

HOW "P.W." SETS ARE TESTED

Popular Wireless

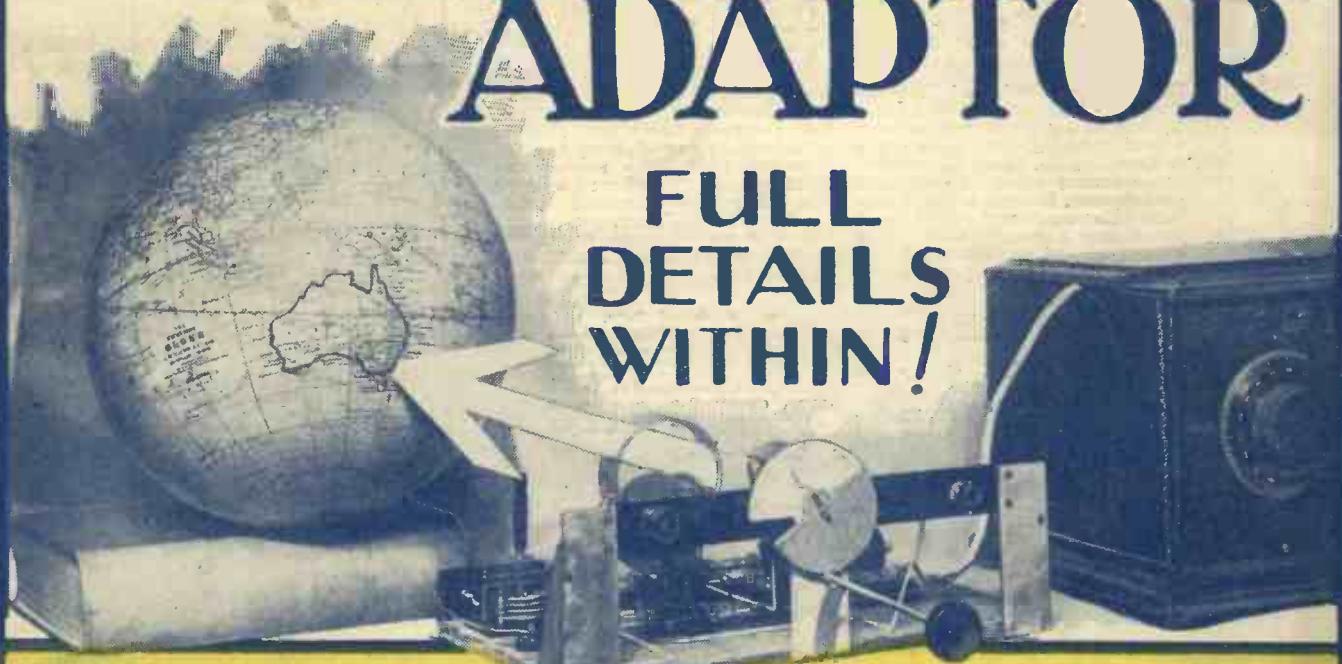
No. 375. Vol. XV.

INCORPORATING "WIRELESS"

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August 10th, 1929.

The 1929 "ANTIPODES ADAPTOR"

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 A Short-Wave "Titan." Trouble-Tracking Tips

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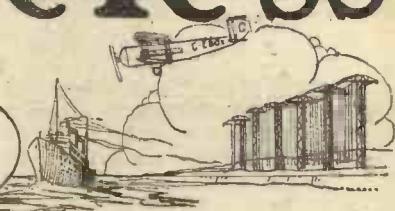


**BRITAIN'S
STRONGEST
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Popular Wireless



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HEAT DROPS.

A MECCANO MAN.

OLD VALVES NEVER DIE.

ALL MAINS RADIO.

RADIO NOTES & NEWS

Heat Drops.

THE burning weather of July seemed to affect the B.B.C. programmes ; they rather sagged, and the Queen's Hall concerts alone can dull their memory. The most conscientious man I ever heard of was he who refused to "top up" his battery during the drought, though he is closely followed by the man who had his "earth" in a sheltered place and rather than spare it a bucket of water gave it a gallon of beer !

The Progress of Telephony.

SLOWLY, but surely, the world is being covered with a network of wireless telephone services. The latest addition is the restricted service from this country to Buenos Aires via Paris or Berlin. At present the hours are from 5.30 p.m. to 9 p.m., and the charge £2 3s. per minute, with a minimum of three minutes. Calls can be made from London only at present, but the service will be extended to the provinces later.

A Man with Meccano Ears.

SELDOM has a louder howl of joy been delivered by our readers than that which they emitted over the first letter dealt with in "Radiotorial" for July 20th, wherein our correspondent wrote : "I assure you that my ears are in perfect order. Also I have thoroughly cleaned them and put them together again correctly." All our crystal-users want to know how it is done. Awkward if someone said "Have one ?" whilst the organs were in bits in the sink. Reminds me of the ad., "Two-valve set, suitable for beginners with one dial and inside visible."

The National Orchestra.

THE great new National Orchestra which the B.B.C. has formed is expected to give its first public performance on October 18th at Queen's Hall, being the first of a series of twenty-two weekly symphony concerts. This orchestra is a hundred strong and includes about ten women, the members having been selected from some thousand applicants. I think that those of us who have sympathy with symphonies are going to have some wonderful evenings.

Short-Wave Eclipse.

WRITING in June from East London (S. Africa), L. J. M. says that he was experiencing an almost total wipe-out on short waves, a phenomenon he

found to be observed by other people in his town. Not only were 5 SW and PCJ barely audible, but in some instances not even their carrier-waves could be heard. Apparently he met a "long fade," or else some seasonal effect came into play. Despite our advantages over the old astrologers, we are still very ignorant of the effect of celestial bodies upon terrestrial affairs.

had, with that abandon which marks the lovelorn adolescent, thrown his D.E.5, box and all, into the furnace. Twelve hours later the remains were rescued. The box was burnt off but the pins and glass seemed to be all there, and on being plugged into the set this salamandrine valve delivered 2 LO all umptydoodle. Our office boy doubts this, saying that the heat would have expanded the vacuum and burst the bulb.

A JOB FOR JUMBO !



As the elephant could not go to 2 LO, engineers interviewed Jumbo at the Zoo, and persuaded him to broadcast for the Children's Hour.

"Old Valves Never Die."

AND very few good ones fade away. The latest story about the durability of the modern British valve is provided by the Marconiphone Company. One of their customers found that his handmaiden

the royalty and the price of the valves. The 12s. 6d. per valve holder basis of royalty was adopted as a simple and convenient means of fixing the royalty ; hence on a two-valver the total royalty was 25s., even

(Continued on next page.)

THE STAR GAZER.
ABOUT A DETECTOR.
SOUTHERN CROSS
FLIGHT.

"All-Mains" Radio.

M^R. HERMAN DAREWSKI tells an amusing tale in the "Sunday Sentinel." He says that whilst having a cup of tea in a country cottage he noticed a radio set, and in course of conversation with the presiding greybeard, asked him :

"Have you taken out your licence ?"

"Not me," was the reply.

"Oh, and why not ?"

"Cause we aren't connected to the wireless station. We're connected to the water-tap."

The Royalty Affair.

THERE seems to be a widespread misunderstanding as to the effect of a reduction of the Marconi royalty upon the price of valves, many papers indicating that this will be reduced accordingly. As I understand the matter, there is no direct connection between the amount of

NOTES AND NEWS.

(Continued from previous page.)

though the set was sold with 5s. valves, or without any valves at all.

Ultra-Violet Storms.

AS a victim of an ultra-violet installation, I am much interested to see how this nuisance is tackled in various countries. In some the law has come down heavily on the owners of the apparatus, and in others the authorities lend advice as to how to stop the interference. In Germany, however, the law steps politely aside, washing its hands of the business, and announces that the public must deal with the problem themselves. Apparently our own authorities don't worry either way—and perhaps that's our fault.

Transmitting Note.

I REGRET that in the note on this subject in our issue of July 20th, the call-signal used by Mr. H. Osborne, 77, Barrett Road, Walthamstow, E.17, did not appear. It is G 5 N C, and if you hear it perhaps you will be good enough to take observations and report them to Mr. Osborne. (The omission was due to the printer mistaking the call-sign for a laundry mark.)

London Symphony Orchestra.

PERSONALLY, I rejoice at the news that the B.B.C. has signed a contract with the London Symphony Orchestra for three years. Seventy-five picked players forming a permanent orchestra, with the deputy system abolished! We may look forward to some excellent performances if only the items are selected with as much care as were the artistes. In passing, however, let us drop a word of praise for the Birmingham Orchestra. A good, hard-working collection of people to whom we owe much. May they never run out of wind or resin.

Wireless Conducting.

TALKING of orchestras, the indefatigable mind of man, to be precise, Dr. E. Fisher's mind, has conceived a means whereby several orchestras separated by large distances can be conducted simultaneously by radio. Plans are being matured for a try-out of the scheme at Zurich on September 1st, when Dr. Fisher will conduct orchestras in London, Paris, Berlin and Milan. They are going to play a hymn to the honour of the tenth Assembly of the League of Nations, which meets on September 2nd.

Matrimonial Bureau Up to Date.

ACCORDING to a writer in "World Radio," a very pretty piece of broadcast publicity was permitted by a Japanese station, when a young lady, who asserted that she has a complexion like velvet (colour not stated), and brown eyes like moons, plus a life competence for two, announced her willingness to wed a young man with a good figure and to share a tomb of red marble. Talk of the tomb strikes one as *de trop* in an instance of this kind, but the velvet and moons ought to rouse up plenty of applicants. How drab the next B.B.C. news bulletin will seem now!

The Star Gazer.

IF you think this is a colloquial allusion to the Astronomer-Royal, I can't help it.

The fact is, there is a bit of a how-d'ye-do in philological circles about the B.B.C.'s book on pronunciation, and for the moment the fight rages round "geyser," either the hole in the ground which spouts hot water, or the gadget in the bathroom which won't. "Geezer" is all right, but sounds like rudeness. "Gazer" is the posh way, and is recommended for tea-parties. But, oh, hasn't the B.B.C. started something?

A Matter of History.

MR. A. H. Shirley, writing in the "Oxford Times" in reference to "atmospherics," and means of combating them, says, apropos of his experiments in the Navy: "We once did bring out what was known as the 'balanced

SHORT WAVES.

A SHORT STORY.

Once upon a time people who talked to themselves were known as madmen. Now they are known as radio lecturers.

How to obtain volume on your wireless : Place a book on it.

"Wireless on drifters," runs a headline in the "Bulletin and Scots Pictorial." We wish the one in the flat, below would drift quite a long way!

A Zulu chief once courted grief, By owning a radio ; For he bought a set that was geared to get Ten thousand miles or so.

And his wifely crew of thirty-two, Were forced to pawn each trinket ; While he took a look, in a shady nook, At the book on "How to sink it."

But there came a day, so the natives say, When he reached the end of his rope ; And learned, too late, his financial state Was four times worse than broke.

Then a maid found out, as she cast about For ways to wreck men's hearts, That a swell headdress, as perhaps you'll guess, Could be formed of radio parts.

Now it may seem queer, but a bright idea Was born to the Zulu bold ; For he opened a store on the ocean's shore, And bartered his "parts" for gold.— "Radio Times."

"If you are a DX fan, use a small opaque-shaped bulb as the only source of illumination."—"Radio News."

"Petting Rule Holds for Radio; Best Results in Dark."—Headline in paper.

crystal, and this instrument undoubtedly did do something," etc. It surely did, though it was a demon to handle, but unless I am much mistaken, the "balanced crystal" circuit was invented by Capt. H. J. Round whilst he was trying to tackle X's at Manaos, Brazil, and was patented by him and the Marconi Co.

About a Detector Valve.

H. D. (Haverhill, Mass., U.S.A.) waxes ecstatic over the performance of his set, which was built from "junk," and which I judge to be Det. 1 L.F., with reaction. He has had 5 S.W. fifty consecutive nights to his great content, and lays most of the credit at the door of his 610 Cossor valve, which he uses as his Det. We don't often get a letter from the U.S.A. in praise of British goods, so his letter is

doubly welcome, though the explanation may possibly be that he himself is British. Massachusetts folk are, I believe, more cordial than some others towards us.

Battery Endurance Test.

VALVES are not the only things which are strong enough to be trampled by elephants, etc., without turning a hair. It is not generally known that the ignition battery, an Exide, on the winning Alfa-Romeo car in the Junior Car Club's Twelve-Hour Race, got loose from its holding-down bolts and careered along dangling from its own connecting cables. In spite of the rough going which Brooklands provides at high speeds the terminals held and the battery ran the car successfully to a bright green finish.

Pos. or Neg. ?

J. L. (Sheffield) makes the interesting revelation that he has made about twelve sets of various kinds, and the only ones which have given him satisfaction were "earthing" positive. He adds that these sets gave fifty per cent "better volume" than those "earthing" negative. Percentage of sound volume is very difficult to judge, and I am inclined to think that fifty per cent is a bit high. However, this is a subject which admits of much discussion and I should welcome the views of other readers.

Jellied Watts.

THE most notable development in the accumulator which I have seen for some time is the new type the electrolyte of which is a jelly. In order to permit the escape of the gas the jelly is accommodated in a honeycomb structure. Obviously we have here the "great unspillable," and the cell can be fixed in any position. Presumably there is no need to "top up," as the loss from evaporation must be negligible ; arrangements are made to keep the jelly damp. I do not quite understand how the jelly operates uniformly on the plates, or what happens to the jelly when the cell is fully discharged, but apparently the idea works well.

The "Southern Cross" Flight.

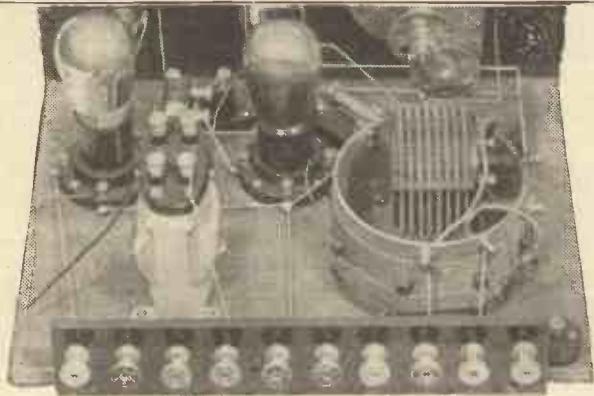
THOSE intrepid and determined airmen, Captain Kingsford Smith and his colleagues, did not disdain to use radio during their remarkable flight from Australia to England, and as a result were rewarded with much valuable data which was collected by their operator, Mr. McWilliams. Their receiver covered the wave-range 18 metres to 2,700 metres. Valve specialists will be interested to hear that the tubes chosen for this set were S.215, D.E.L.410 and D.E.P.410, all of Osram make.

Potted History.

THE following is a condensed edition of an article in "World Radio" showing the history of broadcasting in Scandinavia. Begun in Norway in 1924 ; nine stations and a 50 kw. nearing completion, licence fee, 22s. 6d.; listeners licensed, 65,985. Begun in Sweden in 1925, seven stations, and a 50 kw. being built ; licence fee, about 10s.; licences issued, 400,000; population over six millions. Begun in Denmark in October, 1922. Licence fee, about 11s.; licensed listeners about 230,000.

ARIEL.

A SHORT-WAVE "TITAN"



THE writer believes that he was the first amateur in England to hear a broadcasting station in South America, and therefore the first to hear all six Continents. The following description of

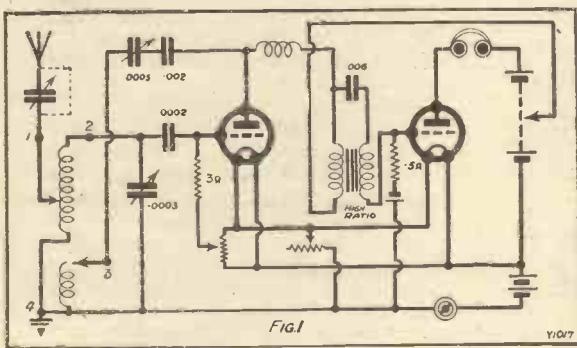
metres with more than two turns in circuit.

A clip is used for the aerial tap, usually about three or four turns from the earth end of the grid coil. A second clip is used to vary the number of turns in the grid coil.

The "broadcast" coil is almost a standard "Titan," and therefore requires no description. The only way in which it differs from the standard is that the "wave-change switch" is mounted on an ebonite disc, screwed to one end of the loading coil. The whole then being mounted on a base similar to that of the short-wave coil. Fig. 3 shows the difference made to the circuit by the addition of the

"Titan" coil; that part of the diagram enclosed by dotted lines is mounted on the base, the connections being numbered.

The H.F. choke is interchangeable, a plug-in coil being used. A No. 50 coil is suitable for the short waves, whilst about



the receiving station may be of interest to readers of POPULAR WIRELESS.

The receiver covers the medium and long wave-bands, as well as the short waves of from 13 to 70 metres. The broadcast bands are covered by a "Titan" coil which is interchangeable with the short-wave coil. The set was first designed as a short-waver, but when the "Titan" sets were described in "P.W." the set was adapted to that circuit by a plug-in system.

Interchangeable Coils.

The short-wave circuit is shown in Fig. 1. The method of L.F. coupling deserves attention. The L.F. transformer can have as high a ratio as 9 to 1, with a consequent gain in signal strength, and no appreciable loss in quality. The writer is using at the moment a 4 to 1 and a 5 to 1 transformer connected in series.

The coils are mounted on a four-pin plug-in base, the connections to which are numbered 1 to 4 in all diagrams. Fig. 2 shows the short-wave coil. This consists of 12 turns of 18 S.W.G. bare wire on a 3 in. by 3 in. ebonite former of the "ribbed" type. The pillars which support the coil and base (Fig. 2b) are made from an old lead-in tube.

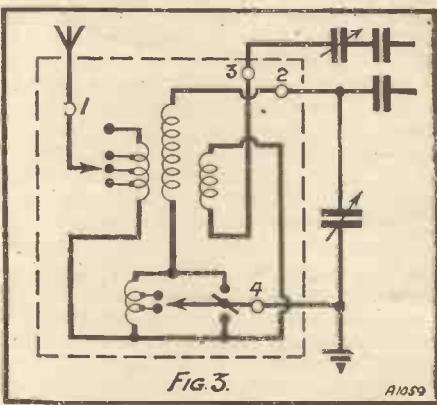
The reaction coil is spaced $\frac{1}{8}$ in. from the earth end of the grid coil; it has 7 turns of 36 S.W.G. tapped at the second and fourth turns. These tappings connect

"A Station from every Continent"—such are the results obtained with the efficient short-waver described below.

BY A CORRESPONDENT.

300 turns is required for the medium band. A "midget" condenser is connected in the aerial lead, which can be shorted out by a second aerial terminal.

The set requires rather more care in construction than many of the simpler types of broadcast sets, but the trouble taken is well repaid by the results obtained, both from the point of efficiency and ease of wave-change and operation. It may be found difficult to operate on the low waves because of a somewhat large grid-tuning condenser, but this is



necessary if the set is to be used on the long waves.

It would be useless to give a list of stations received, but it may be said that a telephony station has been heard from every Continent, together with many amateurs and European broadcasting stations.

REMINDERS AND WRINKLES.

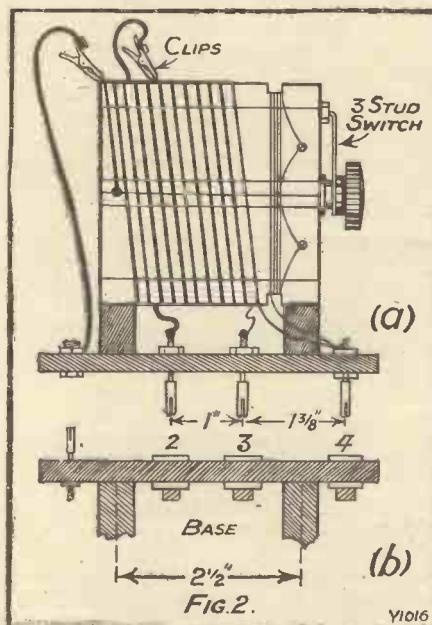
White spots upon accumulator plates are a sign that sulphation is setting in.

One of the best checks upon the condition of a low-tension battery is the specific gravity of the electrolyte.

Use distilled water to make good any loss by evaporation in your accumulator, and never allow the level of the liquid to fall below the top of the plates.

If your set is a portable with frame aerial remember that the connection from aerial to set is probably by flexible leads, and with constant wear these may deteriorate.

If you use an earth connection to a water-pipe make sure that the pipe is not painted or dirty, as such connections depend for their efficiency upon being affixed to a thoroughly clean surface.



THE R.M.A. AGREEMENT.

Full details of the successful negotiations that have now been concluded, thus leaving everything "all-clear" for the coming season.

By THE EDITOR.

OUR readers may have seen in the newspapers that a new agreement has recently been concluded between the Radio Manufacturers Association and the Marconi Telegraph Company. The amateur, who has in many ways benefited because of reduced royalties during the last twelve months, should continue to benefit; for the agreement provides for a definite reduction of the Marconi royalty from 12s. 6d. to 5s. on each valve holder of a broadcast receiving set. In other words, the royalties which were reduced in consequence of the order made by the Comptroller-General of the Patent Office (but which were reversed by Mr. Justice Luxmoore) will continue to hold good because of this private agreement between the Radio Manufacturers and the Marconi Telegraph Co.

5s. Each Valve Holder.

Mr. J. T. Mould, the Chairman of the Radio Manufacturers Association, in discussing the negotiations which led up to the agreement, said that the Radio Manufacturers Association had agreed to a five years' agreement whereby members of the R.M.A. pay royalties on all receiving sets, whether under patent or not, for a period of five years, at a rate of 5s. on each valve holder.

Also, the Radio Manufacturers Association gives the use of their patents to the Marconi Company and H.M.V. Gramophone Co. The R.M.A. gets added to the licences leased to them by the Marconi Co. all patents present and future that are controlled by the Marconi Company and H.M.V. Gramophone Company. This probably includes all the patents of the Radio Corporation of America, the General Electric Company of America, and German and French Associated Companies.

In addition, the Eliminator patent is thrown in, and also an undertaking that infringers shall be prosecuted unless an independent arbitrator awards otherwise.

Good Effects All Round.

Of course, the main thing as far as the listener is concerned in this agreement is that the royalty is definitely reduced and confirmed at 5s. per valve holder.

We should like to offer our congratulations to the Radio Manufacturers Association on this very successful outcome to a dispute which might have ended in a much more troublesome way; and we should also like to congratulate the Marconi Company for the very generous and open-minded way in which they have dealt with the situation.

There is no doubt that this mutual arrangement between the R.M.A. and the Marconi Co. will have very beneficial effects upon the radio industry, and the cloud which has been hovering over the trade ever since Mr. Justice Luxmoore's decision gave the Marconi Co. the right to re-impose the 12s. 6d. royalty has, we hope, now been dissipated, and all augurs well for a most successful radio season.

We notice in our contemporary, "Television," some comments upon the B.B.C.'s decision not to grant the request made by the Baird Television Co. for certain guaranteed periods for television transmission.

It appears that a writer in "Television" asks his readers to believe that influences have been continually working in the background with the object of retarding, if not holding up altogether, the progress of television—or, at any rate, British television. And there is further reference in this article to a "hidden hand."

Force of Circumstance.

This is very melodramatic and, of course, suggests to readers not in touch with the television situation, intrigues of a Phillips Oppenheim nature. But, as a matter of fact, there is no force working in this country to-day against British television, and certainly no particular force working against the Baird Company.

The only force—if one may use the term—is the force of circumstances, plus the fact that there are some people in this country to-day, especially on the engineering side of the B.B.C., who, while thoroughly agreeing

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that the Baird system of television is a meritorious achievement, have the courage to face the fact that, under the present system of broadcasting, where wave-length difficulties, etc., are even worse than they were twelve months ago, it is not practicable to go right ahead with a full blown television service; and it is not even practicable to grant permission for television transmissions in programme hours such as were asked for by the Baird Co.

A Television Station?

The B.B.C. offered quarter-hour periods three times a week, and if the Baird Company really feel that their system was indisputably "the goods," they could have taken that offer, never mind how dissatisfied they were with it, and have proved to the public that their system merited a more generous concession.

Exactly what will now transpire it is difficult to say, but we understand that the Baird Company intends approaching the Postmaster-General and requesting him to exercise his influence on the B.B.C. with a view to getting the request they made accepted. Failing this, we understand that

attempts will be made to start a separate broadcasting station for the sole purpose of giving regular television transmissions in this country.

If the wave-length situation permitted, we should welcome it, because we have always felt that a certain amount of competition with the B.B.C. would be an excellent thing. But facts are facts, and the situation does not permit it. It is therefore extremely unlikely that the Postmaster-General will grant a concession to an independent body to start its own broadcasting station.

In the meantime, we strongly recommend the Baird Company to take what they can get from the B.B.C., even two or three quarter-of-an-hour period transmissions a week, and at least give themselves an opportunity of demonstrating to the public the truth of what they have so often claimed for the Baird television system.

USING AN H.T. UNIT.

TO secure freedom from hum an H.T. unit must be capable of supplying sufficient current to the plates of the valves, it often being wrongly assumed that providing the unit is marked to give the required voltage, the current supply can look after itself.

Some mains require more smoothing than others, and some sets seem particularly sensitive to the slightest trace of hum in certain stages. It is worth remembering that, in general, a hum is more noticeable in a set employing anode-bend rectification than a set employing the grid-leak and condenser detector. Where it is particularly desired that anode-bend rectification should be used, it will often be found an advantage to modify the method of obtaining this. Generally the grid of the valve obtains a negative bias through a fixed resistance of the grid-leak type, but very often the hum will disappear if this resistance is removed, its place being taken by an H.F. choke.

Stopping Hum On Short Waves.

It sometimes happens that when a set is converted to short-wave working a hum appears which hitherto has not been noticed. Upon the short waves this may be sufficient to deprive the set of the remarkable range it is otherwise capable of on the higher frequencies. In nearly all short-wave sets it will be found that the detector is particularly sensitive to humming interference, so that extra smoothing should be provided in the plate lead to the detector if possible.

Often the extra smoothing obtainable by the insertion of an L.F. choke (an L.F. transformer will do, either primary, secondary or both) in the H.T. lead to the detector valve will be sufficient to overcome the trouble. On that side of the choke which is not connected to the H.T. supply take a lead to a large fixed condenser, the other side of which is joined to earth or filament leads.

A final tip which may prove of value in obstinate cases is that of connecting H.F. chokes or large tuning coils of 500 turns or more in series with the supply mains to the unit.



I HAVE a friend living in the West Country who is apt to talk in some such strain as this: "It's all very well for you fellows in town, with a local station on the doorstep, and 5 G B only in the next parish. I'll bet some of your sets wouldn't be so wonderful if you tried them out under my conditions." He finds it quite hard to believe me when I say that in many ways I envy him!

When I have on various occasions taken a set down and tried it on his aerial, it has performed so well that it has been hard to understand the complaints of the local residents about their dud conditions. The absence of swamping effects from a local station is such a refreshing change to the town dweller that one can only marvel at the way the distant stations roll in every few degrees round the dial on even a simple set, and consequently one is apt to forget

Every new "P.W." set goes through an elaborate series of tests which has been worked out very carefully to provide the most perfect guarantee of good behaviour in our readers' hands which we can devise. That part of the testing which deals with the investigation of a set's actual performance is described below in this interesting article.

By G. P. KENDALL, B.Sc.

about the difficulties of fading and Morse, which really do make such situations very difficult ones.

Not This Way !

Quite probably there may be many "P.W." readers who have similar ideas about the testing of sets under London conditions. It is only natural for people who live a long way from a main station to suspect that set designers who live in a broadcasting centre test their products by tuning in the local station and 5 G B, and then, if they come in well, let it go at that, and to assume that all will be well at greater distances. It has occurred to us,

therefore, that it may not be time wasted to try and explain very briefly how "P.W." sets are actually put through their routine tests.

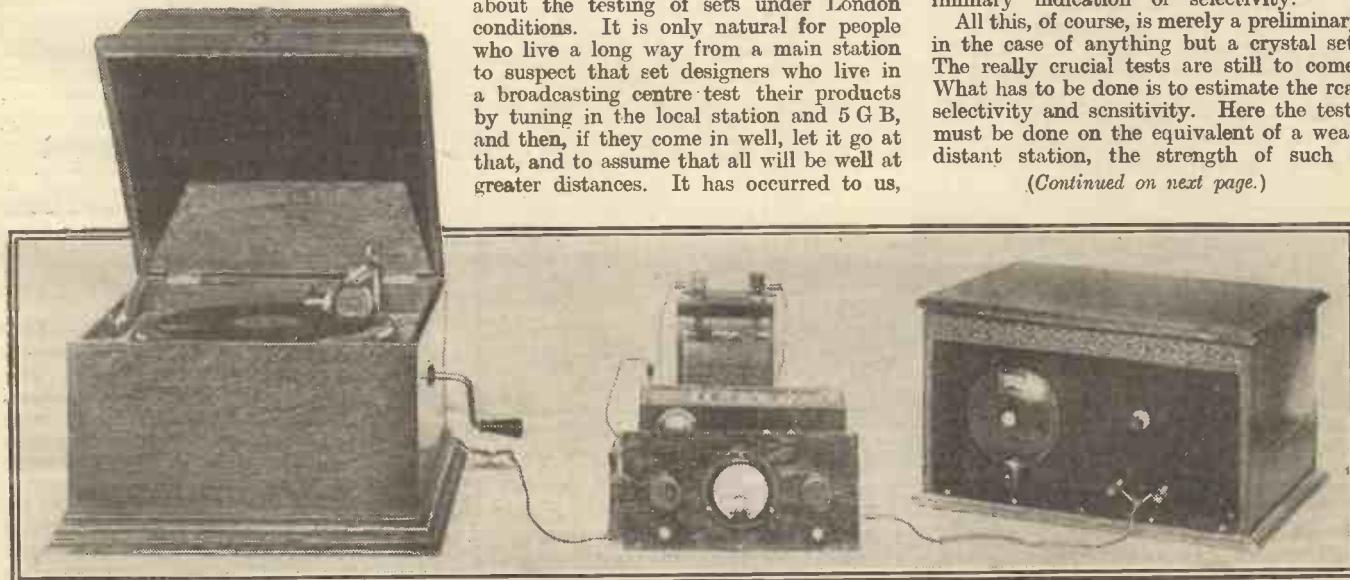
Let us just follow through the tests of a set of moderate size and see what happens. First of all, it goes on the test bench and is connected up. Before any attempt is made to receive signals the reaction control is tested and any peculiarities are noted. Next, the local station is tuned in, and is listened to for some time to permit the standard of quality to be noted.

Quality and Selectivity.

It is, of course, of little use to estimate the volume of the local (we are only about one mile away from 2 L O !). Next, 5 G B is tuned in, and the exact volume noted carefully, having due regard to the size and nature of the set, and also the ease of separation of 5 G B from 2 L O as a preliminary indication of selectivity.

All this, of course, is merely a preliminary in the case of anything but a crystal set. The really crucial tests are still to come. What has to be done is to estimate the real selectivity and sensitivity. Here the tests must be done on the equivalent of a weak distant station, the strength of such a

(Continued on next page.)



The apparatus which provides the equivalent of a weak distant station of adjustable strength and wave-length. On the left is the gramophone drive unit with its pick-up; in the centre is the single-stage amplifying and volume-control panel with a Weston milliammeter for checking purposes. The oscillator and modulator unit is on the right, and the current supply to this is from the mains. The assembly shown is a "photographic" one. In use the gramophone drive and control units are in the test room, and are connected by a line to the oscillator in a distant room.

HOW "P.W." SETS ARE TESTED.

(Continued from previous page.)

signal denoting the true sensitivity, and the ease of its reception without interference from the local when placed on a nearby wave-length, giving a reliable measure of selectivity.

We have found that actual distant stations are too erratic in strength to be entirely satisfactory for this purpose, and so we have devised a rather elaborate "artificial" scheme, which we find works out very well indeed in practice. The scheme is simply to use a very weak, locally-produced imitation of a distant station's transmission, which can be adjusted to almost any degree of strength and placed upon any desired wave-length on the ordinary broadcast band of 200-550 metres.

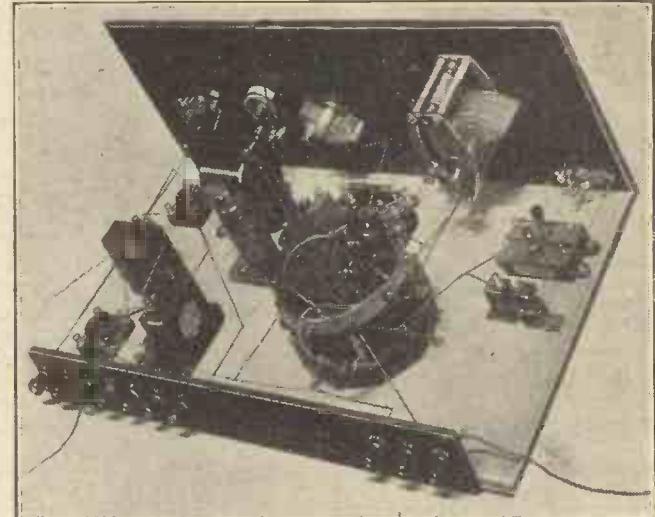
The "Distance" Test.

The essence of the scheme is really no more than a heterodyne wave-meter, that is to say, an oscillating valve wave-meter, which, as the reader will no doubt know, radiates a continuous wave like the carrier-wave of a broadcasting station in miniature. This oscillator is placed in a comparatively distant part of the building, in order to avoid direct picking-up on the coils of the receiving set, and so to imitate real conditions more closely. Constancy of strength is quite easily obtained within reasonable

radiation in a very simple way by means of a gramophone and pick-up. The output from the pick-up is taken to a single-valve amplifier panel with the necessary system of volume controls, and the output from this amplifier goes across to the little oscillator outfit, which includes a choke control modulator valve, which imposes the speech and music upon the radiation of the oscillator valve.

The complete outfit of gramophone and pick-up, amplifier panel, and oscillator and modulator unit are shown in a photograph accompanying this article, in connection with which it should be pointed out that the instruments were all lined up on a bench for the occasion of the photograph, whereas they are normally separated considerably, for the sake of convenience of running the tests. For example, it is usually desirable to have the little oscillator in quite a distant room, while the gramophone and amplifier are in the test room, connection from one to the other being made by means of a twin lead.

this way a very reliable indication of selectivity is obtained. Again, actual conditions can be imitated in various other ways, auxiliary apparatus permitting the introduction of various degrees of hetero-

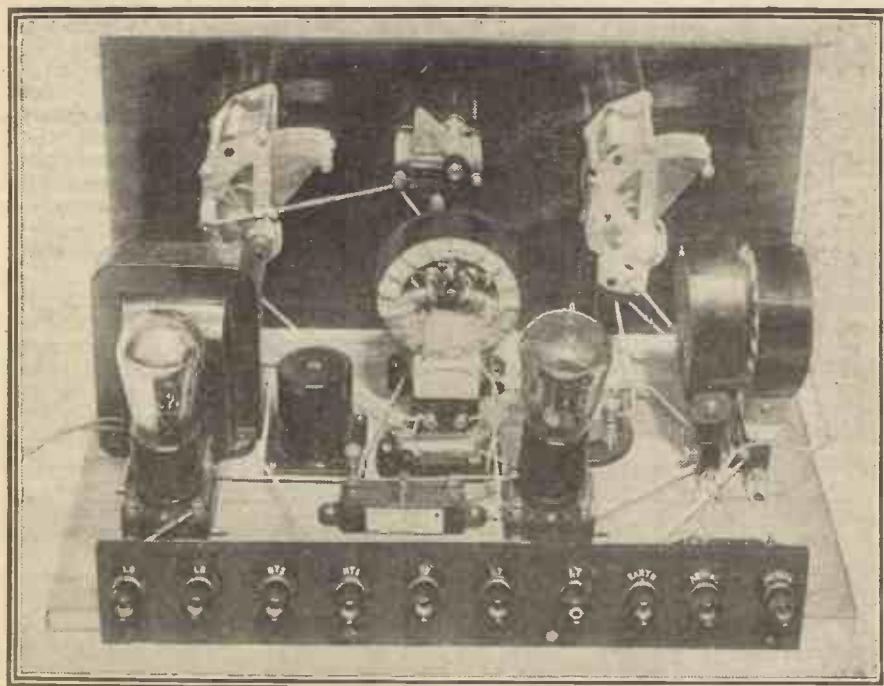


The "Prague" Three, with its twin-wave trapping scheme, is a good example of the type of set calling for such special methods of testing as are described on this page. Such methods were actually employed both in the development of the circuit and the testing of the final product.

dyning into the imitation distant station's wave, ranging from the familiar high-pitched whistle to the mere bubbling distortion indicating two stations working on almost exactly the same wave-length. In these and a number of other ways, we are able to imitate real conditions very closely indeed, with the advantage that our test conditions can be repeated at will.

The Final Check.

Such testing, of course, will go a good way in the determination of the real powers of a set, but it should also be remarked that in the case of the larger instruments, these tests are always followed up by further ones of actual reception of distant stations upon a standard but very inefficient aerial in the suburbs on a series of evenings. This is chiefly to determine the ratio of signal strength to atmospherics under practical conditions, but it also serves as a safety check on the previous tests.



In producing special sets for the regional scheme, of which class the "Kuttemont" Two is another typical specimen, the artificial "distant station" has proved most valuable. With its aid it has been possible to apply selectivity tests which are very severe yet perfectly under control.

limits from such an oscillator, and so a reliable standard of comparison is obtainable.

So far, of course, we merely have a continuous wave radiation like the carrier-wave of a distant broadcasting station when nothing is being transmitted. The necessary modulation is imposed on this

By placing the imitation distant station upon various wave-lengths, close to or far removed from that of the local station, one can find out just how little separation in wave-length is needed for any given type of set to pick up the distant transmission without interference from the local, and in

FOR THE LISTENER.

If you contemplate charging your own accumulators, remember that on no account should this be done with a naked light close to the charging.

If you find that your set distorts only after the receiver has been in use for an hour or two, you can be pretty sure that either the high- or low-tension supply is inadequate for the needs of the receiver, and that the correct and more economical plan would be to use a larger capacity battery.

When building or buying a set it is a good plan to keep all the literature concerning it (constructional article, leaflets, etc.) inside the receiver, so that in the event of any fault developing, or any modification being required, you have all the information available at a moment's notice.



MY RADIO CAREER

BY PERCY W HARRIS M.I.R.E.

A further and notable contribution to a series of nutshell autobiographies written specially for "P.W."

WHEN the Editor of POPULAR WIRELESS asked me to tell his readers how I began in radio, it did not at first, occur to me that there would be any particular difficulty. After all, when one has been engaged so long, and so ardently, in a profession, it seems easy to look back to the beginning. But just what was the beginning?

An Early Start.

Although but seven years old at the time, I well remember my father pointing out to me a paragraph one morning in the newspaper, describing how a young Italian inventor had just come over to England to demonstrate a wireless telegraph. This was in 1896. It seemed so marvellous that even at that immature age the paragraph stuck in my memory. I cannot remember that I read or heard anything more about wireless for a long time, but by 1907 or 1908 wireless telegraphy was already becoming a scientific hobby as well as a practical business proposition, and I had already made and acquired a good deal of wireless apparatus of a crude sort, with which I was receiving signals from the Eiffel Tower and ships at sea quite regularly.

Indeed, so much had my imagination and interest been fired by the new art, that in 1909 (just twenty years ago!) I was already giving lectures and demonstrations on wireless before literary societies and other small clubs. I also gave one or two public lectures during that year.

It is not without interest to look back on the apparatus I used for lecturing in those days. It consisted firstly of a miniature transmitter, made up on a baseboard with a pair of large dry cells supplying a spark coil. In the primary winding of the coil a telegraph key was placed. The secondary or high voltage winding of the induction coil was connected to an oscillator consisting of two vertical brass rods separated from one another by large brass knobs which were adjustable for distance.

So long as the telegraph key was held down, a stream of vivid white sparks roared between the knobs, one spark occurring for each discharge of the tiny condenser made up of the two rods. Very short waves were transmitted by this apparatus and were picked up at the other end of the hall by a receiver. This consisted of a similar oscillator, but in this case, instead of a spark gap, a coherer was placed between the two rods.

By adjusting the length of the receiving rods to be approximately the same as those of the transmitter, the resonance between the two oscillators could be obtained.

The coherer was connected in the circuit of the relay which in turn operated an electric bell set to vibrate at a fairly high speed. After the general principle of wireless had been explained, with the aid of a number of lantern slides, a melodramatic distress message was thrown on to the screen, the Morse characters for each letter being written beneath the words, so that the audience could see both the words and the corresponding Morse.

These Morse signals were then slowly tapped out on the key of the

transmitter on the platform, and simultaneously the bell rang out the dots and dashes at the other end of the hall (or in the gallery, if there was one). This demonstration invariably "brought the house down," and I had great difficulty in convincing many people that there were no concealed wires between the two pieces of apparatus.

In fact, so hard was this task that in later lectures I made a point of using, in



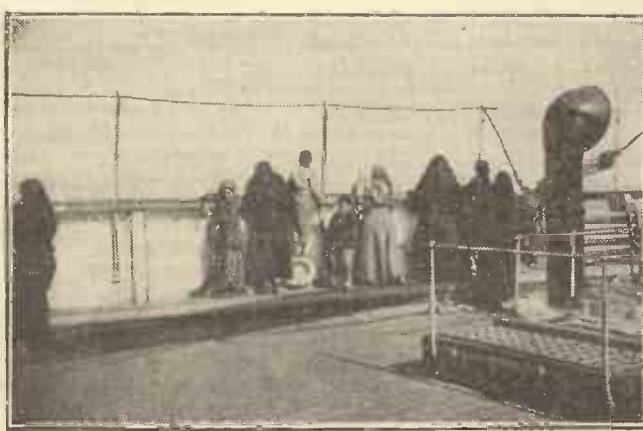
The author, third from right in back row, during his period as wireless telegraphist to the Khedive of Egypt. The photo was taken on the Royal yacht "Mahroussa."

addition to the large receiver, a small one complete with relay and bell, so made up that it could be passed round among the audience. In such a case, of course, there could be no possible wire connection between the two pieces of apparatus, and as the bell rang out clearly while the apparatus was being passed from hand to hand, the results were very effective.

Amazing Crystal Results.

It is difficult for the modern listener, satiated with the delights of high quality broadcast reception, to realise the thrill we gained from the ability to make Morse signals by wireless and to receive them, particularly from a distance. The three-electrode valve was, of course, not available, nor even then invented, our reception depending almost entirely upon the crystal. In order to get the best and most delicate adjustment, crystal holders were of the most elaborate fully adjustable kind. With very good crystals and a carefully-made tuner we could receive Morse signals from

(Continued on next page)



Turkish refugees taking a last look at home from the Khedive of Egypt's yacht during the Balkan War.

MY RADIO CAREER.

(Continued from previous page.)

distances which would scarcely be considered possible in these days.

About this time I visited one of the modern engineering exhibitions at the Horticultural Hall, Westminster, where a wireless demonstration was being given by a telegraph school, the apparatus having been lent by the Marconi Company. The demonstration was, of course, mainly given with the object of obtaining pupils for the school, and the way I loitered around that exhibit must have given alarm to the proprietor, who doubtless feared that if not watched I might make off with anything portable. At this time I was a clerk in a city office, and had I given as much attention to business in daytime as I gave to wireless at night, I should doubtless by now be numbered among what, I believe, are called "captains of industry." As it was, I would have given a great deal to be able to throw up the job at once and start in the new profession, but I could not afford to do so. However, where there is a will there is a way, and as my chief need was instruction in telegraphy, and the practical manipulation of ships' wireless sets rather than in the theoretical side (in which I was already fairly well versed), I managed to take a course of evening classes while carrying on my ordinary work during the day.

Not Many Vacancies !

I shall never forget the relief I felt when I obtained my Postmaster-General's certificate for proficiency in 1910 and was able to say good-bye to office work. At this time, of course, neither the demand nor supply for wireless operators was great. Comparatively few ships were fitted, and in the

whole country there were only two schools teaching wireless telegraphy. A new wireless company (now extinct) had a vacancy; the De Forest wireless agency in this country had also one or two jobs going; and, of course, the Marconi Company were taking on men from time to time. The Marconi Company's pay was the worst of the three, but it seemed to offer more "security of tenure," and so, towards the end of 1910 I joined them and was immediately drafted to Liverpool.

Wireless operators who grumble at the conditions of the service to-day would be interested to hear that when I joined the pay was five shillings a week for the first two trips, uniform being provided by the company, this princely salary being raised to fifteen shillings a week on the third trip!

A Wireless "Scoop."

I can vividly remember setting out in the early days of December, 1910, on what was actually my first sea trip of any kind! It will be as well, perhaps, to draw a veil over the first few days, but in the interests of accuracy it should be noted that the fishes were not unprovided for!

The weather was cold and rough, the ship was light, and we made for Hamburg, where we stayed a week loading sugar—raw beet sugar of the rawest and most objectionable kind. We then left Hamburg for St. John, New Brunswick, hitting such bad weather that on some days we scarcely made any headway, the journey from Hamburg to Canada occupying sixteen days! The wireless apparatus was of the crudest kind.

Having no idea of what the range of this set should be, or what I was expected to get with it, I was always adjusting the transmitter and keeping my head glued to the telephones. When we were a long way off the Canadian coast, I was greatly excited to hear extremely faint signals calling the "Monmouth," and, after a great struggle, I managed to effect communication with the Cape Race station and took a message instructing the captain to proceed, not to St. John, New Brunswick, but to Halifax, Nova Scotia.

About five o'clock on Saturday afternoon, December 31st, 1910, we drew alongside the quay at Halifax, Nova Scotia. There was great excitement ashore, and I noticed that immediately one or two bags of sugar were rushed ashore. Next day, on seeing the "Halifax Herald" (a portion of which

is reproduced herewith), I realised that by receiving the message at the time I did, I had been the means of saving \$31,000,

SAVED \$31,000 BY DIVERSION TO HALIFAX

The Steamship Monmouth Saves Great Sum of Money in Customs Duty by Coming to Halifax and Reaching Here Before the End of 1910.

Had the Steamer Been Allowed to Proceed to St. John 'Twould Have Been Too Late.'

THE WIRELESS BROUGHT SHIP HERE.

The wireless was brought into regulation and the Monmouth was ordered to come to Halifax instead of St. John. She received the message and this port was reached as stated at five o'clock on Saturday afternoon.

She entered at the customs and her freight of sugar will go forward in bond to Montreal.

The duty on this sugar on Monday would have been 33 1/3 cents per hundred pounds. On Saturday, by virtue of the British preferential tariff, the duty was 6 2/3 cents, a saving of 31 cents on the hundred pounds, equivalent to \$31,000 on the cargo of 5,000 tons, contained in 75,000 bags.

THE PROPORTION WAS NEEDED IN 1910.

Of course, had the St. Lawrence refinery allowed this cargo to go against their proportion of sugar to be imported under the rule allowing them to import twenty per cent. of their 1911 annual melt from non-British countries under the British preference they would have obtained the lessened duty all the same, but they wanted to have that full proportion independently of the Monmouth's cargo. There was room for it in 1910.

The Press "story" of a magnificent radio achievement in which Mr. Harris took a leading part.

or over £6,000; for, by diverting the cargo it was possible to land this cargo of sugar before the end of the year, thus coming under special preferential tariff.

Following this came a number of trips across the Atlantic, including one of great interest on an ice-breaking steamer to bring the first cargo of paper from the new "Daily Mail" paper mills in Newfoundland.

About this time I exchanged ships with Jack Phillips, who a little later went down on the "Titanic," Phillips coming from a Union Castle boat to mine and I going to the Union Castle liner in his place.

The First Book.

Many adventures as a sea-going wireless operator followed, but whilst the life was one of great interest, I felt that I was losing touch with radio progress, and so arranged to return to England. Shortly afterwards I became an inspector, and still later an instructor in the Marconi Company's school in London. During the War period I was almost exclusively occupied in training operators for marine service, and to assist in this wrote my first wireless book.

After the War I gave up commercial wireless and devoted myself entirely to editorial work, writing on wireless subjects, wireless research, and designing wireless sets for home construction.

As wireless is even more interesting to me to-day than it was on the day that I built my first receiver, I shall probably continue the same occupation for a good time yet!



Mr. P. W. Harris, as he is to-day, at work in the well-equipped "Wireless Constructor" laboratory at Wimbledon.

THE last obstacle to the use of portable sets has been removed.

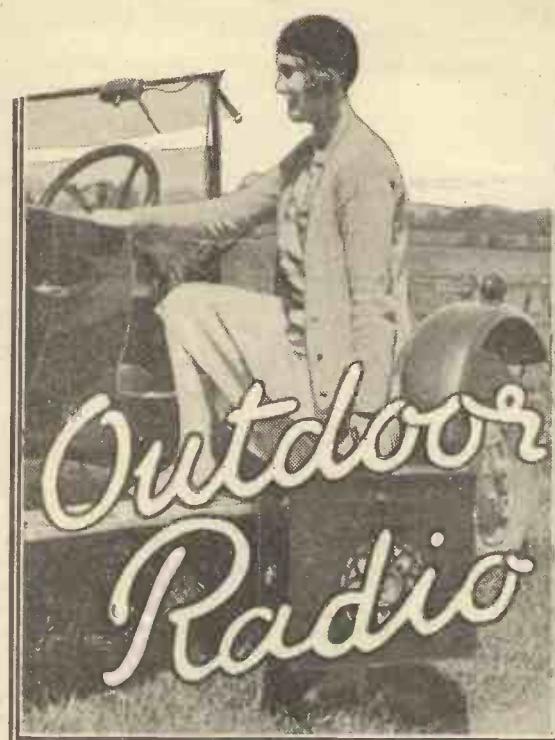
No longer need you take out a separate licence, as the P.M.G. has decreed that the ordinary licence shall cover the use of one portable receiver by any member of the family anywhere in Great Britain. This important concession should do much to increase the popularity of radio out-of-doors. Perhaps you do not realise the scope for experiment in the open. You can try out original ideas about aerial and earth systems, which lack of space at home makes impossible. Then there are many interesting experiments to be carried out with kite and balloon aerials, of which more anon.

If you are to get the most enjoyment out of your portable, be it large or small, it is necessary to have all your materials prepared ready for use before you set out. Accordingly I am going to give you some hints as to the materials you will require, together with a few notes on operation.

Use a Tree.

The most popular temporary aerial for outdoor use is a length of insulated wire thrown over the branch of a tree. It is one of the simplest and easiest to erect, as a tree with a convenient branch is not at all difficult to find in most parts of the countryside. Those who live in districts where the surrounding country is chiefly moorland, with no trees, have to adopt other aerial systems, concerning which I shall have more to say later.

For the tree-supported aerial you will require a length of insulated wire: 30 to 50 ft. is enough for general use, as it takes



An interesting description of some fascinating experiments open to all possessors of portable sets.

By J. ENGLISH.

wire over the branch of a tree, especially if the reel is weighted with a few pieces of lead.

Once over the branch, the wire is so arranged that only the piece of rubber-covered flex touches the tree. The aerial wire can easily be wound up again if the reel is held on a pencil through the centre hole, a screw fixed on one of the flanges serving as a handle for rotating the reel, as sketched in Fig. 1.

The Easiest System.

The earth connection will be the same whatever form the aerial wire may take, and the easiest system to set up is a length of insulated wire merely laid along the ground underneath the aerial, forming a kind of counterpoise earth. This gives very satisfactory results provided the earth wire is not shorter than the aerial.

A contact which is less bulky for transport is an earth-spike. The handiest is a piece of thin copper or brass rod, even a brass stair-rod will do, about 15 in. long. This will be about the right length for carrying inside most portables. A short lead is soldered to one end, and for easy insertion in and withdrawal from the ground a terminal head should be soldered to the top, the other end of the rod being sharpened. (See Fig. 2.)

A more efficient earth connection is obtained if you use three of these rods, all joined to the earth wire so that they can be put in the ground about 2 or 3 ft. apart. This gives a larger area of contact with the ground.

If there are no trees on which to erect your aerial, an interesting field of experiment is open to you in earth-reception.

This consists of two earth contacts spaced some 30 to 40 ft. apart, connected by wires to the receiver, as in Fig. 3, thus dispensing entirely with an elevated wire.

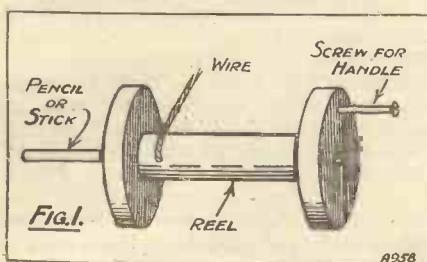
Signals are then picked up from the "earth" waves, and a careful choice of position often results in very good reception. This interesting system is well worth while trying out. An account of some of my experiments on this line was given in the March issue of MODERN WIRELESS to which interested readers are referred for fuller details. You will require two sets of earth spikes of the type described above, together with some 40 or 50 ft. of insulated wire, ordinary 24 or 22 D.C.C. will do.

Kite Aerials.

This system of reception is markedly directional, and it is necessary for the earth contacts to be set out so that a line joining them points towards the station you want to receive. An aperiodic - coupled aerial coil gives better results as the damping of the "aerial" system is thereby reduced.

Another type of aerial system which will doubtless appeal more to members of the younger generation is the kite aerial. Here we have quite a fascinating line of experiment, most extraordinary results being obtained when a large kite with a very long wire is used. Unless you are experienced in flying kites it is better to use a moderate-sized high-flying kite of the aeroplane type, making the aerial wire only a portion of the total length of kite line.

Two or three hundred feet of strong cord will be required and to the end of this one hundred feet of strong wire such as No. 20 enamelled or "Electron" wire is attached. The kite should be flown so that



up less room than the full length of 100 ft., and makes quite an efficient aerial. Rubber-covered flex is often recommended for a temporary aerial as the covering insulates the wire from the branches of the tree, thus dispensing with insulators.

However, this kind of wire is much too bulky and heavy for use with a small portable receiver, and I prefer to use a length of No. 26 or No. 24-gauge enamelled wire, joined at the free end to a 6-ft. length of rubber-covered flex. The end of this is securely fastened to an ordinary wire reel big enough to hold all the wire.

When unwound the reel forms a convenient missile for throwing the end of the

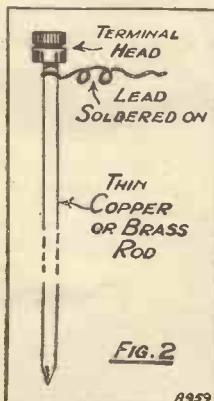


FIG. 2

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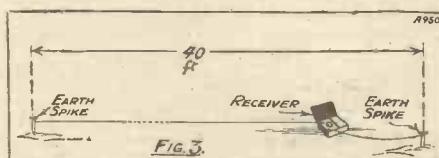


FIG. 3

the aerial wire is suspended in the air as nearly vertical as you can get it. Once the kite is flying properly and steadily, the aerial wire should be anchored by means of an insulator to a stake driven in the ground, leaving a few feet of wire for connection to the receiver (see Fig. 4).

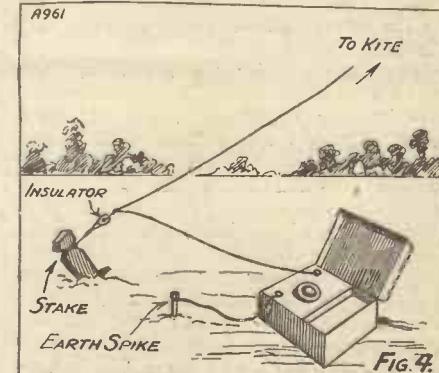


FIG. 4

This type of aerial will give you results surpassing anything obtainable on your home aerial, especially on high ground.

LATEST BROADCASTING NEWS.

AN EPOCH-MAKING BROADCAST

5 G B'S CHILDREN'S HOUR—
RYDAL SHEEP-DOG TRIALS.

Etc., Etc.

where to see it, will be broadcast from the Bournemouth Station by Mr. E. Sydney Allen on Tuesday, August 20th.

5 G B's Children's Hour.

Since 5 G B displaced the old Birmingham transmitter the added interest displayed in the local children's hour has been such as to make the officials, both in the Midlands and London, sit up and begin to wonder when and where this is likely to stop. This applies not only to Britain, but to Belgium, France, Italy, Norway, Austria, and Holland, where correspondence shows there are regular listeners who take the keenest interest in the daily programme arranged for the youngsters.

There may be several explanations for this, the chief being perhaps that Continental people are always ready to study our methods, but there is also another which attracts the Belgian child. Belgium has two

THE running commentary on the great race for the Schneider Trophy, of which the first exclusive information was given in these notes some weeks ago, is to be broadcast by 5 S W, the short-wave station at Chelmsford, as well as from London, Daventry, and other stations throughout the British Isles. The race, as most people are aware, is fixed to take place on Saturday, September 7th, over a 50-kilometre course between Cowes and the eastern end of Spithead, and the competing seaplanes, manned by the world's best pilots, will cover the course seven times.

The running commentary will be given by Squadron-Leader W. Helmire and Flight-Lieut. R. L. Ragg, and will be preceded at 1.50, ten minutes before the race begins, with an introductory talk giving a brief history of the race and details of the pilots and machines.

The B.B.C., in co-operation with the Royal Aero Club, is erecting a special hut on the roof of the Pier Pavilion, Ryde, from where the commentators will have a good view of the race; and their description will be interspersed at intervals of two minutes with the official lap-times communicated by the judge, Col. Lindsay Lloyd, whose post will be situated alongside the commentators.

The race is expected to finish at approximately 4.30 p.m., after which there will be a summary of the event.

Schneider Cup Thrills.

This broadcast should be one of the most thrilling programme items ever heard by listeners. The B.B.C. is making every effort to ensure a successful broadcast, and the commentators, engineers, and programme staff will be busy on the spot carrying out final details for several days before the race. Hitherto broadcasts from the Portsmouth area have been practically impossible owing to land-line difficulties, but these have now been overcome by the installation of special lines through the dockyard.

The last race for the Schneider Cup, which was held at the Lido, Venice, in 1927, was won by Flight-Lieut. Webster at a speed of nearly 282 miles per hour, and it is expected that this year the winner's speed will be increased by an additional 60 miles.

The shores of the Solent form one of the finest marine stadiums in the world, and for the thousands of spectators, both on the mainland and on the Isle of Wight, a loud-speaker system will be installed at numerous points from which the commentary as broadcast from 5 X X will be given.

It is also of interest to South Coast listeners to mention that a talk describing the arrangements for the race, and how and

languages, French and Flemish, and the Brussels station broadcasts a children's hour only on Sundays, so that for the remainder of the week the Belgian child has to rely on what else he can get.

A few months ago the 5 G B Radio Circle raised £1,000 to endow a cot in the Birmingham Children's Hospital, and since then another £400 has been received from profits on the sale of Radio Circle badges and silver paper, while the membership this year has increased by nearly 11,000. It has been decided to endow a second cot as soon as the necessary amount is collected.

Rydal Sheep-Dog Trials.

For the third year in succession the B.B.C. will broadcast a description of the famous Rydal Sheep-Dog trials, which are to take place on Wednesday, August 21st. Hitherto this broadcast has been available to only Northern listeners, but on this occasion it will also be relayed to London and Daventry.

The description will be given by Mr. George Aitchison, Chairman of the Committee, and in addition to details of the display of the clever co-operation between dog and man which attracts thousands of spectators to the glorious scenery of the hills of Westmorland, there will be a programme of music including Shepherd dances.

Here and There in the Programmes.

Sundays, August 11th and 25th.—Concerts relayed from the Kursaal, Ostend, for 5 X X and other stations.

Thursday, August 15th.—Entertainment by the Gaeties Concert Party relayed from the Princes Hall, Aquarium, Brighton.

Sunday, August 18th.—Regional broadcast for the North of a service from the Cathedral Church of St. Peter at Bradford, with an address by the Ven. Cecil Wilson, Archdeacon of Bradford.

Sunday, August 18th.—The next religious service in Welsh for Cardiff, Swansea and 5 X X listeners will be relayed from the Calvinistic Methodist Church, Shilch, Aberystwyth, at 6.30 p.m.

HILVERSUM CALLING.



The chief announcer before the microphone at the famous Dutch station at Hilversum.

TECHNICAL NOTES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

NEUTRALISING.

DAMPING—REACTION AND WAVELENGTH, USING S.G.'S, ETC.

EVERYONE knows that the electrostatic capacity between the electrodes of a valve puts a practical limit to the degree of amplification which can be obtained with the valve; this is because the capacity, not only between the electrodes but in the conductors passing through the valve holder, and also in the wiring, tends to bring about oscillation in the circuit when the amplification is increased beyond a certain point. The result is that the amplification must of necessity be kept below the degree at which oscillation is set up, and this sometimes means that only a comparatively small degree of amplification can in practice be used.

These capacity effects have to some extent been overcome by special design of valves, particularly in regard to the

design of the electrodes themselves and the placing of the electrodes in relation to one another and also by improvements in valve holders and so on.

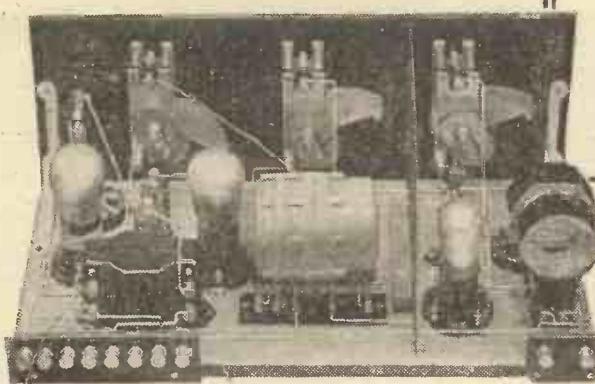
Damping.

Another way of attacking this problem is to introduce damping into the grid circuit by means of a resistance which may be connected either in series or in parallel with it; this, however, although it enables us to use a much greater degree of amplification with the valve, so lowers the efficiency of the circuit that the result is often worse than before—that is, from the point of view of overall efficiency.

The signal strength with the damping resistance is often less than it would be

(Continued on page 706.)

REACTION ARRANGEMENTS



THERE are a number of ways of arranging a regenerative "feed-back" from the anode to the grid of a valve, although most fall into two broad classes, viz., magnetic and capacity. Actually, the Schnell, Reinartz, and other more or less modern methods are combinations of capacity and inductive couplings.

Nevertheless, it is the rather loose practice to term these "capacity-reaction" arrangements, "magnetic regeneration" generally being regarded as referring to "swinging-coil" system.

The Kendall Circuit.

This is the veteran and is a scheme that still has many enthusiastic adherents who claim that in no other way can such "punch" be obtainable. And this was no doubt true until the researches of Mr. Kendall and his department discovered the Kendall Improved Reinartz circuit with which just as much power is obtainable, together with the other undisputed advantages of "capacity" reaction.

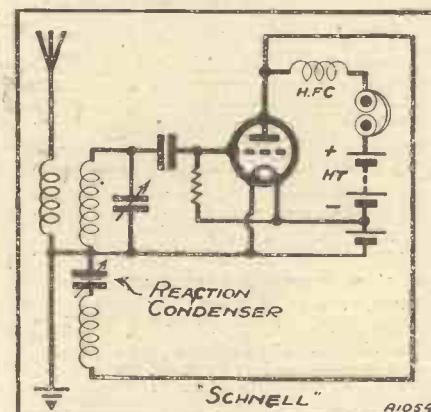
Incidentally, this circuit also achieves a remarkable constancy of reaction effects over wide wave-length variations. Here a word or two in regard to "constant reaction" may not come amiss. The great drawback in the case of "swinging-coil" reaction is that the reaction adjustment plays havoc with the tuning adjustment so that the bringing in of a station necessitates a juggling between the two controls, this calling for a certain amount of skill.

Likewise, the tuning adjustments upset the reaction control just as much. The reason for all this is somewhat obvious. The scheme comprises the coupling of a coil placed in series with the anode circuit of the valve with the grid coil. It is

obvious that the coupling between these coils will vary with variations of the frequency characteristic of the grid circuit, and that the actual inductance of the coils will vary as with the varying distances separating them.

With Reinartz or Schnell reaction the only variation in the coupling constants are the different frequencies to which the grid circuit is tuned and the adjustment of the actual reaction control which, in both cases, takes the form of a variable condenser.

The so-called Schnell circuit has an advantage over the Reinartz, in that it



enables the one set of vanes of both the reaction condenser and the tuning condenser to be "earthed" and so reduce the possibility of hand-capacity effects.

An Important Advantage.

But the Schnell can hardly be said to have this advantage over the "swinging-coil" system because here you generally have a control in the form of a long handle from a coil holder. This long handle is necessary in order that the coils can be placed comfortably on the baseboard of the set while, incidentally, it gets the coils well away from the possible influence of the hands.

Nevertheless, while I am prepared to give the "swinging coil" every bit of the credit that is due to an old and valued friend, I would like to bring forward one important aspect of many forms of "capacity reaction" which I think has been somewhat overlooked.

The Schnell, Reinartz and others of that ilk isolate the anode circuit of the detector valve from the H.F. component, leaving this to deal only with L.F.

With a one-valver this is a very important advantage; for it means that the telephone receivers cease to be "alive" from a

The well-known regeneration schemes are interestingly described, and one of the great but rather overlooked advantages of the "capacity types" is brought forward.

By D. GLOVER.

tuning point of view. The set is not sent into oscillation or that DX station lost when the 'phones or their cords are touched.

It is all very well to say that you can bypass the H.F. in the set by connecting across the 'phones a fixed condenser, but this is not a complete bypassing. At least, a .0005 or .001-mfd. condenser bypass does not constitute isolation such as is given by the interposition of an H.F. choke. If you could use a 2-mfd. condenser things might be different, but this you cannot do.

Batteries and Chokes.

With a multi-valver the "capacity" scores nearly as much as it institutes a barrier of goodly strength against the H.F. getting through to the L.F. stages and so producing instability and distortion.

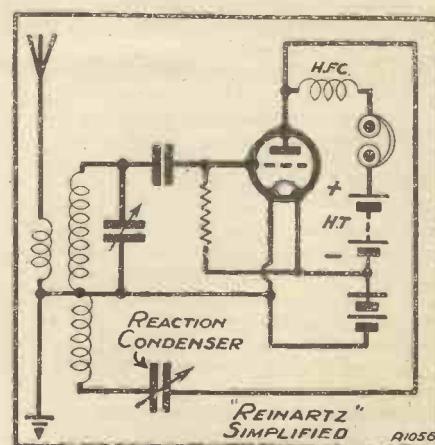
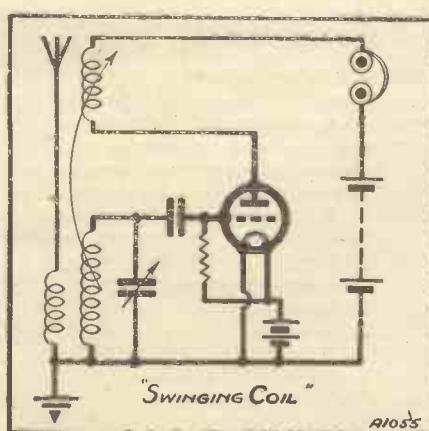
You will notice that in one case I have shown H.T. minus joined to L.T. minus, while the other two diagrams illustrate an H.T. minus to L.T. positive link.

The "minus-to-minus" scheme is now almost universally standardised. It does not appreciably improve results, but it has advantages.

For one thing, it tends to simplify wiring; minus to earth being an easy thing to remember and put in practice.

Also, by making the hard-and-fast rule, the danger of shorts occurring when H.F. or L.F. units are brought into service is avoided.

Another point worth noting is that the H.F. choke that figures in most of these reaction arrangements need not possess that extremely high order of efficiency that the use of such a component in certain S.G. circuits demands. Nevertheless, the choke must possess a certain degree of quality or it will fail even in its simple reaction duties.



CHARGING L.T. BATTERIES.

The Editor, POPULAR WIRELESS.

Dear Sir.—With reference to the letter of Mr. Grayling, published in your issue of July 13th, dealing with the question of charging L.T. accumulators with Leclanché batteries, we think your correspondents interested in this subject would like to hear of our experience.

The charging of L.T. accumulators is extremely difficult in certain districts where the usual charging plant or electric mains are not available. The question of maintenance of L.T. current, in such circumstances, becomes a matter of much greater importance than happens with those more fortunately situated in regard to accumulator charging facilities.

Accumulators are generally recognised to be a convenient and satisfactory method of supplying H.T. current, but to any correspondents who know the difficulty of charging accumulators, it appears that the simple alternative of running direct from a primary battery has been overlooked.

The suggestion of re-charging accumulators by means of the primary batteries may have emanated from the generally understood habit of assuming that wireless receivers must have an accumulator to supply L.T. current. This, however, is not the case; and to employ, say, Leclanché cells to charge accumulators is merely a waste of time and money, as the former battery is quite capable of working the receiver, and with a battery of proper capacity it will not only give extremely long service but this service will be eminently satisfactory; and the reception obtainable has been found, as a result of experiments, to be superior to that obtainable from the accumulator.

The loss of current in charging an accumulator and then discharging it is, usually, with a small type, about 30 to 40 per cent, and this valuable current has all been taken from the primary battery.

The obvious answer is, why waste this current and why employ an accumulator when the primary battery is quite suitable for directly working the set. The practical method of supply is to employ large Leclanché cells with sac elements, weighing about 7 lb. each.

On a 2-volt receiver employing three valves and taking '35 amps, this type of cell should last, on an average of four hours' use per day, eight to nine months before new elements are required. In order to maintain a voltage of, say, 1.8, which is that usually best on the 2-volt valve, two cells are required, connected in series with a variable resistance of 10 ohms.

The resistance can be reduced from time to time to make up for the reduced voltage of the two cells. These facts for L.T. supply will no doubt be of interest to wireless users living in remote districts and in conditions where the charging of accumulators becomes difficult.

On the question of the cost of maintenance of the Leclanché cell for H.T. supply, it compares quite favourably with that of the accumulator, and when it is remembered that the battery does not require disconnecting for re-charging except at, say, intervals of from eight to twelve months, its usefulness should then compare very favourably with that of the accumulator even where accumulator charging is not difficult.

The drawback of the Leclanché cells is their weight and bulkiness in a very large number of cases. This company have been experimenting for some years past with a similar method of H.T. supply, and although progress has been improved sufficiently now to be able to supply satisfactory cells in cases, where they are particularly wanted, the large Leclanché battery is not yet perfected sufficiently to place it on the market as a regular line, although in the

CORRESPONDENCE.

CHARGING
L.T. BATTERIES.THE "WHITE" PRINT SERIES—
BATTERYLESS RECEPTION—
S.G. VERSUS THREE ELEC-
TRODE, ETC.

Letters from readers discussing interesting and topical wireless events or recording unusual experiences, are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

In near future there is every prospect of a perfectly satisfactory battery working on the Leclanché principle being manufactured.

We welcome correspondence from any of your readers experiencing difficulty with L.T. supply, as it is possible we shall be able to give them some definite assistance.

Yours faithfully,
THE STANDARD WET BATTERY CO.
(F. O. L. WATES).

THE "WHITE PRINT" SERIES.

The Editor, POPULAR WIRELESS.

Dear Sir,—I feel I cannot let your splendid series of "White Prints" come to a finish "for the present" without a word of thanks; these are now really a work of reference to the wireless "fan." I trust you may find your way clear to continue same at an early date; also to issue them bound in book form for newcomers.

Would it be possible to give us a "Wrinkle and Gadget" page to replace our loss. This to be conducted by readers sending hints and descriptions of home-made accessories, payments for same to be made by awarding popular components?

Wishing you every success as the amateur's friend.
Yours faithfully,
Hunstanton.

E. WYER.

[ED. NOTE.—We have had a large number of letters of appreciation regarding our "White Prints," and doubtless our correspondents will be interested to learn that we are preparing another feature to take their place. This will be of equal novelty and usefulness, and fuller details will be given as soon as possible.]

BATTERYLESS RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir.—With reference to your paragraph re W. H. G. (Cambridge), what he describes is nothing compared with my recent experience. I am operating a six-valve receiver and a moving-coil speaker.

I recently switched on my set and obtained the usual results—viz. sufficient volume to fill a dance hall with absolute purity, etc. During the course of the evening I tuned in various foreign stations at full loud-speaker strength. Results were quite O.K. Having had my batteries in use for some time (I use super

batteries for H.T.), and thinking they may have run down, I checked them with an expensive moving-coil voltmeter.

I found my H.T. was down to three volts, instead of 4, and the battery across my M.C. speaker was dead.

Can you account for the wonderful results I obtained?

Yours faithfully,
B. GLADSTONE.
W.14.

S.G. VERSUS THREE ELECTRODE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Being a constant reader of "P.W." these last five years, I at last ask you to allow me to encroach on your valuable space just to pass a little comment on what I consider a most interesting subject, that is H.F. amplification.

My principal reason for bringing this subject to mind is that since the entry of the S.G. valve into the market, everyone seems to think of the three-electrode valve as being of no use for H.F. work, just because it has not an amplification factor near that of the S.G. valve.

Well, from my experience of both types of valve I still prefer the old neutralised three electrode, and consider that the S.G. has got to be improved a lot before it can, in my opinion, give the silent background of the "neut."

Having compared the reaching-out properties of both the S.G. valve and the ordinary neutralised three-electrode valve, I don't find a vast difference.

If the H.F. wiring is carried out as it should be and reliable H.F. transformers incorporated, there is not a thing wrong with the three-electrode valve for H.F. work.

Another thing I want to refer to in passing is, why do people use such an expensive valve as an S.G. for rectifying purposes, when for 10s. 6d. they can get excellent rectifier valves? Perhaps imagination is to blame here.

Yours truly,
R. L. GRAY.
Omagh.

"SHAKE OFF DULL SLOTH."

The Editor, POPULAR WIRELESS.

Dear Sir.—Following "Ariel's" remarks in a recent "P.W." re "Fans" selling their beds and buying components, I would like to say that it is well worth while to "shake off dull sloth" in the mornings just to see what is on the air. For instance, this morning I heard 8 X A L, Cincinnati, W 6 X N California, and 3 K 2 M E Sydney. The latter was talking to Suva, Fiji. Suva was very badly jammed by C W and could not be understood. Last Saturday morning I heard an excellent relay of the All Blacks v. N.S.W. Rugby match from the Sydney Cricket Ground, this was from 2 B L, and the reception was excellent. During the interval the Sydney studio gave out the news bulletin, two of the news items I heard from there were contained in the morning paper which I read half an hour later. By the way, could you try and get "P.W." to publish an authentic list of S.W. stations. The above stations, 2 M E and 2 B L, announced their wave-lengths as 28.5 and 31.25 (2 F C) respectively, whereas the S.W. list, published recently, gave them as 31.28 and 32.5. Suva is working on 20.95 m.

A new station, 3 X A L, has also lately been testing in the early morning on about 24 m., and comes in with a rare punch.

Yours faithfully,
HENRY E. RANDALL.
Uxbridge.

economy in space and a smaller amount of wiring, which, in themselves, are, of course advantages.

Atmospherics on short waves are rather puzzling at times. When quite a severe thunderstorm was going on not more than six or seven miles away I recently found atmospherics strong on 20 metres, almost unnoticeable on 40 metres, and unbearable on the broadcast wave-lengths.

Tick-Tock Trouble.

The suggestion by a correspondent a week or so ago that my curious "ticking" interference was due to an electric clock was, I think, correct. I have not yet traced the offender, but his suggestion seems so absolutely obvious that it is almost certain to be right. I cannot think what I was doing myself to have overlooked this possibility!

How many readers situated on or near main roads have noticed that cars with coil ignition cause twice as much noise as those with "mag." ? All the cheap and medium-priced American cars are bad offenders, whereas small British cars can hardly be heard at all.

SHORT-WAVE
NOTES.

By W. L. S.

since even touching the earth terminal makes the set oscillate. With my old set back on the bench everything is normal. Incidentally, the earth connection is quite O.K.

On making a careful reckoning of the pros and cons (at least, all of them that I could think of) I came to the conclusion that a detector and pentode set is more worth while to the short-wave enthusiast than any form of detector and two straight L.F. stages. In cost there is little to choose; in filament and H.T. consumption there is also very little in it.

On the other hand, while distinctly good amplification is obtained on weak signals, a much quieter background is obtainable. In addition, we have the advantage of

Pentode or 2 L.F.?

I had only to put my hand near the metal panel (connected direct to L.T. and earth) to start the set oscillating quite hard. On withdrawing it the set just slid nicely out of oscillation. Quite a nice reaction control, but hardly convenient! I thought the trouble might be caused by H.F. in the headphones, and accordingly put H.F. chokes in series with each side. This had absolutely no effect whatever.

I am still at a loss to spot the trouble,

TROUBLE-TRACKING TIPS

Simple faults can be extremely difficult to track—unless you know where to look for them. Some practical experiences in fault finding are told in this article.

By R. W. HALLOWS, M.A.

TO those who have even the slightest acquaintance with matters electrical the wireless set of to-day is a very simple affair, easily kept in perfect working order; but it must be remembered that there are thousands of people to whom the receiving set represents simply a means of obtaining entertainment—just that and nothing more.

To them everything within the cabinet is a complete and utter mystery, to say nothing of the aerial, earth, batteries and loud speaker. With the ordinary set there are quite a number of queer little things that they can do or leave undone, and it is astonishing to find how often they manage to achieve what the designer of the apparatus flattered himself was an absolute impossibility!

Bad For The Battery !

Like me, you have possibly made quite a long journey in response to an urgent summons only to discover that a high-tension wander plug had been pulled out of its socket by the kitten; you have no doubt come across the "complete breakdown" caused by the disconnected aerial or the closed earthing switch; it is more than likely that reversed battery or aerial and earth connections have come your way; not improbably you have made the acquaintance of the standard capacity high-tension battery serving a four-valve set which was last renewed two years ago.

The prize instance in my own recollection concerns a 100-volt large capacity H.T.B. During the spring-cleaning operations this was disconnected by the simple process of leaving the wander plugs in position and undoing the terminals at the back of the set. Then "just to make them look nice and tidy," the leads were neatly rolled up with the bared ends in close contact. Strange to say the set *simply would not work* when the battery was called upon to do duty once more!

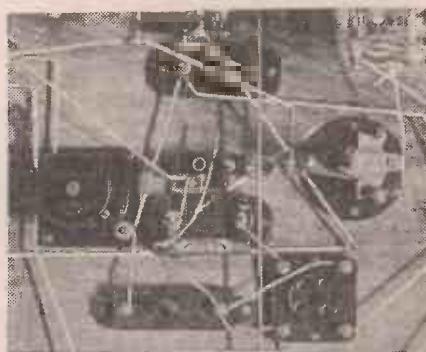
Mysterious Silences.

There are quite a number of ways in which existing apparatus may be made less likely to indulge in mysterious attacks of silence. In the first place I would strongly advise the constructor, the donor, or the installer to see that the wiring is such that the H.T. and L.T. batteries are not connected in series.

This is a simple enough business when making a set, and usually no great amount of alteration is required in a bought or existing set arranged for series battery wiring. With the batteries in series there

are quite a number of ways in which valves can be blown up; if they are in opposition they are few.

Next we must obviously avoid the disconnected lead and we must make it next door to impossible to disconnect the battery wires from the receiving-set end. The best tip that I know is to remove all milled nuts from the receiving set and to clamp down aerial, earth, battery and loud-speaker connections with hexagon nuts turned firmly home with a box spanner. The milled nuts may then be replaced for the sake of appearance if desired. All battery leads should certainly be tagged, but it avails little to have lettered tags all of the same shape, size and colour. Something more striking is called for in order to catch even the most unobservant eye. Coloured leads and coloured tags save a world of trouble. And the same colours must appear on the



All wires should be well-insulated and everything firmly fixed if a set is to be "fool-proof."

batteries at the appropriate points for connection.

Here is a scheme which (touching wood) I have so far found completely successful. Purchase red, green, white, blue and yellow indicating discs, two of each. Stick a red disc on to the top of the accumulator case close to the positive terminal and a green one beside the negative terminal. If the case is of celluloid this can be done with a drop of acetone; for a glass-cased accumulator with a bitumen sealing use Seccotine or rubber solution. Arrange a white disc so that it surrounds the negative socket of the high-tension battery.

Let a blue disc mark the lower H.T. + tapping and a yellow the higher. Should there be more than two H.T. positive tappings other colours—brown, purple and so on—will be required.

No one but a colour-blind somnambulist can now make a wrong battery connection.

If the H.T.B. consists of two or more units in series don't trust to wander plugs for the connections. Here is a useful hint. It will be found that a 4 B.A. tap can be worked gently into the average socket.

Efficient Connections.

It will not cut a full thread but will make one deep enough to engage the male thread of a piece of 4 B.A. studding. Cut off a short length, screw it into a socket and put on a nut to lock it in position. A suitable length of flex, tagged at both ends, and two more hexagon nuts, well tightened with a box spanner, complete the making of a fool-proof series battery connection. The grid battery within the cabinet may be treated in the same way.

Deal with the loud speaker as you dealt with the receiving set: use hexagon nuts for holding down the leads that connect the set to it.

Weak signals, or no signals at all, not infrequently result in a set intended only for the local station from somebody's having "twiddled" the tuning dials and left them in the wrong positions. If the dials are of the indicating pattern mark in the correct setting for each station ordinarily received. Otherwise make a list of the settings and paste it inside the lid of the cabinet.

First-Aid Hints.

Stuck also to the inside of the lid should be FIRST-AID HINTS, which may be divided into two sections headed "Complete Silence" and "Poor Strength." Under "Complete Silence" write:

1. Is the aerial switched on ?
 2. Are all the battery wires connected to the proper points ?
 3. Is the tuning correct ?
- and under "Poor Strength" put :
1. The accumulator should last about at each charge. When was it last recharged ?
 2. The high-tension battery should last about months. When was it last renewed ?
 3. Is the earthing switch quite clean ?
 4. Have you verified the tuning ?

These hints refer chiefly to battery-operated receiving sets. The reader will easily see for himself how they may be adapted to meet the requirements of inexperienced users of mains-driven equipment.



THE "Antipodes Adaptor" is rather too well known to require much of a formal introduction, at least such world seem to be true as far as readers are concerned who have been "regulars" since the beginning of 1928.

But it is now a little more than twelve months since the publication of the original adaptor, and since during that time "P.W." has found many new friends, it would perhaps be advisable to commence by devoting a paragraph or so to a brief description of the purpose of the adaptor.

Separate Reactor.

The "A.A." in its original form consisted of a simple single-valve unit designed to plug into the detector socket of any existing straight set, thereby turning it into an efficient short-wave receiver.

The advantages of such an arrangement were twofold, for not only did it enable short-wave stations to be received on the ordinary broadcast receiver for a very small outlay, but also it enabled use to be made of the existing set amplifiers when receiving on the "ultra shorts."

So much, then, for what the "Antipodes Adaptor" really is, or, rather, was, and now we come to the present model—the 1929 version, and this is where all you Valve Barts, and honourable members of the "H. A. C." (Heard All Continents!) sit up, so to speak, and take special notice.

What is there so very much different between the new model and the one first published to warrant the inclusion of an extra valve? The answer is purely and simply *results!*

For a considerable while I have been

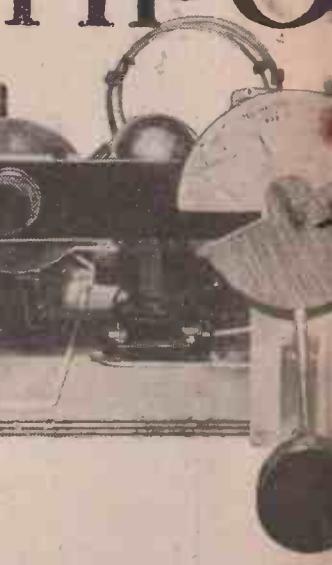
experimenting with a circuit using a separate reactor valve for short-wave reception, and the results obtained under these conditions leave absolutely no doubt in my mind that there are definite advantages in using a separate valve for reaction purposes on short waves.

Regulating Reaction.

Results tend to indicate that a detector valve is more sensitive as a detector when it has a high voltage on the anode, but owing to the difficulties of obtaining smooth reaction control when using a valve for the dual purpose of detecting and reaction, this high voltage scheme becomes impracticable, and it is rarely possible to use much more than 40 or 50 volts H.T. with any degree of success.

But using a separate valve for the purpose of obtaining reaction, there is no limit other than that of the makers to the voltage applied to the anode of the detector valve, and the voltage on the actual reactor valve can be reduced to as low as 15 or 20 volts in order to obtain perfectly smooth reaction without interfering in any way with the efficiency of the detector.

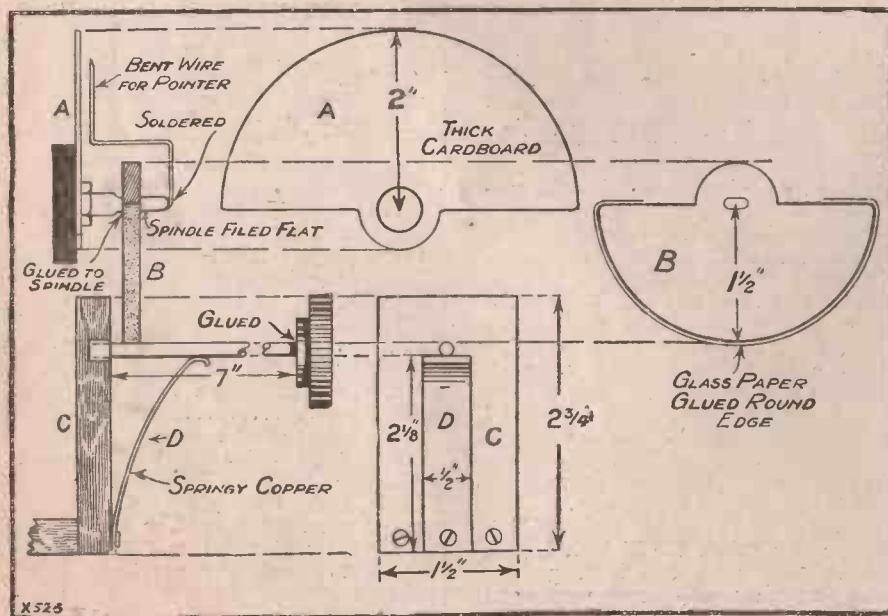
As I explained previously, the practical results obtained with the two-valve arrangement have given me strong grounds for thinking that there are very definite advantages in using a separate reactor valve on



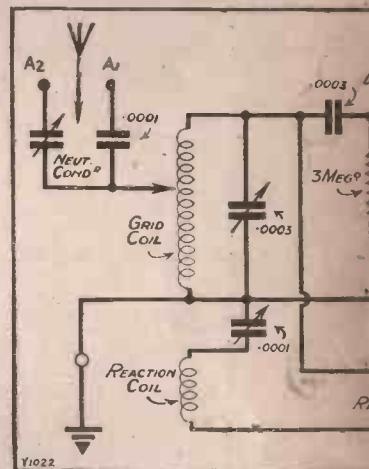
Here is seen the new version complete with coils and valves.

The "Antipodes Adaptor" within the reach of all—an version of the popular efficiency has been greatly any additional tuning

Designed and Described
("P.W." Techni



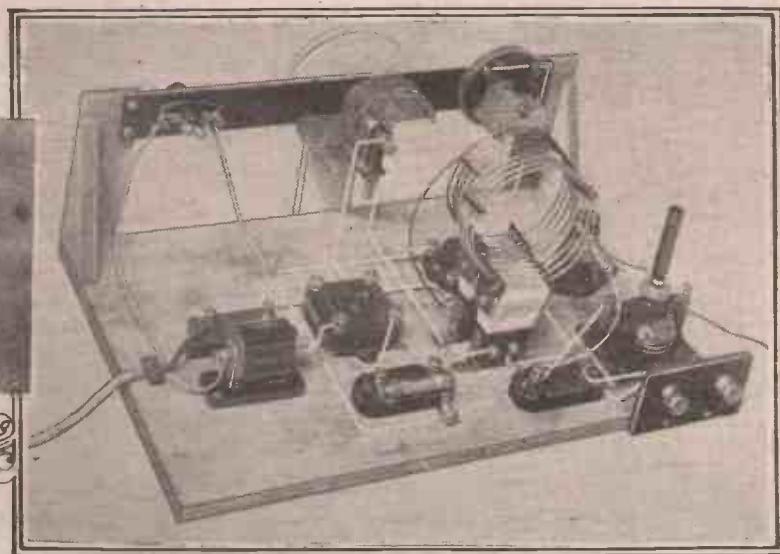
From these details, no difficulties should be encountered in the construction of the special dial.



YOUR SHOPPING LIST

- 1 .0003 variable condenser, plain type, not slow motion (Formo, Lissen, Lotus, Igranic, Burton, Cyldon, Ormond, Raymond, Bowyer-Lowe, Utility, etc.).
- 1 .0001 or .00015 reaction condenser (Raymond, Lotus, Lissen, J.B., Cyldon, Utility, Burton, Ormond, Bowyer-Lowe, Dubilier, etc.).
- 2 Short-wave or all-wave chokes (Magnum, Bowyer-Lowe, Wearite, etc.).
- 1 Neutralising condenser, baseboard - mounting type (Magnum, Bowyer-Lowe, Bulgin, Igranic, etc.).
- 1 Fixed condenser, Igranic, Goltone, num, Clarke, T.C.

ANTIPODES ADAPTOR



The "panel" consists of an ebonite strip held in position by wooden supports.

"brings Australia in this, the 1929 "P.W." Unit, the y increased without complications.

by G. T. KELSEY.
(Staff.)

short waves, and using only one L.F. stage, I have found it possible to receive 7 L.O. and 3 L.O. with the 1929 "Antipodes Adaptor" under very adverse conditions.

Despite the fact that the extra valve has been included in the new adaptor, the actual operation is no more difficult than with the original model, and, in point of fact, there are, as before, only just the two controls to handle.

But stay, what is that weird-looking contraption projecting from the front of the new design?

Well, first of all, for those who may feel inclined to laugh, it certainly is not a joke.

To be precise, it is the outcome of considerable thought in the direction of the elimination of hand-capacity, and, crude though it may look, it answers the purpose intended exceedingly well.

Simple Construction.

I have no doubt that for those who feel so inclined, an ordinary slow-motion dial will answer quite well, but personally I would not under any circumstances do away with my "Heath Robinson" slow-motion, anti-capacity tuning control!

Now, regarding the construction of the new "Antipodes Adaptor," a complete list

of the parts for which is given elsewhere in the article, there is nothing which can be called very difficult, with the possible exception of the "dial," and even this should be a comparatively simple matter if made from the details given in the drawing.

Having therefore mounted up the "panel" (notice I use quotation marks!) in the manner shown in the back-of-panel drawing, proceed by fitting the tuning and reaction condensers, the L.T. switch, and the slow-motion "machinery."

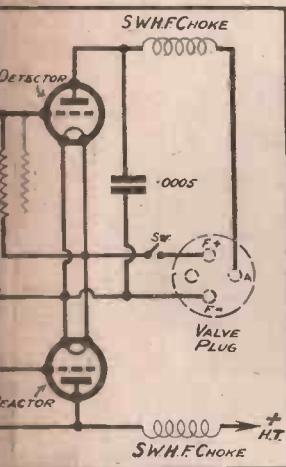
Dial "Don'ts."

A certain amount of care will be necessary when making the dial in order to ensure that the extension handle comes flush against the circular drive at any position of the condenser.

The metal spring will, of course, take up the slack within certain narrow limits, but it is essential to see that the circular piece of wood marked B in the drawing is quite round, otherwise the dial may slip in places.

In this connection it is a sound scheme to stick a piece of fine glass-paper round the rim of the wooden disc, as shown in the drawing. In most other respects the drawing will be found self-explanatory, and perhaps I need only mention as a concluding remark to this part of the construction that the hole into which the wooden extension arm is fitted should not go right through the wooden upright.

(Continued on next page.)



LIST.

units (Lotus, dio, Raymond,

0001 mfd. T.C.C., Igranic, Magnum,

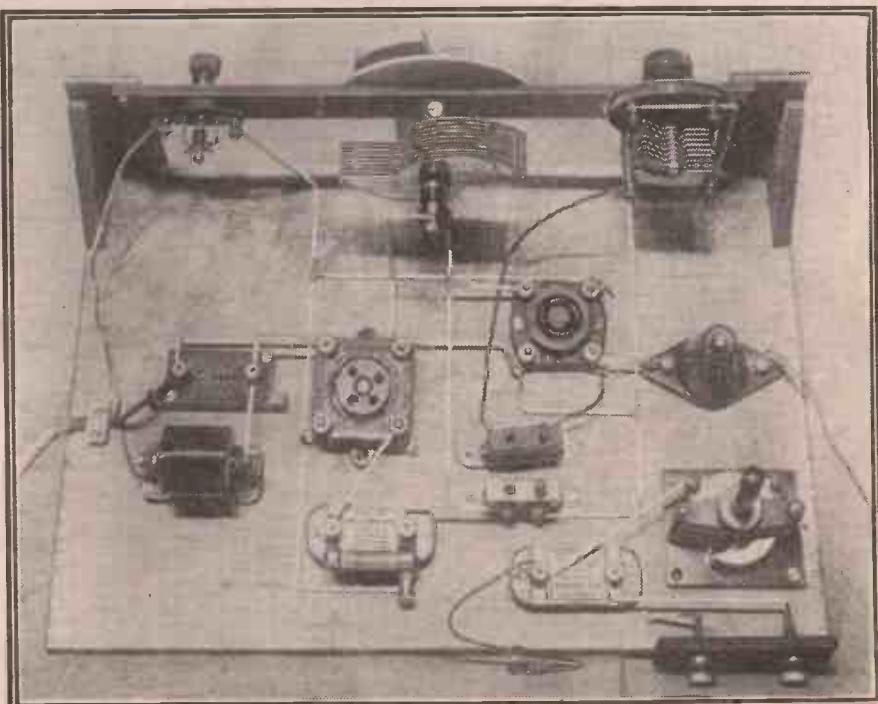
with 1 ordinary clip for leak, 2 separate grid-leak magnum, Clarke, T.C.C., Igranic,

0005 (Lissen, Dubilier, Mag- C., etc.).

- 2 Sprung-type valve holders (Benjamin, W.B., Igranic, Lotus, B.T.H., Pye, Formo, Marconi-phone, Wearite, Redfern, Magnum, Ashley, Bowyer-Lowe, etc.).
- 1 L.T. "on-off" switch (Lotus, Igranic, Lissen, Bulgin, Magnum, Burton, Wearite, Ready Radio, Raymond, etc.).

Strip of ebonite, 12 in. \times 1½ in. Terminal strip with two terminals, Glazite, and flex for wiring, crocodile clip, valve plug of the type used in conjunction with gramophone pick-ups, wood, screws, and the parts for the dial.

1 Baseboard, 14 in. \times 9 in.



No cabinet is used for this adaptor, and in consequence neatness of wiring is an important point.

THE 1929 "ANTIPODES ADAPTOR"

(Continued from previous page.)

With the aid of the back-of-panel drawing you cannot go very far wrong in the main constructional work, since the wiring and general layout are so very simple. There is one point, however, which calls for special mention. In order to obtain the most sensitive results from the detector valve, it is necessary for the grid return to go to L.T. positive, which means to say that there is a right and wrong way in which to connect the filament circuit to the adaptor plug.

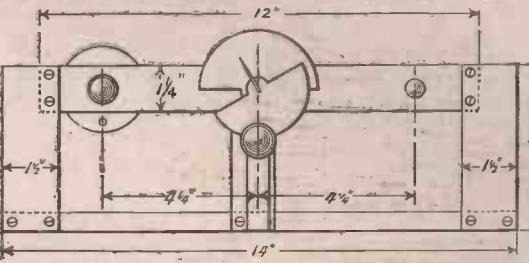
The flex leads from the actual adaptor should be connected to the plug in such a

way that the one from the L.T. switch is joined to L.T. plus of your existing set when the plug is inserted into the present detector valve socket.

Having completed the wiring and the connections to the plug adaptor, with the insertion of suitable coils and valves the unit is all ready for testing.

Valves and Coils.

First remove the detector valve from your set and join the plug from the adaptor to the valve socket thus vacated. Place the detector valve (preferably of the H.F. type) in the detector socket of the adaptor



and if your present receiver has any H.F. stages, proceed by removing these valves, one of which can probably be used in the reactor position.

The most suitable valve for the reactor position is not at all critical, and if you happen to be in the fortunate position of having spare valves, the best course would be to find a valve by experiment.

The grid coil (the fixed one) should be a five-turn plug-in short-wave coil, and the clip—the best position for which will have to be found ultimately by experiment—can, as a start, be attached to the centre turn. For reaction, again the most suitable size is a matter for experiment, but in most cases a four-turn coil will answer the purpose.

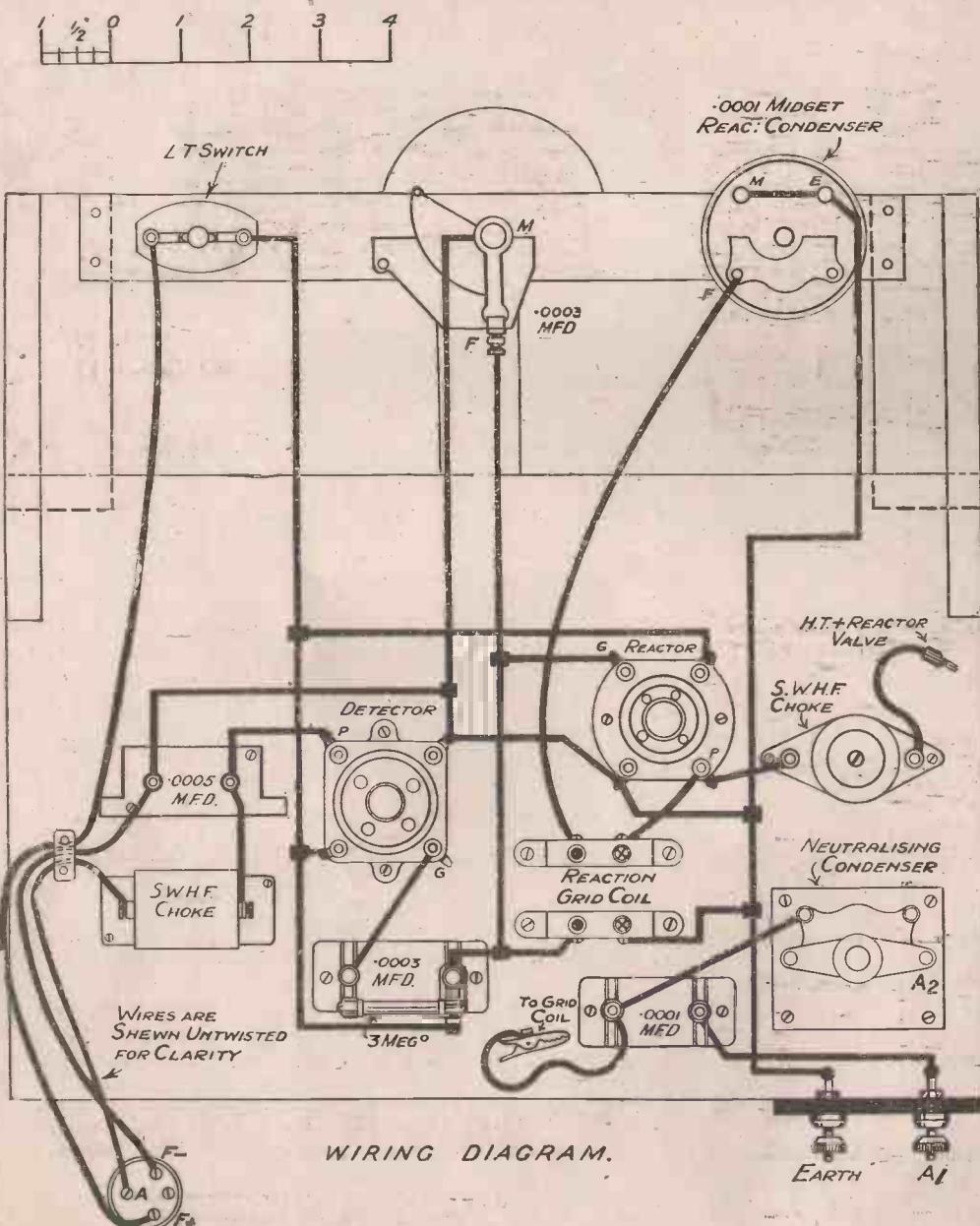
With the aerial joined to A_2 (the terminal on the neutralising condenser), the earth to its appropriate terminal, and the phones to the output terminals of your existing set, all is ready for testing.

Curing a "Plop."

With, roughly, 30 volts on the reactor valve and anything up to 120 on the detector, slowly advance the reaction condenser and note whether the set can be made to oscillate. If reaction is present, but "ploppy," try readjusting the voltage on the reactor and altering the setting of the neutralising condenser.

If you are unable to obtain a reaction effect, try reversing the leads to the reaction coil holder, a higher anode voltage on the reactor, and, if necessary, a larger reaction coil or another valve in the reactor position.

Further helpful notes, together with some indication as to where to find the stations and the use for the A_2 terminal, will be given in an early issue of POPULAR WIRELESS. Meanwhile, you will be able to carry out tests for yourself.





K.C. CONDENSER
With knob, dial and slow-motion device, 12/-
'0003 or '0005
Without knob, dial, or
slow-motion device,
'0003 or 8/-

DUBILIER

K.C. DRUM CONTROL CONDENSERS
With Drum Control and slow-motion device, 15/6
'0003 or '0005
Triple K.C., each condenser '0003 or '0005
Triple K.C. Combinations of 40/-
'0003 and '0005

FOR



MIDGET CONDENSER
A small variable condenser for panel mounting '0005, 5/6
'0001 or '0002

SELECTIVITY

"Toreador Screen-Grid Four"
This set incorporates the latest developments in Receiver design—full constructional details free on request.

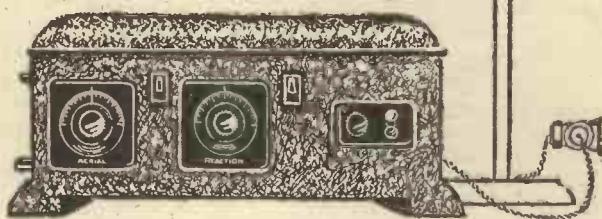
DUBILIER
VARIABLE CONDENSERS

If unobtainable from your dealer, write direct to us giving his name and address.



Dubilier Condenser Co. (1925),
Ltd., Ducor Works, Victoria
Road, N. Acton, London, W.3.
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AS
CONVENIENT
TO USE
AND AS
SIMPLE
as a table-lamp!



This "EKCO"-LECTRIC STRAIGHT THREE is the very latest in modern radio. Plug the "EKCO" Adaptor into the nearest electric light or power socket, and switch on—that's all! And, when you have tired of radio programmes, connect the gramophone pick-up to the sockets provided and amplify your records—the super-power valve gives ample volume to operate a moving-coil loudspeaker. The attractive all-steel fool-proof cabinet is finished to resemble grained leather. Ask your dealer for a demonstration, or write to us for full particulars.

D.C. £16 : 10 : 0
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Complete.

JUST
SWITCH
ON—
THAT'S
ALL!

There are also "EKCO" All-Power Units, eliminating batteries, accumulators and grid bias. D.C. from £5 : 17 : 6. A.C. from £10 : 17 : 6, complete. "EKCO" H.T. Units, eliminating H.T. Batteries. D.C. from 17/6. A.C. from 73/6 complete. L.T. Unit, A.C. only £8 : 15 : 0. "EKCO" products are obtainable on Easy Payments.

E. K. COLE, LTD. DEPT. A, "EKCO" WORKS, LEIGH-ON-SEA.

**'EKCO-LECTRIC
STRAIGHT-THREE'
RECEIVER**

FROM THE TECHNICAL EDITOR'S NOTE BOOK



BATTERY INDICATORS.

MESSRS. PETO AND RADFORD point out that a satisfactory arrangement of accumulator gravity floats can hardly be devised without infringing their well-known patents. They wrote us subsequent to seeing a report on this page on gravity indicating balls which amateurs can themselves insert in accumulators.

FROM LOUIS HOLZMAN.

Everyone welcomes a change now and then, and if for no other reason than this, variations from conventional design in radio apparatus can be pleasing. Certain models of the "Crescent" meters which are handled by Louis Holzman, for instance, are distinct departures from the ordinary and, as well as their attractive appearance, they have the advantage of being compact as panel-mounting instruments.

We were recently sent a sample of the type No. 351, which provides readings of 0-240 volts and 0-60 millamps. It is particularly suitable for use in a mains unit, as it has a resistance of 70,000 ohms total in its voltage winding, while its milliamperc

connected in a novel manner, patented by Hydra. Hydra condensers are, of course, of world-wide repute and our own experience has shown them to be thoroughly reliable. They can with every degree of safety be incorporated in mains units.

THE BROWN "Vee" UNIT.

The simplest kind of sound-reproducing apparatus consists of an electro-magnet placed in close juxtaposition to a diaphragm. This diaphragm being made of iron, electrical vibrations passing through the magnet cause it to be vibrated by virtue of the varying electro-magnetic pull on it.

And this, incidentally, is practically the way most telephone receivers operate. Loud speakers, too, for many years adopted this simple system with merely the addition of an amplifying horn, and even to-day there are a few survivors, but the scheme labours under one serious disability.

For a given strength of current flow in the electro-magnet the magnetic pull on the diaphragm or armature (should one of these intervene between the diaphragm and the magnet) will vary very considerably, as with the distance between the two elements.

In other words, when the diaphragm is some way away from the magnet a very great deal more energy will be needed to attract it than when it is close.

Therefore, it is obvious that a true representation in mechanical form of the electrical impulses flowing through the magnet cannot be obtained. The vibrations of the diaphragm can only follow the vibrations of electrical energy with absolute faithfulness when the relation between the two units is proportional at all positions. There are, of course, other considerations,

but the one with which I am dealing is vitally a primary one.

In the Brown "Vee" Unit we have the latest attempt at achieving uniform sensitivity. Here the poles of the electro-magnet are concentrated into V form and a V-shaped armature is arranged to fall within the space so formed. In this way the armature operates in a very intense magnetic field, and a uniform translation is achieved.

The idea itself is not a new one, but it is the first time that I have seen it in the practical form introduced by Browns. The whole thing looks very simple but on examining it one must not fail to pay a

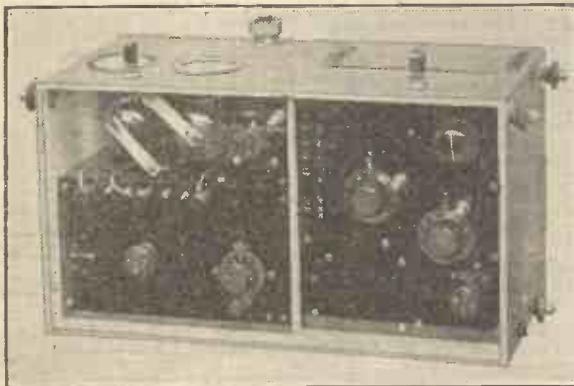
Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

tribute to the ingenious designer, who has so cunningly disposed his "lines of force."

The price of this Brown "Vee" Unit is 25s., and a cone chassis is available at 15s. I would advise "P.W." enthusiasts to obtain the complete assembly. The cone is a nice, large, gold-coloured affair, and the combination is a noteworthy one. You want to fix it to a baffle-board or to a cabinet in order that the "Vee" Unit can give you the fine reproduction of which it is undoubtedly capable. You get plenty of bass, and the higher register is bright and pleasant. It can be used equally well with either a small or large set.

If the constructor so desires he can employ this new Brown loud speaker in combination with any of those semi-free edged diaphragms made of stiff paper which have obtained much popularity.

We tested the "Vee" unit with such a construction and found that the results were very good indeed. The further advantage of buying the chassis as well is, however, that the whole makes a compact and rigid assembly.



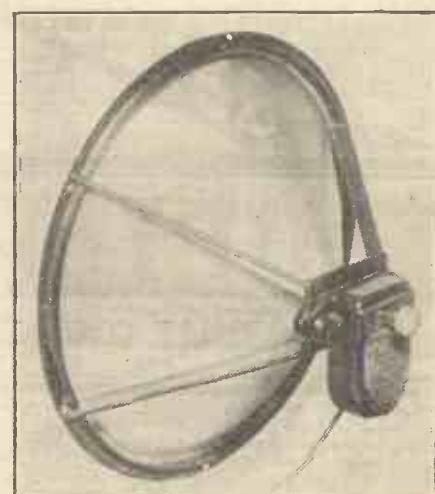
A special light-weight Marconi outfit specially designed for club and private aeroplanes. It only weighs about 60 lbs.

winding is of the usefully low order of approximately 4 ohms.

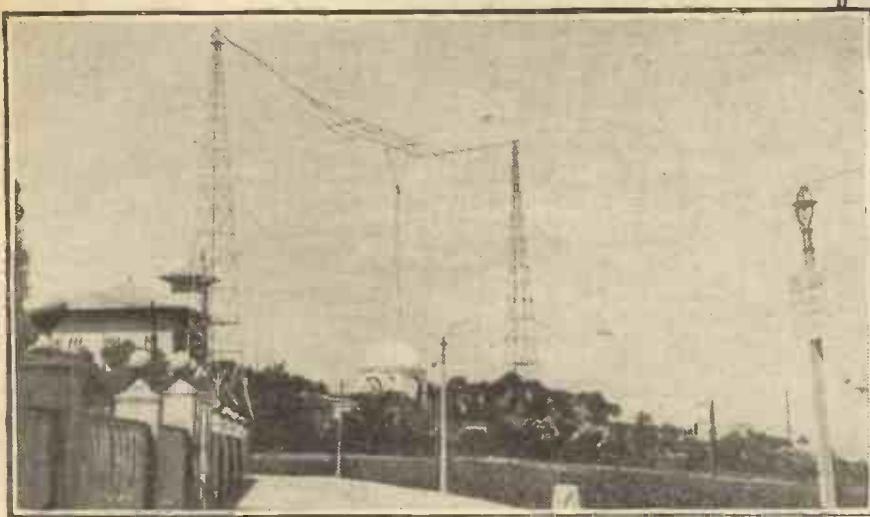
There are two little buttons on the instrument and you press one for voltage and the other for current readings. The needle runs up and down the scale, the effect being similar to that of a "thumb control" scale, except that the scale itself is stationary. A small screw at the back of the meter enables the zero setting sharply to be adjusted. The price of the instrument is very reasonable, and we consider it forms very good value for money.



The "Crescent" Meter.



The Brown "Vee" Unit and Cone Chassis.



SPAIN, for the moment, is very much in the eyes of the world. What with two giant exhibitions and unrest of a political nature now and then, we certainly hear a lot about that bull-fight-loving nation. By the time this appears in print, readers will have had the opportunity of hearing the Spanish stations much better than hitherto. Barcelona has indulged in two high-power stations, each, I imagine, doing its best to drown the other's voice.



Senorita Angeles Fernandez, who controls the amplifier at E A J I Union-Radio.

The listener in Spain has a rare old time of it. He is supposed to be a good little boy, and register his set at the nearest post office, and pay a fee of something like four shillings or less for this privilege. But as broadcasting officials in Spain told me with a sigh, only very, very few good listeners register.

Few British Sets.

And the majority, that is, those that do not register seemingly go scot free. The Spanish stations, therefore, just rely on the good humour of a small number of staunch supporters. The advertiser, the man who buys "air-space," pays the rest.

Spain has no radio manufacturing industry of its own, but I note that American and German sets seem to flourish. I ran round the whole of Barcelona, to all the dealers, and I did see a British transformer or two, also several British loud speakers, but that was all. It is a very sad thing to have to say, but I have been on the same quest in Yugoslavia, Switzerland, Hungary and Czechoslovakia, and everywhere the dealers smile and say: "Oh, we certainly

Some interesting information relative to Spanish broadcasting.

By A. A. GULLILAND.

would stock British goods, they are good, we appreciate them, but who can pay the prices here?"

So German, French and even American manufacturers steal the markets. And I am sure that American sets are no cheaper than ours. The reason? I don't know it, and that is why I am mentioning this sad fact in what I intended to be a cheery chat on Spanish broadcasting. But to get back to our Spanish friends.

How It Began.

In the early days of broadcasting there existed in Spain a company called the Radio-Iberica; this showed promise of developing some excellent Spanish radio patents, but then promptly went bankrupt. The chief engineer of the company and the owner of the patents, quite a young man, by the way, is now chief engineer of one of the Barcelona high-power stations, Radio-Catalana or E A J 13, as the call-sign goes.

He has built the new transmitter according to his own patents, and has personally supervised the construction. The aerial power, according to the usual formula in use in Western Europe, he told me, was 10 kilowatts.

By the way, Radio-Catalana has quite a romantic history. The former 1-kilowatt transmitter originally was built to form a private radio-telephonic communication between Barcelona and Majorca. The firm owning the transmitter have a branch on that island, and desired a rapid and inexpensive means of communication.

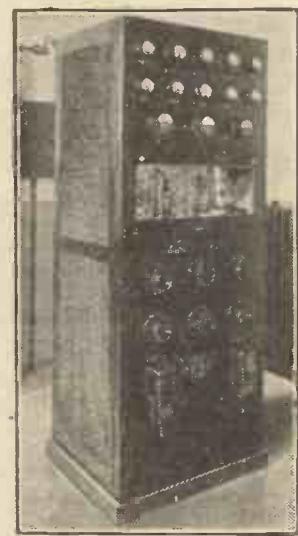
However, the Ministry of Communications stamped out the bright idea as infringing the state monopoly. So the proprietor turned the transmitter into a broadcasting station. That was in 1924.

SPAIN'S RIVAL STATIONS

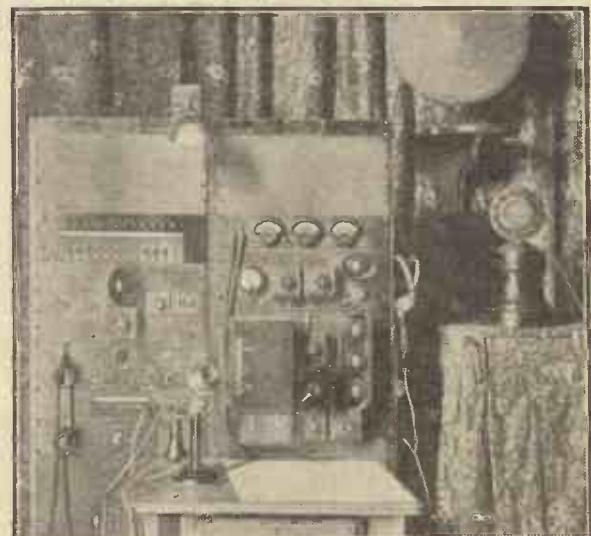
Now the group of people operating Radio-Catalana have launched out with the high-power transmitter, and there are rumours that some influential newspapers in Barcelona will help keep the pot boiling.

The second Barcelona transmitter belongs to the Union Radio group. Union Radio controls a number of Spanish stations. Union Radio also has to get its revenue as best it can, and it receives no state subsidies. The new transmitter was built by the Standard Electric Company, and has an aerial power rated at $7\frac{1}{2}$ kilowatts.

So there you have two giant transmitters. The wavelengths are none too far apart, and the transmitters are only about two miles one from the other, both in or near the town, so you can well imagine that selective sets are at a premium in Barcelona.



The old transmitter at E A J I.



The control panel at the Radio-Catalana station.



Details of a very useful device for constructors.
FROM A CORRESPONDENT.

THE "P.W." Loading Coil will be familiar to all readers of this journal, as it is incorporated in many standard circuits, and also forms the nucleus of the famous "Titan" coil. Normally the loading coil is wound on a piece of ribbed ebonite tubing of 3 in. overall diameter and 1½ or 2 in. length, eight sets of slots being cut into the ribs to accommodate the windings.

The writer of this article has devised a novel method of making the coil former with very little trouble, and at a small fraction of the cost of the ready-made article. Further, no tools are required except a penknife, a pair of scissors, a ruler, and the kitchen poker! The material which the writer uses for construction of the former is gutta percha sheet—a black or brown substance resembling very stiff indiarubber in appearance and feel, but possessing the very useful property of becoming soft and tacky when heated, and of hardening again on cooling. In insulating properties this material is equal to ebonite.

Gutta percha may be bought at any good indiarubber shop; it varies somewhat in quality, and if possible you should select the stiffest. The thickness of the sheet should be about $\frac{1}{8}$ in.; if it is thinner it will not be sufficiently rigid and if it is much thicker it will not be so easy to work. You will require one piece of this material, measuring 6½ in. by 2 in. for the body of the former, and six strips each measuring 2 in. by $\frac{1}{8}$ in. for the ribs.

Material Costs About 6d.

If you intend to use the loading coil as part of a "Titan" coil you will also need one strip 5 in. by $\frac{1}{8}$ in. for mounting purposes. These can all be cut from one piece of gutta percha sheet measuring 10 in. by 3 in., which will weigh about one ounce and will leave you with a little extra material in case of accident. A piece of gutta percha of this size will cost about 6d.

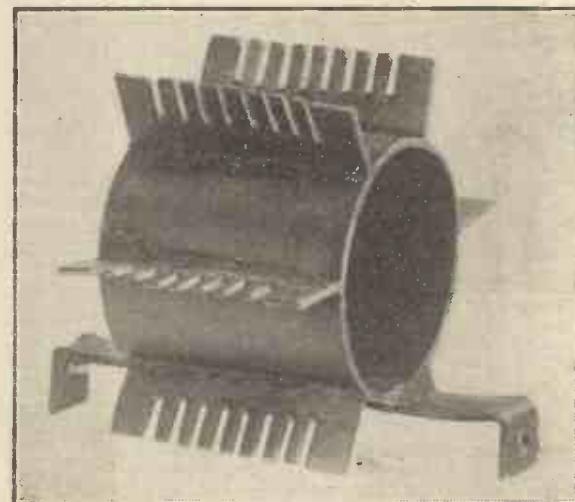
The first thing is to make the "body" of the former—a tube 2 in. long and just under 2 in. diameter. For this, take the largest of the above pieces, warm it *very* slightly in front of the fire until it is just soft enough to bend, but not at all flabby or sticky, and bend it round so as to bring the two short edges close to each other.

Next, gently heat the blade of an old penknife or kitchen knife and pass this in

turn over each of the two edges which are to be joined, rendering them soft and sticky. These edges should now be brought carefully together and pressed into contact with each other, then held in position for a minute or two until hard and firm.

The join can now be further improved by a slight smoothing with the heated knife. Note that the extreme edges only are softened and joined together—they should not be overlapped.

It may be found at this stage that the tube is not perfectly cylindrical, but this can be put right by gently warming and



The completed former fitted with strips for use as a "Titan" coil.

bending it into shape. A convenient way of softening the material is to heat the kitchen poker (not too hot) and hold it inside the tube for a few seconds, the portion of the tube which requires softening being held uppermost, as the heat rises. Take care not to heat too strongly and be very careful not to let the poker touch the gutta percha. Another way is to soften the tube in hot water.

Marking the Former.

The next stage is to mark the positions which the six ribs are to take on the tube. This can be done by guesswork, but if you wish to have the former as neat as possible the following method will enable you to get perfectly even spacing.

First rule a scratch along the tube, $\frac{1}{2}$ in. from the seam and parallel with it. Next cut a strip of paper $1\frac{1}{2}$ in. wide and of such length that when wrapped round the tube its edges just meet. Remove this paper from the tube, measure it, and mark it off into six equal divisions by five equi-distant pencil marks drawn parallel to each other and to the narrow edges of the paper.

Wrap this paper round the middle of the tube again with its two edges meeting at the place where you have already made the scratch on the tube, and make a mark on the tube exactly opposite each end of each of the pencil lines on the paper.

Remove the paper, take a ruler, and, using these marks as guides, make five more scratches along the tube. All six scratches will now be parallel to each other and perfectly evenly spaced.

If you wish to incorporate it in a "Titan" coil, take the strip measuring 5 in. by $\frac{1}{8}$ in., soften the central 2 in. or so, and stick the strip carefully along the seam of the tube, projecting $1\frac{1}{2}$ in. at each end.

For Use in the "Titan."

The surface of the tube itself will first require to be lightly "smoothed over" with the heated knife at this part, to render it sticky, before sticking on the strip. This strip is finally warmed and bent down at right angles about $\frac{1}{8}$ in. from each end, so that the coil can be mounted in position by two screws passing through the outer tube of the "Titan" coil, and through the bentdown ends of this strip, nuts and washers being, of course, used on the ends.

Before making these right-angle bends, the actual diameter of the "tube" you are going to use should be measured, so that you will get the bends in just the right place.

The next stage is to cut the slots in the strips which are to form the ribs. Each rib will have eight slots, each $\frac{1}{8}$ in. wide, $\frac{1}{8}$ in. deep, and $\frac{1}{8}$ in. apart, a space of $\frac{1}{16}$ in. being left at the ends.

When you have prepared all six ribs in this way, the next (and final) operation is to fix these on to the tube. You have already made scratches along the tube to mark the positions which the ribs are to occupy. You must now heat the knife blade and pass the blunt edge along the whole length of one of these marks, making a groove about $\frac{1}{16}$ in. wide and very shallow.

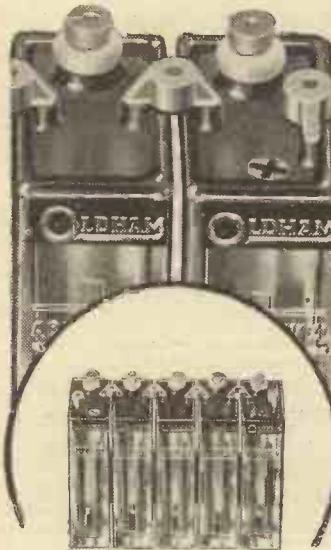
Soften the "continuous" edge of one of the ribs by passing the flat of the heated knife along it, and carefully and gently press this rib into position in the groove that you have prepared. Both surfaces should remain tacky for long enough to enable you to carry out this operation.

Fix the other five ribs into position in the same way, then smooth-off each joint in turn with the slightly-heated knife blade, taking this opportunity to make any slight corrections in the angle at which the ribs project. The former is now complete.

[ED. NOTE:—Instructions for winding the "P.W." Loading Coil are repeated from time to time in "Radiotorial".]

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Less
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Longer
service.

Better
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Because each cell is separated from its neighbour by an air space, Oldham H.T. Accumulators do not discharge themselves. Electrical leakage cannot pass the air gaps. As a result they hold their charge. And because electrical leakage is eliminated, they give that steady abundant supply of H.T. current which is vital to your Set. See an Oldham at your Dealer's.

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Extra Large Capacity
(5,500 milliamps.)

Per 10-volt unit,
Complete with
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Standard 10-volt Unit Capacity
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Wooden tray extra if required.
Ask your Wireless Dealer about them.

6'9

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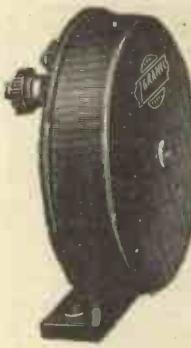
If you have electric light you can charge your H.T. Accumulator at home with the Oldham H.T. Charger. It is simple, efficient, has no moving parts—nothing to wear out—nothing to go wrong. See them at your Dealer's.

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IGRANIC SPRING-MORE WANDER PLUG. Fits all sockets and stays where it's put. Price 3d. each.

IGRANIC "Q.M.B."
SWITCH. The "on
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Price 2/6.



WORKS: BEDFORD

WHY WASTE MONEY ON COSTLY H.T. REPLACEMENTS?

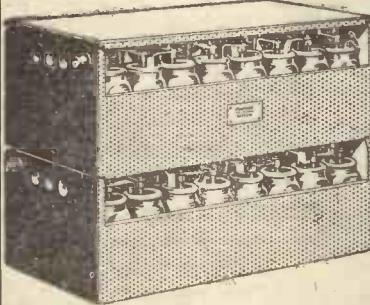
Standard Batteries are proved sound economical H.T. Absolutely reliable and efficient. Improve reception and maintain a constant pressure of non-sagging current that eliminates "background." Self-regenerative. Recharge themselves overnight. Voltage maintained by replenishment of elements at long intervals, when battery is again ready for further use. No other attention necessary. Neat, compact, simple.

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ANY VOLTAGE OR CAPACITY SUPPLIED FROM 7/6 DOWN

Illustrated (assembled complete) is No. 3 size battery, specially suitable for 3 valves or over. Super Capacity. Cash £2 17s. 9d. or down and 5 equal monthly payments of 10/1. Popular model, 98 volt unit for 2 valves. Cash £2 3s. 1d., or 7/6 down.

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As far as possible all advertisements appearing in "Popular Wireless" are subject to careful scrutiny before publication, but should any reader experience delay or difficulty in getting orders fulfilled, or should the goods supplied not be as advertised, information should be sent to the Advertisement Manager, "Popular Wireless," 4, Ludgate Circus, London, E.C.4.



RADIOTORIAL

All Editorial communications to be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lite, Ltd., 4, Ludgate Circus, London, E.C.4.

The contributions and articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

A QUESTION OF DAMPING.

G. M. P. (Bedford).—“Why is it that as soon as I take the aerial lead off my set's aerial terminal I get a very strong howl which can be heard all over the house?”

You have rather a serious fault here, probably due to bad spacing or to too much reaction (coil or reaction condenser). What is happening is that the set is apparently trying to oscillate strongly all the time, but when your aerial is connected this “holds the set down,” probably because this too is inefficient.

We are forwarding you an application form so that you can let us have further details of the set, as we are sure that at present your reception is nothing like as good as it could be.

DISTORTION ON LOUD PASSAGES.

“QUALITY” (Chepstow, Mon.).—“As you will see from the enclosed diagram I have two low-frequency transformers, but although I do not get actual oscillation or howling I find there is an unpleasant distortion on all the loud passages which I am told could be cured by means of an anti-motor-boating unit.

“How should I insert this and what would the value of the anti-motor-boating resistance be?”

To make the anti-motor-boating unit you will require a fixed resistance (20,000/50,000 ohms) and a 4-mfd. fixed condenser. Break the lead which goes from the first low-frequency transformer primary to H.T. positive 1 and insert the resistance between the primary and the other points. Now join one side of the 4-mfd. condenser to the side of the resistance which is joined to the terminal on the transformer, and the other side of the condenser to the L.T.—wiring.

IS A “FRAME” AN INDOOR AERIAL?

W. B. R. (Clacton-on-Sea).—“When buying the set I was told I could use it with an indoor aerial, and I made up a nice frame but got very bad results with it. Upon complaining that signals were weak and I could get no foreign stations, I was informed that a frame aerial was not really an indoor aerial and what I needed was one of the type which is stretched across the room or round the picture rail.

“I must admit I was inclined to be very annoyed about it, for it seemed to me to be a bit of quibbling. For curiosity's sake I tried it out, and sure enough to my surprise I found that with the aerial across the room I got quite excellent results. Is mine an exceptional case or is this kind of thing usual, and were they justified in telling me that the frame

aerial I made was not really an indoor aerial at all?”

A frame aerial is not really an indoor aerial. Admittedly a frame aerial can be used indoors, but nevertheless there are fundamental differences between these two. An aerial which is wound upon a rotating frame is strictly limited in size by the size of the frame, but an aerial which is inside the house is limited only by the space available inside the house. It may be almost as good as a screened outdoor aerial if it is underneath the roof in some large building so that we might expect it to work quite differently from an aerial which is limited in size by being disposed upon its frame.

A frame aerial has certain advantages of its own owing to the fact that it can be swung round, but a well arranged indoor aerial of the type slung across

“P.W.” TECHNICAL QUERY DEPARTMENT

Is Your Set “Going Good?”

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to be run down much faster than formerly?—Or you want a Blue Print?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers an unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Inquiries should NOT be made in person at Fleetway House or Tallis House.

the ceiling or round the picture rail is nearly always far superior in pick-up possibilities, so that we are not surprised that you were unable to get good results.

THE “P.W.” WAVE-TRAP.

D. A. (Handsworth, Birmingham).—“I have just secured one of the ‘P.W.’ standard wave-traps, and although it seems very sharp, and so on, I do not quite know how to operate it, and get a little bit tied up when tuning foreign stations with it. Some time ago I saw an article in ‘P.W.’ (I think it was by Mr. Kendall) upon the proper way to set this wave-trap, and I should be glad if you could tell me where that was, or what the main points of the article were?”

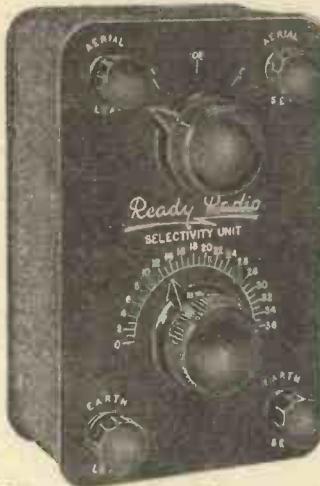
(Continued on page 704.)

MAKE YOUR "TITAN" PERFECT!

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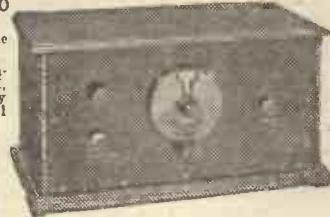
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 702.)

A short article on this subject by Mr. G. P. Kendall was published in "P.W." No. 302 (May 11th issue), and we recommend you, if possible, to read this carefully. It emphasises the fact that the first thing to grasp when erecting a wave-trap is that it must be set once-and-for all at the adjustment which cuts out the local station, and then be left severely alone.

If you attempt to fiddle with it when searching for distant stations you are likely to get into a hopeless muddle. Once set it can be left in circuit and has no effect upon any station except the local and one or two distant ones which are very close to this in wavelength. (It reduces the strength of these somewhat, but since you would not be able to find them at all without the help of the trap, the advantage remains.)

To set a wave-trap, connect it up and adjust the screw-down variable condenser to a minimum by unscrewing, and tune in the local station on the set as usual. Now detune upwards until the volume comes down to, say, one-half; then proceed to screw down the trap condenser very carefully and very slowly until something begins to happen.

You will soon find that the strength of the local station begins to diminish, and if you proceed carefully you will shortly discover a setting at which it goes down to almost nothing or vanishes altogether, and beyond this point it comes up again. Locate this point of minimum strength as accurately as you can, and if it seems "broad" (that is, if the local goes right out over a range of adjustment) proceed to narrow it down.

Turn to the receiver and tune down a little nearer to the normal loudest point until you begin to hear the transmission again. After this you can return to the wave-trap again, leaving the set alone.

The next step is to try the wave-trap aerial in both sockets to see which gives the best and most complete exclusion of the local station in your particular instance, resetting the wave-trap condenser each time. Once the correct setting is found, it can be left permanently.

NAIROBI'S WAVE-LENGTH.

"AFRIKANDER" (Whitley Bay).—"Can you tell me the exact wave-length and the times of transmission of the Nairobi station in Kenya?"

The Nairobi station, call-sign 7 L.O., normally transmits daily from 5 p.m. to 8 p.m. Sometimes instead of closing down at 8 p.m. it relays the 5 S.W., Chelmsford, England, programme for about an hour, the wave-length used for all transmissions being 31 metres.

CONVERTING THE "EMPIRE" TWO INTO DET.-L.F. R.C. COUPLING.

T. F. R. (Bradford, Yorks).—"Last Christmas-time you published a design called the 'Empire' Two, and I built this with old components and must say it certainly upheld the high claims made for it. Even though I was using old components results were excellent, but just lately the transformer broke down and I find from the test which you described the other week, that its primary is broken."

"I have an R.C. unit which I should like to try in place of this, but just for safety's sake I should like to have a description of the actual alterations to the circuit in order to fit this unit. (The unit is marked, A., H.T., G. and L.T.)"

You will need either to make a sketch showing exactly where the leads came from, or mark each lead before you take out the transformer. Although the change-over is very simple, it is easy to get mixed with three or four loose leads knocking about.

Lift out the transformer and in its place screw the R.C. unit on the baseboard in such a position that the G terminal is near to the grid of V2. The flexible lead from the grid-bias negative battery which formerly was attached to the G.B. terminal on the L.F. transformer should be removed altogether from this and placed instead on the terminal of the R.C. unit which is marked L.T.

The G. terminal on the new unit should be taken direct to the grid terminal on the valve holder for V2. The lead from the H.F. choke which formerly went to the P. terminal on the L.F. transformer goes instead to the A. terminal on the R.C. unit. Finally, the lead from H.T.+1 terminal goes to the H.T.+ terminal on the R.C. unit, and this completes the alteration.

If insulated wire is used you will have no difficulty whatever, even although you have not carried out rewiring of this kind before, provided, of course, that the necessary care is taken to ensure that all the wires are properly spaced from one another and from surrounding components.

TRYING DIFFERENT GRID-BIAS VOLTAGES.

E. C. F. (Near Hertford).—"Is it fact that if you are trying the effect of different grid-bias voltages for the last valve that when you alter the grid-bias plug you should switch off the set?"

Yes, if the set is not switched off when the grid-bias plug is removed the effect is quite different from that intended. Suppose, for instance, that an output valve requires a grid-bias negative voltage of 15 and it is desired to see what the effect will be if the voltage is altered to 18.

The correct way to do this would be to switch off the set, alter the grid bias from 15 to 18 on the battery, and switch on again to test the new conditions. The incorrect method would be to take the plug out from 15 and to put it in 18, without switching the set off, but in this case, instead of altering the grid-bias voltage from 15 to 18, we have actually altered it from 15 to 0 and from 0 to 18!

Now although there is nothing much to show it, unless a milliammeter is inserted, the effect of suddenly removing 15 volts negative grid bias from the output valve makes a serious difference in the current flowing through that valve and its associated apparatus, which would not have been the case if the voltage alteration had been a slight one such as from 15 to 18.

If you remember that all the current flowing through the valve has to be drawn from the filament to the plate of the valve, it will be obvious that to suddenly increase that current or double it, it is bound to shorten the life of the valve. If a milliammeter is connected in circuit while the alteration is made, the needle will kick violently in a way that shows strong disapproval of sudden alterations of this type.

STAGE BY STAGE TESTING.

H. S. (Leamington).—"Thanks to 'P.W.' I never have any difficulty in finding a fault in the L.F. stage because I could go over the set with a pair of telephones, tracing the leads, etc., from circuit to circuit until I draw a

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blank when I know just about where the fault lies. There is only one disadvantage in this plan, and that is that it makes one wish a similar stunt could be employed for high-frequency stages.

"Is there any way in which one could follow the current through from aerial to the detector in the same way as one can now take a pair of telephones and put them in place of an R.C. unit, L.F. transformer, etc.?"

You can conduct quite good rough and ready H.F. stage tests by means of a crystal detector in conjunction with a pair of telephones. All you have to do is to join one side of the detector to one side of the telephones, and then equip the remaining two leads of this apparatus with flexible testing leads which can be placed directly across the aerial coil, then the grid coil, then the tuned anode, or subsequent grid circuits, the crystal detector enabling you to hear results as you go along.

For stability's sake, and because of the frequent movement, it is advisable to use a crystal detector of the permanent type for this class of testing.

A MAINS-UNIT PUZZLE.

M. S. E. (Leyton, London, E.).—"Is it possible for an H.T. mains unit to be unsatisfactory with a four-valve set and yet work quite O.K. with a three-valve set? The reason I ask is that I recently changed from a three-to-four-valve set, and was very disappointed to find that the latter caused a loud hum at my house, although the unit worked O.K. on my old set and on a three-valve set at a friend's house where they were both tested."

"As I could not get any pleasure out of it at all, and after continual tinkering with it,

(Continued on page 708.)

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RADIOTRICAL QUESTIONS AND ANSWERS

(Continued from page 704.)

I came to the conclusion it must be the H.T. battery eliminator, and I found this to be the case. Is there any reason why a unit of this kind should be satisfactory for three valves and not for four?

The trouble is due to the fact that your H.T. unit is unable to supply the extra current required by the fourth valve. Although it is sometimes wrongly assumed that voltage is all important with a mains unit, there is, as a matter of fact, a steady current being taken from it when it is in operation.

Obviously your unit was quite capable of supplying the current for the three-valve set, but it is not large enough to supply that required by the four-valve set, and consequently it shows its disapproval of being overworked by giving rise to the hum complained of. It is not the fault of the unit or of its makers. The fact is that the unit is being overworked, and you are expecting it to give more current than it was designed to give.

A QUESTION OF INSULATORS.

R. M. B. (Bexhill-on-Sea).—Determined to get the aerial up as high as possible, I have used rather slender masts both in the garden and on top of the house. We are subjected to pretty severe winds here at times, so in order to avoid a breakdown I want to put up a light yet strong aerial, and for this purpose I am a little bit troubled about allotting the insulators.

"I have been told that theoretically the far end of the aerial should be more carefully insulated than the house end, from which the lead-in is taken. Is this a fact, and if so, do you think that three insulators at the far end and one at the house end would be satisfactory?"

Although theoretically the far end of the aerial should be rather more carefully insulated than the lead-in end, it is not usual to bother about this in practice, except possibly in the case of transmitting aerials in large cities where the insulators are subjected to strains which are not experienced in places like Bexhill.

If you choose good quality insulators we think you will find that even one insulator at each end of the aerial will be sufficient provided you are willing to take them down and clean them every two months or so. But do not choose the little egg insulators which sometimes show signs of not being fully glazed all over, as quite appreciable losses can be introduced by these. What you want is one of the good quality insulators designed to have a long path between the two wires and shaped so as to be reasonably weather-resisting.

A TIP FOR TUNING.

IT is often a difficult matter to tune a receiver effectively in those cases in which the loud speaker is situated in another room, or out-of-doors at some distance from the set. In such instances, the amateur generally brings the speaker near to the set whilst he conducts the tuning operations. Then, after the controls of the receiver are set, the loud speaker is removed to its required distant position.

Without going to all this trouble, however, there is a very useful method of effecting the same end. It will be noted that one of the loud-speaker terminals goes to the plate of the last valve. To this terminal, attach, in addition to the distant loud-speaker lead, one tag only of a pair of headphones.

Under these conditions, a comfortable volume of reception will be heard in the phones, and the necessary tuning can be effected in this manner. Thus, the loud speaker can remain untouched in its distant position, but the tuning of the set can, nevertheless, be accomplished quite satisfactorily.

TECHNICAL NOTES

(Continued from page 690.)

without the resistance, and with the valve working near to the oscillation point.

Reaction and Wave-length.

When working on a single wave-length it is easy enough to adjust the damping so that the high-frequency resistance of the grid circuit is kept about at its original value. But as, of course, it is generally necessary to operate on different wave-lengths, and inasmuch as the reaction effect which we are considering varies with the wave-length, you see that the method is not a convenient one, still more so since the characteristics of the valve and of the circuit (filament voltage and so on) are themselves liable to vary from time to time.

The interaction between plate and grid may be overcome by the method, which has been so largely used, of neutralising or balancing-out the feedback effects by means of a special subsidiary or auxiliary circuit.

Using S.G. Valve.

Many amateurs who are familiar with neutralising and its uses in different cases seem to be somewhat in doubt as to the position when a screen-grid valve is used. In a valve of the S.G. type the inter-electrode capacity is comparatively small and consequently moderate damping in the tuned circuits may be used. Owing to the tendency to oscillation, the comparative inefficiency of the coils in such tuned circuits is not so serious as it might otherwise be.

Of course, the amplification cannot be put up quite to the theoretical limit, because valves differ from one another in their characteristics and also, as I have already mentioned, the reaction which is obtained varies with the wave-length.

The characteristics of the screen-grid valve, however, as compared with the ordinary 3-electrode are much better from this point of view, and consequently the screen-grid stage is, as a rule, about as good over a considerable range of wave-lengths as a neutralised valve of the ordinary type employing high-efficiency coils.

High-Efficiency Coils.

With high-efficiency coils and screen-grid valves, however, there is again a tendency to instability which places a limit upon amplification, and neutralisation becomes an advantage for the same reasons as in the case of an ordinary valve.

The point I am trying to make clear is that whether with ordinary valves or with valves of the S.G. type an increase in amplification under certain conditions leads to instability which, however, may be overcome by means of neutralisation.

A Vital Point.

A writer in these pages recently gave some interesting and important points with regard to the adjustment and maintenance of grid-bias voltages and, as this is a matter which often "comes in"—if I may use the phrase—for a good deal of neglect, I would like to add a few words to what was said then.

Owing to the fact that only an extremely small current passes from the grid bias

(Continued on next page.)

TECHNICAL NOTES.

(Continued from previous page.)

battery, the latter never wears out, but only *rusts* out, so to speak. It is this very fact that a G.B. battery normally requires attention only at very long intervals that accounts for the fact that in practice it generally receives no attention at all but is completely forgotten.

Now, although the current supplied by the G.B. battery is exceedingly small, negligible in fact, and the voltage which it is intended to maintain is also, at any rate in the majority of cases, comparatively small, nevertheless its function is a very important one, quite as important as that of any other component in the circuit.

Gradual Deterioration.

I have remarked before upon the very practical question of H.T. current consumption and how this depends upon the correct value of G.B. but, quite apart from this, the *quality* of the reproduction also depends to a very large extent upon grid-bias adjustments. Owing to the fact that the G.B. battery (if of good quality) takes a very long time to deteriorate, the consequent increase of distortion in the reproduction goes on very gradually, so gradually in fact that it may be imperceptible.

The result is that, if you are frequently using the set, you may not notice anything very much wrong with the reproduction, whilst a friend hearing it for the first time may be painfully aware of the poor quality of the reproduction which it gives.

An Occasional Test.

A grid-bias battery, whilst being one of the most important accessories, is at the same time almost the cheapest component in the circuit, and therefore it is an excellent plan to replace this little battery say every six or twelve months without waiting for it to become completely dead.

I suggest replacing it at intervals rather than merely testing its voltage, as it is inevitable that a dry battery will "dry up" in course of time, whether it is used or not, and although the G.B. battery on test may show a fairly good voltage it may be just on the point of declining.

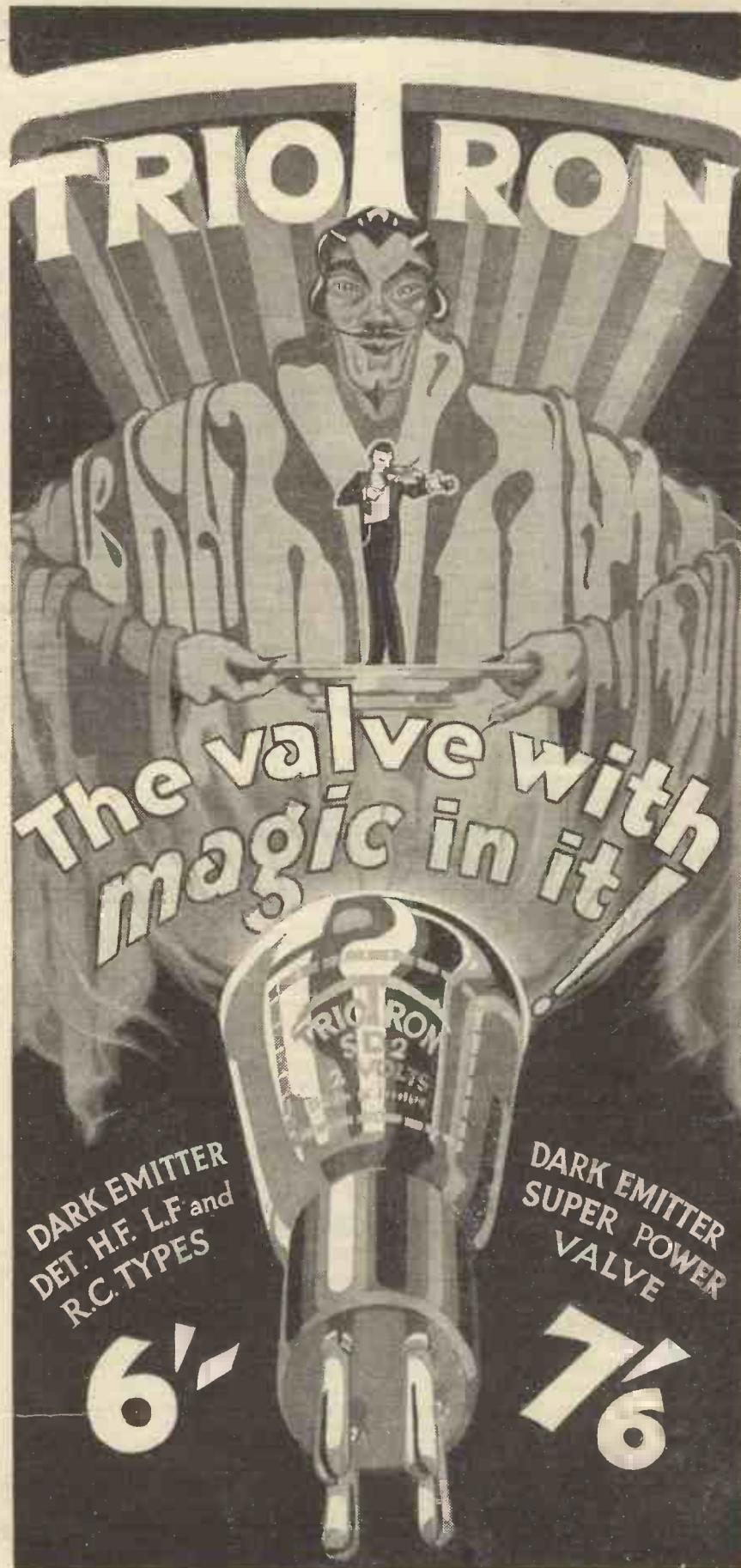
An occasional milliammeter test in the anode circuit is also an excellent thing, not only for indicating the state of affairs generally, but, in particular, for permitting any actual adjustment of grid-bias tappings which may be necessary.

Smoothing Units.

The usual arrangements for smoothing the rectified output in a mains unit intended for use with A.C. mains is a system of chokes and condensers arranged in shunt and, whilst this arrangement is probably the best for the purpose where the cost of components is not a serious consideration, it is at the same time more expensive than certain alternative methods which may be used.

As you probably know quite well, a smoothing effect can in a similar way be obtained by means of a fairly high resistance in place of the choke, the smoothing condenser being shunted across this resistance just as it would be in the case of a choke. The greater the resistance or the

(Continued on next page.)



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TECHNICAL NOTES.

(Continued from previous page.)

greater the capacity (or both) the more effective the smoothing action of this arrangement.

Ohmic Resistance.

There is, of course, a potential drop in the case of the resistance which is much greater than the potential drop which is met with in the case of the choke. Here I am assuming that the choke is of comparatively low ohmic resistance and depends primarily upon its inductive qualities: some chokes have a much higher ohmic resistance than need be and their action depends partly upon induction and partly upon resistance.

The H.T. voltage applied to the valves is thus affected by the current which is passing through the resistance, if a resistance smoother be used.

Separate Supplies.

The amount of smoothing required, however, differs with the different valves; for instance, in the case of the power output valve a much larger current is required, as a rule, than with the other valves and the smoothing action need not be so efficient.

As a matter of fact, although a copper bar of the same cross-sectional area would have a much lower resistance than a lead bar, the difference would be of very little importance, since the lead bars used are fairly thick, and offer, in any case, a very small resistance to the current.

The resistance of the usual lead-bar coupling cannot be more than a very small fraction of an ohm, and to reduce this small resistance still further is to make very little difference to the total resistance of the circuit. Moreover, the copper would be much more expensive than the lead, both as regards the material and the manufacture. These lead bars can be very cheaply cast with the holes already in them.

Corrosion.

But quite apart from these electrical considerations, the main reason that lead is used is because it is, under ordinary conditions, impervious to the action of the acid. If copper or brass were used in close association with the battery they would very soon become badly corroded and altogether useless.

It is true that covered brass nuts and bolts are used in the terminals of small accumulators, but this is because lead nuts would be too soft to be of practical service,

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Consequently, it is possible to use different resistances, each with its appropriate condenser, for the different valves, say, a high resistance and, or large capacity where a comparatively small current is required, but where the smoothing must be efficient and a smaller resistance and, or capacity, for, say, the power valve.

Cost of Construction.

Of course, if a number of resistances and condensers are required under this arrangement, it may become a question whether this is any less expensive than using chokes instead of resistances, but there are some cases when the method will be found to have advantages so far as cost of components is concerned.

Coupling Bars.

I have a letter from a reader who asks whether there is any reason, apart from economy, for using lead coupling-bars between cells in 4-volt accumulators, and why copper bars cannot be used instead. This question, in somewhat different forms, has been put forward before, evidently based upon the idea that copper bars would have greater conductivity, and therefore offer less resistance to the current.

and, as you know, the brass terminal is about the only part of the accumulator that gives serious trouble from corrosion. That is why you are advised to keep it well covered with vaseline.

Pick-up Leads.

If you are using an electrical pick-up in connection with your gramophone you may in some cases find it necessary to have a fairly long lead between the pick-up and the amplifier. In the majority of cases the gramophone and the amplifier are fairly close together (in many cases they are, of course, combined into a single cabinet), but in the minority of cases it may be inconvenient to have the amplifier reasonably near the gramophone. I had a case in point recently where it was necessary to use a single pick-up with several gramophones employing, of course, only one amplifier for them all. In this case it was clearly desirable to have a fairly long lead to the pick-up in order to enable it to reach the different gramophones.

In a case of this sort there is a great tendency to set up oscillation in the amplifier owing to the fact that the connections to the pick-up form part of the grid circuit. Short leads are, obviously, more efficient.

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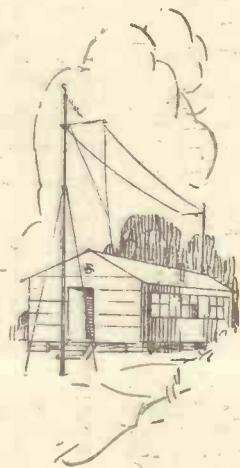
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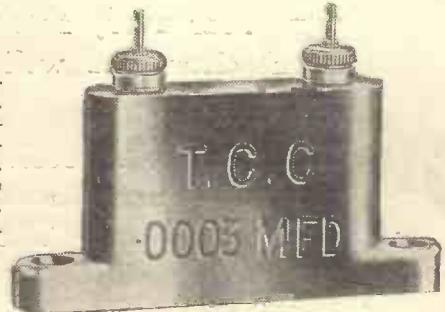
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