9D.

...No. 526
...Y, 1950

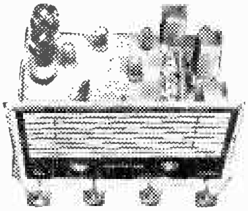
...OR:
...AMM

PRACTICAL WIRELESS

CHIEF CONTENTS

BAND SPREAD

by ARMSTRONG
The *NEW* EXP 119



This model has been produced after exhaustive investigation into the requirements of Overseas Listeners. Ease of operation on the short-wave bands, high sensitivity and quality output have all been studied and incorporated in the EXP 119.

BRIEF SPECIFICATION

1. Designed specifically for the Overseas Listener.
2. 9 wave ranges. (6 bandspread and 3 general coverage) 11-570 metres.
3. High slope pentode R.F. stage.
4. 2 stages of I.F. amplification.
5. Variable selectivity.
6. Automatic noise limiter.
7. 10 watts push-pull output.
8. Separate A.C. power pack to facilitate operation from a vibrator if required.
9. 11 valve circuit (including cathode-ray tuning indicator).

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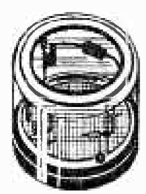

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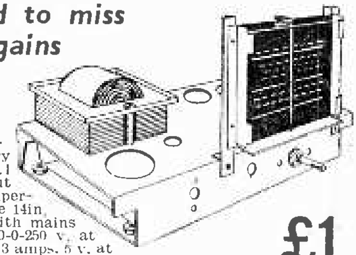

CONSTRUCTOR'S PARCEL (A).
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£1 plus 1/9 post and packing.

CONSTRUCTOR'S PARCEL (B).
As above but with 4v. type transformer, same price.

CONSTRUCTOR'S PARCEL (C).
As above but without mains transformer, 6/6 plus 1/6 post and packing.

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This is a beautifully made 10 in. P.M. Speaker, a real precision product made by a very famous firm you will recognise immediately. It is undoubtedly a 10in. speaker with a 12in. quality reproduction, and has these special features : (A) a solid diecast frame, (B) a dustproof speech coil arrangement, and (C) a patented speech coil suspension which gives wider frequency response. Speech coil is normal 2.3 ohm impedance. The correct retail price of this speaker is 35/-, but we are able to offer them, while stocks last, for 16/6 each, plus 2/6 carriage and insurance.

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THE INSTRUMENT CO.,
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Practical Wireless

18th YEAR OF ISSUE

EVERY MONTH.
VOL. XXVI. No. 526 MAY, 1950

Editor F. J. CAMM

COMMENTS OF THE MONTH BY THE EDITOR

Programme Quality Declining

A HIGH percentage of programme time is occupied by recorded programmes, especially in the case of regular feature programmes, of which there are far too many. There is also criticism of the third feature programmes, the complaint being that they are too high-brow. The recorded programme is a cheap way of filling programme time, and there are far too many feature programmes on similar lines. The gag writers are being overworked and some of their efforts are inferior to those which may be read in a children's comic paper. The programmes, in fact, are either too high-brow or too low-brow and it is time that there was a general revision of them and an overhaul of responsible staff. Producers get tired and when they get tired they get into a rut. Criticism merely makes them turn in their grooves and, as with the theatre, there should be a general change round of jobs every year or so, so that fresh and enthusiastic people with new outlooks are able to infuse their ideas into new programmes. There is a general tendency once a feature has proved popular to overload the public not only with that particular programme but with others of a similar nature. The programme which consists chiefly of interviews with nonentities who have nothing much to say, the humour being obtained from unconsciously humorous replies prompted by questions from the interviewer, who sniggers in a self-satisfied way and seems to enjoy the programme immensely, should be abolished. Listeners do not want to know that a young lady from the cotton mills, for example, enjoys her work; that she has been engaged for a couple of years; that she has a young man but is not going to get married yet. That is the sort of undiluted drivel which is pumped out week after week. The programme consisting of some slick wisecracks, largely American in origin, is also being very much overdone. Why not appoint an independent commission to investigate the problem?

"Practical Television"

OUR new companion journal, *Practical Television*, was an instantaneous success, the first issue being sold out before publication day, notwithstanding a very heavy print. The second issue has similarly been absorbed. In these days of production difficulties it is necessary for publishers to know well in advance how many copies to print. We suggest to every reader of this journal that, as *Practical Television* is complementary to this journal, they should place a regular order now for its delivery each month. It is similar in style, format and price, and it gives fuller details of television developments than is possible in this journal.

The New Wavelengths

THE Copenhagen Plan is now in being, the Light Programme being radiated on 1,500 metres and 247 metres, the Third Programme on 464 metres and 194 metres and the Home Service as follows: North, 434 metres and 261 metres, Scottish 371 metres, Welsh 341 metres, London 330 metres, West 285 metres and 206 metres, Midland 276 metres and Northern Ireland 261 metres. Elsewhere in this issue we show the new positions on which the stations appear on the scale. Owners of push-button receivers will, of course, have to readjust the position of the cams in accordance with manufacturer's instructions. If the tuning dial of your receiver is marked in metres it is only necessary to set the pointer to the new wavelength of the station you wish to listen to, although if station names are also marked on the dial they will not be in their correct places. Some manufacturers intend to supply new scales. With those receivers with only station names on the tuning dial each station will be found slightly to one side of its name. Receivers which have push buttons only, and not manual control, will not receive the new B.B.C. wavelengths, except the light programme on long waves, until they have been readjusted.

Nearly every station in Europe is allocated a new wavelength under the Copenhagen Plan. A list of the principal continental stations is printed elsewhere in this issue.

The new plan was, of course, rendered necessary because of the great increase in the number of broadcasting stations accommodated in the medium waveband. Moreover, the power of these stations has considerably increased during the past ten years. F. J. C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate number of licences issued during the year ended 31st January, 1950.

Region	*Number*
London Postal	2,323,000
Home Counties	1,634,000
Midland	1,713,000
North Eastern	1,874,000
North Western	1,586,000
South Western	1,045,000
Welsh and Border Counties	721,000
Total England and Wales	10,896,000
Scotland	1,113,000
Northern Ireland	200,000
Grand Total	12,209,000

National Radio Exhibition

THE National Radio Exhibition which is to be held at Castle Bromwich, Birmingham, from September 6th to 16th next, will be at Earls Court, London, in September 1951, 1952 and 1953.

The Radio Industry Council in announcing this recently, said that an earlier decision to hold the exhibition at Olympia, London, in June, instead of in the autumn had been changed, but this change came too late to secure convenient autumn dates and the necessary space at Olympia.

In view of the facilities offered at Earls Court, it was decided to go there rather than hold the exhibition at Olympia at a less convenient time.

The National Radio Exhibition, before going to Olympia in 1926, was held at the Royal Albert Hall in 1924 and 1925, the White City in 1923, and the Horticultural Hall in 1922. Sixteen National Radio Exhibitions have been held in all. The one coinciding with the Festival of Britain will be the eighteenth.

Broadcasting Committee

THE Broadcasting Committee, under the chairmanship of the Rt. Hon. the Lord Beveridge, K.C.B., F.B.A., heard oral evidence on Thursday, March 9th, 1950, from representatives of the Renters, Exhibitors and Producers Joint Committee of the Film Industry.

The Committee would like it to be known that they would still welcome representations in writing on any subject within their terms of reference. These are:

"To consider the constitution, control, finance and other general aspects of the sound and television broadcasting services of the United Kingdom (excluding those aspects of the overseas services for which the B.B.C. are not responsible) and to advise on the conditions under which these services and wire broadcasting should be conducted after December 31st, 1951."

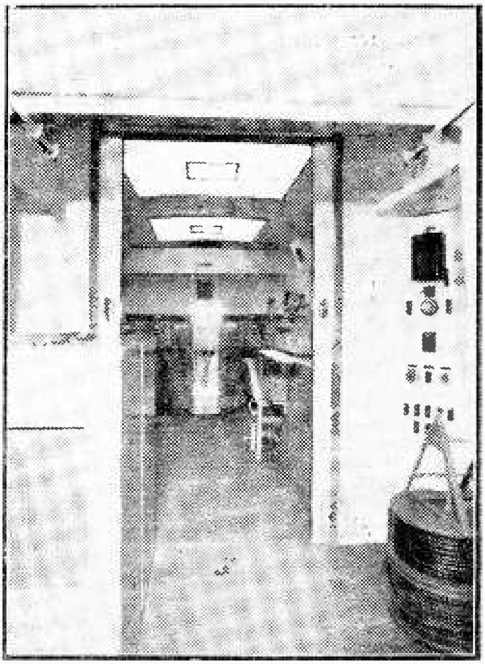
All communications should be addressed to the Secretary, Broadcasting Committee, Iron Trades House, 1, Chester Street, London, S.W.1.

V.H.F. Contest for Amateurs

THE Amateur Division of E.M.I. is organising (in conjunction with the Amalgamated Short-Wave Press) a contest amongst amateurs operating on the 144 Mc/s band. E.M.I. are donating four prizes—namely, two pairs of heavy duty rectifier valves for the transmitting section of the contest, and two sets of three receiving valves for the listener section.

A unique feature of the competition is that although each station is out to make as many contacts as possible, the "merit" of each competitor will be determined by very careful consideration of the conditions under which stations are working, thus competitors who only manage to make a small number of contacts may well be amongst the winners if they are working under difficult conditions.

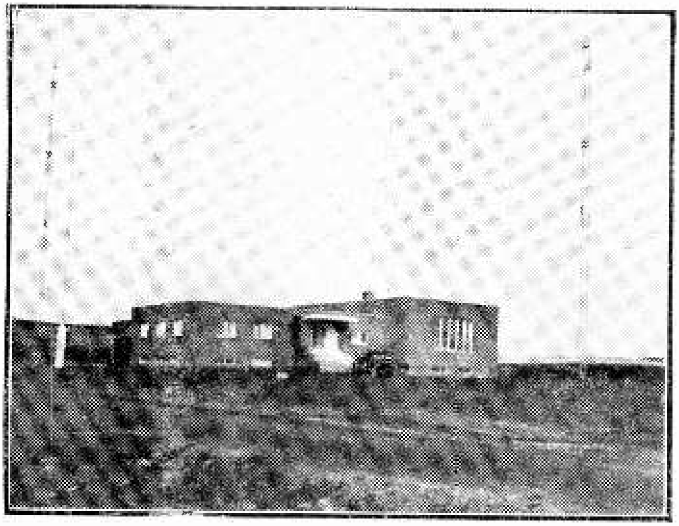
The competition is to be held from 08.00 hours



Interior of a mobile broadcast recording unit supplied by E.M.I. to Radio Luxembourg.

on April 22nd until 24.00 hours on April 23rd. The closing date for receipt of completed contest logs is May 8th.

Any interested amateur who does not receive a circular letter, can obtain further information either from Mr. H. E. Smith, Amateur Division, E.M.I. Sales & Service, Ltd., Hayes, Middlesex, or from the Editor, *Short Wave News*, 57, Maida Vale, London, W.9.



The most northerly broadcasting station at Vadso, Norway.

Most Northerly Broadcasting Station

IN 1933, the most northerly broadcaster in the world was installed in Vadso in the province of Finmark, in Northern Norway. This 10 kW station was within the Arctic Circle, and furnished programmes to the northern half of Norway and Lapland. During the occupation of Norway in the Second World War, the station was destroyed by the Germans.

A new station has now been built, and a 20 kW broadcaster was put into service recently to cover the same area, where about 45,000 people are scattered over 19,000 square miles. By this means the Norwegian broadcasting administration has augmented its service and improved the signal strength and clarity of its radio programmes.

Both the original transmitter and the replacing transmitter were manufactured by Standard Telephones and Cables, Ltd., in England, and supplied through their associate, Standard Telefon og Kabelfabrik A/S, Oslo.

Radio-controlled Models Society

THE Radio Controlled Models Society is seriously perturbed at the number of radio-controlled models taking part in field events at which no official frequency monitoring is arranged. At these events, over which the Society has no jurisdiction, models have been observed operating outside the frequency bands allotted by the Postmaster-General for that purpose. It is of vital importance that these concessions are not abused, otherwise they may be withdrawn, and radio-controls enthusiasts may find themselves forced to operate under the more stringent conditions imposed in other countries.

Monitoring equipment of a simple type is cheap to construct and operate, and in the view of the Radio Controlled Models Society, is essential in any radio-controlled demonstration.

B.I.R.E.

THE following list of meetings has been arranged for April, 1950:

London Section.—London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1 (meetings commence at 6-30 p.m.) April 20th, D. W. Heightman (Member), "U.H.F. Propagation and Characteristics."

West Midlands Section.—Wolverhampton and Staffordshire Technical College, Wulfrune Street, Wolverhampton (meetings commence at 7 p.m.). April 26th, C. R. Amey, "Intermodulation Analysis."

Engineer-in-charge, Aberdeen

MR. W. BALFOUR has been appointed Engineer-in-Charge of the B.B.C. studio centre and transmitting station at Aberdeen. He replaces Mr. W. W. Inder, who has retired from the post of Engineer-in-Charge at Aberdeen, after 17 years' service.

Mr. Balfour came to the B.B.C. from the G.P.O. radio station at Portishead in 1934, and has since had wide experience in the transmitter department of the engineering division. He is a native of Gourock.

Newnes' Motorists' Touring Maps and Gazetteer

THIS book, specially produced for the motorist, has now been revised. It comprises 96 skilfully coloured maps covering the whole of the British Isles. Every road classified by the Ministry of Transport is clearly shown. Every main road is marked with its signpost number. It also shows the railways, level crossings, stations, churches contours, etc.

The scale is 5 miles to the inch, except in the outlying parts of Scotland, where the scale is smaller.

In addition to the 96 road maps, this handy size edition contains a Gazetteer Index to Places—64 additional pages giving place-name, county, mileage from nearest big centre, population, and map reference so that the place, whether it be city, town, hamlet, or even railway station, may be found in an instant.

The book costs 17s. 6d., and is obtainable from George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

The Band-searcher Tuning Unit–4

Concluding Details of this Interesting Accessory for the Short-wave Enthusiast

By J. R. DAVIES

THE contacts next need to be manufactured. No great accuracy is needed here, as the method of fixing allows the downward pressure as well as the sideways movement of these contacts to be adjusted. Fig. 21 (a) and (b) give details of the contacts. The material used may be springy brass (as obtained from a flash lamp battery), phosphor-bronze, or any other fairly springy metal. The contacts are self-wiping and are only needed to light a dial-lamp, so there is little need to worry about special contact surfaces. It will be seen that the contact is bent at one end to fit the semi-circular contact holder, part N. A 6 B.A. nut and bolt are fitted to the two holes drilled in Fig. 21 (a) to allow the contact to grip the holder tightly at the desired position. A small spot of solder holds the nut to the brass, making it an anchor nut. It will be seen that the screw is tightened and loosened from behind.

The part of the contact which touches the contact on the moving disc is made to present a slightly convex surface to that contact. See Fig. 21 (b) and (c). This ensures a smoother travel.

24. The moving contact just mentioned is made from brass plate, as shown in Fig. 21 (d). It is mounted as shown in the photograph, on the front side of the circular disc.

The Tuning Drum

25. The tuning drum is mounted to three 6 B.A. bolts fixed to disc B. Two of these are already holding parts B and C together (see Fig. 7). If the details in paragraph 6 were observed these screws should project forwards at least ¾in. A third screw may now be fixed to the remaining "6 B.A. clear" hole in the disc B. This should also project forward some ¾in. These screws hold the tuning drum as shown in Fig. 22 (a) and (b). The long screw projecting from the centre of the drum may be fitted if it is desired to use a directly-driven pointer on the dial. This point is left to the reader's own desires.

The tuning drum should have a diameter of some 2ins. Ordinary circular tin lids such as those used for boot blacking tins, bottle tops, etc., make excellent drums, and their somewhat un-radiolike derivation may be easily camouflaged by a coat of paint! A small nut and bolt may be mounted somewhere along the periphery of the drum to give an anchoring point for the driving cord. In the case of the bandset condenser it is advisable to insert a spring in both cords going to the driver spindle, as shown in Fig. 22 (c). This is because the condenser, when being "pulled in" on going over to "bandspread," is liable to move through a few degrees of rotation. This would cause an undue strain to be placed on the cord, whose life would thus be shortened. The two springs take up this strain, on whichever side of the drum it may appear.

The Bandspread Condenser

The bandspread two-gang condenser may be of any type, so long as its dimensions do not exceed those quoted for the bandset condenser. The author used an ordinary 500 pF condenser "cut down" by removing all the moving vanes except one on both gangs. The capacity resulting may be easily calculated by counting the *spaces* between the fixed and moving vanes. Before stripping, the condenser used by the author had 12 moving vanes. This gave 22 spaces between fixed and moving vanes (both outside vanes were moving vanes). When cut down there were then only two spaces between fixed and moving vanes, i.e., one on either side of the remaining moving vane (which was, incidentally, the centre vane). The remaining

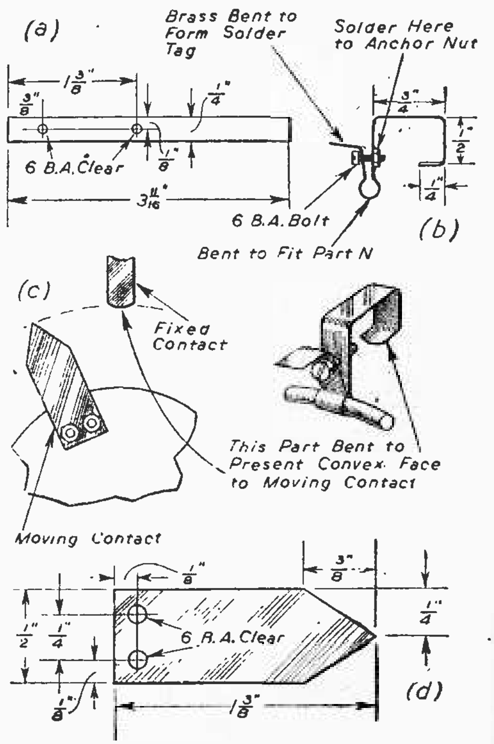


Fig. 21.—(a) and (b). Details of fixed contacts. (c) The convex contact point mentioned in the text. (d) The pointer.

capacity was therefore 2/22 of 500 pF., which is equal to 45.5 pF. This should give just sufficient capacity to "spread" all the short-wave broadcasting bands required.

The mounting of the bandspread condenser is left entirely to the reader, as no hard-and-fast rules may be given, owing to the non-standardisation of these components.

There is plenty of room on the chassis to hold this condenser, and if its spindle is arranged to be at the same height as that of the bandset condenser, two pointers may be used, giving a dial somewhat on the lines of that shown in Fig. 22 (d).

condensers floating and less liable to microphonic feedback from the speaker. The driving spindles for the cord drives would need to be mounted on the receiver chassis proper.

The tuning unit may be used on more than one wave-range. The only necessity is that the bandset condenser positions for the required ranges do not clash on different ranges. Either that or that they coincide!

The warning light contacts may be used to light a particular bulb for each band, each bulb illuminating a window or section of the dial and showing

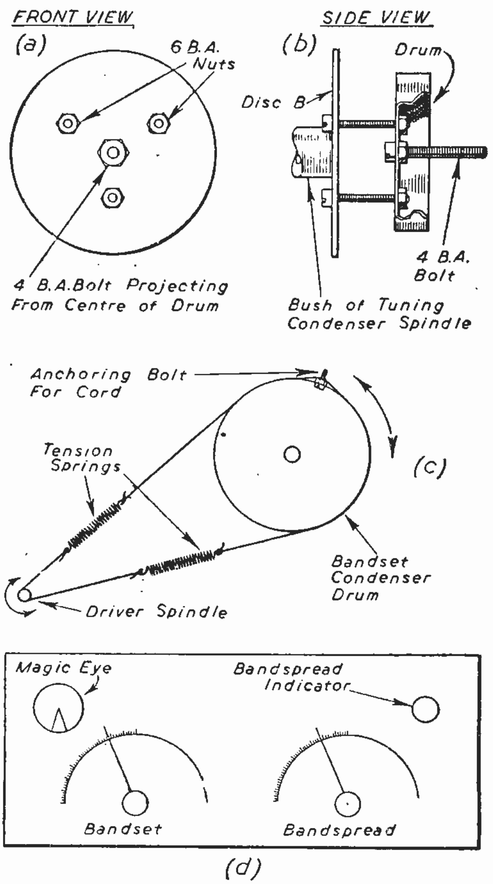


Fig. 22.—(a) and (b). How a drum for a cord drive may be fitted to the bandset tuning condenser. (c) A spring is fitted to both sides of the cord drive to avoid strain (see text). (d) Suggested dial layout for the unit.

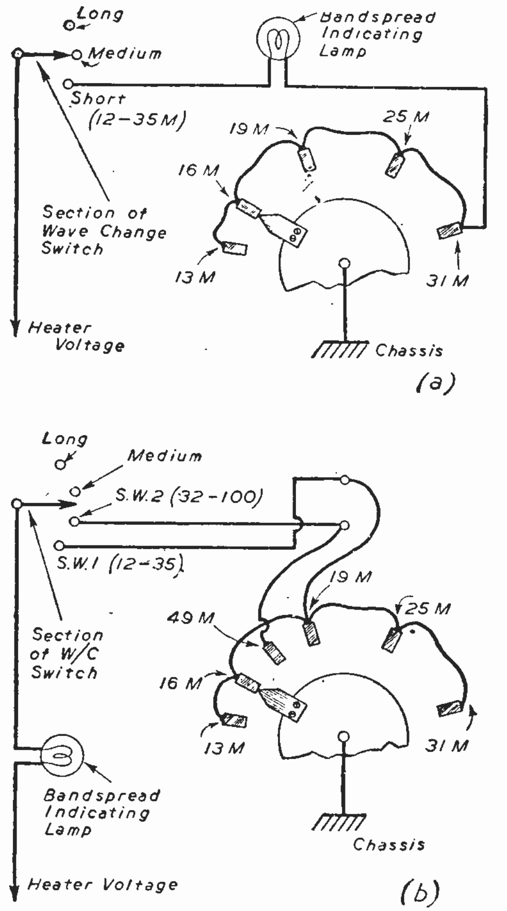


Fig. 23.—(a) and (b). Various methods of connecting the fixed contacts and bandspread indicating lamps to obtain different effects.

Installation in the Receiver Chassis

The installation of the unit in the receiver chassis should present few problems apart from those of obtaining symmetrical layout, etc. Three holes should be sufficient for mounting purposes, two in the front corners of chassis part J and one in the rear centre. It would give a professional touch if the chassis were mounted on soft rubber grommets at these points, thus making both tuning

which band is in use. Alternatively, one bulb only may be used, the position of the bandset pointer indicating which band is being "spread." Fig. 23 shows how a single bulb or various bulbs may be connected to the wave-change switch so as to ensure that they only light when their particular range is switched on.

Fig. 23 (a) shows a simple arrangement using a single short-wave band. Assuming that the range of the coils used is from 12 to 35 metres, we then have available the 13, 16, 19, 25 and 31 metre bands. The bandspread indicating light will only shine when the short-wave range is switched on.

Fig. 23 (b) shows a more complicated arrangement Two short-wave ranges are now available. The S.W.1 range is the same as that of Fig. 23 (a), i.e., 12 to 35 metres. The S.W.2 range (32 to 100 metres) gives us an additional band—the 49 metre band. The contact for this band is set between two used for the S.W.1 range. It will be seen that a section of the wave-change switch is again used to ensure that the appropriate circuit is made for each wave-range. Fig. 23 (c) shows a more ambitious scheme. In this diagram a different lamp is used to indicate each band as the bandset condenser approaches it. The effect of this arrangement is extremely impressive, as may be imagined, and, combined with the ease of tuning and simplicity of accurate bandspreading, makes short-wave listening very pleasurable indeed.

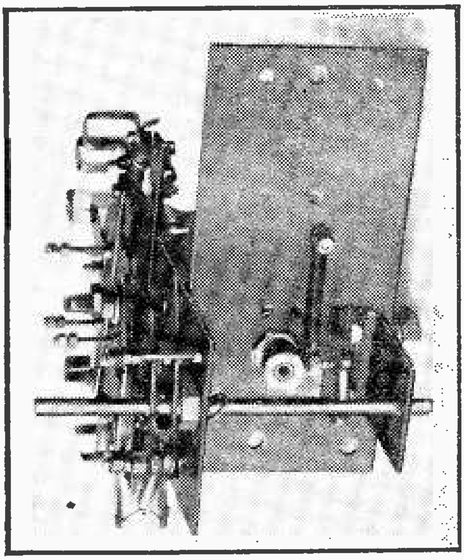


Fig. 24.—View underneath the unit. The D.P.S.T. switch mechanism is clearly visible. ("Condenser free" position, switch open.)

Pre-setting the Mechanism

When the tuner has been installed and wired, the coils, etc., should all be trimmed to their maximum performance. When the constructor is satisfied on this point he may then set up the locating mechanism.

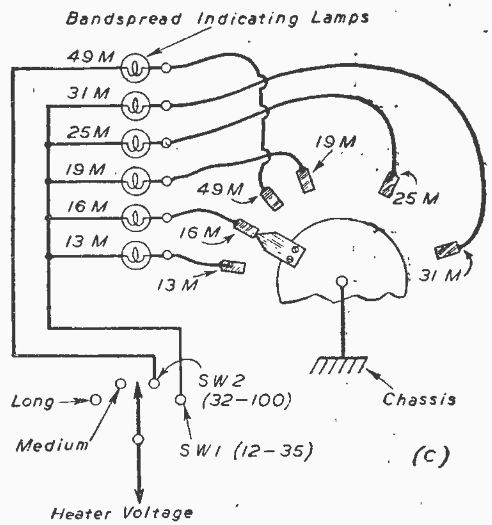


Fig. 23.—(c). Further method of connecting the contacts.

He should first decide what bands he desires. He must then set the locating spikes E so that the bandset condenser is, in each case, locked just at the high-frequency end of each band. It is better to do this whilst actually receiving stations as the calibration of some signal generators is not always sufficiently accurate for this purpose. When the locating spikes are definitely and satisfactorily fixed, the lamp contacts may be adjusted. These should be set so as to afford a contact at least a degree of rotation on either side of the locked position. The fixed contacts should perceptibly move as the moving contact passes them. On the other hand, of course, the contact must not be so tight as to impede the rotation of the bandset condenser. When adjusted, the light should remain lit for some appreciable movement of the tuning knob, and the locating mechanism should "pull in" the appropriate locating spike at any point in which the light is shining.

RADIO SHOW PATRON

H.M. QUEEN MARY has again consented to be patron of the National Radio Exhibition which is to be held from September 6th to 16th this year at Castle Bromwich, Birmingham, instead of in London. Her Majesty was patron of the exhibitions at Olympia, London, in 1947 and 1949, but has not been able to visit the exhibition since 1947.

A prospectus and provisional plan have now been issued to prospective exhibitors with much new information about the size and scope of the exhibition.

Every possible facility is to be provided for working exhibits, subject to their prior sanction by the exhibition committee and subject to their not causing any electrical interference with B.B.C. transmissions or with any of the exhibition services.

The three principal exhibition features, namely, the B.B.C. studio, the communal television demonstration and exhibition control-room, are all arranged at the west end of the hall opposite the main entrance.

Variety in stand designs will be permitted as in London. Space will be allotted by ballot and applications must reach the Radio Industry Council not later than April 15th.

The exhibition will be open from 11 a.m. to 10 p.m. daily, except on Sunday.

Installing Car Radio—2

The Principles and Practice of Modern Car Radio

By ERIC BALLS, A.M.I.M.I., M.A.E.T.

RADIO-frequency components in the ignition primary (low tension) circuit may be by-passed by the connection of a 0.5 μF condenser between the ignition coil SW terminal and earth. It is well to check that the leads to the coil terminals have not been crossed over, as the condenser must not be connected between earth and the lead to the distributor low tension terminal.

Ignition interference is evidenced by a regular clicking noise at tick-over speeds, increasing in periodicity as the engine is revved up. In difficult cases it may be necessary to fit an additional suppressor resistor in each plug lead. Special resistors can be obtained for this purpose and they must be positioned as close as possible to the respective plugs.

Opinions vary as to the effect on ignition efficiency of introducing resistance suppressors into high tension circuits. Nevertheless, where trouble is supposedly caused by the presence of resistors the fault is more likely to be due to some weakness or maladjustment in the ignition system itself. This opinion is confirmed by War Department experience with radio equipped vehicles during the war years and is corroborated by tests carried out by the Institution of Automobile Engineers.

Incidentally, an ignition system which is not functioning correctly will cause much more interfence than one which is operating efficiently. It is important to keep sparking plugs clean and the gaps correctly set, and distributor contacts properly adjusted. Defective parts such as cracked or perished plugs, wires, or burnt-away rotor arms should be replaced.

The Dynamo

A howl or whine which rises in pitch and intensity when the engine is speeded up is probably due to interference from the dynamo circuit and will be aggravated if brushes are badly worn or commutator blackened or rough. Apart from correcting these defects adequate suppression can usually be obtained by connecting a 0.5 μF condenser between the dynamo main terminal and earth, and *if the dynamo is a three-brush one*, between the field terminal and earth as shown in Fig. 7. On no account must a condenser be connected to the field terminal if the charging system is a compensated voltage (two-brush dynamo) one.

On compensated voltage controlled sets trouble is sometimes experienced owing to regulator interference which makes itself heard as a buzz which comes on suddenly above a certain engine speed (i.e., when the regulator comes into operation). This can sometimes be cured by connecting a condenser between control box terminals A and E; also between terminals D and E. Messrs. Lucas are at present developing a filter for use with their control boards when persistent trouble is experienced. Delco-Remy-Hyatt have for some time been fitting specially designed filters to their heavy duty lighting sets on vehicles originally intended to be radio equipped.

Considerable noise will be heard in the loud-speaker every time the self-starter is operated but it is hardly worth while attempting to suppress this infrequent interference.

Petrol Pumps

So far as petrol pumps, wiper motors or other accessories are concerned, should any of these give trouble a 0.5 μF condenser connected between the live terminal and earth will usually be effective.

Noises due to static (irregular crackly noises) may be caused by accumulations of charge between, for example, loose metal panels on the bodywork, or an ill-fitting bonnet. The locating of the source of trouble is often difficult but, once found, a cure can be effected by bonding the parts with copper braid. In the case of static developed between wheel hubs and axle shafts the remedy is to provide a discharge path by filling the bearings with graphite grease or the provision of some form of rubbing metallic contact.

When testing a car radio installation give it a fair chance—take the vehicle on a country road where there is no screening by adjacent buildings and no possibility of interference from nearby industrial machinery or motor vehicles which may not be fitted with suppressors.

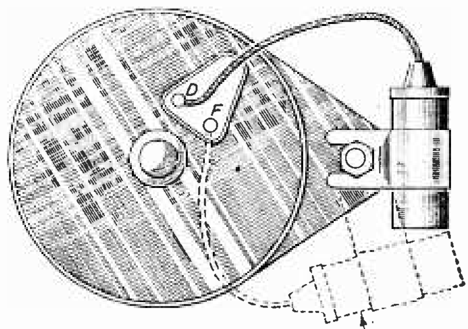


Fig. 7.—Suppressor condensers on a dynamo.

Miniature 465 K/cs Oscillator

A Simple Battery-operated Modulated Unit for the Experimenter

By A. F. STEVENS

WHEN the average home constructor has built a superhet receiver from his spares box, he usually switches on his newly-made set and nothing happens. He is then working very much in the dark when he tries to "line up." It was with this idea in mind that the oscillator was designed. It can be used to check the audio stages of a superhet or "straight" receiver and to "line up" the I.F. stages of a superhet. The complete unit can be constructed on a chassis measuring only 5in. × 2in. and the cost should not exceed 30s.

The Circuit

The three valves are 1T4 which are easily obtainable on the Government surplus market. V2 and V3 constitute the modulating oscillator which is a multi-vibrator working at about 400 c/s. Should any other modulating frequency be required the formula $f=\frac{1}{2R_4C_4}$ gives a good approximation (Note, C_3 must equal C_4 and $R_4=(x+y)$; x and y have been chosen to give between 30 per cent. and 40 per cent. modulation depth. The fact that the modulating frequency is a square wave need not be detrimental in any way to the type of testing for which the unit was designed.

The R.F. section is screen modulated and this method seems quite stable in operation. The grid coil of the R.F. valve is tuned to 465 kc/s and feed-back is obtained in the usual way by using a reaction coil. Care must be taken to connect the reaction coil the right way round; if the oscillator does not work immediately, the connections to the reaction coil should be reversed. The grid coil and its reaction coil can be constructed from an I.F. transformer (465 kc/s) the necessary modifications to which are given below. The R.F. choke is a standard component, but should be as small as possible if size is going to be considered.

Modifying the I.F. Transformer

In the unit which the author constructed an ordinary midget I.F. can was used with the following modifications. (a) Remove the present trimmers from the unit as they are not needed. (b) Remove approximately half the turns from one of the coils (this is to be feed-back coil). Having done this, melt some wax on to the coil to prevent it unwinding further. Sufficient feed-back should take place with the coils in their original relative positions, but it is advisable to reduce the spacing of the coils to say ½in., and methods of doing this will, no doubt, suggest themselves to readers. It is not possible to give them here as a lot depends on circumstances. Having modified the transformer bring the leads out to their normal terminations and replace it in its screening can.

Construction

The lay-out of components should not present any difficulty. The author's chassis measured 5in. × 3in., with 1¼in. sides. The positioning of components does not appear to make a great deal of difference to the functioning of the unit. The leads in the R.F. section, however, should be left as short as possible and fairly rigid. The two outputs (A.F. and R.F.) should be brought out on screened leads, and in the author's case the unit was enclosed in a metal cabinet, but any other form of design could, of course, be used.

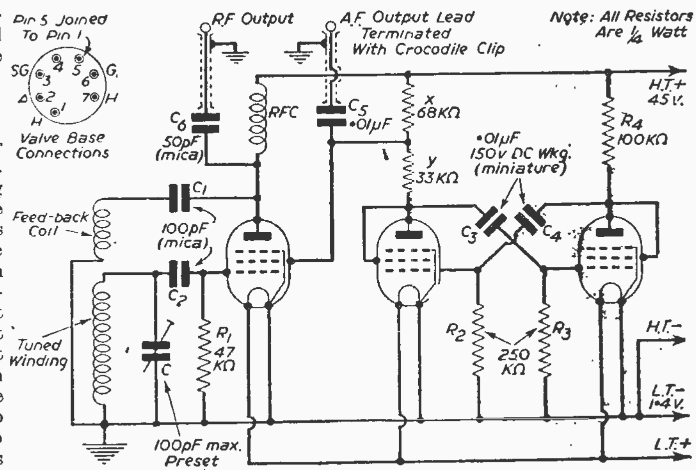
Aligning the Unit

When the unit is complete connect up power supplies and H.T., 45 v., L.T., 1.4 v. Inject the A.F. output into a pair of headphones, when the 400 c/s note should be heard in the 'phones.

Having checked the A.F. section as above, inject the R.F. output on to the grid of the first I.F. stage of a normal broadcast receiver (I.F. 465 kc/s). Tune "C" in the oscillator until unit maximum A.F. is heard in the loud speaker.

As the whole basis of the unit is simplicity, refinements such as attenuated output or variable frequency control have not been included but could be added by the constructor if desired.

It is possible to adapt the unit to frequency modulation by an additional 1T4 valve used as a reactance modulator. If such a unit were constructed it could be used in conjunction with the PRACTICAL WIRELESS miniature Oscilloscope.



Theoretical circuit of the unit.

On your Wavelength

by THERMION

On Your Frequency?

A PEDANTIC critic takes me to task for a minor lapse in grammar in our last issue. As a grammatical purist I bow the head, but in a general feature of this sort I take leave to take liberties with English and apologise in advance to the venerable Mr. Fowler and his Modern English Usage. I will split infinitives, employ terminal prepositions and tmesis where to avoid them would be to pander to pedantry. Apparently my critic will alter "what are you a-doing of," to "of what are you a-doing," a form of pedantry up with which I will not put!

My critic's letter is rendered amusing by the fact that he himself is guilty of grammatical errors! This leads me however to his postscript which was to the effect that the title of this feature should be brought up to date and changed to "On Your Frequency." This suggestion caused my mind to rove back down the decades to those hectic days when the first issue of "Amateur Wireless," one of the first journals to fall by the wayside under the onslaught of PRACTICAL WIRELESS, was being prepared. I was the founder of that journal and one of the problems which always arises when new journals are planned is the selection of titles for regular features. Members of the staff are invited to make suggestions and mine was selected for the feature to which my pseudonym has been subscribed. From that point there was a discussion as to whether the heading should be type set or drawn. Finally it was agreed that it should be in the handwriting of a member of the staff, and as the calligraphy of your present scribe resembles the hieroglyphics of a writer in Choctaw, the specimen submitted by one of my colleagues, a greater expert in pothooks and hangers, was selected. He was completely non-technical and presumably therefore had more time to form his characters neatly than your nimble Thermion. However, it is a feature which has appeared in every issue from the commencement of the now defunct paper to the present; for the first issue of this journal to absorb A. W. (remember at the time of the absorption our title was "Practical and Amateur Wireless") carried that feature over. Indeed, it was the only feature. For your present editor saw nothing in the old journal not more than adequately covered in his existing policy.

Those were indeed interesting and hectic days. A new industry had started and the public was eager to learn about it. There was scarcely a home in the country where some member of the family was not building a crystal set, or had he wished to be a little more luxurious, a one-valve set, using bright emitter valves which blue-glowed at the slightest provocation. They were, of course, of the 6-volt variety with a consumption of about half an amp each, and accumulator charging stations did a roaring trade.

Looking back on some of these old file copies engenders a nostalgia within me. Do you remember the Skinderviken microphone transmitter button? "Amateur Wireless" published a design for a crystal set incorporating one of these buttons and which it was claimed would work a loudspeaker! Indeed, the journal sponsored the publication of a book entitled "Loudspeaker Crystal Sets," as a result of which we had plenty of queries from disappointed readers, just as I had forecast. Then the journal sponsored a receiver using full mains voltage to supply the valves by means of suitable resistances. It gave marvellous results in the office, but no reader seemed to duplicate these results. They all complained of terrific mains hum, since there were no smoothing condensers of any sort incorporated in the circuit. Investigations showed that the office supply was from a bank of accumulators! However, in the early days of any industry teething troubles such as these are inevitable.

In those days you could sell any wireless component, however bad. There were the patent aerials, patent earths, spaghetti resistances, magic condensers, hedgehog transformers, special cat whiskers and patent crystals. Fortunes were made almost overnight by racketeers. Firms sprang up from private addresses and each spoke of its laboratories which usually consisted of the corner of the kitchen table. There were the quack journalists, too, who battened themselves like barnacles on to gullible editors who could not even solder a couple of wires together. The reputation of being a wireless expert was easily made in those days by talking about cat whiskers and antennæ. Of all of the advertisers supporting radio journals in those days less than a dozen remain to-day.

For a period manufacturers deserted the constructor market for the more alluring receiver market, having made up their minds that the constructor market was about to die a natural death, and it was about that time that your editor founded PRACTICAL WIRELESS. It came into the field when there were eleven competitors and, of course, it had to face the fierce onslaught of defensive attack in print and out of it by those journals which resented what they considered to be an intrusion into their special domain. But F. J. C. is a tough warrior and one by one I saw him skittle over his competitors, until to-day only one of them remains. I think it is the only occasion where the newest journal in a particular field has obliterated by merit its older-established rivals.

The specification for the constructor receiver in these early journals was a catalogue. For the various components practically every maker was specified, and it was not surprising to find that a reader who selected his components from the lists found that either the connections were different from the published designs, that the characteristics were entirely different, thus upsetting the component values, or that they could not be accommodated on the baseboard at all.

Radio Valve Review—2

This Month Voltage Amplifying Pentodes are Dealt with

FOR voltage amplification in normal radio applications pentodes are used almost exclusively, for no other type of valve is capable of giving so great a stage gain when correctly operated in conjunction with suitable coupling circuits.

The reasons for this high performance as a voltage amplifier lie in part in the inherent properties of this type of valve, namely, a high mutual conductance and high internal resistance. For R.F. applications, however, and particularly for applications involving very high frequencies, performance is enhanced by the latest constructions and manufacturing techniques whereby the inter-electrode capacitances and the lead inductances and capacitances, all of which contribute to the damping of the associated tuned circuits, are reduced to very small values.

Furthermore, the performance of a valve at very high frequencies is affected by the transit time, that is to say, the time taken by the electrons in passing from the cathode to the anode. For very high frequencies the transit time may be in the same order of magnitude as the periodic time of the R.F. signal. This may result in the phase difference between the anode current and the signal voltage being less than the normal 90 deg. The anode current can then be considered as consisting of two components—one leading the signal voltage by 90 deg. and one in phase with the signal voltage. This latter component in the region between the cathode and control grid produces the same effect as a resistance connected between those electrodes and exercises a damping effect upon the tuned grid circuit, thereby reducing the effective signal voltage.

In the latest miniature valves, made possible by the all-glass form of construction, the electron path and therefore the transit time is considerably reduced, thus minimising this particular form of damping.

Broadly speaking, there are two main classes of voltage amplifying pentodes. The first is a short grid-base, steep slope type for use as a "straight" amplifier, that is to say, without A.G.C. The other is a long grid-base, medium slope type having an I_a/V_g curve of suitable form for operation with A.G.C. Some of these pentodes have a single diode in the same envelope, for use either as demodulator or as A.G.C. rectifier.

Pre-amplifiers

With the general adoption of the superheterodyne principle for normal radio receivers, amplification at radio frequency is not used to the same extent as it once was, although an R.F. stage is often included in the more expensive and de luxe models. But the use of a "pre-amplifier" or R.F. stage before the frequency changer has many advantages and is well worth the extra expense. Apart from the added range and selectivity which it gives to the receiver, such a stage greatly improves the signal-to-noise ratio. It also serves as a buffer to prevent oscillation from the frequency changer stage reaching the aerial circuit.

Some R.F. pentodes can be used with advantage in a frequency changer stage, one as the oscillator and another as mixer. Fig. 1 is a practical circuit for this application for use in television receivers, the two valves being Mullard Type EF91. The oscillator circuit consists of L3 and C7, and is designed to resonate at 32 Mc/s. The first I.F. circuit, which resonates at 13 Mc/s. consists of L2, C2 and R2.

In the following tables, abridged ratings and characteristics of current British voltage amplifying pentodes are given, together with their recommended applications. The list has been compiled from manufacturers' current data, and an endeavour has been made to ensure that it is as complete as possible. New types, however, are produced from time to time so that no list of this sort can remain up to date for very long. New introductions, however, are regularly reported elsewhere in PRACTICAL WIRELESS.

In order to include the maximum amount of useful information in the space available, the column headings in the various tables employ abbreviations in accordance with the latest standard symbols. For the convenience of those who are not familiar with these symbols, the following key is given:

Heater voltage, V_h Filament voltage, V_f
Heater current, I_h Filament current, I_f

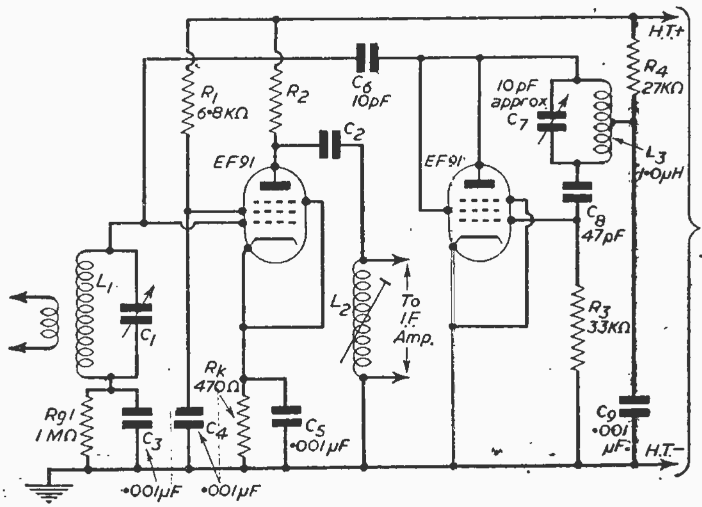


Fig. 1.—Typical television mixer circuit.

Input capacitance, i.e., the capacitance between the control grid and the cathode and any other electrodes operating at the alternating potential of the cathode .... C_{in}

Output capacitance, i.e., the capacitance between the anode and the cathode and any other electrode operating at the alternating potential of the cathode.......................... C_{out}

Feedback capacitance. i.e., the capacitance between the anode and control grid........ C_{a-g}

Anode voltage, V_a Screen voltage, V_{g2}

Control grid bias voltage, V_{g1}

Anode current, I_a Screen current, I_{g2}

Mutual conduction, G_m Anode resistance (internal), R_a

For variable-mu valves the limits of the range of grid bias adjustment and the corresponding range of mutual conductance is quoted.

It may be of interest at this point to suggest a rough guide for use when selecting or comparing voltage amplifying pentodes. Of two such valves, that with the higher mutual conductance is the more sensitive, and in this respect is the better valve. Of two valves of similar sensitivity, that with the lower values of inter-electrode capacitances is the better valve for use in high-frequency (or intermediate frequency) stages.

Type	Description or Application	Construction and Base	V_h V	I_h A	C_{in} μμF	C_{out} μμF	C_{a-g} μμF	V_a V	V_{g2} V	$-V_{g1}$ V	I_a mA	I_{g2} mA	G_m mA/V	R_a MΩ
	MULLARD													
	1—A.C. MAINS TYPES													
	EQUIPMENT TYPES													
EF80	R.F. amplifier or mixer in television receivers	All-glass Noval (B9A)	6.3	0.3	7.5	3.5	0.006	170	170	2	10	2.5	7.2	0.5
EBF80	Double-diode variable-mu pentode. R.F., I.F. or A.F. amplifier	All-glass Noval (B9A	6.3	0.3	4.0	4.6	<0.002	250	85	2	5	1.75	2.2	1.6
EF91	R.F. amplifier or mixer in television receivers	All-glass B7G	6.3	0.3	7.0	2.0	<0.008	250	250	2	10	2.55	7.65	1.0
EF42	R.F. amplifier or mixer in television receivers	All-glass B8A	6.3	0.33	9.5	4.5	<0.005	250	250	2	10	2.3	9.5	0.44
EF41	Variable-mu pentode. R.F. or I.F. amplifier	All-glass B8A	6.3	0.2	4.7	8.0	<0.002	250	100	2.5 39.0	6	1.7	2.2 0.022	1 >10
EF40	Low noise pentode. R.C.-coupled A.F. amplifier	All-glass B8A	6.3	0.2	4.0	5.5	0.025	250	140	2	3	0.55	1.85	2.5
EAF42	Single-diode variable-mu pentode. R.F. or I.F. amplifier	All-glass B8A	6.3	0.2	4.0	5.0	<0.002	250	105	2.5 40.5	6.35	1.75	2.15 0.021	1.0
EF50	R.F. amplifier	All-glass B9G	6.3	0.3	8.3	5.2	<0.007	250	250	1.55	10	3	6.5	1.0
EF37	High gain. low microphony R.F., I.F. or A.F. pentode for pre-amplifier stages	Octal	6.3	0.2	5.5	8.5	<0.02	250	100	2	3	0.8	1.8	2.5
EF37A	High gain. low hum. low microphony R.F., I.F. or A.F. pentode for pre-amplifier stages	Octal	6.3	0.2	5.5	8.5	<0.02	250	100	2	3	0.8	1.8	2.5
EF39	Variable-mu pentode. R.F. or I.F. amplifier	Octal	6.3	0.2	5.5	7.2	<0.003	250	100	2.5 49.0	6	1.7	2.2 0.0045	1.25 >10.0
EF22	Variable-mu pentode. R.F. or I.F. amplifier	Loctal (B8G)	6.3	0.2	5.5	6.4	<0.002	250	100	2.5 46.0	6	1.7	2.2 0.022	1.2
	REPLACEMENT TYPES													
EF92	Variable-mu pentode. R.F. or I.F. amplifier	All-glass B7G	6.3	0.2	4.5	7.0	0.004	250	200	2.5 28.0	8	2.1	2.5 0.005	—
EF54	High-slope pentode. R.F. amplifier	All-glass B9G	6.3	0.3	6.2	4.9	0.02	250	250	1.7	10	1.45	7.7	0.5
EF55	High slope pentode. R.F. amplifier	All-glass B9G	6.3	1.0	15.0	12.0	0.15	250	250	4.5	4.0	5.5	12.0	.055
EF36	General purpose voltage amplifier	Octal	6.3	0.2	5.5	8.5	<0.02	250	100	2	3	0.8	1.8	2.5
EF9	Variable-mu pentode. R.F. or I.F. amplifier	Side Contact	6.3	0.2	5.5	7.2	<0.02	250	100	2.5 49.0	6	1.7	2.2 0.0045	1.25 >10.0
SP4	R.F. or I.F. amplifier or detector	5-pin	4.0	1.0				200	100	2	3		2.3	2.2
SP4B	R.F., I.F. or A.F. amplifier or detector	7-pin	4.0	0.65	6.9	8.1	<0.003	250	250	2.4	4	1.5	3.4	2.0
VP4	Variable-mu pentode. R.F. or I.F. amplifier	7-pin or 5-pin	4.0	1.0	12.4	10	<0.005	200	100	2.0 50.0	4.5		2.3 0.002	10.0
VP4A	Variable-mu pentode. R.F. or I.F. amplifier	7-pin or 5-pin	4.0	1.2	12.5	16.2	<0.006	200	100	2	4.25	1.8	2.5	1.4
VP4B	Variable-mu pentode. R.F. or I.F. amplifier	7-pin	4.0	0.65	5.35	8.0	0.0023	250	250	3	11.5	4.25	2.0	—
	2—"D.C./A.C." TYPES													
	EQUIPMENT TYPES													
UF41	Variable-mu pentode. R.F., I.F. or A.F. amplifier	All-glass B8A	12.6	0.1	4.7	8.0	<0.002	200	120	3 34	7.2	2.1	2.2 0.022	1.0 >10.0

NOTE.—Valves with 0.1A, 0.2A and 0.3A Heaters may be operated with their Heaters in Series with the Heaters of other Valves of the same Heater rating.

Type	Description or Application	Construction and Base	V_h V	I_h A	C_{in} μμF	C_{out} μμF	C_{a-g} μμF	V_a V	V_{g2} V	$-V_{g1}$ V	I_a mA	I_{g2} mA	G_m mA/V	R_a MΩ
UBF80	Double-diode variable-mu pentode, R.F., I.F. or A.F. amplifier	All-glass Noval (B9A)	17	0.1	4.0	4.6	<0.002	200	85	2	5.0	1.75	2.2	1.0
UAF42	Single-diode variable-mu pentode. R.F. or I.F. amplifier	All-glass B8A	12.6	0.1	4.0	5.0	<0.002	200	85	2 40.5	5.0	1.4	2.0 0.02	>1.0
	REPLACEMENT TYPES													
UF42	High slope pentode. R.F. amplifier in television receivers	All-glass B8A	21	0.1	9.5	4.5	0.005	170	170	2	10	28	8.5	0.2
SP13	R.F., I.F. or A.F. amplifier or detector	Side Contact	13	0.2	7.1	7.7	<0.003	200	100	2	3.3	—	2.2	1.3
SP13C	R.F. or I.F. amplifier or detector	7-pin	13	0.2	6.9	8.1	<0.003	200	200	2.2	2.5	0.9	2.8	2.5
VP13A	Variable-mu pentode. R.F. or I.F. amplifier	Side Contact	13	0.2	—	—	—	200	100	2.0 18.0	4.0	1.4	2.2	—
VP13C	Variable-mu pentode. R.F. or I.F. amplifier	7-pin	13	0.2	6.1	8.0	0.0023	200	200	2.0	9.0	3.6	2.2	—
	3—BATTERY TYPES													
	EQUIPMENT TYPES		(V_f)	(I_f)										
DF91	Variable-mu pentode. R.F. or I.F. amplifier	All-glass B7G	1.4	0.05	3.6	7.5	<0.01	90	67.5	0 16	3.5	1.4	0.9 0.01	0.5
DAF91	Single-diode pentode. R.F., I.F. or A.F. amplifier	All-glass B7G	1.4	0.05	2.2	2.4	0.2	90	90	0	2.7	0.5	0.72	0.5
DF33	Variable-mu pentode. R.F. or I.F. amplifier	Octal	1.4	0.05	3.8	9.5	<0.007	90	90	0 4	1.2	0.3	0.75 0.005	1.5
DF66	Sub-miniature. Voltage amplifier for Hearing Aids	Wire ends	0.625	0.015	1.7	2.4	<0.2	22.5	22.5	1.05	0.05	0.015	0.1	>2
DF70	Sub-miniature. Voltage amplifier for Hearing Aids	Wire ends	0.625	0.025	1.6	2.4	<0.5	30	30	0	0.375	0.125	0.22	0.5
	REPLACEMENT TYPES													
KF35	Variable-mu pentode. R.F. or I.F. amplifier	Octal	2.0	0.05	8.0	10.0	<0.1	120	60	1.5 9.5	1.45	0.5	1.08 0.01	—
SP2	R.F. or I.F. amplifier or detector	7-pin	2.0	0.18	11.0	6.0	<0.01	135	135	0	3.0	1.0	1.8	0.7
VP2	Variable-mu pentode. R.F. or I.F. amplifier	7-pin	2.0	0.18	10.7	6.3	0.007	135	135	0 7	3.0	1.25	1.5	0.4

NOTE.—Valves with 0.1A, 0.2A and 0.3A Heaters may be operated with their Heaters in Series with the Heaters of other Valves of the same Heater rating.

A Slow-speed Oscilloscope

A NEW instrument has been produced by A. E. Cawkell for observing and comparing slow waveforms, for which the normal oscilloscope is unsuited, and waveforms of frequency as low as .1 c/s may be easily observed on the long-persistence cathode-ray tube. Alternatively, the instrument may be used like a conventional oscilloscope, although the time base frequency normally extends upwards to 50 c/s only. Two beams are available which may be moved with respect to each other along any axis, and altered in amplitude and phase so as to be superimposed one upon the other. This enables the instrument to be used for waveform distortion comparisons at very low frequencies —a difficult procedure by any other method.

Design

Two completely separate D.C. amplifiers are incorporated with push-pull output incorporating shift controls, their outputs being electronically switched to provide two beams. Beam interaction is very small. The display is on a 6in. long-persistence cathode-ray tube with an orange filter.

A linear time base is included with automatic synchronisation of range .25 to 50 c/s. The time base (X) amplifier is also electronically switched enabling the beams to be independently shifted in the X direction by the controls. The time base voltage and the X amplifier input are available externally.

All necessary power supplies, including 2 KV for the tube and a valve-stabilised general HT supply, are constructed in a separate matching container with multicore cable connection.

Specification

Power Requirements.—210-250 volts A.C.

Tube.—6in. diameter, 5 secs. afterglow approx. Orange filter fitted.

Input.—Impedance of amplifiers 2 megohms.

Amplifiers.—Two separate D.C. amplifiers with two electronically switched beams. Sensitivity. 100 mv for 2 cms. P.P. vertical deflection. Push-pull deflection.

Time Base.—Linear with automatic synchronisation. Frequency .25-50 c/s. Electronically switched X amplifier. Time base voltage and X amplifier input available externally.

Power Supply.—2 KV E.H.T., and valve stabilised (.5 per cent.) for general H.T. Housed in separate container.

Controls.—

Y1 Gain	X Gain
Y2 Gain	Brilliance
Y1 Vertical shift	Focus
Y2 Horizontal shift	Time base f coarse
Y1 Horizontal shift	Time base f fine
Y2 Vertical shift	Time base ext. switch

The price is £135, and the makers are A. E. Cawkell, Electronic Engineers, 7, Victory Arcade, The Broadway, Southall, Middlesex.

The Practical Wireless Television Receiver–6

Aligning the Receiver, and Coil Details for Sutton Coldfield

ASSUMING that the raster has been accurately obtained as described last month, the receiver is now ready for alignment. This may be carried out in either of two ways—with or without a signal generator. The latter method is definitely to be preferred, as it eliminates all guesswork, and enables an accurate response curve of the receiver to be taken for checking purposes. As the method using the signal alone is simplest, it will be described first. All cores should be adjusted level with the top of the coil formers. Connect the aerial, and with brilliance right down and volume right up, turn up the contrast control until sound is heard from the speaker. If contrast has to be turned right up without hearing any sound, slowly turn up the brilliance control until some modulation appears on the screen. If the circuits are nearly in tune, then the contrast will have to be reduced to avoid overloading. As soon as some sort of modulation is seen endeavour to adjust all cores to exactly 45 Mc/s or the vision frequency. This will be indicated by flaring on the tube face, but the brilliance control should be kept well down. Maximum flaring will indicate that all coils are more or less peaked at 45 M/cs. The core of L4 should now be unscrewed 1½ turns, and that of L2 1 turn. The core of L3 should be given about ½ a turn out, and all sound coils (L6, L7 and L8) adjusted for maximum sound output with the coil of L1 unscrewed only a fraction. If the picture is now brightened, and contrast correspondingly reduced, it should be well detailed, although perhaps not at its best. To obtain maximum detail the test card C which is broadcast every morning (except Sunday) from 10 a.m. to 11 a.m. should be used. An endeavour should be made to obtain each of the central ruled squares clearly, without any white line following the right hand large white line. All the white ruled squares on the background should be truly square and of equal size (adjusted at the time base), and the correct setting of contrast and brilliancy will permit each of the central blocks to stand out clearly from black up to white.

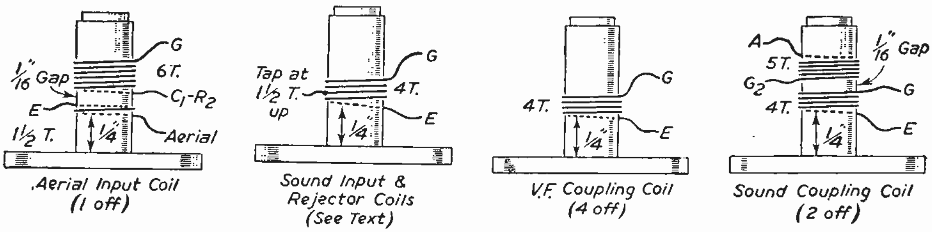


Fig. 1.—Details of the coils for Sutton Coldfield. Wire used is 28 S.W.G.

With a Signal Generator

The most satisfactory method of lining up calls for a good meter in addition to the generator. The anode circuit of the video amplifier should be opened and a meter shunted by a .001 μF condenser inserted. A range of about 20-30 mA. is called for. An alternative is to use a meter with a full scale of 1 milliamp connected in series with cathode of the diode rectifier. Finally, the tube itself may be used, making all adjustments to obtain maximum black and white horizontal bars—keeping the input and brilliancy down to maintain the black and white bars of equal width. Peaking frequencies for the coils are as follows:

Vision:
L1—45.25 Mc/s.
L2—48 „
L3—46 „
L4—49 „
L5—45 „

Sound:
L6—41.5 Mc/s.
L7—41.5 „
L8—41.5 „

Sutton Coldfield

The above frequencies are, of course, for the London transmitter, and for the Birmingham frequency alternative coils are required. In addition to the circuit as already shown one or two extra coils will be needed. Outside the "swamp" area only one extra coil is needed and this is inserted in the cathode circuit of V4 as shown in Fig. 2. Its exact position being on the side runner of the chassis as shown in Fig. 3. Note that it is inserted between the bias and feed-back resistor. At closer distances, or where sound break-through is experienced on vision a further similar coil should be inserted in the cathode circuit of V3. The 33Ω resistor may not be needed. The Sutton Coldfield frequencies are as follows:

Vision:
L1—59 Mc/s.
L2—61.75 „
L3—60 „
L4—61.75 „
L5—59 „
L9—58.25 „

Sound:
L6—58.25 Mc/s.
L7—58.25 „
L8—58.25 „

A small point may be mentioned here in connection with L6—the sound input coil. As shown in the theoretical diagram in the January issue this has no core. In some localities this will be found quite in order, but in some cases a slight modification may be made to this particular coil. Firstly the core may be inserted and the coil peaked to provide the maximum sound output. In other localities it may be found that the sound output is not sufficient. An improvement may be effected by connecting a 47 pF silver-mica condenser across the coil—that is, from grid to chassis. This condenser is, of course, in addition to the iron-core.

Queries

There have been one or two queries raised concerning parts of the complete installation, and these have concerned only minor points which have not been clear to individual readers.

One correction should be made here. In the March issue it was stated that the separating screens in the vision unit should be soldered to pins 5 and 6 on the valve holders. As these pins are adjacent it is obviously impossible to carry out the instruction, and the diagram in the same issue shows that the pins concerned are actually 5 and 9—the latter figure unfortunately having become inverted in printing.

Another major query concerns the use of a 12in. tube. The scanning power of the receiver as designed will permit of a 12in. tube being used without any modification. An alternative mounting device will be needed, of course, and the tube is slightly longer. Brilliancy should be sufficient, but if it is found that a slightly greater brilliance is needed this may be accomplished by increasing the H.T. supply to the E.H.T. unit. Resistance R44 will thus have to be modified. If it is simply reduced in value the H.T. applied to the E.H.T. unit will rise, but unfortunately this point also feeds the EL33 output valve which is rated for a maximum of 250 volts and it will not tolerate too great an overload. Therefore, two separate resistors will have to be used, one to reduce the main H.T. line to 250 for the output valve and the other to give a full 300 to the E.H.T. unit. Care must be taken not to overload this unit in view of the risk of insulation breakdown, and under all normal conditions the 7.5 Kv. provided is adequate for all but aluminised tubes.

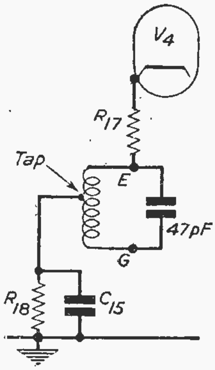


Fig. 2.—Position of the rejector coil in the cathode circuit of V4.

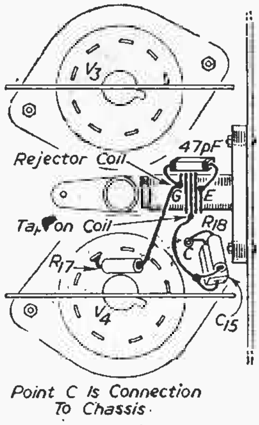


Fig. 3.—Actual position of the rejector coil on the chassis side runner.

Stereophonic Music in Cinema

An experiment with stereophonic reproduction of music has been made in a cinema in Eindhoven by Philips. In contrast to previous demonstrations given in various places to invited guests or in private circles, this experiment was carried out as part of a normal public programme.

In this case stereophonic reproduction was applied for the music played during the interval. It is not likely to be applied for the films themselves for some time, because film producers must first decide to have the sound track recorded stereophonically, and although this is already possible technically, it seems that for the present the alterations necessary in the apparatus and the resultant cost will be considered objectionable. Moreover, the improvement to be expected in the case of films will probably be less striking, since any faulty impression of the direction of the sound is more or less predominated and corrected by the strong visual impression of the picture. When music is played in the interval, however, direction is centred entirely upon the sound itself, particularly so when the music is reproduced mechanically, so that the audience is not distracted by the musicians.

It was therefore a promising experiment to apply stereophony for improving the reproduction under these circumstances, so as to eliminate as far as possible the mechanical nature of the music and thus afford the audience an opportunity to enjoy the music as much as if they were listening to an actual concert performance.

The music given was selected from a series of stereophonic recordings made by the Electro-Acoustic Department of Philips by the magnetic method.

Audience Reaction

Everyone in the audience was given a questionnaire and of the 7,300-odd forms distributed more than 5,800 were returned completed and 500 only partly filled in. About 75 per cent. showed their appreciation, whilst less than 3 per cent. were definitely averse to the idea.

Although experience teaches that a statistical sounding of the public does not always lead to reliable results, and we shall therefore refrain in this case from giving any comment of our own upon the result of the inquiry, it nevertheless seemed desirable to give publicity to the experiment and its results by means of this communication. An application on a large scale can of course only be expected when a sufficient variety of stereophonic recordings become available for this purpose.

Designing "Personal" Portables

Circuit Features of the Popular Mains-operated Bed-side and Similar Receivers

By W. J. DELANEY (G2FMY)

A TYPE of receiver which is receiving increasing attention to-day is the small mains-operated bed-side receiver. Many listeners have purchased a television receiver and have sold their broadcast receiver, and these small receivers enable odd items to be heard on "blind" radio when no television is being radiated. Some of the designs which manufacturers have produced are most interesting from a technical point of view, and, in fact, quite a number of readers have asked for details of construction for this type of receiver. It lends itself more to individuality of design than ordinary broadcast receivers, and amateurs may be forgiven for being in some doubt as to what type of circuit to adopt. An attempt will therefore be made to cover the main features of this particular type of receiver so that those who wish may have some grounds upon which to base their constructional work.

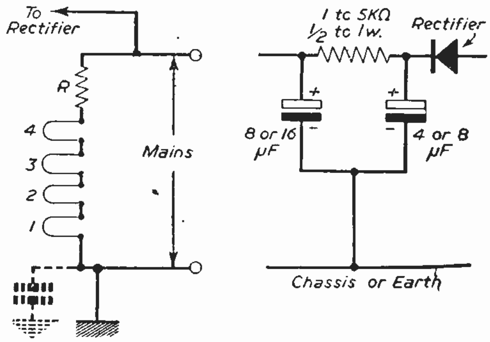


Fig. 1 (left).—Normal arrangement of heaters for A.C. or D.C. supply. Fig. 2 (right).—H.T. smoothing at its simplest.

Mains Feed

The first and most important feature is what type of mains feed to employ. This really boils itself down to the simple problem as to where excessive heat is to be placed, or whether to dispense with such heat. On the H.T. side there is nothing to worry about from a heat point of view, but on the heater or L.T. side there is quite a problem. If the receiver is to be of the A.C./D.C. type, then it is practically essential that the heaters shall be wired in series and some form of voltage dropper fitted to ensure that the heaters are operated at the correct temperature. (Fig. 1). The last heater in the chain (marked 1 on the illustration) should be the detector in order to keep down the risk of hum. Resistance R is the problem here. It has to carry the current taken by the heaters (which obviously must all be of the same rating or otherwise adjusted by parallel resistors to ensure a constant current through the network), and must reduce the mains voltage to that required for the valves. For instance, if the standard 6.3 volt heaters are employed, four in series would give a total of 25.2 volts, and therefore resistance R would have to dissipate a wattage equivalent to over 200 volts at .3 amps., or 60. Obviously a standard type of resistor is out of the question, and the customary method is to employ a line-cord which consists of a specially constructed flexible lead intended for connecting the receiver to the mains, and at the same time incorporating a resistance wire wound round a length of asbestos string. Naturally this gets quite warm, but to reduce the length and rating of it one uses valves with a higher heater voltage rating. Generally the early valves are of the 12 volt type, whilst the output valves (and half-wave rectifier which is needed for the H.T. supply) are usually rated at 35 or 40 volts. This arrangement gives heat outside the cabinet and enables a more compact layout to be obtained, but the line-cord may run quite hot and this is not always convenient.

Cabinet Heat

An alternative arrangement consists of using higher rated A.C./D.C. valves throughout, and then using one of the small special mains-droppers in the cabinet. But even these run fairly warm and it is generally necessary to put a sheet of asbestos inside the cabinet to prevent damage or fire risk, and obviously the cabinet cannot be made too compact.

Where the receiver is designed for A.C. mains only, however, the problem is much simplified, but again there are one or two alternatives to be considered. The series heater scheme may still be adopted, using the line-cord, but if there is no intention of using D.C. mains supplies this may be dispensed with and a simple mains transformer employed. These are available at quite a low figure, either new or ex-service, and are compact. Furthermore, they enable standard (6.3 v.) valves to be used throughout and do not call for the high-voltage heater type of valve. In addition, as there is now no need to worry about heater current the rectifier may be of the metal-oxide type.

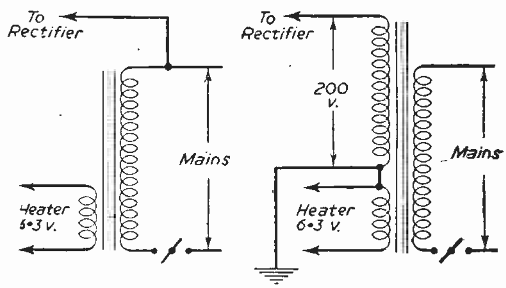


Fig. 3 (left).—Using a transformer for the heater supply. Fig. 4 (right).—Isolating the receiver from the mains by a single transformer.

These take up much less room than a rectifying valve, and generally speaking a more compact type of receiver may be constructed, in spite of the use of the transformer.

H.T. Supply

There are, however, two alternatives still available with this arrangement. The mains input may be taken direct to the rectifier, in which case the receiver is "live" to the mains, or the heater transformer may be of the type having a further secondary winding rated at 200 volts or so. In this way the receiver is isolated from the mains supply, and there is no undue increase in bulk. There is no heat to worry about and ordinary flex may be used to connect the set to the mains.

Other Design Features

The removal of heat from the cabinet enables the receiver to be designed around certain components which could not otherwise be employed. Small electrolytics may be placed where desired for efficiency without the risk of breakdown due to high temperatures; more efficient (superhet) circuits may be used without the risk of frequency drift and so on. For mains smoothing in these small receivers it is not necessary to employ a smoothing choke. The loudspeaker generally employed does not exceed 5in. in diameter and the bass response of these is so limited that slight residual hum passes unnoticed. Therefore a simple low-rating resistor is used for smoothing, in association with the usual canned electrolytics. Here space is saved by using the "two-in-one" type of unit.

The question as to whether to employ a straight or superhet circuit is bound up with the manner in which the receiver is to be used. If required for general listening a superhet is obviously desirable, but if only used as a stand-by for news, etc., or for the odd items not available on television, a straight two-station circuit is obviously good enough. Another point here is the type of aerial to be used. With a straight circuit there will not be much gain, and some difficulty might be experienced with the aerial. A length of throw-out wire may have to be fitted and this will limit the portability of the receiver. On the other hand, a superhet will enable the set to be used with only a small amount of wire inside the cabinet, or even a small wound frame built in, and will then provide a range of stations or at least, adequate volume from the locals, and it may be moved from room to room and plugged in as conveniently as an ordinary table lamp.

Mobile Broadcast Recording Van

E.M.I. FACTORIES, LTD., were recently commissioned by Radio-Luxembourg to supply a broadcast recording van suitably equipped for recording broadcast programmes on magnetic tape.

The interior of the van has been laid out in such a manner as to allow unhindered working by the recording engineers and is divided into two separate compartments. The forward one contains the recording equipment and operator's position, the rear compartment housing the cables, cable entries, drums, etc. therefore, no loose cabling is, necessary in the operating compartment at any time, and all input and output interconnecting cables are concealed in wall ducts.

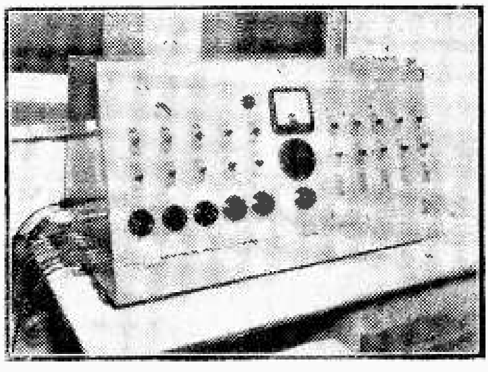
Special translucent roof windows allow the operator to work in natural light during the daytime, and there is provision for artificial lighting from A.C. mains supplies. The interior of the van is heated by an H.M.V. Cavendish convector heater.

Tape Recorders

The main items in the equipment are two of the well-known E.M.I. magnetic tape recorders; these, working together, enable high-fidelity recordings of any duration to be made. Additionally, a disc recorder and replay desk are fitted, with provision for operation at 78 or 33⅓ r.p.m.

The control panel comprises a five-channel microphone pre-amplifier with individual fading, programme meter and 'phone or loudspeaker monitoring facilities. This control console is so designed as to give the operator complete flexibility of control and interconnection of the various items of equipment, and full dubbing, mixing and cross recording facilities are available, enabling any type of studio work to be carried out. In addition, the complete console can be lifted out and carried to the recording site when the distances involved make it undesirable to run long microphone cables.

Two high-quality loudspeaker units are provided for remote replay purposes on the recording site. Communication between the van and the recording site is by a "talk-back" system and the recording signalling system consists of three coloured signal lamps, buzzers and a field telephone. Power supply is taken on site from suitable A.C. supplies, but stand-by lighting may be operated from the van's electrical system.



Close-up of the engineer's control panel in the recording room of the mobile recording unit. *Another picture appears on page 184.*

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Stabilised Power Supplies

An Explanation of the Series-fed Type

By E. N. C.

THE stabilised power supply unit, to a large number of radio enthusiasts, seems to have an air of mystery around it, and it is the purpose of this article to try to explain the action of the stabilised unit and point out some of its useful features. There are two main types of electronically stabilised units; these are the shunt stabiliser and the series stabiliser. The shunt stabiliser works by virtue of placing a load on the power unit which is always in opposition to the external load; for example, when the external load decreases the shunt load increases and vice versa, this tending towards a constant total load on the power unit, which therefore has a reasonably constant output voltage. The series regulator type of stabiliser is the one most commonly used and it is this type which will be discussed here. First of all, what is the stabilised power supply unit? Well, excluding batteries, it is the nearest approach to the perfect generator or power unit. Within its operating range the stabilised unit will deliver an output voltage which is independent of the input voltage, and also independent of the load current. The usefulness of this can be appreciated when one considers such things as (1) oscillators, where a drift in H.T. can cause a drift in frequency; (2) D.C. amplifiers, where a drift in H.T. can cause an error in the output; (3) modulator units, where a high power unit internal impedance will cause distortion on heavy modulation, etc.; in fact, any piece of equipment where the performance is deteriorated by having an imperfect power supply.

Principle of Operation

The series regulator type of stabiliser is really nothing more than a cathode follower stage with an amplifier between its cathode and grid, and it is with the aid of the cathode follower that its principles of operation will be explained. The importance of the amplifier section will be realised as the article goes on. The diagram Fig. 1, shows a set of characteristics of a heavy-duty triode having the following constants: (1) anode dissipation maximum 15 watts; (2) gm=10 mA/v.; (3) μ=12.5; (4) Ra=1,250 Ω. The curves, as can be seen, are anode current against grid volts for three values of anode volts. The circuit Fig. 2, shows a cathode-follower stage being fed with H.T. from a generator or power supply having an internal resistance of 1,000 Ω, and an output voltage of 410 v. We shall see how the cathode follower reduces the effective internal resistance and maintains the output voltage reasonably constant in spite of variations of H.T. input volts and output load current. From the circuit we see that the cathode resistance is 20,000 Ω, the anode current 10 mA, and the output voltage consequently 200 v. The 10 mA. current causes a 10 v. drop in the 1,000 v. internal resistance of the generator, causing the terminal voltage and therefore the anode to earth voltage of the valve to be 400 v. A battery of 186 v. is connected between grid and earth and therefore the actual grid bias voltage—that is, the voltage between grid and cathode—is −14 v. We can see that these conditions agree with the valve characteristics, an anode voltage of 200 v. and a bias of −14 v. giving an anode current of 10 mA. An external load is available which is connected across the output by closing the switch S. Now let the load be of such a value as to draw a current of 50 mA. and on closing switch S let us see what happens. First of all the terminal voltage of the generator will drop from 400 v. to 350 v. because, as one can see 50 mA. through 1,000 Ω produces a drop of 50 v. The output voltage of the regulator will tend to fall below its 200 v. level, but in doing so it causes the grid-cathode bias on the valve to decrease, therefore allowing the valve to pass more current. The total current through the valve is now 60 mA. and the anode voltage has dropped to 150 v. because of the terminal voltage dropping from 400 v. to 350 v. We shall now see from the valve curves what the grid-cathode bias is to suit these new conditions, and therefore arrive at what valve the output voltage comes to rest. Now from the curve of Va=150 v. and Ia=60 mA. we see that the grid-

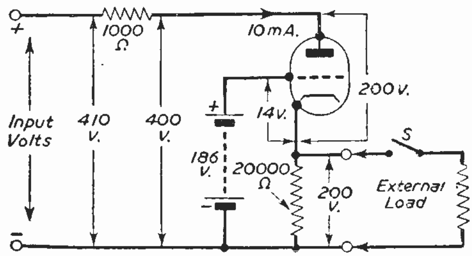


Fig. 2.—A cathode-follower stage.

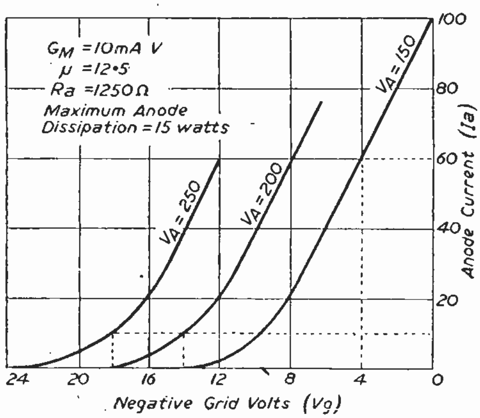


Fig. 1.—Characteristics of a heavy-duty triode valve.

cathode bias is −4 v., which means that the output voltage has fallen to 190 v., that is, a drop of 10 v. has occurred. Now the output impedance or output resistance is equal to the change in voltage divided by the change in current, which in this case is $\frac{10\text{v.}}{50\text{ mA.}}$ which equals 200 Ω. We therefore see that the regulator valve or, if you like, cathode-follower has reduced the effective output impedance from 1,000 Ω to 200 Ω. How the amplifier reduces it still more we shall see later. Approximate values are given so as not to confuse the argument.

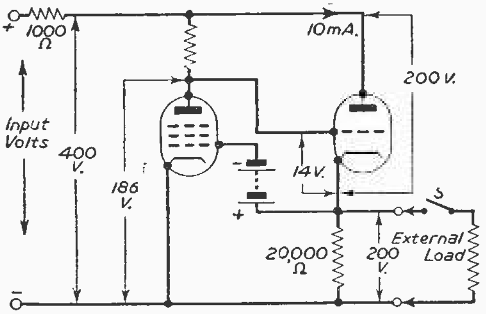


Fig. 3.—A high-gain pentode added to the circuit of Fig. 2.

Incidentally, the output impedance of a cathode-follower is given mathematically as being approximately equal to $\frac{Ra}{\mu}$ or $\frac{1}{gm}$ which in the case of this valve should be $\frac{1}{10\text{ mA/v.}} = 100\ \Omega$ and not 200 Ω but so as not to confuse those who have seen that formula it should be pointed out that it only holds good if you are always working on the straight portion of the valve curves and there is no 1,000 Ω generator resistance.

Independent Voltages

This you can check for yourself. Let us now see just how independent the output voltage is upon variations of the input voltage. We will return to the position when switch S is open and the valve is passing its normal 10 mA. with an anode-cathode voltage of 200 v. Let us assume that the terminal voltage rises from 400 v. to 450 v. The anode-cathode voltage of the valve will rise to 250 v. and the extra current that flows through the 20,000 Ω cathode resistor will tend to make the output voltage increase. But this increase in output voltage is causing the grid-cathode bias of the valve to be greater, this tending to restrict the rise in current. We will consult the curve of the valve for Va=250 v. and find the value of bias required to keep the current as near as possible to 10 mA. According to the curve this value of bias is −18 v. and therefore the output has risen to 204 v. This represents a rise in the output of only 4 v. for a rise in the input of 50 v. We shall see later on how this variation is restricted even more with the aid of the amplifier. It is now becoming apparent that the cathode-follower is doing its best to deliver a constant output voltage of 200 v. regardless of variations of input volts and load current, which is indeed what the perfect power unit should do. As you will have probably realized by now, what the past explanations boil down to is that the effective resistance of the regulator valve varies to suit the input voltage and output current conditions at all times. We shall now see how with the aid of an amplifier the cathode-follower gives almost perfect stability. In the circuit Fig. 3, we see our same cathode-follower, but with the addition of a high-gain pentode amplifier between its cathode and grid. The original regulator valve grid battery voltage of 186 v. has now been replaced by the anode-cathode voltage of the amplifier valve. The battery which is connected between the cathode of the regulator valve and the grid of the amplifier valve is necessary in order to bias correctly the pentode amplifier valve; if this battery were omitted the grid-cathode bias of the valve would be +200 v. and the valve would obviously be saturated, and consequently would not operate. Now let us assume that the gain of the valve from grid to anode is 200; this is a gain which can easily be got as pentodes can give a gain of over 400. If we now revert to our original experiment of pressing switch S to put our 50 mA. load on the output, we saw with the original circuit that a change in bias of 10 v. was required on the regulator valve in order to give the extra current. But now look at the new circuit; the output has only to drop $\frac{10}{200}$ or 0.05 volts to give the extra current because the amplifier which has its grid connected to the output is amplifying 200 times, any change which is occurring and this amplified change is being applied to the grid of the regulator valve. Our 10 v. change in grid-cathode bias has therefore resulted

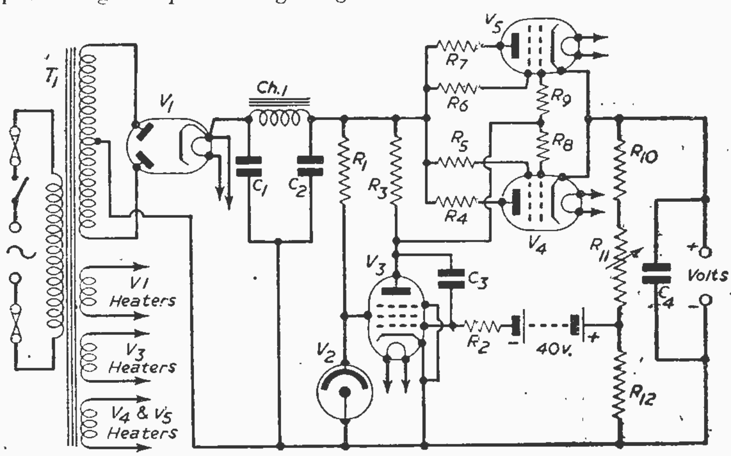


Fig. 4.—A practical circuit incorporating the features dealt with in this article.

from a drop in the output of only 0.05 volts. Let us now calculate the output impedance which is the change in voltage divided by the change in current. This is equal to $\frac{0.05 \text{ v.}}{50 \text{ mA.}} = 1\Omega$. Our unit therefore now has an output impedance of only 1Ω instead of the original $1,000\ \Omega$. If we now look at the second experiment which was to see how the output was proofed against input variations, we saw that the output rose by 4 v. to nullify the input change of 50 v. But, as we can see with the amplifier in circuit, the output will only have to change by $\frac{4}{200}$ or 0.02 volts to nullify the input change of 50 v. And that is really all there is in the operation of the series regulator type of stabiliser

COMPONENT LIST FOR FIG. 4

T1 = Mains Transformer Primary 240 v. 50 cycles. Secondary 350-350 150 mA. + 4v.-2.5 amps. (V1)+4 v. 1 amp. (V3)+4 v. 4 amps. (V4-5).
C1 = 8 μF. 450 v. working.
C2 = 16 μF. 450 v. working.
C3 = 350 pF.
C4 = 8 μF. 450 v. working.
R1 = 20,000 Ω 6 watt.
R2 = 47,000 Ω ½ watt.
R3 = 150,000 Ω ½ watt.
R4, R5, R6, R7 = 47 Ω ½ watt.
R8, R9 = 47,000 Ω ½ watt.
R10, R12 = 4,700 Ω 1 watt.
R11 = 20,000 Ω 4 watt.
V1 = UU5 or any equivalent.
V2 = Cossor S130.
V3 = SP41 or VR65A or any equivalent.
V4/5 = Mazda PEN44 or any equivalent.

A Practical Unit

A circuit of a practical unit and some points of interest on the design and limitations of such units are given. Fig. 4 shows a practical unit capable of giving 100 mA. over the range 100v.-250 v., the output voltage being controlled by R11.

Output Power

The maximum output power ignoring the mains transformer and rectifier is governed by the anode dissipation of the regulator valves and the maximum safe running current is determined by the lowest output voltage. This is shown as follows. The anode-cathode voltage on the regulator valves is equal to the input voltage minus the output voltage and is therefore highest when the output voltage is at its lowest. Anode dissipation is equal to anode-cathode volts times anode current, and so for a fixed maximum dissipation the anode current must come down if the anode volts go up. Therefore the maximum safe running current on the regulated unit is the current which gives the rated anode dissipation at the lowest output voltage, as this corresponds with the highest regulator valve anode voltage. It is obvious that if we could keep the anode-cathode volts at a reasonably low value we could increase the output current before overrunning the valves. Some modern units achieve this by using grid-controlled rectifiers and using a two-gang output in control, so that when the output volts are varied the input volts are varied in sympathy, so maintaining a reasonably constant anode voltage on the regulator valve. The rear stabiliser feeding the screen of the amplifier or central valve as it is often referred to prevents long-term drift of the output volts. It can be seen that if the screen is not held stable any fluctuation of rectifier volts would communicate a signal to the output by virtue of the screen. The output fluctuation would be equal to the input fluctuation present at the screen, divided by the control grid to screen grid voltage factor. The anode and screen resistors on the regulator valves and the anode to grid condenser on the control valve are included to suppress any tendency to self oscillation.

Radio at the Wheel

ON the new Philips MotoRadio Model 574V the reception compares favourably with that obtained with domestic radio receivers, and the quality and fidelity of reproduction is fully retained under all kinds of motoring conditions. Of extremely compact design, and styled to suit every class of modern car, this new Philips MotoRadio does, indeed, bring radio at the wheel close to the perfection of radio in the comfort of the home.

The marketing of the new Philips receiver is being carried out under the guidance of Mr. Alan Knight, who is well known to all motor manufacturers and dealers as a pioneer of car radio in this country. From the year 1932 when he first introduced car radio in this country, Mr. Alan Knight has become fully conversant with all the many problems associated with car radio and its distribution, having studied this aspect of the business in the U.S.A. As the new Manager of the Philips Motor Radio Department, he thus brings with him a wealth of commercial and technical experience.

In the design of the new MotoRadio Model 574V, particular attention has been given to the ease of installation and servicing. An attempt has also been made to obtain the best possible appearance and performance so that the equipment will match and blend with the interior of even the most expensive cars, and will at the same time meet the needs of the most discriminating user of motor radio.

The equipment comprises two units, the radio unit proper, and a separate loudspeaker unit contained in a circular metal cabinet. The radio unit is designed for fitting immediately below the lip in the centre of the car's instrument panel, or in the space available in those cars where special provision has been made for the installation of radio. The controls are thus within easy reach of the driver. The loudspeaker may, if desired, be removed from its case and mounted behind the speaker grill provided in some cars. Both units have a pleasing hammered silver-grey finish, and their dimensions and weights are as follows:—Radio unit: (back), 4⅝ ins; height (front), 3⅜ ins.; width, 6¼ ins.; depth, 10½ ins.; weight, 13½ lb. Loudspeaker unit: diameter, 8 ins.; depth, 3½ ins.; weight, 2½ lb.

9-valve All-w

A Compact Mains-operat

By F. (

THIS receiver was intended to provide entertainment from a large selection of stations, with volume and quality ample for all domestic purposes, and it fulfils these requirements well. It uses a radio-frequency amplifier before the frequency-changer and two intermediate-frequency stages, thus assuring a high degree of selectivity and sensitivity, while the push-pull output stage enables distortion in this section to be kept down and provides a satisfying reserve of power. By employing iron-cored, ready-made coils and a tuning scale to suit, difficulties in this direction are reduced and it is not difficult to align the whole receiver without any service oscillator being necessary. But this will be covered in detail later; it should meanwhile be noted that *all* coils and I.F. transformers throughout the circuit are iron-cored, and that the cores are adjustable. This explains why padding and I.F. transformer condensers are fixed components.

Actually, the circuit lends itself well to construction in a simplified form. As a guide to the constructor who may be interested in this point, the original receiver was built up over a period, beginning with a five-valve circuit. If a chassis about 8in. by 12in. is used no alteration to the work already done will be required when extra stages are added to make up the complete circuit as described. The five-valve arrangement consisted of frequency-changer, I.F. amplifier, double diode, output and rectifier. (This is similar to many commercial popular superhets.) Long- and

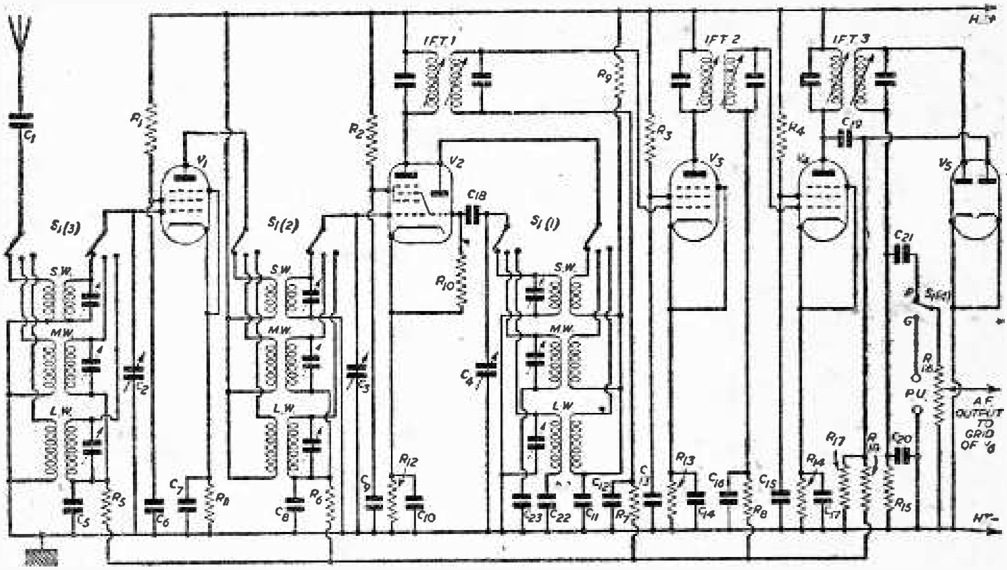


Fig. 1.—Theoretical circuit of the receiver.

LIST OF COMPONENTS

Radio Section

R1, R2, R3 and R4 (screen resistors), 47,000 ohm ½ watt.
R5, R6, R7 and R8 (A.V.C. decoupling), .5 megohm ¼ watt.
R9 (oscillator anode), 10,000 ohm ½ watt.
R10 (oscillator grid), 50,000 ohm ¼ watt.
R11, R12, R13 and R14 (cathode resistors), 220 ohm ½ watt.
R15 (diode A.F. load), .5 megohm ½ watt.
R16 (volume control), .5 megohm potentiometer with switch.
R17 and R18 (A.V.C. line), .5 megohm ¼ watt.
C1 (aerial condenser), .0003 μF 500 volt.
C2, C3 and C4, 3-gang .0005 μF tuning condenser.
C5 to C17, .1 μF each.
C18, C19 and C20, .0001 μF each.
C21, .02 μF.
C22 (long-wave padder), .0002 μF (fixed).
C23 (medium-wave padder), .00045 μF (fixed).
Aerial, H.F. and Oscillator coils for 16 to 50, 200 to 550 and 800 to 2,000 metres. (E.g., "Supacoils" types 3/1, 3/2, 3/3, 2/1, 2/2, 2/3, 1/1, 1/2 and 1/3.) Nine .00005 μF. presets.
6-pole 4-way switch. 5 octal valveholders. 3 465 kcs. I.F. transformers. Wide-vision reduction drive and dial.

ave Superhet

Receiver in Two Units

RAYER

medium-wave coils only were used, but a four-way switch was fitted so that short waves and gramophone operation would be possible later.

Subsequently, a triode was added between the double diode and output stages, and after a while the latter stage was changed to push-pull. The R.F. stage was then added, together with coils for the s.-w. range. Later, the second I.F. stage was added. However, the relative simplicity of an I.F. stage may result in the constructor adding the second I.F. before the R.F. is provided, and a high standard will still be retained if the R.F. is never added.

Amplifier and rectifier sections are built on a separate chassis, thus effectively dividing the construction into two parts.

The Radio Unit

The circuit is shown in Fig. 1. Component values will be seen from the component list, but matters will be simplified if it is remembered all screen grid and cathode by-passing condensers are of .1 μF. capacity; this value is also used for A.V.C. decoupling. On the s.-w. range A.V.C. is not applied to R.F. or frequency-changer valves.

An A.F. volume control is incorporated in this section, being arranged so that it is also effective when a pick-up is used. The circuit proves very satisfactory for record playing, and R.F. and frequency-changer stages are rendered inoperative to prevent possibility of radio break-through.

The chassis layout of the radio section is shown in Fig. 2. The chassis is approximately 8in. by 12in. When mounting the parts in the positions shown place the I.F. transformers so that the adjusting screws on the cores are easily accessible. For preference, the two left-hand transformers should have the screws to the left and the right-hand transformer should have its screws to the right.

The coils are fixed by drilling a ¼in. diameter hole for each coil, passing the narrow stem through, and pressing on the self-locking clip provided, as illustrated in Fig. 4. Place the aerial coils below the chassis (see Fig. 3), with oscillator and frequency-changer grid coils on top, as depicted in Fig. 2.

Wiring Details

The wiring plan is given in Fig. 3, but a few points should be noted. To reduce possibility of hum, keep heater wiring close against the chassis and as far as possible from grid anode connections. All the leads shown can now be put on, leaving coil and wavechange switch connections for the moment.

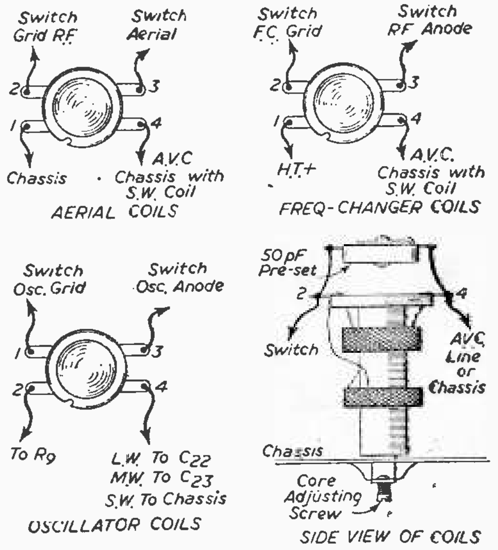


Fig. 4.—Coil connection details.

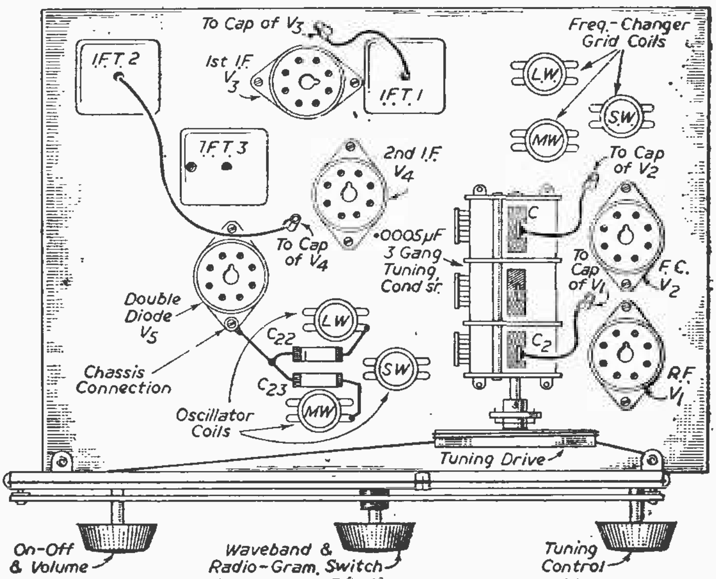


Fig. 2.—Chassis layout of the receiver section.

Some makes of I.F. transformers may have a different method of colour-coding, and this should be watched. As a rule it is quite easy to see which pairs of leads are common to the transformer windings; if not, a test for continuity will reveal this.

All connections should be insulated and joints and wire-ended resistors positioned so that no short-circuit to chassis or elsewhere is possible. Where one end of the decoupling and by-pass condensers is marked with a band or the letters "O.F.," this denotes the outside foil, and this end of the component should be taken to the chassis. (All points marked "M.C." should similarly be taken to the chassis.)

Coil Connections

Connections for the specified coils are given in detail in Fig. 4. Note that each coil has a notch, against which the relative positions of the tags can be identified. All the long- and medium-wave signal-frequency coil tags marked 4 are returned to the A.V.C. line. With the short-wave coils, these tags are connected to the chassis. Similarly, all the primary windings of the three aerial coils are returned to the chassis, and all the primary windings of the frequency-changer grid coils are taken to H.T. positive, so that wiring up is not difficult.

A .00005 μF. preset condenser is connected in parallel with each tuned winding, and the best method to do this is to mount the condensers immediately above each coil, as shown in Fig. 4. Connect the plate in contact with the adjusting screw of the condenser to chassis or A.V.C. line end of the coil; otherwise the presence of a metal tool used for trimming will materially affect capacity and make the final aligning of the set difficult. (These presets are not shown in Figs. 2 or 3 or in the coil diagrams in Fig. 4, for clarity.)

Wavechange Switch Wiring

All the wavechange switch connections will be shown in Fig. 5. To simplify wiring up and to avoid instability, a switch with four wafers and a long spindle is used. Referring Fig. 5 to Fig. 3, the wafers are as follows:

Wafer 1 goes at rear and is for oscillator coils. Wafer 2 is immediately before this and is for the anode circuit of the R.F. valve and grid circuit of the frequency-changer. Wafer 3 is for the aerial coils, and is near the front of the chassis. Wafer 4 is for radiogram switching and is nearest the control knob. When wiring up, note that the anode and grid circuits of the valves are not left open when the switch is in the "Gram" position, but that the control grids of the R.F. and frequency-changer valves are returned directly to the chassis.

(To be continued.)

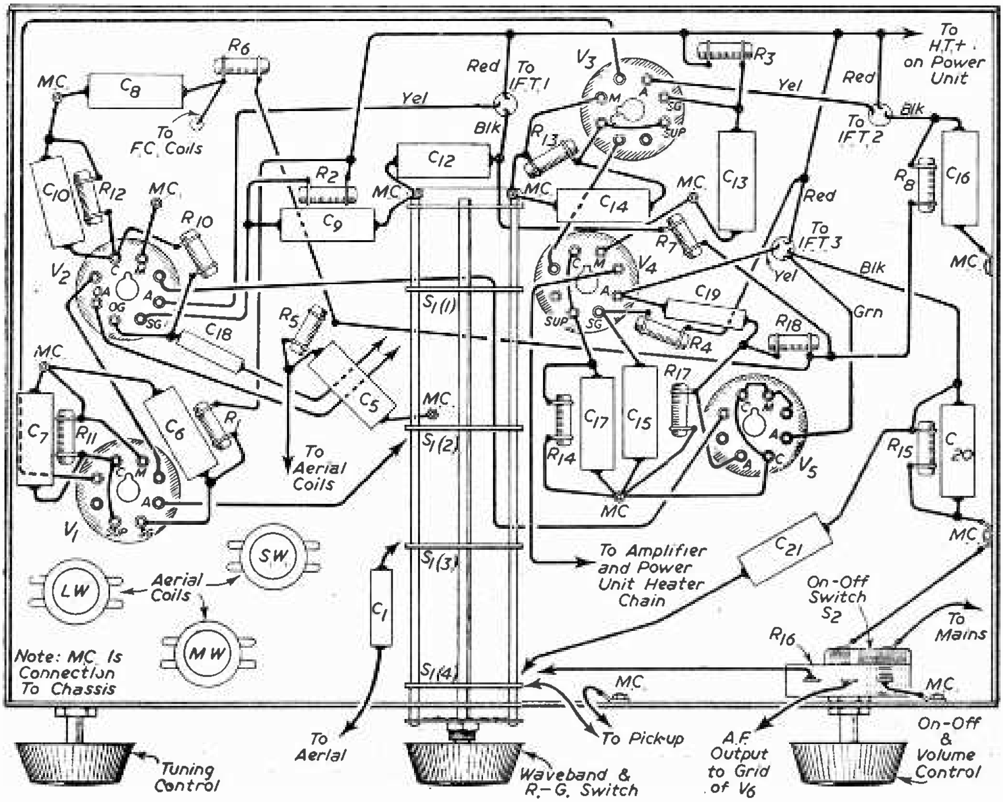


Fig. 3.—Wiring details of the receiver section. The amplifier portion will be dealt with next month.

The Copenhagen Plan

Details of the New Wavelengths

ON March 15th last, the Copenhagen wavelength plan was put into effect with mixed results. There was some confusion at first but since the introduction conditions have settled down and it would appear that the listeners will undoubtedly benefit in spite of "pirates"—stations which have so far refused to adopt the new wavelengths allocated to them.

The Need for a Wavelength Plan

It must be remembered that broadcasting is only one of many services using radio as a means of communication, all demanding clear wavelength channels which will not be subject to interference from other services. The first requirement is, therefore, to segregate the various services which is done by allocating certain blocks of wavelengths, or wave-bands, to each. This must be done on a world basis and the allocations need to be revised from time to time as the use of radio for all purposes expands. The latest revision was made at a conference of the International Telecommunication Union at Atlantic City in 1947, where the wave-bands available for broadcasting were slightly enlarged compared with those allocated at the previous Cairo Conference held in 1938. The two wave-bands allocated for broadcasting in the European area, known generally to listeners as the medium wave- and long wave-bands are as follows:

Medium Wave-band

Frequency kc/s	*Wavelength metres*	
525–1605	571–187	Exclusive to broadcasting.

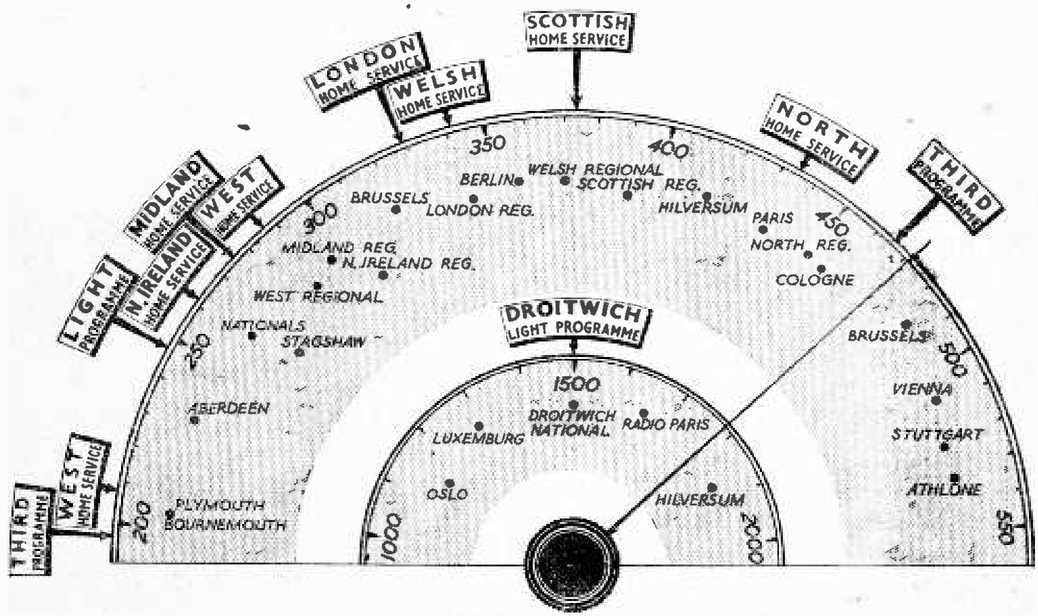
Long Wave-band

Frequency kc/s	*Wavelength metres*	
150–160	2000–1875	Shared with the maritime mobile service.
160–255	1875–1176	Exclusive to broadcasting.
255–285	1176–1053	Shared with the maritime mobile service and with aeronautical radionavigation.

Broadcasting in Europe

The Atlantic City Regulations laid down that a European Regional Conference should be held to allocate individual wavelengths to broadcasting stations and this took place at Copenhagen in 1948. Thirty-three countries in the European area were epresented at this conference.

The need for this detailed allocation arises because the transmissions from a broadcasting station anywhere in Europe may well be audible in neighbouring countries in the daytime and throughout the greater part of the Continent after nightfall. Something must, therefore, be done in order that the transmissions from one station shall not interfere unduly with those from another and thus prevent listeners from hearing clearly the programmes from their local stations. Ideally, every transmitter would be given a different wavelength (or more correctly a different frequency channel), but this is not possible because the number of broadcasting stations greatly exceeds the number of frequency channels available.



Appearance of the standard Tuning Dial showing positions of the B.B.C. stations under the new plan.

Some sharing between broadcasting stations in different European countries is therefore inevitable, and fortunately, if suitable precautions are taken, this is possible without undue mutual interference. The object of the Copenhagen Plan is to reduce interference between stations to a minimum by allocating wavelengths to individual transmitters and not just to countries. The wavelengths are allocated on a geographical basis, in such a way that stations that share wavelengths, or use adjacent wavelengths, are so far from each other that mutual interference should be negligible. The maximum power of every transmitter and the precision with which its allotted frequency must be maintained are specified in the Plan.

Frequency Allocations

The tables below show the distribution of frequencies among the broadcasting stations of the European area and the maximum power which each may use in accordance with the Copenhagen Plan.

Long Waves

Band of 150-285 kc/s (2000 to 1053 metres approximotely)

Frequency kc/s	Approx. Wave-length metres	Station	Country	Power kW
155	1935	Brasov	Roumania	150
		Tromso	Norway	10
164	1829	Allouis	France	450
173	1734	Moscow I	U.S.S.R.	500
182	1648	Reykjavik	Iceland	100
		Lulea	Sweden	10
		Ankara	Turkey	120
191	1571	Motala	Sweden	200
200	1500	Droitwich I	United Kingdom	400
209	1435	Kiev I	Ukraine	150
218	1376	Oslo	Norway	200
227	1322	Warsaw I	Poland	200
236	1271	Leningrad I	U.S.S.R.	100
245	1224	Kalundborg	Denmark	150
254	1181	Lahti	Finland	200
263	1141	Moscow II	U.S.S.R.	150
272	1103	Czechoslovakia	Czechoslovakia	200
281	1068	Minsk	Bielorussia	100

Derogations

(*i.e., stations authorised to work outside the broadcasting bands*)

Bands of 415 to 490 kc/s and 510 to 525 kc/s.

Frequency kc/s	Approx. Wave-length metres	Station	Country	Power kW
420	714	Ostersund	Sweden	10 (1)
433	693	Oulu	Finland	10 (2)
520	577	Hamar	Norway	1 (3)

Medium Waves

Band of 525 to 1605 kc/s (571 to 187 metres approximately).

Frequency kc/s	Approx. Wave-length metres	Station	Country	Power kW
529	567	Beromunster	Switzerland	150
539	557	Budapest I	Hungary	135
548	547	Ouchta	Finnish Carelia	20
		Simferopol	U.S.S.R.	100
557	539	Cairo II	Egypt	20
		Helsinki	Finland	100 (4)
		Monte Ceneri	Switzerland	50
566	530	Athlone I	Ireland	100
		Catania	Italy	5
		Palermo	Italy	10
575	522	Riga	Latvia	100
584	514	Vienna I	Austria	120
593	506	Sofia II	Bulgaria	60 (5)
		Sundsvall	Sweden	150 (6)
602	498	Lyons	France	150
611	491	Petrozavodsk	Finnish Carelia	100
		Eidar	Iceland	5
		Rabat I	Morocco	120
		Sarajevo	Yugoslavia	60
620	484	Brussels I	Belgium	150
		Malatya	Turkey	50
629	477	Vigra	Norway	100
		Tunis II	Tunisia	120 (7)
638	470	Prague I	Czechoslovakia	150
647	464	Daventry	United Kingdom	120*
		Kharkov	Ukraine	100
656	457	Bolzano	Italy	20 by night
		Florence I	Italy	80
		Naples I	Italy	80
		Turin I	Italy	45
		Murmansk	U.S.S.R.	150
665	451	Vilnus	Lithuania	100
674	445	Marseilles	France	100
		Bodo	Norway	10
		Rostov, Don	U.S.S.R.	100
683	439	Belgrade I	Yugoslavia	150
692	434	Nicosia	Cyprus	10
		Moorside Edge	United Kingdom	150
701	428	Rabat II	Morocco	120
		Finnmark	Norway	20
		Banska-Bystrica	Czechoslovakia	100
		and Synchronised network	Czechoslovakia	5
710	423	Limoges	France	150
		Stalino	Ukraine	150
719	417	Lisbon National	Portugal	120
		Damascus I	Syria	50
728	411	Athens	Greece	100
737	407	Seville	Spain	50
		Akureyri	Iceland	1
		Jerusalem I	Palestine	20
		Gliwice	Poland	50
746	402	Hilversum I	Holland	120
755	397	Kuopio	Finland	20
		Norte Nacional	Portugal	50
		Timisoara	Roumania	50 (8)
764	393	Sottens	Switzerland	150
773	388	Cairo I	Egypt	50
		Stockholm	Sweden	150 (9)
782	384	Kiev II	Ukraine	100
		Soviet Troops in Germany		70
791	379	Rennes	France	150
		Thessalonika	Greece	50
800	375	Leningrad II	U.S.S.R.	100
809	371	Burghead	United Kingdom	100
		Redmoss	United Kingdom	20
		Westerglen	United Kingdom	100
		Skoplje	Yugoslavia	135
818	367	Poznan	Poland	100
827	363	Sofia I	Bulgaria	100
836	359	Nancy	France	150
		Beyrouth I	Lebanon	20
845	355	Rome I	Italy	150
854	351	Bucharest	Roumania	150
863	348	Paris I	France	150
872	344	Moscow III	U.S.S.R.	150
881	341	Penmon	United Kingdom	20
		Washford	United Kingdom	150 (10)
		Wrexham	United Kingdom	5
		Cetinje	Yugoslavia	20
890	337	Algiers I	Algeria	100 (11)
		Bergen North	Norway	20
		Kristiansand	Norway	20
		Trondelag	Norway	20
		Dniepropetrovsk	Ukraine	20
899	334	Milan I	Italy	150
908	330	London (Brookmans Park)	United Kingdom	150
917	327	Ljubljana	Yugoslavia	135
926	324	Brussels II	Belgium	150
935	321	Lvov	Ukraine	100

(1) Directional aerial, protection south-west.
(2) Directional aerial; protection south-west.
(3) Directional aerial, protection south.
(4) Directional aerial, protection Monte Ceneri.
(5) Directional aerial. Apparent power in direction Sundsvall, 10 kW.
(6) Directional aerial. Apparent power in direction Sofia II, 20 kW.
(7) Directional aerial, protection Vigra.
* The Plan permits lower-power stations to be synchronised on this frequency. They will be at Edinburgh, Glasgow, Newcastle and Redmoss.
(8) Unless a directional aerial protecting Norte Nacional is used, the power shall not exceed 20 kW.
(9) The apparent power of the station of Stockholm in the direction of Cairo I shall not exceed 20 kW.
(10) Directional aerial. The apparent power in the direction Cetinje shall not exceed 150 kW.
(11) Directional aerial, protection Norway.

Frequency kc/s	Approx. Wavelength metres	Station	Country	Power kW
944	318	Toulouse	France	100
		Voronej	U.S.S.R.	20
953	315	Morava	Czechoslovakia	150
962	312	Turku	Finland	100 (12)
		Tunis I	Tunisia	120 (13)
971	309	Germany (British Zone)	Germany	70
		Kalinin	U.S.S.R.	20
		Smolensk		20
		Izmir	Turkey	50
980	306	Algiers II	Algeria	100 (14)
		Göteborg	Sweden	150 (15)
989	303	Germany (American Zone)	Germany	70
		Rovaniemi	Finland	10
		Beyrouth II	Lebanon	20
998	301	Kichinev	Moldavia	100
1007	298	Hilversum II	Holland	120
		Aleppo I	Syria	20
1016	295	Istanbul	Turkey	150
1025	293	Graz-Dobl	Austria	100
		Jerusalem II	Palestine	20
1034	290	Tallinn	Estonia	100
		Turin II	Italy	10
		Portuguese Radio-club	Portugal	40
1043	288	Germany (U.S.S.R. Zone)	Germany	70
		Kalamata	Greece	5
		Agadir I		20
		Marrakech I	Morocco	20
		Oujda I		20
1052	285	Tripoli	Libya	50 (16)
		Jassi	Roumania	10
		Focsani		5
		Start Point	United Kingdom	150 (17)
1061	283	Denmark (East)	Denmark	60
		Cagliari	Italy	10
		Lisbon Regional	Portugal	15
1070	280	Paris II	France	100
		Krasnodar	U.S.S.R.	20
1079	278	Wroclaw	Poland	50
1088	276	Korca	Albania	10
		Shkodra		10
		Droitwich III	United Kingdom	150
		Norwich		20
1097	273	Bratislava	Czechoslovakia	150
		and Synchronised network		5
1106	271	Moghilev	Biclorussia	100
1115	269	Bari I		50
		Bologna I	Italy	50
		S. Remo		5
		Norwegian Synchronised network	Norway	5
1124	267	Brussels III	Belgium	20
		Varna	Bulgaria	5
		Viborg	U.S.S.R.	20
1133	265	Zagreb	Yugoslavia	135
1142	263	Constantine I	Algeria	20
		Oran I		40
		Kaliningrad	U.S.S.R.	20
1151	261	Baia Mare		5
		Cluj	Roumania	20
		Oradea		5
		Lisnagarvey		100
		Londonderry	United Kingdom	5
		Stagshaw		100
1160	259	Strasbourg I	France	150
1169	257	Odessa	Ukraine	150
1178	255	Hörby	Sweden	100
1187	253	Budapest II	Hungary	135
1196	251	Germany (French Zone)	Germany	70
		Kerkyra	Greece	15
		Agadir II		20
		Marrakech II	Morocco	20
		Oujda II		20

(12) Directional aerial, protection Tunis.
(13) Directional aerial, protection Turku.
(14) Directional aerial, protection Göteborg.
(15) Directional aerial, protection Algiers.
(16) Directional aerial, protection Start Point.
(17) Directional aerial, protection Tripoli.

Frequency kc/s	Approx. Wavelength metres	Station	Country	Power kW
1205	249	Bordeaux	France	100
		Haifa	Palestine	5
		Lublin	Poland	10
1214	247	Atlantic Reg. Azores	Portugal	2
		Brookmans Park		60
		Burghead		20
		Lisnagarvey		10
		Londonderry		1
		Moorside Edge		58
		Plymouth		2
		Redmoss	United Kingdom	2
		Redruth		2
		Stagshaw (Newcastle)		10
		Westerglen		50
		British Troops in Germany		70 (18)
		Kursk	U.S.S.R.	20
1223	245	Stara Zagora	Bulgaria	20
		Barcelona	Spain	20
		Falun	Sweden	100
1232	244	Budejovice		5
		Cechy-Zapad	Czechoslovakia	25
		Moravia-Vychod		25
		Prague II		100
1241	242	Vaasa	Finland	50
		Bayonne		20
		Clermont-Ferrand		20
		Corsica		10
		Grenoble	France	20
		Le Havre		20
		Montbeliard		20
		Nice		20
		Quimper		20
		Tiraspol	Moldavia	20
1250	240	Lower Egypt	Egypt	5
		Lower Egypt		5
		Nyiregyhaza		10
		Zalaegerszeg (or Szombathely)	Hungary	20 (19)
		Athlone II	Ireland	50
1259	238	Stettin	Poland	100
1268	237	Belgrade	Yugoslavia	135
1277	235	Lille	France	150
1286	233	Radio Catolica	Portugal	20
		Kosice	Czechoslovakia	100
1295	232	Ottringham	United Kingdom	150
1304	230	Constantine II	Algeria	20
		Oran II		40
		Danzig	Poland	50
1313	228	Stavanger	Norway	100
1322	227	Ouzhgorod	Ukraine	100
1331	225	Genoa I		50
		Messina		25
		Pescara	Italy	25
		Rome II		50
		Venice I		25
1340	224	Alexandria	Egypt	5
		Budapest		5
		Magyaróvár	Hungary	5
		Miskolc		5
		Pécs		5
		Crowborough	United Kingdom	150
1349	222	Corsica		10
		Marseilles	France	50
		Nantes		10
		Toulouse		50
		Kuldiga	Latvia	20
		Madona		20
1358	221	Tirana I	Albania	100
1367	219	Thorshavn	Faroe Islands	5
		Caltanissetta	Italy	25
		Torun	Poland	24
		Porto Regional	Portugal	5
1376	218	Strasbourg II	France	150
1385	217	Madrid	Spain	100
		Kaunas	Lithuania	150
1394	215	Dornbirn		5
		Graz	Austria	15
		Innsbruck		5
		Linz		5
		Rhodes	Greece	5
		Swedish Sync. network (South)	Sweden	20

(18) The power shown against British troops in Germany is permitted as an exceptional addition to the normal maximum for a synchronised network.
(19) Directional aerial, protection Athlone.

Frequency kc/s	Approx. Wave-length metres	Station	Country	Power kW
1403	214	Baranovitchi	Bielorussia	20
		Bayonne	France	20
		Lille	France	20
		Paris	France	10
		Quimper	France	20
		Montpellier	France	10
		Nice	France	20
		French Troops in Germany	France	25
		Komotini	Greece	5
1412	212	Banja Luka	Yugoslavia	20
		Bitolja	Yugoslavia	20
		Maribor	Yugoslavia	20
		Pristina	Yugoslavia	20
		Rijeka	Yugoslavia	20
		Split	Yugoslavia	60
1421	211	Sarrebruck	Saar	20
		Sfax	Tunisia	5
		Tchernigov	Ukraine	5
1430	210	Girocastro	Albania	5
		Denmark (West)	Denmark	70
		Copenhagen	Denmark	10
		Madrid II	Spain	50
1439	208	Luxembourg	Luxembourg	150
1448	207	Ancona	Italy	25
		Florence II	Italy	3
		Genoa II	Italy	5
		Milan II	Italy	50
		Naples II	Italy	5
		Venice II	Italy	5
		Portuguese Sync. network	Portugal	5
		Swedish Sync. network (North)	Sweden	20
1457	206	Craiova	Roumania	20
		Bartley	United Kingdom	60
		Clevedon	United Kingdom	60
1466	205	Monte-Carlo	Monaco	120
		Norwegian Sync. Network	Norway	2
1475	203	Vienna II	Austria	30
		Salzburg	Austria	20
		Klagenfurt	Austria	20
1484	202	International Common Frequency Types I and II	Albania	
			Germany (British Zone)	
			Austria	
			Belgium	
			Cyprus	
			Vatican City	(20
			Denmark	
			Spain	
			Finland	
			France	
			Gibraltar	
			Greece	
			United Kingdom	
			Hungary	
			Ireland	
			Italy	
			Lithuania	
			Malta	
			Morocco	
			Norway	
			Poland	
			Portugal	
			Roumania	
			Rep. of S. Marino	
			Syria	
			Czechoslovakia	
			Trieste	
			Tripoli	
			Tunisia	
			Ukraine	
			Yugoslavia	
			U.S.S.R.	
1493	201	Gomel	Bielorussia	20
		French Sync. Network	France	60
1502	200	Zaragoza	Spain	50
		Krakow	Poland	50
		Warsaw II	Poland	10
1511	199	Brussels IV	Belgium	20
		Chania	Greece	5
1520	197	Jihlava	Czechoslovakia	5
		Ostrava	Czechoslovakia	30
		Pilsen	Czechoslovakia	30

(20) The Vatican City is authorised to use this wave with a power of 5 kW until receivers for 1529 kc/s are in widespread use.

Frequency kc/s	Approx. Wave-length metres	Station	Country	Power kW
1520	197	Coruna	Spain	20
1529	196	Vatican City	Vatican City	100
		Funchal	Madeira-Portugal	1
		Swedish Sync. Network (North)	Sweden	20
1538	195	Germany (French Zone)	Germany	70
		Spanish Sync. Network	Spain	5
1546	194	Belfast	United Kingdom	5
		Bournemouth	United Kingdom	2
		Brighton	United Kingdom	5
		Cardiff	United Kingdom	2
		Dundee	United Kingdom	2
		Exeter	United Kingdom	5
		Fareham	United Kingdom	2
		Hull	United Kingdom	5
		Leeds	United Kingdom	5
		Liverpool	United Kingdom	5
		Manchester	United Kingdom	2
		Middlesbrough (Stockton)	United Kingdom	2
		Plymouth	United Kingdom	5
		Preston	United Kingdom	2
		Redruth	United Kingdom	2
		Sheffield	United Kingdom	2
		Vinnitza	Ukraine	5
1554	193	Germany (American Zone Occupation Troops)	Germany	70 (21)
		Turi	Estonia	20
		Nice	France	75
1562	192	Portuguese Synchronised Network	Portuga	5
		Swedish Synchronised Network (South)	Sweden	20
		Swiss Synchronised Network	Switzerland	5
1570	191	Germany (U.S.S.R. Zone)	Germany	70
		Spanish Synchronised Network	Spain	5
		Sfax II	Tunisia	5
1578	190	Italian Synchronised Network (Bolzano Region)	Italy	10
		Fredrikstad	Norway	10
1586	189	Germany (British Zone)	Germany	70
		Spanish Synchronised Network	Spain	5
1594	188	International Common Frequency Types I and II	Andorra	
			Austria	
			Belgium	
			Bulgaria	
			Cyrenaica	
			Denmark	
			Spain	
			Finland	
			France	
			Greece	
			Ireland	
			Latvia	
			Maderia-Portugal	
			Morocco (Tangier)	
			Norway	
			Holland (22)	
			Poland	
			Portugal	
			United Kingdom	
			Switzerland	

(21) The methods of use of the frequency 1554 kc/s by the station of Nice, on the one hand, and by the station of the Army of Occupation of the United States of America in Germany, on the other hand, shall be the subject of a special agreement between the Governments concerned.

(Continued on page 222.)

ICS

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MOORSIDE EDGE	Northern	668	449	100	692	434	150
WESTERGLEN	Scottish	767	391	60	809	371	100
BURGHEAD	,,	767	391	60	809	371	100
REDMOSS	,,	767	391	2.5	809	371	20
WASHFORD	Welsh	804	373	60	881	341	150
PENMON	,,	804	373	10	881	341	20
WREXHAM	,,	804	373	1	881	341	5
BROOKMANS PARK	London	877	342	100	908	330	150
START POINT	West	977	307	100	1052	285	150
DROITWICH	Midland	1013	296	60	1088	276	150
NORWICH	,,	0113	296	1	1088	276	20
LISNAGARVEY	N. Ireland	1050	285	100	1151	261	100
LONDONDERRY	,,	1050	285	1	1151	261	5
STAGSHAW	,,	1050	285	100	1151	261	100
CLEVEDON	West	1384	217	20	1457	206	60
BARTLEY	,,	1384	217	10	1457	206	60

LIGHT PROGRAMME

Transmitting Station	*Before the introduction of the Copenhagen Plan* Freq. kc/s	Approx. W/L metres	Power kW	*After the introduction of the Copenhagen Plan* Freq. kc/s	Approx. W/L metres	Power kW*
DROITWICH	200	1500	200	200	1500	400
BROOKMANS PARK	1149	261	60	1214	247	60
BURGHEAD	1149	261	20	1214	247	20
LISNAGARVEY	1149	261	10	1214	247	10
LONDONDERRY	1149	261	1	1214	247	1
MOORSIDE EDGE	1149	261	60	1214	247	58
PLYMOUTH	1149	261	1	1214	247	2
REDMOSS	1149	261	2	1214	247	2
REDRUTH	1149	261	2	1214	247	2
STAGSHAW	1149	261	10	—	—	—
NEWCASTLE	—	—	—	1214	247	10
WESTERGLEN	1149	261	60	1214	247	50

THIRD PROGRAMME

Transmitting Station	*Before the introduction of the Copenhagen Plan* Freq. kc/s	Approx. W/L metres	Power kW	*After the introduction of the Copenhagen Plan* Freq. kc/s	Approx. W/L metres	Power kW*
DROITWICH	583	514	20	—	—	—
DAVENTRY	—	—	—	647	464	120
EDINBURGH	1474	203	2	647	464	2
GLASGOW	1474	203	2	647	464	2
NEWCASTLE	1474	203	1	647	464	2
REDMOSS	1474	203	2	647	464	2
BELFAST	1474	203	1	1546	194	5
BOURNEMOUTH	1474	203	1	1546	194	2
BRIGHTON	1474	203	1	1546	194	5
BRISTOL	1474	203	1	—	—	—
CARDIFF	1474	203	1	1546	194	2
DUNDEE	1474	203	1	1546	194	2
EXETER	1474	203	1	1546	194	5
FAREHAM	1474	203	1	1546	194	2
HULL	1474	203	1	1546	194	5
LEEDS	1474	203	1	1546	194	5
LIVERPOOL	1474	203	1	1546	194	5
LONDON (BROOKMANS PK.)	1474	203	20	—	—	—
MANCHESTER	1474	203	1	1546	194	2
MIDDLESBROUGH (STOCKTON)	1474	203	1	1546	194	2
PLYMOUTH	1474	203	1	1546	194	5
PRESTON	1474	203	1	1546	194	2
REDRUTH	1474	203	2	1546	194	2
SHEFFIELD	1474	203	1	1546	194	2

* *Maximum permitted in the Copenhagen Plan.*

Fixed Resistors

Some Important Facts Regarding a Simple Component

By ERIC LOWDON

THE resistor is, undoubtedly, the simplest and most widely used component in radio. It also gives the least trouble—when properly used. In fact, one might think that it is hardly worth while devoting an article exclusively to resistors.

Nevertheless, there are some interesting points about resistors that are not generally appreciated by the inexperienced. Sometimes even the older experimenters run into difficulties.

For instance, consider the following conundrum. When is a one-watt resistor not a one-watt resistor? At first glance this may seem to be rather silly and pointless, but the answer is of prime importance in the design of oscillographs, television receivers, and, in fact, any equipment where high operating potentials are used. Under high voltage conditions a one-watt resistor may be capable of dissipating only $\frac{1}{8}$ watt with safety.

The reason for this is that if the voltage impressed across a composition resistor exceeds a certain value—irrespective of its nominal wattage rating—then the ohmic value of the resistor will be reduced considerably—sometimes by as much as 50 per cent.—thus causing a corresponding drop in operating voltage in the equipment.

The writer ran into this trouble himself when a resistor which appeared to be working well within its rating kept on going down in value. It was not till a friend drew his attention to the following information that the trouble was satisfactorily cleared up.

Voltage Limits

Resistors, in common with condensers, have voltage limits placed on them by the manufacturers which are calculated to overcome this trouble. One well-known firm gives the limits for their $\frac{1}{4}$, $\frac{1}{2}$ and 1 watt resistors as 250, 350 and 500 volts respectively. These figures will no doubt vary slightly between one maker and another, but they may be taken as representative.

What effect, then, is this going to have on our choice of resistor for a particular job?

Let us consider a 1 watt, 2 megohm resistor. As already stated, the maximum voltage which can be safely developed across it is 500. That is to say the watts dissipated at this figure will be

$$W=\frac{E^2}{R}=\frac{500^2}{2\times 10^6}=.125 \text{ watts.}$$

Thus we have the anomaly that a 1 watt 2 megohm resistor has an actual maximum rating of .125 watts. A higher dissipation than this means, of course, that a voltage higher than the specified limit is developed across the resistor, and will lead to trouble.

To take another example, suppose in some piece of equipment we have a 2,000 volt supply feeding into a resistor chain, through which is flowing .0007 amp. If now we have included in the chain a $\frac{1}{2}$ watt 1 megohm resistor, then the calculated dissipation will be

$$W=I^2\times R=.0007^2\times 10^6=0.49 \text{ watts.}$$

At first glance it would seem that our resistor is safely rated, but—what is the voltage across the resistor?

$$E=I\times R=.0007\times 10^6=700 \text{ volts.}$$

Twice the maximum voltage specified for a half-watt resistor! It is even 200 volts more than that specified for a one-watt resistor. In this case, therefore, it would be necessary to use a two-watt resistor to dissipate 0.49 watt.

A few simple calculations on the above lines will show that the trouble will occur mainly with the higher resistance values and that in normal sound-receiver design the problem will not arise because the voltages involved are comparatively low.

Resistance Tolerances

Resistance tolerances, as we know, vary from 20 per cent. for general purpose resistors down to 1 per cent. for accurate special purpose resistors. In circuit diagrams the tolerance may be taken as 20 per cent. unless otherwise stated. That is to say, a resistor with a nominal value of 1,000 ohms will in actual fact have a value somewhere between 800 and 1,200 ohms.

Yet how often does one see a beginner who is assembling an experimental hook-up search despairingly through his junk box for a 1,000 ohm resistor when he has a selection of 680 ohm and 1,500 resistors, one of which may be 20 per cent. high or low to give a value as near the 1,000 ohm mark as a brand new nominal 1,000 ohm resistor.

If accuracy is important, there is no reason why the old dodge of scraping a carbon resistor should not be resorted to.

The idea is to select a resistor that is *lower* in value than that required and file it gradually, measuring the resistance after each stroke with the file until the desired value is obtained. But it is essential that the measuring instrument be at least as accurate as the accuracy desired in the resistor. To attempt to get 5 per cent. accuracy with an instrument that can be relied on to only 20 per cent. would, of course, be the height of folly.

Don't forget also that if very much is scraped off the resistor, then the wattage will be correspondingly reduced.

Simple Valve Tester

An Adaptable Unit for Testing Special Valves

By D. CAVE

DURING the course of building a television receiver made from ex-Government radar equipment, the writer acquired a large number of VR91 (EF50) and VR65 (SP61) valves, and it became imperative recently to test these valves, so the following simple tester unit was constructed. It was designed to test only the two types of valves indicated above; but if the principle of operation is understood it will be easy to adapt the unit for other types.

The most important factor of a valve is its mutual conductance (often called the "goodness" of a valve); and this is the extent to which the anode current changes for a change of one volt at the grid. Thus the makers quote the mutual conductance (gm.) of an EF50 as $6\frac{1}{2}$ mA. per volt and for an SP61 as $8\frac{1}{2}$ mA. per volt. This means that the anode current of the EF50 will change by $6\frac{1}{2}$ mA., whilst that of the SP61 will change by $8\frac{1}{2}$ mA., if the grid potential of either is changed by one volt over the working range.

The stage gain of a pentode with an anode load much less than the Ra of the valve is given by the product of the mutual conductance and the value of the anode load. Thus, if we use an EF50 with an anode load of 50,000 ohms the gain will be 325.

As a valve ages the mutual conductance falls; consequently the stage gain falls as well.

The Circuit

In order to test the mutual conductance it is simplest to measure the anode current at two bias voltages one volt different from one another. It is important to arrange that the one volt change covers the normal working bias of the valve. In the case of the EF50 and SP61 valves the working bias is about -2 volts. Therefore, the anode currents should be measured at $-1\frac{1}{2}$ volts and $-2\frac{1}{2}$ volts grid bias. The resulting difference in anode current will be the mutual conductance of the valve. The circuit of the tester is as in Fig. 1. The power supplies are obtained from a convenient receiver with an H.T. supply of about 250 volts, and a heater supply of 6.3 volts (one side earthed to chassis and negative H.T.).

The battery B is a twin cell dry battery with a switch S incorporated in its circuit so that battery life may be conserved when the unit is not in use. The resistances R1, R2 and R3 are chosen to give the required -1.5 volts and -2.5 volts grid bias. R3 should be 150,000 ohms, R2 100,000 ohms, and R1 depends on the exact voltage of the battery, which may be checked when purchasing. If it is 3 volts, then R1=50,000 ohms, if 3.1 volts, it is 60,000 ohms, and if 3.2 volts, then R1=70,000 ohms. All the resistances should be as close as possible to their values.

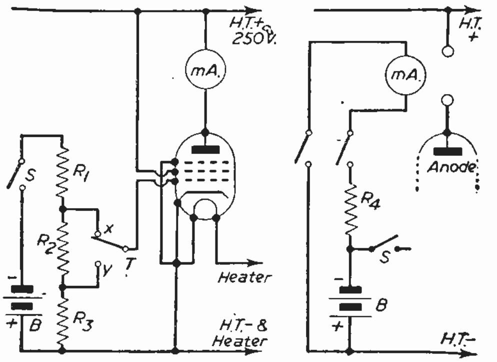
The switch T is a telephone press-button type and is chosen for its quick changeover action. It is not wise to use a slow action switch because the grid will have no bias between the change resulting in a heavy anode current momentarily. The switch T should be so wired that in its normal position the grid is connected to X. On pressing the button, connection is made with Y and the rise of anode current is noted. The milliammeter should have a full scale deflection of 20 or 25 mA.

The tester was constructed from an A.M. control unit type 404. The cover was removed and a piece of $\frac{1}{4}$in. paxolin sheet $4\frac{1}{2}$in. by 10in. was cut to fit the box. Holes were cut in the paxolin to take the meter, two valve holders (EF50 and SP61), the switch S and the press switch T (the last two were removed from the cover of the control unit). Three holes were drilled in the sides of the box to bring out the flex power supply leads which were terminated in crocodile clips. The two valveholders were wired in parallel, the grid connection for the SP61 being brought out to a clip lead through a hole drilled near the valveholder.

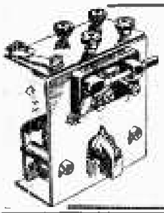
Other Valves

If it is desired to test valves other than those quoted, then the reader must fit the required valveholders, choose a battery B sufficient to supply the working bias of the valves, and calculate the new values of R1, R2 and R3. To calculate these resistances allow 100,000 ohms per volt. Thus if a valve of 6 volt working bias is to be tested use a 9 volt grid bias battery and make R3 550,000 ohms (-5.5 volts), R2 100,000 ohms (1 volt) and R1 250,000 ohms (2.5 volts). On operating the switch T the bias would change from -5.5 volts to -6.5 volts. From the makers' figures check the anode current of the valve at the working bias.

It must be remembered that the battery B has not an indefinite life, so that if the unit is not used for a long period the voltage should be checked. This might be done conveniently by using the meter in the unit with the addition of a multiplier resistance R4 and a double pole two-way switch as in Fig. 2. The value of the resistance R4 would depend on the full scale deflection of the meter and the voltage range desired. Thus for a meter of 20 mA. full scale deflection, R4 might be 1,000 ohms, when the full scale deflection would become 20 volts. For a 25 mA. meter, R4 could be 500 ohms and the full scale deflection would be 12.5 volts. Smaller values than 500 ohms for R4 should be avoided.



Figs. 1 and 2.—The circuit diagram and method of arranging battery check.



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(e) 350-0-350v. 80 mA. ... ...

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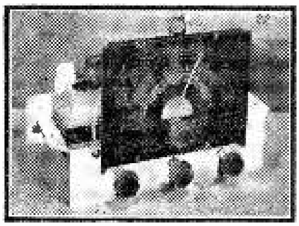

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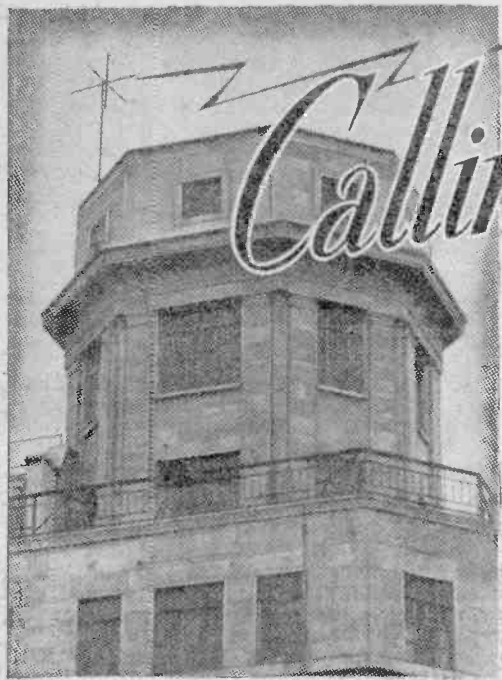

Details of Our Publisher's Radio Link with his Travellers

A RADIO link has recently been installed at Tower House, to enable the circulation manager to keep in touch with all his Town and Home Counties representatives. Many readers may have seen the new aerial on the top of the tower of our building, and the ten cars and vans used by the circulation representatives in this area have been equipped for re-

The aerial on the tower of Tower House.

ception and transmission. It is believed that Newnes & Pearson are the first publishing house to adopt this method of keeping in touch with representatives.

Reception has proved satisfactory up to 15 miles radius, although on occasion excellent results have been obtained at much greater distances. As is usual with mobile equipment, conditions vary in different localities, but so far there have been no grounds for serious complaint. Each representative has his own call sign, and the receiver is kept switched on during the day. When a call comes through he merely has to increase volume if the message is for him.

This new system will enable the publishers to give the trade a much better service in the London and Home Counties area, and in particular they are able to deal with urgent requirements with far greater rapidity than has hitherto been possible.

Mr. E. D. Lush, publisher and director of G. Newnes Ltd. at the control point.

One of our representatives using the car equipment.

Programme Pointers

This Month, Our Contributor, MAURICE REEVE, Deals with Some More Recent Programmes

STUDIO audiences have been a topic of recent discussion, so I shall be in the fashion if I add my quota of opinion to that given by others. It is a very vexing question, and would seem to concern one type of show and one only—that show in which humour, either in the dialogue spoken by the actors or in their antics and gestures, requires the response of laughter from an audience to make it seem real and alive.

Seeing that magnificent concerts, theatres, discussions, lectures, etc., are given every day without audiences, but with complete satisfaction to all concerned, tends to prove this to be the case. The symphony concert, in particular, proves the thesis right, because it is one of the very few, if not the only show we hear regularly under both conditions, i.e., in the Albert Hall with an audience (not specially assembled for the express purpose of applauding, it must be admitted) and in the studio without. Identical programmes, or types of programmes, are given in both places and, short of being present and listening to the "live" show, the consensus of opinion is that the latter are to be preferred to the former.

But, for reasons which I haven't time or space to expound here, whilst the satisfaction afforded by the most excellent performance of Shakespeare, Beethoven or Bertrand Russell is in no way impaired by the absence of rewarding applause, the comedian's jokes, gags and patter find it indispensable. Consequently, audiences have long been provided to give these shows life, substance and reality.

As we listen, however, day by day to the multitude of shows in which comedians take part, we cannot help but be struck by the way that their specially assembled audience tend more and more to defeat their object and reason for being there. Instead of, as would be the case at a "live" show, discretion being shown in the reward accorded to the good and the bad, we find the applause accorded to studio artists utterly and completely indiscriminate. Good, bad and indifferent alike, well-known or unknown, fresh or stale; all are greeted and rewarded with a volume of applause which, if recorded on a recording instrument, would not, I venture to wager, show a variation in intensity of more than five per cent. The result is an effect of complete monotony, sameness and, I fear, mediocrity.

I have never been to a studio variety show, so I cannot say how, or even if, applause is whipped up. But I do know that in studio concerts there are very often large audiences which frequently applaud vociferously, but only *after* the red light has changed to green.

Furthermore, studio audiences have, I regret to say, a habit that is spreading in the West End: I mean the breaking into applause over jokes, points or cracks before even the sentence has been brought to its conclusion is shocking in the last degree. So are the whistles, through the teeth—which always seem to come from the same people, they are so precisely alike—which automatically and unthinkingly greet every "queen of song, that delightful personality," or "that bundle of humour from the North, that comedian with a smile." So is the monotony of the stereotyped announcing. So is the even more stereotyped signature tune. The whole thing wants drastic overhaul and revision. To modernise a famous motion of former days, "studio audiences are bad, are getting worse, and should be improved." I wouldn't necessarily abolish them lock, stock and barrel, but I would definitely draw them up a completely new code of conduct, or "rules governing the actions and behaviour of audiences witnessing broadcasting performances in studios."

Goethe Poems

RICHARD CAPELL'S talk on the Third, on Schubert's settings of Goethe poems, was deeply interesting. Given as part of the Goethe centenary celebrations, the speaker pointed out how, most often, the quality of the poem was the composer's chief inspiration in the writing of a song, and how the poems of Goethe, such as "Earl King," "Margaret at the Spinning Wheel," the songs of Mignon and The Harper from "Wilhelm Meister," and many others, were amongst the master's most glorious and imperishable examples. The upshot was that, not only did Schubert set more Goethe poems than anyone else but there are more masterpieces amongst them than any one else's. There must be something in it.

"The Virginians"

THE Sunday evening serial adaptation of Thackeray's "The Virginians," grievously suffers from far too much of Mr. Thackeray's narration. It clogs the works and acts as a huge brake on the sweep and action of the story, the more so as the author is made to sound so unctious and mealy-mouthed. I have no idea whether he was actually like it in real life. The story, in any case, doesn't seem to have enough life or incident in it, in any case, to sustain it over so many weeks, delightful as it is to read.

Lord David Cecil

ANOTHER delightful talk—home service—was the fourth in "The English Novel" series, "Sir Walter Scott's Vision of Life," given by Lord David Cecil. Quoting the poet Gray as saying he would be content to pass eternity reading French romances, Lord David expressed what would be his bliss at spending it reading Scott's novels. Personally, I would like to spend mine with both those abundant and ripe harvests plus Dickens. But I suppose I should be told by the customs officials on the other side of the Styx that I had exceeded the luggage limit, especially as my "French romances" would include the last two hundred years' contributions, unknown to Gray. What would he have said!

(*Continued on page* 220)

(*Continued from page 218*)

French Music

A MAGNIFICENT pianist in the person of Gieseking gave two marvellous programmes of French music on the Third: Debussy's first book of Preludes and Ravel's complete set of "Mirrors." Such glorious playing of this school of piano music cannot be matched to-day and has not been matched since Cortot was in his heyday. The variety of nuance, subtlety of rhythm and bringing to life of each picture the pieces portrayed, were matchless.

Solomon

THE B.B.C. Symphony Concert contained a lovely performance of a rarely heard Haydn symphony, No. 99, under Sir Adrian, and a good average one of the "Emperor," by Solomon. As with studio audiences' applause, I am sure that the variety of tone colour Mr. Solomon imparts into cantabile passages and such pieces as concerto slow movements, cannot vary by any greater amount, if as much.

"We Beg to Differ"

SINCE I commented on "We Beg to Differ," all doubts as to whether such a type of show would "stay the course" seem to have been resolved into a very emphatic affirmative. It is now well established, though I am a little dubious as to whether its sub-title "a light-hearted discussion on topics of the moment" (I think I am right) is quite fair. It doesn't even suggest the main claim of the show to fame, the sex war. Scarcely one question is ever put to them which cannot be discussed from that angle, or which is not likely to give rise to those feelings of sex superiority, on either side, which are so delightful and entertaining. May no one ever be so foolish as to send one in.

News from the Clubs

EAST SURREY RADIO CLUB

Hon. Sec.: Leslie Knight (G5LK), Radiohme, Maderia Walk, Reigate, Surrey.

AT the A.G.M. in January it was decided to hold meetings twice a month as an experiment. Recent meetings were devoted to a sound film on "Electronics" and a 70 cm. transmitter was demonstrated. Further meetings are detailed in the Club's News Letter Service.

A Listening contest has been arranged and the winner will be presented with a silver cup given by G5LJ of Sutton Coldfield.

The Club's headquarters are at the Toc H Rooms, Station Road, Redhill, Surrey.

READING RADIO SOCIETY

Hon. Sec.: Frank Hill (G2FZ1), 997, Oxford Road, Tilehurst, Reading, Berks.

IN February the Ekco 10,000 Mc/s. Cloud and Collision Warning Radar set was described, and its uses discussed. A complete set excluding the rather cumbersome aerial system was on view to show the construction. Considerable interest was taken in the receiver frequency control system, and in particular in the construction of the very high gain 45 Mc/s. I.F. strip.

EDINBURGH AMATEUR RADIO CLUB

Hon. Sec.: David A. L. Samson (GM3EQY), 56, Elm Row, Edinburgh, 7.

AFTER some disturbing factors which have rather upset club routine, the Club is now back to normal and continues to meet at Unity House, 4, Hillside Crescent, Edinburgh, on Wednesdays, at 7.30 p.m. Another visit to the local headquarters of the R.N.V.(W)R. is planned. A lecture on oscilloscopes will be given and many more lectures of interest to the hams are scheduled.

COVENTRY AMATEUR RADIO SOCIETY

Hon. Sec.: K. G. Lines, 142, Shorncliffe Road, Coundon.

RECENT meetings of the above Society have featured a talk on "Diecasting Methods," by Mr. L. Chapman, and a demonstration of the "BRT 400" by a G.E.C., Ltd., representative.

A Receiving and Transmitting contest for "Cars" members was held on February 19th. Competition is keen for the G2LU trophy awarded to the member who can read the fastest CW.

SOUTH MANCHESTER RADIO CLUB

Hon. Sec.: M. I. Wilks (G3USW), 57, Longley Lane, Northenden, Manchester.

RECENTLY a fully-planned evening was put on, and this included a talk by the Chairman, Mr. C. M. Denny (G6DN), on the Band-switched exciter he had just completed. This was brought to the meeting and fully discussed, being of great interest, as all stages were screened to combat TVI. Following the talk, members had a "Junk Swop Sale." Originally planned as a sale, it turned into a general "Swop" towards the end.

The classes in Morse and in preparation for the RAE still go ahead, and the youngest member (aged about 10 years) is one of the keenest in the CW class, copying up to about six words a minute.

New members keep coming along to the meetings, and prospective members are always welcome—no need to make enquiries beforehand. Dates of meetings in April are the 14th and 28th, and then fortnightly throughout the year at the Church Schools, Northenden. (50 or 64 bus from M/c. Piccadilly to Northenden Post Office.)

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: L. Hobden, 17, Hartington Road, Brighton.

THE Club TX is being hotted up by the TX committee, and it is hoped will bring forth many QSO's on 80 metres. Recent meetings included a Quiz, a talk on AC vectors, and preparations for NFD. The Club magazine has taken on new and improved shape under the able editorship of G3DJD. The Hon. Sec. has promised further instalments to his interesting talk on the History of Wireless. Club nights, Tuesdays, 7.30 p.m., at Eagle Inn, Gloucester Road, Brighton.

WARRINGTON AND DISTRICT RADIO SOCIETY

Hon. Sec.: J. Speakman, Davyhulme Cottage, Dark Lane, Whitley, Nr. Warrington.

MEMBERS of the above society are now building a transmitter and if all goes well G3CKR will be on the air regularly on club nights.

Meetings are held on the first and third Monday of each month at 7.30 p.m. at the Sea Cadet H.Q., off Wilderspool Causeway, and anyone interested in membership is cordially invited.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. A. Higgins, 28, Kingsley Road, Kingswinford.

A TALK on "Matching and Feeding Systems and their Application to Antenna Systems" was given by Mr. J. F. Collett (G3BUR), of Birmingham. In addition, tuned and untuned feeders and methods of balancing, and a 48-element stacked dipole for 420 Mc/s, were described.

Another new station licensed, G3GHC, brings total to 28 licensed members out of sum total of 56 society members.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec.: K. J. Grimes, 3, Clarendon Park, Tor Vale, Torquay.

THE last meeting of the Society was opened for Questions, and many queries were asked and answered. The 1950 R.S.G.B. "Field Day" was discussed.

G2BMZ was congratulated upon obtaining the 2-metre Tropospheric Record (384 miles).

In the absence of the chairman (G2GK) the chair was taken by G3AVF.

The society's president, W. B. Sydenham, B.Sc. (G5SY), hopes to give his lecture, "Demonstration of Aerial Radiation Patterns," with the aid of the 10 cm. Klystron, at the next meeting.

Meetings are held every third Saturday in the month, at the Y.M.C.A., Castle Road, at 7.30 p.m.

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).

Series Condenser Heater Circuits

SIR,—I have been using this scheme in sets for two years with 100 per cent. success. I would recommend "AEROVOX" condenser 2 μF either 600 v. or 1,000 v., obtainable ex-Government, which have porcelain insulated terminals and can be mounted inverted on a chassis so that the terminals protrude underneath. Solar condensers ½ μF 600 v. are also recommended. Electrolytic condensers should be avoided at all costs.

I have built receivers similar to the one described in the March issue excepting that the valve line up was CCH 35—EF 39, EBC 33—EL 32, and having a metal rectifier for H.T. The total heater voltage is 24 volts and the condensers required are 2 μF and ½ μF (total 2½ μF), on 240 volt mains.

The same value of condensers give satisfactory operation even if only two or three valves of the above types are used, e.g., a T.R.F. set using only an EF 39 det. and EL 32 output, or EF 39, RF-EF 39 det., and EL 32 output (metal rect. H.T. in each case), a dial lamp 6 v. .3 amp. in series does not make much difference either.

To operate two valves of the 6.3 v. .3 amp. type, 4 μF is required, whilst a single 2 μF is suitable for a 12 v. .15 amp. valve.

A good superhet can be built using a CCH 35 or EK 32 as frequency changer—EF 39 as IF amp. and EL 32 output. Detection is obtained by a Westector.

The receiver of the type I have built has three station pre-set tuning. As it was intended for local station reception only, A.V.C. was considered unnecessary, although it could easily be added if desired. The set has been designed using the minimum number of components and kept as simple as possible whilst obtaining good results.

The condenser in series with the valve heaters consists of one 2 μF and one 0.5 μF in parallel, making 2½ μF in all.

A metal rectifier of the S.T.C. type is used for providing H.T. It should have a rating of 240 v. at 40 mA. Resistance capacity smoothing is quite sufficient.

The coils used are Wearite "P" coils, type PA2 and PO2. Small condensers of, say, 50 or 100 pF may be wired in parallel with the trimmers to modify the wavelength tuned.—P. E. HARVEY (Peterborough).

Pentagrid v. Triode Hexode

SIR,—With reference to J. Locke's letter on "Pentagrid v. Triode Hexode," may I submit that there is nothing extraordinary in the fact that one can change over from pentagrid to triode hexode and vice-versa.

Although when building a receiver, one would naturally use the correct circuit for the type of frequency changer valve one intended to employ—that is, tuned anode for T.H. valves and tuned grid for heptode, etc. The oscillator section of the valve is a triode to all intents and purposes, whether multigrid or T.H., and the pins are mostly identical, too.

As regards the difference in performance on the medium frequencies and high frequencies I suggest this is nothing more than inter-electrode capacity and the necessity for re-trimming when replacing a valve, even when replacing with one of the same type and make.

I recently replaced an I.F. pentode with a multigrid F.C. valve by mistake. It worked perfectly and is still there. I suggest reader Locke examines a list of valve bases and notes in particular the American octal list, pins 4. 5 and 6, for all F.C. valves carry SG, OG, OA, and valves of the octal base type, which do not use pin 3 for anode, are either "tunerays" or double diodes.—T. BARKER (Norwich).

VCR97

SIR,—I have been a close follower of the VCR97 correspondence over the past months and perhaps my experiences and experiments based on this correspondence may be of interest and use to new entrants to the T.V. field.

E.H.T. (Final anode volts on load).—1,000 volts gives reasonable picture, using single valve T.B.s. *Slight* trapezium distortion and contrast rather shallow; 2,200 volts needs 2 valve T.B.s, but focus, brilliance and contrast are good enough for viewing in lighted room with screen shielded. Trapezium distortion nil.

Modulation.—2,200 volts requires approximately 40 volts signal for full modulation. This is obtained in writer's locality.

Time-Bases. — Miller integrators (paraphase amplifiers). Line linearity good, perfected by 600 pF from amplifier grid to earth. Frame linearity not perfect, but difficult to trace fault on picture (480 volts H.T. supply).

Video.—Positive going picture requires bias resistor lower than normal; 60 ohms approx. correct, and increases amplification of stage and power handling capacity.

Interlace.—Although flyback interlaced, and half line was visible at top and bottom of picture, interlacing was not taking place. Irregular frame waveform apparently to blame. Much improved by condenser (.005 to .02) from *oscillator* grid to earth.

Focus.—Mr. Ward's trouble may be due to external fields as speaker and transformer fields affect beam up to about 3ft. from tube. Interlacing also appears to be faulty as lines are scarcely distinguishable on an interlaced picture 4in. high (approximately 96 lines per inch).

A shadow exists on line on my tube, but is of no consequence. A fault as yet uncured is frequency drift on line. If locked hard on switching on drift is gradual until, after two hours, line crumples to right. No voltage change is apparent and no overheating takes place. Any information from readers who have cured this will be appreciated.—B. SHAHWELL (Oldham).

"Programme Pointers"

SIR,—In his reference to Erskine Childers in "Programme Pointers," your contributor made a bad mistake, and casts a slur on the memory of a great man. Erskine Childers was *not* shot as a traitor in the Irish Rebellion.

He was tried before the Military Court of the Pro-Treaty Party of Ireland, and he did not recognise the authority of this Court.

The charge against him was: "Being in unlawful possession of an automatic pistol."

His defence was that he was an officer of the Republican army taken in war.

The trial concluded late on the evening of November 23rd, 1922, and he was shot at dawn on the morning of November 24th, in Beggars Bush Barracks.

The Irish Rebellion took place at Easter, 1916, and Erskine Childers was shot over six-and-a-half years later.—JAMES W. GRAHAM (Perth).

[You have your facts wrong, or, we should perhaps say, have omitted those that really matter. You will recall that the "rebellion" you mention was the Easter Rising, and was put down in a very few days. The rebellion took place in 1921-22, included the famous exploits of the Black and Tans, and culminated in the establishment of the Irish Free State, a body still acknowledging allegiance to the Crown, though with a large degree of autonomy. It was Childers's opposition to any connection with England that led him into trouble with the newly-constituted Government. Whether that Government shot him to curry favour with Westminster, we do not know. No one would dispute the actual terms of the charge proffered against Childers, as quoted by you. But we feel you have completely failed to disprove the gravamen of that charge—treason.

Details will be found in Childers's biography in the latest edition of Messrs. Dent's "Everyman's Encyclopaedia."—ED.]

Delivery Delays

SIR,—I have read your remarks *re* long delivery times in the last two issues of PRACTICAL WIRELESS.

I feel that these delays are due to the wholesaler who is handling the manufacturers' goods. This system is all right for the normal run of goods but falls down on the items less frequently called for, even if listed in the maker's catalogue. . . .

For example, before Christmas I ordered from my dealer some close-tolerance condensers of a famous make. I still wait!

Surely the retailer should be allowed to "short-circuit" the wholesaler for special or unusual items. —J. E. ELLIS (Harrow).

(Continued from page 210)

Frequency kc/s	*Approx. Wave-length metres*	*Station*	*Country*	*Power kW*
1594	188	International Common Frequencies Types I and II	Syria Czechoslovakia Trieste Yugoslavia	
1602	187	Germany (American Zone)	Germany	70
		Norwegian Synchronised network	Norway	2
		Portuguese Synchronised network	Portugal	5

(22) Hilversum III (or synchronised network) is authorised to use a power of 5 kW.

NOTE: It has been agreed that, as an exception, low-power transmitters serving certain Swiss valleys may use appropriate shared frequencies, provided the protection given by the Plan to other broadcasting stations be maintained.

NOTE: The Plan states that the power of stations operating on international common frequencies must not exceed:

2 kW for stations working on international common frequencies Type I: such stations, or the countries which may use such stations are mentioned in the Plan:
0.25 kW for stations working on international common frequencies Type II: such stations are not mentioned in the Plan.

The General Effect of the Plan

The Plan evolved at Copenhagen is intended to improve listening conditions in Europe as a whole, and, of course, as part of this to improve listening conditions in the United Kingdom. The Plan calls for a change in the wavelength of almost every station in Europe. Such a change means that in every country in Europe it is necessary to make important adjustments to the transmitters.

The listener, too, must play his part if the full benefit of the Plan is to be realised. Listeners who wish to obtain the best reception will make sure that their receivers are properly installed in the first place and that an efficient outdoor aerial is used. The receiver and aerial system should have periodic skilled attention to repair the inevitable falling-off in performance which takes place in the course of time. This point is particularly important when the listener lives at a considerable distance from the station to which he habitually listens, and if it is neglected, bad quality and interference from unwanted stations are likely.

The tables on page 212 show how the wavelengths of B.B.C. stations have been altered under the Plan.

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19/6 Fully Shrouded

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H.S. 3x. Windings as F.S.3. 100 m/A.
19/6 Half Shrouded

F. 6. Filament. Transformer. Input 200/250. Output 6.3 v. at 2 amp. ... ... at 7/6
F. 12. Filament. Transformer. Input 200/250 12.6 v. tapped at 6.3 v. at 3 amp. ... ... at 15 6
F. 24. Filament. Transformer. Input 200/250, 24 v. tapped at 12 v. at 3 amp. ... ... at 21/6
F.S. 43. Mains Transformer. Input 200/250. Output 425/0/425, 200 m/A. 6.3 v. at 4 amp., C.T. 6.3 v. at 4 amp., C.T. 5 v. at 3 amp. ... ... at 42 6
F. 30 X. Mains Transformer. Input 200/250, Output 300/0/300, 80 m/A., 6.3 v. at 7 amp., 5 v. at 2 amp. ... ... at 26/6

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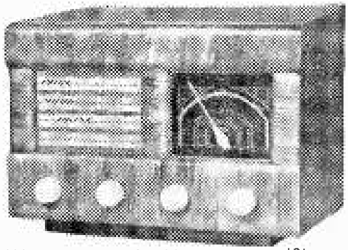

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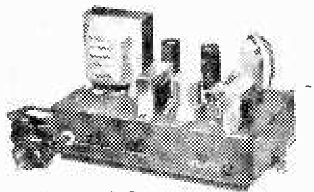

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Impressions on the Wax

Review of the Latest Gramophone Records

THE new Brahms Violin Concerto in D, Op. 77, on *H.M.V. DB*21000-4 (nine parts on five records, one single-sided) is a most impressive affair. Yehudi Menuhin and Wilhelm Furtwangler and the Lucerne Festival Orchestra between them contribute an intensity of feeling to this famous concerto which makes the recording very important. Many will say this is the finest reading of the work at present available. It at least deserves a hearing by those collectors who feel that their own set of the Brahms Concerto could not be improved upon.

A new addition to the "His Master's Voice" special list is a recording of Arnold Schonberg's "Verklarte Nacht," by the St. Louis Symphony Orchestra, conducted by Vladimir Golschmann, on *H.M.V. DB*9280-3. This most widely known of Schonberg's works is a tone poem which, unlike his later work, demands the most modest of resources: no more than a string sextet, though the volume of tone produced by six instruments is so small that the composer recommends the use of a string orchestra for concert performances. It is in this form that the work has been recorded.

"Concerto No. 3" was written by Bela Bartok in 1945 during the last months of his life. When he died he left the score unfinished by seventeen bars which were filled in by his friend and pupil, Tibor Serly. It has now been recorded by Gyorgy Sandor (piano) and the Philadelphia Orchestra, conducted by Eugene Ormandy, on *Columbia LX*1271-3. It is interesting to relate that Gyorgy Sandor was also a pupil of Bartok, and he, Bartok and Ormandy were all born in Hungary.

The cuckoo's note has often been sounded in music. The clavichord composers before Bach's day were specially fond of it and men like Kerl, with his "Cuckoo Capriccio" and Daquin, in "Le Coucou," have built up whole pieces on the basis of its cry. Beethoven, in the "Pastoral Symphony," gave it a place. "On Hearing the First Cuckoo in Spring," by Delius, is a masterpiece of suggestion of the bird's song and has now been recorded by the Liverpool Philharmonic Orchestra, conducted by Sir Malcolm Sargent, on *Columbia DX*1643. The actual cuckoo plays his part in two passages: he first sings his two notes at the interval of a minor third and then at major third, sounding again and again, each time more distant.

Vocal

The Italian film "Canzone Eterna" had its première at the Continentale Cinema in London early in January. The world-famous tenor, Beniamino Gigli, features prominently in this picture singing "Mamma" at intervals throughout the action—frequently enough, in fact, for this attractive song to be considered the theme song. "Se vuoi goder la vita" also has a place in the film, and those who have heard these pieces perhaps for the first time in the film will like to have Gigli's latest record of them on *H.M.V. DA*5397. The record is a typical Gigli recording, even considered away from the picture, and no collection with a pretension to quality should be without it.

Another interesting recording has been made by Marimi Del Pozo, soprano, who sings "Lucia di Lammermoor" and "Carnevale di Venezia" on *H.M.V. C*3967. This young, attractive soprano lives in Madrid. She visited England to make this recording, but has yet to appear in Great Britain in public. She has toured America and Scandinavia.

"The Spinning Wheel," which has now been reissued by public demand, is a traditional air sung in the Irish dialect for which it was written. It is sung by the singer who made it famous—Delia Murphy. On the reverse side is another traditional air, "Three Lovely Lassies"—*H.M.V. BD*1256. The guitar accompanist on both sides, Arthur Darley, has also made the arrangements.

Variety

Donald Peers, who is one of Britain's leading male exponents of popular songs, has this month recorded "Dear Hearts and Gentle People," coupled with an old favourite, "I'll String Along with You," on *H.M.V. B*9877.

That versatile artist, Ronnie Ronalde, presents an Italian and an Irish song in his latest recordings. "Song of the Mountains" achieved popularity in the film "The Glass Mountain" and the number features singing, yodelling and whistling. "If I Were a Blackbird" on the reverse is based on an Irish folk-song.

On her latest recording Dorothy Squires gives her own treatment to two popular favourites. "On the Sunny Side of the Street" is sung in tempo and "Do I Worry" is taken very slowly. She is accompanied in both tunes by Billy Reid and his Orchestra.

Dance Music

Eve Boswell, who made her recorded debut with the Geraldo Orchestra last summer, comes up with another winner, "Dear Hearts and Gentle People," which is enhanced by an immaculate orchestral accompaniment on *Parlophone F*2402. On the reverse side Geraldo gives us a beautifully-scored orchestral performance in waltz time of Castiglione's "Serenade," a Swiss song originally published under the title of "Komm Mit Mir."

Billy Thorburn's tuneful and toe-tapping combination of organ, dance band and piano this month puts its distinctive stamp on new American and British tunes. They are "Why Is It?" and "Mamma Knows Best," on *Parlophone F*2403. For dance fans there is "Dear Hearts and Gentle People" and "If You Could Care," in dance tempo of Joe Loss and his Orchestra on *H.M.V. DB*6062, and "Best of All" and "Time on My Hands," by Victor Silvester and his Ballroom Orchestra. *Parlophone FB*3550.

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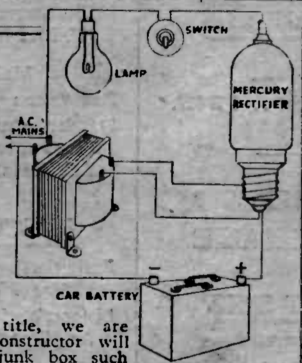

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