler's Wells Company's production is typical of their enterprise and exploratory policy.

"In a Monastery Garden" must share pride of place with "In a Persian Market" as Ketelbey's most widely known work. It has been presented often on the organ and by various instrumental combinations, and it has now been given a new arrangement for the famous Melachrino Strings on *H.M.V. B*9714. For a coupling George Melachrino has chosen the peaceful "Bells Across the Meadow."

"Petite Suite de Concert" and "Hiawatha" are the two works which keep Coleridge-Taylor's name most often before the public. Each of the pieces in the Petite Suite have been perfectly recorded on *Columbia DB*2479-80 by Sidney Torch conducting the Queen's Hall Light Orchestra, who have provided four sides of really attractive orchestra playing.

Andre Kostelanetz and his Orchestra have once again made a delightful recording. Kostelanetz has chosen two Viennese waltzes, "Gypsy Love," by Franz Lehar, and "Gypsy Baron," by Johann Strauss, and both receive subtle handling on *Columbia DX*1540.

Variety

Of all the numbers featured by Danny Kaye during his phenomenal variety season at the London Palladium last year, none was a bigger laughter maker than his hilarious satire on a light operatic tenor and a soprano. Now, under the title of "The Fairy Pipers," he lampoons lyric tenor and coy coloratura in a performance which ranges from the fanciful to the fantastic—*Columbia DB*2481. On the reverse side he sings "Farming" from Cole Porter's "Let's Face It."

A newcomer to the Columbia lists is Lynn Mason, who makes her debut with two sentimental ballads, "Let us be Sweethearts Over Again" and "When the Silver Threads are Shining," on *Columbia FB*3449. She is at present attached to Chappie d'Amato's Orchestra.

French-Canadian Jean Cavall, cabaret star and popular broadcaster, has recorded this month "Ah, but it Happens" and "Quand Meme," the latter being sung in English and French. Jean's neat presentation of "Quand Meme" on *H.M.V. B*9715 may well make it a successor to the popular "Darling, je vous aime beaucoup."

"If you had all the World," on *H.M.V. BD*1233, is a tailor-made number for Perry Como, who knows how to coax all the sentiment from a song without getting mawkish. The soft strings of the Russ Case Orchestra provide an effective background to the singer. Johnny Green's "Body and Soul" is resurrected on the reverse side.

Both of Geraldo's latest hit tunes, "Worry, Worry, Worry" and "Big Brass Band from Brazil," on *Parlophone F*2330, swept to the top of the Hit Parade in America last year. "Worry, Worry, Worry" is by the team that gave us "Woody Woodpecker," while "Big Brass Band from Brazil" became a best seller within a few months of its issue in the United States. Both come under the term novelty songs, and arranger George Evans, who is heard singing with the Geraldo Quartette, renders the lyrics with a grand swing to well-drilled playing by the orchestral ensemble.

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

6K7 Pocket Receiver

SIR,—Having taken PRACTICAL WIRELESS for about two years, I am at last prompted to write to you. And the subject is that set using one 6K7 that you have mentioned several times.

I made this up and, using it at Great Yarmouth, succeeded in getting Hilversum. Owing to the "marvellous" B.B.C. coverage over that way, I couldn't get them at all. Then I started experimenting on my own account.

My first mod. was to use a flat battery for heaters and a 9-volt G.B. for H.T. Then, as I reasoned, the .3 A. of the 6K7 is higher than the .15 A. of a 956. I changed over to that valve, and I think it is *better* than the 6K7. Since I have been here near Bedford I have heard both Home and Light programmes without any trouble. Any time now the heater consumption is going back to .3 A., as I'm going to use another 956 as A.F. amplifier. The small physical size is a good thing for this latest scheme.—C. J. GRICE (Bedford).

R1355 and Television

SIR,—I am writing this letter because I feel the information may be of use to those intending to build television receivers.

Certain retailers are advertising ex-R.A.F. receivers type R1355 (10/13032) as "suitable for television," with "4 Megacycle bandwidth." Now, this is misleading. The actual bandwidth is ±.6 Mc/s. for 6 dbs. down, i.e. 1.2 Mc/s. bandwidth, a very different thing from 4 megs. The I.F. of the R1355 is 7.5 Mc/s., and the I.F. coils are damped by fixed resistors. The R.F. Units 25, 26, 27, etc., are very suitable for television as they stand.

I trust this will be of some help to someone.—K. BERRY (Surbiton).

Old Receiver Performance

SIR,—In the December, 1948, issue of PRACTICAL WIRELESS you state that a set that is more than 10 years old has a lower standard of reception than a new set.

It may interest you to know that my parents have a certain console, price £20, bought in 1934, which has had a great deal of use and, apart from having the wavechange switch cleaned, has never gone wrong and has its original valves.

The specification may also interest you. It has nine valves, 10 watt push-pull output, 12in. M.C. speaker, a tuning device that, as soon as a station is roughly tuned, pulls the station dead on tune, a modern-styled console cabinet, the walls of which are lined with sound-absorbing material. The result is a set which has superb tonal quality and good sensitivity, selectivity and a noise level lower than the majority of modern sets. The only sets I have heard with as a good a performance are very expensive £200 radiograms.

You mention improvements in design and manufacture in the past ten years. I have examined the circuits and construction of many post-war sets, and they all follow conventional five or (if you are lucky) six valve superhet circuits. An imposing radiogram costing over £100 turns out to have only five valves. The local radio dealer, of all people, states that in only one make of receiver are the fixed condensers reliable. To demonstrate his point he tested a representative sample of British condensers. They all had leaks varying from .5 MΩ to 2 MΩ. This is a serious matter, especially from the export point of view. On the other hand, he tested a sample of American condensers and they had no leaks.

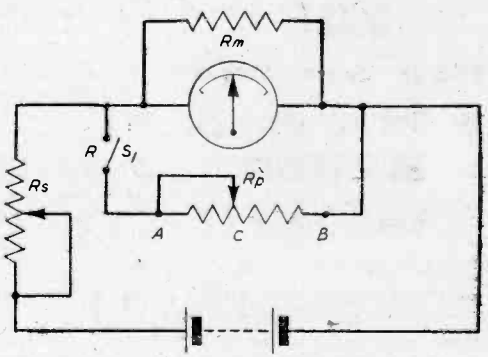
In fact, I challenge you to point out the improvements in design and manufacture which you say have taken place in the last ten years.—T. R. LAIDLAW (Rugby).

Measuring Meter Resistance

SIR,—Further to recent correspondence *re* meter resistance, and to the methods employed in obtaining same, I find the enclosed circuit sufficient.

Let Rs be the limiting resistor to prevent possible damage to the instrument.

With the switch S1 open, adjust Rs until the instrument indicates F.S.D.



Mr. Palmer's arrangement for measuring meter resistance.

Now close S1 to bring Rp into circuit, and adjust Rp until the instrument indicates half F.S.D.

When this condition is reached the resistance of the instrument is Rm=Rp, or Rm=RcB, to be more precise.

The resistance of S1, shown as R, is usually low enough to be ignored.

However, for special purposes, this may be found beforehand.

Therefore Rm=RcB+R.

Thanking you for a most interesting Journal.—F. C. PALMER (Highbury).

"Cæsar's Mistress"

SIR,—May I trespass upon your space to comment upon "Thermion's" article in the February issue? He apparently dislikes "Schools" broadcasts and, rather than have so much dance music during the day, would have the B.B.C. cut out daytime programmes altogether.

Regarding the Schools programmes, these are, surely, very often both informative and entertaining even for adults, and regarding daytime programmes in general, there are very many worthwhile items as, for instance, the midday orchestral hour.

But my main point is that the B.B.C. should, as it does, endeavour to provide broadcasts whenever people may want to listen. One has, after all, not got to listen because programmes are on the air, and to many people daytime programmes are a boon, especially to the sick and to housewives on their own all day. It helps to stop them feeling lonely, or so my wife tells me.

No, sir. There is too much already of this "I don't like it, you shan't have it" attitude abroad in the country. If Thermion does not like daytime programmes he can switch off—but why seek to deny them to people who do?—H. J. BOWER (Kent).

Home-recording Equipment

SIR,—Mr. Sixsmith's letter in February's PRACTICAL WIRELESS reminds me that I, too, sat down and wrote you a letter on this subject recently. Unfortunately the letter was mislaid, and was out of date by the time it was found.

Apparently quite a number of us would like to try our hands at recording now that L.F. amplifiers of ample power output and good quality form part of our equipment.

The main bother, of course, is a recording head and a tracking arm. These things are available—but at what a price! Low-priced versions of these were available in pre-war days, and it would be interesting to know whether any manufacturer is or will be sufficiently enterprising to bring them out again. I, for one, would be content with gear and results somewhat short of professional standards (and within the capacity of my pocket) rather than be able to do nothing at all.—W. MACKINTOSH (Putney).

Ex-Government British Valves

SIR,—Nowadays a large number of amateurs and experimenters are using ex-Government surplus valves. Such valves usually have certain letters prefixed to the type numbers which will help many readers to identify when purchasing such valves. The letters which are prefixed are given below with their meanings:

AR	= Army	Receiving	(Valves)
ARDD	= ,,	,,	Double diode.
ARH	= ,,	,,	Heptode.
ARP	= ,,	,,	Pentode.
ARS	= ,,	,,	Screen grid.
ARTP	= ,,	,,	Triode-pentode.
AT	= ,,	Transmitting.	
ATP	= ,,	,,	Pentode.
ATS	= ,,	,,	Screen grid.
AU	= ,,	Rectifying.	

—MOHAMEDALI A. SHAIKH (Poona).

No. 18 Receiver

SIR,—Concerning the No. 18 Mk. III set, I agree with both Mr. Moore, of Solihull, and Mr. Hearon, of S.E.15, that this receiver works quite well from an ordinary aerial, and, as Mr. Moore states, it is better to omit the untuned R. F. stage when a long aerial is used. I would very much like to hear from any readers who own a R.1224A set. I have one of these, and I am very disappointed with its performance. As a five-valve superhet I am surprised how unsensitive it is. I have replaced the power valve with a Mullard Pen. P.M.22D, and although it now works a speaker fairly well, it has no "punch"—even the Light programme is not at all loud. In "station pick up" it does not compare with a three-valve straight which I have. Can anyone explain this and help me to improve results? I have had it "run over" by a radio expert, and he says it is quite O.K., but agrees with me that it lacks sensitivity. I will answer all letters.—RAYMOND R. RADMORE, JNR., 9, Parsonage Road, Northam, Southampton, Hants.

"Utility 4"

SIR,—I was extremely interested in the "Utility" Four in February's PRACTICAL WIRELESS.

My brother and I have just completed a very similar receiver, which cost even less to make. It was built on the chassis of a Type 24 R.F. adaptor now obtainable so cheaply.

The five-point switch was left intact apart from the third (oscillator) section, which was sawn off by a hacksaw blade. The trimmers in this compartment were removed, and in this space a 25A7 valve (pentode + rectifier) out of the junk cupboard mounted. In the original H.F. and lower valve spaces are mounted two EF50's. We thus have three 0.3 amp. valves fulfilling the functions of Mr. Delaney's four. In series with these is arranged a *good* 60-watt lamp (a cheap make was found to pass about 50 watts and the rectifier filament was underrun, dropping the H.T. badly). The H.T. is taken straight off the mains, and the smoothing condensers 24+16 μF are in the original oscillator valve compartment.

The two remaining portions of the switch and the original trimmers, with suitable miniature fixed condensers in parallel, form the fixed tuning apparatus, and five different medium-wave stations are obtainable.

I have the 10,000 ohms variable bias resistance in the H.F. stage but have not *yet* adapted Mr. Delaney's ingenious connection of one end to the aerial coil. I also have resistance-controlled reaction on the detector. If this is not near oscillation tuning is not disturbed, and it improves volume and selectivity.

The method used is a 10,000 ohm wire-wound resistance in series with the standard reaction coil, and a fixed condenser. Both 10,000 resistors are on the front panel in the H.F. valve partition.

The detector circuit employed has identical screen and plate resistors to Mr. Delaney's, but *no* grid condenser or leak, and a 3,600 ohm cathode resistance found by trial to be most effective.

If necessary, it can be mounted in a wooden box with only the knobs protruding.—H. S. BRODRIBB, M.D., St. Leonards-on-Sea.

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REPAIRS to loud-speakers. Cones, coils fitted. Fields altered, rewound. Output, transformers, clock coils. No mains trans. accepted. Prices quoted. Satisfaction guaranteed.—L. S. Repair Service, 49, Trinity Rd., Upper Tooting, S.W.17. Closed Saturdays. 'Phone : Balham 2359.

REWIND SERVICE.—Armatures, Gram. motors, Vacuum Cleaners. Drill and all small motor Transformers—Fields, Pick-ups, Speakers—New Cones and Speech Coils fitted—New Vac. Cleaners supplied. All work guaranteed and promptly executed. Special terms to the Trade. Send S.A.E. for Price List and Radio Spares.—A. D. S. Co., 261-3-5, Lichfield Road, Acton, Birmingham, 6.

I.F. TRANSFORMERS.—465 kc/s, iron cored, 10/- pair, carriage paid.—W. Pattrick, 288, Becontree Avenue, Dagenham, Essex.

LITZ, quantity 27/38 EDRC for disposal, cheap. Stanwell & Leatherbarrow, Ltd., 6, Stanley Street, Liverpool.

12v. OAK Vibrators. UX4 Base, v.6512 2/6 each. Post Paid.—Electron Works, 6, East Ham, London, E.6.

24 hr. TELEVISION (not Radar Conversion). Uses V.C.R. 97 Tube. Send S.A.E. T-H. PRODUCTS, 92, Leathwaite Rd., S.W.11. BAT. 4889.

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BARGAIN.—58 Set. All Accessories. Cost £19/10/-. As new, £16.—Carver, 90, Barnsley Road, Darfield, nr. Barnsley, Yorkshire.

R1116.—With Valves, + Dipole, 'Phones, Accumulator. Good order, transit case. Offers.—Box No. 176.

ALUMINIUM chassis and Panels for all P.W. and your own designs. Holes punched for valveholders, etc. Estimates free. T.R.F. 2 waveband coil pack with circuit 12/6. 2 gang Condenser 8/9. Superhet coil packs. I.F.T's., etc., stamp for details. Note new address: EAD, 18, Broad Road, Lower Willingdon, Sussex.

CRYSTAL Microphone Inserts (Cosmocord Mic-4) Guaranteed Brand New, 12/6 post free.—Radio-Aid, Ltd., 29, Market Street, Watford. Phone: Watford 5988.

SPLIT STATOR condensers 20 yyf silver-plated ceramic mounted 2½in. x 2½in. x 2½in. heavy construction 260 deg. rotation, 2/8 (boxed). 100 yyf ceramic mounted 2½in. spindle, 1/6, postage extra.—Skillman, G3CSD, Franchise St., Weymouth.

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RADIO OR RADAR.—Full-time training for career in Air or Marine Services as Radio Officer (M.C.A. or P.M.G. Licences). Radio Mechanic, or Radio Engineer. Residential and non-residential courses at Radio and Radar School, Britain's Air University. Enquiries to the Commandant, Air Service Training, Hamble, Southampton.

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THE INSTITUTE of Practical Radio Engineers have available Home Study Courses covering elementary, theoretical, mathematical, practical and laboratory tuition in radio and television engineering ; the text is suitable coaching matter for I.P.R.E., Service entry and progressive exams. ; tuitionary fees at pre-war rates are moderate. The Syllabus of Instructional Text may be obtained, post free, from the Secretary, Fairfield Road, Crouch End, N.8.

A.M.I.Mech.E., A.M.I.E.E., City and Guilds, etc., on " No pass—no fee " terms. Over 95% successes. For details of Exams. and courses in all branches of Engineering, Building, etc., write for 100 page Handbook —Free.—B.I.E.T. (Dept. 242B), 17, Stratford Place, London, W.1.

Practical Television

Vol. 1. No. 1 NEW SERIES MARCH, 1949

The Advance of Television

OLDER readers will remember our monthly journal *Practical Television*, which we published before the war but which was suspended owing to the war and the closing down of the B.B.C.'s television transmitters.

The time has arrived when readers of this journal are entitled to expect a greater proportion of television news and technical articles. For the science has advanced to a stage where it is quite within the ability of many radio enthusiasts to construct a television receiver for themselves.

We have, in fact, given a fair amount of constructional data in recent issues. It is thought, however, that there is sufficient movement in the television industry for such matter to appear under its own title and as a supplement continuing the work of the suspended journal, until such time as it is possible to issue it as a separate publication.

We may hope that the paper position, which has hampered the publishing trade and prevented the dissemination of technical knowledge for so long, may change in the not-too-distant future. But in the meantime this supplement is intended as a temporary stop-gap so that those readers whose main interest is in the visual programme may have a section devoted entirely to their interests. It is hoped, also, that the supplement will prove useful to those at present new to the science. We shall herein collect each month news of the television world, of new developments in this country and abroad, and we shall give constructional articles dealing with the building of television receivers.

Home-made Receivers

We have for some time past been experimenting with home-constructed television receivers and accumulating data for the assistance of our readers. The trade, too, discerning the trend, are now supplying components so that the old difficulty of obtaining the necessary parts has gone. It must not be presumed from this that a television receiver can be built with the same ease, facility and simplicity as with an ordinary broadcast receiver. The alignment of a television receiver is in itself a difficult task, calling for a fair amount of test gear and instruments.

We hope the guidance which will be given in this supplement will take the reader through those difficult stages, as we did in the earlier days of radio.

A Word of Caution

With television, high voltages are used, and we do not suggest that the construction of a television receiver should be lightly undertaken by the very unskilled. Moreover, the cost of the parts is still high—the tube, of course, being the most expensive item.

We cannot expect any radical change in television broadcasting technique for some years. The B.B.C. policy has been clearly stated to be that of continuing the system which was in use up to the time of its cessation at the beginning of the war.

So readers may make, or purchase, a television receiver confident that it will not be made obsolete by some capricious change in the technical departments of the B.B.C.

The new Sutton Coldfield station is due to open this year, and it will carry the delights of the visual programme for the first time into the provinces. Other stations are planned still further to cover the country.

Our Midlands readers will therefore welcome this expansion of our editorial policy. We encourage suggestions from readers for articles, and we shall be happy to consider contributions from those who have experience of the subject.

We shall review the latest productions of manufacturers and advise our readers who prefer to purchase rather than make. The time is not far distant when television will outstrip ordinary broadcasting. At present the spread of television is hampered chiefly by finance, labour shortage, and the economic position. Manufacturers are at present expected to concentrate on exports and selling our wares abroad. They cannot concentrate on the production of goods intended only for the home market.

The supply of television receivers, however, is improving, and the number of viewers, according to the B.B.C. statistics, increases weekly. It is estimated that the total number of viewers in the area served by Alexandra Palace exceeds 70,000. That is approximately the number of television receivers which are in operation, so the viewing public will be at least three times that number. It is small, of course, measured against the background of ordinary listening, but it is here to stay and to expand, just as broadcasting did.

Newnes' Television Manual

We may usefully here draw the attention of television readers to *Newnes' Television Manual*, which costs 8s. by post. This forms a practical introduction to the subject. Now in its 7th Edition, it deals with all the known television systems and contains the list of terms agreed by the Television Committee of the Radio Manufacturers Association. Orders should be sent to the Book Department, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Underneath the Dipole

Television Pick-ups and Reflections. By "THE SCANNER"

THE power of the professional critic is a very real one. The Letters of Junius, the trenchant views of Dr. Johnson, Pepys's Diaries, Ruskin's monographs and Agate's dramatic criticisms have their modern counterpart in the weekly comments of Shulman, Lejeune, Collie Knox, Marsland Gander, and others. Each has his following and a few of them have acquired a sense of power proportional to the vitriolic content of the ink in which they dip their pens. Many a promising play, book or film has been damned at the outset by the comments of a few journalistic camp followers of the arts. On the other hand, it must be admitted that there have been occasions when the critics' chorus of approval has had a most beneficial effect.

Too often, the newspaper critic is preoccupied with contriving a wisecrack, and in the process of so doing will cheerfully drive playwrights, publishers and film producers to desperation, drink or Carey Street. Some of them would metaphorically boil their grandmothers to achieve a smart line and are quite willing to risk a face-slap in the Savoy Grill or a legal battle in the Law Courts. Satiation has given them a point of view which is frequently far removed from public taste, for which they have the utmost contempt. They are, indeed, a law unto themselves.

Television Critics

It is not true to say that critics are unsuccessful exponents of the arts they criticise. St. John Ervine demonstrated his brilliance as a playright, for instance, and Pat Mannock has written many fine film scenarios. Critics, even film critics, have to live, however, and they are expected to say something more than, "I think it was very nice" in order to earn their pay-packets.

These ruminations, by the way, are neither a justification nor an excuse for the attitude taken in this article month by month, especially in respect of B.B.C. television. Praise and blame, bouquets and brickbats may creep into it from time to time, but such items are random reflections underneath the dipole. I have in mind the changing attitude of the lay press to television. Up to now there has been very little serious criticism of television in the daily and weekly newspapers, and comments upon individual television plays have usually been wedged into the last few lines of the radio correspondents' columns. But television has now well and truly arrived in the London area and is installed in nearly 100,000 homes—a fact which has been noticed by the London *Evening Standard*, which led the way with regular television comments and criticisms separate from the "blind radio" column. Of course, the radio correspondent of the *Daily Telegraph*, L. Marsland Gander, has given considerable attention to television for a long time, and even before the war his radio column contained many references, both technical and otherwise, which were well worth reading. Mr. Marsland Gander can, therefore, be looked upon as the first television critic, with over ten years longer experience of the medium than any of the dozens of regular television critics now writing for the newspapers of Britain and America. The writings of some of the new critics will probably induce a smile or two from veteran viewers; but we wish them all the very best of luck—for their professional existence is a proof and a sign that television has well and truly arrived!

Large Screen Television

Up to now large screen television has been presented to paying audiences in the manner of a magician demonstrating the Indian Rope Trick. Many, many years ago, there were the stage demonstrations of Baird at the London Coliseum and, later on, at the Metropole Cinema, Victoria, where an attempt was made to reproduce the finish of the Derby before a packed audience. That was in the days of very-low-definition television, when miracles were accomplished with incredible hay-wire hook-ups, whizzing wheels and bull's-eye lantern optical systems. Big screen television is now an accomplished fact, and very rapid improvements in the results have been obtained in the last few months by Cinema Television, Ltd., and Pye Radio in England, and by R. C. A. in America. I don't think that big screen television will be put on in a London cinema again as a stunt; to start with, it will be installed in two or three Odeon cinemas, including a newsreel theatre, on a permanent basis, ready for relaying a big sporting event, such as a top-line boxing match. In the U.S.A., big screen television has been operated using the "hot" intermediate film process. The received picture and its associated sound is recorded on film, which passes immediately through developing, printing and fixing baths, and the resultant negative is scanned, electronically turned into positive and projected. The developing process is very rapid and the wet film is passed through a special gate which enables the picture (and sound) to be reproduced within five minutes. It is then speedily dried and is available to be circulated to other cinemas in the same district. Leading technicians in this country do not think this system very practical for the average cinema, quite apart from the heavy expense in film and highly skilled operating personnel. Scanning 25 frames per second, it uses 93¾ft. of expensive negative film stock per minute, pick-up and recording equipment for sound and picture, processing plant and developing solutions together with the special projectors for dealing with wet film; and last, but not least, the special enclosures and fire precautions insisted upon under the Cinematograph Films Act. R. H. Cricks, technical consultant of the *Kinematograph Weekly*, prefers the direct system, but considers that the British scanning standard of 405 lines to be too low for satisfactory big screen results. The French experimental system of 819 lines, in his opinion, is much nearer the mark. Transmission difficulties, including the huge band-width occupied, render

this standard impracticable at the moment, though fine results have been achieved on "closed circuit." It is probable that 625 lines will be adopted as the British cinema standard, and I understand that the Cinematograph Exhibitors Association have already applied to the authorities for six wavebands for cinema purposes—three for sound and three for picture. In any case, the film industry will undoubtedly insist upon complete independence from the B.B.C., with its own definition standards and wavelengths, to ensure that its transmissions are not available to the private home viewer. If these requests are granted, the cinemas will still be able to reproduce B.B.C. 405-line transmissions, and experimental apparatus is already existing which enables a 405-line picture to be re-scanned on 625-line equipment.

My own impressions of the Cinema Television Company's 405-line big screen results was mentioned in this article a month or so ago. I thought the results were first class, though it was quite obvious that the type of picture transmitted from the Alexandra Palace, designed for reproduction on small home screens, was cramped and suffered from a preponderence of close-ups. Within the next few months the British film industry will decide upon the standards to be used, and my forecast is 625 lines, with a likelihood of sequential scanning in place of interlaced scanning. The wave-bands to be allocated to cinemas ? Well, your guess is as good as mine !

Latest Television Receivers

New Ekcovision Console

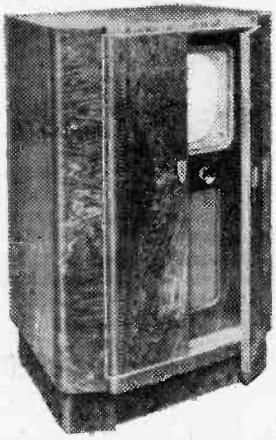
E. K. COLE, LTD., announce the release of Ekcovision Model TSC91—a high-definition television receiver incorporating the chassis of the popular Ekcovision Model TS46 in an attractive and substantial console cabinet of sapele mahogany.

Particular attention has been paid to the framing of the tube face in a neat plastic moulding round the inner picture mask. An exceptionally wide angle of vision is ensured. The entire cabinet can be easily moved, being mounted on large diameter concealed wheels under the plinth.

The features of the TS46 9in. tube chassis are already well respected throughout the television area—high sensitivity on both vision and sound, efficient suppression of interference, high standard of picture definition and tonal contrast, maximum reliability ensured by careful selection and pre-testing of components.

The main controls in the case of the console model are conveniently located in a recessed panel at the side. The chassis is very accessible for servicing. The price is £75 (including £13 18s. purchase tax).

Ekco are also releasing a new indoor television aerial—Model TA94. This consists of three rods already assembled on a base plate to which it is only necessary to connect the cable to the receiver



This new Ultra television receiver is characterised by the folding doors which conceal and protect the screen when the receiver is not being used.

Installation cost and time is reduced to the absolute minimum. The aerial may be either screwed to a joist or can be hung from a beam if more convenient. A modified version TA94/1 is available for the Birmingham area. The price is 30s.

New Ultra Television Receivers

THE latest television receivers produced by Ultra Electric, Ltd., comprise three console models. The largest of these new television receivers

The new Ekco Model TSC91, which has an exceptionally wide angle of vision, and a high standard of sound reproduction.

is Model D.570 and is rightly described as "Television de luxe." It is of the superheterodyne type and employs a 12in. cathode-ray tube and 21 valves. Designed for operation on A.C. mains 200-260 volts (60 cycles), this model gives a pure black and white picture measuring 10in. by 8in., characterised by extra picture detail and particularly stable time bases. The chassis is constructed on the tri-unit principle, features being : automatic frequency control, automatic volume control on sound, new and improved time bases and noise suppression. The sound side is characterised by an 11¾in. elliptical moving-coil loudspeaker, the audio output being 4.5 watts.

The magnificent cabinet is of hand-selected, figured and straight-grained walnut and has two perfectly matched, hinged doors. Brightness/on-off and volume are placed immediately below the screen, while four occasional controls are placed between them and concealed by a simple shutter. The glass view panel may be raised to facilitate easy access to the tube face and protective glass for cleaning purposes. The cabinet is mounted on smooth-running wide tread castors, the over-all dimensions being 41in. high, 28in. wide and 23in. deep.

Model D.5704 contains 22 valves, but is otherwise similar, and is specially designed for use on the fringe of the service area.

Prices are: Model D.570, £141 15s. 6d. (tax paid) and Model D.5704, £144 7s. (tax paid).

Console Model W.570 is technically similar to model D.570, and the fringe area model W.5704 is technically similar to model D.5704.

The cabinet, however, is without doors and has selected straight-grained and figured walnut front and top panels. The black and white picture is 10in. by 8in. and the cabinet is provided with smooth-running wheels, the over-all dimensions being 37in. high, 20in. wide and 18in. deep.

Prices are: Model W.570, £90 4s. 6d. (tax paid) and Model W.5704, £92 16s. (tax paid).

Model W.470 is somewhat similar in appearance to Model W.570, but is slightly smaller, the black and white picture being 7¾in. by 6¼in. It is of the superheterodyne type and employs 20 valves (21 in Model W.4704), and incorporates tri-unit chassis construction with automatic frequency control, automatic volume control on sound, new and improved form of time bases and noise suppression.

The walnut-finished cabinet has carefully selected, figured and straight-grained panels in front and on top. The over-all size is 33in. high, 18in. wide and 18in. deep, and the cabinet is fitted with smooth-running wheels. Prices: Model W.470, £77 6s. 8d. (tax paid), Model W.4704, £79 18s. 2d. (tax paid).

World News and Views

Russian Progress

IT is reported in a European technical journal that the Soviet Union claim that by the end of this year a large number of television stations will be in operation, including some radiating pictures *in colour*. No technical details are given, nor is there any indication as to the types of receiver which will be available to the public.

Dutch Projection System

THE Philips Company of Holland are using a new system for the projection of pictures in the domestic receiver. The tube end is made to project through a plane mirror set at 45 deg. and the image on the tube end is thrown back on to the mirror by a concave mirror in front of the tube. The reflected image is then directed upwards from the plane mirror through a Schmidt correcting-plate and is finally seen on a cloth screen which is drawn up when the lid of the cabinet is raised. The system permits of the use of a more or less standard size cabinet housing an ordinary all-wave radiogram, but providing a picture approximately 12in. by 10in. The actual image on the tube in this case is about 1½in. by 1¼in.

Children's Television Competition

THE result of the recent Children's Television Competition was announced recently in "Picture Parade."

The first prize, a television receiver, was presented by Mr. G. W. Godfrey, Chairman of the Television Promotion Committee of the Radio Industry Council, in conjunction with Miss Joan Gilbert, Editress of "Picture Page," to thirteen-year-old Barbara Nichols, 54, Harvey Road, N.3.

The competition was sponsored by the British Radio Equipment Manufacturers' Association as part of the "Better Listening" campaign held in September.

Second prize, a table model radio receiver, was won by twelve-year-old Elizabeth Wiggins, 6, Cloudesley Place, N.1, and a personal model radio receiver, third prize, went to Gillian Osborne, aged 12, 1, Kenmore Drive, Mitcham, Surrey.

Need for Trained Technicians for Television Servicing

THE need for trained technicians to service the increasing number of television receivers was the keynote of an address by Max F. Balcom, president of the Radio Manufacturers' Association and vice-president and treasurer of Sylvania Electric Products, Inc., to a town meeting of radio technicians held at Hotel Bradford recently.

"The radio technician to-day," he said, "is one of the most important factors in the rapidly expanding television field. Unless the television set owner can get proper servicing, he may soon lose his initial enthusiasm for this new medium for home entertainment. A shortage of qualified television servicemen may prove to be a deterrent to television set buying and thus reduce receiver production and sales."

"Suicide on Wheels"

THIS was the description given to television receivers in cars by the National Safety Council of America last month. "Keeping one's eye on the road ahead and on traffic behind and on both sides is the first essential of safe driving," a council statement said. The council said its staff would make a further study of television installations visible to passengers only.

Television for Export

BRITISH Television manufacturers are actively contacting many overseas Governments to secure contracts for installation of British Television Transmission Equipment in preference to foreign systems. Acceptance of British Television System would probably result in considerable subsequent sales of British Television receivers.

The E.M.I. Television System, as used here by the B.B.C., created tremendous interest amongst Dominion and foreign visitors during the Olympiad broadcasts. An illustrated folder featuring the outstanding efficiency of the British System on this memorable occasion, is being circulated throughout the world.

Further information on this subject, if required, can be obtained from the E.M.I. at Hayes, Middlesex.

Practical Wireless
BLUEPRINT SERVICE

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Beginners' One-valver	—	PW35
The " Pyramid " One-valver (HF Pen)	—	PW93*
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The Signet Two (D & I F) ..	—	PW76*
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Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Summit Three (HF Pen, D, Pen)	—	PW37*
Hall-Mark Cadet (D, LF, Pen (RC))	—	PW48*
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	—	PW49*
Cameo Midget Three (D, 2 LF (Trans))	—	PW51*
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53*
Battery All-Wave Three (D, 2 LF (RC))	—	PW55*
The Monitor (HF Pen. D, Pen) ..	—	PW61*
The " Colt " All-Wave Three (D, 2 LF (RC & Trans))	—	PW72*
The " Rapide " Straight 3 (D, 2 LF (RC & Trans))	—	PW82*
F. J. Camm's Oracle All-Wave Three (HF, Det, Pen.	—	PW78
1938 " Triband " All-Wave Three (HF Pen, D, Pen)	—	PW84*
F. J. Camm's " Sprite " Three (HF, Pen, D, Tet)	—	PW87*
The " Hurricane " All-Wave Three (SGD, Pen. Pen)	—	PW89*
F. J. Camm's " Push-Button " Three (HF Pen, D (Pen), Tet) ..	—	PW92*
Four-valve : Blueprints, 2s. each.		
Beta Universal Four (SG, D, LF Cl. B)	—	PW17*
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C*
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46*
" Acme " All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	—	PW83*
The " Admiral " Four (HF Pen, HF Pen, D, Pen (RC)).. ..	—	PW90*
Mains Operated		
Two-valve : Blueprints, 2s. each.		
Selectone A.C. Radiogram Two (D, Pow)	—	PW19*
Three-valve : Blueprints, 2s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23*
D.C. Ace (SG, D, Pen)	—	PW25*
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	—	PW35C*
D.C. Premier (HF Pen, D, Pen) ..	—	PW35B*
Ubique (HF Pen, D (Pen), Pen) ..	—	PW36A*
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
" All-Wave " A.C. Three (D, 2 LF (RC))	—	PW54*
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56*
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70*
Four-valve : Blueprints, 2s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20*
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45*
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS		
Battery Sets : Blueprints, 2s. each.		
£5 Superhet (Three-valve) ..	—	PW40
F. J. Camm's 2-valve Superhet ..	—	PW52*
Mains Sets : Blueprints, 2s. each.		
A.C. £5 Superhet (Three-valve) ..	—	PW43
D.C. £5 Superhet (Three-valve) ..	—	PW42*
F. J. Camm's A.C. Superhet 4 ..	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
" Qualitone " Universal Four ..	—	PW73
SHORT-WAVE SETS. Battery Operated		
One-valve : Blueprint, 2s.		
Simple S.W. One-valver	—	PW88*
Two-valve : Blueprints, 2s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A*
The " Fleet " Short-wave Two (D (HF Pen), Pen)	—	PW91*
Three-valve : Blueprints, 2s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A*
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63*
The Band-spread S.W. Three (HF Pen, D (Pen), Pen) ..	—	PW68*
PORTABLES		
Three-valve : Blueprints, 2s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) ..	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	—	PW77
Four-valve : Blueprint, 2s.		
" Imp " Portable 4 (D, LF, LF, Pen)	—	PW86*
MISCELLANEOUS		
Blueprint, 2s.		
S.W. Converter-Adapter (1 valve)	—	PW48A*
AMATEUR WIRELESS AND WIRELESS MAGAZINE		
CRYSTAL SETS		
Blueprints, 1s. each.		
Four-station Crystal Set	—	AW427
Lucerne Tuning Coil for AW427	1s.	
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint. 2s.		
B.B.C. Special One-valver ..	—	AW387*
Two-valve : Blueprints, 2s. each.		
Full-volume Two (SG det, Pen)..	—	AW392
A modern Two-valver	—	WM409*
Three-valve : Blueprints. 2s. each.		
£5 5s. S.G. 3 (SG, D, Trans) ..	—	AW412*
Lucerne Ranger (SG, D, Trans) ..	—	AW422*
£5 5s. Three De Luxe Version (SG, D, Trans)	—	AW438
Transportable Three (SG, D, Pen)	—	WM271
Economy Pentode Three (SG, D, Pen)	—	WM337*
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PRACTICAL WIRELESS. MAR. 1949

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, LTD., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rates including postage: Inland 10s. 6d. per annum; Abroad 10s. per annum. Registered at the General Post Office for the Canadian Magazine Post.