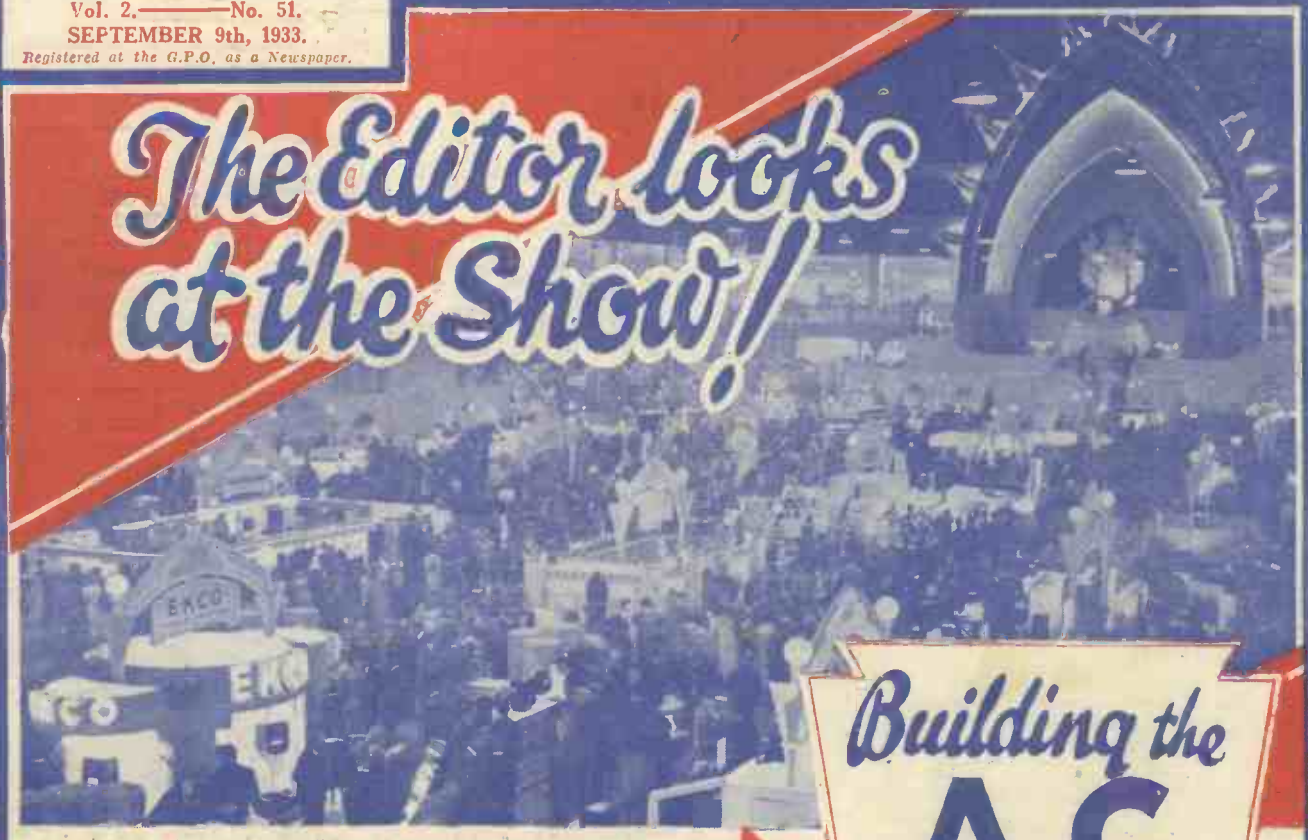
THE MOST PROGRESSIVE WIRELESS WEEKLY!

Practical Wireless

3D

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 2.——No. 51.
SEPTEMBER 9th, 1933.
Registered at the G.P.O. as a Newspaper.

The Editor looks at the Show!



Building the A.C. THREE

Also Inside

KINGS OF THE AIR

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Those stations that you can only just hear—the ones that are mere whispers in the distance—they too can give you entertainment. Fit a Cossor Screened Grid Valve. You'll be surprised at the difference it will make—longer range, and a general all-round improvement. Your dealer will gladly advise you on the most suitable type for your receiver. Ask him to-day.

Cossor 2-volt Screened Grid Valves

Type	Filament Amps.	Anode Volts	Imped.	Amp. Factor	Mutual Conductance m.a./v.	Price
*215 S.G.	·15	120-150	300,000	330	1·10	15/6
*220 S.G.	·2	120-150	200,000	320	1·60	15/6
*220 V.S.G.	·2	120-150	110,000	—	1·60	15/6
*220 V.S.	·2	120-150	400,000	—	1·60	15/6

Cossor A.C. Mains Screened Grid Valves

Type	Purpose	Imped.	Amp. Factor	Mutual Conductance m.a./v.	Price
*†MSG-HA	Super H.F. Amp'n.	500,000	1,000	2·0	17/6
*41 MSG	Super H.F. Amp'n.	400,000	1,000	2·5	17/6
*†MSG-LA	Super H.F. Amp'n.	200,000	750	3·75	17/6
*†MVSG	Variable-Mu	200,000	—	2·5	17/6
*†MS/PEN-A	H.F. Pentode	—	—	4·0	17/6
*†MS/PEN	H.F. Pentode	—	—	2·8	17/6
*†MVS/PEN	Variable-Mu H.F. Pentode	—	—	2·2	17/6

The above Valves have Indirectly Heated Cathode, 4 Volts, 1 Amp.

Cossor D.C. Mains Screened Grid Valve

*DVSG	Variable-Mu	—	—	2·5	17/6

The above Valve has Indirectly Heated Cathode, 16 Volts, 0.25 Amp.

*These Valves available with or without Metallised Bulbs.
†Characteristics measured at 1·5 grid volts.
** Stocked with Metallised Bulb only.

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Address.....

PRAC. 9/9/33

THE LEADING HOME CONSTRUCTORS' WEEKLY

ROUND *the* WORLD *of* WIRELESS

New Long-Wave Station at Droitwich

STEADY progress is being maintained in the construction of the new long-wave station near Droitwich, both with the building and technical equipment, and it is anticipated that the long-wave National transmitter will begin public transmissions in about a year's time, that is, in the summer of 1934. The transmitter will work on the slightly altered wave allotted to this country under the Lucerne plan, namely 1,500 metres (200 kc/s). The new Midland Regional transmitter, which, as stated previously, will be on the same site at Droitwich, will not begin radiating transmissions for some months after the long-wave National transmitter goes into regular service.

Better Signals from Cincinnati

BROADCASTS from WLW, Cincinnati (Ohio) on 428.3 m. (700 kc/s) have been recently heard at better volume on this side of the Atlantic Ocean in the early hours of the morning. This is due to the fact that this 50-kilowatt transmitter is now using its new 830-feet aerial tower. The broadcasts from the Cincinnati and other studios of the Red and Blue networks of the National Broadcasting Company of America, are also available nightly through W8XAL on 49.5 m.

New Television Receiver

KURT SCHLESINGER, a Berlin engineer, recently demonstrated in that city a new receiver for television transmissions; it has aroused considerable interest in German wireless circles. The instrument has been specially constructed for the reception of ultra short waves, and it is stated that the image projected on a small screen is in many ways equal in quality and clearness to that given by a 16 millimetre home cinematograph projector.

More Ascents to the Stratosphere

ALMOST every week news reaches us regarding new attempts to beat Professor Piccard's altitude record. The latest ascent to be tried out is one from Leningrad by the Russian engineer Tcherkovski who, for this purpose, has built a gondola of a specially light alloy, and which has been coated with a new preparation capable of resisting both excessive heat and intense cold. Some items of the technical description would appear to suggest that the inventor has based the construction of his gondola on the lines of a Thermos flask!

The Housewife's Hour

A FEATURE which has proved a great favourite in the A.V.R.O. (Hilversum-Huizen) broadcasts is the Housewife's Hour, in which, alternately, lessons are given in cooking, dressmaking, and other accomplishments required by the perfect Dutch "vrouw." Lectures are given in designing clothes for the bairns, and pamphlets with patterns published by the studio have been sold in thousands.

Protect the Listener

IN the opinion of French fans, in view of the fact that European broadcasting stations possess their own union, and that there also exist conventions of State authorities in regard to radio transmissions, a scheme to form an International union to protect the interest of the listener would meet with general approval. The proposal has been put forward to a number of radio clubs in France, and in every instance support has been promised. Such an organization would bring both experimental amateurs and listeners in closer touch with their respective governments, and would no doubt permit their representation at international radio conferences.

Forty-four Stations—One City

SHANGHAI, as the chief port of China, in view of its numerous international settlements, possesses forty-four different broadcasting stations; in all, seven Asiatic and European languages are used in the course of a day. In a lesser degree there are also transmitters in other centres, the most powerful being that of the recently completed station XGOA, at Nanking, working on 440.6 m. (681 kc/s). It is rated at 75 kilowatts and is mostly used for commercial purposes, although some of the broadcasts are devoted to musical entertainments. Chinese compositions and American jazz gramophone records are equally appreciated by the native population.

League of Nations Short-Waver

THE political and news bulletin hitherto broadcast by the League of Nations through the Prangins (Switzerland) transmitter on Sunday nights are now given on Saturdays on 31.3 and 38.47 metres. The English version is timed to start at 11.30 p.m. and is followed by the French and Spanish translations at, respectively, 11.45 p.m. and midnight B.S.T.

PTT Grenoble Now 15 Kilowatts

FOLLOWING a complete overhaul of its plant, the PTT Grenoble station of the French broadcasting network has increased its power from roughly four to fifteen kilowatts, and tests of the new installation are now being carried out daily. Although 309.9 m. (968 kc/s) is the channel on which the station may be requested to broadcast in January, 1934, in view of the mountainous character of the area for which the service is required, efforts are to be made to retain a wavelength in the 500 metre band. Grenoble PTT, at present, may be heard on 569 metres.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

Radio Nantes

WORK on the construction of the high-power transmitter at Thouries, near Nantes, destined to provide an adequate broadcast service to France's north-western provinces, is progressing so favourably that it is hoped to begin tests towards the end of the year. Broadcasts from this station would be well heard in the British Isles, and might prove an agreeable alternative to programmes from Paris.

Back to the Jungle

THE French newspaper, *Dépêche Coloniale*, states that the authorities of the Upper Katanga province of the Congo have been asked by native chiefs to erect a broadcasting transmitter at Brazzaville. It is suggested that for the benefit of dwellers in distant villages the studio might brighten the programmes with concerts on tom-toms and other primitive instruments played by native musicians. The Government had already considered the advisability of building a station at Brazzaville for the relay of news bulletins from Paris *viâ* the *Paris Coloniale* short-wave transmitter. If the scheme matures listeners in the French capital, in exchange, may be given the opportunity of hearing broadcasts from equatorial Africa.

Monte Ceneri

RADIO SVIZZERA ITALIANO (Lugano), on 1,145 m., which has been closed down for a week or so for adjustments to the transmitter, still broadcasts its time signals by verbal announcements. Listeners are warned to stand-by, and the exact time is indicated by a stroke on a gong. For this purpose the ordinary studio clock is not consulted, but the "announceress" utilises a ship's chronometer set to signals received from the Neuchâtel Observatory.

For the Unemployed

IN Germany, where free licences are granted to the unemployed, some of the stations broadcast at the end of the mid-day programmes a few details regarding the evening transmission with special reference to particular items which should prove of interest to these listeners. The step has been taken to assist people who cannot afford to buy the individual official programme papers published by the studios.

Ceylon to Relay Empire Broadcasts

IN order to facilitate the reception by English residents in Ceylon of the "home" wireless entertainments, a short-wave station is to be erected on a suitable site, with a view to relaying the programmes of the Daventry Empire broadcasters.

Radio Agen

NOW and again, when conditions are favourable, you may pick up a broadcast from one of France's smallest transmitters, namely, Radio Agen, situated at some eighty-four miles south-east of Bordeaux. Usually working on 453 m., it broadcasts a programme daily between 7.30 and 8.30 p.m. B.S.T. For such a small station, it puts out relatively a long call: *Ici poste départemental de Radio Agen en Lot-et-Garonne.* It is one of the many private transmitters which may be frozen out of the waveband when the Lucerne Plan comes into force.

INTERESTING and TOPICAL PARAGRAPHS.

Hourly Weather Reports

TO secure weather bulletins at times other than those at which such broadcasts are made by the B.B.C. stations, tune in to Heston Airport on 833 m. for forecasts transmitted by the Automobile Association. Information secured from the Air Ministry is broadcast almost hourly throughout the day from 9.30 a.m. until 6.30 p.m. B.S.T.

A SET OF THE FUTURE?

A television and sound set which obeys the human voice and gives any station asked for. It is described as Marconi's vision of 1960.

Ee-En-Air

ON many occasions when listening to Brussels (No. 1) on 509 m., you may have heard the announcer call: *Ici Bruxelles ee-en-air.* The last words stand for the letters I.N.R., an abbreviation of *Institut National de Radiodiffusion* (National Broadcasting Institute). When the concerts are provided by a private organization the individual initials follow the call: thus, R.C.B. (phonetic: *air-say-bay*) would indicate that the entertainment was offered by the Radio Catholique Belge.

The Lucerne Broadcasting Conference

IT is learnt from the B.B.C. that after five weeks' deliberations a wavelength plan for European broadcasting stations has been accepted by a large majority of countries, represented at the Conference recently held at Lucerne. The new "Plan de Lucerne" is embodied in a Convention which has been signed by twenty-seven countries. The delegates of seven countries—Finland, Greece, Holland, Hungary, Lithuania, Poland and Sweden—have not signed the Convention, but it is anticipated that they will in fact adopt the wavelengths allocated to them. As far as Great Britain is concerned, the number of waves available will be the same, but in general the wavelengths are slightly lower than formerly, several of them also being shared with distant countries. The actual wavelengths allocated to Great Britain are as follows:—

Kilocycles per second.	*Metres.*
200	1,500
668	449.1
767	391.1
804	373.1
877	342.1
977	307.1
1,013	296.2
1,050	285.7
1,122	267.4
1,149	261.1
1,474	203.5

The plan will come into force on January 15th, 1934, and in due course a further statement will be issued as to the exact use to which the wavelengths allotted to Great Britain will be put.

SOLVE THIS!

Problem No. 51

Blacksmith had a commercial receiver fitted with a moving-coil loud-speaker. As the most-convenient mains plug was in one room and he desired to listen in another, he removed the loud-speaker, and fitted the speaker transformer into the cabinet with extension leads to the next room for the speaker. When put into use, results were definitely poor, and he was unable to trace the reason. He measured the extension leads, but found these were only 7 ohms total resistance, so concluded that this was not the cause. What do you think was wrong? 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, and mark the envelope Problem No. 51. No entries will be received after September 11th.

SOLUTION TO PROBLEM No. 50.

The length of Coates' aerial-earth system was such that a harmonic of its natural wavelength came within the wave-range covered by the receiver. This resulted in the "dead spots."

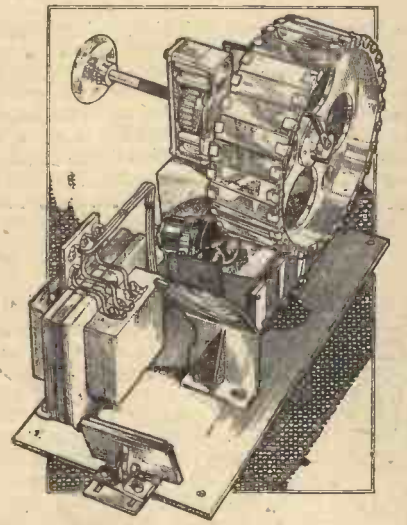
Only two readers succeeded in correctly solving Problem No. 49, and books have therefore been awarded to:—

T. Warrington, 8, Coronation Road, Hartshill, S.O.T.; A. H. Thorpe, Millfield Road, Plateley Bridge, Nr. Harrogate.

THE EDITOR LOOKS AT THE SHOW

Mr. F. J. CAMM Makes a Critical Survey of the Radio Show at Olympia, and Gives Here His Impressions of His Stand-to-Stand Inspection.

IT is not possible to survey the present position of the radio industry so attractively encompassed this year at Olympia unless one has the perspective



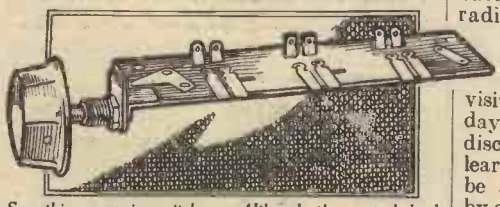
The new Baird Televisor. The arrangement of the mirror-drum, the new light valve, the lens and the synchronising coils can be seen clearly from this illustration.

and the outlook acquired by association with that industry from the earliest inception. It is the absence of such outlook and such experience which leads some "experts" who write for the daily press to besmirch their respective papers with such unmitigated balderdash about radio. You know the sort of stuff: "Firm books million pounds worth of orders"; "Unruly crowd storms Olympia"; "New valve revolutionizes radio," etc., etc.

Most of these hack scribes merely go to Olympia to find a catch headline with no scruples about the accuracy of the matter which appears beneath it. It is for them, too, an occasion to gaze upon and quaff the vintage. I feel that editors of daily papers ought in their own interests to avoid this sort of tosh which does immeasurable harm.

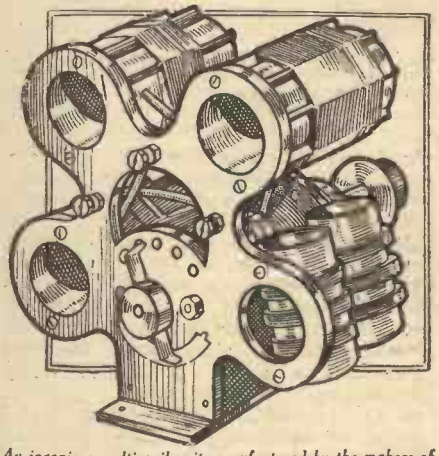
As one of the earliest radio journalists in this country (and also one of the first manufacturers of radio sets and components), I *have* watched the growth of the radio industry; the rise and fall of catch-penny manufacturers; the introduction of every improvement; the booms and the sloughs, and naturally I have visited every Radio Exhibition.

With the publication of No. 1 of PRACTICAL WIRELESS last September it was felt that a fillip could be given to the radio industry in general, and the home constructor market in particular, by pursuing a policy of catering in a practical way for the practical reader. The events of the past year have proved that we were right, for a greatly increased interest, as evinced by the increased sales of those who cater for the home constructor,



Something new in switches. Although the control knob rotates, the movement is converted into a push-pull action with improved results. This is a Utility product designed especially for coil switching.

has been evident everywhere. Another point which makes this self-evident is the tendency of the manufacturers to cater more this year for the home constructor; last year mains sets represented by far the greater proportion of each manufacturer's programme.



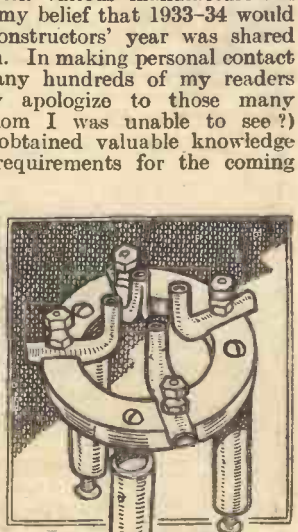
An ingenious multi-coil unit manufactured by the makers of the well-known Eddystone components. Five different wave-ranges are covered by these coils which represents a complete departure from conventional practice.

This year, however, most of the sets are battery-operated, and even battery-operated radiograms are marketed by some of our largest radio manufacturers.

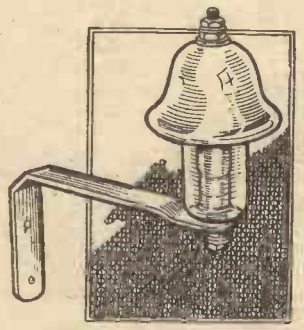
This year I made a very careful study of every stand, for which purpose I visited Olympia every day during the nine days it was open, and in the course of my discussions with various manufacturers I learned that my belief that 1933-34 would be a home-constructors' year was shared by all of them. In making personal contact also with many hundreds of my readers (may I now apologize to those many hundreds whom I was unable to see?) I have also obtained valuable knowledge as to their requirements for the coming season.

The fact that this year's attendances broke all previous records is further evidence of the re-awakened interest in home-constructed radio, and we take extreme pride in the fact that we have played no mean part in bringing

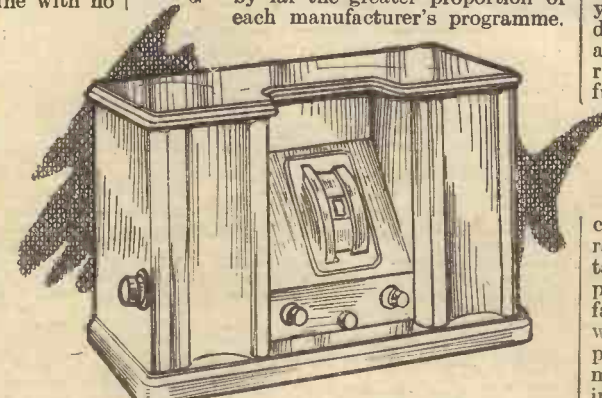
(Continued overleaf)



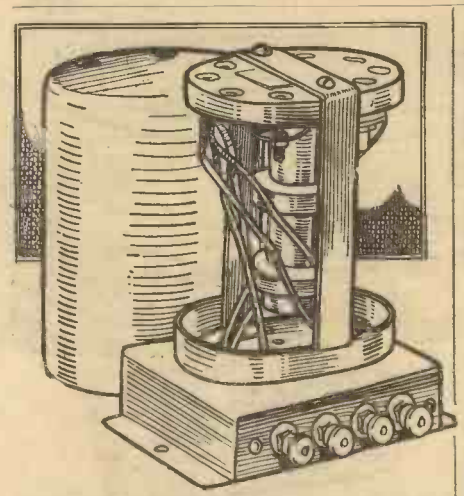
For short-wave work great care has to be taken to reduce losses. This valve-holder by the Eddystone people shows how losses have been removed in the mounting of the valve, and in the leads to it.



A safety device for the aerial system. This is the Phillips Aerial Discharger and it removes the necessity for an aerial-earth switch, and renders the aerial perfectly safe.



Something new in battery receivers. This is the Burton Two-valve Midget, and costs only 40/- complete with valves.



An Intermediate Frequency Transformer made by British Radiophone. This is of the Band-Pass type and is provided with screened adjustable trimmers to enable the self capacity to be counter-balanced.

(*Continued from previous page*)

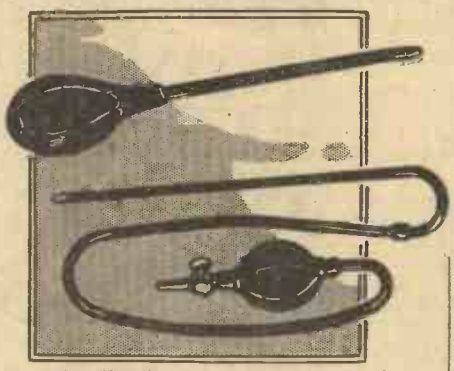
about this state of affairs, and this year, more than any other, the home constructor found at Olympia plenty to interest him. The succession of important developments which took place during the past few months—iron-core tuning coils—quiescent push-pull—Class B amplification—all-metal valves—cold valves—delayed automatic volume-control—all were responsible for the greatly increased attendance this year. Readers freely

This is one of the most interesting new types of tuning coil. It has a powdered iron core, and is provided with an adjustment so that circuits may be matched up. It is an R.I. product.

expressed the hope that future developments should not occur with such bewildering and almost internecine frequency, for, as quite a number of visitors to our stand said, "we hesitate to build a set because we do not know what is coming next." I pass along the hint to the manufacturers.

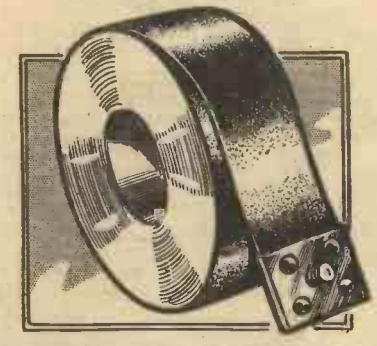
The arrangement of the Show this year was commendable; the wider gangways permitted even at crowded periods a ready inspection of any exhibit. The theatrical entertainment was a sheer inspiration on the part of the organisers. There might have been, perhaps, better arrangements in the body of the hall and in the gallery for the seating of those visitors who were fatigued. I have no doubt that this will be attended to next year.

Perhaps the most outstanding feature of the Show was the tendency of all manufacturers to increase the sensitivity and the selectivity of the completed receivers. From this aspect alone 1934 receivers by comparison with 1930 receivers are ten years ahead. Another feature of outstanding interest which early impressed even the casual observer was the tendency to reduce



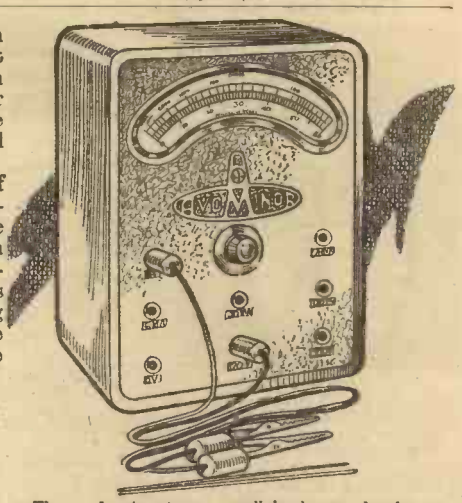
The Milnes H.T. Supply Unit is a most efficient battery, but the filling must be carried out carefully to avoid spilling. The fillers illustrated have been produced especially for this purpose.

To remove interference from the sparking plugs on a car fitted with radio, special suppressors are required. The illustration shows a suppressor sold by Page Car Radio at a cost of 3s. 6d. each.

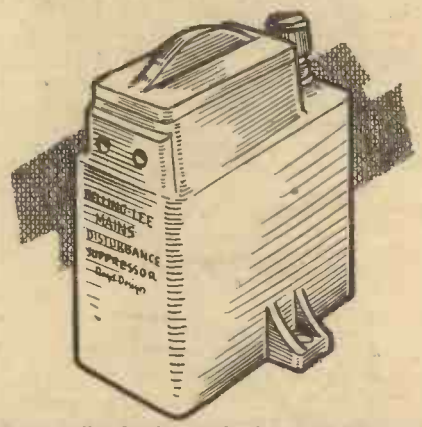


A novel indoor aerial. A film of metal is deposited on paper provided with an adhesive back, and is obtainable in silver or gilt at 1s. 6d. This is the Het aerial made by Univolt Electric, Ltd.

the size of the set. I am not quite certain, from the point of view of the public which often takes an obtuse point of view, that this is a move in the right direction, for I overheard a remark to the effect that as the prices of sets were reduced the size seemed to have been reduced also. Apparently this visitor thought that the size of a set was commensurate with its price! In point of fact, it actually is more expensive to make a satisfactory set of reasonable proportions, and it is certainly a move in the right direction to house, say, a six-valve set in a cabinet of such proportions that it looks in place even in the smallest flat.



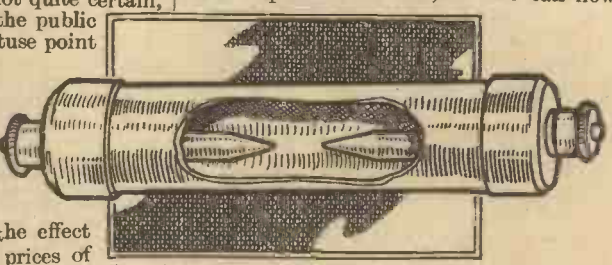
This is the Avominor, a small brother to the Avometer. It provides for the reading of volts, amps and ohms and may be used in conjunction with the well-known Avodapter.



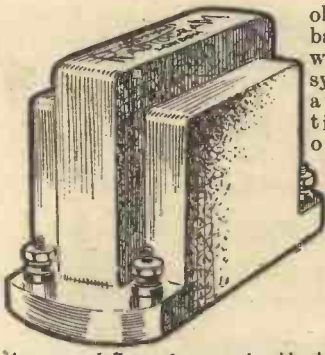
Messrs. Belling-Lee have produced this mains disturbance suppressor which is simply connected to the mains and removes troubles from electric cleaners, fans, etc.

That is where design is leading—smaller radio sets. The fact, too, that they can be made in such small sizes yet vastly more efficient than their larger brethren of a year or so ago is an indicative straw which shows the vast improvement which has been made in detail design, efficient screening, avoidance of interaction, and so on. A point not so apparent to the visitor was the preponderance of battery-operated sets. I have no doubt that the introduction of Q.P.-P. and Class B has been responsible for this, for one can now

For obtaining various voltages from a mains unit, a potential divider is very useful. The illustration shows an Igranic Potential Divider, which may also be obtained without the metal containing case.



The "Instant" Pole Finder suitable for voltages from 1 to 250. The negative pole turns purple on D.C., and both points purple on A.C. It costs 4s.

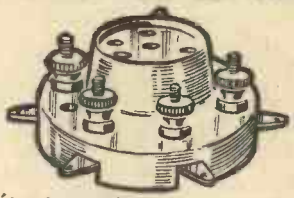


A very neat L.F. transformer produced by the British Radiogram Company. This is less than two inches tall and can be fitted into the most compact receiver with admirable results.

obtain from battery sets with these systems of amplification an output which is quite equal in every way to that obtainable from the mains.

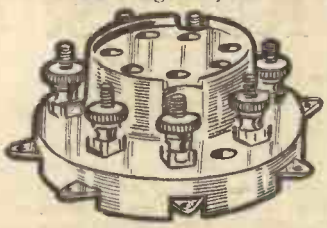
The super-heterodyne was well represented. Here again the battery version was in the majority. Several firms are marketing a battery-operated radiogram with Q.P.-P. or Class B.

Portable sets are definitely in the minority. I refer, of course, to battery-operated-portable sets.



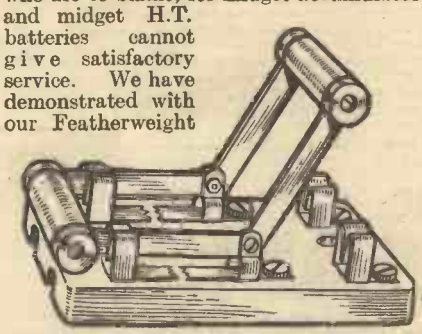
Low-loss; soldering tags or terminals; reversible connections and other interesting features are included in this Benjamin valveholder. It may be obtained with 4 or 5 pins.

An examination of the speakers, both those sold separately and those included in the complete receivers, revealed the important fact that the large diameter cone (" to bring out the bass ") is obsolete. Cones are getting smaller and smaller; one, in fact, was only 3½ ins. in diameter, which seems to indicate that eventually the cone will vanish altogether, the coil itself operating direct on to a correctly-designed combined diaphragm and baffle.



For the new 7-pin valves, this Benjamin valveholder also possesses the attractive features of the standard valveholder illustrated above. The contacts are of nickel-silver and provide a very firm contact with the valve legs.

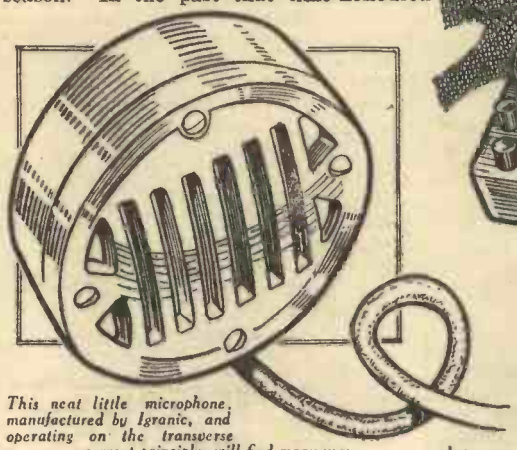
In this direction battery manufacturers have had to contend with almost insurmountable difficulties set them by the designers of the receivers. Too often the set has been designed and batteries made to fit the available space. If the portable (do not confuse this with the transportable) is under a cloud, I fear it is the set manufacturers themselves who are to blame, for midget accumulators and midget H.T. batteries cannot give satisfactory service. We have demonstrated with our Featherweight Portable Four that a satisfactory portable receiver, small in size, and light in weight, yet accommodating batteries of ample capacity can be made. There is still a market for a satisfactory portable set, and I would here pay tribute to those few firms (the survival of the fittest!) who continue to make a satisfactory portable.



Produced by the Whiteley Electrical, this knife switch is provided with a spark gap, and is very useful for inclusion in the aerial-earth system.

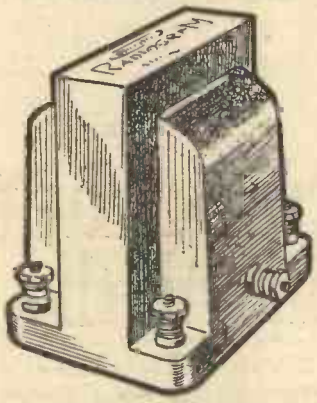
Cabinet work is vastly improved this season. In the past that time-honoured craft has been invoked to supply veneered imitations with inferior joints and inferior finish. In passing round from stand to stand it occurred to me that the speaker grille, with its frets and gauze backing, is something of an anachronism. No one to-day would dream of purchasing a piano with a fretted front backed by old-fashioned

(Continued on page 891.)

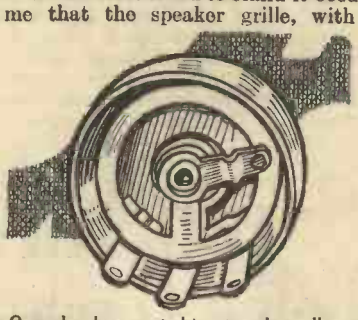


This neat little microphone, manufactured by Igranic, and operating on the transverse current principle, will find many uses.

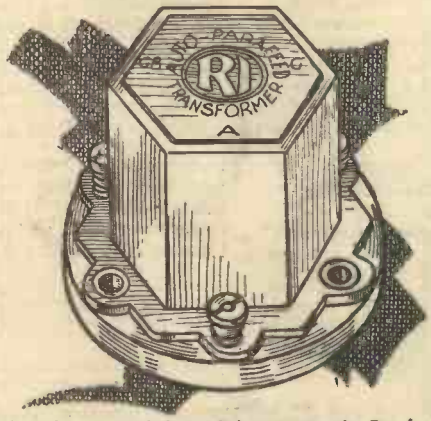
Good meters will be found invaluable, and this neat tester, incorporating two of the high-class Ferranti meters, is designed for measuring A.C. and D.C. potentials.



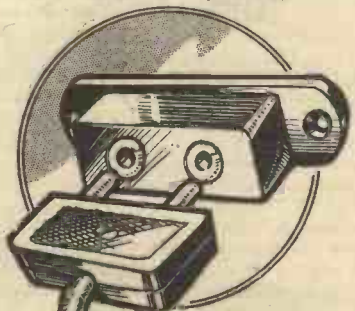
This is the British Radiogram Class B Driver transformer. It is suitable for most modern Class B valves.



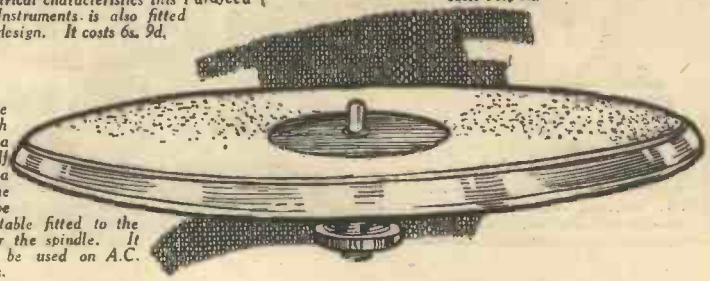
This Ormond volume control is extremely small, occupying a back of panel space only half-an-inch deep. It is of the one-hole fixing type.



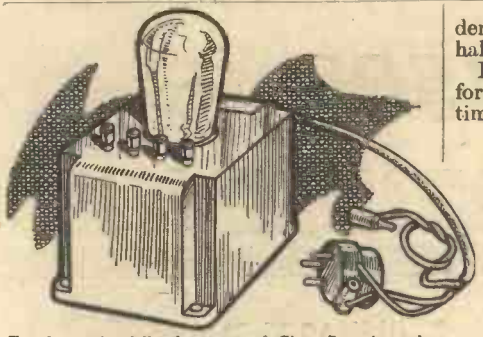
Apart from its novel electrical characteristics this Parafeed Transformer by Radio Instruments is also fitted with a case of new design. It costs 6s. 9d.



Extending the loud-speaker leads is not always a simple problem, but this ingenious extension Kit, produced by Messrs. Lamplugh makes it a simple task. A Kit for one extension consists of two switches and plugs and 50 feet of flat twin wire, and it costs 10s. 6d.



A synchronous turntable for the gramophone which is fitted by means of a one-hole fixing device. If you already possess a clock-work machine, the present motor may be removed and this turntable fitted to the present clearance hole for the spindle. It may, of course, only be used on A.C. mains.

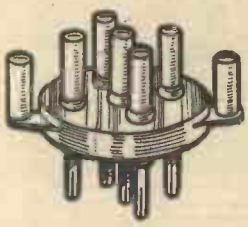


To obtain the full advantages of Class B working this neat Adaptor, made by Sound Sales, Ltd., may be plugged into the last valveholder of your present set, replacing the present valve in the top of the adaptor plug. The necessary connections and voltages are then automatically obtained and the conversion is complete.

(Continued from page 889)

plush or silk. I forecast that the grille will eventually go.

The knob twiddler must have been sadly disappointed with this year's Radio Exhibition for the introduction of unified control with its attendant simplicity of operation was a feature of the range of most manufacturers. The improved tuning system, with their full vision scales and shadow-line tuning are steps—many steps — in the right direction. The band-pass tuning unit complete with ganged iron-core coils, ganged condenser, and combined controls (on-off, reaction, volume control, radiogram, etc.), represents the very last word in simplified control, and at once gets rid of a number of bugbears.

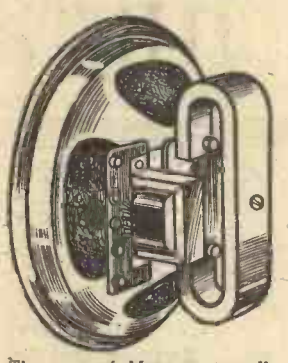


To enable the various voltages applied to the valve to easily be measured the manufacturers of Emicol measuring instruments have introduced this neat device which is included between a valve and its sockets on the receiver. It costs 1s. 11d.

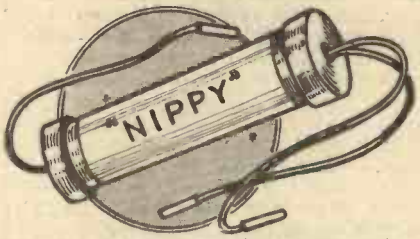
The new skeleton W.B. valveholder.

Components vied with sets in point of size, for most of the components used by the home constructor, speakers, condensers, transformers, etc., are only about half the size they were formerly.

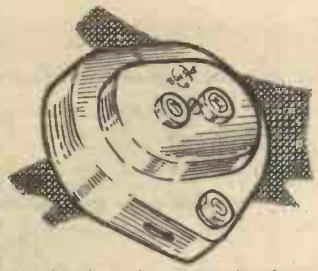
For the first time, a set specially designed for car radio was shown. Also, for the first time, was exhibited a combined receiver and television viewer. Automatic volume control has evidently come to stay for many manufacturers were fitting this as standard. Only one firm showed a permeability tuning unit, and this was suitable only for a single tuned circuit.



The name of Magnavox is well-known in association with loud-speakers, and the above model is the Senior permanent-magnet. It costs 3 guineas, and is a new addition to the comprehensive Magnavox range

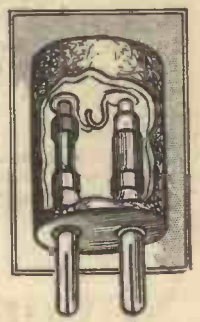


This little device is known as an "Aerial Exempter," and is claimed to prolong the life of the H.T. battery, remove noises, modulation hum and interference, and give vastly clearer reception. It costs 2s. 6d.

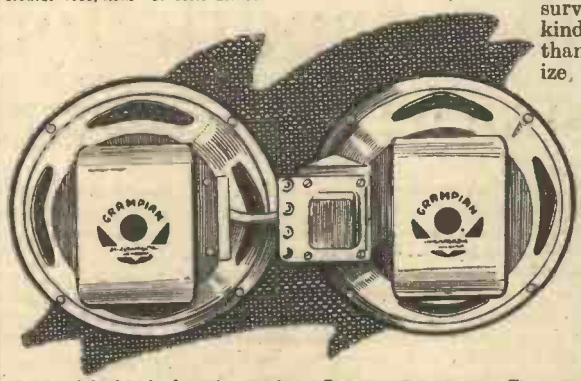


Another device for removing disturbances introduced in a receiver via the electric mains. This is a Blue Spot product. It is plugged into the mains socket, and the receiver plug inserted into the device.

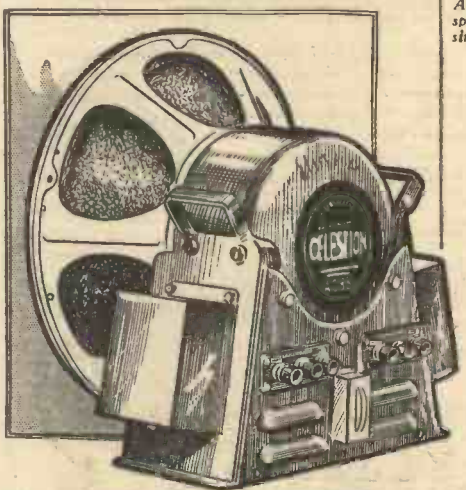
The luxury market was catered for by sets which combined mental refreshment with that of a more tangible nature, namely, receivers which house also a cocktail bar, a bookcase, etc. The comfort of the listener was borne in mind by one manufacturer who exhibited an adjustable footrest so that the listener could recline in luxurious comfort and operate his receiver by means of remote control attached to the arm of his favourite chair. No novel circuits were featured. That is to say, if we exclude as novel Class B, Q.P.-P., etc. The tendency both in sets and components is towards cheaper radio. It is impossible in a survey of this kind to do more than summarize, as I have done, the tendencies and my reaction to them. The reactions of our draughtsmen which pictorially illustrate this review will throw into relief most of the points mentioned.



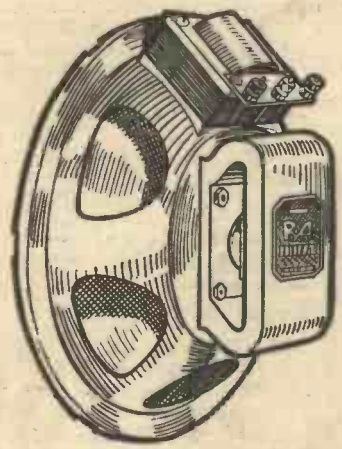
Safety First! This plug has two fuses included in the moulded body and they are instantly replaceable by unscrewing the end. This is a new Lissen product and costs 3s.



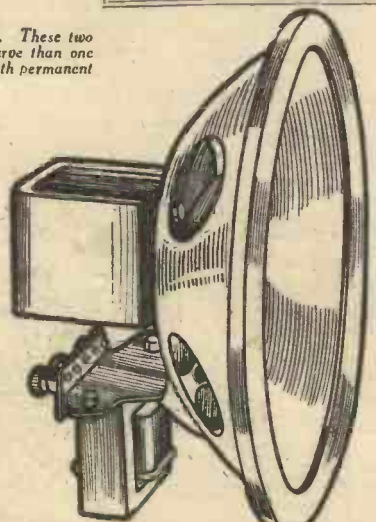
A pair of Midget loud-speakers made by Grampian Reproducers. These two speakers are balanced and give a much better reproduction curve than one single speaker, and cost very little more. They may be obtained with permanent magnets or with energized field windings.



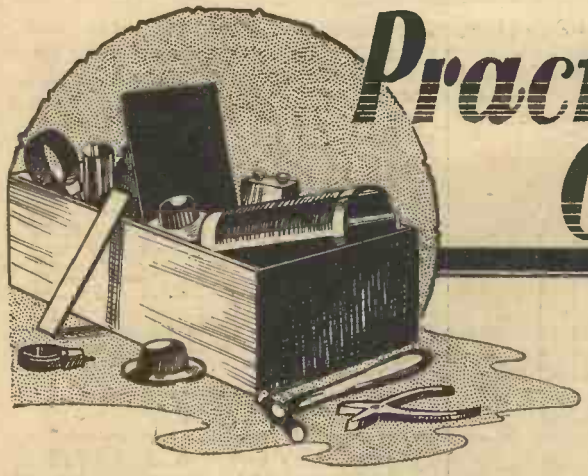
This loud-speaker is designed to handle a really hefty power input and is known as an Auditorium model. Manufactured by Celestion, it weighs round about 70 pounds and costs 15 guineas.



This is the Challenger speaker made by R. & A. We have previously drawn attention to the many good points possessed by this speaker which is in a class by itself.



Costing only 27s. 6d. this speaker by Goodmans has an energized field winding, and the input transformer will carry 50 mA.



Practical uses for Old Components

By W. B. RICHARDSON.

How They Can Be Adapted for a Number of Useful Purposes.

SOME time ago I was severely criticized by a number of readers for suggesting in one of my articles that the hoarding of old "junk" was a silly practice. I fear I went even farther. It was my remark that such hoarding was merely a sign of meanness which brought forth the greatest wrath and indignation. Of course, I admit that such a statement was rather sweeping. Naturally, we all keep a junk box, but I was thinking at the time more of the person who stores up every little piece of rubbish with the idea that one day it *may* come in useful, than of the average constructor who naturally collects a few "spare" components in the course of his hobby. Obviously, there is a happy medium in all things, and I should be the last person to suggest discarding good components because there is no immediate use for them. It is, therefore, to placate my critics and detractors that I put forward the following suggestions for the use of some of the contents of the inevitable junk box.

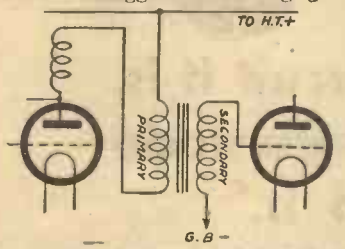


Fig. 1.—Circuit showing ordinary transformer coupling in which a burnt-out transformer would be useless.

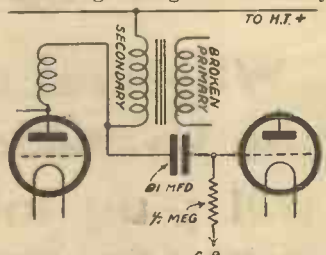


Fig. 2.—How the circuit can be altered using the faulty transformer as a choke.

You may happen to have an old transformer the primary winding of which has "burnt out." You may have discarded it when it got to the crackling stage—when it produced a good imitation of atmospherics all the time the set was in use; or it may have ceased to function altogether. Anyway, the point is that it has no further use as a transformer. However, the secondary winding is most unlikely to be damaged, and for that reason it may still be used as a *choke*.

Choke coupling in the L.F. stages is preferred by many designers to transformer coupling. It is particularly suitable where there is already one transformer stage and where further high stage gain would be neither necessary nor desirable. The connections for a choke-coupled stage using the secondary winding of an old transformer as a choke is shown in Figs. 1—3 (the secondary terminals of a transformer are usually marked "G" and "G.B.—"). It will be noticed that the only extra parts required are a fixed condenser of from about .01 mfd. to .1 mfd. capacity, and a grid-leak round about ½ or 1 megohm.

Although choke coupling is usually used where there are two L.F. stages, it does not mean to say that it is not suitable in a single stage. I have several times proved this when a transformer has suddenly ceased to function during a performance, owing to the primary winding burning out. By quickly changing over the connections, and using the offending instrument as a choke, the receiver has been going again within a few minutes, while the loss in volume was hardly perceptible.

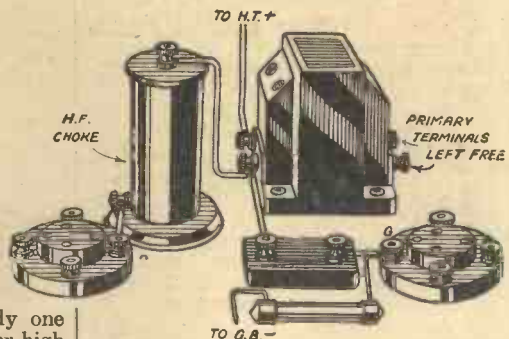


Fig. 3.—How a "burnt out" transformer can be used for coupling two valves. See also Figs. 1 and 2.

Plug-in Coils

It always seems a great pity that no use can be found for disused tuning coils. Many of these are perfectly sound and quite efficient components, but, owing to the changing trend in design, have become ousted by others of a more advanced type. I am afraid that to try to use them as anything else than coils is not usually very successful. I have certainly used a long-wave plug-in coil before now as a temporary H.F. choke, but I cannot recommend the use of *any* long-wave coil in this capacity. If you happen to have a coil of large inductance and *very* small self-capacity, it *may* work. Of course, two large coils connected in series would be better, but here the question of space arises, besides the risk of interaction with other components.

A Wave Trap

If you happen to suffer from interference from *one* source only, such as a powerful local station, then a *wave trap* is quite a useful accessory to have. It is connected between the aerial and the aerial terminal of the set, and will enable you to cut out the local station and so receive others. It cannot, however, cut out more than one station, so that if there

(Continued on page 894)

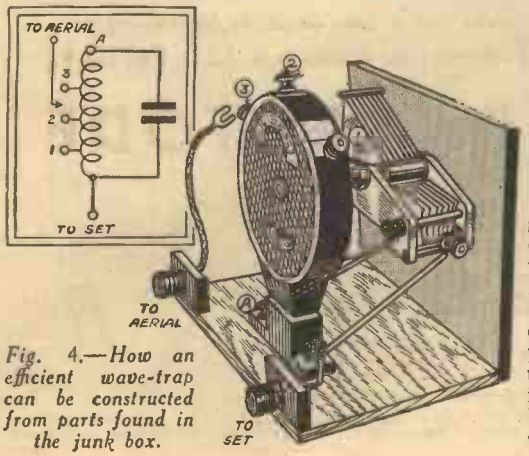


Fig. 4.—How an efficient wave-trap can be constructed from parts found in the junk box.

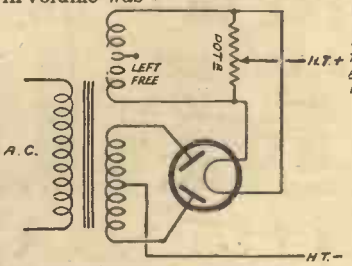
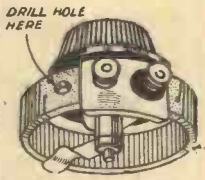


Fig. 6.—Circuit illustrating how the potentiometer may be used to stop mains hum.



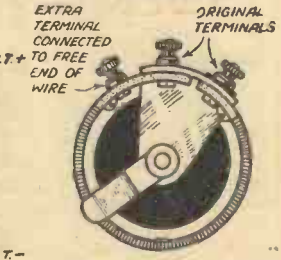


Fig. 5.—How to convert an old filament rheostat into a potentiometer.

(Continued from page 892)

is another station causing trouble besides the local it will not be able to deal with both of them. This is because of the principle on which it works. It is tuned to the station it is desired to eliminate, and cannot, of course, be tuned to two stations at once. Now a wave trap can be quite easily constructed from parts found in the junk box. The chief components needed are a tuning coil and variable condenser. The circuit is

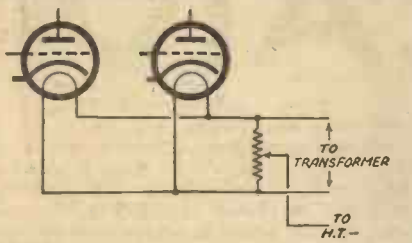


Fig. 7.—Another hum-reducing circuit using a potentiometer made from an old rheostat

shown in Fig. 4. This is what is known as a "rejector" type of trap. As you see, it consists essentially of a tuned circuit. If this is connected in series with the aerial and tuned to the wavelength of the unwanted station, then signals from that station will be unable to reach your set.

The construction of such a wave trap, using plug-in coils, is illustrated in Fig. 4. It is best to use tapped coils, then a greater range of control is possible. For instance, with the aerial connected to the end A of the coil (Fig. 4) the trap is most effective, although it alters the tuning positions of the set somewhat. When joined to the other end, that is, to No. 1 tapping, the cutting-out station is least powerful, but there is very little disturbance of the usual tuning positions.

A Stand-by Receiver

Another use which may be found for old coils, etc., is in the construction of a small stand-by receiver. Such a receiver will be very little trouble to make, and should be kept handy for use in an emergency. How three plug-in coils may be arranged to provide medium and long-wave reception without coil-changing is shown in Fig. 9. A medium-wave and a long-wave coil are mounted on the baseboard and another coil placed between them for reaction purposes. As there is only one reaction coil it will naturally be a compromise as regards size. It should be rather larger than is normally needed for the medium waves, but placed nearer to the long-wave coil than to the medium-wave one. In this way it will be effective on both wavebands. A simple on-off switch is all that is needed for wave-changing.

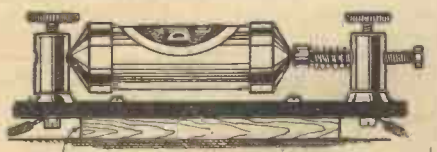


Fig. 11.—A resistance holder made from parts found in the junk box.

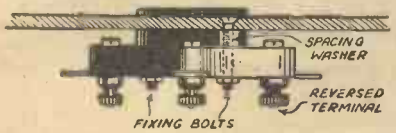


Fig. 12.—How to convert an ordinary valve-holder into the chassis mounting type.

Valves which are no longer used because they have lost some of their original emission, and those which have been replaced by later types, provide yet another example of those many parts which it seems sacrilege to place on the scrap heap. I have seen many suggestions for using the bases of old valves as plugs for plugging in amplifiers, short-wave adaptors, etc., but I doubt if the conversion is worth the trouble, since such parts can be bought so cheaply. No, I think the best use for old valves is for testing purposes. Whenever I construct a new receiver I always plug-in old valves when I first switch on. Should there then be any fault which has escaped my checking, I do not run the risk of damaging my new valves.

Of course, one or two spare valves, even if they are past their prime, should always be kept handy in case of emergencies, for although modern valves do not usually cease to function without warning it is best to be prepared. An old valve is better than no valve!

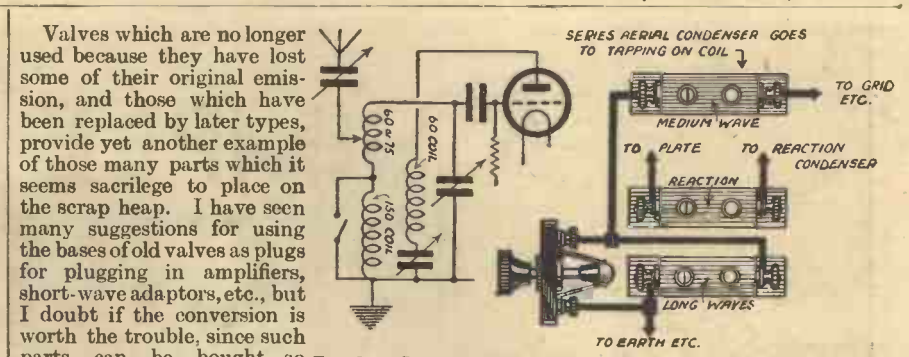


Fig. 9.—Circuit layout showing method of wave-changing with old plug-in coils without coil changing.

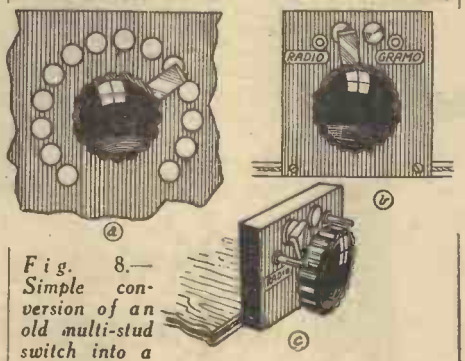


Fig. 8.—Simple conversion of an old multi-stud switch into a radio-to-gram. switch.

Old Type Filament Rheostats

One of the chief features of sets of a few years ago was the array of variable filament resistances on the front panel. There was usually one rheostat for each valve. Many of these have since found a resting place in the bottom of the junk box. However, some of the higher resistance ones, say about 30 ohms, need not necessarily continue to lie there. It is usually a simple matter to provide a third connection, and so convert them into potentiometers. How this was done with one well-known type is shown in Fig. 5. A hole was drilled through the fibre support and a terminal fitted and joined to the free end of the resistance wire. Now, a 30-ohm potentiometer has quite a number of uses, especially if you have a mains set and are troubled with mains hum.

Sometimes mains hum is due to the centre tapping on the mains transformer winding, which supplies the rectifier valve filament with current, being electrically slightly out of balance. In this case a 30-ohm potentiometer should be placed across the ends of the winding, and instead of taking the H.T.— lead from the centre tap it is taken from the slider of a potentiometer as in Fig. 6. The slider is moved until the exact electrical centre is obtained as denoted by the disappearance of the hum. If the arm of the potentiometer is bent so that it works rather stiffly it will then "stay put" once the correct position is found. In a similar manner a potentiometer may often with advantage be connected across the heater winding to the other valves in the set. It is best to place it across the leads nearest the valves as in Fig. 7, and not across the transformer terminals themselves. (The same remark applies in the case of the rectifier valve just referred to.) The centre tap of the heater winding is left free and the wire joined as in the other case to the slider of the potentiometer. The value of both these potentiometers is not critical. The only thing is that their resistance must not be so low as to cause an appreciable drop in the voltage to the heaters or filament. As already stated those made from 30-ohm rheostats are quite suitable. A 5-ohm rheostat would be too low.

Converting Old Switches

The type of switch which is used probably less than any other nowadays is the multi-contact type which figured so largely in the days of elaborately tapped tuning coils. The arm of the switch was mounted direct on the panel of the set and was surrounded by an array of studs as in Fig. 8. Such an arrangement on the front of a set would be considered very unsightly nowadays. However it is quite possible to use one of the smaller types as a radio-gram switch. Two studs only are used, so that the appearance is nothing like so fearsome as with a dozen or more. The arm is moved one way for radio reception and the other way for the gramophone. Such a switch may easily be mounted on a small strip of ebonite at the back of the set and will save the cost of a modern rotary switch. The studs should be mounted fairly close together as in Fig. 8 so that the arm does not drop between them as it moves from one to the other. The action will then be quite smooth. Stops to prevent the arms swinging beyond the studs should not be forgotten. The pins sold for making home-made six-pin coils are suitable for this purpose.

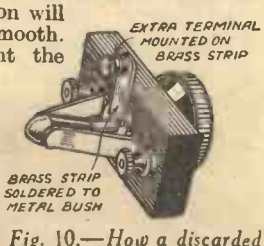
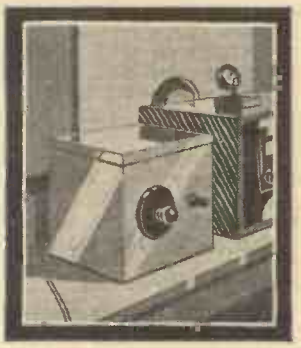


Fig. 10.—How a discarded filament switch may be converted into a 3-point wave-change switch.

Ordinary push-pull filament switches which may have been discarded through the conversion of a battery set to all-mains can be used as three-point wave-change switches by a very simple modification. A small strip of brass with a terminal

(Continued on page 919)



A SIMPLE OSCILLATOR

A Useful Unit Intended to Help the Amateur to Adjust His Set. By "TEST ENGINEER."

MANY readers who have constructed receivers described from time to time in this journal, must have wondered whether they are getting the best results possible, after adjusting them while listening to broadcast stations. There are many difficulties attendant on the procedure often advocated, of tuning in a weak foreign station on the medium wave-band, and then adjusting trimming condensers, H.T. voltages, and grid-bias until loudest signals are obtained, then repeating the process on long waves; not the least being the tendency for the transmission to fade at the critical moment and upset all one's calculations.

Having had some experience of these annoying phenomena, the writer is of the opinion that the simple oscillator described will prove of exceptional value to the reader who wishes to get the best results from his set. Far from being expensive, the whole apparatus can be rigged up from parts which are usually to be found in every junk-box, and no difficult should be encountered in procuring satisfactory results if the instructions are followed carefully.

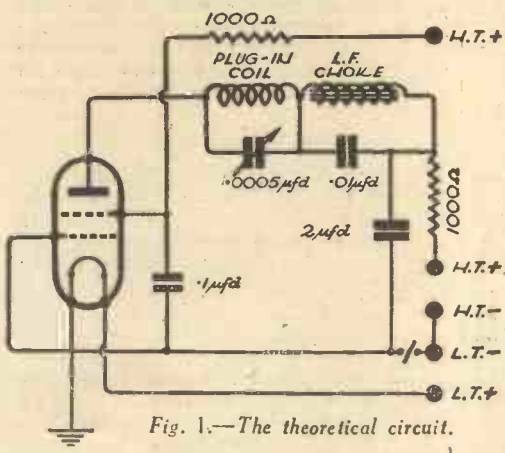


Fig. 1.—The theoretical circuit.

Principle of Operation

For its operation, the oscillator depends upon the so called dynatron principle, which is merely that a screen-grid valve, suitably fed with anode and screen voltages, will oscillate without the need for coupled circuits, and moreover can be made to provide its own modulating note.

Fig. 1, shows the theoretical circuit, and it will at once be noticed that, contrary to usual practice, the H.T. voltage on the screen of the S.G. valve is higher than that applied to the plate, and because it is this fact which is responsible for the whole functioning of the oscillator, it is the one adjustment which must be made carefully when the apparatus has been assembled.

The first steps in the assembly consist in mounting the components shown on the panel and baseboard, and the writer would emphasize that almost any make of variable condenser which has no vanes touching will serve to tune the coil, though if a metal panel is used, or the unit is enclosed complete in a screening box (which is strongly advocated), the spindle which is connected to the moving vanes must be insulated from the panel as it is at H.T. potential. The L.F. choke should possess a low inductive valve and must not be enclosed in a case of any sort, but mounted in clamps. Should the constructor possess an old L.F. transformer with the primary intact, this may be used as the choke, the secondary winding being left disconnected.

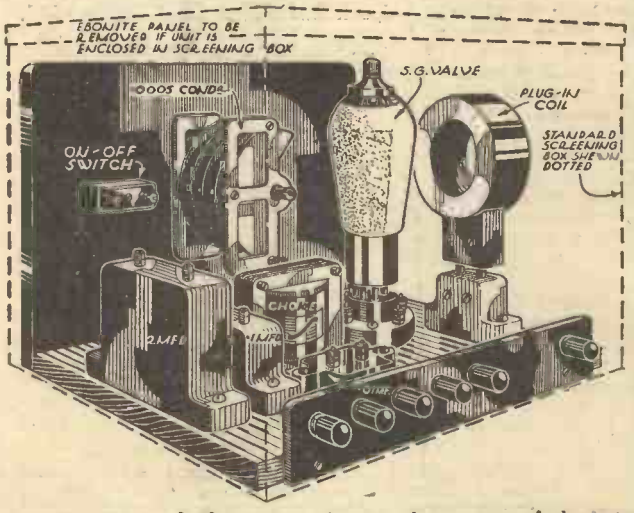


Fig. 2.—The unit ready for wiring, showing the position of the main components. Any type or make of the latter may be used, and the spacing of same is not at all critical. If screening box is used the .0005 variable condenser must be fitted with an insulating bush.

Adjusting and Testing

When the components have been mounted and wired as shown in Figs. 2 and 3, it only remains to connect H.T. and L.T. batteries to their appropriate terminals, and we are ready to begin adjusting our oscillator. First plug a 35-turn coil into the coil-holder, and place the plug attached to H.T.+1 into the 60-volt pocket of your H.T. battery. The plug attached to H.T.+2 should be placed in the socket giving the highest H.T. available (120 volts being convenient). The oscillator should then be stood near the aerial connection of the receiver to be tested and, with the set switch on and tuned to roughly 250 metres, the tuning dial of your oscillator should be slowly rotated from zero to maximum. Now if our S.G. valve is oscillating, a rushing noise will be heard in the loud-speaker at one point in our oscillator condenser travel. Should this not be heard, increase H.T.+1 to 66 volts (or the next tapping), and rotate the oscillator condenser again. This process must be repeated until the rushing noise is heard, when the oscillator condenser should be left tuned to the point where the noise is heard.

It is possible that the rushing noise will be accompanied by a musical note like the B.B.C. tuning note, but it is unlikely that we shall be lucky enough to make an oscillator function at both high and low frequencies at the first attempt. If, however, such should be the case, do not interfere further with the adjustments, but use the oscillator as described later.

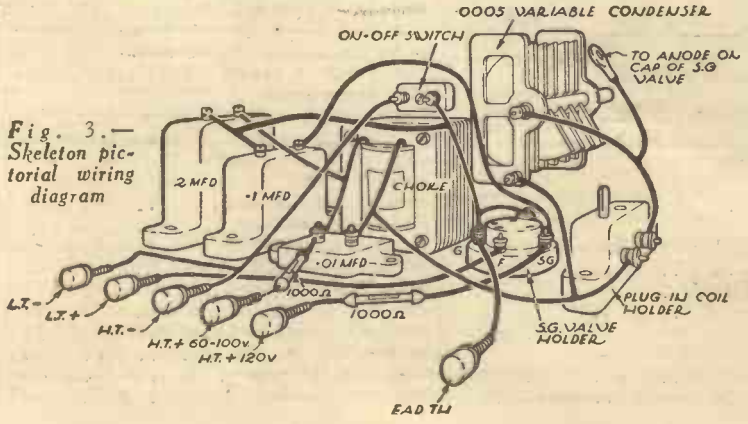


Fig. 3.—Skeleton pictorial wiring diagram

Obtaining the Tuning Note

To obtain the musical note it is necessary to adjust the inductance of the L.F. choke

and the easiest method is to remove some of the laminations from its core. For this purpose, and without altering the tuning of the oscillator in any way, disconnect the H.T. from the unit, take out the choke, unclamp the core and remove, say, ten pairs of laminations. Then reclamp the remaining laminations, reconnect in the circuit and try again. It may be necessary to remove nearly all the laminations in this way before a musical note is heard in the receiver, but trial and error is the only method which will ensure success in this instance. It is interesting to note that the pitch of the note heard may be raised or lowered by removing or adding one or more laminations at a time (Fig. 4) until a note pleasing to the ear is obtained.

Having now made our oscillator function at 250 metres, remove it some distance from the receiver under test, *i.e.*, until the note in the loud-speaker is barely audible, and then readjust the trimmers of the gang condensers in the receiver until the note is heard at its loudest. We can now be reasonably certain that our receiver is correctly adjusted. Then tune the receiver to roughly 500 metres, rotate the oscillator condenser until the musical note is again heard in the loud-speaker and make sure,

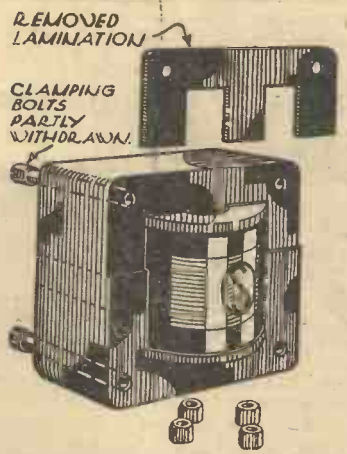


Fig. 4.—The easiest method of adjusting the inductance of the choke is by removing some of the core laminations.

by carefully moving the gang condenser trimmers, that the receiver is still correctly aligned.

Further Adjustments

Now by removing the 35-turn coil from the oscillator and inserting a 120-turn coil in the holder, we can check up the performance of our receiver on long waves, the procedure being exactly similar except that we must switch our receiver to long waves and check at, say, 1,200 and 1,900 metres. It will be found comparatively easy to adjust any receiver with the aid of the steady note given by the modulated oscillator, and the ear is quite sensitive to the changes of intensity of a single note while adjustments to the receiver are being made.

More accurate adjustments can be made to the receiver when there is a visual indication of relative signal strengths. In addition to its use as indicated above, the oscillator can easily be calibrated quite accurately as a wave-meter, it being only necessary to tune in powerful broadcasting stations of known wavelength on the receiver, and then to rotate the oscillator condenser until the note is heard superimposed upon the broadcast transmission, and a record made of the oscillator dial reading. Many other uses will be found for this handy instrument, and the constructor will find it well worth while to make up such a versatile and interesting piece of apparatus.

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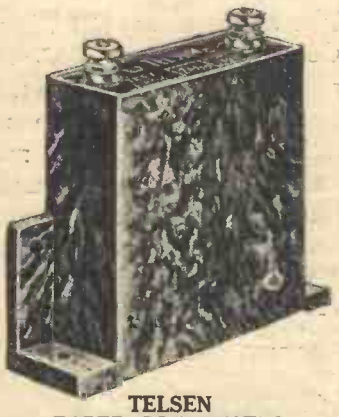
'0002 ,,	1/-	'005 ,,	1/-
'0003 ,,	1/-	'006 ,,	1/-
'0005 ,,	1/-	'01 ,,	1/3
'001 ,,	1/-	'1 ,,	1/6



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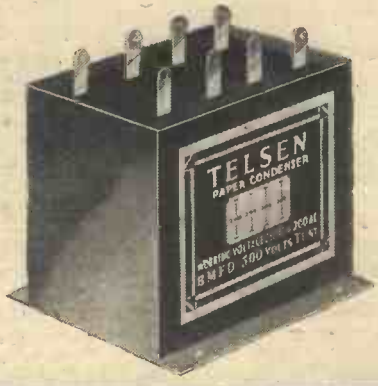

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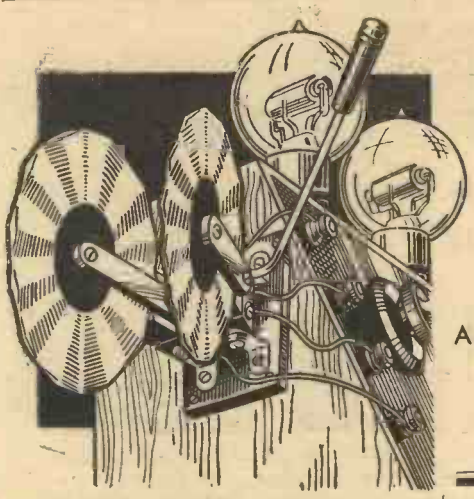


The History of Reaction

And How it is Employed in Several Well-known Circuits

By LAMBDA

IT was about twenty years ago that the principle of reaction was first disclosed, but it was not, however, until the advent of broadcasting after the war that this principle was put to any very extensive use. The demand then arose for cheap and efficient receiving sets, and at the prices then ruling the application of reaction to two and three-valve receivers was a tremendous advantage. In the early days receivers were expensive, small battery receivers costing as much as twenty pounds, and by incorporating reaction a saving of practically one valve was effected. Without reaction the cost of a receiver would have been prohibitive, so that few of us could have afforded to indulge in what would have been a very expensive luxury. Reaction properly handled can be of great benefit, and with care quality does not suffer to any appreciable extent.

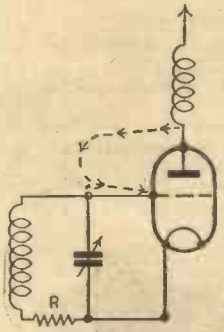


Fig. 1.—Showing principle of reaction.

To the constructor it has been of considerable utility. Although the cost of receivers and components has been enormously reduced, even now we cannot all afford the more pretentious sets incorporating two or more high-frequency stages, or superhets. Even in the two H.F. set, reaction is often incorporated. It is particularly useful in boosting up signals, especially for constructors who live in parts of the country which are rather remote from the local station, or who wish to receive that rather distant foreigner. A three-valve circuit embodying reaction, in the hands of a skilled constructor, has been known to perform prodigious feats, and the number of stations logged by constructors of even some of the more simple receivers described in this journal have been amazing.

During recent years reaction has been somewhat neglected, possibly due to the reduction in the price of components. Many of the early constructors have indulged in more ambitious receivers. Most of us are like the car owner: we start with the modest baby car, but are not satisfied; we want to launch out; want more power; so that eventually the car enthusiast graduates into the six-cylinder type. Likewise the constructor: he wants greater power, greater command over the ether; and why shouldn't he?

However, there now seems to be a tendency for research engineers to direct their attention to regenerative receivers, and it is possible that we may hear of great improvements in this type of circuit in the near future.

In spite of the great benefits derived from the application of reaction in receiving circuits, there has been from time to time an outcry against its use. Unfortunately, over enthusiastic persons have misapplied this instrument, and in forcing their reaction control to the point of oscillation have caused considerable annoyance to their neighbours. The majority of constructors, however, know better, and this interference has been minimized to a very considerable extent.

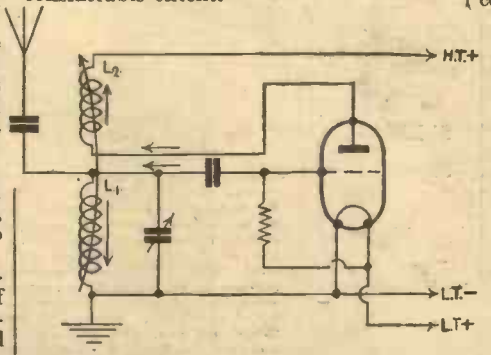


Fig. 2.—Circuit with swinging coil reaction.

What does reaction do to produce such wonderful amplification as is obtained in some receivers? Is it affected by circuit conditions? What are the limits of regenerative amplification? We all know that reaction is only possible in a power amplifier. A crystal detector cannot be made to produce reaction effects, as it is not a power amplifier: the wireless valve is essentially a power amplifier. Regeneration consists in taking a small portion of the output power from a valve and sending it back to the input side of the amplifier. The amplified H.F. currents flowing in the anode circuit are fed back to the grid circuit to be further amplified.

Now the potential available for application to the grid-filament of the valve is inversely proportional to the resistance of the tuned circuit. When the aerial is coupled to the tuned circuit it is rather difficult to keep this resistance very low. By employing reaction, however, it is possible to compensate for the resistance of the tuned circuit. The principle can be shown in Fig. 1. Some of the energy flowing in the anode circuit is fed back into the grid circuit, so compensating for some of the energy lost in the resistance R of the circuit. Actually, this is tantamount to reducing the resistance R, and therefore increasing the potential which is applied to the grid of the valve. Let us proceed and examine this principle a step further.

In Fig. 2 is shown a simple tuned circuit, with swinging-coil reaction (which will be discussed later). Assume a current is oscillating in the aerial circuit at the frequency of the transmitting station, and a corresponding voltage is impressed on the grid of the valve. A rectified H.F. current is therefore produced in the plate circuit of the valve which flows through the reaction coil L2. As far as we are concerned in this discussion, we are not interested in the modulated H.F. currents which cause speech and music to be heard in the loudspeaker. By coupling the coil L2 to the grid coil L1, an E.M.F. is induced across the latter coil, adding to the current in this coil. We are assuming, of course, that coil L2 is connected in the correct manner. If connections were reversed, the result would be a decrease in signal strength.

In Fig. 2 the direction of the arrows indicate the conditions which are essential for producing regeneration. The currents flow outward from the grid and plate respectively, and pass through the coils in opposite directions. Therefore, the reaction coil should be wound in an opposite direction. The same effect can, however, be produced by reversing the connections to the reaction winding if it is wound in the same direction as the grid coil. By increasing the feed back of energy there should be a definite increase of signal strength. If we go on increasing the coupling of the reaction coil, the decrease in resistance of the grid coil is further reduced until it theoretically reaches zero. Eventually, the valve will oscillate, and these oscillations will manifest themselves by a howl in the loud-speaker.

(To be concluded next week.)

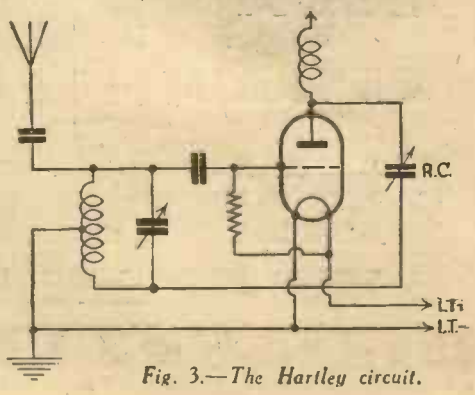
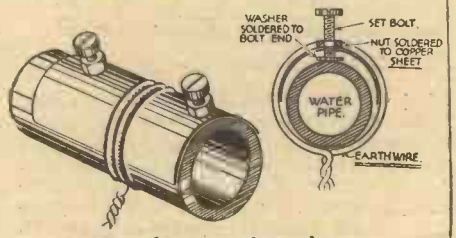


Fig. 3.—The Hartley circuit.

READERS' WRINKLES
The HALF-GUINEA Page

An Earthing Clamp

A VERY effective earthing device may be constructed from a piece of copper sheet $\frac{1}{16}$in. thick and 1$\frac{1}{2}$in. square, two 4BA nuts, bolts and washers. The copper sheet is bent around the water-pipe to which



An efficient earthing clamp.

the earth-wire is to be attached, and $\frac{3}{4}$in. from the extreme curved edges and along the centre line are drilled two 4BA clearance holes. The two 4BA nuts are firmly soldered to the outside surface of the sheet, above the holes, the bolts being threaded down through the nuts, and, to prevent penetration of the pipe when the device is in position, the washers are soldered to the ends of the bolts. The device is placed on the pipe and the earth wire wound around the extreme outside and between the two bolts. By screwing the bolts on to the pipe a varying degree of tension on the earth wire may be made thus ensuring good electrical contact.—G. McGAHAN (Sunderland).

Switching Arrangement for All-mains Working

THE conversion of a battery set to all-mains operation can be done by a method of simple switching, which I have evolved to meet the circumstances of my own case. I have a D.C. eliminator, but found that my accumulators were not being properly charged by the so-called charging stations. Having a six-point switch, I decided to use it to help solve my problem. I now have no trouble and may say that my set is now "all-mains," using 2-volt battery valves. The switch is of the six point type, though any similar switch will do. The lighting point, or load lamp, can be extended to a table lamp, for use on any small table near the set. When the switch is in top position set is on; central, all off; and when in the bottom position, the accumulator is on trickle charge.

This arrangement, as shown in Fig. 1, completely isolates the accumulator from set so that the H.T. fuse in the set is unaffected, and is still serving the purpose of protecting the valves. The circuit can be adapted to A.C. working, as shown in Fig. 2.

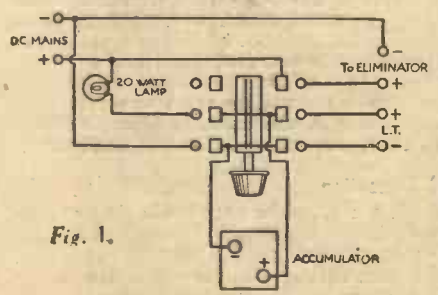


Fig. 1.

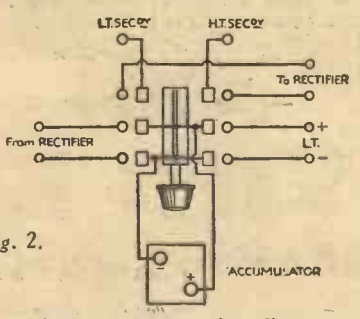


Fig. 2.

A switching arrangement for all-mains working.

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.

Increasing Volume and Sensitivity

THE following description of a gadget may interest readers who use portable or transportable receivers and find that reception grows worse during the summer months, and also when their H.T. voltage begins to drop. It consists of a home-made coil of 40 to 50 turns, tuned by an old .0005 tuning condenser, connected in parallel and joined to any form of aerial and earth, as indicated diagrammatically in Fig. 3. The coil and condenser are in my case mounted in a small box which carries terminals for aerial and earth leads. The box is placed close to the frame aerial of the receiver, as in Fig. 4, which is tuned in to a station normally. The gadget is then roughly brought into tune by rotating the knob of the .0005 condenser. A great increase in volume and sensitivity is obtained, whilst the receiver loses a little of its directional property; this, however, is easily overcome by varying the distance between the device and the receiver, or turning the whole device so that the frame aerial of the receiver and the coil in the device are varied from parallel to right angles to each other. Operation is simplicity itself and the sketch is self-explanatory. By tuning it to the unwanted station the gadget can be made to act as an absorption wave trap. Of course, the medium waves only are covered.—R. STROUD (Wendover).

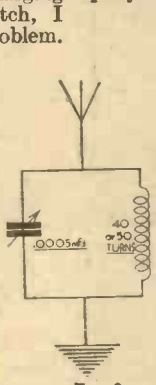


Fig. 3

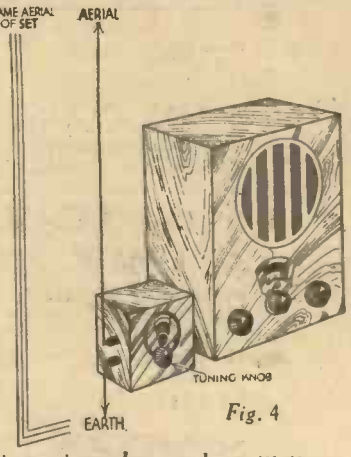


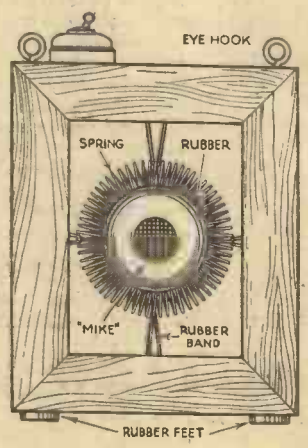
Fig. 4

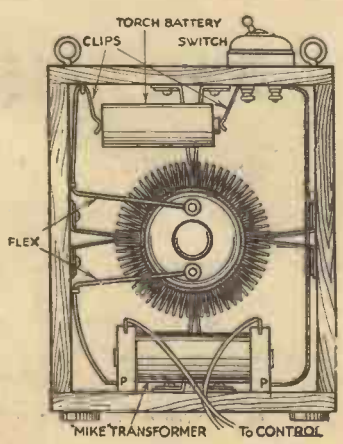
A device for increasing volume and sensitivity.

A Useful Microphone Unit

AN old telephone, or W.D. microphone, can be built up into a useful portable unit, in the manner indicated in the accompanying sketches. The case in this instance is made from an old fuseboard cover with the glass removed, but anything light and strong will serve. The "mike" is surrounded with a wide rubber band, thick enough to "insulate" it (mechanically) from the large spiral spring. This spring is cut to such a length that, when wound round the microphone, it holds it tightly

(Continued overleaf)





Front and rear views of a simple microphone unit.

RADIO WRINKLES

(Continued from previous page)

enough to prevent a normal jar from displacing it. Next, four stiff rubber bands are passed through the spring at appropriate points, and secured to the case sides by means of small tacks or screws. Place large washers over these screws if the rubber shows signs of tearing away.

The microphone transformer is now screwed into the base of the case at the back, taking care that it does not touch any part of the suspension. An old resistance or crystal detector-clip is now fastened at the top left-hand corner of the case, and another in such a position that an ordinary small torch battery will clip tightly between them.

If the switch is of the type with long-fixing bolts, it can be mounted directly over this clip, and one of its bolts used as both connection and fixing for the clip, as shown; otherwise it will have to be wired separately. The wiring and connections will be seen from the diagrams. Small rubber feet and eye hooks complete the job and make the "mike" readily adaptable. The control-panel (potentiometer, etc.), could, if desired, be mounted as a back for the unit, but usually it is more convenient to have it separate.—L. SHEPHERD (Bradford).

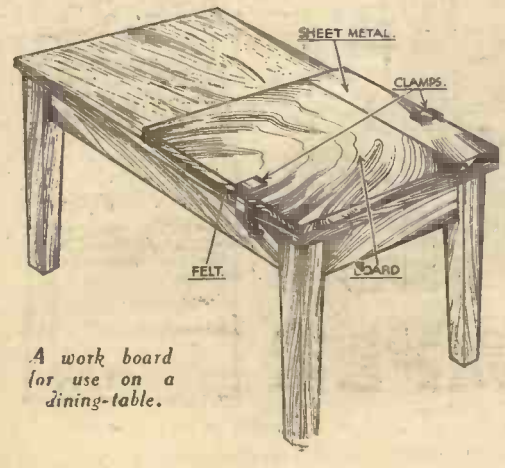
Work Board for Dining-Table

MOST radio enthusiasts are, like myself, compelled to do all their set constructing, soldering, etc., on the dining-table, owing to lack of space for the accommodation of a proper work bench. An ordinary dining-table is quite satisfactory to work on, but great care has to be taken to avoid burning the table top with the soldering iron, and the flux tin has a nasty trick of falling face downwards on to the table! Even the most careful constructor cannot help scratching the surface, owing to the fact that the set is always being turned round when wiring up.

In order to prevent this, I used a thick deal board as long as the width of the table (in my case 3ft. and about 2ft. wide, which I planed and sandpapered. I also obtained a piece of felt the same size, which I fastened with strong glue to one side of the board. A piece of thin sheet metal, about 6ins. wide, is screwed to one end of the other side of the board, upon which a hot soldering iron can be rested without fear of burning.

The idea is that when you have any constructing or soldering to do the board is fastened felt side downwards on one end of the dining-table by means of small clamps, as used for fretwork, and there is then no fear of spoiling the polished table-top when doing soldering, drilling, or other work.

The board can, of course, be of different dimensions to those mentioned. If thought necessary, it could be made large enough to cover the whole of the table, but a smaller board usually provides sufficient space for working on, and is quite easily stored in a cupboard when not in use.—C. C. ALGAR (Forest Gate).



A work board for use on a dining-table.

A Pick-up Adaptor

AN old valve base makes an excellent plug for connecting a pick-up to a set and at the same time breaking the filament connection to the H.F. valve or valves. Fig. 5 gives a circuit diagram of the switching arrangement and connections of a Clix 4-pin chassis mounting valve-holder which is fitted at the back of the set over the terminal strip.

About ¼in. of one of the filament legs of this valve-holder is cut off as in Fig. 6, and a small brass strip, bent as shown, is fitted to the uncut leg, so that it bears firmly against the cut leg and makes a good electrical contact. The grid of the valve-holder is connected to the grid of the detector valve in the set, and the anode to G.B.—1½ volts. A connection is made with the cut leg of the valve-holder and L.T.+ on H.F. valves, and the uncut leg is joined to L.T.+ on the detector valve. On the valve base a portion of the identical banana pin is also cut off and a piece of thin ebonite or other insulating material fitted firmly, as in Fig. 7, so that when the plug is inserted in the valve-holder the insulating material will push up the brass strip and break the L.T.+ connection to the H.F. valve. The grid and anode terminals on the valve-base are connected permanently to the pick-up. From the foregoing it will be obvious that to play records it is only necessary to insert the plug in the valve-holder. On withdrawing it the set functions in the ordinary way.—J. GALLAGHER (Belfast).

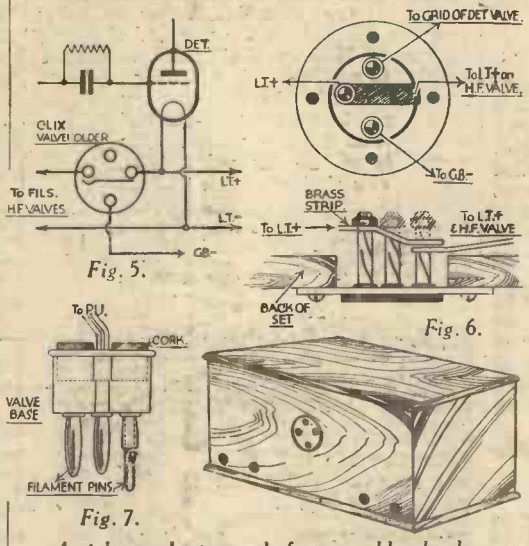


Fig. 5. *Fig. 6.* *Fig. 7.*

A pick-up adaptor made from an old valve base.

A Useful Shorting Switch

WITH a large number of sets employing a triple range coil, tuning with a .0005 mfd. variable condenser on the short-wave section of the coil is often a very delicate and troublesome business. This can be remedied to a great extent by the inclusion of a .0005 mfd. fixed condenser in series with the variable condenser, thus, halving the capacity to .00025 mfd. Of course, this condenser must be shorted when reverting to the medium and long waves or the tuning ranges would be restricted. The following arrangement will be found very convenient for this purpose, and as can be seen from Fig. 8, is quite simple. The parts required are: an ivorine disc (an old terminal indicator), about 2ins. of bare No. 18 gauge wire, and of course a .0005 mfd. fixed condenser. First, make a small loop at one end of the wire just sufficient to clear the terminal shank of the fixed condenser, and at the other end make a larger loop so that the terminal shank does *not* touch the loop. (See Fig. 9.) Then disconnect the wire that goes from the grid condenser to the variable condenser and take it to one side of the .0005 mfd. fixed condenser. On the same terminal place the ivorine disc. From the other terminal of the fixed condenser take a wire to the fixed vanes of the variable condenser and place the smaller loop on, and tighten. Put the large loop over the other terminal shank so that it rests on the disc but does not touch the shank. On replacing the terminal head and screwing down, the condenser is shorted and is then suitable for the medium and long waves. On unscrewing it, the capacity becomes .00025 for short-wave use.—J. IRWIN (Blackburn).

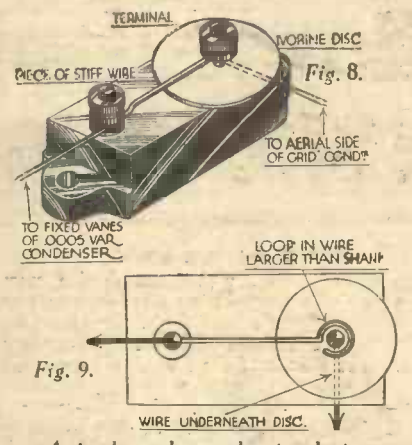
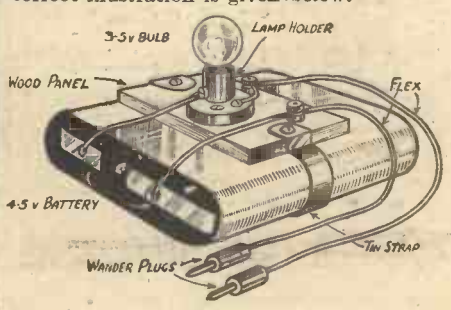


Fig. 8. *Fig. 9.*

A simple condenser shorting device.

A Correction

ON our Wrinkles page in the August 19th issue, under the heading A Handy Tester, we published a wrinkle by J. G. Simpson, of Durham, for which the wrong illustration was inadvertently used. The correct illustration is given below.



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SHORT

MEDIUM

LONG WAVES

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World "Skyscraper" 4 tunes from 12 to 2100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra Short and Short-Wave transmissions from the ends of the earth. And remember you get these stations through Double-Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker — as much power as a Mains Set from ordinary high-tension batteries.

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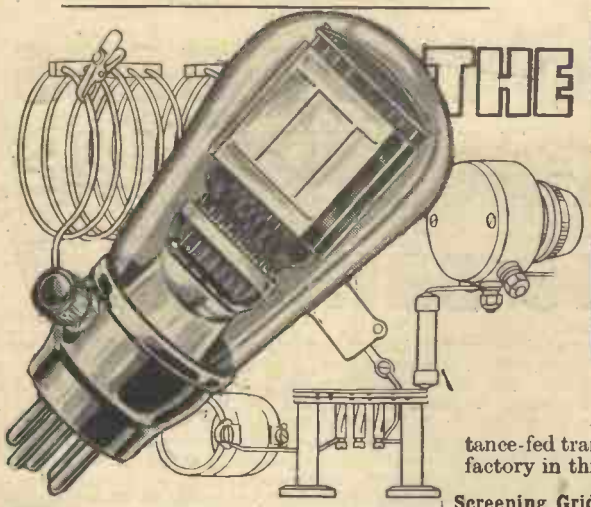
OUR SHORT-WAVE SECTION



THE PENTODE SHORT-WAVE DETECTOR

By K. E. BRIAN JAY.

THE introduction of the new high-frequency pentodes has done much to remove the idea that the pentode is solely an L.F. output valve, and it is almost certain that in a very short time H.F. pentodes will have ousted screen-grid valves from receivers altogether, as they have done already in the U.S.A., for there is practically nothing that a screen-grid valve can do that a properly designed pentode cannot do as well or better. This applies as much to detectors in short-wave receivers as to anything else, and these notes are intended to help experimentally-inclined readers to try out the pentode in the detector socket of their short-wave sets. At present there are no battery-operated, high-frequency pentodes available, although no doubt they will appear soon, but excellent results were obtained with the ordinary low-frequency power type. The chief advantage of the pentode over the screen-grid valve is that owing to its lower internal resistance it does not need such a high impedance load for maximum voltage output; also, the removal of the negative resistance kink in the characteristic curve, by the introduction of the third grid, makes larger voltage swings possible, and the potential of the screening grid of the pentode is not as critical as in the tetrode. The circuit arrangement found most satisfactory is shown in the accompanying illustration, and is practically identical with that used with a tetrode detector; throttle control of reaction is indicated, although the more usual modified Reinartz arrangement can be used; in either case the capacity of C2 can be about .0002 mfd. Screening-grid voltage is supplied by a potentiometer of 50,000 ohms resistance, in series with another 50,000 ohm fixed resistance, the variable contact on the potentiometer being by-passed by a fixed condenser C3, whose capacity may be between .01 and 1 mfd.; C3 should be a mica component for preference, although a non-inductive paper condenser would probably be satisfactory. The detector plate circuit is decoupled by the resistance R6 and condenser C5, whose respective values are 10,000 ohms and 2 mfd. Coupling to the L.F. valve is by an auto-transformer, resistance fed by the 50,000 ohm resistance R5. Choke feed can be tried and may be successful with some valves, but the writer found that it is very conducive to threshold howl. With either feed system, or, if simple resistance or choke coupling is used, the coupling condenser C4 can be about .01 mfd. or more. One of the complete coupling units containing a resistance-fed transformer would be very satisfactory in this position.

Screening Grid Voltage

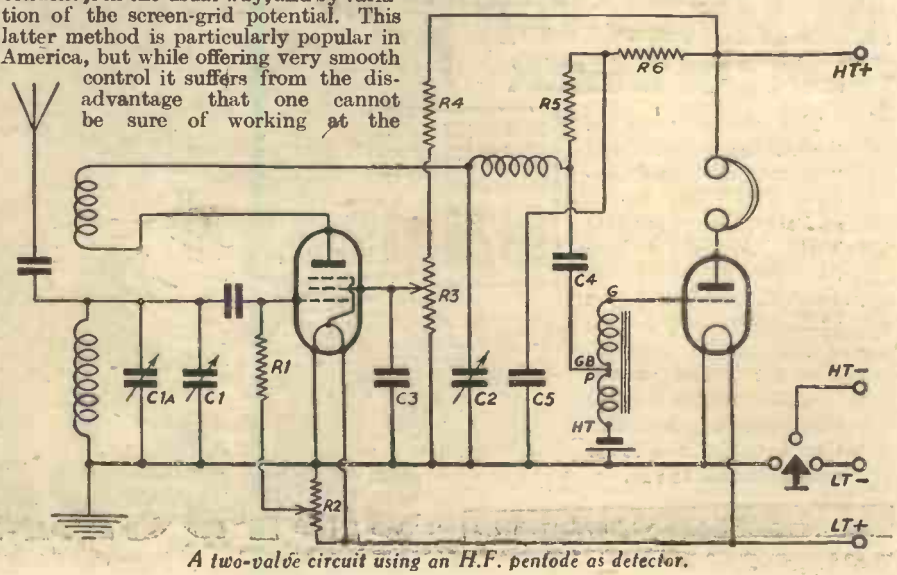
Although the pentode does not seem to be quite as fussy about its screening-grid voltage as the tetrode, none the less it is desirable to have a means of close adjustment of this potential, hence the provision of R3; it will be found that the voltage should be quite small, about 30 to 40 volts with 135 volts H.T., as otherwise reaction will be very harsh indeed and the tendency to threshold howl accentuated; also, keeping the screen volts low will reduce the plate current taken by the valve and hence prolong the life of the H.T. battery. Too low a screen voltage is undesirable, however, both with screen-grid valves and pentodes, because the amplification may be considerably reduced and it is worth while varying the size of the reaction coil until a combination is obtained, which gives the smoothest control with maximum screen volts. If, in making the initial adjustment, the screen voltage is too high the set will sound dead, as though it was not oscillating, whereas, actually, it is oscillating much too strongly, as can be verified by putting a moistened finger on the aerial terminal and noting the sharp double click on touching it and again on letting it go.

Reaction Control

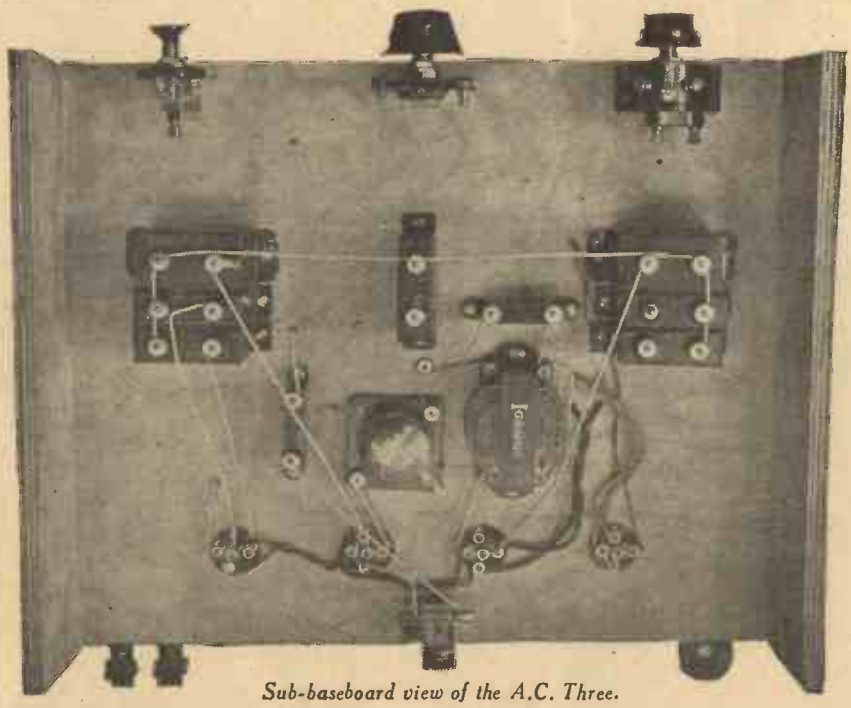
Two methods of reaction control are available with the circuit given, *viz.*, by variation of the capacity of the reaction condenser in the usual way, and by variation of the screen-grid potential. This latter method is particularly popular in America, but while offering very smooth control it suffers from the disadvantage that one cannot be sure of working at the optimum screen-grid potential, since the setting of R3 to give maximum signal strength will not necessarily coincide with that for no oscillation. A third control of reaction is possible by making the decoupling resistance R6 a 50,000 ohm variable component; from the point of smoothness and absence of detuning effect this is probably the best method, but it was found difficult to obtain controllable reaction over a wide range of wavelengths with a single reaction coil. It could be used with advantage as an auxiliary source of control to C2 over fairly small bands of wavelengths.

Any ordinary short-wave coil unit can be used, the value of C1 depending on the recommendation of the manufacturers. In the interests of easy tuning it should be as small as possible, of course, and, as usual, the writer prefers the band-spread system, using a small .00005 mfd. condenser C1a in parallel with C1, in the manner previously described in these pages.

The pentode oscillates very easily, but the low-frequency type has a high grid filament input capacity, consequently, the minimum wavelength of a given tuning coil will be somewhat increased and the valve might be a little unsatisfactory on very short waves, around 10 metres. Doubtless a special high-frequency pentode would be free from this fault. No marked increase in signal strength over the screen-grid detector has been noticed when using a pentode, but it does seem to be less critical in its adjustments and to that extent worth while.



A two-valve circuit using an H.F. pentode as detector.



Sub-baseboard view of the A.C. Three.

IT might seem somewhat contrary to the policy of PRACTICAL WIRELESS to introduce yet another new receiver so soon after the three sets described in the "Show" numbers, but there is a very good reason for our describing the "Modern A.C. Three." Whilst we were at Olympia we had the pleasant opportunity of meeting a very large number of our readers, and by so doing to learn just what their views were, and what kind of receivers they would like to build. And despite the enormous amount of interest and enthusiasm shown in our latest battery receivers we discovered that many readers were desirous of changing over to all-electric instruments. We therefore made detailed inquiries in order to learn exactly what type of set in the A.C. class would prove of interest to the majority. It was at once clear that careful consideration must be given to the price question, whilst at the same time all the most important and reliable modern improvements must be incorporated. Immediately after the Exhibition, then, we set to work to design a set which would fulfil the requirements mentioned above, in order that we might maintain the high reputation for which PRACTICAL WIRELESS is now noted of giving Real Reader Service. After carefully surveying the problem and carrying out a number of experiments another PRACTICAL WIRELESS *guaranteed* receiver was evolved.

High Selectivity and Power Output

It will be of interest briefly to describe the system which was followed in combining the requirements and ideas of our readers to produce a thoroughly efficient and likeable receiver which will give really good reproduction from a number of stations. The set had to be eminently up to date, which means that it must be ultra-selective and capable of providing an undistorted output of not less than two watts. Tuning must be easy and of the "single-knob" variety; a real pre-detector volume control must be incorporated to prevent any possibility of overloading when receiving local stations; there must be provision for connecting a gramophone pick-up and, above all the set must be perfectly safe electrically. Furthermore, the construction must be on easy and straightforward lines.

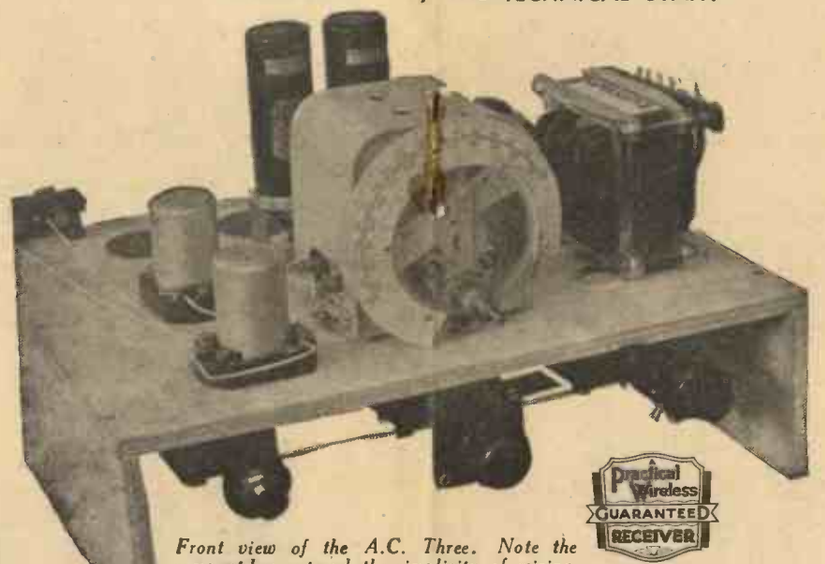
It was evident that a three-valve circuit, consisting of variable-mu S.G., detector and pentode stages would be most suitable, so this was decided upon. To ensure ample selectivity for all purposes meant that either a band-pass input circuit or iron core coils must be used. Since the latter are both more efficient and cheaper there was no hesitation in adopting them, and it only remained to find two of a type that would most suit the requirements of a provisional circuit which had been drawn up. Telsen type W. 349 were decided upon because they are of the double-wound pattern and can be used as high-frequency transformers to give an extraordinarily high degree of selectivity. By using transformer coupling between the variable-mu and detector valves the usual coupling choke is not required and thus expense is saved, despite the fact that a slightly greater degree of efficiency is at the same time secured. To facilitate the connection of a gramophone pick-up a plug and jack connector was employed, so that when gramophone reproduction is required it is only necessary to insert the plug (to which the pick-up leads have been connected) into the jack. This simple process automatically breaks the lead between the grid and grid condenser of the detector valve and connects the pick-up in place of the tuning circuit. Due to the method of wiring up the grid leak and a voltage dropping resistance a suitable bias voltage is also applied to the detector to make it function as a most efficient amplifier.

Good Bass Response

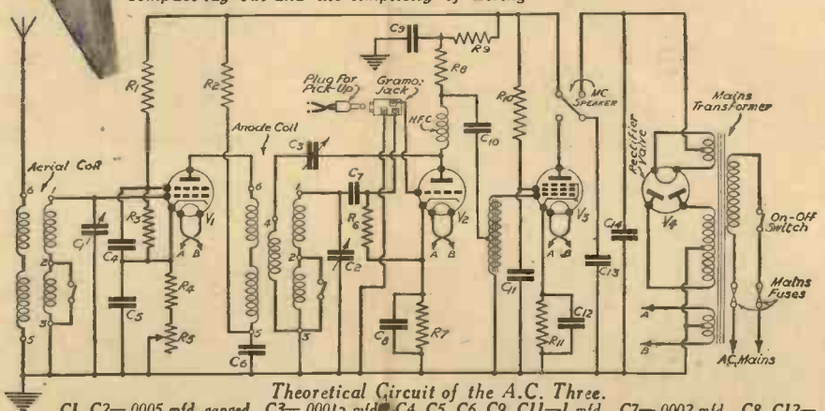
So as to improve bass response the detector valve is coupled to the AC/Pen. output valve through a resistance-fed transformer.

THE A.C. THREE

A Really Efficient and Economical All-Mains Receiver for the Home Constructor. It Has Iron Core Tuning Coils, a Variable-Mu H.F. Valve and Numerous Other Modern Refinements. By THE TECHNICAL STAFF.



Front view of the A.C. Three. Note the compact lay-out and the simplicity of wiring.

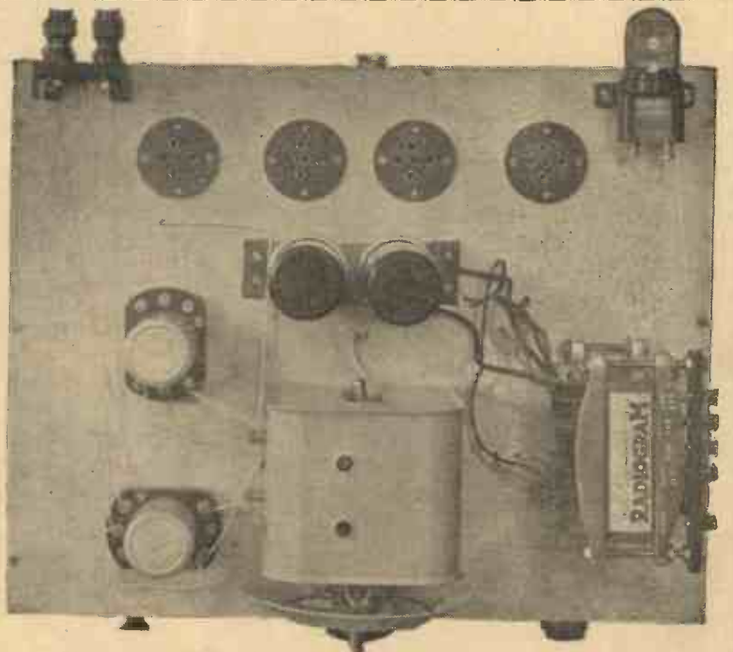


Theoretical Circuit of the A.C. Three.

C1, C2—.0005 mfd. ganged. C3—.00015 mfd. C4, C5, C6, C9, C11—1 mfd. C7—.0002 mfd. C8, C12—2 mfd. C10—.05 mfd. R1, R8,—30,000 ohms. R3, R9—20,000 ohms. R2, R10—5,000 ohms. R4—150 ohms. R6—2 megohms. R7—400 ohms. R11—300 ohms. R5—15,000 ohms graded potentiometer.

LIST OF COMPONENTS FOR THE A.C. THREE.

- Two Telsen Iron-core Tuning Coils, type W.349.
- One Polar Uni-knob .0005 mfd. Twin Gang Condenser.
- One Graham Farish "Litlos" .00015 mfd. Reaction Condenser.
- One Bulgin 15,000 ohm Volume Control with Switch, type G.S.15.
- One British Radiogram Mains Transformer, type 55.
- One Igranic Jack, type No. 72.
- One Igranic Plug, type No. 40.
- One Bulgin Mains Connector with Fuses, type F.15.
- One Igranic L.F. Transformer, type T.24.B.
- Four Clix 5-pin Chassis Mounting Valve Holders, Standad type.
- One British Radiogram 2-point Switch, type No. 48.
- Four British Radiogram Component Brackets, type 21.
- One Graham Farish H.F. Choke, type H.M.S.
- Two Telsen 4 mfd. Electrolytic Condensers with Brackets.
- Five T.C.C. 1 mfd. Condensers, type 80.
- Two T.C.C. 2 mfd. Condensers, type 80.
- One T.C.C. .0002 mfd. Condenser, type 34.
- One T.C.C. .05 mfd. Condenser, type 40.
- One Graham Farish 2 megohm Grid Leak.
- Nine Graham Farish "Ohmite" Resistances; two each 5,000, 20,000 and 30,000 ohms; one each 150, 300 and 400 ohms.
- One Belling Lee Terminal Mount.
- Two Belling Lee Terminals, marked "A" and "B," type B.
- One Peto Scott "A.C. Three" Cabinet, and Metaplex Chassis.
- One Celestion Energized Speaker with 1,500 ohm field, type E.8.
- Two Coils Glazite, length screening braid, flex, screws, etc.
- One Mazda AC-SG VM Valve.
- One Mazda AC-2HL Valve.
- One Mazda AC-PEN Valve.
- One Mazda UU.2 Rectifying Valve.



Plan view of the A.C. Three. The wiring is part completed.

This transformer is of a type rated at 3 : 1 ratio, but by connecting it on the auto-transformer principle (both windings being in series) an actual voltage step-up of 4 : 1 is obtained, and this ratio has been found to be just sufficient to enable the pentode to be fully loaded on signals of average strength. Thus, the output valve is able to operate under conditions of maximum efficiency and so to give an undistorted signal output of approximately two watts.

Novel System of Smoothing

It need scarcely be mentioned that every stage is thoroughly decoupled to ensure that the set shall be perfectly stable and free from all kinds of motor-boating and similar noises which are often very objectionable in a mains receiver.

Once the main features of the receiver proper had been decided upon the question of the power supply unit came up for consideration. With a view to economy it was decided to employ a valve rectifier, and that chosen is rated to give 220 volts at 60 milliamps when fed from a centre tapped transformer supplying 250 volts on each side of the tapping. As the current consumption of the three valves chosen, plus that of the potentiometer used to supply the screening grid voltage, is rather less than 35 milliamps, the rectifying valve is not fully loaded and the unsmoothed output therefore attains a voltage of about 260. Allowing 200 volts high tension there is a "surplus" of some 60 volts to be "dropped" in the smoothing system and across the automatic bias resistance of the pentode. In order to save the expense of a smoothing choke a loud speaker of the energized type was chosen, and the field winding of this was employed for smoothing purposes. Incidentally, it might be pointed out that this type of speaker is actually cheaper than a permanent magnet one of similar sensitivity, and thus the saving is two-fold. The Celestion speaker employed has a field resistance of 1,500 ohms and the inductance of the winding is slightly over 60 henries when passing a current of 35 milliamps. Thus the speaker gives better smoothing than the average type of choke and only produces a voltage drop of about 50. It is also interesting to observe that the field strength of the magnet under the conditions of use does not fall far short of 6,000 lines, and this compares very favourably with the corresponding figure for good speakers of the permanent magnet kind.

In order that the smoothing should be as complete as possible a dry electrolytic condenser was connected from each side of the field coil (serving as smoothing choke) to H.T. negative.

High Quality—Low Cost

After working out the design in the manner outlined, and after the set had been tested and every point checked, the total cost was calculated. For the complete receiver, including mains unit and speaker, the price was found to be approximately £8 15s.; to this must be added the price of the cabinet and valves, so that the inclusive figure comes out at rather less than thirteen pounds. It can be seen from these prices that the cost of the set is distinctly reasonable, especially when the many up-to-date features and the high quality of the parts employed are taken into consideration. It might have been possible to cut down the cost still further, but only at the expense of quality, and we feel sure that such a procedure would not have been welcomed by our readers.

Metallized Chassis for Easy Construction

Although it is not possible to give all constructional details in this issue, because of space limitations, it will be of interest to mention the form of construction employed. The complete instrument, comprising both receiver and power supply unit, is built on a Peto-Scott "Metaplex" (metallized wood) chassis which can be obtained completely assembled and drilled. To facilitate the construction and to enable the set to be easily fitted into the cabinet there is no panel, the controls being mounted on small angle brackets which are screwed to the front edge of the baseboard. At the rear of the chassis there is a two-point mains

(Continued overleaf)

THE A.C. THREE

(Continued from previous page)

plug fitted with twin fuses and this is of moulded bakelite so that it would be impossible to receive a shock whilst making the mains connections, and any wrong wiring in the set could do no more than cause one of the fuses to "blow." A pair of terminals for aerial and earth connections, as well as the pick-up jack, are also mounted at the back of the chassis and are easily accessible.

The controls are four in number and comprise a knob for the two gang tuning condenser, a wavechange switch, reaction condenser and combined variable-mu volume control and on-off switch. A small knob is mounted concentric with that used for operating the tuning condenser and this drives a trimmer; perfectly accurate tuning is thus possible over the whole of both wavelength ranges and yet there are no preliminary and delicate trimming adjustments to be made.

Look out for full constructional details next week; in the meantime you can order the necessary components of which a complete list is given on the preceding page.

Instability with Class "B."

A DIFFICULTY which is occasionally experienced with a class "B" output stage is that there is a certain amount of parasitic oscillation due to slight variations in the class "B" valve, or to other causes. This is generally evidenced by a faint, high-pitched whistle or by a peculiar form of distortion on certain high notes.

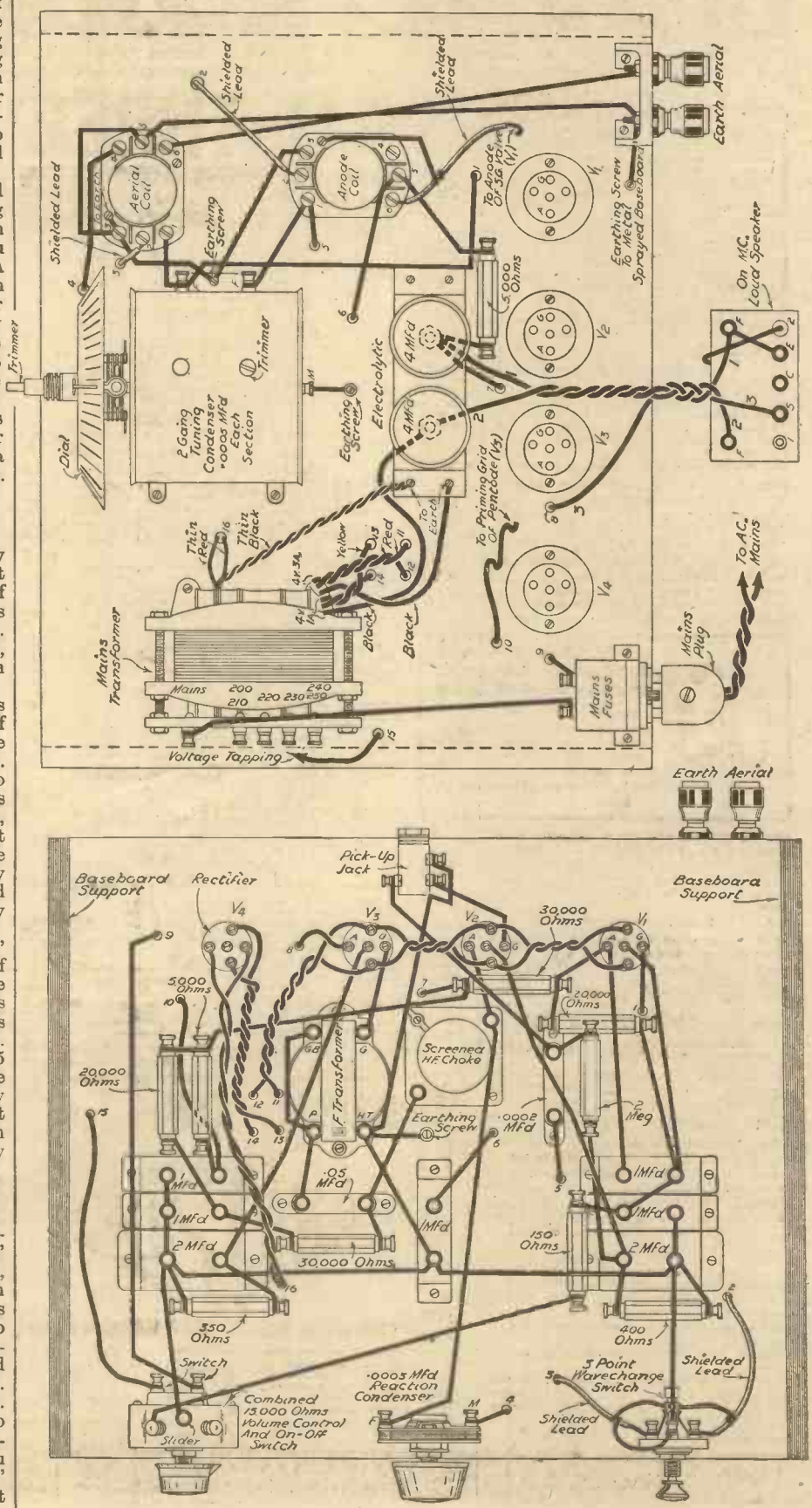
A satisfactory cure can nearly always be effected by connecting a condenser of about .005 mfd. across each half of the primary winding of the output transformer. The condensers also have a tendency to reduce the high-note emphasis which is always produced by class "B" valves, but they are not usually quite sufficient in themselves for this purpose. A more complete measure of tone correction may be secured by joining a .02 mfd. fixed condenser between the ends of the secondary winding of the "driver" transformer.

Another point to watch in a class "B" set is that there should be no leakage of H.F. current from the detector anode circuit into the amplifier, because this is liable to be magnified and to cause serious low-frequency instability and distortion. The usual expedient of inserting a .25 megohm resistance in the grid lead of the first L.F. (or "driver") valve is usually sufficient, but occasionally a better effect is produced by wiring a 50,000 ohm resistance in shunt with the primary winding of the first L.F. transformer.

He Never Switched Off!

A GOOD French story was recently published in one of the Paris "dailies." It concerns a forty-year-old citizen who, wishing to secure an annuity policy from an Insurance Company, consulted his doctor as to the means to be adopted to live to the ripe old age of four-score-and-ten. The practitioner examined him and pronounced him a perfectly healthy case. "Do you smoke?" he asked the patient. "No." "Do you drink?" "No." "Do you enjoy big meals?" "Not particularly," was the answer. "Do you listen to the Paris radio programmes?" "Yes, I never miss an item." "Great Scott!" said the doctor, "what do you want to live so long for?"

TOP AND SUB-BASEBOARD WIRING OF THE A.C. THREE



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Short Cuts in Wiring

The Best Methods of Making the Connection in a Set to Ensure Efficient Working.

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

AS I sit at my desk writing, I can see on the bench at the other side of the room my latest receiver—a useful hook up with two of the new screened pentodes in the high-frequency stages, pentode output, and power pack complete. I am rather proud of that set; proud of its wonderful performance, that is, and a little bit proud of the layout. But I am most decidedly *not* proud of the wiring.

There is this to be said in extenuation; the set was built in a great hurry because I simply had to try out right away a new idea which had come to me overnight. Then, again, in adjusting the layout for best results much of the internal wiring had to be altered more than once—and that, of course, plays havoc with the stiffest and most carefully bent wires.

Some time in the near future, when I have more leisure, I am going to rewire my new receiver, and I am going to do the job carefully and well, using for every connection just the right kind of wire, running each lead along just the best route, and employing the best and most suitable materials for every section of the wiring. Perhaps you will be interested to know what I shall use, and how I shall go about the job?

The First Task

Well, in the first place I shall make a clear sketch of the top and underneath portion of the baseboard, marked with the positions of all the components—coils, condensers, valve holders, chokes, transformers and the rest of them, and then I shall sketch in the runs of every wire and connection. This, of course, I shall take from the present "lash up" which, as I have remarked, has been altered several times, and now is about as satisfactory as it is ever likely to be. My drawing will naturally correspond to the blue print or point to point wiring diagram which most home constructors follow when building up a set.

The next step will be to complete the wiring of the filament circuit. As this set is for A.C. mains a good heavy twin metal-braided flex will be used, with the braiding properly connected to earth. Remember, in this connection, that the heater leads have to carry one ampere per valve, and that thin wires not only overheat but cause a voltage drop which may be serious. The earthed metallic braiding is, of course, to avoid risk of inducing hum in other neighbouring leads. It is, I admit, a counsel of perfection, and I have built many a successful and hum-less mains set using thick twin twisted flex without metal screening, but in those cases the routes of the heater wires were carefully selected. One merit of metal-covered heater leads is that they may be run almost anywhere without much risk of hum.

Filament Wiring

If the set had been a battery operated one there would not have been the necessity for these precautions—usually the shortest and most convenient route is also the best. For filament wiring in battery sets I prefer No. 16 gauge tinned copper wire—either bought as a roll of bare wire, and with sleeving cut to length for every lead, or one of the many good wires obtainable in convenient coils, and ready insulated. Good insulation of battery wires is a wise precaution, for many a set of valves has been ruined by an accidental contact between H.T. and L.T. due to bare wires sagging and touching each other, or by a loose wire carrying H.T. flicking against the bare filament wiring.

Some constructors like to use different coloured wires for different circuits—red for L.T., blue for high-frequency wiring, yellow for audio-frequency wiring, and so forth. I do not myself, for I think nothing looks nicer than a set neatly wired up with yellow Glazite, but you can suit your own taste in this connection. By the way, if an illuminated dial is incorporated in the set the dial light wiring should be completed with the filament wiring. It is frequently not an easy task to wire up a dial lamp after the whole of the set has been connected up.

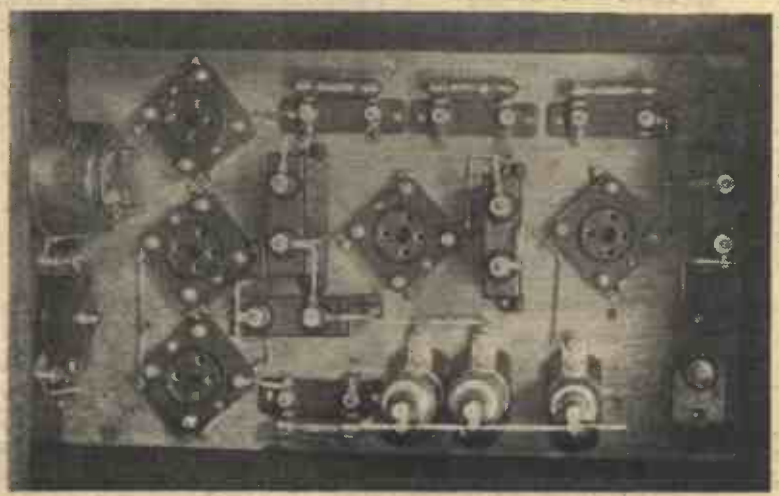
Having finished the heater circuit I shall proceed to make every connection which has to be joined to earth. This set is a chassis one, and the chassis itself forms the common earth return. I am not relying on this entirely, however, because I have found from experience that a multitude of earth connections taken to a metal chassis at times causes all sorts of small currents to flow in the chassis, slight differences of potential existing across different connections, and the magnetic effects of these stray currents are not unlikely to affect the general stability of the set. So although the chassis, screening cans, transformer and condenser cases and the like, are earthed *via* the chassis, I shall run a good stout earth lead from point to point in the set.

Power Pack and L.F. Side

The next stage will be the wiring of the power pack. Good high insulation rubber-covered and metal-braided flex will be used for the incoming mains, and the connection to the power transformer primary. The rectifier filament connections will be carried out in the same wire as the heater circuit of the receiving portion and the same No. 16 gauge for the H.T. leads. A really good quality insulating sleeving is essential here—avoid cheap or inferior makes. The remainder of the audio-frequency circuit may now be finished off, still using No. 16 wire and always running by the shortest route provided neat right angled bends are made wherever possible, as the finished set looks so much smarter.

At this stage of the proceedings I usually make a preliminary test of the low-frequency portion of the set, and the power pack, with a gramophone record or two. Anything wrong with this section can then be put right without the risk of upsetting

(*Continued on page 913*)



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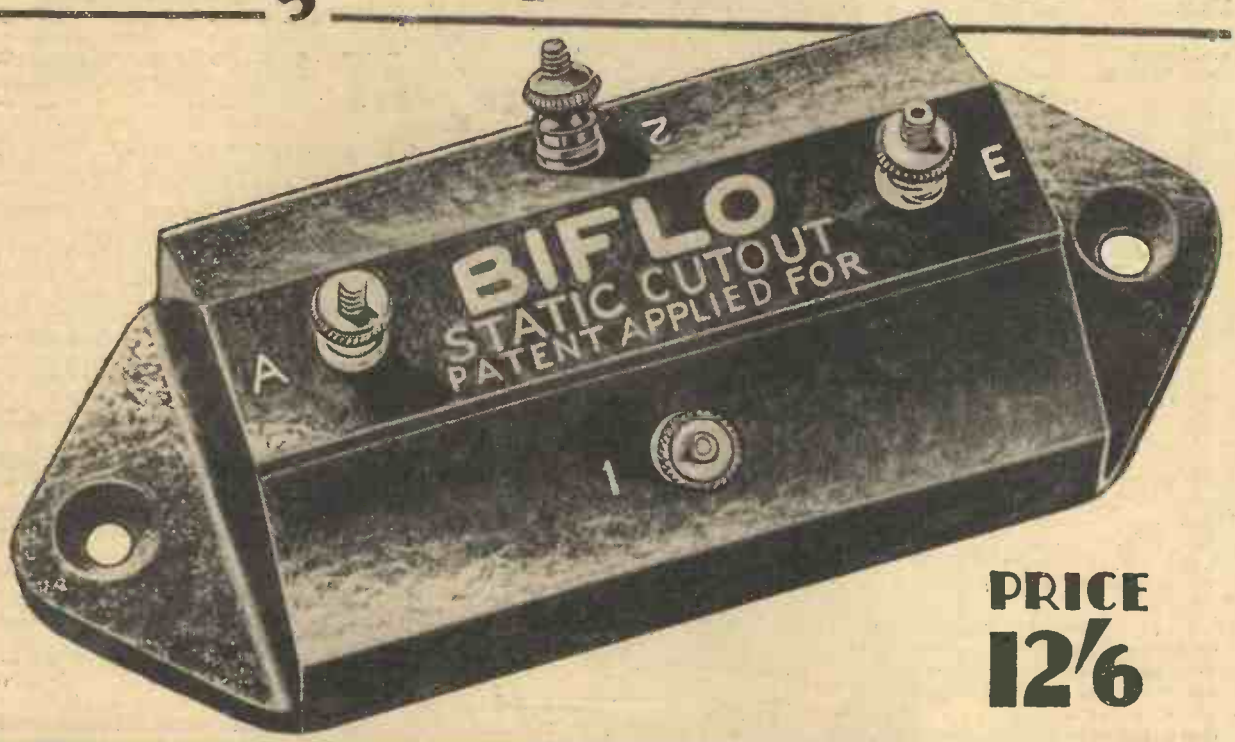

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(Continued from page 910)

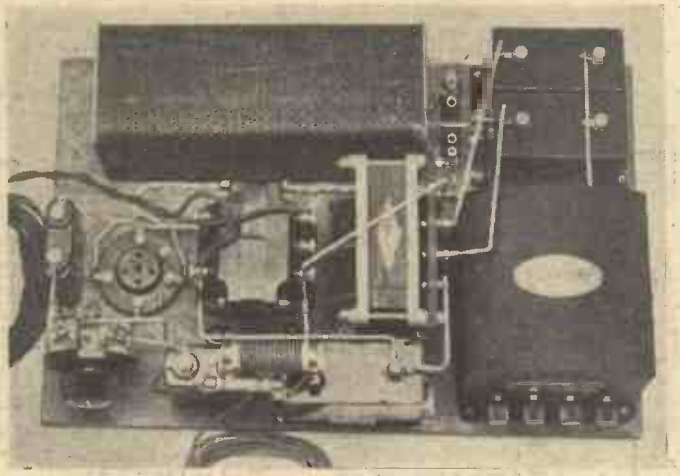
carefully spaced radio frequency wiring. Having passed this test, the high-frequency end may be tackled. It is here that the trickiest part of the work occurs. Carefully screened coils and condensers, metallized valves, and precision coils and ganged condensers, avail little or nothing if stray couplings exist between high-frequency circuit.

Widely spaced wires, but always running by the most direct routes possible, are the rule here. Danger points are those at which wires enter screening cans. Be certain that the insulation is intact right up to the terminal head in every case. Also bend each wire so that it is centred accurately in the opening to the can, thus minimizing and equalizing the small capacities to earth.

Grid and anode leads of the high-frequency valve or valves should be kept well apart, and as the wire from the top anode cap of these valves has usually to be a fairly long one, often passing down through the chassis, it is best to screen it.

Joints

So much for the wiring itself. Now for a word on the subject of joints. There are two main types of junctions in set wiring—the connection between a wire and a component, and a joint between two wires, and each demands special treatment.



An eliminator and amplifier with the wiring all neatly arranged and completed.

Most components are fitted with screw down terminals, and a connection made in this way is usually quite satisfactory if properly carried out. Make the loop just big enough to slip over the thread of the terminal—too loose a fit will cause it to open out or escape from the securing nut.

If the terminal nut is very small (and unfortunately there are still some manufacturers who will fit mean little terminals) slip a washer above and below the wire loop. Similarly, use washers when more than one wire is connected to a terminal and always on those rare occasions when you find it necessary to fix flexible wire under a terminal. I strongly advise you not to fix flexibles under terminal nuts—single strands will ride up between the thread and the nut, and prevent it from being screwed home. Where flexible wires must be used it is best to solder the flex to a spade end or tag of some sort. To my mind this is the only instance where a soldering tag is necessary or essential in the main permanent wiring of a set. If a terminal is of any use at all, use it, by all means; but if it is necessary to solder the wire to a tag, why not incorporate the tag in the component and solder direct on to it, thus saving one junction! There are frequently instances in receivers where it is desirable to join one wire to another. A T-joint can be easily made with solder, using a well-tinned iron.

It is fashionable, I know, to make the "outside" wires and leads—battery cords and so forth—permanent connections, but I admit that I have a great partiality for the older system where a terminal strip is provided at the back of the set for all these leads. It makes it so easy to disconnect the set for adjustment. A favourite choice is a set of sockets on the terminal strip, all clearly labelled, and a set of connecting cords bearing corresponding labels. Alternatives are good, large, non-rotating terminals with engraved heads, the leads being fitted with spade ends.

HOW YOUR RECEIVER WORKS—1

The first of a series of articles in which the author shows how a wireless signal passes through a receiver and explains in simple terms the function of each component.

This week the Aerial Tuning Circuit is dealt with.

By FRANK PRESTON, F.R.A.

IT was recently suggested to me by the Editor that readers of PRACTICAL WIRELESS would appreciate a straightforward and semi-technical article explaining the functioning of a wireless receiver. I must confess that at first I was under the impression that the subject had already been dealt with so frequently in various handbooks that further articles on it would appear superfluous. But on collecting and perusing a number of the books I had in mind, it seemed that very many of them were lacking in some way or other. Some were too highly technical to be of interest to the average wireless amateur, others had been written so long ago that they had become more or less obsolete, whilst in other cases the authors had made their books so "readable" that they had found it necessary to omit many things of importance, or to use simple analogies, which were far from accurate. In attempting to write an article which will be free from the above-mentioned defects, I realize to the full that I have set myself a difficult task, but if I succeed in making clear the function of the various components in a typical wireless set I shall feel more than repaid for my efforts.

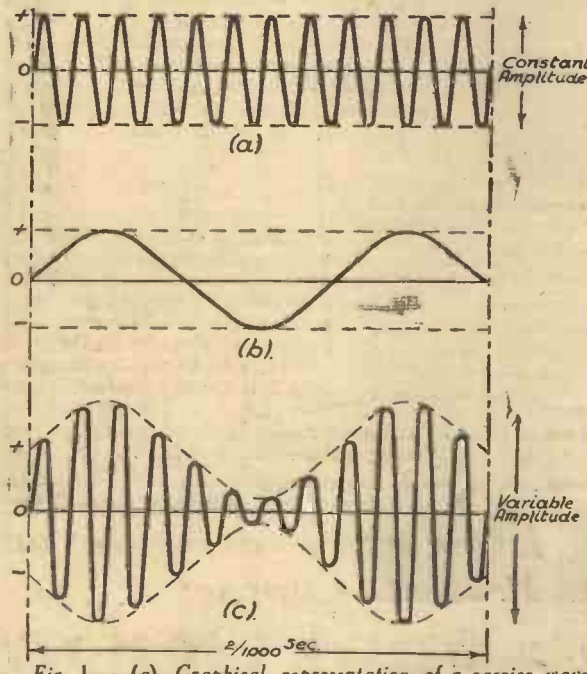


Fig. 1.— (a) Graphical representation of a carrier wave having a frequency of 10,000 cycles per second. (b) This graph represents a musical note of 14,000 cycles frequency. (c) A graphical representation of the oscillating signal voltage applied to the receiver; it represents the "modulated" carrier wave.

An Analogy

Before we can appreciate just what a wireless receiver does, it is essential that we should have a clear idea of the material upon which it works, or in other words, of the signal energy which is collected by the aerial-earth system. We speak very loosely about wireless "waves," carrier "waves," and the like whilst, in point of fact, they are probably not waves at all. The analogy of dropping a stone into a pool of water and so creating waves which will cause a cork floating on the surface to "bob" up and down, is frequently exploited to explain the function of a transmitter (the stone), the receiver (cork), and intervening ether (the water). But is this analogy a correct one? It is certainly difficult to imagine a surface on the ether, which we understand as being all-pervading, and if there is no surface there can be no waves.

We must, therefore, explain wireless transmission and reception in some other way, and for the present dispel the "wave" idea. If an analogy must be used, let us rather imagine a disturbance *inside* the water (which we will use to replace the ether for the purposes of explanation). Should, say, a glass bulb containing compressed air be exploded under water, the explosion would momentarily force a certain amount of water away from the bulb, but due to the pressure of water outside the spot where the explosion occurred there would be some opposition to the water's movement, and, therefore, it would be compressed. Immediately the explosion ceased, however, pressure would be reduced and the water would rush back to the place it had previously occupied. By this simple process, the water would have been set into a state of oscillation, that is, it would have been caused to move backward and forward. But the disturbance would not be confined to the spot where the explosion occurred, and would have been transmitted to the whole volume of water. In consequence there would be an oscillatory movement throughout the mass, so that the pressure at any point would be changing at the same rate as the original oscillations, and this could be detected by the movement of a piece of paper placed in the water.

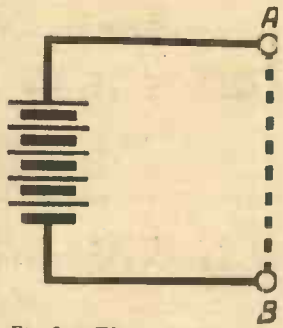


Fig. 2.—There would normally be a voltage or pressure between A and B, but this would vanish if the two terminals were short-circuited as shown by the broken line.

Electro-Magnetic Vibrations

Please bear in mind that the above is only an analogy intended to convey the idea of oscillation, and once the principle has been grasped, the analogy can be set aside. Let us now see more exactly what happens in the

(Continued on page 917.)

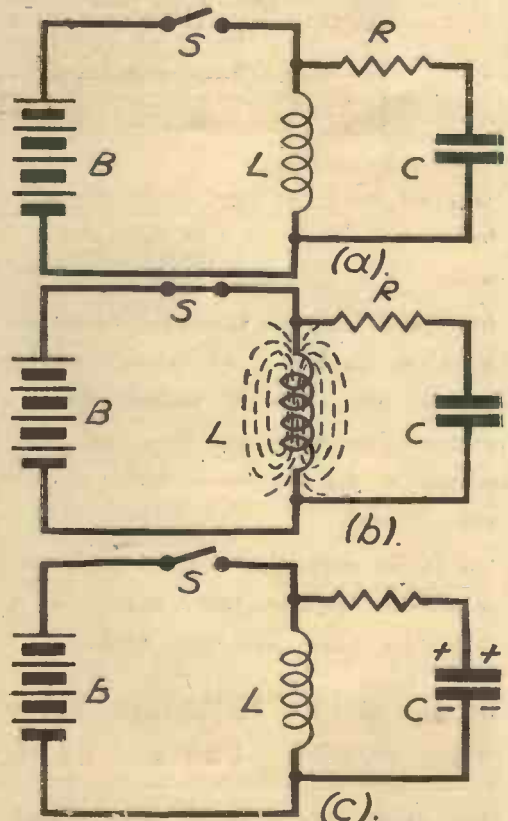


Fig. 3.—Showing the action of an oscillating circuit comprising a coil, condenser, and resistance. (a) A simple oscillating circuit connected through a switch to a battery. (b) When the switch is "closed" current flows through L and causes it to become an electromagnet. (c) When the battery circuit is again broken current flows through the coil L and "charges" condenser C.

(*Continued from page 914*)

case of wireless oscillations or signals. They are electromagnetic vibrations and, although they have a pressure of several volts, or even hundreds of volts on leaving the transmitter, the pressure falls off rapidly until, by the time signals reach the aerial-earth system of the receiver, it is measurable only in millionths of one volt. The voltage of the oscillations is not the same as that given out by a battery, where one pole is always positive and the other negative, but is constantly changing between positive and negative. It is this fact which gives rise to the use of the name "wave" as applied to the oscillations, because they can be represented graphically as a wave, in the manner shown in Fig. 1 (a). The graph is really a mathematical expression used to show how the voltage varies between maximum positive and maximum negative values with the passage of time, and the number of changes from positive to negative which occur over a given period is dependent, of course, upon the frequency of oscillation. Actually the graph given covers a period of only two thousandths of a second assuming the frequency of the signal voltages to be 10,000 per second (corresponding to a wavelength of 30,000 metres). I have purposely chosen a low-frequency (high wavelength) to simplify the illustration, because to represent a high frequency so many "waves" would be required that it would be impossible to show them clearly on a page of this size.

The oscillations we have considered so far, are those of the "carrier wave" (I refer to it by its popular name, although we know that it is not really a wave at all), but in addition to these we have other oscillations corresponding to sound frequencies. At Fig. 1 (b), a graph is drawn to represent a musical note having a frequency of vibration equal to about 1,400 per second, and which, incidentally, approximately corresponds to the highest note of a cornet. The frequencies applied to the receiver consist of a mixture of those of the carrier-wave and those due to the musical sounds impressed upon it, and can be represented in graphical form in the manner shown at Fig. 1 (c). It is seen from the latter figure, that the "amplitude" (maximum positive and negative voltage) of the signal currents is constantly varying in sympathy with the musical note, but that the frequency is precisely the same as that of the carrier-wave.

We must now see how the signal affects the receiver. The aerial and earth act like two plates of a condenser, each of which is constantly receiving a fluctuating or oscillatory voltage, and so a potential difference occurs between them; whenever one is positive the other is negative, and *vice versa*. In consequence, if the two were connected together there would be a flow of current similar to that obtained if points A and B in Fig. 2 were joined together, the difference being that in one case the current would be oscillating, or constantly changing in value, whilst in the other it would be of uniform intensity. But we know from our experience of electricity, that if the battery of Fig. 2 was short-circuited by connecting A and B together, there would be no indication of voltage between the latter points. In the same way, there would be no voltage, or potential, difference between the aerial and earth if they were joined together. And since it is the voltage that is required to operate our receiver, we must avoid making a direct connection between the aerial and earth.

Tuning

This brings us to the reason for "tuning" the aerial circuit, generally by means of a coil and condenser. We wish so to arrange things that at any one frequency (corresponding to that of the transmission it is desired to receive) there shall be an infinitely high resistance between the aerial and earth, so that a maximum voltage will be developed between them. On the other hand, however, the signal currents of all other frequencies must not be allowed to develop a voltage, and the aerial and earth must therefore be short-circuited so far as they are concerned. It is thus essential that those components connected in the aerial-earth circuit shall be able to discriminate between various frequencies. When the oscillatory (or tuning) circuit is adjusted to have a frequency of vibration equal to that of the desired signal it prevents the signal current from passing through it, but at the same time provides a very easy leakage path to currents of every other frequency. "But," you say, "how can a coil and condenser be made to have a particular frequency of vibration?" This can best be explained by making a reference to the diagram of Fig. 3 (a), which shows a battery (B) connected through a switch (S) to an "oscillatory circuit" consisting of a coil (L), a condenser (C), and a resistance (R). Now suppose the switch be momentarily closed; what will happen? Nothing, so far as the eye can see, but there will be many changes which could be detected by suitable instruments.

RADIO RAMBLINGS

By JACE

Jottings from my Notebook

A Precaution Concerning Accumulators

I HOPE you all know that it is dangerous to hold naked lights over accumulators whilst they are being charged, but you may or may not have read of the accident that befell a Continental family the other day. It appears that paterfamilias was a "junk-merchant" who had bought up a lot of old accumulators. He salved the lead plates and not knowing of a use for the old celluloid cases, thought they would make good fire-lighters. They did, but the fumes given off poisoned the family, and the economy nearly cost several of them their lives. It appears that on most accumulators a deposit of lead in the form of lead sulphate becomes coated on the cases and this, when heated, gives off noxious fumes that cause lead poisoning to anyone inhaling them. Don't, therefore, burn up your old accumulators, though I don't suppose you will relish the thought of having anything to do with burning celluloid any more than I do. A risky business, at the best!

Using a Pentode Output Valve

BATTERY set users whose sets employ small power valves in the output stage often ask if it is possible for them to use a pentode valve output and thus obtain "that little extra" which perhaps enables loud-speaker reception to be possible on an increased number of stations. It is usually possible to do so to advantage, but only when one stage of low-frequency amplification is used as attempts to use a pentode in conjunction with another L.F. valve are generally not successful. If a moving-coil speaker is being used, it is necessary to see that an output transformer with a pentode tapping is included in the circuit somewhere, either as a part of the speaker or else as an adjunct to the output side of the receiver. This also applies where an inductor type of speaker is used and often speakers of the balanced armature type give improved results if an output transformer is used to ensure that the impedance of the loud-speaker does not under-load the valve. Especially is this important when pentodes of the low-consumption types are chosen.

Tone Control

IN connection with the use of pentodes it often happens that the change over to this type of output valve reduces the *apparent* selectivity of the receiver owing to the fact that signals that were previously inaudible now become a nuisance because of the increased low-frequency amplification, which gives greater prominence to all signals, both weak and strong. This can be often overcome by fitting a series aerial condenser of the compression type which has a small variable capacity, or by the use of a variable-mu valve in the screen grid stage, although the latter cure is perhaps too elaborate for listeners other than ardent enthusiasts. Mention must be made, too, of the fact that the tonal qualities given by a pentode valve may not be to the taste of the listener who has become used to the low, rather woolly, quality given by some power valves. The output from a pentode is often quite brilliant and has a decided "attack" which some people consider lacking in bass response. This can be overcome by the fitting of one of the various methods of tone control or compensation described at length in previous issues of PRACTICAL WIRELESS.

Improvised Resistances

A FAULT particularly common with older sets of the det. 2 L.F. type is the breakdown of the anode resistance, and if a spare is not immediately available it is necessary to look around for a substitute. A piece of wet string can be used, although when it dries its resistance becomes so high that it ceases to be a conductor at all, and a piece of lead pencil or a small piece of paper soaked in Indian ink will often work satisfactorily if placed between the two resistance holding clips. Better still, however, is the use of a high-resistance voltmeter for a temporary resistance and as the usual value is 1,000 ohms per volt a 150-volt scale would give a resistance of some 150,000 ohms. This is quite a suitable value, but care must be taken to ensure that the deflection of the needle over the scale is not less than the value of the H.T. voltage through the resistance, otherwise damage might be done to the meter. By this I mean that it is no good using a voltmeter reading up to 150 volts if the H.T. feeding the anode in question has a value of, say, 200 volts.

Sensitivity and Power

DO you know the difference between a sensitive set and a powerful one—and when is a set both sensitive and powerful? No prizes are offered for solutions of these conundrums, but I hope you will agree that sensitivity is not necessarily power. If you had an efficient detector followed by a multi-stage amplifier you might get a dozen stations at tremendous volume, but a man with a detector stage preceded by one or more stages of efficient H.F. amplification would get a nightly bag of stations at medium strength running well into three figures. The first set would be powerful, but the other one would be the most sensitive, so that the ideal set is one with an efficient H.F. stage to get in the stations and feed their weak signals, sufficiently amplified so as to be capable of being handled by the detector, to the rectifying stage, and followed by a good low-frequency amplification side to make all the signals audible at good strength on the loud-speaker.

Cold-emitter Valves

THERE is another problem, the solution of which would do much to further the progress of Empire Broadcasting—or, at least, Empire listening. I refer to the development of cold-emitter valves. You might think it impossible to invent a valve which will give off an electron stream from a perfectly cold cathode, but remember that it was at one time considered necessary to heat a filament to incandescence to persuade it to emit electrons; since then the dull-emitter has been universally adopted. Various methods have been tried in attempts to produce a cold-emitter valve, but as yet none have proved satisfactory. One way was to coat the cathode with light-sensitive substance such as is used in photo-electric cells, but, although this did give some emission, it was not sufficient to enable the valve to operate successfully. I understand that an alternative method is being experimented with in Germany at the present time. In this case two electrodes, an anode and a cathode, are mounted very close together in a glass bulb containing a small amount of some inert gas. The high-tension voltage is applied between the two electrodes and this produces a kind of glow discharge such as occurs in a neon lamp, and like we used to get when using the old Dutch valves. Under conditions of discharge the gas becomes a conductor, and a free flow of electrons takes place between the cathode and anode. I have not been given any definite facts in regard to the "glow-discharge" valve, and I cannot quite see where the grid is going to fit, since it is apparently essential that the other two electrodes must be separated by only a minute space. Nevertheless the idea offers some interesting possibilities.

The Transmitting Licence

IT might prevent a good deal of misunderstanding if I point out that a transmitting licence is not an easy thing to acquire, unless the applicant has in mind some useful experimental or research work. I have no desire to damp the ardour of anyone, and it would please me tremendously to know that PRACTICAL WIRELESS numbered among its readers a good proportion of amateur transmitters, but I do think that the position should be made clear.

Any reader who contemplates serious transmitting experiments should, first of all, write to: The Secretary, General Post Office, London, E.C.1, for a Licence Application Form, which will be accompanied by a list of "Conditions of Issue." After studying the latter he will be in a better position to understand what is required of him before a licence can be granted. Space does not permit of my reproducing all the conditions here, but I will give the most important one. Condition Number 4 reads as follows: "Applicants must satisfy the Postmaster-General that they are qualified to conduct experiments of scientific value or public utility. If scientific research is intended they should be certified as competent investigators by a Government Department or some recognized scientific body. Authority to use wireless sending apparatus, even with an 'artificial' aerial (*i.e.*, a practically non-radiating aerial), can be granted only if the nature of the proposed experiments and other circumstances warrant that course." It will be seen from this that a licence is not just issued to anyone who cares to make application, and that the applicant must first have in mind the carrying out of some definite and useful experimental work.

In order to meet the requirements of readers who prefer to work from a full-size blueprint when building up any of the "Practical Wireless" Receivers, we can now supply full-size Blueprint Wiring Diagrams of all the "Practical Wireless" receivers for 1s. each, post free. When ordering, quote the number. Copies of the paper containing descriptions of the particular receiver cost 4d. each. Address orders to: The Publisher, George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

Blueprint No.	Receiver.
1.	Dolphin Straight Three.
2.	Long Range Express Three.
3.	Mains Express Three.
4.	Sonotone Four.
5.	Bijou Three.
6.	Argus Three.
7.	Empire Short-Wave Three.
8.	Solo Knob Three.
9.	Midget Two (6d. only).
10.	Selectone Battery Three.
11.	Fury Four.
12.	Featherweight Class B Four-valver.
13.	Q.P.-P. Three-Four.
14.	Alpha Q.P.-P. Three.
15.	Ferrocart Q.P.-P. Hi-Mag Three.
16.	Supersonic Six.
17.	Beta Universal Four.
18.	A.C. Twin.
19.	Selectone A.C. Radio-Gram Two.
20.	A.C. Fury Four.
21.	Radiopax Class B Four.
22.	Three-Valve Push-Pull Detector. (6d. only.)
23.	Double Diode Triode Three.
24.	Three-Star Nicore.
25.	The D.C. Ace.
26.	The Superset.
27.	The Auto-B Three.
28.	The All-Wave Two.
29.	The A.C. Three.

OLD COMPONENTS

(*Continued from page 894.*)

mounted on it is soldered on to the centre bush of the switch as in Fig. 10, or else a flexible wire is connected to the same point. The switch thus becomes a 3-point instead of a 2-point instrument.

A Resistance Holder from Odds and Ends

A use for old telephone terminals which may appeal to some readers is shown in Fig. 11. Two terminals are mounted on a strip of ebonite to form an anode resistance or grid-leak holder. One point of the resistance fits in the hole in one terminal, while the other point fits in a hole drilled in the head of a screw held by the other terminal. The screw has a spring behind it to keep it pressed in contact with the resistance and is fitted with a nut at the other end to keep it from jumping out of the terminal when the resistance is removed.

Ordinary type valve-holders of most makes can usually be converted to the chassis-mounting type for under-baseboard wiring by the method shown in Fig. 12. The terminals are reversed and a hole is drilled in the baseboard or wooden chassis to allow the body of the holder to pass up through as shown. The fixing screws are fitted with small spacing washers to keep the holder well away from the underside of the baseboard so that the heads of the terminal screws do not touch the wood. With a metal chassis instead of a wooden one the fixing is just the same except that small bolts will be required instead of wood screws for securing the holder in position. In this case the spacing washers must on no account be omitted, otherwise the terminal screws will short-circuit against the chassis.

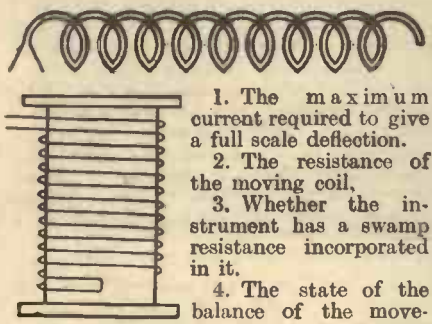
MOVING-COIL INSTRUMENTS

How to Adjust and Test Them for Accuracy

By "MICRON"

AN article was published in PRACTICAL WIRELESS recently on fitting up a workshop, and no workshop can be complete until one of the most indispensable pieces of apparatus is included, namely, a moving-coil instrument. There are many such instruments that can be bought to-day quite cheaply. Its uses are numerous, and while many of them have been ably described, there are still some little-known facts about these instruments—which I will try to make clear—that are an advantage to anyone who buys either a second-hand or new instrument and wants to make it suitable for universal use.

For general utility, I would recommend one to buy a milliammeter that gives a full scale deflection with one milliamp, and, having bought the instrument, the following points should be noted:—



1. The maximum current required to give a full scale deflection.
2. The resistance of the moving coil.
3. Whether the instrument has a swamp resistance incorporated in it.
4. The state of the balance of the movement.

Figs. 1 and 2.—Methods of winding a swamp resistance.

Now let us take these points one by one and sift them out. Number one can easily be found by noting the maximum reading on the scale, and as regards number two, an easy method of finding this was given a week or so ago. At this stage, perhaps it would be better to explain a few of the basic principles which govern the operation of these instruments.

Ohm's Law

All moving-coil instruments take a definite current to give a full-scale deflection, and, as the moving coil has resistance, it always obeys Ohm's Law, namely, the voltage necessary to drive the current through this resistance is always equal to the value of the current multiplied by the resistance, and, knowing any two factors, we can always find the third. Perhaps an example will make this clear. Supposing our milliammeter will give a full-scale deflection when one milliamp flows through it, and that we have found that the moving coil has a resistance of 20 ohms. When we put this in a circuit that is passing one milliamp, we find that across the moving coil we have a difference of pressure equal to .02 volt—or 20 millivolts—and you can now appreciate the fact that our milliammeter is also a calibrated millivoltmeter, giving a full-scale deflection with 20 millivolts, the scale reading being multiplied by 20.

Most milliammeters are designed to give a full scale deflection with 60, 75, or 100 millivolts, and as such, providing the current in the circuit is much greater than that taken by the instrument, it will measure millivolt drop accurately. We have already found that our instrument will give a full-scale deflection with 20 millivolts, and the question that comes to one's mind is, how can we make our instrument give a full-scale reading with any of these pressures? This is where item number three—the swamp resistance—comes in.

If we were to examine the inside of a moving-coil instrument that has been designed as a multi-range ammeter, we should find a resistance permanently connected in series with the moving coil.

Swamp Resistance

This is the swamp, or, swamping resistance. It is wound with either Eureka, Manganin, or Constantan wire, or any wire that has a low temperature coefficient, and is silk covered, the value of this resistance being from three to four times the value of the moving coil. It is wound non-inductively on either an ebonite or porcelain bobbin. There are two methods by which this can be done, as shown in Figs. 1 and 2.

In the first case the wire is doubled in two, and the loop fixed to the bobbin with a spot of shellac varnish, and the two wires are then wound on side by side, finishing with a piece of fine flex soldered on to each end of the wires. The winding is now covered with shellac varnish, and over this is placed a layer of insulating tape. If it is found that more than one layer of wire is required a different method must be adopted. One layer must be wound on, say, in a clock-wise direction, insulate this with shellac varnish and tape, then wind the next layer back over the first layer, but in an anti-clockwise direction, insulate as in the previous layer, then the next layer should be wound in a clockwise direction and so on, until the whole amount is on, taking care to thoroughly insulate each layer. This case is extended in the case of series resistances for voltmeters. Here we have a slab of insulating material cut as shown in Fig. 3.

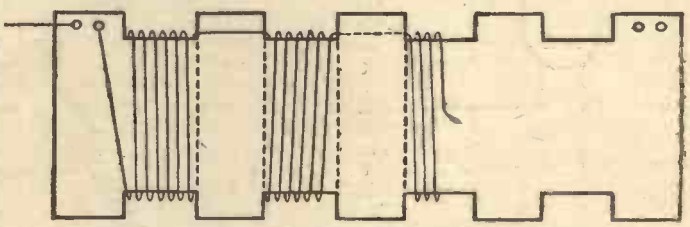


Fig. 3.—Winding a series resistance for a voltmeter.

The wire is first wound in the end slot for a pre-determined number of turns, then the next slot is filled by winding the wire in a reverse direction until the whole amount of wire is on. You must now be wondering what the swamp resistance is used for. Taking our moving-coil instrument, we know that it gives a full scale deflection with one milliamp, and its resistance is 20 ohms. We further found from Ohm's Law that the difference of pressure across the coil is .02 volt. If we were to use this instrument to read a greater current than one milliamp we would employ a shunt connected as in Fig. 4.

The value of the shunt depends on the resistance of the instrument, and the maximum value of the current which we want to measure. If the milliammeter did not have a swamp resistance in its coil circuit the value of the shunt resistance

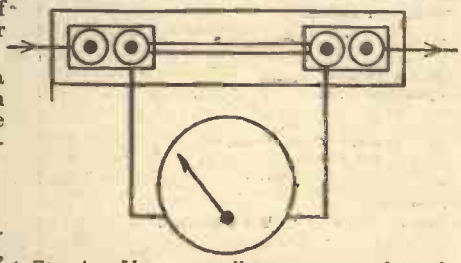


Fig. 4.—Using a milliammeter in shunt for measuring small currents.

would have to be very low and contact resistance would be a serious factor; furthermore, after the instrument had been in circuit for some time—assuming no swamp—we would find that its readings would become inaccurate owing to temperature errors. Most shunts are designed to give a pressure drop of 60 millivolts (.06 v.), 75 millivolts (.075 v.) or, in the case of some commercial instruments, 100 millivolts (.01 v.), when carrying a certain current. Having found that our instrument requires 20 millivolts for a full-scale deflection, and we want to use it with a shunt that has a drop of pressure of 60 millivolts when carrying a certain current we must design the swamp resistance to absorb 40 millivolts, and therefore it should have a resistance of twice the value of the moving coil, namely, 40 ohms. Working this out by Ohm's Law we have R=E/C .06/.001=60 w., but the moving coil has a resistance of 20 w., so we shall require a swamp of 60–20=40 ohms.

Checking the Balance

We now come to the final operation, that of checking the balance of the movement, and it is as well to check this very thoroughly, as an instrument that is fairly accurate, and the movement of which is slightly out of balance, can be made most accurate, while if the balance is correct, the instrument can be used in any position, and from this it follows that if the balance is not correct, the instrument can only be used in the position it was calibrated in. Spend plenty of time on this operation.

even if it takes three or four hours, and your trouble will be well repaid, at the same time not forgetting that it is a delicate operation. If you look at the movement of the instrument you will find an extension to the pointer at the other end of it, and on this will be found a balance weight which is usually some very small nuts on a thin screwed wire. The nuts are prevented from moving by a spot of shellac varnish. Fig. 5 shows the movement with balance weight.

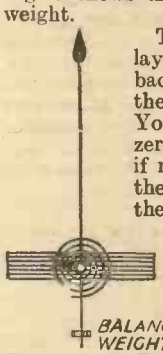
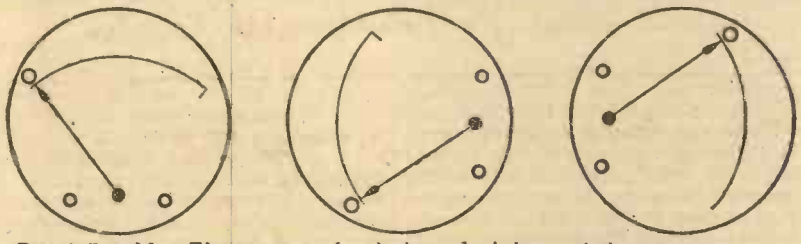


Fig. 5.—The movement for a moving-coil instrument.

The first thing to do is to lay the instrument flat on its back on the table, and bring the pointer to the O position. You will undoubtedly find a zero adjuster for this purpose, if not, you will have to take the cover off the instrument, then this operation can be carried out by altering the arm to which the control spring is soldered Under these conditions the balance weight does not come into operation, and it has no control over the movement, the position of the pointer being determined by the control springs. Now mount the instrument vertically, as in Fig. 6. The pointer should now remain at the 0 position. In this position the balance weight comes into operation, and if the pointer deviates from 0 it can be brought back by altering the position of the balance weight, by running it up or down the screwed thread. However, before you can do this, you will have to free the little nut or nuts, and the best way of doing this is to heat a large steel knitting needle until it is red hot, then hold this on the balance weight when it will be found that the shellac melts, allowing the weight to be moved with a pair of tweezers. Of course this operation will have to be done every time the balance weight requires to be moved. Our next operation is to place the instrument on its side, as in Fig. 7, and if the balance is correct the pointer will stop at 0. If it is out, this must be corrected by moving the balance weight. We have still the final operation to carry out, and that is to turn the instrument until the zero lies in the other direction, as indicated in Fig. 8, and if you have made your adjustments accurately the pointer should still stop on the 0. If you find that the balance has been accurate up to this stage, but out on this test, it is best to correct it, and to go through the three previous operations again, and when you find that the instrument obeys all these operations: it should read accurately throughout its range, and in any position. By the way, you may find that you want to lower your weight more than the screwed thread will allow it, in this case a spot of solder on it will allow a further range of adjustments to be carried out, and the converse case is also true. If you find that you have to screw the weight right up to the moving coil, and still cannot get a true balance, taking off one of the nuts will enable you to do it. Should you find that through frequent manipulation the weight has become unstuck, a little spot of shellac varnish will put it right, but it must be just a speck or else you will undo all the good work you have done, by upsetting the balance.



Figs. 6, 7 and 8.—Three positions for checking the balance of the instrument.

By paying attention to these small points and carrying out these tests with great care, you will find that not only are you improving the reliability of your instrument, but you are also acquiring skill and knowledge, and do not forget that the finest way to learn and acquire knowledge is to experiment. Perhaps a useful tip—one which the author has found to serve him well for many years as a test engineer—is to assume that everything is wrong, until you have proved it correct by experiment. This is by far a better method than to assume that everything is correct until you find something that is wrong.

CURING MAINS HUM

IT is surprising how many times one comes across A.C. mains operated wireless receivers, especially home-constructed ones, in which the quality of reproduction is marred somewhat by the presence of residual mains hum. One of the most effective methods for overcoming this is to incorporate a special resistance with a movable centre contact which moves over the centre portion of the winding in order to determine the true electrical centre.

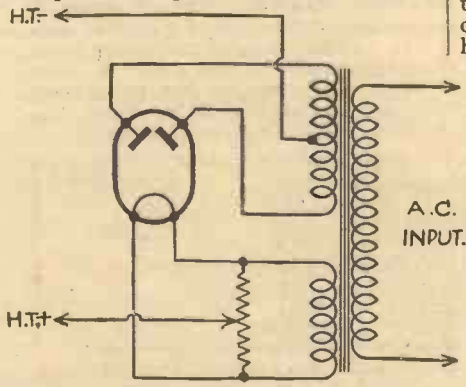


Fig. 1.—A potentiometer used to obtain a centre-tap.

Many eliminators have a low voltage winding for the direct application of raw alternating current to the filament of a power valve. The resistance mentioned provides a method for obtaining the necessary electrical centre of this filament supply winding, and in this way cancels out the last traces of A.C. hum which may be present in the amplifier output stage. It is best to place the resistance as near to the valve terminals as is conveniently possible and not actually across the transformer terminals. To a lesser degree the same course can be adopted when indirectly heated cathode valves are being used, and, furthermore, such a scheme is by no means limited to application in the final stage of the receiver.

The resistance should be adjusted for the elimination of the hum when no signals are being received, but with the receiver or eliminator in operation. The tuning circuits are brought into resonance, but at a wavelength on which no station is transmitting at that moment. This permits the degree of A.C. hum to be noted and the resistance control is turned slowly to left or to right until the hum is "tuned" out. It is necessary to select the value of this resistance so that there is no undue extra "load" imparted to the circuit, and a resistance of 30 or 50 ohms generally will be found suitable. Three diagrams are given to show exactly how the resistance can be included in certain circuits.

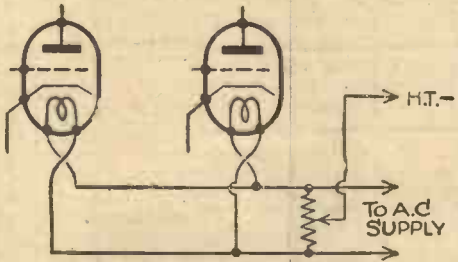


Fig. 2.—How to use the potentiometer when two indirectly heated valves are used.

Examples.

In double wave rectifying valve circuits the mains transformer sometimes has its centre winding electrically out of balance. This is a common source for the introduction of objectionable A.C. hum into the filter circuit. If a suitable resistance be connected across the filament winding as shown in Fig. 1 this hum can invariably be balanced out with ease. The centre tap terminal of the transformer winding is of course left blank.

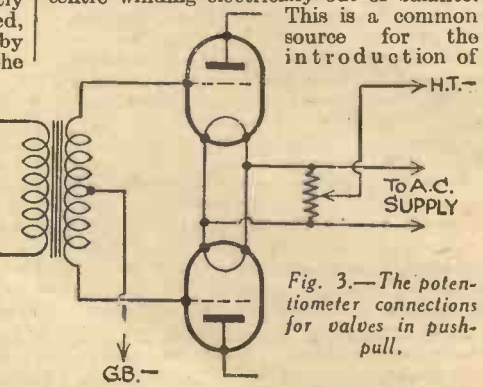


Fig. 3.—The potentiometer connections for valves in push-pull.

Where indirectly heated cathode valves are employed the filament leads should be bridged as near as possible to the valves by the resistance, the centre tap of which is taken to H.T.— as indicated in Fig. 2. The variable position of the movable contact should then be adjusted.

A BATTERY ELIMINATOR FOR A.C. MAINS

Constructional Details of this Unit Are Here Given, Together with Some Notes on Voltage Dropping and Decoupling.

By G. H. WRAY, F.C.S.

THE construction of an eliminator for use on A.C. mains is a matter which neither calls for specialized technical knowledge nor unusual engineering skill. Many readers who have alternating current in their homes are deterred from building up their own eliminators through having the impression that it is a complex business, involving a multiplicity of calculations and technicalities which are beyond their scope.

On the other hand they would, however, have no hesitation in embarking upon the construction of a complicated receiver, which would require considerably more skill and care to carry to successful completion than does an eliminator. The advantages to be derived from a supply from a battery eliminator are manifest, and readers may commence operations without any qualms as to their ability to successfully construct one suitable to their requirements, and without doubt as to the successful working of the finished assembly. The constructional details of the H.T. eliminator described here will enable them to build one which will provide an ample supply of current for the average three-valve set, free from any trace of distortion, motor boating, or hum, on good speakers.

The advantages of a mains supply over that obtained from H.T. batteries are, briefly, current at approximately one sixtieth of the cost, unvarying voltage (neglecting the small variation existing in the mains voltage itself), and a liberal anode current supply for the output valve, enabling the use of a super-power valve in this stage which would otherwise be impossible owing to the heavy drain on the H.T. battery. In addition, the installation of an eliminator ensures an inexhaustible trouble free supply, and the inconvenience usually associated with battery charging becomes a thing of the past.

An eliminator consists essentially of two circuits, the rectifying, and the smoothing circuit. The components contained in the rectifying circuit are the mains transformer, the rectifier, and the reservoir condensers. The smoothing circuit contains the smoothing choke and the filter condensers. The eliminator described here was designed to supply H.T. for a three-valve set—screened grid, detector, and power valve—and the results under working conditions leave nothing to be desired, particularly with regard to absence of background noise.

Constructional Details

The first step in building the eliminator is to consider the necessary components. The mains transformer has already been described in a previous issue of PRACTICAL WIRELESS, and by referring to this article readers can obtain full constructional details. These details also apply very closely to the construction of the smoothing choke, the essential difference being that the choke coil consists of only a single winding wound on a smaller spool, which in turn surrounds an iron core of smaller cross sectional area than that of the transformer.

The coil is wound with 4½ ounces of No. 38 S.W.G. enamelled wire on a ¾in. spool, and the winding should be carried out as firmly and evenly as possible, the starting and finishing leads being brought out through holes drilled in one of the end cheeks of the spool. The coil, when completed, may be covered with one layer of thin leatheroid, which protects the winding and improves the finished appearance of the coil.

The laminated core is next built up, for which 6 doz. pairs of No. 30a pattern stalloy stampings are required, and the whole assembly is tightly clamped together in accordance with the instructions already given for assembling the transformer, and the leads enclosed in insulated sleeving are connected to the terminals.

The chief requirements in the design of an efficient choke will be provided for if the choke is built to the constructional details given. These requirements are, generous dimensions of the iron core, as low a D.C. resistance as possible, and the inductance should be approximately 30 henries when the choke is carrying the full anode current taken by the set. This latter proviso is a necessary one, as the inductance of a choke varies inversely with the current which it is carrying. That is to say, the inductance becomes less if the current is increased, and if the current is reduced the inductance becomes greater.

The actual constructional work is now completed, and the next step is to assemble the components. The rectifier used is the Westinghouse style H.T.8, giving a smoothed output of 250 volts, 60 milliamps, in the voltage doubler circuit. This is a larger output than is required for present needs, but the H.T.8 was chosen in preference to a smaller rectifier, with a view to possible future requirements.

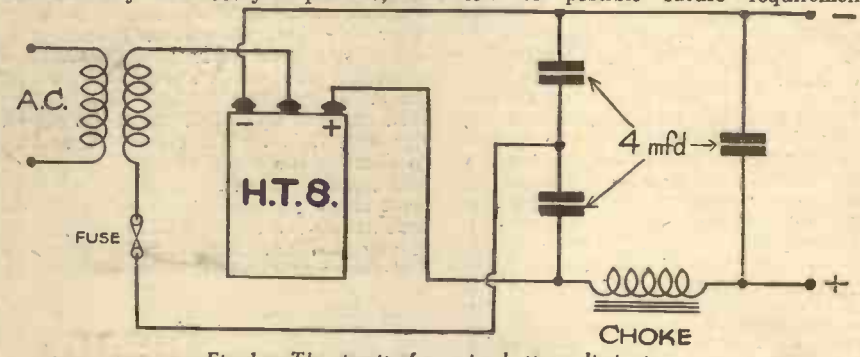


Fig. 1.—The circuit of a mains battery eliminator.

The reservoir and filter condensers are Ferranti 2 mfd. type. Six of these are required, four of them are for reservoir condensers and should have a working voltage of 200 volts, and the other two are filter condensers and must be of the 400 working voltage type. The Ferranti condensers are made only in 2 mfd. capacity, and 4 mfd. is obtained by connecting two such condensers in parallel.

The circuit arrangement for rectifying and smoothing is shown in the diagram, Fig. 1. A "Bulgin" fuse, blowing at 1 amp. should be incorporated in the primary circuit of the transformer, and one blowing at ½ amp. in the secondary circuit. The capacity values given for the condensers apply only if the frequency of the mains supply is at 50 cycles. If the supply is at 25 cycles, the capacity values must be doubled. The H.T. rectifier must be mounted in a horizontal position and not placed on end, but otherwise the positioning or layout of the components is not of great importance.

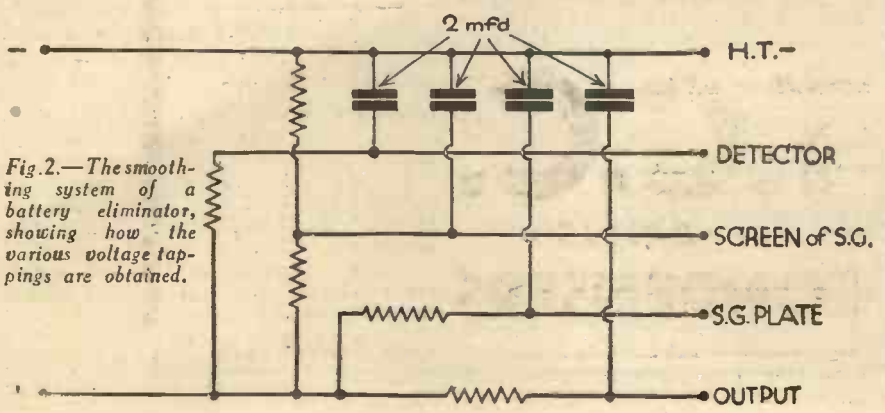


Fig. 2.—The smoothing system of a battery eliminator, showing how the various voltage tappings are obtained.

Voltage Dropping and Decoupling

We now have a smoothed output available, capable of delivering 250 volts, 60 milliamps, but before it can be used it is necessary to provide the means of obtaining the different voltages required by the valves in the receiver. Separate feeds are provided for each valve, and this is done by means of resistances and condensers. The problems arising from this are really quite simple ones, and are easily solved by the application of Ohm's law, which for our purpose may be expressed in a simplified form, as :—

Resistance required=volts to be absorbed, divided by current taken in milliamps, multiplied by 1,000.

We will assume that from the valve-maker's curve we ascertain that the approximate anode current consumed by the power valve is 30 mA. at 200 volts, the detector valve 3 mA. at 150 volts, and that the screened grid valve requires .5 mA. at 100 v. on the screen, and 2 mA. at 180 v. on the plate. The total current consumed by the set is therefore, 30+3+.5+2=35.5 milliamps.

Examining next the maker's voltage regulation curve of the H.T.8 rectifier, we find the 35 mA. position on the "smoothed current" line and we see that at 35 mA. the smoothed output of the rectifier is approximately 360 volts. This voltage is in excess of that required by any of the valves, so it must be lowered to suitable values. The maximum anode voltage required is 200 v. for the power valve therefore the output voltage from the rectifier must be dropped from 360 v. to 200 v. by absorbing the surplus voltage by means of a series resistance.

Applying the simplified formula already given, we find that the value in ohms of the resistance required is $\frac{160}{30} \times 1{,}000 =$ 5,333 ohms, and the nearest standard resistance obtainable would be used. Exactly the same procedure is adopted in calculating the values of the resistance required for the supplies to the other valves in the set.

Decoupling

We now come to decoupling. Each resistance, together with a fixed condenser, forms a decoupling unit in the circuit which forms the H.T. feed to the valve being supplied. The capacity of the decoupling condensers is 2 mfd. This value is adequate, and no advantage is to be gained by increasing the capacities. The condensers should be of the 200 working voltage type.

The object of decoupling is to prevent stray coupling between the different anode feeds to the valves, which would result in low frequency instability with the consequent possibility of "motor boating" and distortion. The circuit arrangement for decoupling and voltage dropping is shown in the diagram Fig. 2.

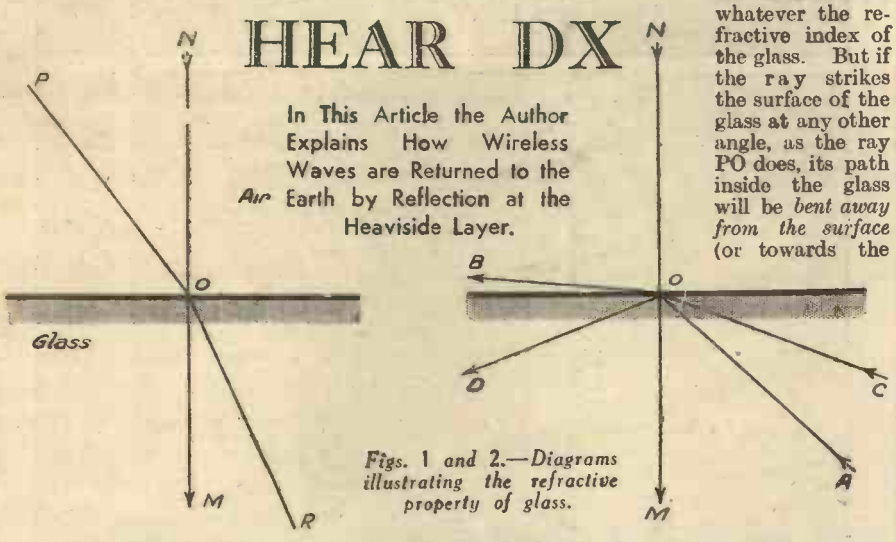
Two resistances are connected in series across the H.T. supply and by-passed to earth in the case of the feed to the screen of the S.G. valve. One of these resistances may, with advantage, be made variable, to provide for adjustment of the voltage to obtain the best results, but the actual potential applied is not really critical.

Wiring connections throughout are made with Glazite, or with copper wire, about 18 gauge, insulated with Systoflex sleeving. Neatness in laying out and wiring up the components will reflect itself in the finished eliminator. No connection to the lighting mains should be made until the apparatus is completely wired up. Provision for ventilation is essential, and the enclosure of the complete eliminator in an earthed metal case, while not absolutely necessary, is an added refinement.

In the construction of mains transformers or chokes to requirements other than those specified in this article, material assistance will be obtained by reference to PRACTICAL WIRELESS Data Sheets, Nos. 4 and 6.

HOW WE HEAR DX

In This Article the Author Explains How Wireless Waves are Returned to the Earth by Reflection at the Heaviside Layer.



Figs. 1 and 2.—Diagrams illustrating the refractive property of glass.

WHEN Marconi first demonstrated telegraphy-without-wires so many years ago the pundits of the time announced that although it was undoubtedly an interesting experiment, as a signalling system it could be of no practical use because the radiations would shoot off at a tangent to the earth and consequently nothing would be heard of them outside a comparatively small radius. Marconi had faith in his method, however, so he transported his receiver across the Atlantic, and showed that signals from England could be heard 3,000 miles away, wherefore the pundits had to think again. An explanation of this distinctly puzzling result was finally offered independently by the English and American physicists, Heaviside and Kenelly. Their suggestion was that the earth was surrounded, like a yolk by its shell, by a blanket in the upper atmosphere that reflected the signals back on to the earth. The kind of blanket that would do this would be a layer of ionised gas molecules, whose height above the earth they calculated as about sixty miles. This layer was our now familiar friend, the Kenelly-Heaviside layer. Many years elapsed before a method was devised to determine its height, but when measurements were made the results were in close agreement with the value predicted. Later on, in the course of some height measurements carried out on the then newly-introduced short waves it was found that the layer sometimes appeared to go up to more than twice its usual height; this phenomenon led Professor Appleton to suggest the existence of a second layer above the first, about 160 miles up, and the new layer, which was christened after its discoverer, is generally regarded as being mainly responsible for long distance transmission of short waves. I will try to explain how these layers actually reflect the wireless waves, but before doing so it is necessary to refresh my reader's memories of an important optical phenomenon.

What happens when a ray of light, travelling in the air, passes into a more dense medium such as glass? This depends on the angle at which it strikes the glass and a certain property of the glass called its refractive index. Suppose a ray of light starts in air at the point N in Fig. 1 and follows the path NOM, striking the glass at right angles; in this case it goes straight through without changing its direction whatever the refractive index of the glass. But if the ray strikes the surface of the glass at any other angle, as the ray PO does, its path inside the glass will be *bent away from the surface* (or towards the perpendicular NOM, called the normal by an amount that depends only on the refractive index, so that the ray will follow the path OR. This bending process is called refraction, and the refractive index is a measure of the bending ability of a medium. Now consider the opposite case of a ray starting inside the dense medium, glass in this case, and passing out into a less dense medium such as air; such a ray would be one starting at R and traversing the path ROP, and we see that on emerging into the air it is bent *towards* the surface of the glass, *i.e.*, the direction of bending is reversed. Let us take this a step farther. There will be one ray starting inside the glass which will be bent so much on emergence that it will come out only just skimming the surface of the glass. Such a ray is AOB in Fig. 1B and the angle between AO and the normal MON (the angle of incidence) is called the critical angle. From this it is quite easy to see that any ray striking the surface at an angle to the normal greater than the critical angle will not emerge at all, but will be completely reflected inside the glass as COD as in Fig. 2. This phenomenon is called total internal reflection.

Ionised Region of the Atmosphere

Now let us turn to the Heaviside layer. I have referred to it previously as an ionised region and now I must explain this term. A gas molecule is said to be ionised when some external agency supplies enough energy to detach an electron from it so leaving a free electron and a positively charged gas ion. An ionised region of the atmosphere, then, is one which contains a great many atmospheric-gas ions and free electrons; this is the state of the two upper layers. Of course, both ions and electrons will combine with other electrons or ions if they collide and consequently there is a continual recombination of molecules, but since at the same time there is a continual disintegration the aggregate effect is to maintain a constantly ionised layer. The recombination effect, whose rate depends on the gas pressure, is most important, as we shall see later. We cannot regard the ionised layer merely as a solid layer of ionised gas clearly defined at top and bottom, and whose ionisation is equally strong throughout. Quite to the contrary; the boundaries are very ill-defined and constantly moving and the density of ionisation is very much more intense somewhere near the middle than either at the top or bottom. For convenience in describing the mechanism of returning a wireless wave to earth the layer is generally regarded as a number of strata of different intensities of ionisation piled one on top of another, as indicated in Fig. 3.

The case of a radio wave entering a highly ionised medium from one of lesser ionisation is parallel to the case of a light wave entering a less dense medium from a more dense one; the electrical quantity corresponding to the refractive index (which increases with density) is the dielectric constant and the dielectric constant of a gas is decreased by ionisation by an amount proportional to the number of free electrons. Consequently a radio wave starting from a point T on the earth's surface and striking the bottom of the layer at O will, on passing into the more highly ionised region, be bent towards the surface of the layer; this refracted wave will then strike the next stratum of higher ionisation at P and will be bent still more nearly parallel to the surface so that it will enter the next more highly ionised stratum at such an angle that it strikes the upper surface of the stratum at an angle greater than the critical angle and hence undergoes total internal reflection, with the result that the wave is started downwards in the direction of the earth's surface. On its downward journey it is refracted at the boundary of each stratum in the opposite direction to that in which it was refracted on going up, being bent farther and farther from the surface. If the strata of the layer were absolutely parallel to one another and to the earth the angle of emergence RAB of the ray would be equal to the angle of incidence, TON, but this of course is unlikely to occur in practice. By continuing the paths TO and RA of the ray along the dotted lines until they intersect at X we have what is called the "equivalent path" of the ray, the path it would have traversed if it had gone straight up to X and been completely reflected there. The vertical distance of X from the earth is called the equivalent height of the layer and it is

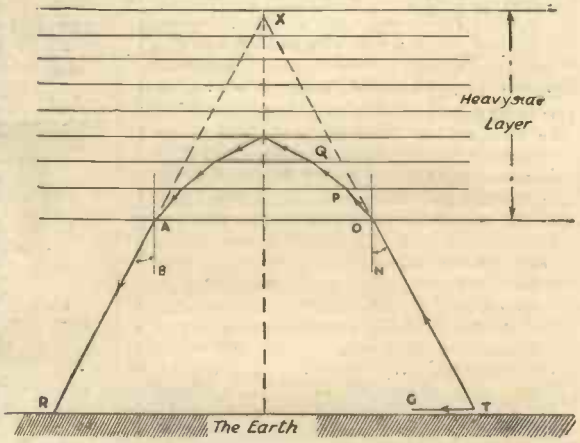


Fig. 3.—Illustrating how a wireless wave returns to earth after passing through the Heaviside layer.

clear from the figure that other things being equal the range of transmission represented by TR will be greater the more the equivalent height increases.

Refraction of Wireless Waves

We see then that the process of returning a wireless wave to earth is not truly one of reflection, but of refraction. In the case of long waves, however, the depth the wave penetrates the layer is so small compared with the wavelength that the process may be regarded as true reflection.

The bending power decreases with wavelength and short waves require a higher density of ionisation than long waves. Hence it is easy to see that some waves will be so short that they will not be completely bent round before they reach the upper strata of less highly ionised gas, which will tend to straighten them out again so that they will go right through the layer and not be reflected at all. It is also clear that small angles of incidence TON at the layer will make it necessary for the wave to go farther into the layer before it is bent round and this again may permit some waves to go right through. These short waves will then continue to go upwards until they reach the second, or Appleton, layer, which is much more highly ionised than the first. Here they stand a good chance of being returned, but even this is not enough for very short waves and there are good reasons for believing that waves below about eight metres go clean through the Appleton layer as well so that they are not reflected back to the earth at all.

Skip Distance Effect

We must now discuss a phenomenon known as the skip distance effect. A transmitter at T (Fig. 3) can radiate waves in all directions, the ray TO being one particular case, and so in addition to the so-called "air waves" or "indirect waves" to which TO is an example, there is a wave that clings close to the surface of the earth and is called the "ground" or "direct" wave. Because it is so close to the ground it encounters many sources of loss so that it is rapidly reduced in strength, the attenuation increasing very quickly as the wavelength is decreased, a twenty-metre ground wave seldom covering more than twenty miles. Suppose TG in Fig. 3 represents the distance covered by a ground wave and R is the nearest point to T at which the indirect wave is heard; then between G and R there will be a region where no signals at all will be heard; this is called the skipped distance. Skip effects are especially prominent on short waves.

Returning to the indirect wave we have to consider another important effect. Since the atmosphere is not a perfect dielectric waves passing through it will be attenuated, although this attenuation is very small indeed for all except very long waves. When the wave passes into the ionised part of the atmosphere the attenuation becomes very much greater, because it is proportional to the density of free electrons and this is, of course, much higher in the ionised layer than outside, where it is nearly zero. Short waves are also attenuated less than long waves in the ionised regions, which is one of the reasons for their utility for long distance work. In connection with the effect of the sun on radio however, the chief points of importance about the attenuation of waves in the ionised region are that it depends on the intensity of ionisation and the atmospheric pressure in the layer.

THE MAINS SUPPLY CHANGE OVER

An Explanation of the Reasons Governing the Change from D.C. to A.C., and the Advantages Which Will Accrue from the Change. By L. A. HODGES, Grad.I.E.E.

WITH the increased popularity of running wireless sets from the electric supply mains, the change-over system from direct current to alternating current, at present taking place in this country, is having a marked effect on many users of mains-operated sets. To the mains set owner a direct current supply seems to be just what he requires to adapt easily for his high-tension current and battery charging, since no rectifying apparatus is required as with alternating current. However, the current consumed in mains-driven sets is so small that the supply companies cannot let wireless preferences govern the type of electricity that they are to generate and distribute—there are far more important power users to consider.

It will be interesting to see just why a change-over to A.C. is taking place.

Demand for Standardization

As most readers know, there are at present A.C. and D.C. supplies at varying frequencies and voltages throughout the country. Electricity consumers (including mains set users) cannot with confidence buy a considerable amount of electrical apparatus, because if they move to different parts of the country, or sometimes a different part of the same town, the type of supply may be different and their apparatus rendered useless. Manufacturers cannot quote or supply for electrical apparatus without lengthy inquiries as to the type of electric supply available.

These inconveniences, coupled with the recent rapid growth in the demand for electricity, calls, in a definite manner, for standardization in the voltage and type of current to be supplied. This would give advantages to manufacturers and consumers alike; further, a standard system should reduce the cost of electrical apparatus and thereby probably increase the demand for electricity still more, and cheapen it. Consequently the big point arises: is it to be universally direct current or universally alternating current.

Advantages of A.C.

The Central Electricity Board is at present engaged, at a heavy expenditure, in securing the maximum efficiency in the generation and transmission of electrical energy. It seems to be generally accepted that alternating current systems are the better, from the supply company's point of view, as well as from the manufacturer's and the consumer's.

Concerning the electrification of a new area, the advantages of an A.C. system over a D.C. system are summed up as follows: 1. Reduction in capital outlay. 2. Reduction in maintenance and development charges. 3. Reduction in valuation for rating purposes. 4. Increased efficiency, with longer life of plant and network.

Where D.C. Systems Exist

In areas where a direct current supply exists the increased demand for electricity has caused these systems to be overloaded, and to make proper provision for the future it would, in some cases, be necessary to double or even quadruple the capacity of the system. However, the Electricity Commissioners have decided that in many cases like this it is less expensive to install an A.C. system (concurrent with the advantages of standardization and increased efficiency) to give the total capacity required, than to lay down more D.C. plant and network to give the extra required capacity. Hence the decision for an A.C. system for distribution throughout the country.

Concerning the Consumer

The maintenance charges of A.C. motors and control gear are less than those of the corresponding D.C. plant. A.C. is more adaptable to all classes of electric furnaces and heaters. Certain types of high-temperature furnaces, electrode water-heaters, and a large variety of electro-medical apparatus cannot be made for use on D.C. Engineering firms find A.C. a necessity for the many resistance welding methods. For city areas the use of Neon signs as advertisement has brought the advantages of A.C. to the front. Where D.C. systems are already installed the supply companies carry out, at their own expense, any alteration to consumers existing apparatus to make it suitable for the A.C. change-over supply.

These claims for A.C. distribution, in addition to the generating advantages, form an overwhelming case in favour of installing A.C. systems, or where D.C. systems exist, a change-over to a standard supply of alternating current throughout the country.

Mains Wireless Sets

Concerning mains-operated wireless sets, there seems no doubt that, taking all things into consideration, a set can be operated more efficiently, more safely, and much more economically on A.C. than on D.C.

So that on the whole, the standardization of A.C. supply is all to the good from everyone's point of view.

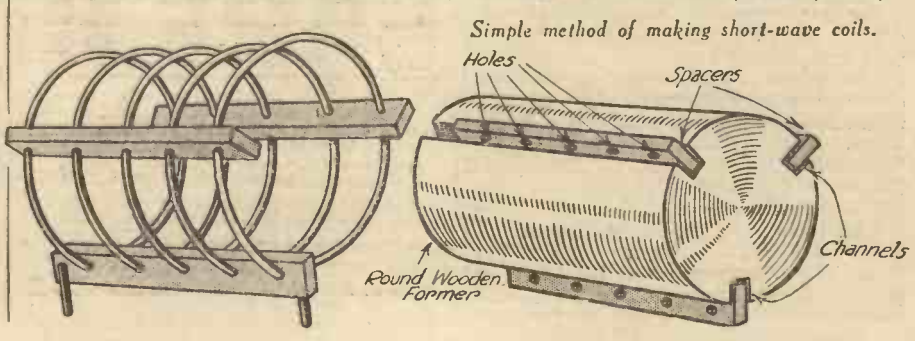
Making Short-wave Coils

A REALLY neat job may be made of a home-constructed coil, of the type illustrated, if a special but inexpensive former is used for shaping the turns.

This former consists of a round piece of wood, about 2½in. diameter and 6in. long—a short length of stout curtain pole will do—with channels cut along it. In these channels are slipped the ebonite spacers, ready drilled with holes to take the wire, which should be 16 or 18 gauge, enamelled. The depth of the channels must be such that the spacing holes come just level with the surface of the former.

The wire is then threaded through the holes, and bent to the circular shape of the former as it is eased on turn by turn. When the required number of turns is reached, the whole coil can be slipped off, down the channels, with each turn equally and neatly circular.—W. H. CAZALY (London, W.C.).

Simple method of making short-wave coils.



RADIO CLUBS & 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.

SLADE RADIO

It was a members' night at the meeting of the above society held last week, and suggestions for lectures were invited, and a very large number of these were forthcoming. After this members were asked to raise questions on any point which had not been clear to them in the lectures during the past quarter. A number of members availed themselves of the opportunity and in each case a satisfactory answer was given. The innovation proved very popular, and will be repeated at a later date. Anyone interested in wireless is invited to attend the meetings, full details of which can be obtained on application.—Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

THE NEW ZEALAND D.X. CLUB

This club welcomes reports from members on stations of interest. Certificates for the best reports of the month will shortly be issued. The "Club Notes" will shortly be here, containing items of interest to every member. New members are welcomed and the fee is only 2s. 6d., which includes membership badge and card. Lists of stations are supplied, and bulletins issued, to make your hobby much more interesting. Those interested should write to Mr. S. Cullen, 33, Dilston Grove, London, S.E.16, the London representative.

THE KETTERING RADIO AND PHYSICAL SOCIETY

The first annual Radio Exhibition to be held in Kettering will take place on September 14th, 15th and 16th at the Co-operative Central Hall, Kettering. This Exhibition, which is being sponsored by the above Society, will take the form of exhibits by local dealers, and in addition Television, short-wave transmitters and receivers—including those used on 56 m.—and several other experimental sets will be shown.—R. Pankhurst, secretary, 9, Shakespeare Road, Kettering.

RADIO SOCIETY OF GREAT BRITAIN

The following letter from the British Empire Radio Union (British Section International Amateur Radio Union) has just been received by the High-Vacuum Valve Co., Ltd., 113-117, Farringdon Road, London, E.C.1:—

Sir,

Attention of Mr. S. de Laszlo.

On behalf of the Council of the Radio Society of Great Britain, I wish to thank you for the kindness extended to a number of our members on Saturday last, when they were conducted around your works in Farringdon Road, London.

I have had an opportunity of obtaining impressions from several of the persons who were included in the party, and all expressed extreme interest in the methods used for assembly and pumping. As a point of additional interest "Hi-Vac" valves have been recommended by the designers of short-wave receivers and frequency meters described in "A Guide to Amateur Radio," recently published by my Society. "Hi Vac" valves have also been employed successfully in 56 m/cs (5 metre) transmitters and receivers operated by certain of our members. (Signed) JOHN CLARRICOATS, *Secretary*

EXPERIMENTAL TRANSMISSION TESTS

We have received the following letter from Dr. Cecil G. Lemon, Electrical Research Laboratory, 72a, North End Road, West Kensington:—

Sir,

I am carrying out a series of tests on Radio Transmission utilizing various kinds of transmitting antennae on wavelengths of 42.2 m. (7,097 k/c.) and 5 m. (56,000 k/c.). The times of the transmissions are as follows:—

From Monday to Friday.—5 m.: 10.45 p.m. to 11 p.m., telephony. 42.2 m.: 11 p.m. to 11.15 p.m., telephony.

Sunday.—42.2 m.: 10.30 a.m. to 11 a.m., telephony. 5 m.: 11 a.m. to 11.30 a.m., telephony. 42.2 m.: 11.30 a.m. to 12 noon, telephony.

The tests commenced on Monday, the 28th ult., and will continue till Sunday, the 10th inst. My call sign is G2GL, and the address of the station is given above.

I shall appreciate any reports upon my transmission, and all reports will be duly acknowledged.

C. G. LEMON.

SOME D.C. DODGES

Useful Hints on the Construction of Simple Eliminators.

By G. HOWES.

NOWADAYS, owing to the increase of the extent of the grid scheme, listeners on A.C. are generally more often catered for than D.C. listeners. In this article a few hints and circuits

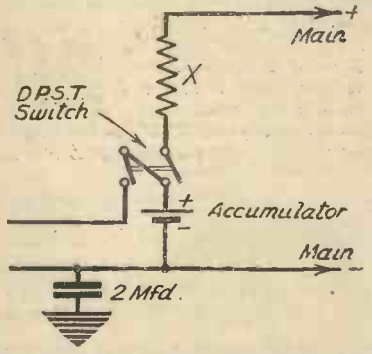


Fig. 1.—How the accumulator may be charged from D.C. mains.

are given which can be applied to any D.C. circuit with success.

Charging Accumulators

The first problem is that of obtaining L.T. This either means a periodic journey with an accumulator to a charging station or the use of special D.C. valves and associated resistances. Fig. 1 shows how to charge the accumulator.

To take an example: Suppose a 3-valve receiver takes a total L.T. current of .45 amps. Then some suitable resistance will have to be found to insert at X to pass about ½ an amp. To calculate this, use Ohm's Law, *i.e.*, that the current flowing is equal to the voltage divided by the resistance.

Thus by substituting current and voltage, assuming for this example that the latter is 200 v.

$$\frac{1}{2}=\frac{200}{X}$$

where X is the unknown resistance.

From the above, it is evident that the only value of X which fits is 400 ohms. Therefore the resistance must have a value of 400 ohms: but the power used by the circuit is equal to the current squared times the resistance, *i.e.*, C^2R=power (in watts).

$\therefore (\frac{1}{2})^2\times 400$=power.

$$=\frac{1\times 1}{2\times 2}\times 400=\frac{1}{4}\times 400=100 \text{ watts.}$$

Thus the power used is 100 watts (approximately) and, consequently, a 100-watt lamp can satisfactorily be used. The reason that the power is only approximately 100 watts is that, owing to the fact that the accumulator's 2 volts oppose the mains voltage, only 198 volts are used to pass the current of ½ amp. A double pole single throw switch is necessary and should be connected as shown.

Eliminator Construction

After L.T. comes the question of providing H.T., which with D.C. is a fairly easy problem. In Figs. 2 and 3 are shown two circuits, illustrating how ordinary L.F. transformers, new or old, may be used to make eliminators. The additional resistances shown are made by coating strips of marble, stone or asbestos with grate polish. For the potentiometer P (Fig. 3), a strip 2ins. long and ¼in. wide, coated fairly heavily and tapped in the centre, is all that is necessary. The resistances in Figs. 2 and 3 are all about 1in. long and ¼in. to ½in. wide, coated one side only.

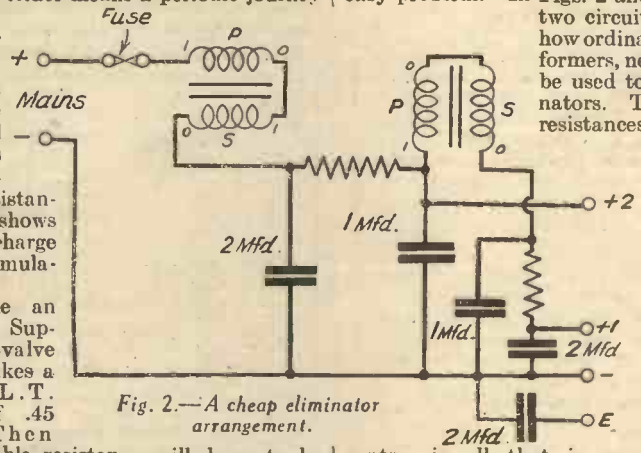


Fig. 2.—A cheap eliminator arrangement.

With an eliminator made as in Fig. 2, the tappings on the maximum voltage give 40 mA. at approximately 100 volts and 15 mA. at approximately 160 volts.

In view of the fact that these eliminators can be built for a few shillings, they are well worth trying. One word of warning is necessary, however: before manipulating a home-made eliminator, make a stout metal cover to fit over the baseboard and apparatus.

This will prevent any danger of receiving shocks, whilst if an earth connection is joined to it, the cover will act as a good screen.

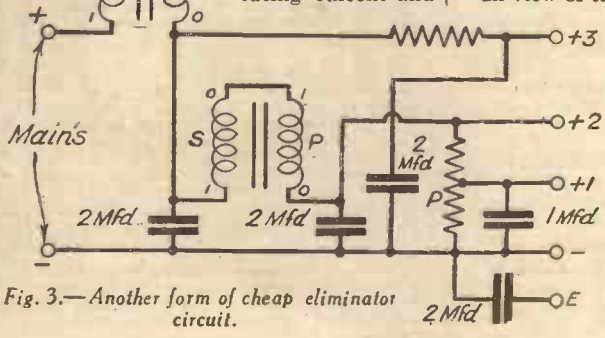


Fig. 3.—Another form of cheap eliminator circuit.

Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by his correspondents

"Real Reader Service"

SIR,—It is difficult to express in writing my appreciation of your journal. I visited the Radio Exhibition, and had several queries to put to your technical staff. I might say that I received better attention at their hands than at any other stand in the Exhibition. This I consider to be real reader service.

In conclusion, I would like to add that I consider PRACTICAL WIRELESS to be the best paper ever published for the wireless amateur. It has set a very high standard, and *kept it up*. The show numbers were particularly interesting, and lived up to their title by providing a really practical and efficient guide to the Show.—H. E. QUINN (Highbury).

Gramovision

SIR,—Besides being interested in wireless I am also interested in television, although, as yet, I don't know much about it. I have a suggestion to make. Why not make a gramophone record of a televised scene. It would facilitate experimenting and making adjustments during the day when none of the available transmitters are working. Of course, the reproduction would not be so good, but I should think it would make a good substitute, like the radio-gram. I am a comparatively new reader, but I must congratulate you on producing such a fine practical paper.—J. G. ECCLES (Beds.).

A.C. Fury Four Radio-Gram.

SIR,—A few particulars of my "A.C. Fury Four Radio-gram," which I have recently completed, may be of interest. It is absolutely the best set I have handled, and it gave me great pleasure to build. I have built or rebuilt over twenty sets for friends and acquaintances. I completed the whole of the work in a small top back room equipped as a workshop. The set was built last April and actually tested on April 16th (Sunday) at 6.15 p.m. Paris on the long wave at this time came through at almost unbelievable strength and quality. The set and mains pack were simply laid out on a table and the W.B. Speaker propped against the wall. But what a test. Everyone concerned was delighted and, except to reduce the volume, not a thing was altered. I have taken PRACTICAL WIRELESS from the start and look forward to my weekly treat. Many congratulations for such a fine and trouble free A.C. set.—F. C. H. COLE (Harlesden).

A Bouquet from Rochdale

SIR,—Considering the number of periodicals that have been published on wireless, it is nothing less than wonderful that in these days of perfection, and more or less standardization of reproducing apparatus, you should have evolved a paper which is absolutely practical, remarkably constructional, and at the same time entirely different from any other. To be different does not always mean better, but in your case, no one could seriously suggest that you were not leading the field. However, I have said enough to show you how much I appreciate your work, and I wish you every success.—HORACE CHADWICK (Rochdale).

From a Reader in the Far East

SIR,—As a wireless constructor beginner, may I congratulate you on your admirable practical weekly, to which I have been a subscriber since its inception. Also, I can certainly recommend to others the "Short-Wave Two," in "Tested Circuits," by F. J. Camm.

May I point out that you promised, in issue of November 5th, 1932, page 353, to give us the "Experimenter's Short-Wave Three," which is so anxiously awaited by we exiles from home.

I again thank you for such excellent, interesting, and practical articles for the beginner, and trust that we may have more on the Short Waves, which is *the* band of interest to the wireless enthusiast in this country.—JAS. R. DAY (Rangoon, Burma).

[The article on The Experimenter's Short-Wave Three was published in our other journal, *Hobbies*, for January 21st and 28th, 1933. These issues can be obtained from our publishing department for 8d. post free.—ED.]

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT the product of amperes squared and ohms gives the power in watts.
—THAT the square root of the power in watts divided by ohms gives the current in amps.
—THAT iron has a resistance approximately six times greater than that of copper.
—THAT mercury is nearly ten times greater than this, or approximately sixty times greater than copper.
—THAT a mains transformer should not get hot under normal working conditions.
—THAT practically every form of man-made interference may now be removed.
—THAT special units will shortly be obtainable for incorporating automatic volume control in a receiver.
—THAT the battery superheterodyne will come into its own next season.
—THAT the popular mains multi-stage valves will shortly be obtainable for battery users.

NOTICE

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 addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, 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.

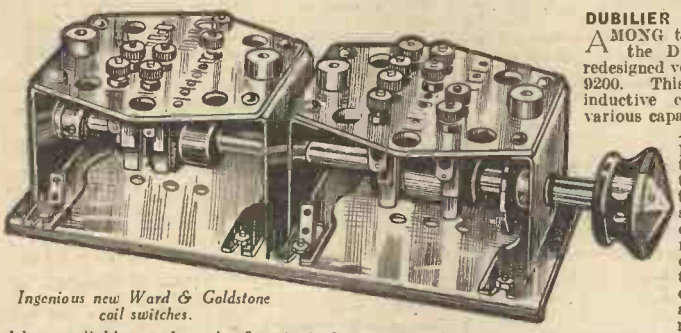
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

WARD AND GOLDSTONE COIL SWITCH

SOME very efficient coils are manufactured by Messrs. Ward & Goldstone, but these are not of the type which include a switch in the base. Consequently, when two or more of these coils are included in a receiver it is necessary to arrange a multi-contact switch on the panel and to run wires from each coil to the switch. In some cases this may result in instability unless the wires are efficiently screened. Furthermore, the layout of a receiver with coils arranged in this manner is not always very neat. To overcome these defects Messrs. Ward & Goldstone have introduced a special switch unit chassis, and a two-unit chassis is illustrated below. It will be seen that a solid aluminium baseplate is provided with mounts and a combined switch rod. Cams are provided on this rod, and terminals and contact fingers are fitted to the coil mount. In addition to the wave-change contacts for each coil a S.P.D.T. switch is fitted for pick-up switching, and a pair of contacts for switching the L.T. supply on and off. A special fitting is also provided at the end of each chassis to accommodate a Q.M.B. switch for use with mains receivers, the chassis in this case costing slightly more than the battery model. The control knob is engraved with indications for "Off," "Medium," "Long" and "Gramo," and the cost of the model illustrated is 8s. 3d. for the battery model, and 9s. 6d. for the mains model. A 4-coil unit costs 15s. and 17s. 6d. respectively.



Ingenious new Ward & Goldstone coil switches.

J. B. LINACORE BAND PASS TUNER

MESSRS. JACKSON BROS. have introduced a very neat complete Band Pass Tuner which obviates the difficulties of accurate trimming and ganging. It consists of one of the well-known J.B. three-gang condensers with the addition of three screened iron-core coils, a combined reaction and volume control, and an on/off and radio-gram switch. The complete unit makes the erection of a highly-efficient receiver a really simple matter, and the wiring is reduced to a minimum. The new straight-line dial is fitted to the condenser drive, and the control for this is fitted on the right of the complete assembly. On the left is a combined control for switching, etc., and the straight-line dial is mounted centrally above these two controls. This results in a very neat layout and also enables the complete unit to be built in a very compact manner. The Unit is intended, of course, for a circuit comprising an H.F. valve followed by a detector, and band-pass tuning is provided for the input circuit, and H.F. transformer coupling, with reaction, for the detector grid circuit. The complete unit costs 69s. 6d.

T.C.C. CONDENSER ANTI-INTERFERENCE UNIT

AMONG the many new interference eliminators which have been introduced this season the new T.C.C. component is one which calls for attention on account of its neatness of design and general efficiency. In appearance it is not unlike a large T.C.C. condenser with the double fixing lugs moulded into the case. At the top is a twin-fuse holder, and a substantial earthing terminal. The unit consists of two high-voltage test T.C.C. condensers designed for working on 250 volts raw A.C. or 450 volts D.C. These are joined in series with an earth connection from the centre point, and the input from the mains is connected, *via* a fuse, to each side of the two condensers. This is, of course, the standard method of removing mains interference, and it must be remembered that this will not effect a cure in every case. There are many forms of interference which call for special attention, but where the mains are badly smoothed, or interference from a motor or some similar apparatus is fed to a receiver *via* the mains the unit will be found most useful in removing at least the greater part of the interference. The price is 9s. 6d. complete.

DUBILIER CONDENSERS

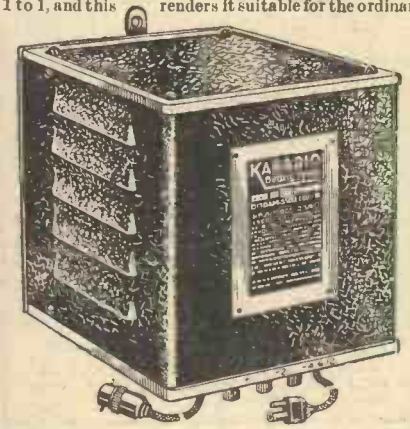
AMONG the new developments in the Dubilier components is a redesigned version of the popular type 9200. This is a cylindrical non-inductive condenser, obtainable in various capacities from .1 to 10 mfds.

A difficulty which was previously encountered in this particular model was that the metal case was too near the terminals and short-circuiting sometimes occurred due to the connecting wires coming into contact with the case. In the new design the top is domed and the terminals are so disposed that the risk of shorting is almost removed. In addition the bottom of the metal container is provided with a coarse thread and a small cap is screwed on to the lower end and is fitted with screw holes. The great advantage of this idea is that the small cap may be screwed to the base and any value condenser screwed into it and is then held firmly in position. Changes in values may thus be carried out and the condenser is at the same time held firmly in position. The prices remain unchanged, namely 2s. for the lower value and 16s. for the 10 mfds., with proportional rates for intermediate values.

Some neat dry electrolytic condensers are also announced, and these are obtainable in aluminium cases and also in impregnated cardboard containers with connecting wires fitted to the ends. These are especially suitable for grid bias smoothing purposes.

NEW BRITISH RADIOGRAM COMPONENTS

WE have received three interesting new components from the British Radiogram Company, and these include an L.F. Transformer, a Class B Driver transformer and a Class B choke. The Transformer is rated at a ratio of 3 to 1, and has a primary resistance of approximately 1,000 ohms. It is admirably suited for inclusion in the anode circuit of a small L.F. valve, but better results are obviously obtained by means of the parallel-fed arrangement. It is a very small component, measuring less than two inches tall, and being just over one inch wide. The overall response is very good for such a small component, the price of which is not at the moment fixed, but which will probably be about 5s. The Class B Driver has a primary resistance of approximately 300 ohms and the secondary is of similar rating. The ratio is thus 1 to 1, and this renders it suitable for the ordinary type of Class B valve. A test showed that the component was perfectly satisfactory in all the normal Class B circuits, the inclusion of tone compensating devices acting in a perfectly normal manner. The Output Choke is designed to provide three ratios, namely 1 to 1, 1.5 to 1, and 3 to 1. The total D.C. resistance is only 450 ohms, although, of course, this is of no importance in the Class B circuit. The load offered is suitable for the normal type of Class B valve and results are fully up to standard. The prices of these two Class B components are not yet decided upon, but they will be no doubt in the neighbourhood of seven or eight shillings.



On page 755 of our issue dated August 19th, we included a photograph of two Crypto Chargers, and owing to a misunderstanding described one of these chargers as the Karadio apparatus manufactured by the same firm. The Karadio apparatus, which is manufactured by the Lancashire Dynamo & Crypto Ltd., is illustrated above, and the two pieces of apparatus illustrated on the page above-mentioned are both Valve Rectifier Battery Chargers.

NEW TELSEN IRON-CORE COIL

AMONG the many new Iron-core coils which we have received, the new Telsen coil possess many novelties. It is used, as readers will no doubt have noticed, in the new A.C. Three receivers described in this issue, but its various characteristics are not described in that article. The actual dimensions of the coil are smaller than any which we have so far received, and the method of winding also differs in several ways. The former is of bakelite, and the core is inserted from the base. The medium-wave winding is of enamelled wire wound in strict solenoid fashion (in contrast with the majority of Litz section-wound coils now available). The long-wave winding is wound in slots at the lower end of the former, and a reaction winding is situated in these slots and is designed to cover both wave-bands without switching complications. To enable the coil to be kept compact no switching is incorporated, and to avoid losses due to inefficient wiring to the coil the reaction winding has been internally connected to one end of one of the windings so that only six terminals are now fitted to the base. The method of winding enables the coil to be used in the aerial circuit (with a periodic aerial coil) or as an H.F. transformer, and the actual windings are so arranged that selectivity and sensitivity are of a much greater order than with the ordinary air-core coil. The coils cost 8s. 6d. each.

The two receivers illustrated above were included on page XV of the Show Supplement in our issue dated August 26th, but the wrong descriptions were applied to them. The receiver on the left is the Varley model A.P.48, a self-contained 5-valve Superhet. The model on the right is Model A.P.52, a Superhet Radio-gramophone which includes automatic volume control and other modern refinements.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

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.

H.F. INSTABILITY

"My receiver has been built up from ideas which I have obtained through reading your interesting book. I have adapted various components which I have had by me, and the result is shown on the attached sheet. Unfortunately, I have apparently not yet fully understood wireless, as the set won't work. Can you offer any suggestions as to the reason. When I switch on all I can hear is a high-pitched whistle, and I have yet to hear a broadcasting station. Any suggestions will be thankfully accepted."—T. G. B. (Preston, Lancs.).

You do not give any details regarding the actual results which are obtained, and it is therefore rather difficult to offer a really helpful suggestion. However, after carefully examining the layout and the various parts which you have bought or used, and bearing in mind your remarks regarding a whistle, we are definitely of the opinion that the H.F. side is unstable. You should at least screen the coils from one another, as well as arrange the parts in a more regular manner. The whole arrangement is rather haphazard, and as you are using a rather efficient valve we think you will find that it will be very difficult to stabilize the circuit without adequate screening between the two H.F. and detector stages. We shall be glad to help you again if this does not result in stabilizing the circuit.

UNDISTORTED OUTPUT

"I am very anxious to work out the various technical details of my receiver, and your data sheets and other interesting data has been of great use to me. Unfortunately, I have not yet found a formula for working out the undistorted output from a power valve, and I should like to find this out for myself without accepting the valve-maker's figures. Can you give me the formula for working this out?"—A. L. (Kensington).

There are several different ways of working out the undistorted output of a valve, but the following formula will probably be found the most accurate :—

$$\text{Output} = \frac{kI}{2}(V - kIR_1) \text{ watts.}$$

where
$k = .6$
I = Normal anode current (in amps).
$V = nG_V$.
n = Amplification factor.
G_V = Normal Grid Bias.
R_1 = Valve impedance.

SCREENING LEADS

"I am building a mains receiver, and think it advisable to screen some of the leads. I know that special screening sleeving is obtainable, but being an electrician I have quite a lot of lead-covered lighting cable on hand. Is there any objection to my using this for wiring, and connecting the lead covering to earth? I believe that lead is as good as the ordinary thin copper screening that is used, but should like your confirmation."—W. T. (Bromley.)

We do not recommend the use of the wire you specify. From your remarks we believe that you intend to use the wire for all leads, which would certainly not do. Certainly one or two leads may be screened with advantage, but the indiscriminate use of covered wire (especially with the large surface which is exposed in such wire) will inevitably lead to instability. Where you do employ this wire, make quite certain that the earth connection is of low resistance, by scraping the surface of the lead cable before wrapping the connecting wire round it.

DATA SHEET No. 51.

Cut this out each week and paste it in a notebook

OUTPUT TRANSFORMER RATIOS

Valve impedance. ohms.	Speech coil impedance. ohms.	Transformer Ratio.
1,000	4	22 to 1
	10	15 to 1
	14	12 to 1
2,000	4	33 to 1
	10	20 to 1
	14	15 to 1
4,000	4	45 to 1
	10	25 to 1
	14	22 to 1
8,000	4	65 to 1
	10	40 to 1
	14	33 to 1

NOTE.—The ratios given are the nearest commercial ranges which are obtainable. The Impedance of a speech coil is approximately double the D.C. resistance.

PICK-UP SWITCH AND SUPERSET

"I have examined your new set, the Superset, and should very much like to make this up. Unfortunately, however, I notice that the pick-up switch is on the back of the baseboard, and this will be impossible to operate from the front of the receiver. As I wish to put the gramophone in a radio-gramophone cabinet I am unable to make the set, as I cannot use the switch. Can you give your reasons for putting the switch in such an awkward position, and let me know whether I can put it in a sane position on the front of the panel."—G. J. (Nottingham).

We are afraid you have overlooked the theoretical considerations which govern the design of a receiver in an endeavour to make the receiver suit your own requirements. First of all it should be unnecessary to point out that the grid lead is broken to insert the gramophone switch, and if the switch were mounted on the panel, this would result in a grid lead being brought from the coil up to the panel and then back to the grid wire, resulting inevitably in hum or instability. If you must use your cabinet you will have to install your own remote control for the switch, but we must remind you that the receiver has been designed as a whole to be fitted into the Osborn cabinet, wherein the switch is easily controllable.

BUILDING RECEIVERS FROM OLD COMPONENTS

We have had many requests from readers who wish to build modern receivers described in our pages, and who also wish to utilize the components from an existing set. In many cases these sets are two or three years old and we do not, therefore, recommend the use of the old parts in the construction of modern receivers. Whilst in many cases the components may be of high-class design and quite expensive in their time, they may be quite unsuited for inclusion in a modern receiver, due to their physical characteristics as well as their electrical characteristics. If, therefore, you wish to build one of our Guaranteed Designs, and have a receiver already in use, our advice is to try and sell the present receiver complete, and purchase the new parts for the new receiver. This will not only save disappointment, but will result in the acquisition of modern apparatus which will give the utmost satisfaction.

ADDING AN L.F. VALVE TO THE FEATHERWEIGHT

"I live in the remote districts of Cornwall, and have built the Featherweight Portable. This gives splendid results on several stations, but I find that Daventry 5XX, and several long-wave foreigners are not sufficiently loud to be really comfortable. The volume on the West Regional is more than sufficient for home use, and several other short-wave stations come in at similar strength, but I cannot build quite a lot up to what I call full room strength. Would you advise me to add a stage of L.F. coupling between the detector and the driver valves? If so, what will be the connections?"—G. H. (St. Ives).

We certainly do not recommend any alteration to the published circuits which appear in PRACTICAL WIRELESS, but you may, of course, build a receiver to incorporate the arrangements which we show. Thus, you may build a five-valve portable, in which the arrangement of the Featherweight is utilized, plus an intermediate L.F. stage, but we must remind you that we do not guarantee such a circuit, nor can we undertake to help you in redesigning the circuit. A great deal of time and thought is expended in arranging a receiver to function satisfactorily, and the whole lay-out may have to be changed in order to insert your intermediate L.F. stage, with the result that you may spend many days before you get the set in a stable and efficient condition.

FREE ADVICE BUREAU

COUPON

This coupon is available until Sept. 16th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 9/9/33.

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. Newnes, 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.

UTILITY COMPONENTS

SEVERAL new lines are shown in the new season's catalogue just issued by Wilkins and Wright, Ltd., including Mite Gang Condensers. These are small but efficient instruments and are obtainable either with diecast or steel frames. Bakelite ganged and single condensers with disc dials; full vision dials; micro-dials; a straight line dial complete with a .0005 condenser; a combined volume control and reaction condenser; and anti-capacity switches with silver contacts are amongst other new components listed. Constructors desirous of using high quality components of modern design in their sets would do well to obtain a copy of this catalogue. The address is Utility Works, Holyhead Road, Birmingham, 21.

COLUMBIA RECEIVERS AND RADIOGRAMS

WE have received two folders from the Columbia Graphophone Co., Ltd., one dealing with the C.Q.A. Battery Four, a high-class receiver giving tone and volume comparable to an all-electric equivalent model. Embodying three-stage band-pass tuning, Q.P.-P. pentode amplification, and a P.M. moving-coil speaker, this model is priced at eleven guineas. The other folder deals with the C.Q.A. Battery Radiograph, a high-class instrument embodying all the latest improvements, the selling price of which is twenty guineas. Interested readers can obtain copies of these folders by applying to the firm at 98–108, Clerkenwell Road, London, E.C.1.

G.E.C. RADIO

AN attractive folder issued by the General Electric Co., Ltd., displays a new range of superhet. all-mains receivers. Two 5-valve models, one for table use, priced at fourteen guineas, and the other of the console type priced at seventeen guineas, are shown, and also two 8-valve models. The table model in this series is listed at twenty-one guineas, and the console model at twenty-four guineas. There is also the G.E.C. Superhet 5 Radiogram, priced at twenty-five guineas. All the 5-valve models are fitted with an illuminated index dial, a moving pointer indicating the name and wavelength of the station received on a full vision illuminated tuning scale. The 8-valve models have a vertical tuning indicator, a moving oblong of distinctive colour indicating the wave band. Keen selectivity, ample volume, and flexibility of control are appealing features of these fine sets. A copy of the folder can be obtained from Magnet House, Kingsway, London, W.C.2. Ask for G.E.C. Radio, 1933–4 Folder.

FULLER BATTERIES

FOR upwards of sixty years the name of Fuller has been associated with battery construction, coupled with the highest possible quality of materials. This reputation is fully maintained in the range of accumulators and dry batteries shown in this firm's latest price list. Accumulators suitable for multi-valve receivers, or for lighting and ignition purposes are obtainable in glass, celluloid or ebonite cases. There is also a range of Fuller 2-volt "Non-Spill" accumulators, and dry batteries for all purposes. Copies of this list can be obtained from Fuller Accumulator Co., Ltd., Woodland Works, Chadwell Heath, Essex.

VARLEY COMPONENTS

A FINE range of Varley components is given in this firm's new season's list. Particulars and prices of "Nicore" tuning coils, together with their associated equipment, are given; also the "Nicore" A.V.C. Unit, a compact and efficient little component which enables automatic volume control to be fitted to almost any type of receiver. Other components include a compensating R.C. coupling unit, power potentiometers, wire-wound resistances, L.F. transformers, various Q.P.-P. and Class "B" components, and a useful range of L.F. chokes. Messrs. Varley have also sent us a batch of instruction folders with diagrams showing the connections for their components in various circuits. These folders should prove very useful to home constructors, who can obtain copies of the catalogue and folders from Kingsway House, 103, Kingsway, London, W.C.2.

THE COSSOR 3456 MODEL

In our issue dated August 5th, 1933, we gave a test report of the new Cossor 3456 Model receiver. In this article the price was erroneously given as £19 19s. It should, of course, have been £9 19s.

THE THREE-STAR NICORE

We described, in our issue dated June 24th last, a receiver with the name "The Three-Star Nicore." In this receiver a unique component known as the Duovol was employed for controlling reaction and the bias on the H.F. valve on a single control. The makers of this component, The British Radiophone, Ltd., now inform us that they have decided to withdraw this component owing to the fact that it is difficult to set this control to give smooth working on the various types of valve which might be obtained by the constructor. Consequently, it will be necessary to employ two separate components in future models of this receiver, and a new circuit will appear in our pages in due course.

CHANGE OF ADDRESS

SIR,—We beg to advise you that we have removed our offices and stores from 129, Park Lane, to:—
54, WELLINGTON STREET, LEEDS, 1,
where new premises have been prepared for us containing larger office and stores accommodation, which will enable us to hold more comprehensive stocks of goods manufactured and dealt in by us. We shall also have extensive showrooms displaying modern lighting fittings, domestic electrical apparatus, telephone equipment and industrial electrical materials.

Our telephone number—Leeds 27395 (Private Branch Exchange)—and telegraphic address—"SIEMENS, LEEDS"—remain unchanged.

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LIMITED, A. M. Hicks, Secretary.

"THE ALL-WAVE TWO"—PETO-SCOTT PRICE CORRECTION

In the advertisement of Peto-Scott Ltd., which appeared in our August 26th issue the details and price of the Kit A were omitted, owing to an error in proof reading. The wording of the advertisement should read "Kit A Authors kit of first specified parts including Peto-Scott Metaplex chassis, ready drilled panel, but less valves, cabinet, and speaker. Cash or C.O.D. Carriage Paid £4 2s. 0d."

The novel Mullard Stand at Radiolympia.

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REPLIES TO BROADCAST QUERIES

MOSS (Exeter): Many thanks for your information. RAC WIRE (Poplar): Athlone (IFS); sponsored concert. The announcements are in English and Gaelic. MEACHEM (Bletchley): PAOIM, Dutch experimental amateur (M. B. Gorter, 30, Pieter de Hooghstraat, Amsterdam); (2) Cannot trace GB6AD, as call appears to be incorrect. The call-letters of the s.s. *Bremen* are DDAS; (3) Details required by transmitters are: Call heard, locality of receiver, time of reception, signal strength; receiver used, quality of transmission and any other information you may care to give. PRALESS (Glasgow): PAOOPA, J. W. Wehkamp, Radio Centrale, Markt, 21, Coevorden (Holland); cannot trace PAOQPA and PAOLOP in latest lists. Advise you to write to *Nederlandsche Vereeniging voor Internationale Radio Amateurisme, Post Box* 400, *Rotterdam* (*Holland*). We do not know the address of G6ZT; would advise you to send your advice of reception to Radio Society of Great Britain, 53, Victoria Street, London, S.W.1.

P. W. Gift Stamp No. 50

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