

# ENLARGED BIRTHDAY NUMBER!

# Practical Wireless <sup>3<sup>D</sup></sup>

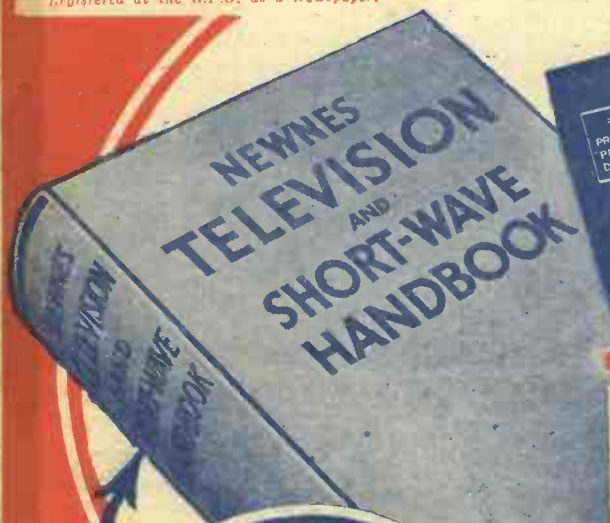
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Edited by  
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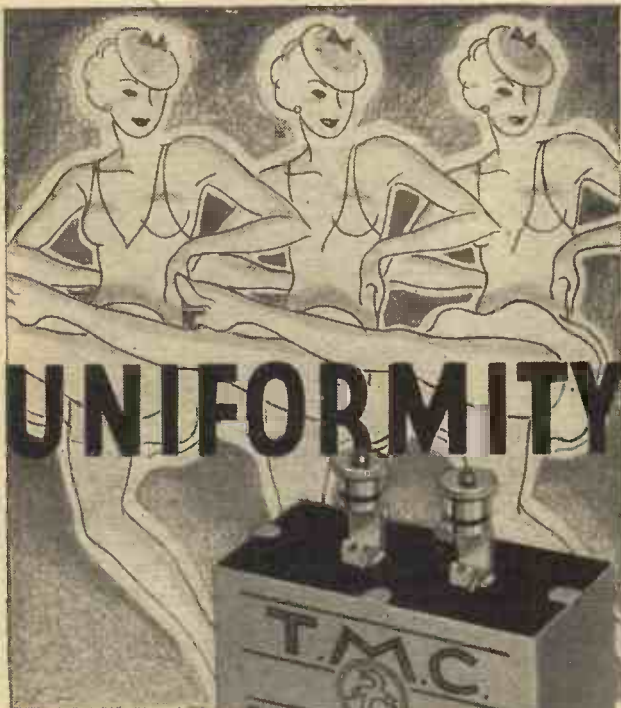
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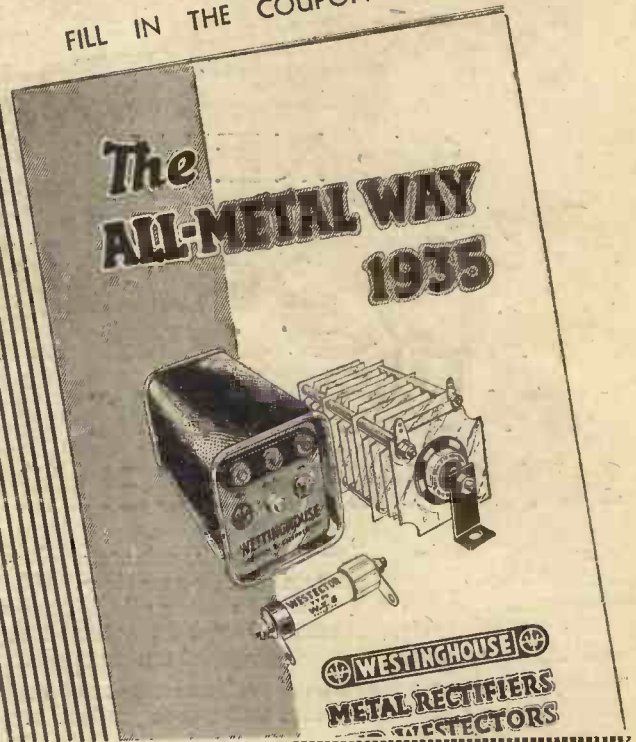
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## BUILDING THE ALL-PENTODE THREE—See pages 20-23



**Practical Wireless**

EDITOR :  
Vol. V. No. 105 || F. J. CAMM || Sept. 22nd, 1934.  
Technical Staff :  
W. J. Delaney.  
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.,  
Frank Preston, F.R.A.

ROUND *the* WORLD of WIRELESS

## Greetings

MANY thanks to the many readers who have sent messages of goodwill in connection with our second birthday—and the completion of Vol. IV.

## “Newnes’ Television and Short-Wave Handbook”

THE latest addition to our series of presentation volumes, “NEWNES’ TELEVISION AND SHORT-WAVE HANDBOOK,” is available to all regular readers who comply with the simple conditions given on pages 24 and 25 of this week’s issue. Reserve your copy at once.

## Microphonicity

WE observe in a contemporary a new word—microphonicity! Ugh!! After this we may expect telephonicity, telegraphicity, metaphysicity, telescopicity, and microscopicity. Personally, we prefer the correct dictionary word—microphony!

## Index to Vol. IV Now Ready

THOSE readers who are having their copies of Vol. IV bound (Nos. 79-104, comprising issues dated March 24th, 1934, to September 15th, 1934) may have copies of the title page and index for 3d., or by post 4d. It is now ready. Binding cases, complete with title page and index, cost 2s. 9d.

## At the Blue Moon

“ONCE in a Blue Moon,” described as “A romantic play with music,” will be heard by London and Midland Regional listeners on September 25th. Francis Durbridge is the author of the “book,” and music and lyrics are by Jack Hill. The scene is the Blue Moon Café, and the cast includes artists well-known to broadcasting: Gladys Joiner, Alma Vane, Wortley Allen, Dorothy Summers, Hugh Morton and many others. Martyn C. Webster will be the producer.

## The Harmony Boys

THE Harmony Boys will be heard again on September 27th in a programme with the Govan Burgh Band, conducted by Gregor J. Grant, and Jackson Dodds

(entertainer). The Harmony Boys—a combination which originated in one of the many ex-service men’s clubs which sprang into existence in the years immediately after the War—first broadcast ten years ago, and in the interval have become widely known in Scotland.

## From Sadler’s Wells

THE prologue and Act I of Rimsky-Korsakov’s opera, “The Snow Maiden,” will be relayed from Sadler’s Wells Theatre in the National programme on September 25th, which is the opening night of the season.

The scene of the prologue is the edge of

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the forest near the Red Mountain of Yarilo at the end of winter, and that of Act I is the village of the Berendeys in spring. The cast includes John Greenwood, Betsy de la Porte, Roderick Lloyd, Olive Dyer, Powell Lloyd, Susan Turner, Edith Coates, Ruth Naylor, and Sumner Austin. The conductor will be Lawrence Collingwood. Clive Carey will be the producer, and the chorus master will be Geoffrey Corbett.

## Bristol’s Radio Exhibition

THE Bristol and West of England Radio and Home Entertainments Exhibition, organized by the Bristol *Evening World*,

will be held in the Colston Hall, Bristol, from September 24th to 29th. A relay of variety will be taken for West Regional listeners on the opening day, when Tom Webster, the sporting cartoonist, will introduce the artists. Included in the programme will be Ronald Hill, Bertha Willmott, Tom Burke, and Freddie Williamson and his Dance Band. A concert will be relayed on Wednesday, September 26th. The artists will be Esmé Dunning-Moore, Ridgway and Partner, and the Lockier Grosvenor Sextet.

## S O S Analysis

DURING the second quarter of 1934, 149 SOS and police messages were broadcast Nationally and twenty-eight from provincial stations.

In the case of those given Nationally, 107 were in respect of illness, seventy-one of which were successful, thirty-three unsuccessful, and three unknown. The percentages were 66.36, 30.84, and 2.8 respectively. Forty messages called for witnesses of accidents, twenty-three, or 57.5 per cent., of which were successful, and seventeen, or 42.5 per cent., unsuccessful. Two were special or crime messages, neither of which met with success.

Of twenty-eight broadcasts from provincial stations, twelve were in respect of illness, four, or 33.33 per cent., being successful, and eight, or 66.67 per cent., unsuccessful. For witnesses of accidents there were ten messages, half of which were successful. Six crime or special messages were broadcast, three being successful.

## A Choral Event

ON September 23rd, the Wisbech Male Voice Choir, thrice winners of “the open” at the Norwich Festival, and holders for two years of the South Midland Championship Cup, have their first Regional broadcast from the Midland station. They have sung at Broadcasting House for the National programme, and still recall a hectic afternoon in May, 1932, when they made two singing films in London, recorded and broadcast. Mr. F. Ingram, who founded the Choir eight years ago, is the conductor. There are over forty members, several of whom have to travel from March to Wisbech for rehearsals.



# ROUND the WORLD of WIRELESS (Continued)

## America's Cup

THE first race in the series for the America's Cup took place on September 15th. To secure the trophy one of the competing yachts must win four races, and consequently the deciding race cannot take place before September 19th. It is more probable, however, that the issue will not be reached until perhaps September 22nd, or even a later date should postponements occur on account of bad weather.

On the evening on which the deciding race is completed a special programme entitled "Endeavour's Challenge for the America's Cup" will be broadcast on the National Wavelength at, approximately, 11.15 p.m. This will be an experiment in news presentation, and will include a brief history of the Cup and the competing yachts. It will also give incidents in Endeavour's short career. It is hoped to conclude this composite programme with a relay from America. The programme will be devised and produced by Gerald A. Cock.

## Cornish Harvest Customs

A. K. HAMILTON JENKIN will give a talk for West Regional listeners on Friday, September 28th, on Cornish harvest customs. In this talk Mr. Hamilton Jenkin will describe the ceremony associated with the cutting of the last few handfuls of standing corn in the harvest field, which was known as "crying the neck": it is only within the last thirty or forty years that the custom of crying the neck has ceased to be observed in the Duchy. A. K. Hamilton Jenkin is an acknowledged authority on the old customs of the Duchy, and has done much, not only in his talks, but also in his writings, to shed light on many ancient rites and ceremonies of which the truth has been obscured or misunderstood. Of course, his reassuring must be accepted merely as opinions.

## Midland Auto Club

IN June, Whitney Straight made a new record for the Shelsley Walsh Hill Climb, recognized as the British event for the Hill Climbing Championship of Europe. He did the thousand-yard climb, which includes two sharp corners, in forty seconds. Whether this will stand for two years, as Hans Von Stuck's old record did, remains to be seen. The opportunity for beating it will occur on September 29th, when the Midland Automobile Club have organized the autumn open event. Major V. Brook will, as usual, give the running commentaries for listeners. The outside broadcast hut, van and lines arrangement follow the plan which has worked smoothly and

## INTERESTING and TOPICAL PARAGRAPHS

successfully at previous meetings on this famous Worcestershire hill.

### "Gaelic To-day"

ON September 28th Sheriff McMaster Campbell will give a talk for the

### A PICK-UP RESPONSE TESTER



Visitors to the Radio Exhibition were very interested in the H.M.V. tester shown above. The response curve is shown on the screen whilst the pick-up is working. Note the stroboscopic edge to the turntable.

Scottish Regional on "Gaelic To-day, and the Mod," preceding the relay from the concluding concert of the National Mod being held at Oban. This festival of Gaelic is of great importance to the Highlands of Scotland, and so great is the interest shown in it that folk gather from all parts of the British Isles and sometimes even from abroad. The relay is from the concluding concert, at which the prize winners will appear.

## Salonika

### Reunion

THE Salonika Reunion Association Service, conducted by the Rev. H. G. Marshall, Assistant Chaplain-General, Eastern Command, will be relayed to National programme listeners on September 30th, from the Horse Guards Parade.

The service will be opened by the singing of "O valiant hearts, who to your glory came," and following prayers the Rev. H. G. Marshall will give his address. Then "God of our Fathers, known of old" will be sung, and the service will conclude with Benediction and the

playing of the Last Post. By permission of Lieut.-Colonel R. E. K. Leatham, D.S.O., the music will be rendered by the Band of H.M. Welsh Guards, conducted by Major A. Harris, Senior Director of Music, Brigade of Guards.

## "Squaring the Circle"

"SQUARING THE CIRCLE," which will be broadcast on September 26th in the Regional programme, and on September 28th in the National, is a farce dealing with the housing problem of the post-revolution period in Moscow. It carries no political significance whatever, and is written in an extremely amusing vein. The author is Valentine Kataev, and N. Goold-Verschoyle was responsible for the translation from Russian into English.

"Squaring the Circle" was staged at Ashley Duke's Mercury Theatre, where it was seen by the B.B.C. Director of Drama, Val Gielgud, who will produce the broadcast version. The adaptation for broadcasting is by Marianne Helweg. Only five artists will be required for the cast.

## Another New Cinema Organ

A NEW cinema organ comes into the Midland Regional programme for the first time on September 24th, namely, that at the Ritz, Nottingham, which, with its 220 "tabs," is one of the largest cinema organs in Europe. The player will be Jack Helyer, organist at the cinema.

(Continued on page 30)

## SOLVE THIS!

### PROBLEM No. 105.

Miller found a number of wireless components on sale at a junk store, and purchased a three-gang condenser of the superhet. type, together with a pair of I.F. transformers and a set of three superhet. coils. He connected these together, following the Premier Superhet. Circuit which was recently published in these pages, but when tested out he found that although he could receive the local stations at very good strength, it was impossible to hear any others. He carefully adjusted the trimming controls on the gang condenser, as well as the trimmers on the I.F. transformers, and found that when adjusted to various points different stations could only be heard when the trimmers were adjusted. Why was this? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 105, and must be posted to reach here not later than the first post Monday, October 1st, 1934.

### Solution to Problem No. 104.

Martin had so chosen the value of coupling condenser that it had a resonant frequency low down in the audio range. If he had tried condensers of different value he would have found that reproduction was satisfactory.

The following three readers successfully solved Problem No. 103 and books have accordingly been forwarded to them: Benjamin Bernstein, 25, Winchester Street, Bethnal Green, E.2; F. W. Cooper, 74, Peel Street, Birmingham 18; J. N. Avery, 73, Barmston Street, Hull.



# VISUAL TUNING FOR THE CONSTRUCTOR

A Number of Suggestions for the Construction

and Use of Simple Tuning Indicators are Given on This and the Following Page. By FRANK PRESTON.

**VISUAL-TUNING** indicators are to be found on nearly all modern commercial receivers of the more pretentious type, and there are probably many constructors who would like to fit

bear in mind the function of all systems of A.V.C.: a minute portion of the signal voltage applied to the grid of the detector (the second detector of a superheterodyne) is rectified and passed back to the grids of the H.F. valves as negative bias. Consequently, as the detector receives a greater signal voltage, so the H.F. valves are more heavily biased. And it is a principle of the valve that the anode current which it passes is inversely proportional to the grid-bias voltage. In other words, the anode current becomes less as the G.B. voltage increases.

need not be calibrated in milliamps, but should preferably be divided into about ten equal sections.

To avoid possible instability due to the resistance of the meter in the anode circuit it is generally necessary to connect a 2-mfd. fixed condenser in parallel with the meter as shown. It is by no means essential that the meter for visual tuning should be accurately calibrated, and it is therefore quite permissible to use a cheap instrument costing no more than ten shillings. The most important point is that the meter should have a full-scale deflection of no more than the maximum current consumption of the valve in whose anode circuit it is connected. For example, when used with a single battery-operated variable-mu H.F. pentode, a maximum reading of 5 milliamps. will generally be most suitable; when the meter passes the combined anode currents of two mains-operated variable-mu valves a suitable full-scale reading would be 10 milliamps.

Although many readers may be aware of the fact, it is interesting to point out that there are on the market a few special meters made expressly for visual tuning. These are made with the "reversed" scale mentioned above, and are available in three main patterns: with normal arc-shaped scale, with straight horizontal scale, and with straight vertical scale. Those who already have a suitable milliammeter can easily modify it to be more in keeping with the receiver controls by extending the pointer by attaching to it a short length of thin aluminium wire bent to a right-angle, as shown in Fig. 2. This can be made to read over a curved scale made by gluing a strip of paper or white celluloid over the edge of a wooden disc or an old condenser drum.

### Shadow Tuning

Another form of visual indicator, which is somewhat more spectacular than the

(Continued overleaf)

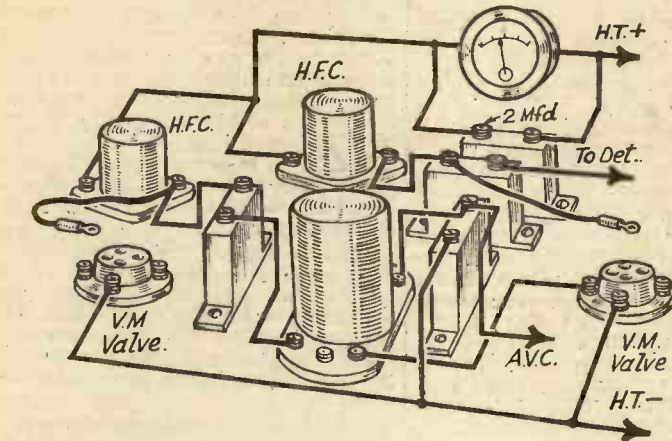


Fig. 1.—This pictorial circuit shows how a milliammeter or other visual tuning indicator is connected in the H.F. + lead to the anodes of V.-M. valves.

such devices to their own sets. Before describing some methods of providing visual means of tuning it might be advisable to point out the particular advantages and difficulties which are attendant upon it. In the first place it should be emphasised that the full benefits of visual tuning can only be obtained in the case of a receiver provided with automatic volume control. With sets of this type it is practically impossible to make rapid tuning adjustments by ear, due to the fact that, as the set is slightly de-tuned from the resonant point of any particular transmission, the amplification of the H.F. stages becomes greater, with a result that signal strength does not decrease, but sometimes actually seems to become greater.

### De-Tuning Produces Distortion

But, particularly when the set is very selective, slight de-tuning immediately produces distortion, due to the over-emphasis of one side-band and the partial suppression of the other. Thus, in tuning such a receiver by ear, one must not tune to the loudest point, but to the position at which there is no distortion—a difficult procedure. When a system of visual tuning is provided, however, all that is necessary is to select the approximate tuning position for the desired station, and then carefully set the tuning dial until the visual device (which may take one of many forms) indicates exact resonance.

Contrary to popular opinion, a visual-tuning indicator is by no means a complicated device, and its method of operation is easy to follow. Additionally, it is generally a perfectly simple matter to construct a visual indicator from simple and comparatively inexpensive parts. To understand exactly how it works, one must

It will now be clearly understood that if a milliammeter is inserted in the anode circuit of one or more of the H.F. valves its

### Anode Current Varies with Signal Strength

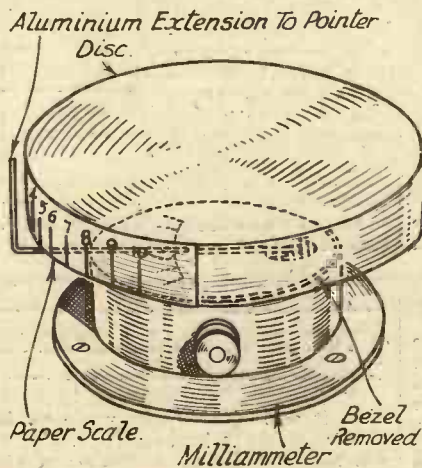


Fig. 2.—Showing a simple method of converting an ordinary milliammeter into a horizontal-scale visual-tuning indicator. The new aluminium-wire pointer may be attached to the original needle by means of a spot of wax.

reading will be at a minimum when a station is exactly tuned in. A meter of this kind, connected as shown in Fig. 1, is the simplest form of visual-tuning indicator and is used in several commercial receivers. The only slight objection is that the reading of the needle becomes lower as signal strength increases. This can readily be overcome, however, by the simple process of making a new scale which reads anti-clockwise. The scale

### Window In Panel. Matt Celluloid.

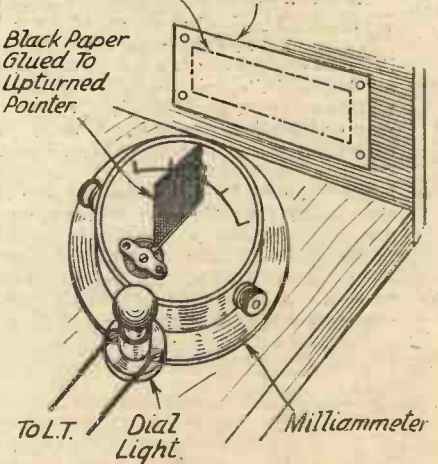


Fig. 3.—A simple form of light-tuning indicator can be made as shown in this drawing. It is explained in the text.



(Continued from previous page)

simple meter, is that in which the length of a shadow, or of a strip of light, is made to vary according to the strength of the signal being received. Some of the devices used are rather complicated—and they are not sold to the home constructor—but there are several arrangements which the constructor can devise, simply by making use of a slightly modified meter. One of these is shown in Fig. 3, where it will be seen that a strip of thin black paper is attached to the upturned pointer of the

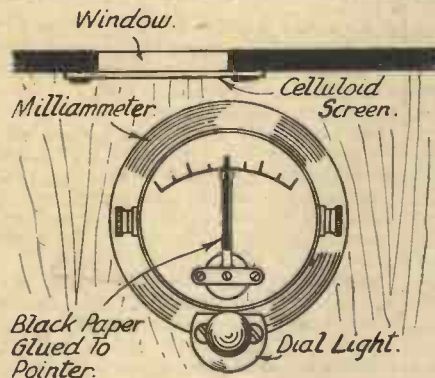


Fig. 4.—A simple form of shadow tuning indicator. The general arrangement is similar to that shown in Fig. 3. In some cases it might be necessary to screen the light on the right-hand side.

meter and an ordinary dial light is placed behind this. The complete indicator is mounted on a small shelf behind an opening in the cabinet front, which is covered on the inside with a strip of matt celluloid or even tissue or tracing paper. The meter and light are so placed that when the set is completely off tune (maximum anode current) the black paper completely screens the light from the panel opening. Then, as the set is tuned, the needle is deflected and the screen becomes illuminated, the length of the light strip being dependent upon the strength of the signal—a strong signal will give a long strip, and a weak one a short strip.

#### Light-strip Tuning

This arrangement can be reversed, so that the screen is normally illuminated, a

shadow appearing as the exact tuning-point is reached. To do this it simply means that the meter must be rotated in a clockwise direction, the light being moved a little to one side. An entirely different system can be set up by gluing a strip of thin black paper to the millimeter pointer (without bending it), turning the meter so that the edge of the paper is exactly in line with the end of the screen when the valves are passing their maximum current, and placing the light in line with the paper, as shown in Fig. 4. It will be seen that as the needle is deflected the width of the shadow will be increased.

The above are only suggestions, and many other ideas will present themselves to readers if the general principles described are borne in mind.

#### Visual Tuning without A.V.C.

Although, as mentioned above, the chief advantages of visual tuning are only to be obtained when A.V.C. is employed, there is one benefit to be derived when A.V.C. is not present. This is that stations can be tuned in correctly without any sound being emitted from the speaker. To secure this result an L.F. volume control must be fitted, so that it can be turned to its lowest position whilst tuning; it can be turned to its most suitable position after tuning has been completed. In this case, however, the meter cannot be placed in the anode circuit of the H.F. stages, but must be wired in the detector circuit. It is preferable that the detector should operate on the anode-bend principle, since a wider variation in current can usually be obtained from such a circuit. The meter should show a full-scale deflection on no more than 2 milliamps. (even a 1-milliamp. meter is better, provided that the valve does not pass a greater maximum current than this), and should again be shunted by a 2-mfd. fixed condenser. With these connections (shown in Fig. 5)

the reading of the meter will increase as the set is brought to resonance.

A similar arrangement, which is also shown in Fig. 5, can be employed when the detector operates on the leaky-grid principle, but the meter must then have a full-scale deflection of about 5 milliamps. when A.C. valves are used, or 2 milliamps. for battery valves, and the deflection is considerably smaller, so that accurate tuning adjustments cannot be made quite so easily. Additionally, it should be noted that with leaky-grid detection the current becomes less as resonance is reached. With all the arrangements described, a certain magnification of the needle movement can be obtained by placing the meter farther from the screen, or by lengthening the pointer. In making the pointer longer, however, care should be taken that the extra length does not weight it down or otherwise restrict its movement. In addition, it will be found that the screen must be recessed into the cabinet so that it is shielded from outside light, otherwise the intensity of the indicator light will be insufficient to make the shadow or light-strip clearly visible.

In this article special reference has been made to indicators which the constructor can make for himself, and those who wish to fit one of the neon visual tuning devices, which are now available fairly cheaply, will find the necessary information on another page in this issue.

The Cossor neon tube visual indicator is described and its method of connection given in the article entitled "Those Old Bulbs."

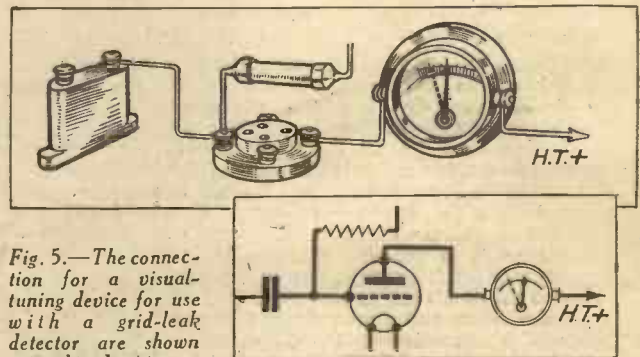


Fig. 5.—The connection for a visual-tuning device for use with a grid-leak detector are shown in this drawing.

#### "Radio Pie"

RONALD HILL has arranged forty-five minutes of Variety for West Regional listeners on October 4, when he will present a "Radio Pie." Included in the programme will be some songs, West Country legends, piano music and sketches. Ronald Hill's career is of special interest to West Regional listeners. His home is at Langford, Somerset, and he broadcast for the first time from Cardiff while still an undergraduate. He played opposite Adèle Dixon in Cecil Lewis's broadcast play "Honey-moon in Paris," and he has written the music for several shows of which perhaps the most successful was "Tickets, Please."

#### Bristol Male Voice Choir

THE Bristol Harmonic Male Voice Choir will be heard by West Regional listeners in a programme of part-songs and Negro Spirituals on October 1st. The conductor, Joseph Jenkins, went to Bristol from his native Wales 35 years ago and

#### TOPICAL PARAGRAPHS

liked it so much that he made his home there: he has trained scores of singers and has also established a number of choirs. In recent years his work has extended to North Devon, where he trains choirs and singers.

#### Cornish Fare

A CORNISH concert will be relayed from the Foster Hall, Bodmin, on October 5th, for West Regional listeners, when the artists will be Marcel Kingdon (tenor), Tom Robins (baritone), Morris Gilbert (pianoforte), and the Bodmin Centenary Choir conducted by A. M. Hearn. This choir is the oldest Methodist Church Choir in Cornwall and, in May, 1934, it obtained the Smith Shield at the Cornwall Musical Festival. Marcel Kingdon is described as one of Cornwall's leading tenors:

he broadcast last year for the first time and has since sung in London and also at the Torquay Pavilion with the Municipal Orchestra.

#### Air Race Commentary

A RUNNING commentary on the finish of the London-Cardiff Air Race, organized by the Cardiff Aeroplane Club for the "Western Mail" Trophy, will be given for West Regional listeners by Captain W. R. Bailey on October 6th. This will be the fourth annual race: the three previous races were started from Heston Airport and, this year, by kind permission of the De Havilland Aircraft Co., Ltd., the race is being started from Hatfield Aerodrome. All aircraft entering the race will be handicapped by Mr. W. Dancy, who has an international reputation as handicapper for the principal air races in Europe. All machines entering for this race fly non-stop from Hatfield Aerodrome to Cardiff Airport, with a compulsory turning point at Beachley, near Chepstow.



# THE NEW DROITWICH STATION

Interesting Facts about the New B.B.C. High-power Transmitter

**T**HE Droitwich station has been designed as a dual-programme transmitting station, and in time it will house the new Midland Regional transmitter. In this article we propose to deal only with the long-wave transmitter that came into general use on Thursday, September 6th. The main points of difference in the design of the Droitwich station, as compared with the four Regional stations are:—

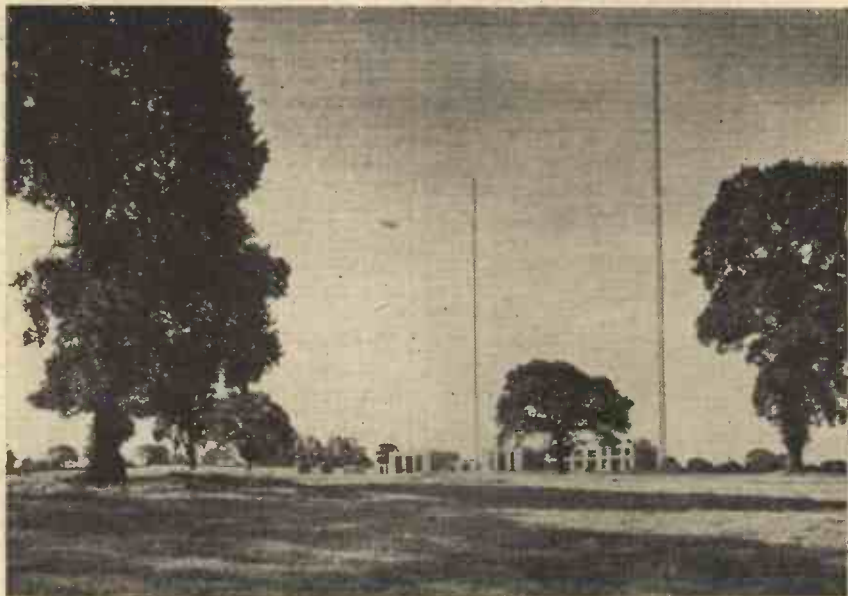
(1) The power house generates alternating instead of direct current.

(2) Series modulation has been employed for the transmitter.

(3) The high-tension supply is normally obtained from mercury-arc steel-tank rectifiers and not from motor generators. (Actually at the time of the switch-over on Thursday, however, motor generators were used. These will normally function in the new Midland Regional transmitter.)

(4) An important unit, which has been termed the "transducer," has been introduced between the output of the transmitter and the feeder lines to the aerial transformer house to overcome the difficulty in obtaining a good response at the high-audible frequencies on the long wavelength.

(5) The masts are 700 feet in height, the



General view of the transmitting station from the north side.



The switchboard and one of the generators.

highest previously used by the B.B.C. being 500 feet.

The aerial is fed from the aerial-transformer house, supply being led to the latter through the so-called "transducer" (which will be mentioned again later) from the transmitter.

The transmitter is made up as follows:—

(A) One three-stage low-frequency power amplifier with four 10-kW water-cooled valves in parallel working on 10,000 volts.

(B) One two-stage high-frequency power

amplifier with four 15-kW water-cooled power transmitting valves. (The final stages of (A) and (B) are connected in series.)

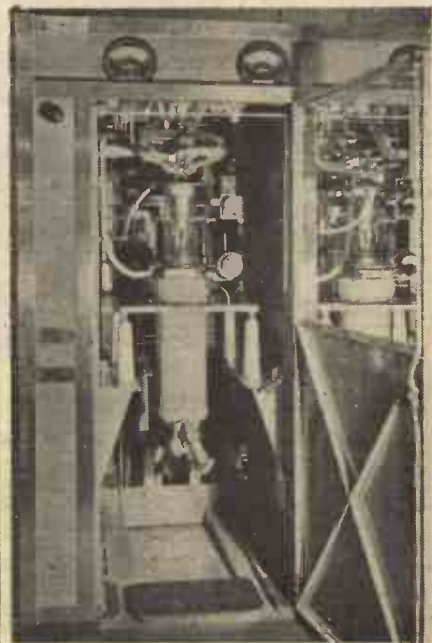
(C1) and (C2). The two halves of the final push-pull-modulated high-frequency stage, each with three water-cooled, new type transmitting valves, each capable of a maximum output of 50 kW., one valve in each circuit acting as spare.

(D) The tuning circuits for (C1) and (C2).

Governing the transmitter is the power-

control table, which has all essential transmitter controls. The transmitter requires an H.T. supply of about 30 amps. at 20,000 volts. This is normally supplied by one of two mercury-arc rectifiers, the other being used as a stand-by. In place of either of these, however, two H.T. motor-generators, having a maximum voltage of 12,000 each, may be used, though their normal purpose will eventually be to feed the new Regional

(Continued overleaf)



One of the valves in a "C" unit.



(Continued from previous page)

transmitter. The power house contains four 750 b.h.p. six-cylinder Diesel engines and the same number of 470 kW three-phase alternators, each complete set being directly coupled. Normal speed is 375 r.p.m. and the output 415 volts. The maximum capacity of the power house is 1,880 kW., but the normal load will be 1,000 kW. There is a battery room containing a 1,500 amp.-hour 220-volt battery,



Front view of a "B" unit.

for lighting, etc., when no programme is being radiated. Fuel-oil storage is provided by two tanks, each having a capacity of 150 tons.

The "transducer," which is situated between the output of the transmitter and the feeder lines to the aerial-transformer house, contains high-frequency circuits, the main function of which is to reduce attenuation of the higher audio-frequency sidebands, thus enabling the long-wave transmitter to have a straight-line frequency response up to about 9,000 cycles per second.

The aerial circuits are situated centrally

between the two masts, and, of course, at the foot of the vertical down-lead. Two complete sets of aerial-tuning circuits have been installed in the aerial-transformer house, one acting as a stand-by to the other. This principle has been adopted by the B.B.C. for the first time in this station, owing to the possibility of damage to this part of the circuit by a lightning flash which may not be cleared by the lightning arrestors. Situated immediately outside the aerial-transformer house is a steel pylon, carrying the lightning arrestors, and the termination of the down-lead from the aerial.

The station is connected to the simultaneous broadcasting land-line network by means of buried cables to Birmingham. A special input control room contains, in addition to the line relay switching circuit, all the necessary line-amplifiers, programme meters, and "line-monitoring" circuits. The amplifiers are mains-driven, the H.T. supply coming from rectifiers and the L.T. supply from motor generators, through suitable smoothing circuits.

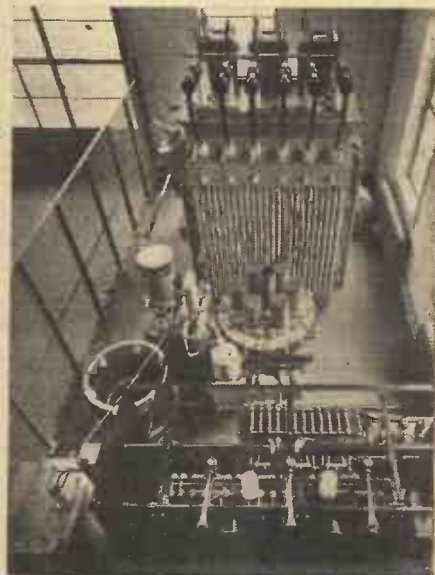
**The Part Droitwich Will Play**

The new transmitter was designed for a power of 150 kW. to its aerial, that is, at least three times the power of any station previously built by the B.B.C. It should give a satisfactory service under average atmospheric conditions to nearly the whole of the British Isles. It is anticipated that it will in time be possible to withdraw the National transmitters at Washford Cross, Moorside Edge, and Brookmans Park. It will not be possible to determine the exact performance of the station until it has been in regular service for at least a year and all types of atmospheric conditions have been encountered.

**Where Inconvenience May Result**

Users of unselective receivers in the immediate neighbourhood of Droitwich will undoubtedly have something to contend against in receiving other stations without interference, and to a lesser extent will users of unselective receivers elsewhere, owing to the greatly increased signal strength provided by the new transmitter. This applies whether the interference occurs when receiving foreign stations fairly near in frequency to the Droitwich transmission,

or even when transmissions separated widely in frequency are being received, depending on the degree of selectivity. The carrier-wave frequency of Droitwich being 200 kilocycles per second, the band of frequencies occupied is from 191 to 209 kilocycles per second, and this spread will have to be reckoned with at present transmission power. The remedy, of course, is to make the receiver sufficiently selective to cope with the changed conditions. Those who live within a small heart-shaped area surrounding Daventry (the flattened part of the heart pointing towards Droitwich) will find transmission weaker than they have been accustomed to by virtue of their extreme proximity to the former transmission, but only those who have been taking advantage of an accident of birth, as it were, and making do with a receiver that is only practicable at very short range. A certain amount of grousing there may be, but it is worth remembering that what the B.B.C. have done is undoubtedly for the benefit of the majority of listeners.



A corner of the machine room, showing an H.T. transformer, mercury-arc rectifier, and switchboard.

**WHAT IS YOUR FAVOURITE CIRCUIT?**

**Competition Result Next Week.**

We have received many thousands of entries for the "What is Your Favourite Circuit?" Competition which appeared on page 618 of our issue dated August 18th (First Special Show Number). The work of deciding the favourite circuit as decided by the votes of the competitors has been extremely heavy, and it was impossible therefore to include the results

as promised in our issue dated Sept. 15th.

The following, however, is an analysis of the voting; and readers will agree that this provides really valuable information for our designers and enables them to design receivers of popular demand.

Our Competition Editor is busily at work judging the competition, and the names and addresses of the winners of the Fifty W.B. Stentorian Loudspeakers will definitely appear next week.

	Order of Voting.			
Battery	..	..	..	1,875
Mains ..	..	..	..	2,822
All-Wave	..	..	..	1,897
Broadcast	..	..	..	2,603
Short-Wave Bands	..	..	..	104
Superhet	..	..	..	2,165
Straight Circuit	..	..	..	2,303
Power Output Over	..	..	..	2,273
Under 2 Watts	..	..	..	2,137
Self-contained	..	..	..	2,503
External Speaker	..	..	..	1,877
Table ..	..	..	..	1,925
Console Cabinet	..	..	..	2,455
Combined	..	..	..	2,211
Separate Controls	..	..	..	2,194
Radiogram	..	..	..	2,078
Provision for Pick-up	..	..	..	2,295
Self-contained	..	..	..	468
External Aerial	..	..	..	3,729



# Preparing for Winter Reception

Some Methods of Improving Selectivity, Particularly on the Long-wave Band, which will Soon Present a Difficulty Due to the Opening of the Droitwich Station, are Described Below.

ON first thought it might appear that the title of this article is scarcely justified, and that no special preparation for reception during the darker months is called for. But those who have built a receiver (particularly if it is of the simpler type) during the past few months will already have noticed that reception conditions are rapidly changing.

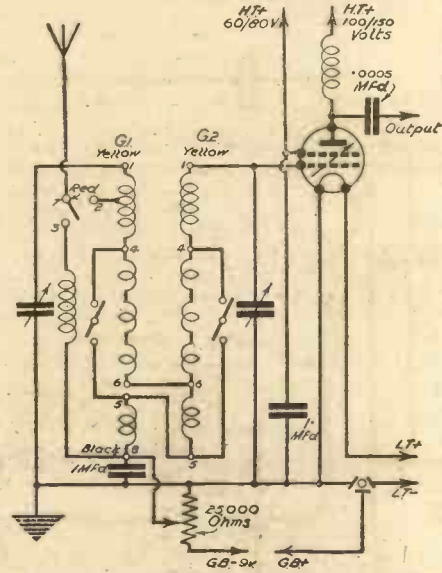


Fig. 1.—Circuit of an efficient H.F. amplifying stage.

The first sign is that a considerably greater number of stations can now be received than was the case, say, a month ago. The chief reason is that the hours of daylight are shorter and reception conditions are always much better after dark. In many ways it is an advantage to have more stations available, but there is also the accompanying disadvantage that the problem of cutting out unwanted stations is more difficult of solution. It is therefore found that the set's selectivity must be increased.

## "Practical Wireless" Selectivity Booklet

A number of methods of improving selectivity were described in the booklet which was given free with PRACTICAL WIRELESS dated January 20th, 1934, and it is not proposed to repeat the information given there. It might be mentioned, however, that back numbers of the copy referred to can be obtained for 4d. post paid from: The Publishing Department, Messrs. Geo. Newnes, Ltd., Exeter Street, London, W.C.2.

One of the simplest (and also the most effective) methods of increasing selectivity is by adding an H.F. amplifier to the existing receiver, and a design for such a unit was published in this journal for November 25th, 1933; for the convenience of new readers the circuit of this amplifier is reproduced in Fig. 1 on this page. Although it is nearly a year since this design was given, the unit is still eminently

up to date, and the only recent improvement which it is suggested might be incorporated is a variable-mu H.F. pentode valve. A Cossor VPT 210 is suitable, and this can be obtained with a four-pin base, so that it can simply be inserted in place of the plain variable-mu originally specified without any alteration to the wiring being called for.

## An A.C. H.F. Amplifier

Owners of mains-operated receivers are rather at a disadvantage when it is desired to provide an additional valve stage because the power-supply unit is not always capable of supplying the extra current required. In most instances there is a little surplus H.T. current, but on the L.T. side the transformer is generally designed to give the current required by the valves in the set, and no more. In such instances the simplest method of overcoming the difficulty is by providing the extra amplifier with its own L.T. transformer, as is shown in Fig. 2, which is a circuit similar to that in Fig. 1, but modified for A.C. operation. The lay-out of the components might be practically the same as in the battery amplifier referred to above, whilst the method of connecting to the receiver is evident.

In the case of a set which is already provided with an H.F. stage, and when selectivity is almost sufficient, it will often be found that a suitable improvement can be secured by the simple process of replacing the ordinary S.G. or V.M. valve by a corresponding one of the H.F. pentode type. In many instances the set will not require to be modified in any way, although it will sometimes be desirable to change the resistance values slightly. In buying the new valve care should be taken to ensure that it is not of the seven-pin type, since if it is a new valve holder will be called for, and the wiring will have to be altered to a certain extent.

The H.F. pentode is appreciably more stable than the previous four-electrode

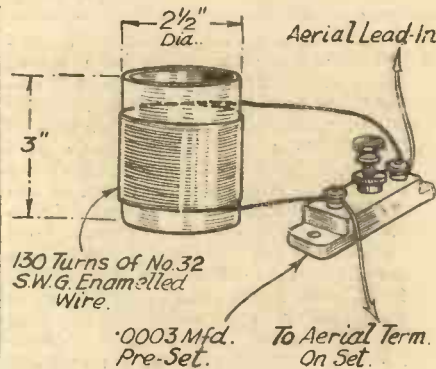


Fig. 4.—A simple wave-trap for use on the long waves.

valve, so that it will frequently be found that greater selectivity can be secured (by tapping down the coils or by a similar method) without introducing parasitic oscillation or instability which might have been troublesome before. It should also be pointed out that the tuning can very often be sharpened very appreciably by replacing the "plain" high-frequency valve by a variable-mu. Reducing the volume, by increasing the grid bias on the valve, increases the effective impedance of the valve, and thereby minimises the damping effect.

## On the Long Waves

Quite apart from all the points mentioned in the opening paragraph it must be borne (Continued overleaf)

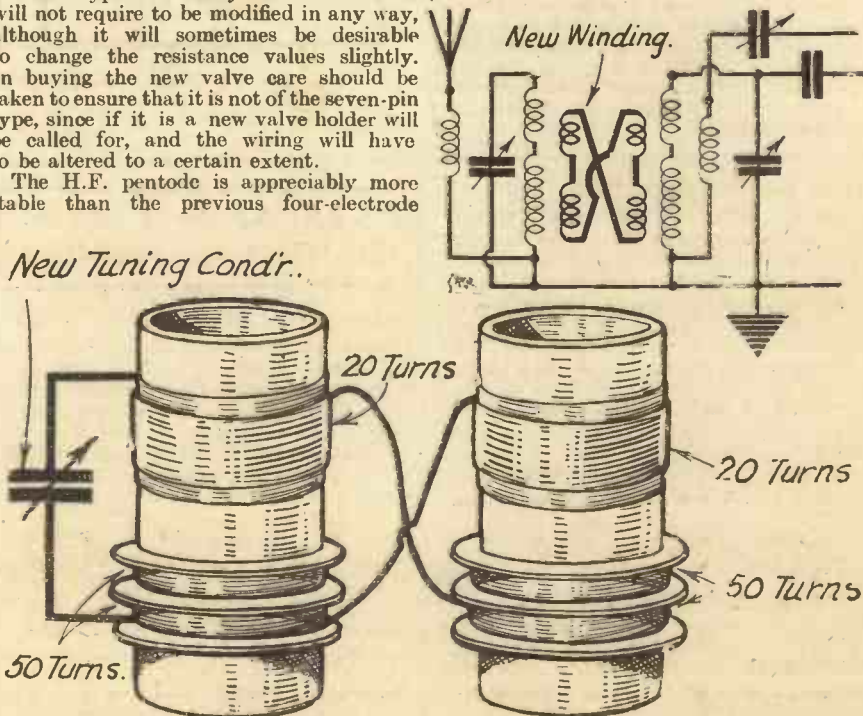


Fig. 3.—How inductive coupling windings can be added to ordinary dual-range coils to form an inductive band-pass filter.



**PREPARING FOR WINTER RECEPTION**

*(Continued from previous page)*

in mind that the new Droitwich transmitter will be in regular operation during the winter, and this, due to the very high power to be employed, will considerably increase the difficulty of station separation, not only on the long waves, but also very often on the medium-wave band. It is rather early to speculate as to the eventual effect of Droitwich, but its preliminary experiments give some indication with regard to what might be expected. The transmission has been received at tremendous strength, and it has been found that it occupies the whole of the long-wave band on many of the older-type sets which are in use, whilst it can still be heard at the "top" of the medium waveband. Long-wave selectivity has very largely been ignored in the past, because it has seldom been of very great importance, but it must be faced now. Moreover, it is by no means an easy matter to get really sharp tuning on the long waves when a det.-L.F. style of set is in use; the methods which are effective on the medium waves—such as using a series-aerial condenser, providing a loosely-coupled aerial winding, and tapping down the coil—are seldom of much value. The most reliable method of all is to employ a band-pass filter, and this should preferably incorporate inductive coupling. This will generally make it necessary to buy a new pair of coils, as well as a new variable condenser to cover the extra tuning circuit. At the same time it might be possible to make use of the coil at present fitted to the set in conjunction with another similar one. "Coupling" windings will have to be placed on both coils, and these may consist of a total of seventy turns of 32-gauge d.c.c. wire of which twenty turns are wound near to the medium-wave, and the other seventy on top of the long-wave windings. The turns should be wound in the same direction as those of the original coil, and the "coupling" windings should be cross-connected as shown in Fig. 3. To secure really satisfactory results by this method will probably involve a good deal of experimentation in order to find the optimum position and numbers of turns for the new windings.

**Using a Wave-trap**

Although it is a method which is not recommended too strongly, long-wave tuning can be much improved by the use of a simple wave-trap, which will prove valuable to those whose aerials are within fifty miles of Droitwich. The wave-trap will consist simply of a coil and condenser wired in parallel, one end of the circuit being joined to the aerial terminal on the set, and the other to the aerial lead-in, as shown in Fig. 4. The coil may be a No. 150 plug-in type, or may consist of a winding of 130 turns of 32-gauge enamelled wire on a 2½ in. diameter cardboard former,

whilst the condenser may be of the usual type or may be a pre-set one of .0003 mfd. maximum capacity.

The idea of this series wave-trap is that if it is tuned to the wavelength of the interfering station it will "reject" the signals from that station. The method of adjusting it is first to tune in the interfering station to its maximum strength, and then to vary the capacity of the pre-set condenser until the signals disappear or become very weak. Once that has been done the wave-trap need not be touched again unless the powerful transmission (Droitwich in the case under consideration) is required

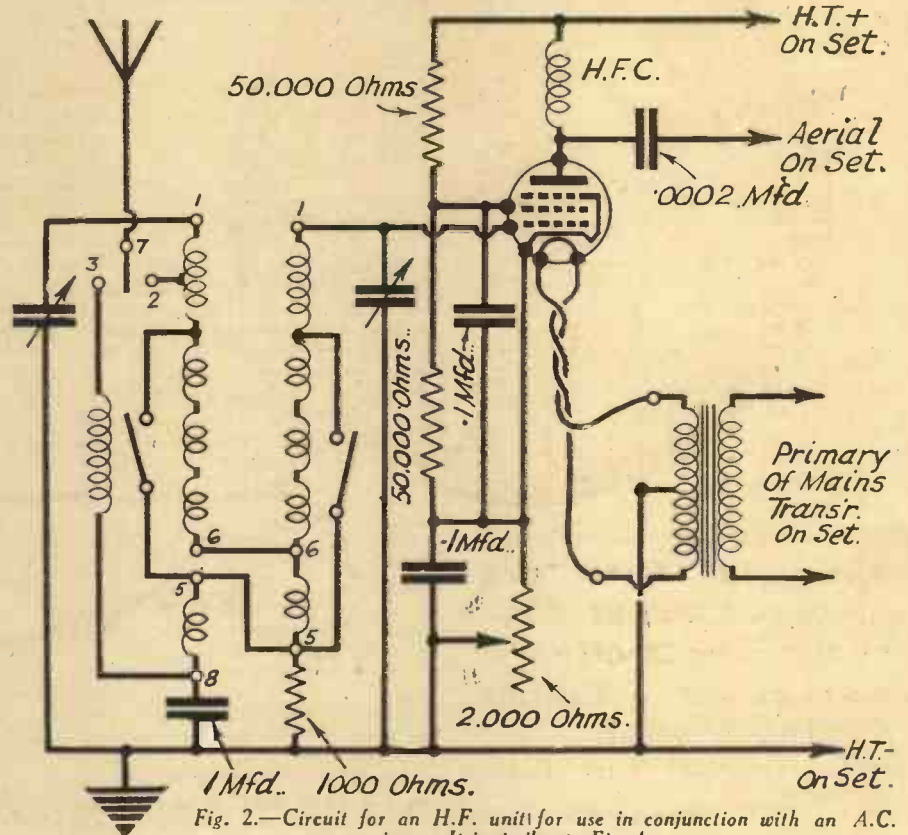


Fig. 2.—Circuit for an H.F. unit for use in conjunction with an A.C. receiver. It is similar to Fig. 4.

**"The Stuff of Radio"**

LANCE SIEVEKING, the B.B.C. playwright, has just done a new and highly original book, "The Stuff of Radio." Writing for the Microphone; Acting before the Microphone; Producing the Play, and eight complete plays by Sieveking, are but a few of the items in this remarkable book. There are a dozen photographs and drawings, some discussion of other books on the same subject, and comprehensive appendices with diagrams. For those who like speculation about the Future there are Prophecies. Containing over 400 pages, it costs 8s. 6d.

**Winter Season of Promenade Concerts**

THE B.B.C. announces that a two-weeks' season of Promenade Concerts will be given at Queen's Hall from December 31 to January 12, inclusive. The winter season will be run on the same lines as the famous summer concerts, and the services of Sir Henry Wood have been secured.

**PARS ABOUT PRO-GRAMMES & PERSONS**

**Composers of the North**

THE fifth instalment of the "Contemporary Composers of the North" series of anniversary concerts will be broadcast on September 24th. It will be devoted to the works of Cyril Scott, born at Oxton, in Cheshire, on September 27th, 1879. Scott will take part in the concert himself, playing a number of piano solos, including "Bells," "Paradise Birds," "Pierrot Triste," and "Lotusland." Isobel Baillie, well-known Manchester soprano (who has co-operated with Scott in previous broadcasts), will sing "The Blackbird's Song," "Don't come in, Sir, please," and other songs.

**"Jannock" Postponed**

UNFORESEEN circumstances have necessitated the postponement of D. G. Bridson's feature, "Jannock," from

September 18th to November 12th; in its place on the earlier date "Muggleston on the Map: a Municipal Mockery," by A. V. Williams and Ernest Milligan, will be broadcast. This short play tells the tale of a small Lancashire township in which nothing ever seemed to happen, until His Worship the Mayor (also a local brewer) decided to institute a police raid on a rival public-house. Then things woke up with a vengeance.

**A Train Secretary**

LORNA C. PHELPS, train secretary on the London and North Eastern expresses between Newcastle and London, comes to the microphone on September 25th to tell West Regional listeners about her work. She was born in Cardiff, but began her business career in London at the age of sixteen. She has typed letters on the train for Cabinet Ministers, business men, and lovers; she deals with the correspondence of foreign visitors, and does not get confused by the strange dialects from the remote parts of the British Isles which come her way.



# DON'T BE DROWNED BY DROITWICH!



**4,000,000 Wireless Sets Out Of Date AFTER SEPT. 6**

Here are three important news announcements about radio:—  
 Four million wireless sets in British homes will become out of date with the opening of the B.B.C.'s new high-power station at Droitwich on September 6. Last night, orders worth £10,000,000 were placed for the new station.

**4,000,000 Sets are rendered out of date by the new Droitwich high-power Transmitting Station . . . those 4,000,000 Sets can be modernised with SLOT!**

The new conditions call for super-selectivity, otherwise you simply cannot get the Stations you want without interference. If the selectivity of your set could be better—if your favourite station is swamped out—don't worry—SLOT makes reception keener, clearer, it conquers interference; it brings in more stations. No need to buy a new Set for the new conditions—try SLOT on your present Receiver, it takes but a moment to fit.

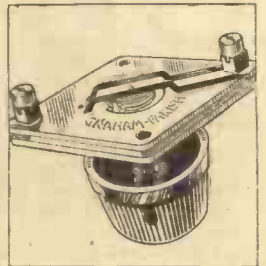
*Increase Selectivity with*

# SLOT AERIAL FILTER

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Obtainable from all Dealers or post free from sole manufacturers

## SPECIFIED FOR THE ALL PENTODE THREE



**LITLOS Reaction Condenser**

A very carefully constructed Condenser, compact in size and efficient in design, with accurately gauged bakelite dielectrics and solid brass pigtail connection to moving vanes. All capacities up to 0005 mfd.

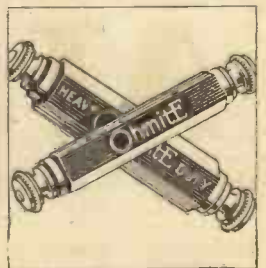
Price **2/-**



**'MAX' TRANSFORMER**

MAX Parallel Feed Transformer. One of the most astounding Graham Farish contributions to better and lower priced 1935 Radio. Alternative ratios of 1-1, 1-2, 1-3, 1-4, 1-5 and 1-6 are obtainable with the same transformer. Black bakelite case fitted with the new type of terminal developed by Graham Farish for the home constructor. Without doubt the greatest value in radio to-day.

Price **4/6**



**OHMITE RESISTANCES**

The most popular and efficient type of fixed resistance for all general purposes. "Better than wire wound." All values, 50 ohms to 5 megohms, 1/2 watt Heavy duty type, 3 watt

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**2/3**



# UNIQUE

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AT EITHER  
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## HAS THESE 6 OUTPUTS

This [wonderful new "Atlas" T.10/30 is quite unique. It has no less than 6 TAPPED OUTPUTS. This ensures correct H.T. supply to any and every battery set—straight, superhet, Class "B" and "Q.P.P." Not only is it the ideal mains unit for your present set, but it is also the ideal unit for every set you may buy or construct in the future.

In addition to H.T. supply it embodies a trickle-charger to keep your accumulator always fully charged.

### FOR A.C. MAINS

H.T. Tappings 60/80 v. (min. and max.), 50/90 v. (min., med. and max.), 120 v. and 150 v. Tapped Outputs 10, 20, or 30 mA at 120 or 150 v. Trickle Charger 2 v. at 0.5 amps. Westinghouse Rectifiers. Guaranteed 12 months.

H.P. Terms : 10/- deposit and 8 monthly payments of 8/6 each. Ask your dealer to-day for a demonstration.

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# ATLAS

MAINS UNITS CLARKE'S **ATLAS**

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Please send me FREE copy of Folder 95, telling me how to run my battery set from the Mains.

Name .....

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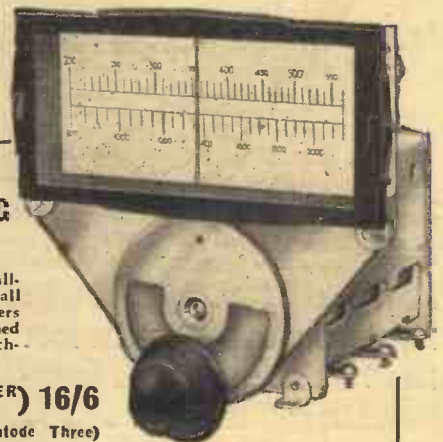
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**ALL-PENTODE THREE**  
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Catalogue



### POLAR 'MIDGET' GANG CONDENSERS

Steel frame and cover. Ball-bearing shaft. Small overall dimensions. Trimmers operated from top. Matched within 1% or 1 mfd., whichever is the greater.

**3 GANG (CONDENSER) 16/6**  
(Suitable for the All-Pentode Three)

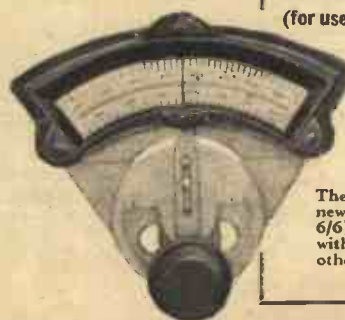
Other 'Midget' Condensers  
2 Gang (condenser only) 11/-

3 Gang Superhet (condenser only) ... 16/-

**THE HORIZONTAL DRIVE** shown on the condenser above is slow motion with vertical moving pointer and is provided with two Lamp-holders.

6/6

### POLAR 'ARCUATE' DRIVE (for use in the ALL-PENTODE THREE)



A slow motion drive with bevelled scale and moulded escutcheon. Complete with Lamp-holder ... 5/9

The two drives illustrated and the new Polar Vertical C.K. drive (Price 6/6) are all interchangeable for use with the 'Midget,' 'Minor' and other Polar Condensers.

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# RUNNING YOUR SET FROM THE MAINS

Several Methods of Operating a Battery Receiver from A.C. and D.C. Mains Supplies are Described and Illustrated in This Article.

THE proportion of mains-operated to battery-operated receivers now in use is steadily increasing. There are several reasons for this, one rather obvious reason being that the electrical grid scheme is taking electricity into hundreds of new homes every week. Another reason is that it is now almost as cheap to build (or even to buy) a mains set as one intended for battery operation; and it is well known that the cost of operating a mains receiver is infinitesimal by comparison with that of running a similar type of mains instrument. Added to these advantages, there is the almost complete and unflinching reliability of the mains set as compared with the constant risk of run-down batteries—always when a programme is most required.

When we turn to home construction we find that the number of mains-operated sets, compared with the number of battery receivers, is not nearly so high as the corresponding ratio where ready-made sets are concerned. This is no doubt partly due to the fact that many constructors feel somewhat afraid of building mains apparatus, feeling that there is a certain amount of risk attached to such an undertaking. It is certainly wise to treat a 230-volt mains supply with all due respect but, provided that reasonable precautions are taken, there is nothing to fear, and

nothing very difficult to do.

## The Simplest System

There are a variety of different methods of converting an existing battery set for mains operation, the most suitable being largely dependent upon the kind of supply, the type of receiver, and the amount which one is prepared to spend. The simplest method of obtaining all-mains working is to employ an H.T. battery eliminator of the type provided with a trickle charger for keeping the accumulator "up." This system can be adopted without making any alteration to the receiver itself, and the general arrangement is shown in Fig. 1. It will be seen that a change-over switch is used to switch on and off the eliminator,

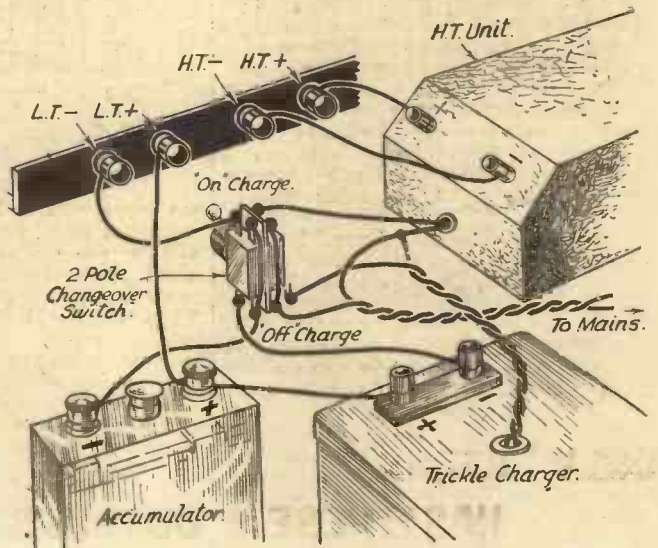


Fig. 1.—The arrangement for obtaining all-mains operation with an ordinary battery receiver.

trickle charger, and accumulator, the idea being that when the switch is "on" the accumulator is connected directly to the L.T. terminals of the receiver, the trickle charger is out of use, and the H.T. supply from the eliminator is applied to the set. When the switch is turned to the "off" or "charge" position the accumulator is disconnected from the set and joined to the output terminals of the trickle charger, the H.T. supply being cut off.

## Not Economical on D.C.

Details of the eliminator and charger are not given in the drawing, but these may be of standard type and can easily be made according to instructions which have previously been given in these pages, or they can be bought ready made from all makers of mains equipment. It is also possible to buy complete eliminators which are complete with trickle charger and the change-over switch referred to.

The method just dealt with is applicable to both A.C. and D.C. supplies, although it is by no means economical when direct current is used because the mains voltage must be "dropped," by means of a resistance, to that of the accumulator while the latter is being charged. This means that, if the accumulator has a voltage of 2 and is to be charged at .5 ampere it will consume 1 watt (volts times amps.). But to obtain this amount of power the drain on the mains supply is .5 amp. at, say, 220 volts, or 110 watts. Thus, for every watt used 109 are wasted. In terms of expense it means that the approximate cost of charging a 2-volt, 30-a.h. accumulator will be 1s. 1d.

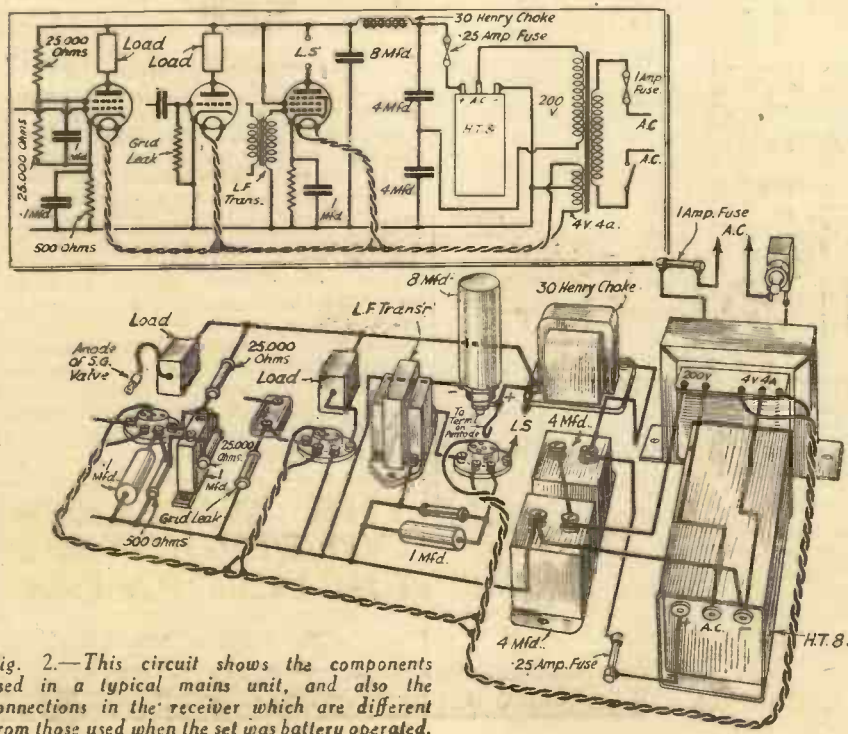


Fig. 2.—This circuit shows the components used in a typical mains unit, and also the connections in the receiver which are different from those used when the set was battery operated.

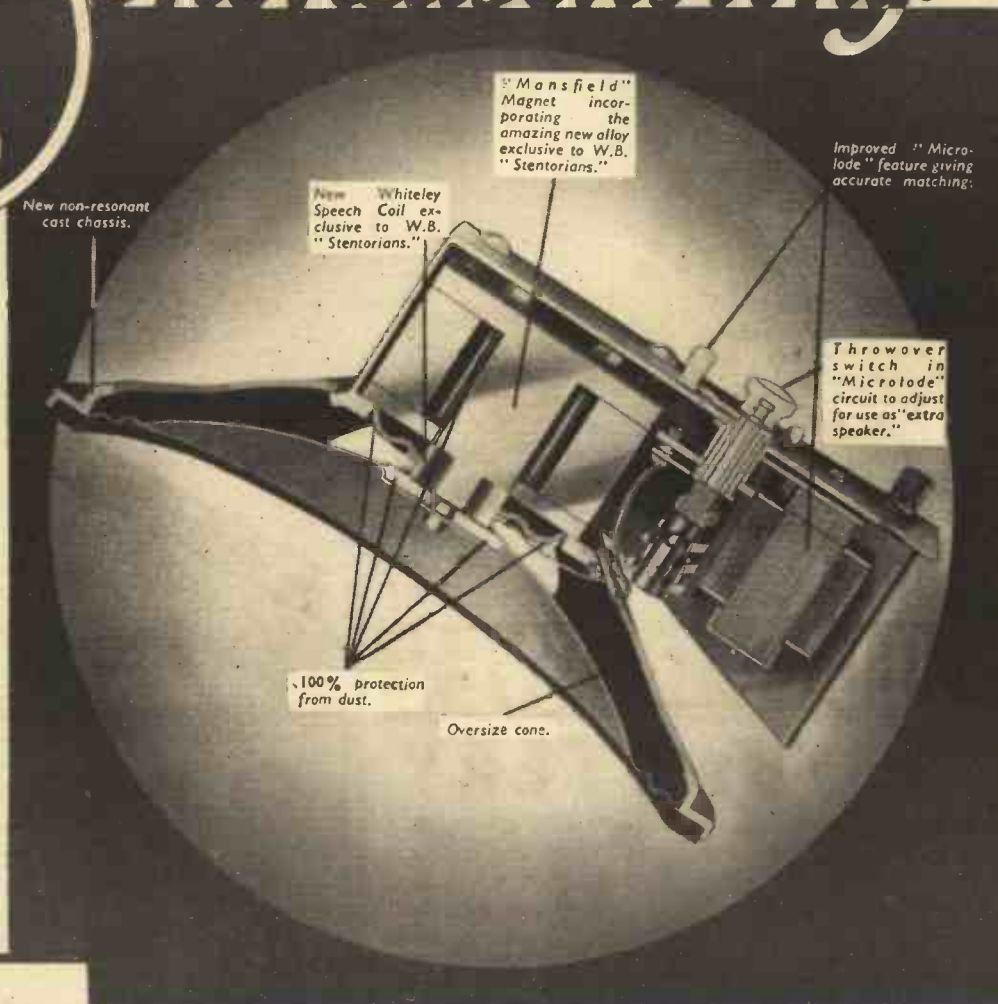








# "The Reasons Why!"



New non-resonant cast chassis.

New Whiteley Speech Coil exclusive to W.B. "Stentorians."

"Mansfield" Magnet incorporating the amazing new alloy exclusive to W.B. "Stentorians."

Improved "Micro-lode" feature giving accurate matching.

Throwover switch in "Micro-lode" circuit to adjust for use as "extra speaker."

100% protection from dust.

Oversize cone.



Stentorian Senior (PMS1) as illustrated - 42/-  
 (100 per cent. dust protection. Oversize cone).  
 Stentorian Standard (PMS2) 32/6  
 Stentorian Baby (PMS6) - 22/6

The extraordinary performance of these new moving-coil speakers is now universally acknowledged. "You have surpassed yourselves," says Mr. F. J. Gamm, editor of "Practical Wireless," and in enthusiastic reports other leading technicians have expressed their delight at the results obtained.

Every leading wireless journal has announced its wholehearted approval of the new design, and specified a W.B. "Stentorian" as exclusive or first choice for every important "constructor" receiver published.

The illustration shows some of the unique features which bring this revolutionary performance

**Test a W.B. "Stentorian" on your set. Listen to the greatly increased volume, clearer definition, and new, vivid "realism." You will be amazed at the improvement it brings for such a modest outlay.**

# STENTORIAN

## PERMANENT MAGNET MOVING-COIL SPEAKERS

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Sole Agents in Scotland: Radiovision Ltd., 233, St. Vincent Street, Glasgow. C.2

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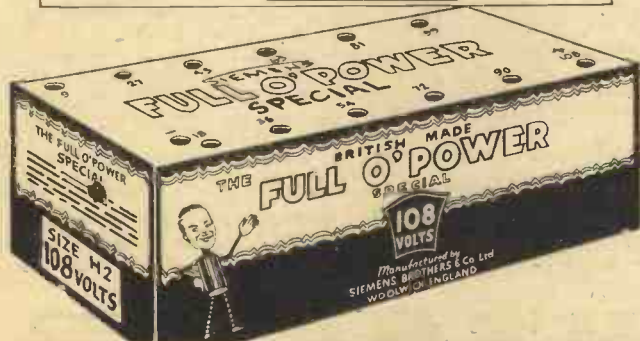
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BATTERY**

The incomparable Radio Battery with exclusive features, which can be depended upon to provide the maximum of enjoyment from your wireless set, and the best possible service at the lowest cost consistent with dependability.

Buy one to-day, it proves its value by performance.

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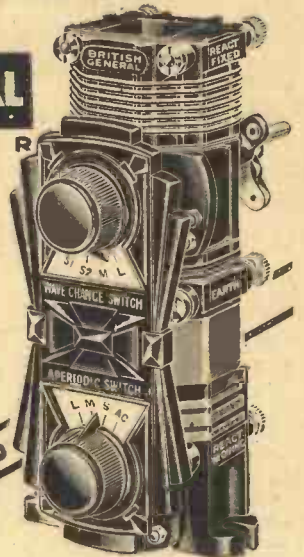
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SHORT WAVE set  
with the  
BRITISH GENERAL  
ALL WAVE TUNER**

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Its remarkable popularity is due to the superb workmanship, reasonable price and, above all, its unequalled efficiency.

Easy fixing and simple tuning.

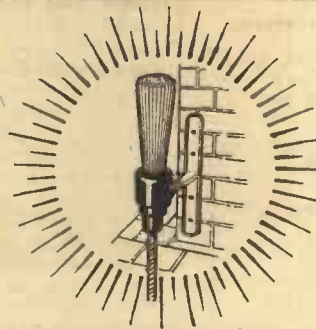
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**9/6**

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**NO-MAST  
THE WORLD'S BEST  
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Neater and far more efficient than the old-fashioned ugly pole aerial. Enables you to tune in stations never heard before on your set, increasing volume and reducing interference. Is non-directional, designed for modern congested wave-lengths. Especially valuable to flat-dwellers.

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SEE THEM BOTH AT THE \*  
NORTHERN RADIO!  
EXHIBITION,  
MANCHESTER. **STAND 37**

Sole Concessionaires: Central Equipment Ltd., 188-192, London Road, Liverpool.

**JUST the Aerial for  
Droitwich!**

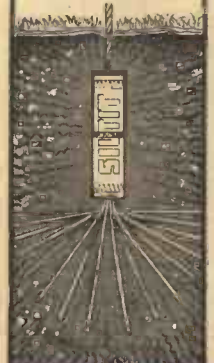
"Sunday Mercury" expert says:

"Tried against Droitwich when it was testing, the result was a very considerable improvement in long-wave selectivity on an ordinary three-valve set."

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EVER-MOIST  
EARTH**

Maximum contact area through patent spreading antenna. No metal terminals to corrode—the 8-ft. lead-in is part of every "Siltit" earth. 100 per cent. efficient in any soil or climate.

3/9 Complete with 8-ft. lead-in wire



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# ASKED AND ANSWERED AT RADIOLYMPIA

This Article Gives a Brief Résumé of the Various Inquiries Dealt with by Our Technical Staff at the 1934 Radio Exhibition

**T**HE PRACTICAL WIRELESS Advice Bureau endeavours to give readers free advice of a reliable nature, but it is sometimes found very difficult to ascertain the nature of a receiver fault from information given in a letter. We therefore welcomed the arrival of Radiolympia, as by personal contact with our readers we were better able to solve their problems than is possible by means of a postal reply.

During the recent exhibition, thousands of readers visited our stand in order to avail themselves of our free advice service, and many intricate problems were solved by the technical staff in attendance. Other readers called to submit suggestions, and we would assure them that these are being given careful consideration.

## PRACTICAL WIRELESS Receivers

We were not able to exhibit all the sets we have designed during the past twelve months, but the most popular ones were available for inspection.

The receiver that created a great deal of interest, especially with the ladies, was the Atom Lightweight Portable—our midget three-valver, with throw-out aerial. We are now convinced that there is a greater demand for a compact set of this type than for the frame-aerial type of portable, and, therefore, the advent of a Super-Atom next summer is practically assured.

The Leader series of receivers also created a good deal of interest, mainly because they have proved that home construction is worth while, even from the economy point of view. The greatest advantage of home construction lies in the fact that the receiver circuit is known to the constructor, and, therefore, he is able to conduct his own repairs and effect improvements when more modern components are available. The Leader sets were designed with a view to lowering the price of home-made sets, however, and only absolutely essential components were used. Thousands of readers have had surprisingly good results with these receivers, and the queries asked at the Exhibition indicate that poor performance is mainly due to bad constructional work—especially poor soldering. Soldered joints are undoubtedly better than pressure joints, but there still seems to be a number of constructors who find soldering difficult. If care is taken to clean the soldering iron and the surface to be soldered, and to keep the tip of the iron tinned with solder, no difficulty should be experienced.

It is also evident that the purpose of the



metallized baseboard is not clearly understood by some constructors. The metallized surface takes the place of a metal sheet, but is much more easily worked than metal, and therefore lends itself admirably to home construction. The metal is only a coating on the surface of the wood, however, and therefore, to ensure good contact, it is advisable to fit a metal washer underneath the wire that has to be connected to this surface.

Many querists asked for a superhet design, and we would again assure these readers that the matter is receiving our careful attention. Past experience has indicated, however, that the average constructor finds it less difficult to construct a straight receiver than a superhet, this being mainly due to the high degree of selectivity obtained with the latter type of receiver, with the consequent necessity for greater care being taken in adjusting the trimmer condensers. Past season superhets have also proved more expensive to run than straight receivers owing to the use of more valves. Manufacturers have concentrated on the design of economical multi-electrode valves for use in superhets during the past few months, however, and therefore, it is to be hoped that during the coming season it will be possible to design a three- or four-valve superhet that will compare in sensitivity with a straight receiver having the same number of valves—this, by the way, can hardly be said of last season's supers.

## Servicing Difficulties

Judging from the number of inquiries received concerning receiver servicing, there is seemingly a great demand for up-to-date data on this subject. Fault tracing has been dealt with in a series of articles in PRACTICAL WIRELESS, but in the interests of new readers, this subject will be fully dealt with in a further series during the coming season.

It is evident, however, that many servicing difficulties which beset the average constructor could be cleared very easily if a knowledge of Ohm's Law and the theory of the ammeter were acquired. Most receiver faults can be located by means of an ammeter fitted with external series and shunt resistances for measuring voltage and resistance values.

## Short-wave Troubles

The number of inquiries made relative to short-wave reception tends to indicate that there is a growing interest being taken in this branch of wireless. The main difficulties experienced by constructors are concerned with the methods adopted for converting existing broadcast band receivers for short-wave reception. Briefly, an adaptor is required if the receiver has no H.F. amplifying stage, the adaptor plug being inserted in the detector valve-holder. When the broadcast receiver is fitted with one or more H.F. stages, however, a converter should be used. It is only necessary to connect the output lead of this to the aerial terminal of the receiver, and set the receiver tuning dial at long-wave maximum; the converter-receiver combination will then function as a short-wave superhet.

## Postal Inquiries

In conclusion, we would assure readers that we are anxious to help them in their difficulties, and every query is carefully dealt with, but we would point out that all available details pertaining to their problem should be given, and if this relates to apparatus described in PRACTICAL WIRELESS, delay will be avoided by stating the issue and page number on which the article appeared. Long, rambling letters containing vague requests take up so large a portion of the staff's time that legitimate queries are sometimes delayed in consequence. We would, therefore, ask querists to co-operate with us in this matter, by ascertaining that their query comes within the scope of the Advice Service, as outlined on the Inquiries page, and by giving full details of their difficulty as mentioned above.

**REMEMBER  
OUR  
QUERY SERVICE  
IS FREE  
TO ALL READERS**



# HOW THE CAR SET GETS ITS H.T.

Some Effective Schemes which are Employed for Car Radio Receivers

THE designer of the car-radio receiver has a number of difficulties to confront him which are additional to those found in ordinary receiver design. From every point of view the car radio works under exceptional difficulties.

Firstly, it is impossible to fit a good aerial in such a limited space, while the presence of so much metal, especially in steel body work, acts as a shield against the pick-up of signals. The aerial, such as it is, must have but little directional effect if the strength of signals is to remain independent of the direction of travel. The chassis of the car must provide the only earth, which, apart from its obvious inefficiency, introduces yet another difficulty to successful reception—electrical interference from the magneto, distributor, sparking plugs, and even the electric screen-wiper. Finding a suitable site for the loud-speaker and the receiver is not always easy, but if the designer has solved all his problems of the H.T. supply he can tackle his other troubles with confidence.

## Different Methods of obtaining Car H.T.

The generator and vibrator systems are most commonly used. The former is the better system in every respect except the question of first cost. It is foolproof and practically faultproof and has an efficiency of about 85 per cent. Both generator and vibrator obtain their power from the car accumulator, which makes reception independent of the running of the car. In some systems, the valves obtain their L.T. supply direct from the accumulator. One or two commercial firms use the new universal valves for their car radio receivers, so that only one input voltage is required for the receiver, which operates exactly as an ordinary A.C.-D.C. set.

### A Compact Generator

A very compact and efficient generator for supplying H.T. from the car battery of 6 or 12 volts is the M.L. Anode Converter. In this machine a common armature carries the L.T. and H.T. windings, a commutator for each being arranged at either end. Field losses are eliminated by the use of permanent-magnet fields. This double-wound rotary transformer is housed in an aluminium case containing all the necessary H.T. smoothing apparatus and an anti-interference device. The generator system has proved its reliability, but its comparatively high cost has led to the development of the vibrator.

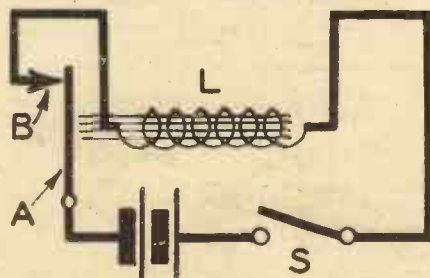


Fig. 1.—The wiring of the electric bell or buzzer is the basis of the vibrator used for supplying the car-radio's H.T.

## The Vibrator System

There are two main types of vibrator, one having a valve rectifier and the other mechanical rectification. These two systems will be explained after the theory and the design of the vibrator have been considered. Fig. 1 shows an interrupter circuit exactly as found in the electric bell or buzzer. In a position of rest, the steel spring A makes contact with B, so that the circuit is completed when the bell-push or switch is closed. The current then flowing through the coil L magnetizes the iron core and attracts the end of the spring away from the contact B, so that the current stops. The iron core loses its magnetism and the spring returns to contact B. As it completes the circuit by this action, the entire cycle of movement is continued repeatedly so long as the switch is kept closed. The speed of the make and break will depend upon the strength and inertia of the spring, the amount of its travel and the power of the magnetic force.

Just at the moment of the break of the circuit the self-induction of the coil causes

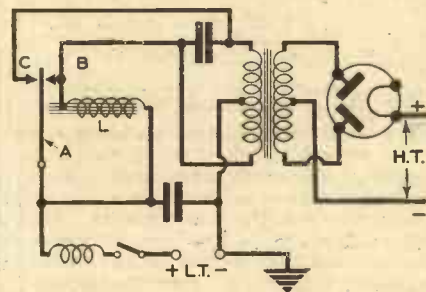


Fig. 2.—This circuit is now employed for full-wave rectification using the vibrator.

a high voltage to be produced, which, if not usefully employed, will discharge across the contacts and seriously pit them.

## The Valve Rectifier Vibrator

The circuit in Fig. 1 has been developed into the more elaborate form of the valve-rectifier vibrator illustrated in Fig. 2. The interrupter circuit will be recognized at the coil L, with its iron core, and the spring A with the contact screw at B. The spring stops midway between the two contacts B and C in its position of rest. A special iron-cored transformer, centre-tapped on the primary winding, is connected at its outer ends to these two contacts. The secondary of the transformer can be regarded as an ordinary H.T. secondary winding connecting to the anodes of a rectifier valve in the usual way.

A condenser is wired across the transformer primary to flatten out the high-potential peaks which, as previously mentioned, are created at the collapse of the magnetic circuit and to prevent excessive sparking at the contacts. The second condenser assists in this, and with the choke in the L.T. lead suppresses any H.F. interference.

When the switch is closed, the circuit is completed through the coil L, and half the transformer winding. The core becomes magnetized and pulls the spring

A to make contact with B. Now the coil L is short-circuited and its hold over the spring is lost. The latter flies back to C so that current flows in the second half of the transformer. With the coil no longer shorted the spring is pulled again to contact B to start the

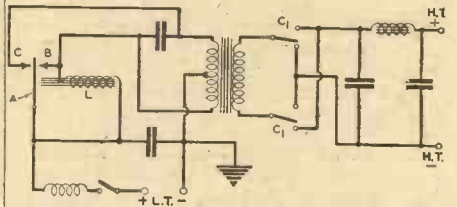


Fig. 3.—In the mechanical vibrator shown here, the rectifying contacts C are operated by the interrupter spring A.

cycle once more. Thus each half of the transformer winding becomes energized in turn, and the A.C. output is rectified on the secondary side in the usual way. A rectifier of this type has an efficiency of 40 to 60 per cent. and can deal with 50 milliamperes at 200 volts. The frequency of the A.C. output is about 200 cycles per second.

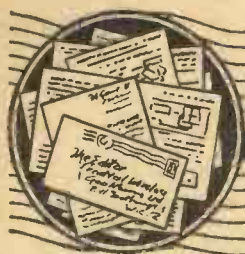
## The Mechanical Rectifier Vibrator

The circuit of the mechanical rectifier vibrator is given in Fig. 3. It differs from the valve rectifier type only in the method of rectification. The secondary winding of the transformer connects to a set of contacts mechanically coupled to the interrupter B, A, and C. The efficiency of this system is not quite so high as the valve rectifier and, with the additional contacts, is not as reliable. Troubles with vibrators of either type described are nearly always connected with wear, pitting, or mal-adjustment of the contacts.

## "RADIO SERVICING SIMPLIFIED"

A HANDY service manual has just been issued by the Automatic Coil Winder & Electrical Equipment Co., Ltd., makers of the well-known Avo-meter, Avo-minor, Avo-daptor, etc. This book contains some valuable information regarding the testing of wireless receivers and wireless components and will prove invaluable to the service engineer as well as to the keen experimenter. Among the contents are: Standard Valve Tests, Standard Resistance Tests, Standard Condenser Tests, Inductance and Capacity Tests, Graphs for Determining Values of Inductances, Routine Tests for Receivers, Ganging a Straight H.F. Receiver, Superheterodyne H.F. and L.F. Circuits, Ganging Superheterodyne Receivers, Automatic Volume Control, and Gramophone Pick-up Arrangements. In addition the book contains numerous diagrams and graphs and an abac connecting amps, volts, and ohms. The price of the book is 2s. 6d. (2s. 9d. post free) from the above-mentioned company. The address is Winder House, Douglas Street, London, S.W.1.



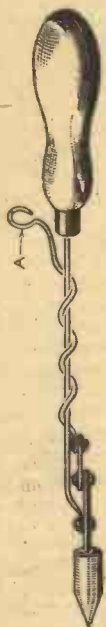


# READERS' WRINKLES

THE HALF-GUINEA PAGE

## Universal-angle Soldering Iron

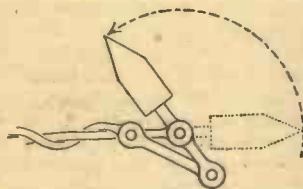
MANY wireless constructors will find this adjustable soldering iron very useful when wiring sets. It is made from two 16-gauge cycle spokes. Rivets are made from brass springs. The iron can be screwed or soldered with silver solder. By pressing loop A the iron can be put to any angle between 100 and 30 degrees.—H. PEEBLES (Glasgow).



## A Clothes-peg "Synchronizer"

A SIMPLE device which acts very well as a television synchronizer can be made from a spring-type clothes peg.

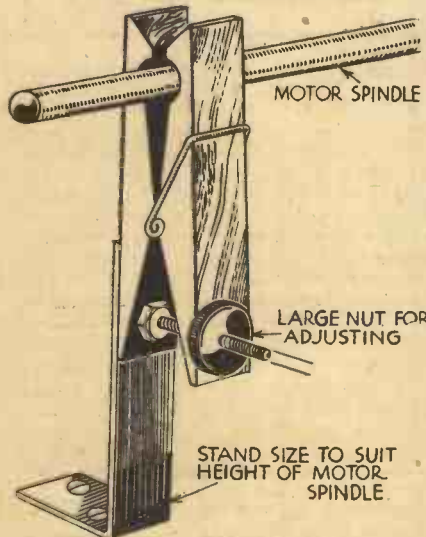
Two holes, one about 1/4 in. diam., the other about 3/16 in., are drilled, one in each tapering end of the peg. [A length of



An adjustable soldering iron which has many useful applications.

B.A. rod is passed through both holes and one end is secured at the small hole by means of two nuts. The sloping side of the peg will have to be squared to allow the nuts to rest parallel to each other.

A large nut is then placed on the protruding end of the rod. By screwing this in or out the pressure on the motor spindle,



A simple device for controlling the speed of a television-receiver disc.

## THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be original. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

which passes through the top of the peg, can be altered, thus changing the speed of the motor. If the spindle is not gripped when the peg is tightly closed the rounded surfaces of the peg can be lined with rubber.

The "synchronizer" is mounted on a stand or bracket, its size depending on the height of the motor spindle from the base-board.—G. G. SMITH (Blackheath).

## Galvo. from Old Brass Watch Case

THE description of the construction of a pocket galvo. from an old brass watch case will serve as a guide for making one from almost any size of case.

Remove one of the brass plates. In the centre of one drill a small hole to suit an end stone, such as jewellers use in watches. Cut a piece of brass to fit across the diameter of the plate. This strip should be 1/4 in. wide and 3/16 in. thick. Drill a hole at each end to correspond with holes in the plate. Mount this strip by means of two small pillars 1/4 in. in diameter by 1/4 in. long. Drill a central hole in strip to correspond with hole in plate, and fit another end stone in this.

Taper a piece of watch-spring at each end from the centre to form a pointer. Drill a 1/32 in. hole in it and fit a shaft in it tight to the hand. Magnetize the pointer, and pivot the shaft at the ends to suit the end stones.

Cut a piece of tin to the shape shown below in the main sketch. Lap it with silk tape. Varnish and lap it once more with about 8ft. of 28 S.W.G. silk-covered wire.

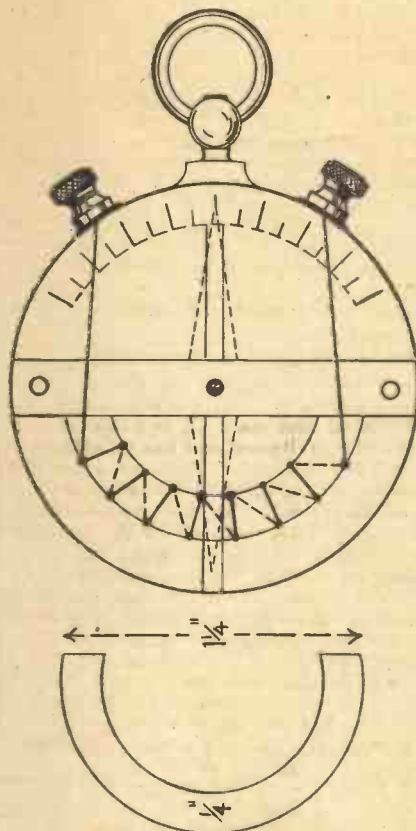
Take a piece of spring steel 1/16 in. in diameter by 1 1/2 in. long, magnetize it and fasten in cross section to the horseshoe magnet after taping and varnishing. Fasten the two magnets to the back of the brass plate by means of a short piece of ebonite and small screws at the ends. Drill two holes at each side of the case for the placing of two terminals, and connect as shown in sketch. A graduated scale should be fixed to suit.—W. H. GRAYLING (Cambridge).

## Keeping Records Clean

A BICYCLE-BELL clip, on the grub-screw of which a small cut-down paint brush has been mounted, will be

found useful for obtaining better reproduction from gramophone records, if fitted to the carrier-arm of a pick-up.

The brush cleans the dust from the grooves before the needle traverses them.—D. BURSTON (Liverpool).



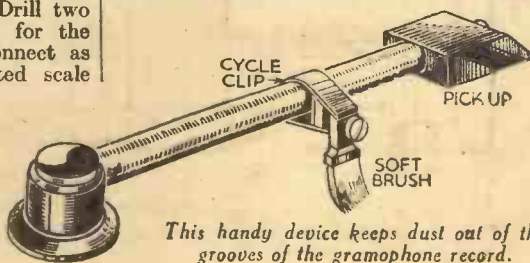
How to construct a galvanometer from an old watch case.

## 50 Tested Wireless Circuits

By F. J. Camm (Editor of "Practical Wireless")

This handbook contains every modern circuit complete with instructions for assembling, component values and notes on operation.

Obtainable at all Book-stalls or by post 2/9 from Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. 2/6



This handy device keeps dust out of the grooves of the gramophone record.



# CONSTRUCTIONAL DETAILS OF

Ultra Selectivity—Simple Construction—Powerful Output—Tone Control—Fretless Cabinet—

HERE are constructional details of my latest receiver. I want no fanfare of trumpets to proclaim the many important features which it incorporates. I prefer the receiver literally to speak for itself. The design carries with it my assurance that this it is well able to do in a convincing manner. It has always been part of my policy to originate—to start fashions, rather than to follow them. I think it is generally agreed that I have brought some degree of originality to home construction in the two years encompassed by the weekly issues of PRACTICAL WIRELESS. The "Fury Four," the "Featherweight Portable Class B Four," the "Atom Lightweight Portable," the "Leader" series of cheap receivers, and the "Summit," are but a few of the designs which have left the beaten track and definitely revived interest in home-constructed receivers. Until the publication of PRACTICAL WIRELESS, the flat baseboard and panel system of construction had held sway from the very inception of wireless as a hobby. This journal was responsible for standardizing the wooden chassis system, and later the metallized chassis. This journal is the only one which guarantees its receivers when constructed from the parts we specify (no alternatives!) to function in the manner claimed. It is the only journal which makes no charge for its Query Service. That our policy has been soundly designed and was long overdue is supported by the goodwill we have built up in the brief space of two years; in spite of the fact that our policy is



The "All-Pentode Three" is housed in an attractive fretless cabinet designed by Mr. F. J. Camm and made by Peto-Scott, Ltd. This represents a marked advance in cabinet design.

It is a plain statement of fact to say that PRACTICAL WIRELESS lifted radio as a hobby from the rut into which it had fallen. Those readers who have a complete file from No. 1 of this journal will find it interesting to compare the vast strides for which we have been responsible in two years with the comparatively slow rate of growth during the previous twelve years. Not only have we sought to improve home-constructed receivers, we have endeavoured to cheapen them. Regular readers will be well aware of the success attending our efforts if they compare the prices of valves and components with those ruling a year ago.

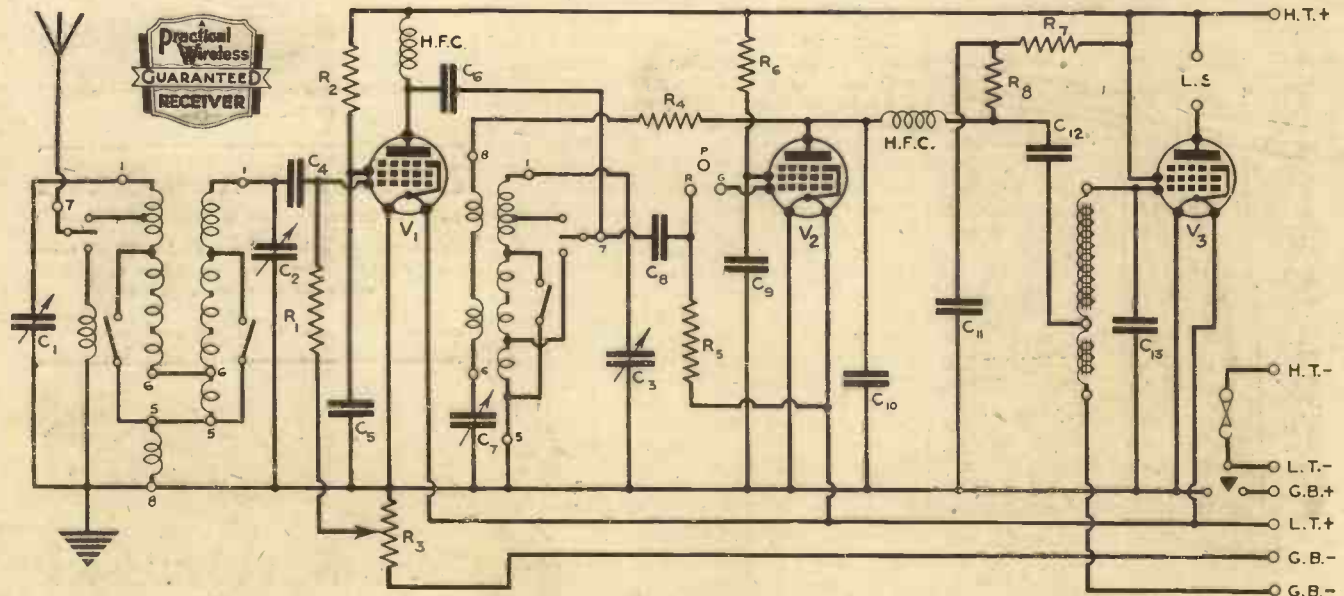
unfettered by advertising interests, we enjoy the goodwill and the co-operation of many thousands of readers and the entire radio industry.

## A Real Advance

The "All-Pentode Three" marks another step forward in our policy of originality. It is not just another set. The only reason for inviting readers of this journal to make another receiver is that it should mark an advance on previous designs. My designs have been so popular in the past that they are still being made, notwithstanding the fact that my later designs represent a marked advance. The "All-Pentode Three" is my best receiver. It would not be presented to you if it were not. If you are interested in a receiver which gives equal selectivity on both wave-bands without loss of signal strength, which has a really healthy output, which employs iron-core coils, which has graded and extremely smooth volume control, which contains no stunt knob introduced merely as a stunt, employs tone correction on the output

### SPECIAL FEATURES.

- Variable-Mu H.F. Pentode—for long range, selectivity, distortionless volume control, and complete stability.
- Screened Pentode Detector—for maximum amplification and smooth reaction.
- Pentode Output Valve—for economy, high-class reproduction and high L.F. amplification.
- Inductive Band-pass Filter—for uniformly high selectivity on both wave-bands, and best results from the new Droitwich transmitter.
- Auto-choke L.F. coupling—for greatest step-up at minimum expense.
- Tone correction on L.F. coupling—for best reproduction.
- New "Practical Wireless" design of fretless cabinet.



Theoretical circuit of the All-Pentode Three, specially designed by Mr. F. J. Camm for "Practical Wireless" readers.



# THE ALL-PENTODE THREE

Speaker Attached to Lid—Few Controls—Combined Wavechange and Radiogram Switch

valve, in fact, if you are interested in a receiver which represents the very latest for home constructors, the "All Pentode Three" merits construction. Even the cabinet marks an advance; it is fretless. The speaker is attached underneath the lid and the sound escapes through the slots provided by a raised portion. I have long been of opinion that the fretted grille will be relegated to the limbo where repose the fretted-front pianos of the Victorian days. It is quite unnecessary, and whilst designers of radio receivers (like the designers of motor-cars who seem to think that the shape of the radiator is the only part of the car which can be improved) have concentrated their attention on producing some new design of grille, none of them, except myself, has thought it desirable to get rid of it altogether. You will like the arrangement. Not only does it permit a symmetrical arrangement of the cabinet; it also makes use of a waste piece of space between the valves and the lid. Microphony is markedly absent, and merely by raising the lid the internals are revealed for adjustment if and when necessary.

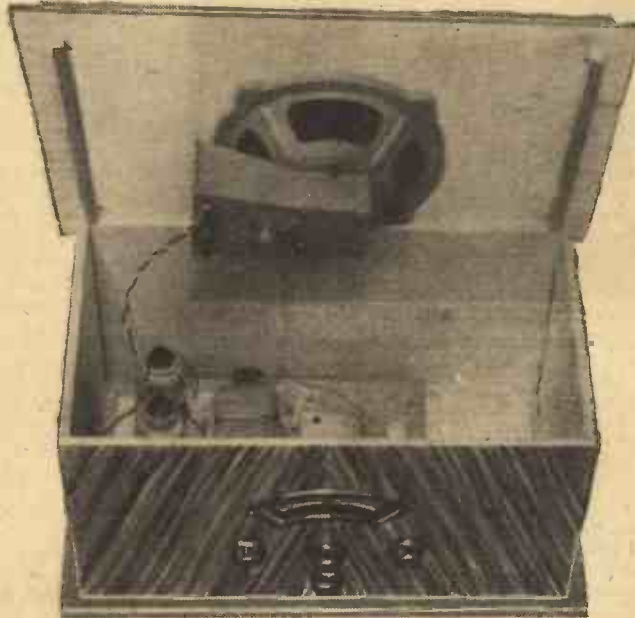
followed will be unnecessary. As, however, the set is sure to be made up by hundreds of readers who have not previously made a receiver for themselves, the following constructional details are given.

away in readiness for drilling holes for the valve-holders and terminal-socket strips. The holes for the valve-holders are all 1 in. in diameter and can therefore easily be made by means of a brace and centre bit. It is hardly necessary to mention that each hole should be started from the top surface of the chassis baseboard, the circle traced on the under side, and the hole then completed from the top; this avoids any possibility of the wood being split or the holes being made jagged.

The holes required for the terminal-socket strips are 3/4 in. in diameter and 1/2 in. between their centres. Two pairs of these holes are required, one for the aerial-earth strip, at the back of the chassis, and the other for the speaker connector on the left-hand side.

After attaching the valve-holders, it will be found most convenient to turn the chassis upside down and then to mount the few components on the underside; this will prevent any possible damage to such components as the tuning condenser and coil assembly. Next, attention should be paid to the variable condenser, which is attached to the chassis by means of three 3/4 in. screws which are supplied with it. The positions for the screw holes in the chassis are easily determined by using the

template which the makers thoughtfully provide. The holes should be made 5/32 in. in diameter by means of a twist drill, when the screws can be inserted from below. Care must be taken in mounting the condenser to ensure that the spindle of the "Arcuate" drive will project sufficiently far through the front of the cabinet



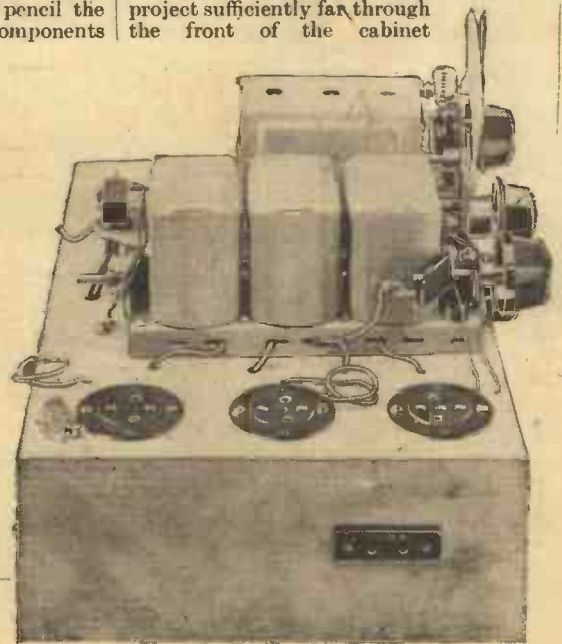
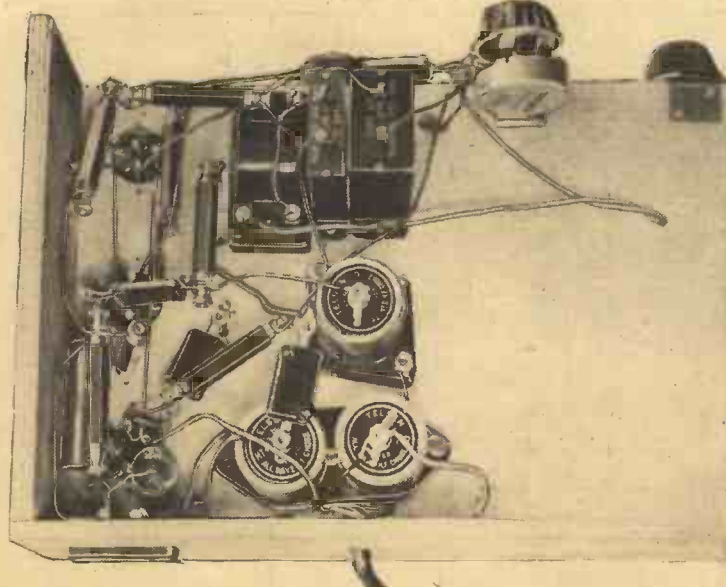
A top view of the "All-Pentode Three."

## Simple Construction

You will find that the construction of the receiver is simplicity itself; the chassis can be obtained ready built up and only requiring to have a few holes bored in it. Also, as it is made of wood (the surface being metalized, of course), all the components can be mounted merely by the use of ordinary wood screws. In fact, so simple is the construction that to many readers a complete description of the process to be

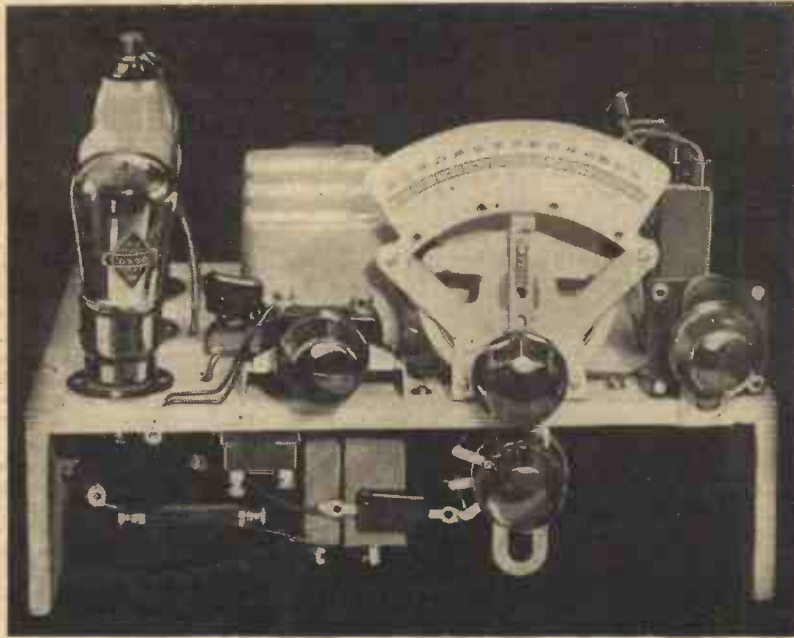
## Positioning the Components

Having obtained the chassis, the first thing is to place the components in their approximate positions, which are clearly shown on the full-size free blueprint given with this issue, and also in the various photographs. Lightly mark in pencil the positions and then take the components



The arrangement of the sub-chassis components of the "All-Pentode Three" and (right) a side view. Note the speaker lead strip.





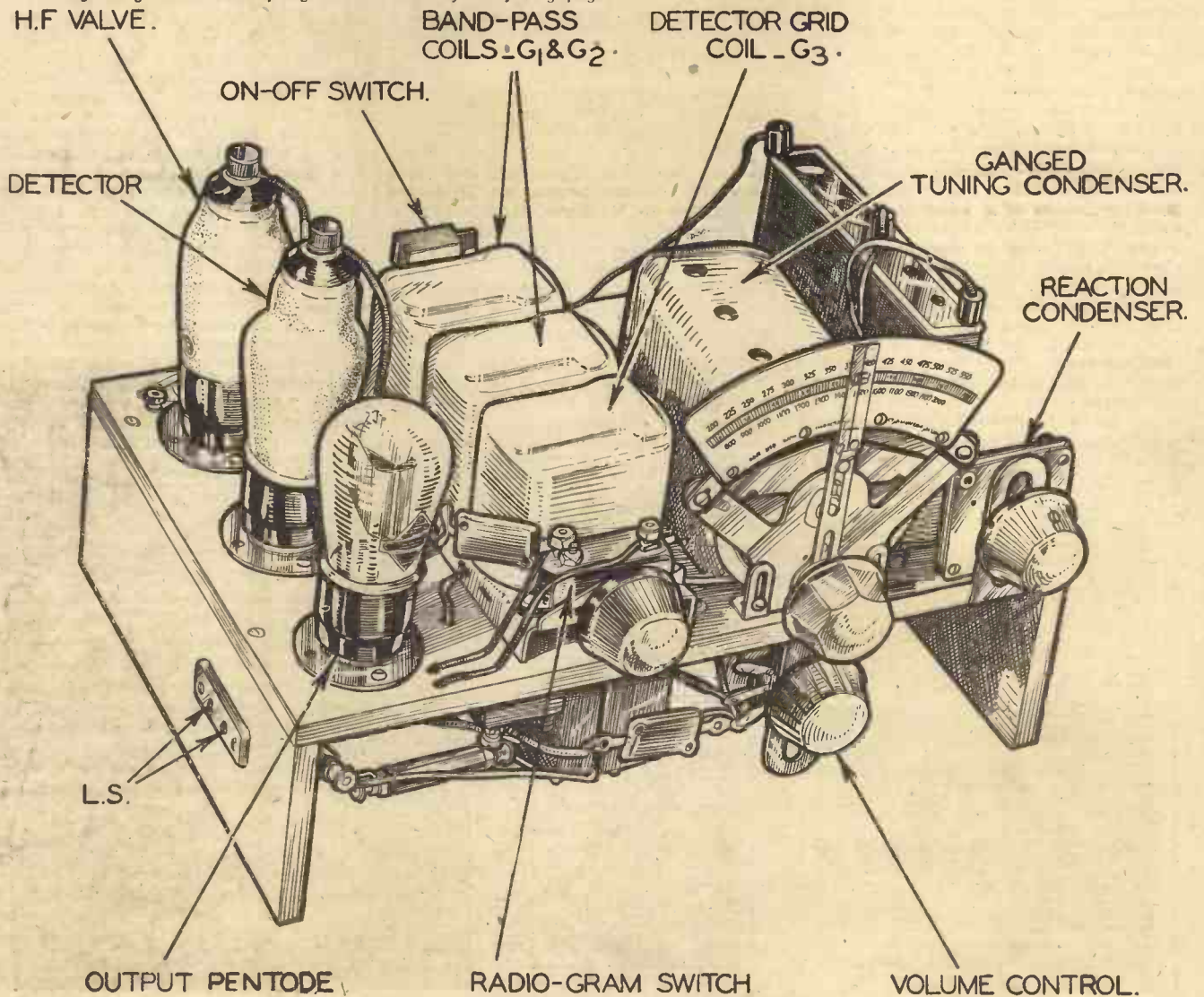
Front view of the "All-Pentode Three." Compare with the front of chassis lay-out given in the top right-hand corner of the facing page.

MANY NOVEL FEATURES  
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for the knob to be securely attached. This will be obtained by so placing the condenser that the extreme end of its operating spindle comes to within  $\frac{1}{16}$  in. from the front edge of the chassis.

Coil and Condenser Assemblies

Little need be said concerning the mounting of the coil assembly, since this is held in place by means of two  $\frac{1}{8}$  in. screws, the front of the metal chassis being approximately  $\frac{1}{16}$  in. from the front edge of the chassis. It will be noticed that two component brackets are used to support the reaction condenser and the variable- $\mu$  volume control. Both of these are screwed to the underside of the chassis and, in the case of the volume control, the screw should not be more than  $\frac{3}{8}$  in. long, otherwise they will touch the metal coating on the upper



Our artist's impression of the All-Pentode Three.

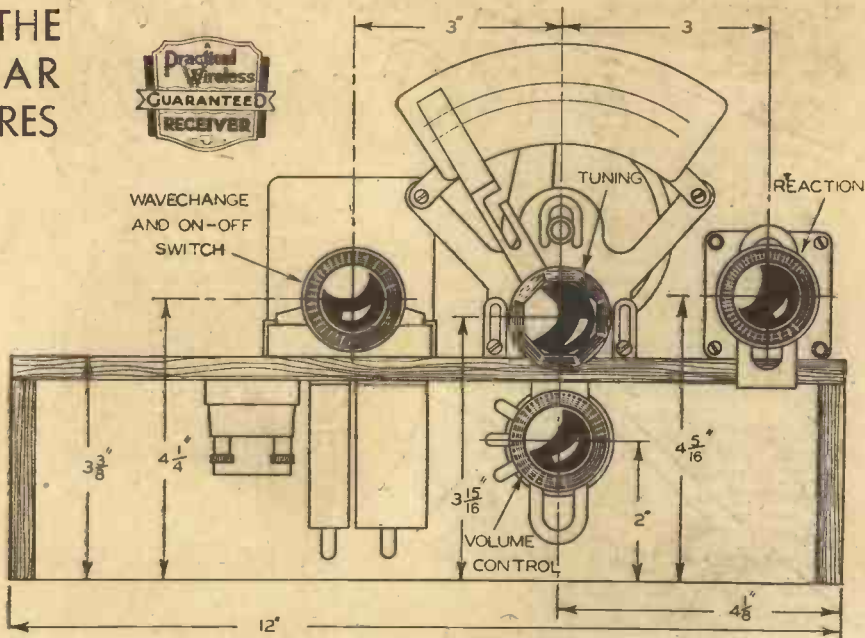


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surface and might thereby short-circuit the potentiometer.

## Easy To Wire

The wiring is just as simple as the assembly of the components, and can be undertaken with complete confidence. First of all, it will be found most convenient to connect up the coil assembly, and this matter is very much simplified by the provision of colour-coded leads which are attached to this assembly. Start by connecting the three yellow leads (from terminals 1) on the right-hand side of the unit to the three soldering contacts on the left-hand side of the gang condenser. After that the other coil connections can be dealt with in any order. It will be apparent from the blueprint that some leads go through holes in the chassis to components mounted on the underside, and the necessary holes can be made as the construction proceeds, by means of a 5/32-in. twist drill. The Q.M.B. switch mounted on the bracket at the rear of the coil assembly can next be dealt with, and it will be seen that two of the leads to this are from the battery cord assembly, another one being for the G.B. + connection, whilst the fourth one is connected to the metallized chassis. This connection, as well as one or two others, is made by means of a wood screw with a small washer placed under its head. The washer should not be omitted because it



Front of chassis lay-out, with drilling dimensions for the cabinet.

helps to maintain a perfect contact between the wire and the chassis, and prevents the looped end from being splayed out.

## Using a Pick-up

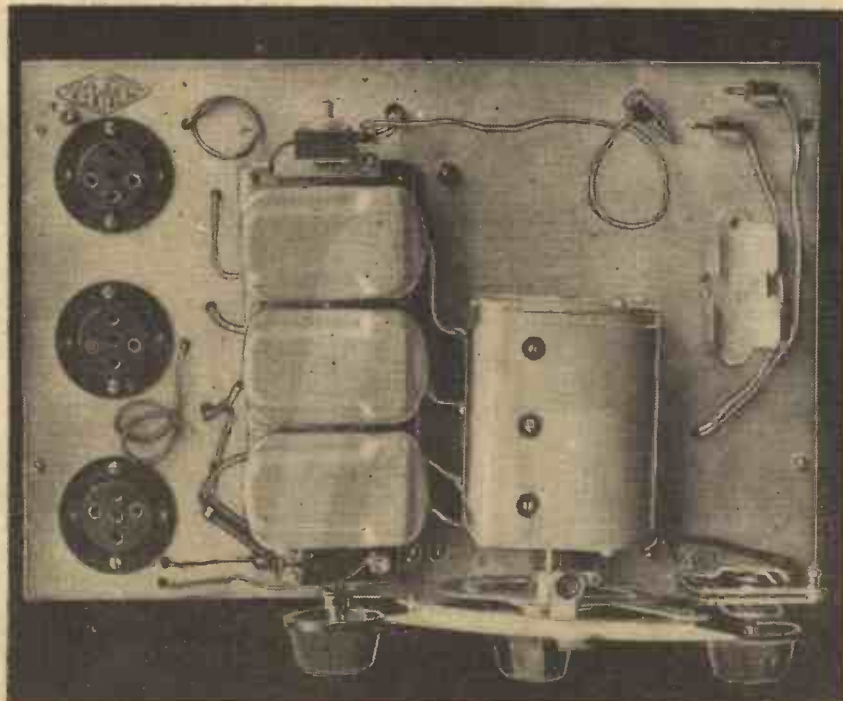
There is a radiogram switch (the black bakelite box) on the front of the coil assembly, and this is provided with three terminals. In the original set illustrated actual pick-up terminals have not been fitted, but a pick-up can be connected very easily by joining one lead to the front (vacant) terminal on the radiogram switch and attaching a wander plug to the other and placing this in the 1 1/2 volt tapping on the G.B. battery. If desired, it will be a perfectly simple

matter to fit permanent pick-up terminals on the chassis, and these could be in the form of a terminal-socket strip similar to, and symmetrical with, the aerial-earth strip on the rear of the chassis. If this is done it is desirable in the interests of stability and with the idea of avoiding possible high-pitched whistles, to screen the lead from the terminal strip to the appropriate terminal on the radiogram switch. No matter which way the pick-up is connected it will be brought into circuit by the simple process of turning the wave-change knob to its third, or "gram." position. The "All-Pentode Three" makes an excellent gramophone amplifier and can well form the nucleus of a complete radiogram.

## Full-Size Blueprint Wiring Diagram

### LIST OF PARTS FOR THE ALL-PENTODE THREE

- One Ferrocart ganged coil assembly, type G1, 2 and 3 (Colvern).
- One Baby 3-gang condenser (Jackson Bros.).
- One Arcuate drive (Jackson Bros.).
- One .00015 mfd. reaction condenser, C7 (Graham Farish).
- One .0001 mfd. fixed condenser, type M, C8 (T.C.C.).
- One .0002 mfd. fixed condenser, type M, C10 (T.C.C.).
- One .001 mfd. fixed condenser, type M, C4 (T.C.C.).
- Two .0003 mfd. fixed condensers, type M, C6 and C13 (T.C.C.).
- One .1 mfd. fixed condenser, type 65, C12 (T.C.C.).
- One 2 mfd. fixed condenser, type 65, C11 (T.C.C.).
- Two .1 mfd. tubular condensers, C5 and C9 (T.M.C.).
- One 500 ohm ohmite resistor, R4 (Graham Farish).
- One 10,000 ohm ohmite resistor, R7 (Graham Farish).
- One 30,000 ohm ohmite resistor, R2 (Graham Farish).
- One 80,000 ohm ohmite resistor, R8 (Graham Farish).
- One 150,000 ohm ohmite resistor, R6 (Graham Farish).
- Two .5 megohm ohmite resistors, R1 and R5 (Graham Farish).
- One 50,000 ohm volume control, R3 (Ferranti).
- One screened binocular choke (Telsen).
- One standard screened choke (Telsen).
- One Max. transformer (Graham Farish).
- Two 4-pin valveholders (Clix).
- One 5-pin valveholder (Clix).
- Two component brackets (2 1/2 in.) (B.R.G.).
- Two socket strips (A, E, and L.S.) (Belling Lee).
- One G.B. battery clip (Bulgin).
- One 4-way battery cord with Wanderfuse (Belling Lee).
- Three Bowspring wander plugs, G.B., G.B.-1, G.B.-2 (Belling Lee).
- One Metaplex chassis, 12 in. by 8 in., with 3 in. runners (Peto-Scott).
- One Cossor 210 VPT valve.
- One Cossor 210 SPT valve.
- One Cossor 220 HPT valve.
- One Stentorian standard speaker (PMS2) (W.B.).
- One "All-Pentode Three" cabinet (Peto-Scott).
- Wire for connections, screws, flex, etc.
- One 120-volt Full O'Power H.T. battery (Siemens).
- One 2-volt L.T. accumulator.
- One 9-volt G.B. battery (Siemens).



Top view of the All-Pentode Three.

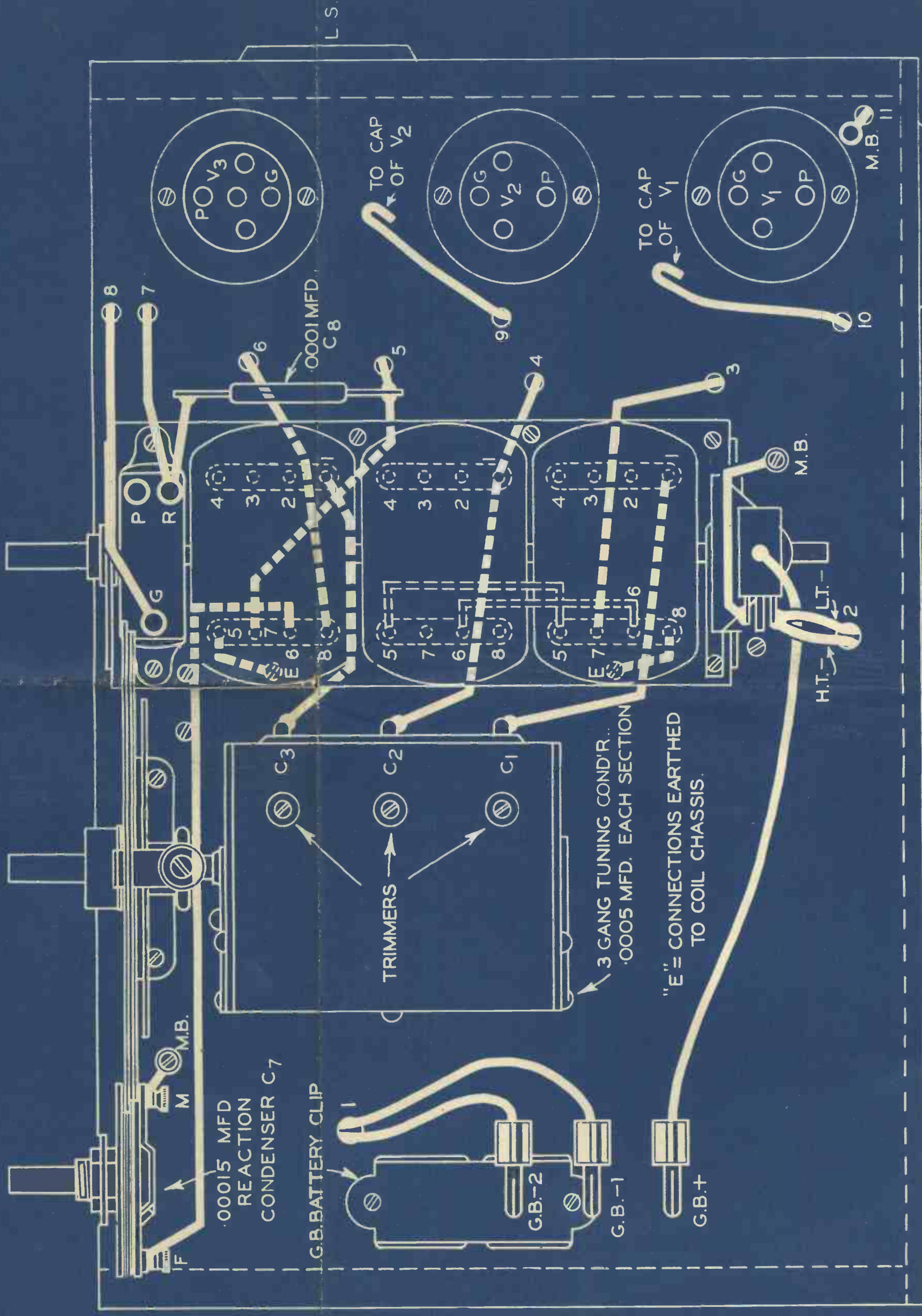


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# THE ALL PENTODE THREE

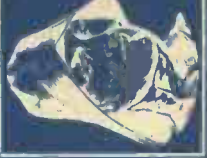
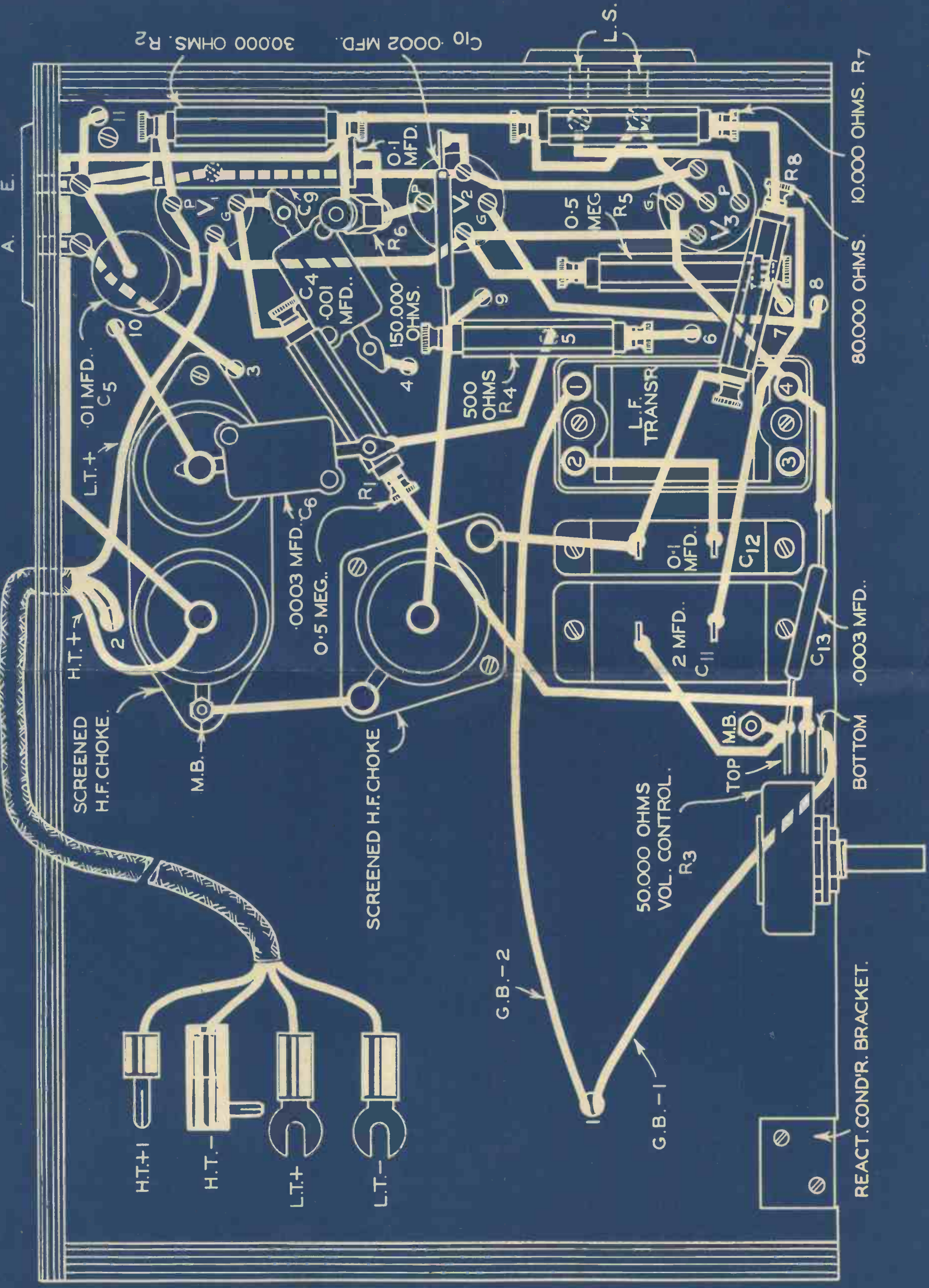
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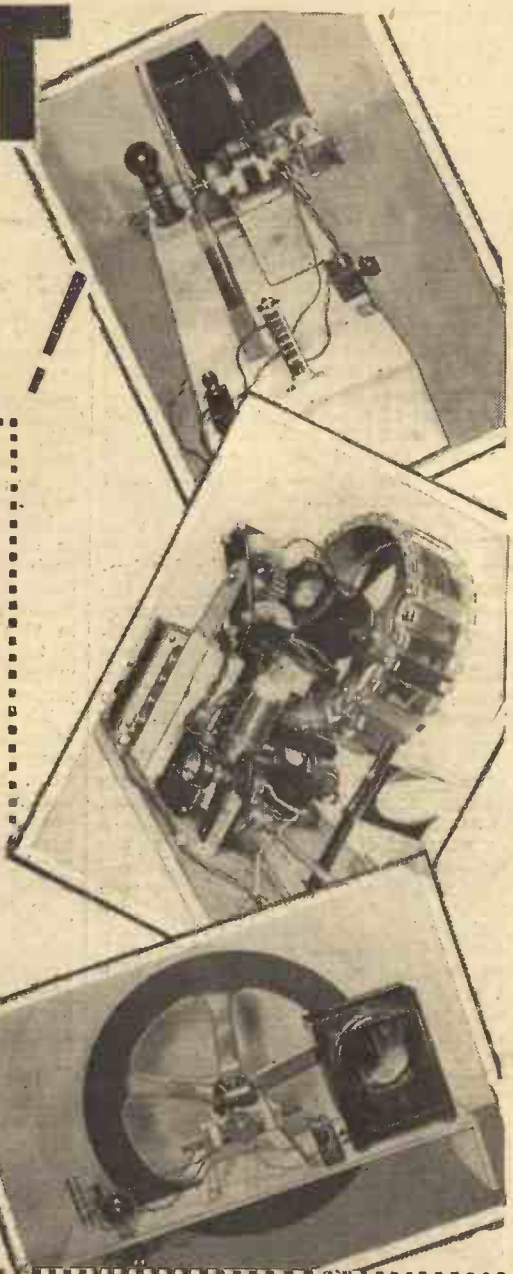
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# NEW SPEAKERS FOR OLD

Some Interesting Details Concerning the Design of Modern Loud-speakers

By THE PRACTICAL WIRELESS TECHNICAL STAFF

**A** CAREFUL review of the latest types of speaker seen at Radiolympia this year reveals that the general standard of reproduction has been improved to an almost amazing extent, with the result that the best among modern speakers, allied to the best in modern receiver design, will yield results to satisfy the most critical. These improvements affect almost every aspect of radio reception. In many cases they are so pronounced, and, indeed, so radical in principle, as to render it difficult to classify them and to set them out in logical sequence.

## Improved Sensitivity

One of the most striking of the developments is the improved sensitivity of the present-day moving-coil speaker, more particularly to that of the permanent-magnet type. Without delving too deeply into the mechanics of speaker design it is obvious that the sensitivity depends in part upon the flexibility of the suspension, and in part upon the magnetic field.

In these connections, modern methods of centring the moving-coil in the air gap and of supporting the periphery of the cone, give ample axial flexibility to provide a wide range of displacement, while at the same time rendering the risk of the coil getting out of centre a very remote contingency. Thus, one factor in high sensitivity is assured and the mechanical strength of the speaker greatly improved. The second requirement for high sensitivity is a strong magnetic field. The strength of a magnetic field, or "flux density" as it is called, is measured by the number of hypothetical "magnetic lines" per square centimetre across the field. By a reduction of the length of the air gap and by an improvement in the material of which the magnets are made, flux densities very

much greater than those hitherto employed are now being obtained.

## A New Magnet Steel

It is, of course, a comparatively easy matter to obtain a high flux density in a mains-energized speaker provided that material of ample section is used for the magnet, and ample magnetizing force is provided by the ampere turns of the field winding. But in the case of permanent-magnet instruments everything must depend upon the design and strength of the permanent magnet itself.

Hitherto, using the best tungsten steel or chrome steel magnets, flux densities have not been greatly in excess of 8,000 lines for the average permanent-magnet loud-speaker. Much of the improvement in this year's permanent-magnet models is the result of the discovery of a new magnet steel containing carefully balanced proportions of nickel and aluminium.

This nickel-aluminium-steel is not only capable of being magnetized to a higher degree than previous types of magnet steel, but it also retains its magnetism better and is not so liable to lose a proportion of its strength after a period of use. Many makers claim that their new speakers have a density in the region of 11,500 lines.

In fact, the modern permanent-magnet loud-speaker is little, if any, inferior to an instrument of the energized type. Improvement in performance is also in many cases due to better design of the magnet itself, which is specially shaped to reduce magnetic leakage to a minimum.

## Better Response

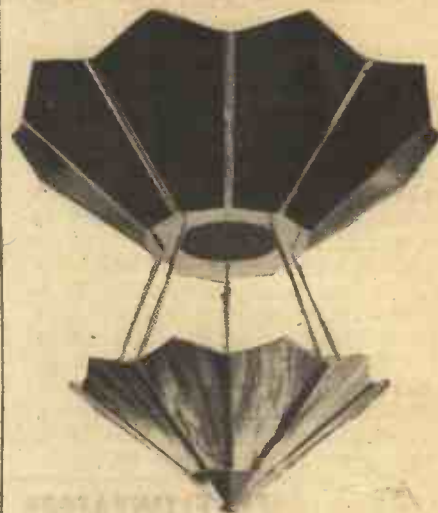
Another important series of improvements has to do with the general quality of reproduction. Even the smallest speakers have an adequate and natural bass response, and instead of a monotonous thump, the bass section of an orchestral performance is a colourful reproduction in which the tones of the different drums are easily distinguished and the distinctive character of double bass and other low-toned instruments stand out in all their realism.

At the other end of the scale, also, response has been greatly augmented, with the result that the somewhat dead reproduction which resulted from full middle register response and deficiency in the upper register has been replaced by a brilliance which enables the characteristic colouration of each instrument in a full orchestra to be reproduced with remarkable fidelity. In addition, improved methods of suspension give that crispness which musicians term "attack."

These improvements are mainly the result of a better understanding of the principles of cone design and suspension. They are also in great measure due to better design of the chassis itself. Even in the smallest speakers, steel pressings of deep girder section and containing adequate

amounts of metal result in a rigid construction, while the larger instruments employ heavy-section castings so proportioned that resonance within the audio-frequency range cannot occur. In some cases, in order to save weight, these castings are made from aluminium.

Another factor which has reacted greatly towards improvement in tonal reproduction



A completely new design in loud-speakers. The Michell and Brown Lampshade Model.

is the further development of the dual type of speaker. The system of employing a large cone, whose duty it is to reproduce mainly the bass and lower middle register, and a second and smaller cone charged with the task of reproducing the higher frequencies is not new, but this year is employed by an extended number of manufacturers. In one instance the smaller cone with its driving unit is mounted concentrically on the larger cone, while other manufacturers prefer to use two distinct chassis side by side on a common casting. In all cases, however, a suitable filtering device is incorporated in the output so that the low-frequency component is diverted to the larger unit and the upper register components to the smaller unit in correct proportion to give a faithful and natural reproduction. In some speakers the input to the high note section of the dual speaker can be adjusted to suit the listeners' own personal taste.

## Proper Matching

One of the most important factors in speaker application is the question of matching the speaker impedance to that of the output valve or valves.

There is at present no complete unanimity among speaker manufacturers as to the most convenient method of arranging for the all essential matching. Three general methods are in vogue. In some cases speakers are supplied with no transformer and are therefore intended to be used

(Continued on page 28)



The new W. B. speaker which incorporates a special matching transformer, as well as a new magnet system giving great field strength.



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| 1 Colvern Ferrocart ganged coil assembly type G.1. 2 and 3 with 3-pt. switch                  | 1 17 6  |
| 1 J.B. 3-gang Baby condenser, type 2122   | 15 0    |
| 1 J.B. arcuate drive, type 2125   | 5 9     |
| 1 Graham Farish .00015 mfd. reaction condenser  | 2 0     |
| 5 T.C.C. type "M" condensers: .0001; .0002; .001, and .0003 mfd (2)                           | 3 8     |
| 2 T.C.C. type "65" condensers: .1 mfd. and 2 mfd.   | 4 4     |
| 2 T.M.C. 1 mfd. tubular condensers  | 2 6     |
| 7 Graham Farish Ohmite resistances: 500; 10,000; 30,000; 80,000; 150,000 ohms; and 2.5 megohm | 10 6    |
| 1 Ferranti 50,000 ohm volume control  | 3 9     |
| 1 Telsen screened binocular choke   | 5 6     |
| 1 Telsen standard screened choke  | 3 6     |
| 1 Graham Farish max transformer   | 4 6     |
| 2 Clix 4-pin chassis mounting valveholders  | 1 4     |
| 1 Clix 5-pin chassis mounting valveholder   | 9       |
| 2 B.R.G. component brackets, 2 3/4 in.  | 8       |
| 2 Belling Lee socket strips, A.E. and L.S.  | 1 6     |
| 1 Bulgin G.B. battery clip, No. 2   | 4 1/2   |
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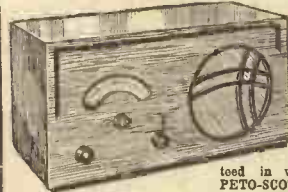


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### NEW SPEAKERS FOR OLD

(Continued from page 26)

with a separate transformer. Other speakers are fitted with a built-in transformer wound for a definite ratio; others, again, have built-in transformers which, by means of numerous tappings, permit a more or less wide variation in the transformation ratio.

Dealing first with the instrument which has no self-contained transformer, it should be noted that universal-type transformers for use with such speakers are available in several types. One of the most ingenious is arranged to give no fewer than fifty-eight different ratios by the correct selection among nine terminals only.

The same type of transformer is also built-in on certain speaker models, while other makes and models have transformers giving slightly smaller numbers of ratios. For example, one maker fits to his speakers a transformer giving 8 ratios and representing load impedances ranging from 750 to 10,000 ohms. In another make, 10 ratios giving impedances between 10 ohms and 16,000 ohms are provided, while yet a third will give a range of no fewer than 30 transformer ratios by the manipulation of plugs.

An entirely new idea in impedance matching is provided by a scheme incorporated in one speaker, whereby the impedance of the load is "tuned" to the optimum load of the valve by a simple switching device. Another useful device embodied in some speakers is a switch which immediately readjusts the load from the value required if the speaker is used as the main speaker to the value necessary when it is used as an extension instrument.

There are still a number of speakers which are sold with a built-in transformer giving one ratio only. In each case, however, a number of different ratios are made and it is only a matter of specifying the actual value required. Such speakers are, of course, more particularly of interest to the listener who buys or builds a set entirely for serious listening and is not likely to make any alteration to the type



Another example of a matching device which gives a large range of impedances.

of output valve he employs. On the other hand, speakers with multi-ratio transformers will obviously appeal more strongly to the experimenter.

### Chassis or Cabinet Models

The vast majority of speakers are available in chassis form, but there is a growing number of speakers mounted in a more or less ornamental cabinet. Such speakers are obviously intended mainly for use as extension instruments in rooms other than that in which the actual receiver is installed. On the other hand, it cannot be denied that the position which is most convenient for the receiver itself is not always that most suitable for the speaker either from acoustic or artistic points of view. It thus occurs that there are many listeners who prefer their speaker to be a unit separate from the receiver itself, and these listeners are fully catered for in this year's models.

In general, these cabinet-type speakers are of fairly simple design, consisting of a square or rectangular cabinet with front fret and protected by the usual fabric. For the most part, the cabinets are well designed acoustically and are free from box resonance. The range of designs, woods, and finishes is sufficiently wide to cover most requirements, and there are even models in well-designed bakelite cabinets. There is a notable absence this season of freak designs, the only really unconventional forms being a bowl-shaped instrument and another of pendant type. In each case, however, the form of the speaker has not been allowed to detract from the efficiency of the instrument as a reproducer.

Finally, mention must be made of those features of the latest type instruments which make for long life and trouble-proof operation. The greater permanence of the present day magnet has already been discussed, as well as the improved design of centring devices.

### Television Items

TELEVISION "lookers" and listeners will have an old-time programme on September 25th, when Bertha Willmott, John Rorke, Rosalind Wade and her Radiolympia Girls and Sydney Jerome's Quintet will be seen and heard in "For Old Time's Sake," with Eustace Robb as producer.

On September 28th Lydia Kyasht, famous Russian dancer, paid a visit to the television studio in the company of Katherine Arkandy (soprano) and Gavin Gordon (bass). So another distinguished name is added to the list of well-known dancers to appear before the scanner.

### Droitwich Programme

WITH the coming of autumn and the opening of the new National transmitter at Droitwich, B.B.C. programmes will undergo a change. Starting on October 8th, continuous alternative programmes will be broadcast on the National and Regional wavelengths between 10.45 a.m. and 6.0 p.m. from Monday to Friday each week, and another innovation takes the form of a regular alternative to the late dance music between 10.0 and 11.15 p.m., when a general programme will be broadcast from the National transmitter.

### "Monsieur Beaucaire"

AN adaptation of the romantic opera "Monsieur Beaucaire," composed by André Messager and first produced at the Prince's Theatre, London, in April, 1919, will be broadcast Nationally on October 4th, and Regionally on October 5th.

### ODDS AND ENDS

In this broadcasting version an attempt will be made to eliminate not only unimportant characters, but all dialogue tending to obscure the main plot. In the opera seven characters appear in the first scene, while in the broadcasting version only four voices will be heard. Certain incidents occurring in Booth Tarkington's original story, but omitted from the opera book, will be included; and an attempt will be made to emphasize the dramatic side of the romance.

As the action covers a period of almost thirty days, a narrator will be necessary, but explanatory matter will be cut down to an absolute minimum, and his voice will be heard only twice during Beaucaire's adventures. Jan van der Gucht will play the part of Molyneux, and the cast will include Margaret Lauder, a soprano new to broadcasting; Mark Raphael, the well-known concert singer; Claude MacConnell, who made his broadcasting debut in "The Lilac Domino"; Marjery Wyn; Wilfred Essex and Boris Ranovsky. The identity of Monsieur Beaucaire himself will not be disclosed until the conclusion of the broadcast.

### Launching the New Cunarder

WHEN the new Cunarder 534 is launched at Clydebank on September 26th, the proceedings will be broadcast in the National programme. Sir Percy Bates, Chairman of the Cunard-White Star Line, will read an address of welcome, to which

the King will reply. This will be followed by the launching by the Queen and a running commentary will be given by Mr. George Blake.

### Promotion

ALTHOUGH he is only 21, Francis Durbridge, of Erdington, has had two sketches and two revues produced by Martyn Webster for broadcasting, and has also written several Children's Hour plays and stories. His first "straight" play in the evening programme from the Midland Regional will be heard on October 3rd. It is called "Promotion," concerns the rivalry for a departmental manager's job in a big store, and is developed in fifteen episodes. The principal conflict is between an oldish man, who has been with the firm since its small beginning, and the managing director's son, who has become engaged to his daughter. Vincent Curran and Hugh Morton play the father and prospective son-in-law, Cecily Gay, the daughter, and John Lang, the director.

### The Abbot's Way

A NOVEL feature will be produced for West Regional listeners on October 6th, entitled "The Abbot's Way," a trek across Dartmoor. It is described as a radio-drama jaunt written for broadcasting, and listeners will follow two men on their way from Buckfast Abbey across the Moor. Familiar and unfamiliar spots of Dartmoor will be introduced and many songs of old Devon will be sung. The author, E. W. Sanders, wrote the Devonshire episode on the Christmas Day National programme.



# THE BEGINNER'S SUPPLEMENT



## TROUBLE-TRACKING SIMPLIFIED

There are Many Receiver Faults which can be Traced Without the Use of Even Such Simple Apparatus as a Milliammeter, as is Explained in this Article

ONE of the first things which an enthusiastic constructor must learn is the method of tracing faults and minor troubles which can occur in any type of set, whether it is home constructed or ready made. The precise system of testing and of localizing the fault depends very largely upon the form taken by the trouble, but there are a number of tests which apply in all cases, and these should be studied first of all.

It is surprising how many really useful tests can be made without the need for any equipment whatever, and without the necessity for dismantling the set or removing any components, once a clear understanding has been obtained of the underlying principles of receiver operation. As an example of this it might be mentioned that it is often possible to tell which valve stage in the set is at fault by merely tapping the glass bulbs of the valves in turn, or by touching their respective grid terminals.

### Preliminary Tests

When a set is completely "dead" it is a good plan to switch it on and off quickly, listening for a click from the speaker. If there is no sound at all the speaker itself might be faulty or there might be a break in the high- or low-tension supply circuits. In the case of a mains set the complete absence of mains hum would probably indicate a break in the H.T. circuit, but before testing the mains equipment the anode and cathode terminals of the output-valve holder should be bridged with a 10,000-ohm resistance. Should a certain amount of hum then be heard, or should there then be a click in the speaker as the set is switched on and off, it will be fairly evident that the last valve is defective or making bad contact with its holder. This test might also be applied to a battery set and, just the same as with a mains receiver, a click should be heard in the speaker if one of the leads to it is connected or disconnected.

### Output Valve Holder

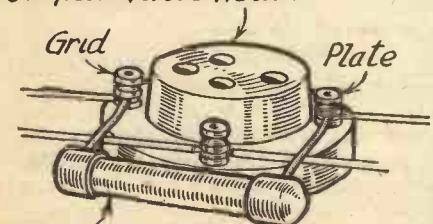


Fig. 2.—The output valve can be checked for emission by connecting a 10,000-ohm resistance between the grid and anode terminals of its holder.

Another very simple test for the valves of a mains set is to feel at the glass bulb of each after the set has been switched on for a few minutes; each one should feel distinctly warm, whilst the output valve

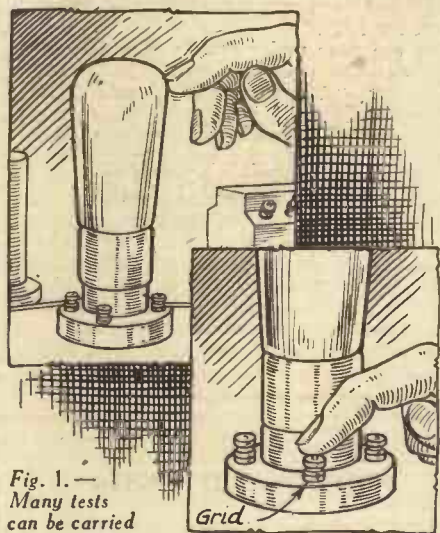


Fig. 1.— Many tests can be carried out by using the fingers alone. (Above) Tapping the glass bulbs of the valves shows whether or not the following valves are at fault. (Below) A noise should be heard when the grid terminal is touched with a moistened finger.

will almost certainly be very hot if it is functioning properly. If any valve is quite cold, this can be taken as an almost certain indication that the valve is faulty, or that its pins are not making contact with the holder.

### Checking Resistances

A very simple test which can be applied to either a battery or mains set after it has been switched on for some little time is to switch off and immediately go over all the resistances, feeling each in turn. If any one is more than comfortably warm it is probable that there is a short-circuit and that the resistance has been passing more current than it should. An examination of the circuit in which the resistance is included will probably lead to a solution of the difficulty. On the contrary, a resistance in an H.T. circuit which is found to be quite cold might easily point to an internal "dis." or to a break in the circuit in which it is placed. Bias resistances in mains sets should receive special attention in this respect, particularly when reproduction is poor, when the output valve becomes abnormally hot, and if the anode-circuit feed resistances or smoothing choke seem unduly hot, without there being any sign of a short-circuit.

Undue heating of the mains transformer

in an A.C. receiver generally points to an overload, which might be caused by a faulty bias resistance, a short-circuit in the wiring, or a fixed condenser which has developed an internal short. In the same way, frequent "blowing" of a fuse will often indicate a partial short-circuit, always assuming that the fuse is of suitable value. Generally speaking, the input fuse in a mains set should be rated at 1 amp., or about 2 amps. when the set includes a gramophone motor with automatic record changer. The fuse in the main H.T. positive lead of either a mains or battery set should be rated at about three times the steady current which it is normally required to carry.

### Some Causes of Crackling

When a fault shows itself in the form of crackling noises there are three possible causes: the noise might be caused by interference picked up by the aerial or by the mains supply, it might be due to a loose contact, or it might be produced by a break in one of the components. To find which of these items is responsible the aerial and earth leads should first be removed. After that the set should be tapped in various places, whilst individual components might be gripped and an attempt made to move them; this test will generally indicate the location of a loose connection. If the noise is entering the set via the mains leads it will almost invariably change in intensity or disappear at certain times of the day, so that it can be checked by watching this point. When it is found that the noise is unaffected by

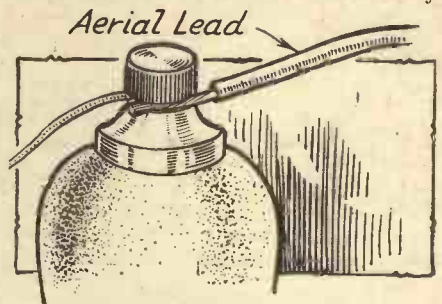


Fig. 3.—S.G. valves can be cut out by connecting the aerial lead to their respective anode terminals.

any of the tests mentioned it will generally be safe to assume that some particular component is responsible for it. The component which is more prone to give rise to crackles than any other is the L.F. transformer (when it is connected directly in the anode circuit of the detector) and one check can be made by short-circuiting the primary terminals. Even if this entirely stops the troublesome noise one cannot be sure that the transformer is faulty, because the trouble might arise at some point in the circuit previous to the transformer. Nevertheless, it will be an indication that the transformer might well be tested more thoroughly, or that the substitution of another one might be tried.

(Continued overleaf)



(Continued from previous page)

If it is found that the crackling noises are just the same whether the transformer primary is shorted or not it will be clear that the fault is confined to the L.F. portion of the set. Consequently, the various feed resistances, output choke (where fitted), coupling condenser and speaker should be tested. A fairly good and simple check for the speaker is to connect it in place of the transformer primary, or coupling resistance, in the anode circuit of the detector. In any case the crackling will almost certainly be reduced in strength, but if it has not vanished it will be reasonable to blame the speaker.

When the fault (whether it is evidenced by crackling or lack of signals) appears to be prior to the detector valve the best course is to eliminate the preceding stages in turn. All of the H.F. stages

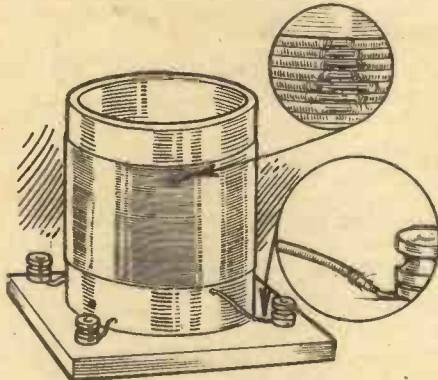


Fig. 4.—When the accumulator is housed in the cabinet, examine the turns of the coils for corrosion.

which precede the detector can easily and quickly be cut out by transferring the aerial lead from its normal terminal to the anode terminal of the valve immediately before the detector. If reasonably good reception can be obtained after this slight change has been made there will be little doubt that the fault lies in one of the H.F. stages. When there is more than one H.F. valve each can be brought into circuit in turn by transferring the aerial lead to the various anode terminals, working towards the first valve.

Once the stage responsible for the trouble has been found it is not usually a difficult matter to find the actual source. It might be found that one of the coil screens is touching a lead passing through it to one of the terminals, thereby causing a short; perhaps the screening can on one coil is not properly pressed into position with a result that it is not earthed and is therefore making the various tuned circuits un-matched; the contacts of a wavechange switch on one coil may not be touching each other when the switch is turned to the medium-wave position. When the coils are unscreened and the set is of the console type with self-contained batteries particular attention should be paid to the windings of the coils, because it will often be found that acid vapour from the accumulator will have corroded some of the turns, or have eaten away some of the cotton insulation. Trouble of this kind can be productive of various kinds of crackling noises, whilst it might even cause a complete cessation of signals. The very same thing applies—although with more force—in the case of a portable receiver with frame aerial, for it will often be found that the finer wire used for the long-wave section has been corroded.

## ROUND THE WORLD OF WIRELESS

(Continued from page 4)

### Some Historic Events Recalled

WHAT happened in 1910? In another of his "Scrapbook" programmes to be broadcast on Regional wavelength on September 24th, and on the National wavelength on September 25th, Leslie Baily will assist listeners to recall to mind some of the most interesting events of that year. Musical comedy was at its zenith. The first aeroplane flight from London to Manchester was made. Pelissier's Follies were at the height of their fame. The pursuit of Mr. Robinson took place. "The Speckled Band," by Conan Doyle, was staged at a London theatre. King George V ascended to the throne, and the *Olympic* was launched. All these events will be recalled in this microphone medley—"Scrapbook for 1910."

In the year under review such popular musical comedy productions as "The Dollar Princess," "The Quaker Girl," and "The Chocolate Soldier" were captivating huge audiences. The first aeroplane flight from London to Manchester was a race staged between M. Paulhan and Mr. Grahame-White, for which one of the large national papers offered a prize of £10,000. Starting in the 'nineties, Pelissier's Follies gradually gained public favour, and later took London by storm, and in 1910 the famous troupe were still a popular feature of London's entertainment. The nation was thrilled by the launch of the *Olympic*, at that time the largest ship in the world, and looked upon as a wonder of the 'ocean. The contrast between it and the Cunard-White Star liner No. "534," which will be launched at Clydebank on the day following the repeat broadcast of this programme, is very striking. The *Olympic* was hardly a quarter of the size of "534."

### New Light Orchestra

THE New Light Orchestra will be heard again by Scottish Regional listeners on September 26th. The conductor will be Ian Whyte, and an interesting feature of the programme will be the performance of the "Arran Suite," by Waught Wright. The soloist will be Robert Burnett (baritone), who will sing two groups of songs—one devoted entirely to songs of the sea.

### The Launching of "534"

ONE of the most important broadcasts of the year takes place on September 26th, when Her Majesty the Queen will perform the launching ceremony of the new Cunard liner. In addition to the actual ceremony, listeners will hear speeches by His Majesty the King and Sir Percy Bates, Chairman of the Cunard Steamship Company, and a full description of the scene at the shipbuilding yard will be given.

### Harry Kemp's Summer Show

A SCOTTISH Regional variety programme will be given on September 25th, when an excerpt from Harry Kemp's Summer Show at the Barrfields Pavilion, Largs, will be relayed. The artists taking part in this programme need no introduction to listeners, for all the members of this well-known cast have already been heard "on the air" several times already during the summer months. This relay concludes the summer broadcasts from popular holiday resorts.

### The Old Parish Church

CORSTORPHINE old parish church, Edinburgh, from which a religious service will be broadcast on September 23rd, has a long history. It is not known how long the site has been dedicated to the worship of God, but a chapel was granted by King David I to the Abbey of Holyrood in 1128, the date of its foundation being unknown. Several changes have since taken place, but a votive chapel, dedicated to St. John the Baptist, which was built in 1405, is now represented by the chancel of the present church. In 1905 extensive restoration was carried out, and the church now represents as nearly as possible the original collegiate church as constructed in 1429.

### A Self-taught Organist

Cecil Chadwick, the organist of the Classic Cinema, who recently gave his one hundredth broadcast recital, always permits his mother to draw up the programme for his recital on her birthday. Mr. Chadwick was originally a mill worker, and as far as the organ is concerned he is a self-taught player. He confesses to a whole-hearted dislike to mills and everything pertaining to them.

### Symphonic Variations

A NEW work by Clifton Helliwell, called "Symphonic Variations," which was first performed last season at one of the public concerts in Belfast, will be broadcast by the Belfast Wireless Orchestra in its concert on September 21st. This is Mr. Helliwell's first essay into the realms of serious music, though he is already well-known to Northern Ireland listeners for his syncopated numbers and his adaptations of operetta.

### A Pianist at Three

THE Manchester Tuesday Mid-day Society opens its season on September 25th with a recital by John Davies, a young Manchester pianist. His mother relates that Davies could play the piano by ear at the age of three, but he did not receive tuition until five years later. Subsequently he studied at the Manchester Matthay School, at the Hochschule für Musik at Berlin, and under Lamond. Now but twenty-four, he was featured at a Manchester municipal concert last winter. Broadcasting from the Houldsworth Hall, Manchester, on September 25th, he will play works by Brahms and Chopin.

### The Bouquets' Farewell

THE Bouquets Concert Party, presented by Murray Ashford, are broadcasting a farewell programme from the Spa Theatre, Scarborough, on September 25th. On September 27th a farewell show by Ernest Binns' Arcadian Follies will be relayed from the South Pier, Blackpool, and, immediately following, Captain Amers' Orchestra will broadcast a programme of popular music from the Royal Hall, Harrogate.

### Uncle Eric's Goodbye

UNCLE ERIC'S last appearance in the North Regional Children's Hour is fixed for September 26th. He then goes, as Mr. Eric Fogg, to London to take up his appointment as Empire Music Director. The League of Helpful Uncles, of which he has hitherto been a prominent member, has arranged to give him a grand send-off in a programme which will include many old favourites.



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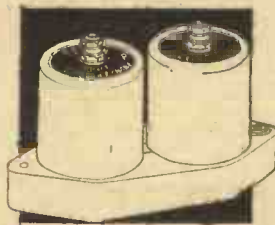
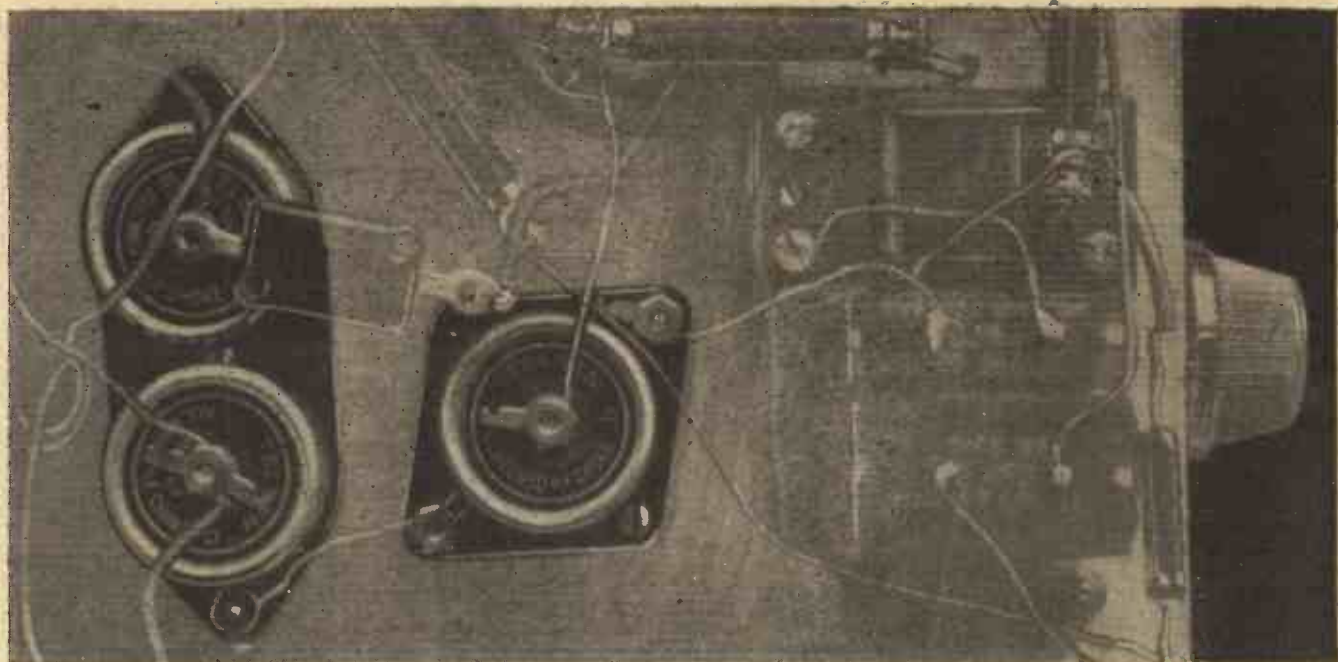
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**"STILL KEEP GOING WHEN THE REST HAVE STOPPED"**



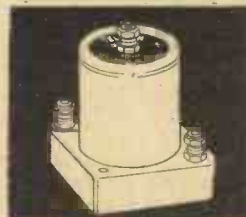
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# Where the Home Constructor Scores

In this Article the Author Points Out the Many Advantages the Amateur Set-builder Has Over the Owner of a Ready-made Receiver

IN one or two quarters it has been mentioned that the heyday of home construction is passing, and that there is little or nothing to be gained in making up a radio receiver in the home. Let it be stated right at the beginning that nothing can be more erroneous, for in dozens of ways the amateur constructor is at a great advantage over the owner of a mass-produced commercial receiver.

Consider first the question of freedom of choice which the constructor possesses. The purchaser of a ready-made set must take exactly what the manufacturer has made. A certain set may be just what he needs from the technical point of view, but it may be too big to rest on his wireless table or its cabinet may be quite out of harmony with the remainder of the furniture in his home. Or he may see a receiver which would be quite an ornament to his living-room, but its specification may be quite unsuited to his technical requirements. The amateur, however, can please himself in every direction. He can build a set to meet his individual needs—a family set, a DX fan's set, a short-waver, or a transportable—and he can mount it in a cabinet of any shape or size, and of any finish to harmonize with its surroundings. He can build it into an existing piece of furniture or tuck it away among the books on his bookshelf. He can incorporate a clock in the set, and can indulge in any fads or fancies in technical design or in appearance.

## Keeping Pace with Development

In the modern small home, where space is at a premium, this is a point worthy of serious consideration. Moreover, a cabinet used for a previous receiver can be pressed into service, thus saving considerably on the cost of maintaining the radio equipment in line with modern technical practice.

So rapidly do technical developments arise that practically any commercial receiver is quite obsolete three years after it is made, and many sets are at least obsolescent in a twelvemonth. But the home constructor can modify his set whenever he likes and so keep abreast of the times. He need not even wait for his equipment to become obsolescent, for the latest developments can be introduced, if he so desires, immediately they are announced—or may be postponed just as long as he wishes. Moreover, remodelling a home-built set does not involve scrapping the whole of an expensive outfit. The replacement of a coil or condenser, or of a valve, the re-arrangement of a circuit, and re-designing of an individual stage, all can be done while retaining all the remaining portions of the set. Such renovations can also be carried out by instalments, as and when convenient to the leisure and to the pocket.

Examples of improvements which can be made in this way could be multiplied indefinitely, but it must suffice to mention only a few. Figs. 1 and 2 show how simple it is to replace an ordinary screen-grid valve or high-frequency pentode by a variable-mu valve in the high-frequency

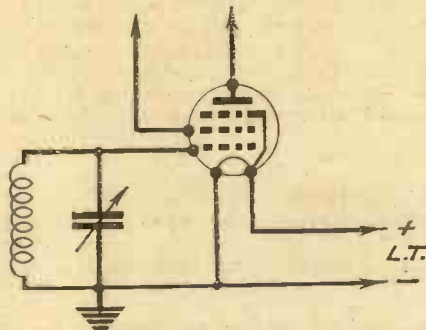


Fig. 1.—The normal connections for a battery-operated H.F. pentode.

stage in the case of a battery set. The arrangement for a mains set, although not

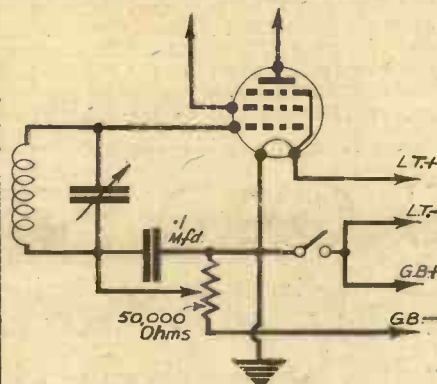


Fig. 2.—The simple modifications necessary when changing over to a variable-mu H.F. pentode stage are shown above. The potentiometer should have an "off" position, otherwise a 3-point switch is necessary.

quite so simple, since it involves a resistance network to give the correct screen voltage

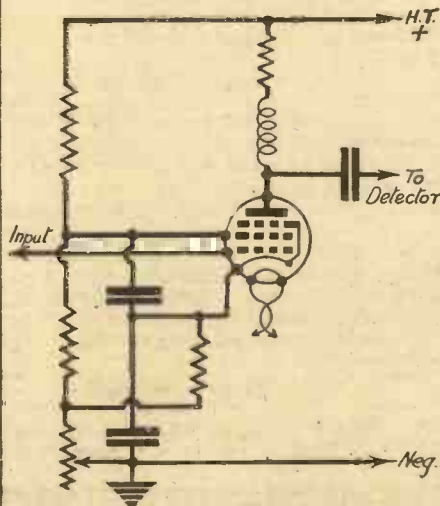


Fig. 3.—Necessary connections for a mains variable-mu H.F. stage. Component values will depend upon the valve employed and H.T. available.

and variable automatic bias, is perfectly straightforward and the connections are shown in Fig. 3. Again, a neat device for changing over from anode-bend to leaky-grid detection is illustrated in Fig. 4, but none of these conversions would be possible in the average mass-produced receiver.

Greatest of all among the points whereon the constructor scores is that with a home-built set he can definitely experiment. He can try any device he pleases, which is quite impossible with a commercial receiver, and generally speaking the benefits of experimenting are threefold. By conducting tests of all descriptions the amateur gradually builds up a wealth of knowledge concerning the technicalities of radio in a way which is far more rapid and far more certain, than can ever be possible by mere reading and study. Many amateurs have found it impossible to draw a circuit diagram, or even to read one until they had built one or two sets and experimented with them. Thereafter, technical diagrams were no longer a sealed book, and they were able to follow articles and descriptions which previously were quite incomprehensible to them. Added to this, radio experimenting is a source of real pleasure, a fascinating hobby and a highly intellectual exercise. Finally, the experimenter has the satisfaction of knowing that his receiver can always be in fashion, always up to date, always at the height of efficiency, always complete, yet never finished.

## A Few Suggestions

With regard to experimenting there is very much still to be learned about automatic volume control—simple A.V.C., amplified A.V.C., amplified and delayed A.V.C., and automatic volume control combined with inter-carrier noise suppressor. The number of possible circuits is legion, using double-diode-triodes, Westectors, separate double-diodes and so forth. There is, thanks to the new battery operated double-diode-triode, ample scope for the investigation of A.V.C. in battery-operated sets. One of the simplest arrangements is that shown in Fig. 5.

Then different forms of output stage can be tried—triode, pentode, quiescent push-pull, class "B," and so forth—while methods of tone control, in order to achieve high quality, is another fruitful field for research.

To carry out even a minor repair on a modern factory-made receiver is almost impossible. Most of the essential components and connections are inaccessible and frequently special tools are required. Seldom is the complete circuit diagram of the receiver available, and there is always the threat that if unauthorized repairs are undertaken the receiver is no longer covered by the maker's guarantee.

The constructor, on the other hand, has no difficulty about repairs. You see, he knows his set, having built it. He knows just what each component is and where to find it; he knows the runs of the wires, and remembers the little places where he had difficulty when making up the set.

(Continued overleaf)



(Continued from previous page)

He also remembers spots where breakdowns are likely to occur, and components about which he had previously had suspicions. Moreover, his set is accessible, for he has built it with the object of pulling it to pieces and remodelling again and again. All repairs he can undertake himself; he has not to wait while the set is sent to a service depot, and he does not even have to rely upon the tender mercies of his local dealer.

**Conversions**

Another point is that people change their place of abode. Where previously they had to rely on batteries they may now have the boon of electric mains. Where once their electricity supply was on the direct-current system they may now be on alternating current, or vice versa. The home constructor need not purchase a new set and

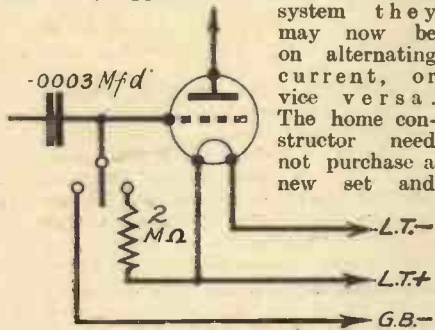


Fig. 4.—Leaky grid or anode bend rectification at will.

sell his old one at a sacrifice. All he need do is to convert his old set, usually only a matter of a few evenings' pleasant work and at a very small cost. In nine cases out of ten all that he will have to buy are new valves and a few yards of wire, but the owner of a commercial set must buy an entirely new receiver, and he will be fortunate if he can dispose of the old one at one-fifth of its original cost.

The large variety of different cases which arise when considering the conversion of a set from battery to mains, or from one type of mains to another, is so great that it would be impossible here to give any extensive instructions for carrying out such a conversion. It must, therefore, suffice to point out that in the case of a battery to mains conversion it is no doubt advisable to employ the latest types of universal (A.C./D.C.) valves, as this makes the set suitable for use on any electric light system. If the set is ultimately to be used on an A.C. supply there will be a considerable saving in the cost of conversion by reason of the fact that with universal valves, no power transformer is required.

Finally, there is one great point on which the constructor scores over the purchaser of a complete receiver. This is the thrill which every constructor experiences when he has built a set that really works. It may not be that the home-made receiver is quite as efficient or as neatly built as the best commercial sets of similar design, but it is quite conceivable on the other hand

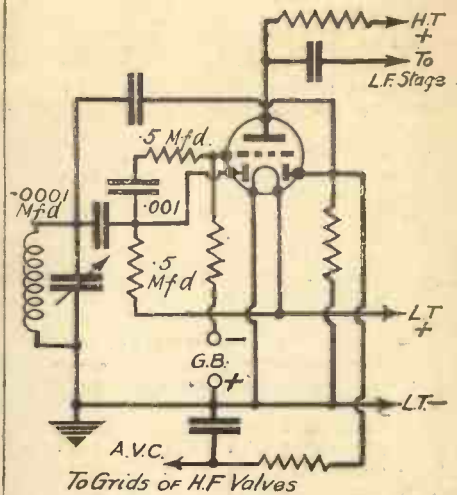


Fig. 5.—One method of applying simple A.V.C. in a tuned radio frequency battery receiver.

that it may be much better. In any case, the builder knows that it is the work of his own hands and possibly, to a greater or less extent, the product of his own brains. There is a wonderful thrill in that, a fact which all new readers of PRACTICAL WIRELESS can prove for themselves by making up the "Star" set described in this issue.

# THOSE ODD "BULBS"

An Interesting Description of the Incidental "Lamps" in Radio Receivers, which Include Fuses, Dial Lamps, Barretters and Tuning Indicators. By H. BEAT HEAVYCHURCH

**FUSES** are desirable in many positions in the modern set. For powerful mains-driven receivers specially designed wire fuses enclosed in glass tubes and housed in bakelite carriers are strongly recommended. In battery-operated sets, however, and also in certain positions in the mains set, lamp bulbs of the ordinary flashlamp type are perfectly satisfactory. The correct position for such a fuse in a battery receiver is in the lead joining the H.T.—terminal to the L.T.—terminal, and the object is, of course, to safeguard the valves from destruction in the event of an accidental connection between any H.T.+ lead and the filament wiring.

The diagram of connections reproduced in Fig. 1 makes it clear that any current derived from the H.T. battery and circulating in the valve filament circuit must pass through the fuse bulb. For general use in this position an ordinary 3½-volt flashlamp rated to carry 0.15 ampere will be found most suitable, for it will easily carry the normal anode current of the receiver, but will "blow" before any excessive current can damage the valve filaments.

**Dial Lights**

The illuminated dial has two great advantages—it facilitates the accurate setting of the tuning condenser and it also indicates whether the set is "on" or "off," thus providing a warning to the listener to switch off before retiring.

In choosing a bulb for a dial light it should be remembered that the ordinary

flashlamp bulb is not designed for continuous operation at its rated voltage, but is only intended for intermittent flashing. Select, therefore, a bulb rated for a voltage higher than that of the low-tension supply. Thus, for a battery set using a 2-volt accumulator, a 3½-volt bulb should be used. In addition to ensuring a reasonable life for the dial lamp, considerable economy in battery consumption will result, for a bulb rated to consume 0.3 ampere at 3.5 volts will only take approximately .2 ampere on 2 volts.

In the case of an A.C. mains set, the filament transformer of which gives 4 volts, a bulb intended for a 6-volt or 6½-volt supply should be used for the dial light. Such a bulb, normally taking 0.3 ampere will only consume 0.2 ampere in the set when operated at 4 volts. If your set is of the universal type or of the D.C. mains type having the heaters of the valves connected in series, it is convenient to connect the dial lamp also in series with the heater circuit. In this case it is necessary to ensure that the bulb is rated to carry continuously at least the full current of the valve heaters. Most modern universal valves have 0.2 ampere heaters, but some manufacturers have adopted 0.3 amperes. There are suitable flashlamp bulbs for each type, a 6.0 volt 0.3 ampere lamp being recommended for the 0.2 ampere heaters and a 6.5 volt 0.3 ampere lamp for the 0.3 ampere series. Bulbs of the above ratings will carry the full heater current with safety and should give a burning light of about 1,000 hours.

Some listeners find the white light from an illuminated dial somewhat annoying—bright lights have a kind of fascination for some people and distract their attention. This can be remedied by giving the dial lamp a coat of coloured varnish. Green is the most restful colour, but red or orange also give excellent results. Quite good results can also be achieved with coloured gelatine or even with coloured crêpe paper interposed between the lamp and the tuning dial.

**Tuning Indicators**

In the interests of high quality reproduction it is important that when listening the set should be accurately "on tune." If the set is fitted with automatic volume control judgment on this point is difficult because, when the set is "off tune" the

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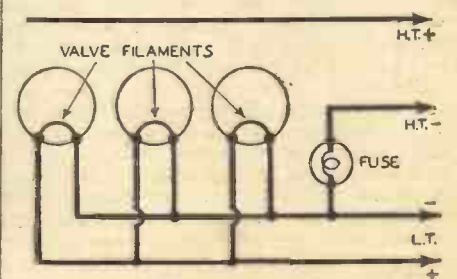


Fig. 1.—Indicating the correct position for a fuse in a battery set.



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automatic volume control feature will bring up the volume to maximum. Fortunately, devices have been developed which give a clear visual indication when a station has been accurately tuned in.

Two main types of visual indicator are available. In the first and simplest an ordinary electric lamp bulb of the flashlamp type is employed and a shutter is located between the light and a screen on the panel. The shutter is operated by the anode current of one of the receiving

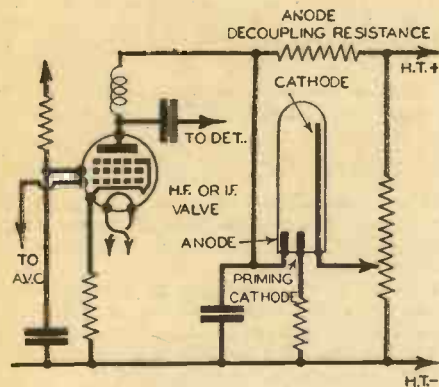


Fig. 2.—Conventional diagram to show the operation of a neon visual-tuning indicator.

valves—usually a high-frequency or intermediate-frequency amplifier in a set having automatic volume control, but sometimes the detector valve. The movement of the shutter alters the shape or size or position of the beam of light falling upon the screen, thus showing whether the set is accurately tuned or not.

The second type of luminous tuning indicator makes use of a neon discharge tube, which is again actuated indirectly by the anode current of one of the valves. The neon bulb for this purpose is of special type, tubular in form and usually having three and sometimes four electrodes. Of these one is a cathode in the form of a long rod running practically the whole length of the tube; another is a very short anode located at the bottom of the tube, and the third a priming cathode of small size also situated near the bottom of the tube.

The usual method of employing the indicator tube is to connect the cathode to a point in the H.T. supply giving a potential of about 50 volts. Generally this point is selected by means of a high-resistance potentiometer with one fixed tapping connected across the high-tension supply, which in the normal mains receiver gives about 200/250 volts. The main anode of the tuning indicator is then connected to the valve side of the anode decoupling resistance of one of the H.F. or I.F. valves, which is of such a value that when the normal anode current of the high-frequency or intermediate-frequency valve is flowing the voltage between the cathode and anode of the tube is about 130 volts. This voltage, of course, is not sufficient to cause the tube to glow, but the subsidiary or priming cathode is connected through a resistance to the high-tension negative terminal so that approximately 200 volts is applied between the priming electrode and the anode, which is sufficient to cause a small area of glow at the bottom of the tube. When, owing to reception of a carrier signal, the automatic volume control feature of the receiver comes into

action, the anode current of the H.F. or I.F. valve is gradually reduced as the set is brought into tune. The reduction of the anode current decreases the voltage drop in the anode decoupling resistance and thus increases the voltage applied between the anode and cathode of the indicating tube. The area of glow therefore increases and the circuit is so arranged that the point of optimum tuning coincides with the maximum length of the glowing column. A conventional diagram showing the essential connections for this arrangement is shown in Fig. 2.

### Barretters

In universal sets, and also D.C. mains sets in which the heaters of the valves are connected in series across the lighting mains, some form of resistance is also necessary in the circuit in order to absorb the difference between the total mains voltage and the voltage required to drive the heaters. Thus, with the new 0.2 ampere nominal, 13-volt universal valves a 4-valve set actually requires only some 85 volts across the filaments, namely: 13 volts each for the two high-frequency valves and detector; approximately 26 volts for the output pentode and some 20 volts for the rectifier. If the set is operated on a 200 volt circuit approximately 115 volts remain to be absorbed by the ballast resistance and a rather larger value if the mains voltage is 220 or 240 volts. It is, of course, not difficult to calculate the correct value for a wire-wound resistance for this purpose, but such a resistance would only be suitable for one definite mains voltage. Moreover, commercial lighting systems are subject to considerable voltage variations during the day, and a fixed value resistance cannot automatically compensate for these variations.

In place of a wire-wound resistance, a barretter or regulator lamp is usually connected in series with the heater circuit. A barretter consists of a filament, usually of iron wire, enclosed in a bulb filled with some such gas as hydrogen. This combination has the property that its resistance will vary automatically in order to maintain the current passing through it at a substantially constant value, even though the voltage applied to the circuit varies over fairly wide limits.

Barretters are available for use with the 0.2 and 0.3 ampere series-running valves and also the older 0.18 and 0.25 D.C. valves. Each is available in various types to cover different voltage ranges. A skeleton circuit of the heater arrangements for a universal set is given in Fig. 3, and shows where the barretter should be connected.

### Voltage Regulators

When a radio receiver employing quiescent push-pull or class B amplification is operated from a mains high-tension unit, very considerable variations in high-tension voltage occur on account of the very large fluctuations in anode current in the output stage. These voltage variations are due to the fact that the internal resistance of the ordinary vacuum type of rectifier valve is fairly high. Two ways of minimizing these fluctuations are available. The latest, and probably the best, is the use of a gas-filled type of rectifier, in which the bulb is filled with mercury vapour. Such a rectifier has a very low internal resistance, and the output voltage

of a high-tension unit in which such a rectifier is employed remains constant within close limits at all loads.

Alternatively, an ordinary type of rectifier can be employed, and a neon stabilizer

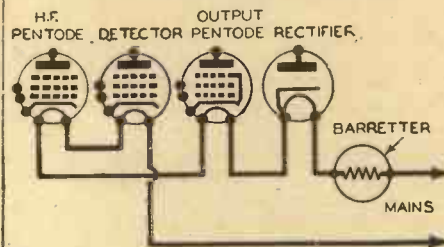


Fig. 3.—Heater circuit for an A.C./D.C. set showing the position of barretter.

tube connected across the H.T. output. The voltage stabilizer may be considered as a kind of high-capacity condenser having a low breakdown voltage which will maintain the voltage substantially constant, taking a heavier discharge when the voltage tends to rise and thus reducing the voltage to a normal mean value.

## PROGRAMME NOTES

### "I Want to Abolish"

THE series of discussions entitled "I want to Abolish," which begins on October 1st, is certain to arouse a great deal of comment through the country. Mrs. Catherine Carswell will open the series with a strong plea for the abolition of Burns Nights. Those listeners who read her recent book on the poet will know that Mrs. Carswell knows her subject thoroughly and is not afraid of speaking her mind. Sheriff J. G. Jameson, who will defend Burns Nights, is also an expert on Burns, and has had the advantage of presiding at more Burns Nights than he can remember. Other discussions of an equally controversial character will be broadcast at fortnightly intervals.

### Pleasley Colliery Band

THIS well-known band comes to the Birmingham studio from a pit in the Mansfield district for its first broadcast on October 2nd. Most of the bandmen work on the coal-face. Bert Lambeth has been the conductor since 1924, and his son, Leslie, plays a cornet solo. This band has won nearly £2,000 in prizes.

### Back in Town

ENGAGEMENTS with seaside concert favourites have prevented several radio favourites from coming to the microphone for some considerable time. Listeners may remember that a few of these artists made a fleeting visit to the studio on June 12th in a programme entitled "Out of Town To-night." Now that the holiday season is fast drawing to a close, Charles Brewer is preparing another programme on similar lines to extend a welcome to artists returning from the seaside. This will be broadcast on October 8th, on the Regional wavelength, under the title "Back in Town," and will be of a high-speed nature, representative of concert parties on the South and East coasts.



# Tracing Faults in Superheterodynes

The Methods of Carrying Out Systematic Tests of a Superhet. are Described in This Article.

A SHORT time ago, in an article entitled "Superhet. Pointers," I explained some of the minor difficulties which are likely to crop up when building a superheterodyne receiver. Since that article was written, correspondence has shown that many of those who construct superhets. are in an absolute quandary if reception is not immediately forthcoming. Many readers who are perfectly conversant with

mentioned in passing that, in the case of a mains-operated receiver, 'phones (when used) should not be connected directly in the high-tension circuit, but must be isolated by means of a low-frequency choke (the primary or secondary of an old L.F. trans-

oscillator valve should then be broken and an attempt made to tune in the local station. Signals will, naturally, be weak, but the station should be heard; if not the valve or its associated tuning circuit is probably at fault. If a band-pass tuner is employed it will be desirable to eliminate one tuned circuit by connecting the aerial direct to one end of the grid coil. The other tests will be exactly the same as when a "straight" set is being dealt with.

The second detector can most readily be tested by breaking the connection between the secondary of the intermediate-frequency transformer and the grid condenser, and connecting the latter point to the aerial-tuning circuit, after disconnecting the grid of the first detector. (In the case of a mains receiver, and when the first valve functions on the anode-bend principle and has a high anode voltage, it is best to connect its grid direct to earth to avoid the flow of too great an anode current.)

This test covers both the preliminary tuning circuit and the second detector, whilst the L.F. amplifier can also be brought into use in addition. If it is found that the first and second detectors and also the low-frequency portions of the receiver are functioning correctly, only the oscillator and intermediate-frequency amplifier remain. The next step, therefore, should be to check the oscillator. This can be done by replacing the broken oscillator connection, connecting the grid of the first detector to the tuning circuit and joining the grid condenser of the second detector to the first I.F. transformer, removing the lead from this to the grid of the first I.F. valve.

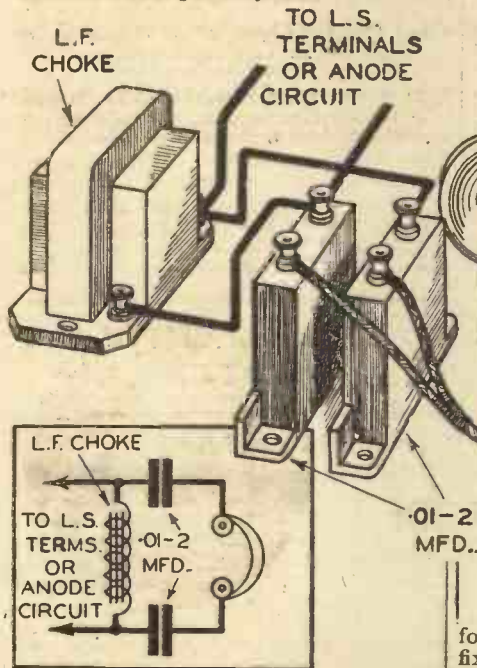


Fig. 2.—When connecting 'phones to a mains-operated receiver it is desirable to isolate them by means of a circuit on these lines.

former will often suffice) and a couple of fixed condensers of between .01 mfd. and 2 mfd. The connections are shown in Fig. 2.

## The First and Second Detectors

After the last stage has been checked, either the first or second detector can be tested; in most cases it does not matter which is dealt with first. If the first detector is being dealt with the 'phones (or speaker) should be inserted in the anode circuit of that valve in the position marked B in Fig. 1. The anode circuit of the

the general systematic method of testing through a "straight" receiver do not appreciate either that an almost identical procedure may be followed, or that certain valve stages can easily be eliminated.

It has been explained in these pages before that in making stage-by-stage tests of a "straight" set the idea is to cut out the low-frequency and high-frequency valves one at a time, working toward the detector. The actual method is slightly different in the case of the superhet., because there are two detectors, but it is possible to work toward each of these in turn. For example, if nothing can be received, or if there is a persistent crackling or other fault, the first step should be to eliminate the L.F. valve by connecting the speaker (a pair of 'phones is better, when available) in the anode circuit of the second detector; at the point marked A in the circuit diagram, Fig. 1.

## Eliminating the L.F. Stage

If the fault which was previously in evidence has disappeared after transferring the speaker connections it will be evident that the last valve was at fault. On the other hand, if the trouble is just as bad as before, the L.F. stage is almost certainly blameless, and the defect is in one of the previous valve circuits. In this respect it must, of course, be borne in mind that signals will, in any case, be weaker when the L.F. valve is out of use, and, therefore, such faults as crackles, hum, etc., will not be heard so loudly. It should be

## Testing the Oscillator

Signals will certainly be very weak when using these connections, but they should, nevertheless, be heard, provided that the oscillator valve and the first I.F. transformer are not at fault. If nothing whatever can be heard it will probably be found that the oscillator valve (or section

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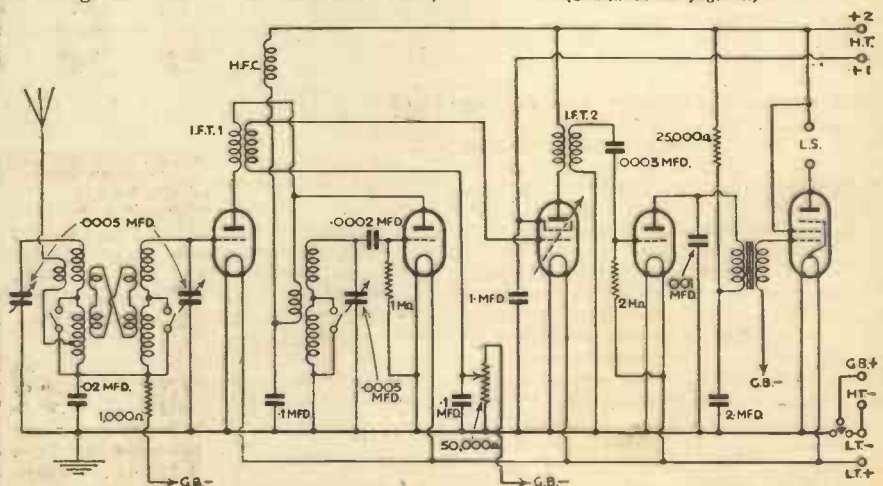


Fig. 1.—A typical Superhet. circuit used to illustrate methods of testing described in this article.





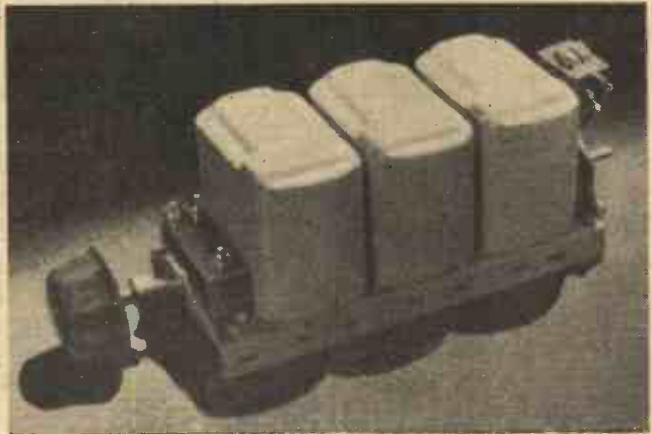
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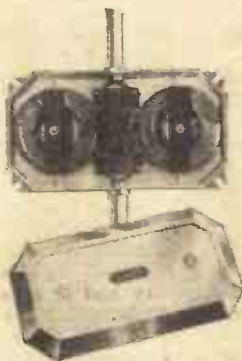
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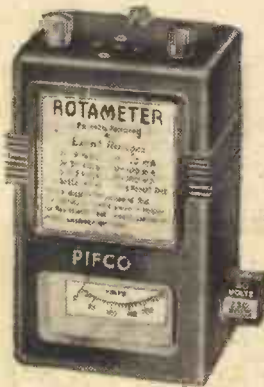
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| 3—0-250 volts. For high-tension voltage test. | 8—FILAMENT AND RESISTANCE TEST (4,000 ohms). For D.C. and Rectified A.C.                |
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By JACE

**Amplified Physical Jerks**

TEN thousand gymnasts, men and women, performing exercises in perfect unison to music on a twenty-acre field—that was the imposing spectacle recently staged in the Strahov Stadium, Prague, by the Third Workers' Olympiad. The military precision of the serried ranks of athletes was made possible largely owing to the orchestra of 120 musicians amplified by a Philips installation and heard by 120,000 spectators.

The amplifying apparatus included twenty-four horn loud-speakers, 6ft. long, and four 120-watt amplifiers. In addition, a "Maxiwatt" amplifier was used by the Philips engineers for off-setting the difference in sound volume due to the direction of the wind.

The success of this experiment is considered by experts to prove that there is virtually no enclosure too large to receive distinct amplification, provided that sufficiently powerful apparatus is used.

**Mr. Grierson's Flight**

THE Marconi Company received recently the following telegram from Mr. John Grierson, the British airman who has just completed a flight from London to Ottawa by the Northern Transatlantic route across Iceland, Greenland and Hudson Bay:—

"Marconi receiver and transmitter never failed to function. Only regret unable make full use wireless owing difficulties solo piloting. Transmitter probably saved my life on east coast Greenland. Wireless proved indispensable to such a flight."

Mr. Grierson's aeroplane was fitted with a Marconi short-wave transmitter covering a waveband of 30 to 50 metres, and a receiver with a "homing" device attachment as an aid to navigation.

**American Stratosphere Ascent**

WITH reference to the stratosphere ascent made in South Dakota, U.S.A., during July, it is interesting to note that Ferranti Class "B" input and output transformers were employed in the short-wave transmitter which was used in the balloon for communication purposes.

The equipment was supplied by the Ferranti Company through the National Broadcasting Company of America, and the transmitter with Ferranti Class "B" transformers is now reposing in the National Broadcasting Company's Museum.

**Pifco—New Address**

THE Provincial Incandescent Fittings Co., Ltd., best known by their trade mark, Pifco, the word being made up with the initials of the registered title of the company, manufacturers of the well-known electric cycle lamps, testing instruments for radio, heating stoves, and

Sharpex stoppers, have, after occupying Pifco House at 71, High Street, Manchester, for twenty years, deemed it necessary to remove to more commodious premises at Shudehill, an arterial road in the centre of the City of Manchester.

The foundation stone of the new buildings was laid by Mrs. R. Webber, wife of the founder and managing director. It consists of five storeys and basement with three modern communicating lifts: A handsome show-room has been fitted out on the ground floor in Shudehill, and a trade counter in Watling Street section. Office accommodation has been taken up on the top floor, capable of seating over 100 clerks.

We are requested to beg through these columns for a little further indulgence from those customers who are still awaiting deliveries of orders placed early in the summer.

**Stentorians at Glasgow**

THERE was a rather amusing incident at the Glasgow Exhibition which will no doubt interest our readers.

The W.B. Stand, No. 38, was close to the B.B.C. Theatre. From the first day it was found that demonstration of speakers on the stands from the common feed supplied by the B.B.C. was interfering seriously with performances inside the theatre, and it was found necessary to cut down the output of the B.B.C. amplifier in order that the items inside the theatre might be properly heard and enjoyed.

Naturally, this could not continue, and experiments were made by the B.B.C. engineers to find out how the trouble could be minimised without entirely rebuilding the walls of the theatre itself with sound-proof construction.

After a little time it was found that the chief culprits were the Stentorian models which were being demonstrated, and if these were discontinued full volume could be put through the other speakers in the hall without discomfort to the audience in the theatre. Therefore, on Saturday evening this stand was dismantled, and on Sunday an entirely new

stand was erected for them at the far end of the hall. Full volume was then possible through all the demonstration speakers in the Exhibition and, having been moved far enough away from the theatre, the W.B. Stentorians were allowed to live up to their name without disorganising the Exhibition arrangements.

**A Critic Retracts!**

ONE of the most critical letters yet received at Belfast arrived in the B.B.C. office there recently. It was from a listener who expressed himself "disgusted" with a certain programme. Its contents were duly noted. In the afternoon it was followed by another letter from the same writer, entirely withdrawing his first remarks, apologizing and requesting that the original letter might be destroyed! What was the reason?

**The Highest Radio in Great Britain**

WE have heard of radio receivers in coal mines, diamond mines, and numerous other places below the earth's surface, but information comes to hand of the latest effort of a Marconi man—Mr. C. S. Wakeham, 32, High Street, Llanberis. Mr. Wakeham managed to interest a director of the Mount Snowdon Railway in the pleasures of radio listening, with the result that this gentleman became fired with enthusiasm and determined to provide entertainment for visitors at the Summit Hotel, Snowdon. Mr. Wakeham was given to understand that whatever was installed had to be first class quality and of good appearance; there was to be no outside aerial as this would detract from the surroundings of the hotel which are particularly beautiful. He therefore took a Marconiphone Model "273" via the Snowdon Mountain Railway and installed it in the Summit Hotel at the top of Mount Snowdon. An inside aerial was slung round the wall inside close to the roof, and the only earth that could be obtained was a certain amount of sheet iron which formed the framework of the building. The ordinary "ground" was impossible, the foundations being of solid rock. Reception is reported as being splendid, dozens of stations coming in at full loud-speaker strength.

**MASSED GYMNASTS.**

A wonderful demonstration of massed drill—controlled by loud-speaker commands. See the paragraph on this page giving details of this novel Philips demonstration.



SUPPLEMENT TO "PRACTICAL WIRELESS"

# AMATEUR TELEVISION

## CATHODE - RAY TUBE SCANNING

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

**A**LTHOUGH the methods of controlling the scanning spot appear to be understood by readers interested in television, the cathode-ray tube is not so generally understood. Whereas with discs, drums, etc., the movements of the parts can be watched, in the case of the cathode-ray tube such a course is not possible.

### C.R. Tube Electrode System

Take the tube itself and examine the bare essentials of the electrode system. This is shown in Fig. 1, which illustrates an

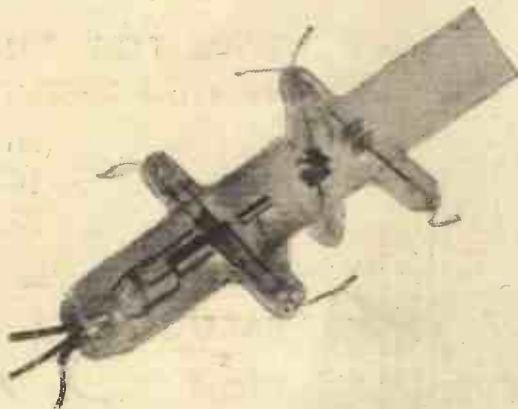


Fig. 1.—Showing the bare essentials of a cathode-ray tube's electrode system.

ordinary filament (the cathode) which is heated by an electrical current, so that a stream of electrons is emitted from the filament surface just as in any ordinary valve. Completely surrounding the filament is a small diameter metal cylinder. This is termed the control cylinder or "gun," although in many cases it is known as the Wehnelt cylinder, after its inventor. This cylinder has applied to it a negative charge, so as to concentrate and direct the stream of emitted electrons towards the circular disc or anode mounted just in front, as seen in Fig. 1. In practice the incoming television signals are applied to

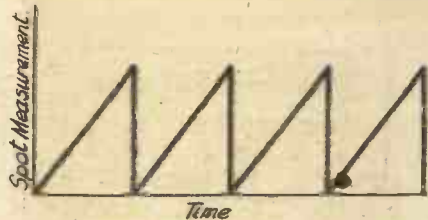


Fig. 2.—This graph illustrates the saw-tooth motion of the television scanning spot.

the control cylinder and vary the potential accordingly for the purpose of altering the intensity of the electron beam.

The anode has applied to it a high positive voltage varying from a few hundred to two or three thousand volts, according to the type of tube employed and the purpose for which it is required. This has the effect of forcing the electrons towards

the plate at an enormous speed, and as at the centre of the plate a small hole is made, a large proportion of the electrons pass right through this hole and continue unchecked until they reach the front screen, where their high velocity renders them visible as a spot on the fluorescent material with which the screen on the inside of the bulb is coated.

### Spot Movement

This is really equivalent to the stationary scanning spot noticed in mechanically-operated receivers when the scanning mechanism is at rest. Interposed in the path of the electron stream between the anode and the screen, however, are two pairs of plates at right angles to one another. These are called deflector plates, and when no voltage is applied to either pair the electron path is normal to the screen. If, however, either pair or even both pairs of these plates are given an electrical charge it will have the effect of diverting the electron stream from its previous straight path so that it "bends" and strikes the front fluorescent screen at another point. Furthermore, the amount of deflection imparted is proportional to the potential charge given to either or both pairs of plates.

Here, then, is a method for making the spot describe a definite predetermined path, provided the potentials on the plates can be varied by just the right amount to suit the conditions imposed by the scanning spot movement at the transmitting end.

First of all, each pair of plates is connected to a separate frequency generator. With all scanning processes there is a primary and secondary movement, the first depending upon the number of strips into which the picture is divided, and the second upon the number of picture repetitions per second. For example, with the B. B. C. television service the primary movement takes place 375 times per second (12½ pictures per second multiplied by the 30 scanning strips), while the secondary one is 12½ per second. On the other hand, with the higher definition images which

are now being investigated the frequency is altered, being 4,500 in the case of 180-line pictures for the primary motion and 25 for the secondary motion, respectively.

### Saw-Tooth Motion

In the former case the spot has an upward movement at a steady velocity, and when it has reached the top of the scan a "quick return" is made to the bottom of the light field being explored, when the process is repeated all over again except that the path followed is next to the one previously described. With most high definition processes the same effect takes place, except that scanning is horizontal instead of vertical, but in both cases the movement

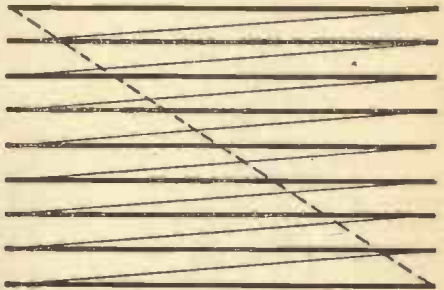


Fig. 3.—The heavy and light lines show how the scanning field is built up by the time bases.

is popularly termed "saw tooth" motion. This will be seen from Fig. 2, which indicates the steady spot movement with time (uniform velocity) and at the end of the scan a rapid return to the original datum level. The reason for applying the term "saw tooth" is readily apparent from the diagram, and it is necessary to devise a means whereby this can be brought about by the electron spot.

If a voltage variation (having a regular and uniform rise in value up to certain pre-determined limit followed by a sharp fall to its initial value), can be applied to one pair of deflector plates, this will bring about the primary scanning motion desired, provided the cycle of operations is uniformly repetitive. One of the simplest and most

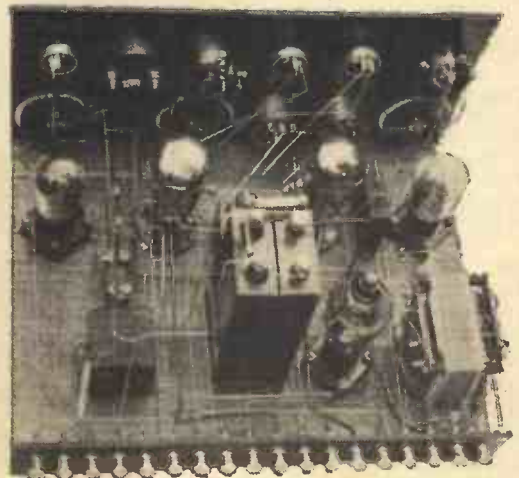


Fig. 4.—An example of a well-designed double time base for controlling the cathode-ray beam movement. The scanning rates can be altered quite easily and this is one of the distinct advantages of cathode-ray tube working for television reception when it is desired to change from one light area shape to another, or adjust the scanning lines for low- or high-definition transmissions.



effective ways of carrying this out is to use a thyatron or gas-filled discharge tube.

**A "Triggered" Effect**

These tubes resemble somewhat an ordinary valve in appearance but the electrode construction, and gas filling, cause them to function in a different manner. The usual grid volts/anode current curve is not followed, but the grid voltage can be fixed at a certain prearranged figure above which no anode current will flow. The moment the grid voltage falls below this value, however, the full anode current flows immediately, or in other words the anode current is "triggered" by the fall in grid voltage.

A circuit is therefore arranged—commonly known as a time base circuit—which in its simplest form is merely a saturated diode valve. To this is connected the biased gas-filled discharge tube and a fixed condenser in such a way that a uniformly increasing potential is applied to a pair of the cathode-ray tubes deflecting plates. This deflects the electron stream in a proportionally uniform manner, so that the original stationary spot now describes a vertical or horizontal line on the fluorescent screen, according to which pair of plates the time base circuit is joined. The thyatron is arranged to trigger at the moment when the deflector plate voltage is sufficient to divert the stream the required scanning distance along the strip. At this instant the tube causes the voltage to drop to its initial value almost instantaneously (corresponding to the vertical drop in the saw-tooth graph, Fig. 2) and the cycle of operations starts again, to continue for such time as the time base voltage supplies are maintained.

**A Second Time Base**

At the same time that this line traverse or primary scanning operation is taking place another action is imposed on the second pair of deflector plates. This corresponds to the pictures per second traverse, and is at right angles to the first operation. Either a 12½- or 25-frequency time base circuit is made to function, and obviously its action is to pull down (horizontal scanning) or pull across (vertical scanning) the spot so that each line traverse is not over the same path but contiguous one to the other.

As the field of light is therefore traced out on the fluorescent end of the tube, this second time base action persists until at the end of the last scanning line the second thyatron is triggered and a "fly-back" stroke is made to the starting-point once more. If the whole of this scanning operation is imagined to be pulled out somewhat it will appear as in Fig. 3.

**An Advantage**

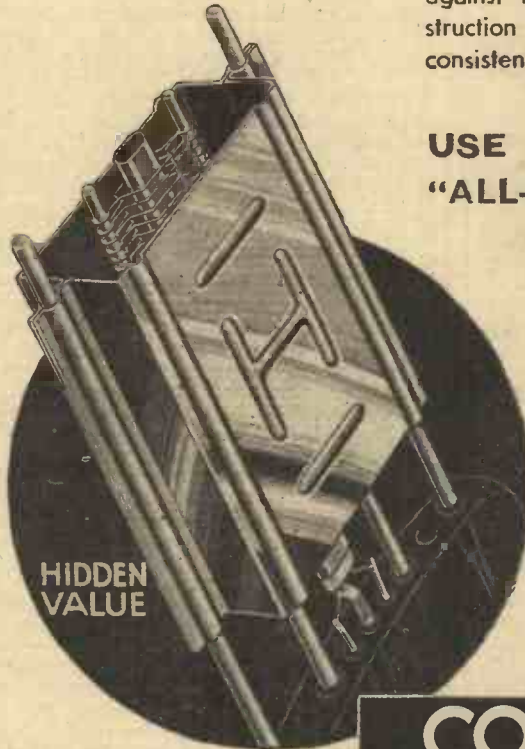
Although simple in theory the time bases call for very careful design in actual practice. Usually they are built up in "double" form to allow one unit to perform the dual function, and in Fig. 4 is shown an example of a unit of this character. The two thyratrons are in the centre, being flanked by the saturated diodes, while on the panel are the controls which determine the frequency of the action and the length of the scanning strokes.

Being a voltage-operated device but little power is consumed by a cathode-ray receiver; indeed, quite small-size high-tension batteries are marketed specially for this class of work.

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## FERRANTI POTENTIOMETERS

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### TRACING FAULTS IN SUPERHETS

(Continued from page 36)

of a multiple valve) is not functioning, due either to the lack of H.T. voltage or a break in one of the windings of the oscillator coil. These items should therefore be tested in the conventional manner before proceeding further. As a check on the I.F. transformer it might in some cases be found convenient to change over two of the transformers in the set.

If it is definitely established that the oscillator valve is at the root of the trouble, no good purpose can be served by leaving one or more of the I.F. valves out of circuit, and they should therefore be re-connected. When the receiver is being tuned by a multi-gang condenser it might often be found that the oscillator section is not tracking correctly, because of a fault in the coils or because the condenser plates are not of correct shape. In either instance the best check is to connect a single variable condenser in place of that section which operates upon the oscillator coil; this must be tuned at the same time as the gang condenser, and if it is found that signals are much louder with the new connections it will be evident that one of the faults mentioned does actually exist.

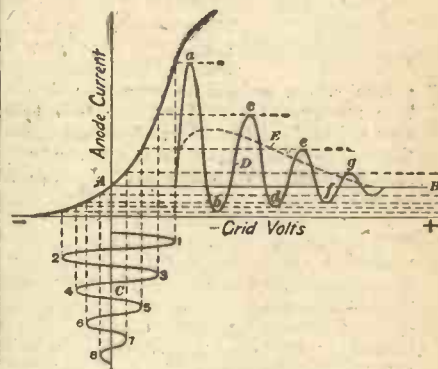
#### I.F. Troubles

When it is found that the oscillator is functioning correctly, and after following the series of tests described, there will be nothing left to suspicion except the I.F. stages. If there is only a single such stage, all altered connections should be re-made to conform with the original circuit. Check the voltage on the anode of the valve, and also test the windings of the transformer for continuity. Where there is a variable- $\mu$  control, this should be eliminated by short-circuiting the variable resistance, in the case of a mains set, or disconnecting the lead to the centre potentiometer terminal and joining the "lower" end of the transformer secondary to earth in the case of a battery receiver.

If there are two intermediate-frequency stages the second can be eliminated by joining the grid condenser of the second detector to the grid terminal of the second I.F. transformer, removing the lead which normally goes from here to the grid of the I.F. valve. The same tests as were described above in respect of a single I.F.-stage set can then be applied before bringing both intermediate-frequency stages into use.

The above instructions have necessarily been of a general nature, and reference has chiefly been made to circuits incorporating a separate oscillator valve and a triode detector. Some of the details will differ slightly when more modern circuits designed around multiple valves are being dealt with. Nevertheless, the principles will be the same, and a similar method of systematic testing can be employed. When the first detector is preceded by an H.F. stage, the latter can be eliminated exactly as in the case of a "straight" receiver, by transferring the aerial from the first to the second tuned circuit.

## Do You Know What This Graph Means?



The man who can analyse these curves and understand what they indicate knows his job. But if they do not convey to him perfectly definite information, it would appear that he needs more training than he has had. He is not competent to fill a responsible position in wireless.

Radio has developed so rapidly throughout the last ten years that it has now greatly outgrown the supply of technically qualified men required for the better posts. Moreover, it continues to develop with such speed that only by knowing the basic principles can pace be kept with it.

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Edited by F. J. CAMM

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# Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

## Lissen Iron-core Coils

THE Lissen iron-core coils are, of course, well known to our readers, having been specified in some of our constructional articles. Formerly these were only obtainable in the form of a rather bulky nature, in the deep base of which was included a wave-change switch mechanism. This method of assembly is, of course, admirable when it is desired to use two or more coils in a circuit of a rather compact and efficient nature, as the apparatus may be constructed without any external switch wiring, and thus instability avoided. For the benefit of those who wish to use this type of coil with an external switch, such as one of the multiple switches which are now on the market, Messrs.



The new Lissen iron-core coil without switch.

Lissen have produced the coil without the switch base, and consequently the overall dimensions have been considerably reduced. The accompanying illustration shows the new coil, from which it will be seen that the base is reduced to a normal thickness, just sufficient to accommodate the terminal locking nuts and the connecting wire. When using two or more of these coils some care will have to be exercised in the wiring to the wave-change switches, but otherwise they will prove very useful to the experimenter. They are available in several types, from the simple aerial coil with reaction, to an oscillator coil for 126-kc. intermediate-frequency amplifiers. The price without the switch is 8s. 6d., and with the switch 12s. 6d. The long- and medium-wave windings are separated, and wound on individual formers, one forming the upper part of the complete assembly, and the other being passed through a hole in the lower part of the assembly at right angles to the first coil. Litz wire is used for the medium-wave grid winding, and losses have been reduced to a minimum. The coils may be highly recommended and are very efficient.

## Clix Master Plug

IN last week's issue we gave details of a new master plug which had been introduced by Messrs. Lectrolinx, Ltd., and which was designed to accommodate much larger gauges of wire than the existing types of plug. We now understand from Messrs. Lectrolinx that this particular plug may be obtained in red as well as black. The price, as previously mentioned, is 3d.

## "A Coil That is Wanted"

IN our issue dated August 25th we dealt with various tuning schemes, and on page 666 we stated, under the above heading, that there was a need for a coil which would operate satisfactorily with the battery-fed heptode valve. Messrs. Colvern point out that their G.8 coil is designed for use with either a triode or a pentagrid type of oscillator, and that it will function quite satisfactorily with the battery-operated heptodes which are now available. This coil is of the iron-core type and the windings are balanced to provide adequate oscillation over the complete wave-band with the majority of superhet. circuits which are now available. It may be used with a ganged condenser having a shaped oscillator section, or with a straight gang condenser and a separate series padding condenser.

## B.T.S. Screened Connector

A NOVEL connecting lead has been received from British Television Supplies, and is illustrated at the foot of this page. This consists of a thin connecting wire, to the ends of which are soldered some stout ring connectors. This wire is surrounded by a porcelain tube which is shaped somewhat after the manner of a string of small beads. Surrounding this is a spiral of springy metal, each turn of which locks over the preceding turn and, owing to the springy nature, the whole remains quite rigid and grips firmly in a connecting link which is provided for an earth connection. By gripping the two ends of the device and twisting, the spiral covering is reduced slightly in diameter and the earthing clip is thus free to be moved to any desired position for convenient earth connection. As a further useful feature the small beaded tube may be easily fractured by bending the lead, and thus the complete device may be shaped to fit between any convenient points and it will not be liable to move and thus upset any ganged tuning adjustments or otherwise give rise to troubles from the movement of the connecting lead. The sketch shows the various points which are mentioned above, and also gives a very good idea of how the connector may be used to link an S.G. or H.F. pentode valve to a choke. The price of this handy device is 1s.

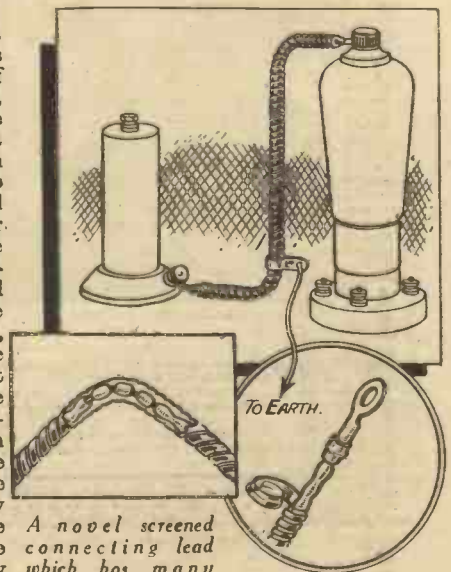
## A Popular Mail-order House

MESSRS. HERAUD, of Number One, Edmonton, London, N., are again entering into a busy period of activity. This firm, as we have previously pointed out, is one of the largest mail-order houses in London, and is in a position to supply practically all the well-known receivers, etc., on popular hire-purchase terms.

## Two New Condenser Drives

TWO interesting straight-line dials have lately been received from Messrs. Wilkins and Wright, these being of novel construction and having very distinctly marked horizontal scales. The more pretentious of these drives is the Straight-Line Micro-Dial, and this provides two reduction ratios of 12:1 and 150:1; either ratio can be employed at will, and without making any alteration, simply by using the appropriate knob, of which two are provided, these being of similar size and concentric with each other. Both knobs drive through the medium of a special cord which actuates a hair-line pointer arranged to move over a scale divided into 100 divisions. This drive is of particularly fine design and will be found of extreme value to the experimenter and short-wave worker who requires absolute precision, entire freedom from backlash, and, in fact, every important asset to accurate tuning. The price of the Micro-Dial (type No. W. 350) is 15s.

The other drive is simply styled a "Straight-Line Dial" and has a single reduction ratio of 12:1. It operates on the same principle as that described above but has, of course, only a single control knob. It can be supplied with a two-colour scale marked either in wavelengths (both medium and long) in addition to a 100-degree scale running along the centre, or with a plain black scale marked with 100 divisions only. The two-colour scale is correct for use with coils having inductances of 157 and 2,200 microhenries, respectively, and in conjunction with "Utility" condensers types W.347 and W.349. This simpler model (type W. 346) is priced at 6s. 6d. and, like that first mentioned, can be obtained with either black or walnut knob.



A novel screened connecting lead which has many special features.



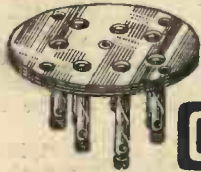
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# PRACTICAL LETTERS FROM READERS

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

## Chassis Modifications Wanted.

SIR,—I am very glad to know that you will be giving us a heterodyne set later on, for the congestion of the ether is such that it is impossible to get real selectivity on an ordinary set.—S. Grid, Det. and L.F.—and with the advent of the Droitwich transmitter matters are very much worse.

May I venture a suggestion for the next set? The box chassis adopted in most of your sets is undoubtedly neat in appearance, but is that the most important thing to aim at? For an experimental owner it is a great nuisance to be obliged to reverse the whole set when a condenser, etc., has to be changed or a test made; and if this system is adopted might I suggest an alternative "above board" diagram be given for those who, like myself, prefer to "get at" the set with the least inconvenience. This arrangement has deterred a lot of us from trying out many of your new sets.

Also, I hope the condenser dial with a 3 in. aperture is a thing of the past and that full view scales will be adopted.

In a set working direct off the mains, could an alternative be given for those having eliminators or batteries?—GEO. E. WELCH (Birmingham).

[What do other readers think regarding Mr. Welch's suggestions?—ED.]

## A Querist's Thanks

SIR,—I thank you for your answer to my enquiry re excessive oscillation and beg to inform you that I found the by-pass condenser between screening grid and cathode of S.G. valve defective, just as you stated. Again thanking you for your assistance.—R. PATTISON (Cheltenham).

## A Friendly Gesture from America

SIR,—In the July 14th issue of PRACTICAL WIRELESS you published a letter of mine concerning the reception of the "Phantom Strings" through W3XAL. I thought perhaps you would like to know of a very friendly gesture I received from America.

Following my reception report to the N.B.C. I received a letter from Mr. Aldo Ricci, who offered to play any request. Eventually I heard my request and also my name mentioned preceding it. I considered the matter closed after acknowledging reception, and was greatly astonished to receive a gift of an electrical transcription recorded off the air during the broadcast. The reverse side of the record contains greetings from each of the "Phantom Strings" to myself. As I am a person of no position or importance, the gift of this record can only be construed as a gesture of goodwill and friendship.—F. WADE (Catford).

## Another Chassis Suggestion

SIR,—While appreciating your efforts re stripped components as an aid and incentive to assist home constructors in building efficient sets, there is one refinement which would be a great help which you might be able to effect. It is usual to build

on either a metal or Metaplex chassis, and this seems to be likely to endure for a long time.

The provision of a Paxolin panel, say 10 in. by 3 in., about 3/32 in. thick, would give a finish to either type of chassis. This might be engraved as follows:—

A1 A2 E. Pick-up L. S.

O O O O — + + —

and have a series of holes to take terminals underneath, as shown, plus smaller holes at the corners for fixing to the chassis. This is not so much a "wrinkle," as an idea that possibly you can find useful.—E. E. WOOD (Rushden).

## An 8-valver for Overseas Use!

SIR,—It is a matter of disappointment to constructors out here that you do not publish a set that meets with their requirements. For instance, it is no use buying a set in Capetown that has less than six valves unless one desires to listen in to our local station only. What we desire is an 8-valve all-wave superhet. with all the latest improvements and working from 220 A.C. Do you think that you could include this in your programme for the near future?—H. TAYLOR (Capetown, S. Africa).

[We hope to consider the design of a suitable receiver for overseas use in the near future.—ED.]

(Continued on facing page)

CUT THIS OUT EACH WEEK.

*Do you know*

—THAT resistance-capacity H.F. coupling offers a very good medium for long-wave reception.

—THAT a higher input is required for a metal rectifier than the desired output.

—THAT an aerial may probably be shortened now that the darker evenings are coming, as signals will be found to be much stronger.

—THAT an accumulator should not be left for any length of time without charging.

—THAT if the accumulator is not to be used for a long period it should be charged and emptied out, and refilled when required.

—THAT leads to a dial-light in an A.C. receiver should be kept away from the H.F. wiring in order to avoid the risk of induced hum.

—THAT periodical cleaning of the L.T. switch in a battery-operated receiver will avoid noises due to dirty contacts.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, Geo. Neumes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

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



**PRACTICAL LETTERS**

*(Continued from previous page)*

**Quality Reception**

SIR,—I was rather interested to see the letter from Mr. Boyd, of Harrow, and your reply. I rather doubt whether your reply is quite correct, as my own experience is that there are more people to-day who are in search of real quality and few stations than at any time since broadcasting commenced. It is, moreover, quite possible with tone control and var. selectivity to get enough foreign stations with a quality that is enjoyable. I made up sets for friends and not one had a quality which I would listen to.—A. B. (N.W.2).

**“Alternative Connections”**

SIR,—I have just read with interest the article on Alternative Connections, and feel sure some mistake has been made. Surely Fig. 2 shows the more practical method of connection, as this in effect is a decoupled circuit, and will allow any H.F. currents to be by-passed to filament. As a matter of fact, this is now the accepted way of using an output choke. In Fig. 1 the H.F. currents have to find their way back to filament through the resistance of the H.T.-battery, and this is liable to cause instability if the H.T. battery is at all run down.

There is one point in using the arrangement shown in Fig. 1, and that is a smaller test voltage condenser can be used. Should this condenser break down, little damage will be done. In Fig. 2 a faulty condenser will pass full H.T. voltage to the filaments of the valves, if as in some cases L.T. positive is connected to H.T. negative.—**H. V. WATLING** (Colchester).

*[There was no mistake in the article and the method shown in Fig 1 is generally preferred.—ED.]*

**An Exhibition Echo**

SIR,—As a visitor to Radiolympia I saw plenty of woodwork and various tuning arrangements, but what about the hearing part of it? Loudspeakers working from the most perfect amplifier it was possible to have, under perfect conditions. All very nice, but how about those same speakers working behind their own particular circuit. Will they sound so perfect? I doubt it. If they are going to have exhibitions let us also hear the whole machine, not one part of it. I know that is asking a lot, but it is not impossible.—**A. ROGERS** (High Wycombe).

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# RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

## ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

THE West Middlesex and East Buckinghamshire Branch of the Anglo-American Radio and Television Society is resuming meetings on Wednesday, October 3rd at 8 p.m. Will all interested please write to Mr. Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge, for particulars?

It is probable that a television demonstration will be held on this evening, whilst other attractions have been arranged.

Mr. J. H. Searle, hon. sec., Southland Branch of the above society, is transmitting, in an endeavour to communicate with Great Britain, between 5 p.m. and 5.20 p.m. (British Summer Time) on September the 15th, 22nd, and 29th.

He will transmit the following, in Morse code, for the whole twenty minutes on each occasion: CQ (---) CQ De (---) ZL4CE (---) (---). Wavelength, 80 metres, power 15 watts.

Reports should be addressed to the A.-A.R. & T.S. H.Q. at 11, Hawthorn Drive, Willowbank, Uxbridge, England.

## INTERNATIONAL SHORT-WAVE CLUB

A VERY successful meeting of the London Chapter was held on Friday, August 31st, and was attended by over seventy short-wave listeners. The meeting was addressed by Mr. A. E. Bear, who gave a very interesting talk on short waves. He made it clear that short-wave listening was really worth while, and appealed to the radio manufacturers and the Press to provide more for the short-wave listener. In the past short-wave listeners had been poorly provided for.

On Saturday, September 1st, the members of the London Chapter visited the Battersea Power Station, over which they were shown by the Engineer in Charge, A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, S.E.16.

## SLADE RADIO

THE lecture at the meeting held last week was given by Mr. A. F. Poynton, who described the two new Telsen superhets. At the conclusion of the lecture a demonstration was given, and this showed that both models gave a fairly good quality of reproduction with ample volume, and the selectivity came up to expectation. Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

# CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Neaves, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

## RICH & BUNDY

LISTENERS who make a point of studying quality L amplification will be very interested in the new catalogue issued by Messrs. Rich & Bundy. This firm specialises in the manufacture of transformers and chokes and a special feature of their products is the provision of transformers designed for duo-phase output circuits. The catalogue contains circuits of two typical duo-phase amplifiers and in addition gives full details concerning the system and other interesting information regarding output transformers; mains transformers, line transformers, etc.

## PIFCO

A PAMPHLET has just been received from the Pifco Co., in which the Rotameter, the Radiometer, and the All-In-One meter are shown. The leaflet also illustrates the eight ranges which are provided on the novel rotating scale fitted to the Rotameter, and gives full details concerning the use of the instruments. A copy may be obtained on writing to the Provincial and Incandescent Fittings Co., Pifco House, High Street, Manchester.

## CELESTION

THE new Celestion booklet contains full details of a complete range of Celestion speakers, which include the E5 having an overall diameter of only 5in., and the Auditorium speaker, which with an overall diameter of nearly 14ins. weighs 7½ lbs. A speaker for all needs may be seen in this handy booklet. A second small booklet entitled "When Big Men Fiddle" will provide interesting reading, as it deals with the development of the loudspeaker. Messrs. Celestion point out that 25,000 of these booklets were distributed at Radlolympia recently.

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## REPLIES TO

LET OUR TECHNICAL STAFF SOLVE  
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ENQUIRIES

by Our Technical Staff

The coupon on Page  
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## SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

- (1) Supply circuit diagrams of complete multi-valve receivers.
  - (2) Suggest alterations or modifications of receivers described in our contemporaries.
  - (3) Suggest alterations or modifications to commercial receivers.
  - (4) Answer queries over the telephone.
- Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

which is used, etc. However, you can fit one with the certain knowledge that you will get the increased output given by the pentode with the saving in current which is given by the economising device.

## American Valve Types

"I notice that several manufacturers advertise American-type valves for sale in your columns. Are these valves suitable for the various types. If so, I should be greatly obliged if you will tell me how and where I can obtain it."—G. A. B. (Barnsley).

The valves are not interchangeable, owing to the fact that the valve pins are arranged in a different manner. Therefore, to use the American valves you would have to obtain American valve-holders, and these are not so easily obtainable. The characteristics are generally the same, although there are several special American valves obtainable, of which there are no English equivalents. We do not know of a book of equivalent tables.

## Local Disturbance

"I have constructed a two-valve receiver using an S.G. detector and pentode circuit. In the daytime this works splendidly, but at night I get a noise like a motor-cycle engine. Please could you help me to rid my set of this?"—J. G. (Yateley).

As the set functions during the daylight it would appear that the circuit is O.K., but that when daylight ceases some form of electric sign is put into action nearby. This would give the trouble, and you should look round for a flashing sign or a powerful neon sign, and you will no doubt find that your noises start when this is put into action. The remedy is in the hands of the owner of the sign, who should fit a suppressor. If you communicate with the postal authorities they will no doubt assist you if you cannot trace the interference to a definite sign.

## The "Leader Three"

"I am going to build the 'Leader Three,' but do not want to use a metallised chassis. Could I join all the parts marked M.B. to earth?"—P. M. McN. (Wreelverston).

You could do as you suggest, but it is highly probable that some difficulty would be presented due to lack of stability. We

have not tried out the scheme and therefore cannot say with certainty just what would happen. We would refer you to the first query on this page.

## Chassis Dimensions

"I am anxious to try out the 'Summit Three,' but you do not give any details of the actual chassis size."—J. H. W. (Ilkeston).

The size of the chassis in question is 14in. by 8in. with runners 3in. deep.

## Safety and Mains Transformer

"I have built an A.C. mains receiver, but wish to fit a fuse in it to avoid damage. Where is the best place to put the fuse so that ample protection is afforded?"—R. B. N. (Manchester).

The most suitable place for a fuse to protect from damage from the mains is between the mains leads and the primary of the mains transformer. To protect the transformer from damage due to a short on the receiver side, a fuse should be inserted in the H.T. negative lead, and should be joined immediately following the centre tap of the secondary winding. Alternatively, a fuse could be included in each anode lead of the rectifying valve if one is used.

## H.T. Battery Troubles

In your issue of "Practical Wireless" in the Queries and Enquiries page for Sept. 8th you describe how the H.T. battery is made up. I have tried this several times before, but with poor results. I think the fault lies in the sac, which I have taken from old batteries. These are supposed to be all right to use, but I've never had any success. I get good "push" from one, but not from another, and linked together I can't average 1 volt per cell. Can you put me right?"—W. R. (Liverpool).

It is impossible to say from your letter exactly where you have gone wrong in the construction of the H.T. batteries, but the fact that you are only getting an electrochemical efficiency of 1 volt per cell would seem to indicate wrong proportions. You do not say whether individual cell tests show variations per cell or whether your 1 volt per cell is an average. One defective cell having high internal resistance would, of course, reduce the total voltage.

THE QUERIES COUPON APPEARS  
ON PAGE iii OF COVER

## The "Summit"

"I am anxious to build your set the 'Summit,' but have one drawback. At the moment I am using a three-valve set with — valves, and I was wondering would these valves come in useful for the set, to be used as V1, V2 and V3. I give here with the characteristics of the valves in question."—J. H. (Blackburn).

As we have many times pointed out in these pages, we can only guarantee the receivers which we describe when they are constructed exactly in accordance with the published specification. The valves which you wish to use have almost similar characteristics, but the anode current of two of them is greater than the specified valves, consequently the H.T. applied to the valves will not be so great as when the correct valves are in use. Therefore, if you wish to get exactly the same results as were obtained on the original receiver you must use the original parts.

## H.T. Economisers

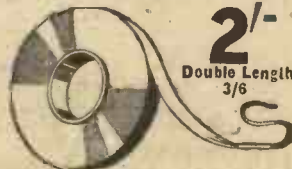
"I should like your opinion of the H.T. economisers using the Westector. I have only a two-valve set but would like to use a pentode in the output stage. At the moment I am afraid of the H.T. consumption, as I cannot afford too many H.T. batteries, but if the economiser works I should like to fit one."—A. J. B. (Stranraer).

The economiser does definitely function, although the exact economy which is effected obviously depends upon the total current taken by the receiver, the valve

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### Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8, Southampton Street, Strand, London.

### PREMIER SUPPLY STORES

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**TYPE 4480,** 9in. diameter, permanent magnet. Handles 4 watts, 7 ohms speech coil, 13/6.

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**ELIMINATOR Kits,** including transformer, choke, Westinghouse metal rectifier, T.C.C. condensers, resistances and diagram, 120v., 20 m.a., 20/-; trickle charger, 8/- extra; 150v., 30 milliams, with 4v., 2-4 amps. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v., 60 milliams with 4v., 3-5 amps. C.T., L.T., 30/-; 300v. 60 m.a. with 4 volts, 3-5 amps., 37/6; 200v. 50 m.a. with 4v. 3-5 amps. L.T., 27/6.

**PREMIER chokes, 40 milliams, 25 hys., 4/-; 65 milliams, 30 hys., 5/6; 150 milliams, 30 hys., 10/6; 60 milliams, 20 hys., 2,500 ohms, 5/6; 25 milliams, 20 hys., 2/9.**

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