POPULAR WIRELESS, June 8th, 1929.

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

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No. 366. Vol. XV.

INCORPORATING "WIRELESS"

June 8th, 1929.

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ANOTHER SCEPTIC.
ALL ABOUT PORTABLES.
EXPLORING DE-LUXE.
ON TO THE POLE.

RADIO NOTES & NEWS

A BUTTON SHORT.
SWEDEN SATISFIED.
BRAINS & BREVITY.
ASTOUNDING DISCOVERY.

Another Sceptic Converted.

I BELIEVE I was weak enough to confess in these columns that my private conviction that the portable would not come into its own in this country was crumbling. Well, as the blessed thing has tumbled clean down I might as well admit it. During the Whitsun holiday I saw a fair number on the road, and in the open country one was actually on an ancient horse vehicle. I asked one picnic party why they had lugged their set out, and they said that music added the finishing touch to their environment.

All About Portables.

IT is appropriate to tell you at this stage that the current number of "Modern Wireless" is a special effort devoted to portable sets and their components, the chief item being a description of the "M. W. Portable Five," a self-contained, powerful, long-range receiver designed by one of the technical staff. It is specially recommended by the editor of "P. W." A twelve-pound (avoirdupois) "Traveller's" Two, particularly designed for the needs of a radio tourist travelling light, is also described. Mr. P. W. Harris contributes a long article on portables, and there is another dealing with pentode valves and portables. A notable half-a-crown's worth—sold for a "bob."

This is a Fact!

DURING Whitsun I and a boon companion went a'walking down into Kent to see how the hops were coming on. (Very backward!) In one little hostelry which sheltered us we espied a piano of sorts, upon which the boon companion was soon playing, there being no other guests. Enter the landlady, who said, "That's right! Play something to cheer us up. We've the wireless, *but it only gets 2 L O.*" I judged that the lady was incapable of wilful sarcasm—so *there's* an indictment of London.

Gem from Letter-Bag.

SOMETIMES the letters which I get are funnier than could be invented. If I didn't see 'em I wouldn't believe they were genuine. This one was addressed to "The Marsconi Popular, Wireless, London," and ran as follows: "They read the books Popularr Wires so help me. If we shall not get louspeker on so many meets, where was the use, eh. Tell station 5 S sending loudest lest perishing monies waste aways. Can't buy never more. And get nothins. No." This came from Uganda. Very sad! Especially the perishing money.

Exploring de Luxe.

COMMANDER RICHARD BYRD, of what they are pleased to call "Little America, Antarctica," has a programme dedicated to his expedition every alternate Saturday evening by the National Broadcasting Company of the U.S.A. The programmes, which are transmitted through W 2 X A F from W G Y, originate in the Capitol Theatre, New York, and are designed to cheer and encourage the expedition; they include messages from friends and relations. Never were adventurers so pampered. Can it be that the ice is being specially warmed?

HOW VALVES ARE MADE.

The making of valves for radio has now become an important and growing industry. This picture shows a small high-speed pump for exhausting valves

On to the Pole!

HERE is a sample of the messages sent to the intrepid daredevils: "We were so interested in reading about your snow-tunnels; you'll have a great time playing hide-and-seek in them this winter. We're so glad you'll all be protected from the cold, and will not need to go out into the Antarctic blizzards." One feels inclined to add, "Why did you leave mother and go amongst those wild and woolly penguins? This is making great ventures read like comic opera.

A Button Short.

YES, just like grandpa! I refer to a new type of receiver which a manufacturer says he expects to market at an early date. This set disdains knobs and prefers buttons, of which there are to be twenty upon its waistcoat. You press the button and get a station; press 'em all and you get twenty stations in succession. I hope it's true. However, I do think that while they were arranging for twenty buttons they might have included another—to bring the waiter. But if the tuning on a given station is not to be variable, what will happen to the set if, say, half a dozen stations change their wave-lengths—as is not unlikely.

"Avez vous S.G.?"

THAT radio has brought with it a new language, or jargon, is only too evident, but I wonder whether we realise the agony it causes the Latin races. A writer in the "Echo de Paris" pleads for the rescue of the French language from such horrors as: "Avec mon excellent square law et mon puissant push-pull, j'ai voulu entendre le Broadcasting de Daventry qui emploie trois self-standards montes en tickler. mais ma reception a ete trouble par le fading et le buzzer de postes voisin."

Vive la Leading Lady!

RADIO is not the sole butcher of the lovely language of France, for the cinema and the "talkie" also slay it. Our agonised French writer quotes: "A la lueur des spots et des sunlights le camera-man reglait un gag á la leading lady d'un star qui tournait dans une talking picture." Reminds me of the sort of thing I used to see in Spanish papers: "Mister Lord Churchill (Winston) witnessing un match de futbol, vestido en frac coats."

Brained by a Wire!

I REALLY cannot understand the morbid horror evinced by so many town councils at the erection of a simple aerial so that it crosses a street. Do not Post Office lines criss-cross all over the shop? And do they ever menace life or limb?

(Continued on next page.)

NOTES AND NEWS.

(*Continued from previous page.*)

The Torrington Town Council is the latest to take fright, and people within its jurisdiction whose aerials cross main streets are to be asked to remove them. It is only just that in the interests of wireless science these councils should divulge their horrific discovery. Are they afraid that oscillation from these aerials will stop the trams ?

Sweden is Satisfied.

AS we are so exercised about our own programmes it is interesting to observe the results of a questionnaire in another country. In Sweden 155,000 people replied to a questionnaire sent to 384,000. By a majority, no change of importance was desired. The inference is either that the Swedes are complacent or that their programmes are well-nigh perfect. The chief criticism was that the programmes contained too much music; they want more speeches. One supposes that they have a Chamber Music Charlie over there! This proves that the Swedes are easy-going and will put up with almost anything provided someone will talk lots to them about matches and pitch.

"I Wish . . . . . "

I DO not know whether I am, as usual, a lone voice, but I do wish that the B.B.C., or someone, would sell me two-pennyworth of plain, unembellished programmes. In the newspapers I get a bare outline and in the B.B.C. "organ" I get oodles of print which I can do without. A nice stout card, with full programmes, which I can have around during the week, and which will not tempt my household to use it for illegitimate purposes, would be well worth two D.

Brains and Brevity.

PLEASE see title to this note. Those commodities are all that I require from the B.B.C. publicity staff. If the band is going to play Bach's What's-his-name in Z minor, I don't care a hoot for the B.B.C's statement that the first movement is lively, the second sinister, and the third solemn. I want to hear the darned thing for myself and I do *not* need Mr. Gladstone Murray or anyone else to tell me that the wood wind has a sinister motive. I confess that I listen to music solely for the sensuous pleasure it affords to me, and I can do without paid guides to my own physiology.

The 'Busman's Holiday.

DURING Whitsun I ran down into the hop-gardens of Kent in the hope of evading wireless and all its works. My companion and I struck a beautiful 1560 inn, complete with oaken beams and nut-brown ale. The snuggery was a dream of old and rustic England. Suddenly, in the midst of an argument about cricket, I noticed a nice carved box in black oak; it looked mighty old and I began to rhapsodise about antiques. Then they told me that it was the loud speaker!

The Nightingale Stunt.

IT is pleasant to know that the perseverance of the B.B.C. engineers was rewarded and that they succeeded in broadcasting the nightingale's hullabaloo as far as New Zealand the other week. You may, however, discount the rumour that two of the birds were found dead of swollen head and that a local owl broke its neck in trying to reach their top note.

A Word of Warning.

IF you charge your accumulator at home, and are unlucky enough to be connected to D.C. mains, you will do well to advise the local electricity undertaking what you are doing. For there is a general tendency to change from D.C. to A.C., and if your supply is so changed and the supply people have not been notified about your charging installation, you may find that you will have to bear the expense of converting your charging arrangements for use with A.C. I am happy to say that, in my own case, the local electricity people treated me most generously—or rather, fairly. But we do not all live in Kent.

SHORT WAVES.

TALKING OF RELATIONS.

B.B.C. "Uncles" are going into the "talkies." It sounds an appropriate resort also for the "Aunties."—"Bulletin and Scots Pictorial."

* * *

Mother: "What's your brother Jimmy doing with the soldering iron and screwdriver?"

Bobbie: "He's going to put another stage of ossified frequency in the radio set so that he can get the six-day race on five hundred kilocycles."—"Radio News."

* * *

A coroner's officer who has just retired attended 2,000 inquests. I suggest that the B.B.C. persuade him to give a bright talk on his experiences.—"Daily News."

* * *

"One of the Eskimo dogs, evidently dissatisfied with the regular table d'hôte, found his way to the roof of the wireless cabin on the 'City of New York,' and fastened his teeth in the loop aerial of the radio compass," we read in the "Birmingham Evening Despatch."

* * *

"Broadcast political speeches go in at one ear and out at the other," says a writer. Tight-fitting headphones seem to be the only remedy.—"Humorist."

* * *

"It *offten* happens that a listener, after having been perfectly satisfied with the demonstrated performance of a loud speaker, will purchase it, take it home, attach it to his set, only to be disappointed at the results," we read in the "Manchester Evening News."

Oh, *very* of-t-t-t-t-ten!

* * *

Teacher (who is working up to a lecture on the wonders of radio): "Can any of you name something that talks, sings, and plays, but was not in existence twenty years ago?"

Handy Andy: "Yes'm; oh, yes, ma'am."

Teacher: "What is it?"

Andy: "Me!"—"Radio News."

* * *

The Kentucky Derby was recently broadcast to England from station W G Y Schenectady through short-wave transmitters. Personally, we found the transmission decidedly "horse."

Astounding Discovery.

THAT well-known wireless paper, "Reynolds' News," has made an important discovery (exclusive to its readers), no less than that it is advantageous to disconnect the "earth" lead from the set and connect it to the negative L.T. battery terminal. The fact that in most receivers the "earth" terminal is connected inside to the L.T. negative does not seem to be known to the professor of radio who made the "discovery." All he recommends, therefore, in effect, is that you shorten (or lengthen) the "earth" lead by an amount equal to the connection between the "earth" terminal and the L.T. negative.

The Usual Practice.

PROBABLY the reason why some people have noticed an improvement when they did this is that their particular sets were not wired up in the usual fashion, and the change was for the better. I examined seventeen circuits which were in vogue in 1923. Thirteen showed the "earth" connected to the L.T. negative, and four showed it connected to L.T. positive. The practice is, to my knowledge, at least twenty years old. However, as our friend winds up by saying that we are all groping in the dark, I trust that he will in due time discover the "grid."

Where Did That One Come From?

AT the recent conversazione of the Royal Society there was on view a wonderful instrument for the instantaneous visual direct reading of radio messages. So exquisitely precise is it that by its means the direction of arrival of a single "atmospheric" (or "x") lasting for $\frac{1}{1000}$th of a second can be determined to within a degree of accuracy. It must be a great comfort to know that an "x" which robbed you of a word from America, arrived from the N N E, for instance.

That Historic Event.

W. T. (Slough), who has lively recollections of the great evening when under the auspices of "P.W." Senatore Marconi made a presentation to Sir O. Lodge, asks when we are going to repeat the performance. Never, I fear. The occasion was unique and those who attended were privileged beyond belief, for it was a great evening, even though Captain Eckersley's voice echoed badly from the opposite wall. The sight of those two great men shaking hands and smiling at each other was unforgettable and I doubt whether a pleasanter affair was ever arranged by any paper.

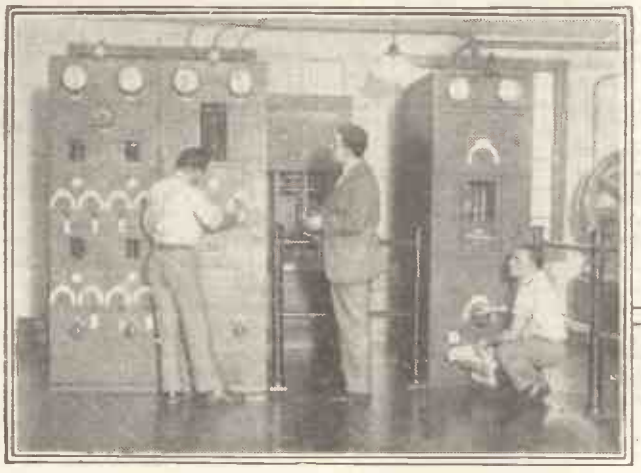
The Leclanché Charger.

H. L. M. (Harwick) provides more details of his method of charging accumulators by Leclanché cells. If when he shuts the set down the accumulator shows less than 1·97 volts he connects up his primary battery and goes to bed leaving the good work to proceed. There is, of course, a heavy drain on the primary, but this recovers after a rest. I am still a little astonished, because Leclanché cells are seldom used for continuous "loads" owing to their polarisation.

How It's Done

H. L. M. strips the covering from large dry cells such as are used for bells, punches holes in the zinc, and immerses the cell in sal ammoniac solution. Large P.O. pattern sac type Leclanchés give good results also. He does not recommend the porous pot type; using these he finds that the zincs last about six weeks. I quite agree with H. L. M. that to put one's accumulator out to the average garage is to court disaster. Luckily, I can charge my own from the mains. To conclude, I accept H. L. M's testimony, but I still feel that the method is like a sheep suckling a young lion!

ARIEL.



SOLVING WAVELENGTH PROBLEMS

by

CAPT. P.P. ECKERSLEY M.I.E.E.

(Chief Engineer of the B.B.C.)

3.—FUTURE DEVELOPMENTS.

This is the third and last of a short series of articles dealing with the intricate question of international wave-length appropriations in a popular and most interesting manner. Captain Eckersley exercises his gifts of clear explanation and fascinating writing to their utmost in this special article.

LET us then again summarise in the light of the past analysis:

The ultra-long wave is dead. It requires for its generation stations of a very high capital cost; the received signals are interrupted by atmospherics, its use for short distance communication between mobile stations is for the same reasons debarred. The long wave is useful for certain point-to-point communications, particularly ship to shore working, because its stability is great, its attenuation small, and the range required limited, and the atmospherics not bad enough greatly to hinder communication. Medium waves are good for limited direct ray or ground ray services, particularly telephony which includes broadcasting. In general, telephony, particularly broadcasting, must depend upon direct ray service. The electrified layer, responsible for world-wide communication, is, as has been before stated, variable, and the strength of the rays reflected from it is always variable.

Fading Prevents Fidelity.

This does not matter for telegraphy signals, because, provided they are always stronger than a minimum it does not matter how much stronger. Telephony is a different matter and, particularly for broadcasting, a fading signal is no good as it does not represent fidelity. Fading may *without special precautions* produce distortion, and therefore the indirect space rays have to be treated specially at the receiver even for telephony. Short waves are excellent for very short point-to-point services with telephony and telegraphy, and have some possibilities of application for telegraph services via the indirect ray over long distances. Ultra-short waves are wholly suitable for world communication by telegraphy, and are being developed for world telephone communication.

Problem of Separation.

Before approaching the actual Washington Conference another point has to be appreciated, and that is that different services take up a certain portion of the wave-length gamut or frequency gamut available. We have available, say, from 13 kilocycles per second to 30,000 kilocycles per second. Let us consider the short-wave band from 40 to 200 metres. This is from 7,500 to 1,500 kilocycles. Each transmission takes up a certain number of kilocycles. Broadcast telephony for good quality requires in practice 10 kilocycles in all, each station, if they are a fair geographical distance apart, works without interference with another 10 kilocycles apart. Thus we could get 7,500—1,500 divided by 10 = 600 broadcasting stations between 40 and 200 metres. A commercial telephone station requires in most cases 5 kilocycles and 30 telephony stations might be contained in the short-wave band. Properly equipped telegraph stations ought to occupy about 0·5 kilocycles, and so the short-wave band *could* contain 12,000 stations! The table below gives this in detail:

Band.	Wave-length limits.	Kilocycles available.	No. of Stations Possible. Broadcasting. 10 kc.	Telephone. 5 kc.	Telegraph. 0·5 kc.
Ultra Long	23,000–10,000	13 - 33·3 = 20·3	2	4	40
Long	10,000– 1,000	33·3– 333 = 300	30	60	600
Medium ..	1,000– 200	333·3– 1,500 = 1,277	130 (say)	260	2,600
Short	200 – 40	1,500 – 7,500 = 6,000	600 „	1,200	12,000
Ultra Short..	40– 10	7,500 –33,333 = 25,800	2,580 „	5,160	51,600

Captain Eckersley's pipe is almost as well-known as Mr. Baldwin's and certainly quite as close a personal companion.

Bureaucrats at Washington.

It is somewhat amazing to find that we could, in theory, contain 51,000-odd telegraph stations between 40 and 10 metres, and only 40 between 23,000 and 10,000 metres, but so it is. But there are many things which have to be considered besides these numbers. We have to realise the conditions of operating, the complication of building stations for very short waves under conditions of mobile reception and transmission, obsolescence and so on.

The Conference at Washington met, however, with a full knowledge of all these facts. The Conference was composed of men from all over the world, who must have known these facts if they had taken account of their technicians. The delegations were headed in many cases by technicians, but they were, of course, composed in practically every case of bureaucrats—men used to administration, and not often actual large-scale operation of wireless. There has been no similar conference in the world before, the 1912 Convention concerned itself purely with wireless and safety of life at sea.

Useful Work Done.

Decisions were finally come to, and the result of the work done by the Conference in the all-important matter of wave-length allocation is set out in the accompanying table.

I am certain that the result cannot be criticised from an administrative point of view. It is admirable. It is the result of a series of long-debated compromises. Most things have to be based on compromise eventually, like the automatic carburetter, which automatically gives the wrong mixture at all speeds—but which works.

(Continued on next page.)

SOLVING WAVELENGTH PROBLEMS.

(Continued from previous page.)

I am certain, however, that a technician could find and does find much to criticise, but, of course, purely from the technical angle. Firstly, it might be justly said that the Conference was not technically inspired. No one went, I feel (and I was there), with the idea that there was a Heaven-sent opportunity to set the house in order on a sound technical basis. Problems were acute. The new (toy ?) broadcasting was clamouring for wave-lengths for its rapidly expanding activities. The great Peace having been signed less than a decade ago, the fighting services wanted a large share of existing facilities. Flying wanted waves for its uses, and its technicians were not in a position to use the latest technique. Shipowners, being truly conservative, saw no necessity to change what was almost a tradition, the use of spark sets which represented a technique 20 years old.

Individual Interests.

Besides which, trade being bad, and no sinking fund being put aside for obsolescence of a small part of their equipment (in spite of recent war freights), they saw themselves potentially involved in a tremendous expenditure.

Commercial firms operating wireless services, where the wire ought to have served, and which were strictly speaking ancillary to wire services, still wished to see their profits. Safety of life at sea, devices such as the "radiophares" recently built on the basis of a technique 20 years old (spark), wished for facilities to continue as of old. Many wanted few rules, and talked of fettering development by a too-rigid ruling out of available space, others vaguely wanted to grab all they could for future development. Few envisaged the whole as a world problem capable of resolution in terms of sound technical reasoning. Such is my humble opinion. I am not saying that any one delegation could have brought about my ideal; I am saying, however, that if the majority had been inspired by the view that this world problem was wholly technical (in its collective sense), more might have been done. One must not make such wide generalities without the support of facts. For this reason let me analyse the problem.

The Gifts of Washington.

Now we see the same mobile service and fixed service and broadcasting. Let us only consider the short and medium and long waves, and analyse the gifts of Washington.

I have calculated roughly that mobile services get about 2,500 kilocycles, that fixed services get the same. Broadcasting gets about 1,000 kilocycles which is useful to it. The total available is 7,500, and we have accounted for 6,000, the remainder goes to short-wave broadcasting (which is no good to it), but which may come in for inter-linking national services later and to amateurs.

The Lion's Share.

There is in this wave-band about 6,500 kilocycles available. I have made a rough analysis and find 2,500 kilocycles for fixed services, 2,500 for mobile services, 500 for amateurs, and 1,000 to broadcasting. This means that, as fixed and mobile services are mainly telegraphic, that there could be say 20,000 fixed telegraph stations and, allowing a greater margin for mobile services, 10,000 mobile stations in any given continent. On this basis also we can have only 100 broadcasting stations. (These calculations are rough, and give only the order of quantities).

It seems, however, that the lion's share is given to fixed and mobile stations, while poor broadcasting has to make compromise after compromise on account of its restricted wave-band.

A Commonsense Re-arrangement.

Now suppose Washington had founded at any rate a forward policy, what might it have done? In my opinion, and because broadcasting relies upon direct ray services and suffers from all sorts of difficulties on that account, broadcasting should have been given the promise for the future of a wave-band of from 200 to 2,000 metres, allowing 1,500 to 150 kilocycles, i.e. 135 stations in all.

This is only a gain of 35 per cent, but the long waves are very valuable, and with one station one can cover huge areas necessary for broadcasting unnecessary for point-to-point services.

Mobile and fixed services could be contained between 40 and 200 metres and 2,000 metres upwards. Why not with the will so to do? Ships should use waves between 150 and 200 metres, because we have seen that over sea these waves are as valuable as 1,500 and 2,000 metres over land.

With tonic train and valve receivers there should be no difficulty with the 500 channels available with 1 kilocycle difference between, and a calling wave on one particular channel for one particular shore station and an automatic watch on an S.O.S. wave, etc.

These things can be done even though there are difficulties. Civil aviation could use waves about 2,000 metres for telephony with larger aerials. The waves are excellent for mobile services of all sorts involving small aerials and working small ranges. For larger ranges and 2,000 metres and upwards, waves are valuable on C.W. suffering little attenuation.

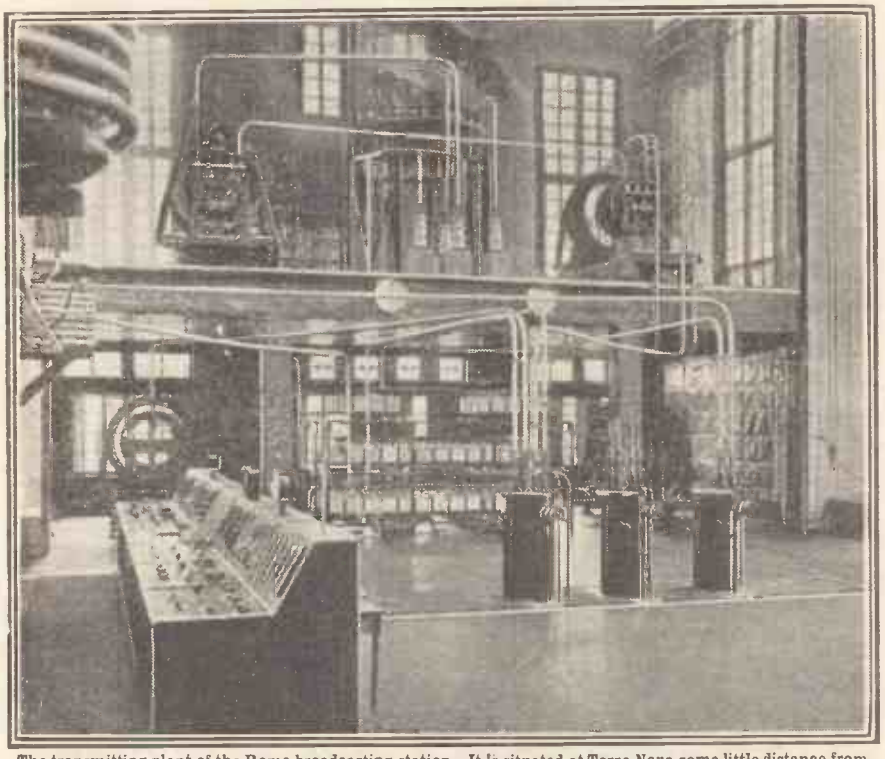
Eliminating Morse Interference.

It would be better, if this were objected to, to give up 35 waves at the bottom of the broadcasting band, and have 100 waves below 2,000 metres separated by 10 kilocycles, than to retain these low waves and not have the long waves.

My plan has the advantage, too, of not uniting together telegraphy and broadcasting services, so that the listener is subjected to the everlasting interference from Morse. It is wrong, in my opinion, to continue on a basis of the status quo and the disregard of technicalities such as are now so well known.

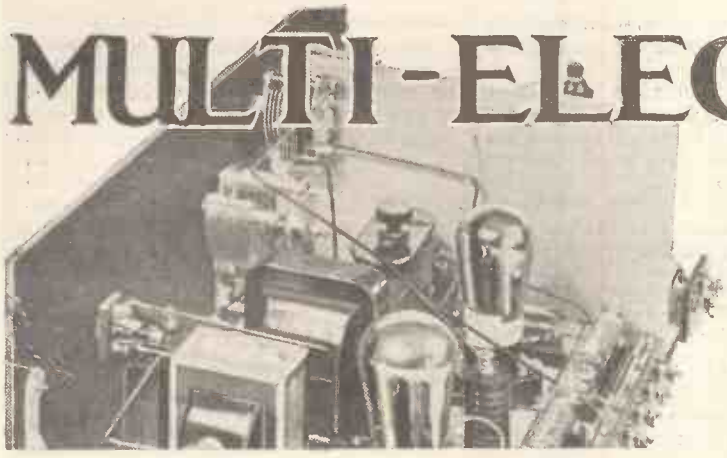
There is to be a new "Washington" at Madrid in 1932. It is to be hoped that this proposal will merit some consideration by Governments. It may not be the official view of our Government nor even of the B.B.C., it is simply my point of view as a technician for a moment basking in the sunshine of a dream of an autocracy and unhindered by the necessity of argument.

STATION RADIO ROMA.



The transmitting plant of the Rome broadcasting station. It is situated at Torre Nova some little distance from the capital. The call-sign is I R O and the station operates on 445 metres with a power of 3 kw. Radio Roma comes over very well and can be heard in this country during the hours of darkness on quite ordinary sets.

MULTI-ELECTRODE VALVES



Some details concerning the latest advances in valve design — the Screened-Grid and Pentode Valves.

By G. W. EVANS.

IT is a long time now since the original two-electrode valve was invented by Sir Ambrose Fleming, and it is also a considerable time since Dr. Lee de Forest took that valve and made his world-renowned improvement by putting in the grid and thus giving it another electrode.

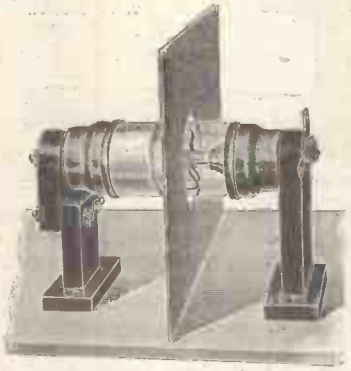
Since those days all sorts of weird and wonderful valves, having, three, four, five, six and even more electrodes have been made, but it is only recently that the four- and the five-electrode valves have been placed upon the British market for use in ordinary receivers.

The S.G. Valve.

The four-electrode valve, with two grids and a plate, has been known for some time, and has been used in more or less freak circuits, with quite a considerable amount of success, but it is to the screened-grid valve that the real honour must be given where four-electrode valves are concerned, for this valve has very nearly revolutionised high-frequency amplification, and has, for the time being at any rate, thrown other H.F. valves completely into the background.

The screened-grid valve consists, as probably most of you know, of the ordinary filament, followed outside by the ordinary grid, then by a special screening grid and then by a plate. The screening grid is connected to H.T. positive and serves not only to assist the electrons on their way between filament and plate, but also to isolate the plate from the ordinary grid to a very large degree, and thus prevent inter-electrode capacity-coupling.

Thus the screened-grid valve does not require neutralising, and owing to this screening effect very high magnification can be obtained with perfect stability, each stage of screened-grid amplification giving about one and a half stages of amplification as supplied by the ordinary H.F. neutralised type.



The "Parex" screened-grid valve holder (Paroussl).

Following on this valve we have also other multi-electrode valves, including the Loewe, in which complete stages of amplification are enclosed in one vacuum tube, and then the five-electrode valve commonly known as the Pentode.

This consists of the ordinary filament and grid, then outside the ordinary grid a second grid, and then a third grid outside grid No. 2 and finally the plate.

The ordinary grid is connected to the input in the usual way, the next grid is taken to the H.T. positive terminal, and the third grid is connected to the filament inside the valve.

Most readers will be more or less familiar with the pentode's peculiar characteristics of exceedingly high amplification factor, and fairly high impedance.

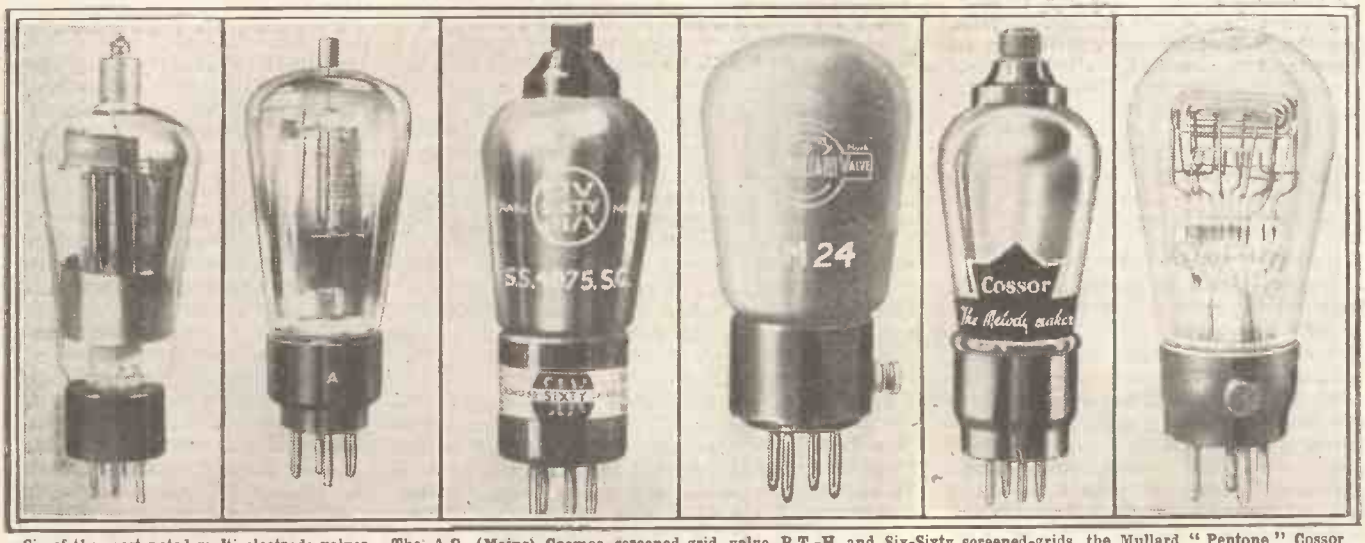
Properly-Designed Circuit Essential.

It is not a valve that should be used haphazardly. It has its own peculiarities, one being that its grid biasing for best results is usually very critical, another being that a special output circuit is necessary, in order that the impedance of the valve shall be suitable matched, and that good reproduction over the whole of the musical scale shall be obtained.

If the output circuit is not correctly designed and the valve is placed straight in the loud-speaker circuit, then one is liable to get more reproduction of the high notes than is the case with the average output valve and a corresponding loss of bass, which gives the reproduction a very unpleasant quality.

Given the proper output circuit, correct grid bias, and sufficient H.T. current the pentode can be an exceedingly useful valve.

SOME SCREENED-GRID AND PENTODE VALVES.



Six of the most noted multi-electrode valves. The A.C. (Mains) Cosmos screened-grid valve, B.T.-H. and Six-Sixty screened-grids, the Mullard "Pentone," Cossor screened grid and Osram Pentode.

LATEST BROADCASTING NEWS.

NEW WAVE-LENGTH RE-SHUFFLE.

"MR. CINDERS" ON THE AIR —LEAMINGTON RELAYS— DUNLOP MUSIC—CAPTAIN WOOD'S FAREWELL—THE SEARCHLIGHT TATTOO AGAIN.

New Wave-length Re-Shuffle.

THE application of the Prague Plan on June 30th will involve a number of important changes in British broadcasting wave-lengths. The ten waves now permanently allotted to the B.B.C. will be redistributed with an eye to the advent of the Regional Scheme. Daventry 5 X X remains on 1,562·5 metres; Manchester is given 479 metres in place of its present wave of 378·3. Manchester's new wave is regarded as the best of the lot. Daventry 5 G B is given 399 metres instead of its present 482·3. London is changed from 358 to 356. Cardiff substitutes 310 for 323·2. Glasgow gets 377 in place of 401·1. Aberdeen's recent good luck still holds, the exclusive wave of 301 taking the place of 311·2.

Newcastle goes up from 243·9 to 261, which should considerably improve the service on Tyneside. But in September, when the new London Station begins working, Newcastle will change again, probably joining the national common-wave stations that work on 288·5. Belfast drops from 302·7 to 242. Leeds descends from 260·9 to 200, which is an international common wave. Bradford goes on the national common, 288·5, which will then be carrying as well Bournemouth, Dundee, Edinburgh, Hull, Liverpool, Plymouth, Sheffield, Stoke, and Swansea.

The B.B.C. swear that this will be the last wave-length shuffle except for local adjustments caused by the introduction of twin-wave-length working. Listeners will notice the change mostly in Leeds where new coils will be necessary. In the autumn, when Newcastle joins the national common, there should be improved distribution on Tyneside, but practically all local programmes will disappear in favour of London ones. The demobilisation of the local B.B.C. staffs north of the Tweed proceeds apace. By September there will be only three or four broadcasters in Scotland. With the development of concentration there is less and less for local staff to do.

"Mr. Cinders" on the Air.

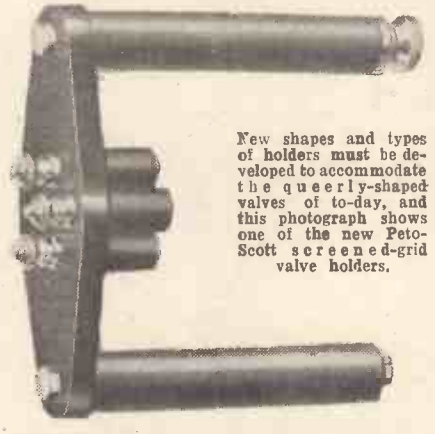
Although relays from the stage of London theatres are now frequently included in vaudeville programmes, it is some time since listeners heard an excerpt from the stage production of a musical comedy. A few years ago outside broadcasts of this type were considered high spots in the broadcast programmes and though, of course, still very enjoyable, they are not so outstanding as formerly, so great has been the all-round advance of studio work. Nevertheless, many listeners will look forward with pleasurable anticipation to the broadcast of an excerpt from the musical comedy, "Mr. Cinders," which is doing good business at the Adelphi Theatre.

The relay will take place on Friday evening, June 21st, when for thirty-five minutes, between 8.25 and 9 p.m. listeners will hear some of the best items of the show including "True to Two," "I Want the World to Know," and "One Man Girl," sung by Jack Melford and chorus, Basil Howes and Lorna Hubbard, and Binnie Hale and Bobby Howes.

Care and Maintenance.

The first of a series of fortnightly broadcasts to be given by 5 G B during the summer from the Jephson Gardens Pavilion, Leamington Spa, takes place on Sunday afternoon, June 16th, when a concert by the band of the 17/21 Lancers will be heard. This famous regiment, formed in 1759, owes its existence to Lieut.-Col. John Hall, who brought home the despatches of victory at Quebec. His reward was the honour of forming the regiment.

HOW VALVE HOLDERS CHANGE.



New shapes and types of holders must be developed to accommodate the queerly-shaped valves of to-day, and this photograph shows one of the new Peto-Scott screened-grid valve holders.

Dunlop Music.

Besides being engaged in the manufacture of motor-car tyres, the firm of Dunlop has an excellent works band, which rehearses in its own time, at Fort Dunlop on the outskirts of Birmingham. Full advantage is taken of professional tuition, and during its five years' existence the band has become very proficient. It has, however, not yet appeared before the microphone, but this little matter is to be remedied on Saturday, June 22nd, when it will play for 5 G B listeners.

Captain Wood's Farewell.

Captain F. W. Wood, whose retirement from the joint post of Director of Music of the Scots Guards and Senior Director of Music of the Brigade of Guards was recently marked by a dinner given by Scottish societies in London, will conduct his famous band for the last time in Kelvingrove Park, Glasgow, on Thursday, June 20th. For thirty of his fifty-one years' service with the Guards, Captain Wood has been bandmaster, his career being as successful as it is lengthy. Unfortunately, it is not possible to broadcast the final performance on June 20th, but arrangements have been made for listeners to hear for the last time the band of the Scots Guards under his direction when it plays in the Kelvingrove Park on Sunday afternoon, June 16th.

The Searchlight Tattoo Again.

The Aldershot Command Searchlight Tattoo, from which for several years past listeners have enjoyed extensive excerpts, is to be broadcast again this year, the date selected being Tuesday, June 18th. It is hardly necessary to give elaborate details of the function which, for broadcast purposes, is to begin at 9.35 p.m. and go on until a few minutes before 10, and afterwards restart at 10.47 and continue until midnight. There will be the usual music by massed bugle bands, massed drums, and massed bands, with a Highland episode and a grand finale.

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

WHY VALVES BURN OUT.

CARE AND MAINTENANCE—HEATING CURRENT, ETC., ETC.

Why Valves Burn Out.

I HAVE been asked to say something as to the various causes which contribute to shortening the life of a valve. As I suppose the great majority of wireless listeners now use valve sets, the question of the care and maintenance of valves is one which is of very general interest.

The coming of the dull-emitter—and the *very* dull emitter—type of valve has largely done away with the danger of actually burning out the filament under operating conditions, that is, apart from accidental short-circuits and similar causes. In the old days—it seems the old days, although I suppose it is not more than four or five years ago—when bright-emitter filaments were the order of the day (consuming anything from ·7 to 1½ amperes), and when the filament was operated in a really incandescent condition there was always the danger of applying a little extra current which just put it "over the mark."

Apart from this altogether the life of any filament, whether a valve filament or that of an incandescent electric lamp, is very much shortened as the operating temperature approaches nearer to the fusing point.

Heating Current.

However, as bright-emitter filaments have had their day, there is little point in considering them any further, and we may better turn our attention to the dull-emitter type.

With this type the actual operating temperature is far away below the fusing point of the metal of the filament and therefore, apart, as I said above, from accidental causes, there is no reason why a dull-emitter filament should ever be burnt out by passing too large a heating-current through it. Perhaps this statement should be subject to certain modifications which I will discuss presently.

(*Continued on page* 432.)

Valve Holders

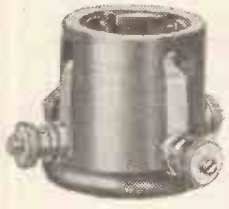
Do you choose your valve holders with the same care as you do your other radio components? This article tells you what to guard against and what to look out for in these small but important sections of the wireless receiver.

By PERCY W. HARRIS, M.I.R.E.
(*Editor, "Wireless Constructor."*)

"AND anything else?" says the dealer, assembling your components on a sheet of brown paper.

"Oh, yes!" you answer. "I want three valve holders!"

You have been careful to ask for a blank transformer, dash coils, and an asterisk resistance-capacity coupler, for you know these makes are well-made and will ensure good results. Are you as careful about your valve holders? A valve holder to you is perhaps just a valve holder. "They are all as good as one another!" you may say, and be content to take anything that is offered to you.



On the left we see the Lissen rigid type of holder, while below is the Lotus anti-microphonic holder.

Don't you believe it! I have had valve holders through my hands for test that were quite capable of nullifying all the special advantages of some particular components used with them, and, it may be said, they have *not* always been any cheaper than the good and reliable makes.

The Two Types.

Unfortunately, whether a valve holder is good or bad cannot be found from a cursory examination. Let us get together for a few minutes and see what we require in a valve holder, and where it may "let us down" if it is not of reliable make. And perhaps the information given here may enable you to remedy that mysterious and intermittent fault which has been worrying you.

A five-pin valve holder specially made for either ordinary valves or the new A.C. 5-pin valves that are to become standard. The holder shown is a Harlie.

There are two kinds of valve holder available to the home constructor—the rigid, and what is generally termed the "anti-microphonic." The rigid types are usually cheaper, they can be made to occupy a slightly smaller space, and they can also be quite as efficient electrically as the best anti-microphonic types.

An Important Advantage.

The anti-microphonic type of holder suspends the valve on some form of spring mounting and more or less effectively isolates it from severe shocks transmitted through the baseboard and from the minor vibrations which set up microphonic troubles.

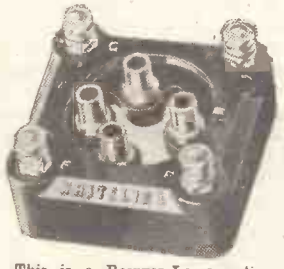
Another advantage—to my mind one of the most important, although it is rarely mentioned—is that the flexibility of the portion of the holder into which the pins of the valve are inserted, prevents the pins and base being severely wrenched if the valve is carelessly withdrawn from the socket. With a rigid holder a slight sideways pull on the valve may break the bulb from the base, bend the pins and make them difficult of insertion on future occasions.

These two holders are the "Magnum" and the Pye, both of the anti-vibration variety.

In an experimental set, where valves are taken out and replaced at frequent intervals, this advantage is one not to be forgotten.

Most valve holders nowadays have small brass or bronze tubes embedded in a bakelite moulding, the pins of the valve making contact with the insides of these tubes. Sound electrical contact must be made between each of these tubular sockets and the soldering lug, or the terminal to which its connecting wire is joined, and considerable ingenuity is displayed by the different makers in designing good holders to give sound contact.

All of the leading makes are quite effective in this regard, and if you choose a valve holder of a well-known brand you are very unlikely to be let down in this way, but some valve holders of foreign manufacture are so poorly made that contact between the actual socket and the soldering lug or terminal is very poor. I have on more than one occasion actually found insulating material between the two parts!



This is a Bowyer-Lowe anti-vibration, low-capacity valve holder.

If you have doubts about your valve holder, examine it carefully to see that good, sound contact is made between the soldering lug or terminal and the portion of the holder with which the pin makes contact. In the anti-microphonic varieties the current has to pass through some sort of spring or flexible connection and one make of holder is so ingeniously designed that the soldering lug, spring and contact tube are all in one piece.

Good Insulation Essential.

Other good makes ensure certain contacts by soldered connections, while still others have good firm pressure contacts, the contact surfaces being relatively large.

Not only must we have good contacts between soldering lugs and terminals and the actual sockets, but we must be sure that the insulating material is really insulating, not only between the filament sockets but between grid and filament, grid and plate, and plate and filament sockets.

Two more good examples of modern valve holder design are to be seen here. On the left is one of the "Benjamin" models, while below is the "W.B.," a popular product.

All black material is not a good insulator and in some unbranded products I have found considerable leakages.

VALVES FOR A.C. MAINS.

If you have A.C. Mains you can run your set completely from the electric-light system. Details of the special valves for this purpose are given in this interesting article.

By G. P. KENDALL, B.Sc.

IF you were to ask an electrical engineer whether he thought it a good idea to design an electrical appliance to be used with batteries, he would probably smile broadly and reply by asking you what you thought the public electricity supply was for? When you look at it in this light, it does seem a rather strange proceeding to run so modern a thing as a wireless set with batteries in this twentieth century, doesn't it?

That is only one way of looking at the matter, of course, and it would be easy to make too sweeping a generalisation about it if we did not keep a number of other factors in mind. For example, we must remember that a very large proportion of the users of wireless sets have not got electricity laid on at all, and so cannot be expected to take much interest in "all from the mains" talk.

The Marconi version of the new type of mains valve holder.

Standardising Difficulties.

Again, there is the point of view of the designer of sets, who must turn out receivers which can be built and used by anyone who so desires, whether or not the mains are available, a problem much complicated by the fact that we have such an extraordinary variety of different electric mains supplies in this country. The question of cost enters into the matter to some extent, too, for although mains-operated sets are mostly very cheap to run, their first cost is necessarily rather higher than the battery-driven type.

Evidently, then, we must not hastily assume that the mains-driven set is necessarily the only one worthy of consideration just yet, but all the same it is a very attractive type to those who have the mains available, and a very interesting one.

On direct-current supplies, of course, the matter is in some ways much simpler, because we can use the ordinary types of valves and run their filaments in series straight off the mains through a suitable resistance adjusted to pass the right current. Quite a number of successful schemes have been worked out for doing this, and many such set designs have been published of late.

Where the supply is an alternating one we can no longer use ordinary valves, because we should get too much hum. Special types are required, and it is the purpose of this article to give you very briefly a general idea of the working and uses of those now available.

Directly-Heated Filaments.

Probably the easiest type to understand is the one known as the "directly heated" variety, which is actually the most recently developed. These valves are really very much like the ordinary battery type, having very much the usual arrangement of filament, grid and plate. Where the difference comes in is in the filament, which is very short and thick, and consequently requires quite a large current at a very low voltage. The idea is to produce a filament which heats and cools relatively slowly, so that it shall not respond to the rapid changes of the alternating current, which would otherwise produce a hum.

The only valves at present on the market of this type are the Marconi and Osram "Point 8" series, which all take ·8 amp. at ·8 of a volt for their filaments.

Their characteristics are very similar to those of battery valves, and the types at present available are these: H.F., R.C., and small power. A screened grid is expected to be added to the series almost immediately. The low voltage A.C. for their filaments, of course, is derived from a small step-down transformer or from a special winding incorporated in the main transformer.

The first type of A.C. valve to be produced and marketed in this country was the "indirectly-heated" form, which is not quite so simple to understand. Here we have a rather different system of construction. The equivalent of the filament is now a little metal tube which is specially prepared to emit the necessary stream of electrons at a comparatively low temperature.

The original baseboard-mounting Cosmos A.C. valve holder.

The Indirectly-Heated Cathode.

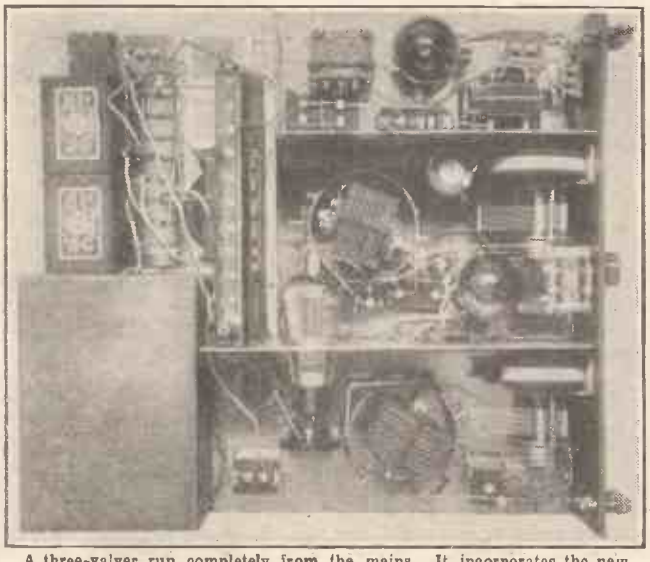
Inside this tiny tube is arranged a little heater element which is run with low voltage alternating current, and only warms up the "filament" (more correctly called the "cathode") indirectly. There is no actual connection between the heater and the cathode, hence the hum difficulty is not a serious one with this construction. Examples of these valves are the Marconi and Osram "K.L.1" and "K.H.1" valves, the new Cossor series which is just being introduced, and the Cosmos range.

The current required by the heater is fairly large, but since it is at only a low voltage a step-down transformer is used, and so the actual consumption from the mains is quite small. In the Cosmos series, for example, the heater requires one ampere, but this is at only 4 volts.

Remarkable Characteristics.

The characteristics of the indirectly-heated cathode variety can be made extremely good, partly as a result of the large supply of heat available. Taking the Cosmos range as an example once more, we are immediately struck by the very high amplification factors of the valves in relation to their impedances. The power valve, for instance, has an impedance of only 2,500 ohms, yet its amplification factor is as high as ten.

This type of A.C. valve requires a special form of holder, since there are five connections to be made, i.e. two for the heater, and one each for the plate, grid and cathode. The holders used up to the present have been rather different from those of ordinary valves, and hence the A.C. type has not been interchangeable with the battery kind without the use of an adapter. It is learned, however, that a new fitting will be standardised in the near future which will overcome this difficulty.



A three-valver run completely from the mains. It incorporates the new Cosmos S.G. A.C. valve together with a detector and L.F. valve, also of the indirectly-heated cathode variety.

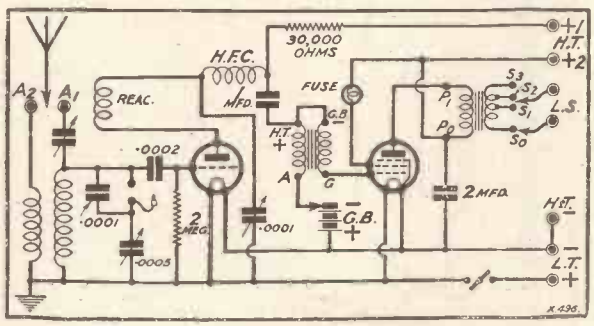
The "DEPEN" TWO

A neat little design which incorporates that extremely useful circuit, the detector and pentode, which is rapidly becoming a favourite for short-wave work. Special devices are included which ensure easy operation and high efficiency on short waves, while if suitable coils are inserted the set will work excellently on the ordinary broadcast and long waves.

Designed and Described by the "P.W." RESEARCH DEPT.

IS the pentode worth while? The enquiry is a natural one, and is always asked sooner or later about any new development, once one has got over the first novelty—that novelty being in this case a low-frequency amplifying valve which gives us nearly as much magnification as two ordinary L.F. stages. The answer in this case seems to be that it all depends on what you want to do with the valve. In a number of special cases it is undoubtedly proving exceedingly useful, and one of those special cases is to be found in short-wave work. Here one of the main difficulties is to secure powerful amplification and at the same time maintain a relatively quiet background for the signals that you are trying to hear.

Two ordinary L.F. stages are apt to be rather trying to use when one is attempting to receive the desired signals on headphones. A good deal of noise and mush will often be heard, some of which appears to be picked up in the intervalve couplings and the wiring and some no doubt is due to slight imperfections in valves, components and batteries. If, therefore, we can greatly increase the amount of amplification of only a single stage we are evidently likely to benefit to a certain extent, and this expectation is borne out in practice when we come to try a pentode valve for the purpose.



A Favourite Circuit.

As a matter of fact, some extremely effective little sets can be arranged for short-wave work with a pentode for the L.F. side, and the combination of a detector and a pentode L.F. stage seems likely to become something of a favourite with the more experienced short-wave listener. We have accordingly prepared a special design on these lines, incorporating a number of modern features, which we are presenting this week, and we can strongly commend it to the notice of the man who wants a highly efficient short-waver which can be depended upon to give really good signals whenever conditions are at all passable, and moreover to give him loud-speaker reception from such stations as the American short-wavers whenever they are coming in with any degree of strength.

Throttle Control.

The circuit chosen for the receiver is something of a favourite for short-wave work, and is one often used by our short-wave expert, who is known to readers of "P.W." as "W. L. S." The main interest naturally lies in the detector portion, and there are one or two special devices here calling for explanation. The circuit is a fairly straightforward form of reacting detector, reaction being of the throttle-control type in which the reaction coil is directly in series in the anode circuit of the valve. The necessary operating control is obtained by means of a small variable reaction condenser shunted straight down to filament and acting as a bypass across a high-frequency choke which would otherwise prevent the circuit from giving reaction effects.

Two alternative methods of coupling the aerial are provided, the simplest of these being to connect the aerial lead to terminal A1, which gives the necessary coupling effect to the tuned grid circuit through a semi-variable condenser of the compression type mounted on the baseboard. By turning this to various small values you will soon find a setting which gives good results on the average aerial.

The Coupling Arrangements.

The other method is to connect the aerial to terminal A2, in which case we have the usual scheme of a so-called aperiodic aerial coupling coil, this being the one indicated at an angle in the diagrams. Here again a little adjustment of coil sizes is usually needed to get the best results on any given wave-band, possibly with a little adjustment of the coupling between the aerial coil and the tuned secondary (The socket is to be fastened to the baseboard by means of only one screw, so that it can be moved to a different angle if desired. To enable this to be done, do not forget to wire up the socket with flex instead of stiff wire.)

The set uses standard short-wave plug-in coils, which of course are extremely convenient and flexible in use. The scheme has the further advantage that by inserting ordinary broadcast coils you can use the set as your standard broadcast receiving outfit.

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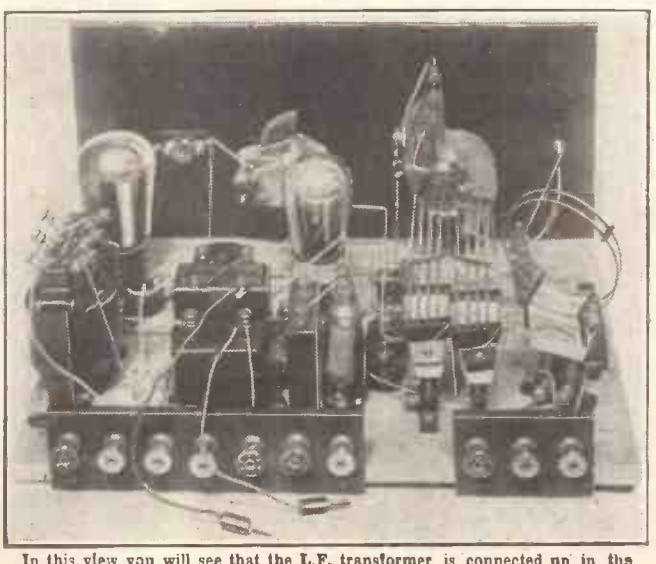


In this view you will see that the L.F. transformer is connected up in the special fashion shown in the circuit diagram, with a 30,000-ohm feed resistance. Note: This scheme only applies to the particular transformer shown (see text on this point).

THE "DEPEN" TWO.

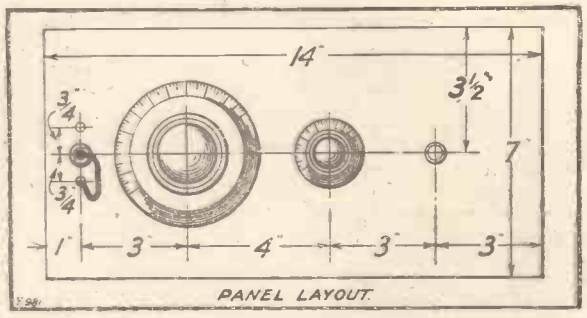
(Continued from previous page.)

To make it more convenient still in this dual capacity we have made provision for altering the effective tuning capacity of the variable condenser. This is done by providing a fixed condenser of ·0001-mfd. capacity on the baseboard and a special little device of a plug and socket on the panel for short circuiting it when not required.

Making Tuning Easy.

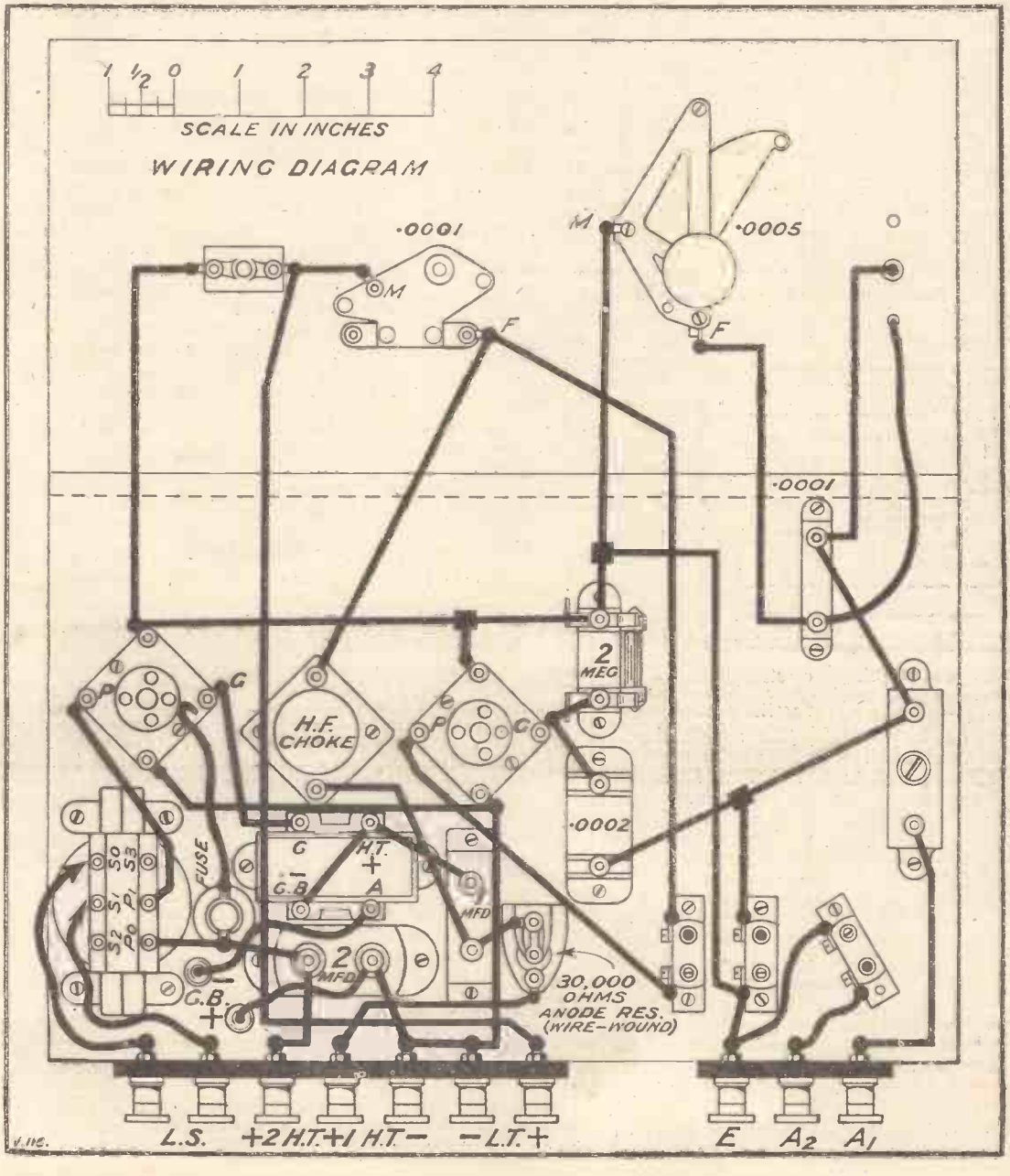
Thus, when you insert the plug in the socket this condenser is shorted and you have the full ·0005-mfd. capacity of the tuning condenser available for the broadcast waves. When you desire to work on the lower waves you simply pull the plug out of the socket and tuck it down out of the way so that it shall not be too near your fingers when operating the set, and you then have a tuning capacity which is in effect a little less than ·0001-mfd. maximum. This still gives quite a good tuning range for each set of coils on the low waves, and makes tuning very much less sharp and critical.

Passing on to the low-frequency side of the receiver you will see that we have a stage of transformer-coupling feeding on to the grid of the pentode valve, and here we have a choice of two different methods. In the original set we used one of the new R.I. "Hypermu" transformers, which can be employed in two different ways. In the first method the transformer is connected up in just the ordinary manner, the primary being connected to the anode circuit of the detector valve and the secondary going to the grid and grid bias of the pentode valve. This gives maximum amplification, and for these connections you will understand that you can use any good make of inter-valve transformer.



These connections are best if your main interest is in the low waves, where plenty of amplification is the greatest consideration rather than absolutely the last word in quality of reproduction. After all, short-wave signals are not as a rule obtainable at very perfect quality as a result of what is called "night distortion" and other factors, and so it is not very much use trying to obtain an absolutely B.B.C. standard of quality.

If, on the other hand, you are intending to use the set largely for broadcasting, with short waves as an occasional diversion, it is interesting to note that you can use this transformer with a different set of connections which gives more perfect reproduction than the ordinary scheme, the actual standard obtainable being extraordinarily fine.



Alternative Schemes.

You will understand that this special method of using the new transformer is intended to give extremely perfect amplification but slightly less magnification than the other scheme, hence it is recommended to the man who wants the set mainly for normal broadcast purposes, where high quality is available in the tranmission, rather than for short-wave work where our main interest is extra high amplification. The chief difference is in fidelity of reproduction of the lowest bass notes, which of course is of little importance on short waves. Using other makes of transformers, of course, the point does not arise and you will connect up in the usual manner.

The special method calls for the use of a 30,000-ohms anode resistance and a 1-mfd. condenser. It is actually shown in the full wiring diagram of the set. For

(Continued on next page.)

"THE DEPEN" TWO.

(Continued from previous page.)

the benefit of those who want to connect up this transformer in the ordinary fashion, or who wish to use some other make, we are also reproducing a small wiring diagram of just this particular portion of the layout, showing the normal method of connection, and this you will find quite easy to follow.

Turning to the pentode valve and its circuits, you will note that there is a small flex lead coming from one side of an H.T. fuse and this, it should be explained, is intended to be connected to the terminal on the side of the valve base. In the anode circuit of the pentode you require one of the special output transformers which are now on the market for the purpose, the one we have used being again of R.I. make. On this transformer you connect the anode of the valve to the P.1 terminal, while the P.0 terminal goes to H.T.+.

Adjustment of Ratio.

The transformer has various secondary terminals which enable you to obtain a number of different ratios to suit your loud-speaker or 'phones, and so on, and to permit the necessary variations to be made we have indicated flex leads from the 'phone terminals to the transformer. These flex leads should be connected to various pairs of secondary terminals in turn until you find the particular pair which gives the best results in your case, whereupon they can be tightened up and left permanently. Other makes of pentode output transformer can, of course, be used if desired, with a suitable slight modification of wiring.

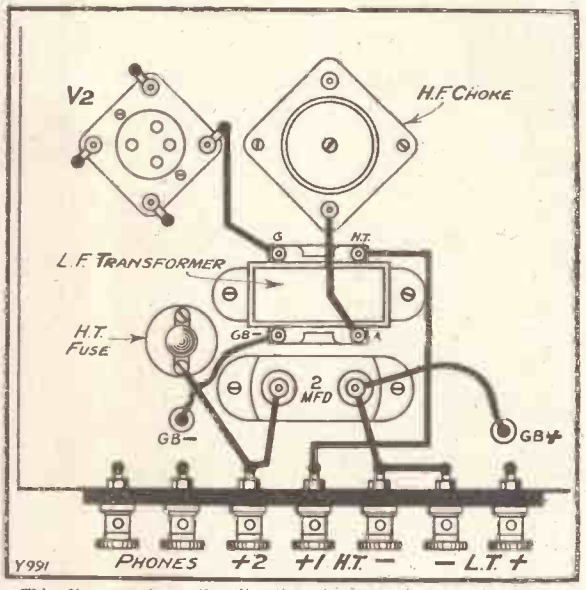
The rest of the circuit is entirely standard, and we can now go on to the more important details of the operating adjustments. First of all there is the choice of valves, and this is extremely important if you want to obtain the best results on short waves, where smooth reaction is so essential.

Choosing a Detector.

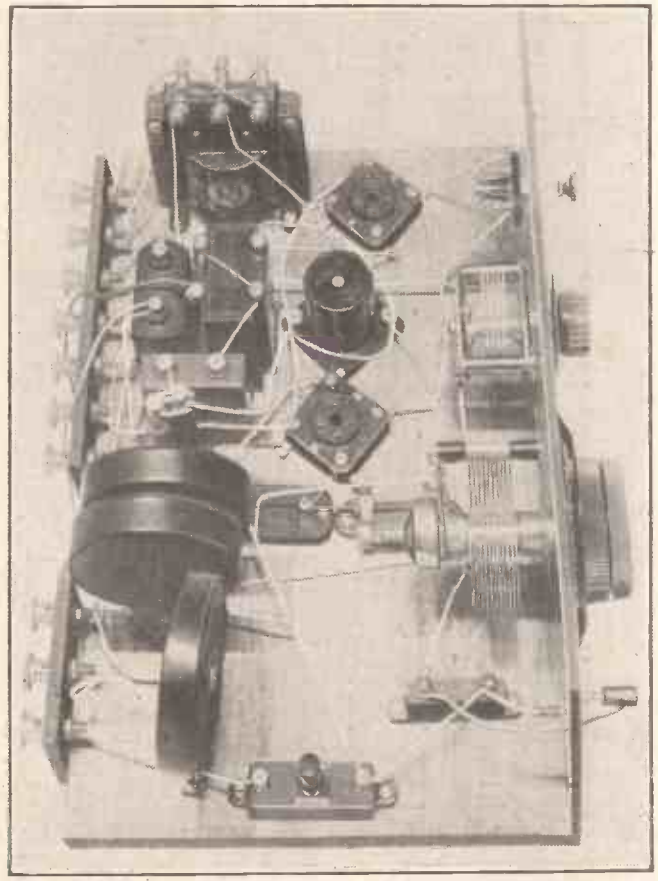
This really comes down to a question of choosing a good detector valve, and here you will find the newer types of two-volters to be particularly fine. One of the H.F. type, with an impedance of about 20,000 ohms, is usually very good, but if you happen to have an R.C. type on hand this is also worth trying, because a certain number of them give particularly smooth reaction effects. H.T. voltages will be best at the usual figures of somewhere about 30 to 60 volts on the detector (adjusted to give the smoothest possible reaction), and perhaps 100 volts on the L.F. terminal. A figure of 120 volts or perhaps a little more is advised here if the set is being used for loud-speaker work on the ordinary broadcast waves. About 100 volts is ample for short waves, however.

Next, about coil sizes. The aerial coupling coil you will generally find should be of a very small size, otherwise you may have difficulty in getting good reaction effects. A No. 2 or a No. 4 short-wave coil will generally be found satisfactory. For the secondary circuit you will require another No. 4 for the interesting band of waves from about 20 to perhaps 30 metres, and a No. 6 or a No. 9 for reaction for the same wave-lengths.

For the next interesting band of wave-lengths from 30 to perhaps 40 or 45 metres, a No. 6 should be used in the secondary and a No. 9 for reaction. There are not so many interesting stations above this tuning range, but for any you may wish to search for on 40 to about 60 metres you should use a No. 9 for the secondary coil and a No. 6 for reaction. The larger aerial coil (No. 4) is usually best for these longer waves.



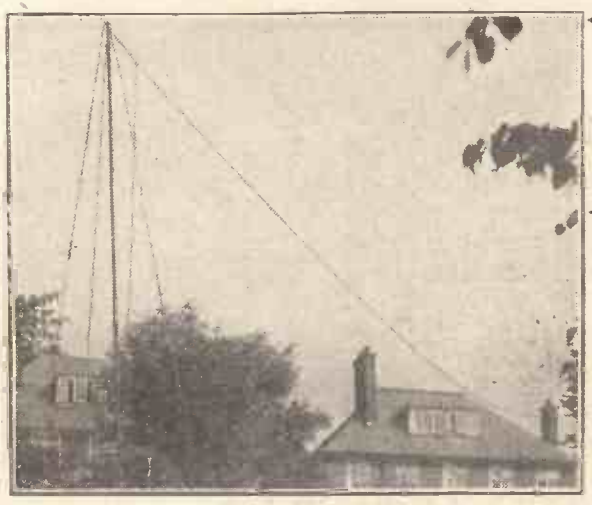
This diagram shows the alterations in connections required when using the L.F. transformer in just the standard fashion (this point is explained in detail in the text).



The original set was fitted with two separate terminal strips, but if your cabinet has a slot right across the back it is best to fit one long strip to keep out dust.

COMPONENTS REQUIRED.

1 Panel, 14 in. × 7 in. (Resisten, "Kay-Ray," Becol, Ripault, Trelleborg, etc.).
1 Cabinet to fit with baseboard 10 in. deep (Raymond, Cameo, Lock, Pickett, Arteraft, Gilbert, etc.).
1 ·0005-mfd. variable condenser, slow-motion type or with really good slow-motion dial (J.B., Lissen, Igranic, Lotus, Burton, Cyldon, Utility, Pye, Formo, Ormond, etc.).
1 ·0001 or ·00015-mfd. reaction condenser (Cyldon, Lissen, J.B., Dubilier, Raymond, Burton, Igranic, Utility, Ormond, etc.).
1 L.T. on-off switch (Bulgin, Lissen, Igranic, Lotus, Benjamin, Wearite, Magnum, etc.).
2 Sprung valve holders (Formo, Benjamin, Lotus, Igranic, W.B., Marconiphone, Precision, Magnum, B.T.-H., Bowyer-Lowe, Pye, etc.).
1 H.F. choke (this should be of the standard type, not the special short-wave form). (Dubilier, Lissen, Igranic, R.I., Magnum, Lewcos, Wearite, Bowyer-Lowe, Cosmos, Colvern, Climax, etc.).
3 Single-coil holders (Lotus, Magnum, Peto-Scott, etc.).
1 L.F. transformer (R.I. "Hypermu," Ferranti, Cossor, Lissen, Brown, Igranic, Mullard, Marconiphone, Philips, etc.).
1 30,000-ohm wire-wound resistance and holder, and 1 1-mfd. condenser (see text regarding these since they are not always necessary). (Lissen, Dubilier, Mullard, Igranic, Ferranti, etc., for the resistance and T.C.C., Mullard, Ferranti, Dubilier, Lissen, Hydra, etc., for the condenser.)
1 Pentode output transformer (R.I., Marconiphone, Igranic, etc.).
1 H T. fuse (Magnum, Bulgin, Ready Radio, etc.).
1 2-mfd. condenser (Lissen, Ferranti, Dubilier, Mullard, etc.).
1 Semi-variable condenser, baseboard-mounting type (Formo type F).
1 Fixed condenser ·0001 mfd. (Magnum, Lissen, T.C.C., Mullard, Igranic, Clarke, Goltone, Dubilier, etc.).
1 ·0002-mfd. fixed condenser (Dubilier, etc.).
1 2-megohm grid leak and holder (Lissen, Igranic, Pye, Ediswan, Mullard, Dubilier, Cosmos, etc.).
1 Terminal strip, 12 in. × 2 in., or two separate strips, as illustrated.
10 Terminals (Eelex, Belling and Lee, Burton, Igranic, etc.).



THUNDER IN THE AIR.

A timely and reassuring article about lightning and radio.

By THE EDITOR.

EVERY year the first few spring thunderstorms usually result in one or two cases of aerials being struck by lightning, although, except in very rare instances, little danger results.

However, so much publicity is usually given to cases where aerials are struck by lightning—especially in the newspapers are these cases reported—that a few words on the subject would not be out of place this month. Despite the growth of interest in the technicalities of wireless, and the consequent wider appreciation of some of the elementary facts concerning electricity, there is still—especially among listeners who have not dipped into the technicalities of radio—a fairly strong belief that a wireless aerial is a source of great danger during a thunderstorm.

No Serious Danger.

But a glance at the records of aerials struck by lightning will show that since the inception of broadcasting in this country, some eight years ago, there have not been more than four or five cases where any really serious damage has been done through lightning striking an aerial; and in the cases where the damage has been done it has usually been found that the aerial was not earthed.

Readers of POPULAR WIRELESS who have friends possessing wireless sets, and who may, through lack of knowledge of the subject, feel frightened during a thunderstorm because of the aerial, should do their utmost to convince their non-technical neighbours that as long as the aerial is earthed through a switch, not much harm can result in a thunderstorm, even though the aerial be struck by lightning. The safest method is to have an outside switch, so that the down lead of the aerial connected to the centre of a single-pole double-throw switch can be directly connected through the lead-in tube straight on to the aerial terminal of the set. If you do not do something like this the lightning may discharge itself through the set.

Preventable Trouble.

Incidentally, if the lightning discharge is serious, the set may be set on fire. There was a case last year where a set was completely disintegrated—in the mechanical sense—parts of the set being strewn all across the room, and a fire narrowly prevented. This, of course, was a case where lightning had directly struck the aerial and discharged to earth through the down lead via the coil windings of the set. If this particular installation had been fitted with an outside aerial-earth switch, very little damage indeed would have been done, and certainly there would have been no danger to be frightened of.

Secondary School Broadcasts.

The Central Council for School Broadcasting recently held its second meeting, and one of the recommendations to the B.B.C. was that a Scottish sub-council should be established which would be responsible to the main council for supervising the development of school broadcasting in Scotland. Incidentally, a sub-committee has also been appointed in order to investigate the question of special broadcasting facilities for secondary schools, and also to supervise detailed arrangements for such broadcasts as are included in future school broadcast programmes.

The Council also recommended that local broadcast lessons to schools should be discontinued, because it has been found that since the opening of Daventry most schools in the habit of receiving broadcast lessons used that particular station and not the local station.

There is no doubt that the interest in school broadcasts is growing, and the question may soon grow acute as to whether so much time and public money should be devoted to this development of the B.B.C.'s activities; for it must be borne in mind that the listener primarily pays his licence fee for the purpose of legitimate entertainment. It is expected that when the new Parliament meets this question is likely to become an acutely controversial one.

Listeners are soon to have their first opportunity of giving an opinion on television broadcasting, for it is now pretty definite that experimental tests will begin some time in July. But, of course, the phrase "some time in July" is a vague one, and no specific date can be given until the new Regional station now in course of construction at Brookman's Park is ready for work. And certainly no definite regular programme can be contemplated with regard to television until facilities have been made for the use of dual wave-lengths in order to give listeners simultaneously transmission of vision and of speech.

Television Transmissions.

The first tests are likely to be experimental broadcasts of television only. It is understood that the Baird people have their plans all ready, and that a series of discussions have been going on between the Baird Co.'s engineers and the B.B.C.'s engineers.

We have made arrangements to inform our readers directly these tests start; and, further, we hope to be able to arrange a limited number of tests whereby invitations will be extended to some of our readers to call at our offices, witness the results of the television transmissions, and write their impartial views for publication in this journal.

As we reported in POPULAR WIRELESS recently, the new Tatsfield station, which replaces the old experimental station at Keston, may be utilised later on in the year for swapping programmes with American broadcasting stations. This scheme is very much favoured by Mr. Aylesworth, the president of the United States National Broadcasting Company, who recently paid a visit to this country.

The New Tatsfield Station.

On his return to New York, Mr. Aylesworth informed the Press there that he had been discussing plans in this connection with the London authorities for the early inauguration of this exchange programme scheme.

Ever since the B.B.C. was inaugurated attempts have been made from time to time to relay American programmes; but, on the whole, with indifferent success. It is now understood, however, that the new Tatsfield station is being fitted up with such modern and highly improved apparatus that success seems to be much more favourably indicated than heretofore, and that really serious attempts will shortly be made to bring about a workable system for the exchange of British and American programmes.

Look out for the JUNE issue of

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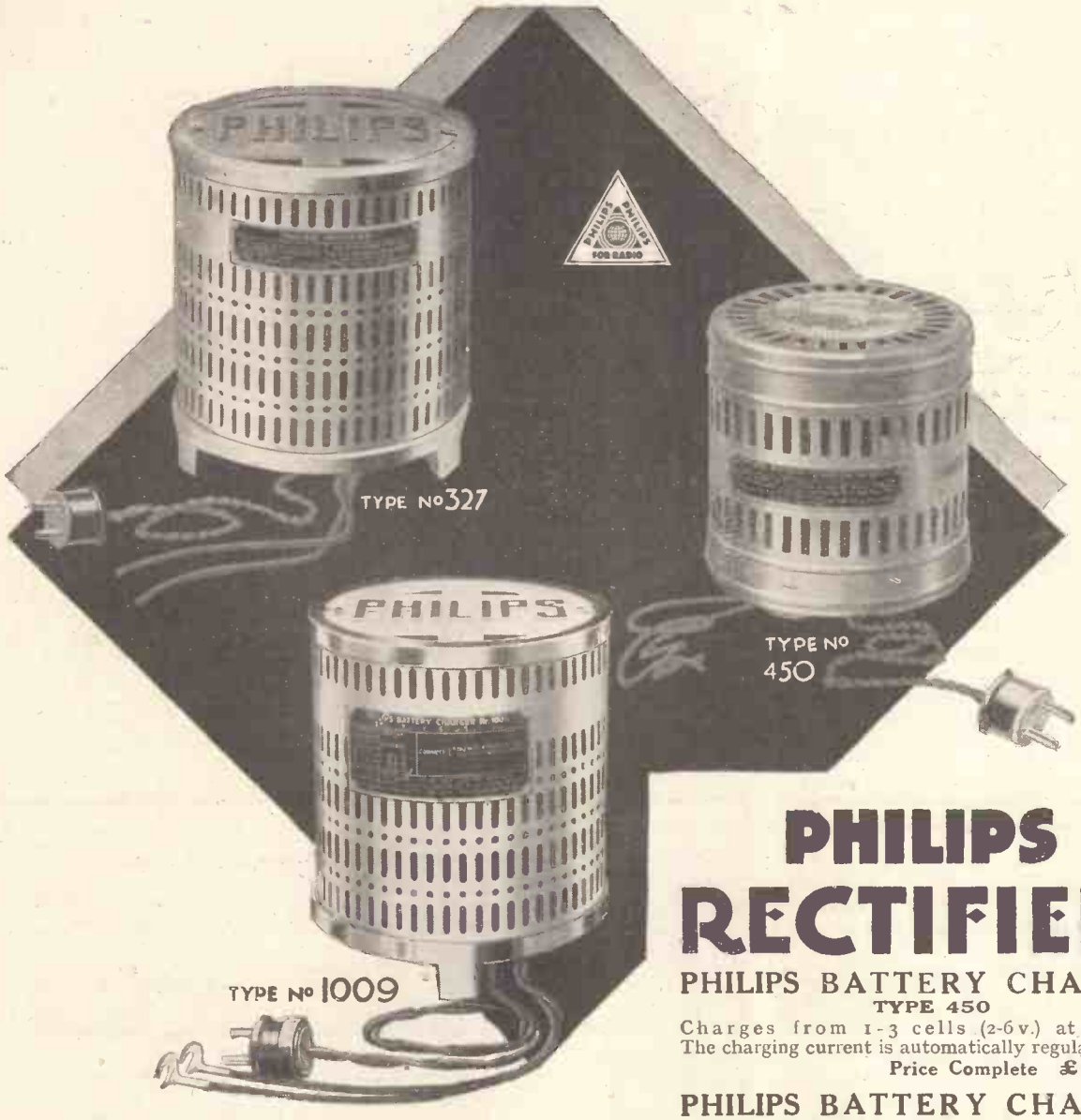

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CHOOSING and USING MODERN VALVES

In no country in the world is there such a choice of valves available to the ordinary listener as in Great Britain. The set-constructor need have no doubts that he is getting the best out of his set owing to the valves being not "up to scratch"—if he chooses them properly. This article shows you how to do this quite easy job.—By KEITH D. ROGERS.

ALTHOUGH there is a tremendously large number of valves on the market at the present time, there need be no difficulty in picking out a selection to suit exactly the purpose you require for a particular receiver if you go about it in the right way.

Valves are well classified by the makers, and although the various types may be called under slightly different names by various manufacturers, yet they are carefully classified, and it is not a difficult matter to pick one out from any maker's list, and to be sure you will get the results you desire in any particular part of the receiver.

The Six-Sixty Pentode two-volter.

As most of my readers will know, valves are classified into various headings according to their uses, and according to their filament voltages. For instance, we have the complete ranges of 2-, 4- and 6-volt valves for all the following purposes: Resistance-capacity coupling, H.F. amplification, screened-grid H.F. amplification, detector, general-purpose, low-frequency, power, and super power.

These divisions between the valves are, of course, not absolutely rigid, for it is very difficult to lay down any law and form distinct dividing lines between the classes.

For instance, where the R.C. and H.F. valves are concerned, these valves are in certain cases interchangeable, and it is difficult to know at what impedance and what magnification factor a valve ceases to become an H.F. valve and can be denoted as an R.C. valve.

Well-Made Divisions.

But, on the whole, the divisions are very well made, and if a constructor wants a valve for any particular purpose, he has merely got to look down a list and he will find numbers of valves under the various headings which are quite suitable for that purpose.

These lists are, however, not quite "fool-proof," and it requires a little experience and care in order to pick a valve from the right pigeon-hole, so to speak, for any particular stage of amplification.

Let me explain what I mean. Take an average four-valve set, and assume, because there are so many users of 2-volt valves, that we are going to use 2-volt valves in this particular receiver. We will, furthermore, assume that the high-frequency stage, of which there is to be one, shall be of the ordinary type. If it were the type for a screened-grid valve, that is all there would be to it, and a screened-grid valve would be used.

But if it is of the ordinary type, neutralised, then one has a little more latitude in regard to valves, because there are so many types of valves that can be used in this H.F. position. It really depends upon the exact circuit as to which valve will be best.

Continuing the circuit we will assume that the detector is quite ordinary and is resistance-coupled to the next stage, which, in turn, is transformer-coupled to the last. In other words, we have an H.F., det., and 2 L.F. set.

Picking the H.F.

It must not be assumed that because we have used 2-volt valves as an example, that 4- and 6-volt valves are no good. On the contrary they are excellent and, in certain exceptional circumstances, possibly the 6-volt valves—the super-super power types—are more suitable than the 2; but for all normal purposes there is nothing against the 2-voltvalve. It is extremely popular and can quite conveniently be taken as an example to show how the valves should be chosen.

A neat anti-capacity holder—the Precision.

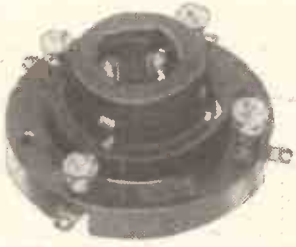
Now let us tackle the H.F. side first. We must examine the circuit to see whether the neutralising is carried out from a tuned-anode coil and from an H.F. transformer.

The reason is this. If a tuned-anode coil is employed we can quite usefully employ an R.C. valve in this stage, whereas if a transformer-coupled stage is used we should do much better to employ an ordinary H.F. valve.

If the coupling had not been neutralised, and had been of the resistance type, then we could have employed either an H.F. or a resistance valve quite well, the resistance valve giving us a greater amplification than the H.F. type.

Rough Dividing Line.

Now when we speak of an H.F. valve, or a resistance valve, we mean a valve either below or above an impedance of about 30,000 ohms and a magnification factor of 30, while the resistance-capacity valve comes above 30,000 ohms with a factor of more than 30.



The "Wearite" anti-vibration valve holder.

There are exceptions—e.g. the S.G. valve and the Pentode—but that is a rough line we can draw when we want to choose valves. Some makers may call their valves "H.F.

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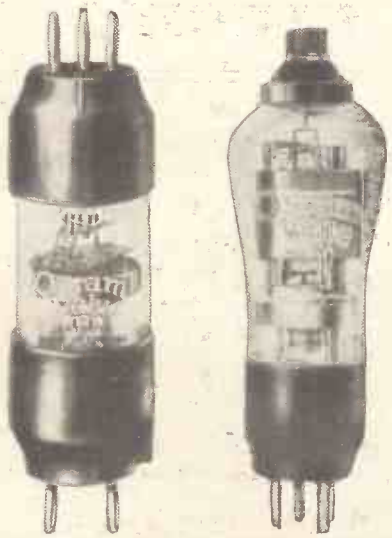


The two types of Osram screened-grid valve. The S.625 (left) was the first to be placed on the English market, while the vertical 4-pin type followed more recently. The Marconiphone Co. also market the S.625 as well as the vertical types.

CHOOSING AND USING MODERN VALVES.

(Continued from previous page.)

type" when they have an impedance of a little above 30,000 ohms, and some may call their valves the "R.C. type" when they have an impedance of slightly less than this figure; but, as a general rule, one can take the 30,000 mark as the line dividing the H.F. and resistance-capacity valves.

A popular power valve—the P.625, made by Osram & Marconiphone Cos. The impedance is 2,400 ohms and the mag. factor 6.

In this set, therefore, we want a valve below 30,000 ohms; but, in order to get the best amplification, we want one having the highest magnification possible under the circumstances.

Unfortunately, magnification factor and impedance are inseparable, so that we do our best by using a valve of somewhere about 20,000-30,000 ohms impedance and a magnification factor of 20-30.

The H.F. valve "type" can reasonably be said to stretch between 17,000 and 30,000 ohms, for any valve in this range will generally act quite well, though it must be remembered that, as long as the impedance is not too great, the higher the amplification factor the better results in this stage.

The Detector Stage.

We can now pass on to the detector valve, and here we see that, although it is resistance coupled to the next stage (and from that one might imagine that a resistance valve would be best), it yet has to deal with a certain amount of heavy work, especially as an H.F. valve precedes it, and for the sake of quality it wants to be of not too high an impedance or we shall be in danger of losing some of the upper musical notes, as we shall see in a moment. Furthermore, we want to get reaction from this valve.

If a resistance valve is used, reaction is sometimes inclined to be not quite as smooth as is desirable, and a certain roughness of control is liable to ensue. Furthermore, a resistance-capacity valve would necessitate a fairly high anode resistance in order to get the best out of it—a higher resistance than perhaps we should use if we had an H.F. valve—and this militates against the getting of the high notes at their proper value.

A special anti-microphonic valve holder made by the Ashley Wireless Co.

For the detector, then, we will use a valve similar to that in the previous stage (of the H.F. variety), such as the Mullard P.M.1 H.F., Marconi or Osram H.L. 210, the Mazda H.F. 215, Cossor H.F. 210, Six-Sixty H.F., Ediswan H.F., and so on, and I think we shall find that this will give far better results than would the resistance-capacity valve in this stage.

The Cosmos 5-pin panel-mounting mains valve holder for A.C. valves.

As the magnification obtained is not quite so great from the H.F. valve, as it would be from the R.C., we shall find that the tendency to overload the next stage is not so great, and, on the whole, better quality and better overall results are more likely to be obtained than when the resistance-capacity valve is used in this stage.

The next stage is an L.F. one, the valve being transformer-coupled to the last or output valve. This L.F. valve should be of the order of 10,000 ohms, or thereabouts, and the magnification somewhere about 10 to 15.

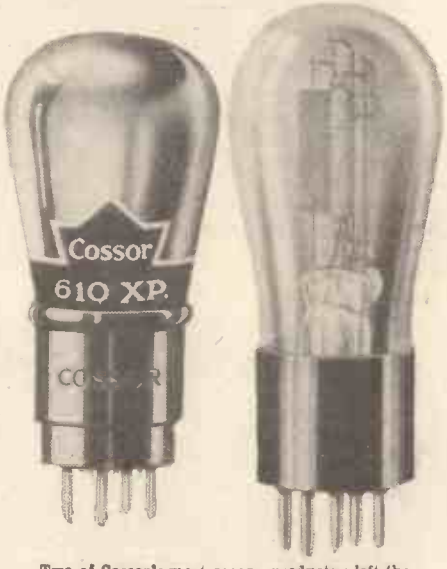
Avoiding Saturation.

As it is followed by a transformer it is obvious that the impedance of the valve must not be too low, otherwise it will take too great a plate current, and this flowing through the windings of the L.F. transformer will tend to saturate the core of the transformer, and thereby upset the reproduction.

So, as a rule, we choose here a valve with from 7,000 to 13,000 or so ohm's impedance, but when the lower figure is used we have to be very careful with our biasing in order to see that saturation does not take place.

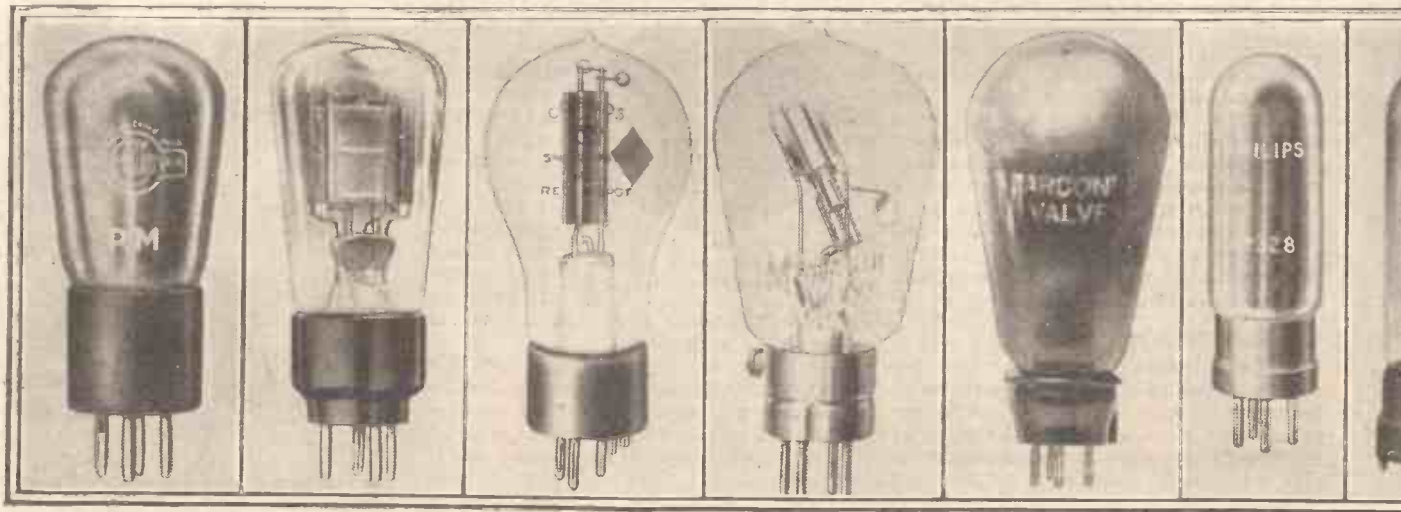
As a general rule, however, a 10,000-ohm valve is O.K. in this place (the valve often being known by the makers as a general-purpose valve or L.F. valve—not the power valve), and we can be sure we are going to get good results.

TWO NEWCOMERS.



Two of Cossor's most recent products: left the special 6-volt extra-power valve (610 XP.) and an example of the new A.C. Mains series.

A FEW OF THE LARGE AND VARIED SELECTION OF VALVES



A typical selection of modern valves taken at random from the "P.W." research room. Reading from left to right, we have the average Mullard receiving valve, the B.T.-H triple valve, Cossor Pentode, Dario, Triotron, Osr

The magnification factor should be above 10 if useful results are to be obtained, but we do not want the impedance to be any higher than necessary or we shall find that a loss of bass notes will ensue.

13,000 ohms is quite high enough for this L.F. stage valve, and 10,000 or 8,000 is even better, so we should pick out a valve having an impedance of between 7,000 and 13,000 ohms, with as high a magnification factor as possible.

Such valves in the 2-volt range are Mullard P.M.1 L.F., or where signal strength is not going to be very great the P.M.2 D., which it will be seen the Mullard people say has an impedance of somewhere about 10,700 ohms and an amplification factor of 13·5. Although this valve is labelled a "special detector" valve it acts very well as a first stage L.F., and this is one of the examples where a valve may act in either one or two or possibly three capacities, for it would do quite well as a second stage R.C. L.F. amplifier.

The Output Valve.

Amongst the Osram and Marconi valves we have the D.E.L.210, while the Mazda general-purpose G.P.210, or even the L.F. 215 would do here, though possibly the G.P.210 would be best in the majority of cases. The Cossor L.F.210 valve having an impedance of about 12,000 ohms, Six-Sixty L.F., Ediswan L.F.210, Dario, and so on, are also suitable.

This brings us to the last stage, which we will assume is choke-coupled to the loud speaker by means of the usual choke and the condenser filter. We will also assume that the receiver is to be used fairly near to local station and that loud results are required.

Question of Grid Swing.

Under these conditions we have to choose a valve for the last stage that will carry a fairly big grid swing in order to enable it to handle a large enough power in order to give really good big signals.

If the receiver should not be desired for use on a nearby local station, the nearest station being some considerable distance away, then possibly an ordinary power valve having an impedance of between 4,000 and 8,000 ohms might do quite well, but if local signals are to be received then a super-power valve having an impedance of between 1,500 and 5,000 or 6,000 ohms should be employed.

One model of Messrs. Burndept's valve holders.

It is necessary to use a valve with a low impedance here first in order to get sufficient amplification of the stage, and also to have a large grid swing for the energy to be dealt with. Grid swing and good bass amplification go hand in hand, as a comparatively large power is required to bring out a good strength of bass notes, while far less is required to bring out the same apparent strength of high notes.

Suitable valves in this stage, therefore, would be the P.M.252 for local station work, or the P.M.2 where only fairly weak signals are to be received. The P.M.2 gives the higher magnification, though for average work it is not so much higher as to warrant the loss of grid swing, which the use of such a valve will give.

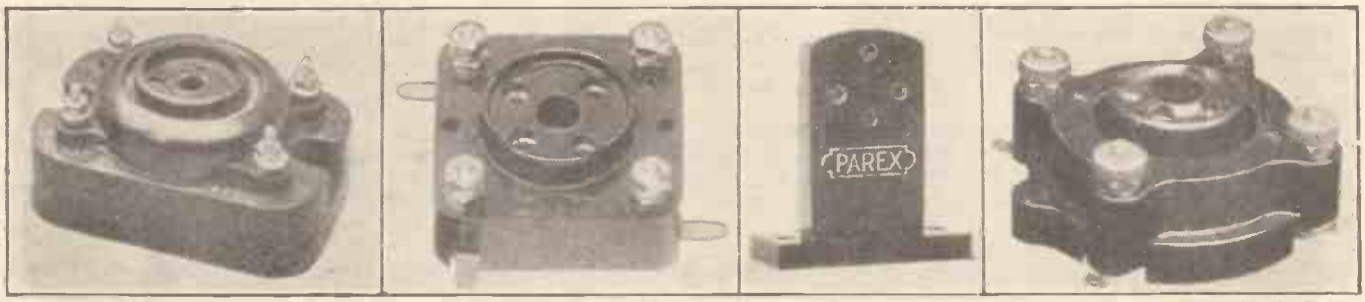
Amongst the B.T.-H. Mazda valves we find that the P.227 fills the bill quite well, while the Osram and Marconi valves provide us with the D.E.P.240, an excellent super-power valve with a magnification factor of 4 and an impedance of 2,500 ohms. The Cossor 220 P or 230 X.P. (the latter for extra power handling), and Six-Sixty power valve, and the Ediswan P.V.225 are valves of other makes which are perfectly suitable in this stage.

We must not forget, however, that the ordinary H.T. battery will not work a super-power valve properly. We need a triple-capacity battery for really reliable service under these conditions.

Certain Success.

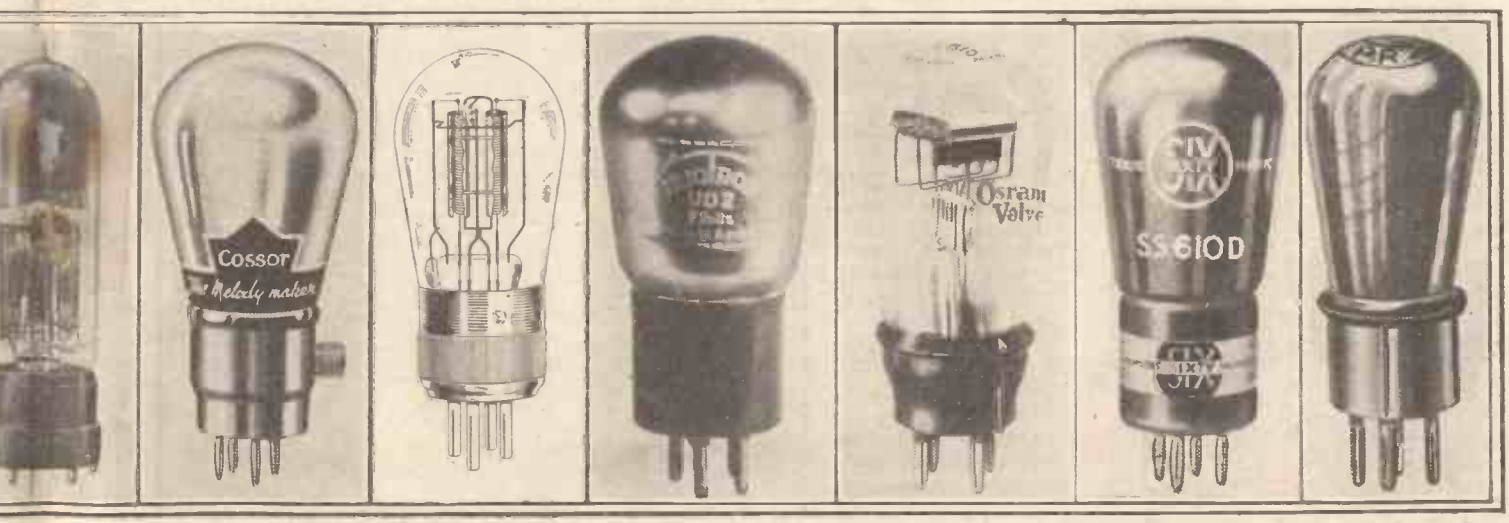
Thus, we see that in choosing valves we have to be careful of the type of work they have to do before we can be absolutely certain of any particular type being absolutely suitable. So far we have not mentioned the pentode valve, because this really comes under the section of multi-electrode valves, but we might state here that the pentode valve is always useful as an output valve provided that not too great a signal strength is given to it. In other words that it is not expected to carry

(*Continued on next page.*)



Here we have a typical assortment of modern valve holders. Reading, from left to right these are the B.T.-H., then the Formo anti-vibration holder. Following these are the Parex horizontal S.G. valve holder, and finally the Igranic "anti-pong" type.

FROM WHICH THE SET-CONSTRUCTOR OF TO-DAY CAN CHOOSE.



I, Mazda power valve, Cosmos A.C. indirectly-heated cathode power valve; then we come to the Marconi K.L. type of A.C. "tube," the P.625A, Philips rectifier for L.T. chargers, Loewe m D.E.L.610, Six-Sixty 610 detector, and the P.R. two-volter.

CHOOSING AND USING MODERN VALVES.

(Continued from previous page.)

too big a grid swing. Also, a proper output circuit consisting of either a pentode choke or a pentode output transformer should be employed.

Two in One.

It must not be forgotten, of course, that the amplification given by the pentode enables us to do away with an L.F. stage, so that in the set under consideration we could quite well make it an H.F., Det. and Pentode, rather than an H.F., Det., L.F. and super power.

The pentode, however, wants careful handling with plenty of H.T. current, and an H.T. voltage of about 150 volts, together with very careful grid-biasing if the best results are to be obtained.

All the big manufacturers of valves have suitable pentode valves in the 2-volt classes, and, properly handled, excellent results can be obtained. But the man who does not understand valves at all and has not had any previous experience with a valve set should go very carefully into his choice of a pentode and get into touch with either the makers or the "P.W." Query Department, and state his case to them before deciding whether the pentode or an ordinary output valve would best suit his purpose.

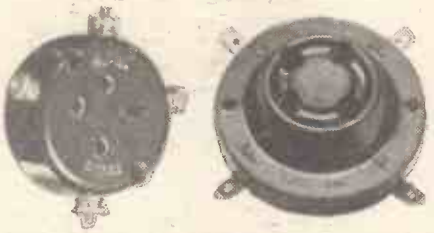
A moderately-priced holder is the "Godwinex" shown here.

The modern valve will last a very long time indeed with careful treatment. The construction of the electrodes is fairly robust, and the filaments have a very long life

Typical examples of the Ediswan 2-volt range. That on the left is for resistance-capacity coupling, while the one on the right is a 2-volt super power valve.

provided they are not overrun, either by being supplied with too much L.T., too little bias, or having the H.T. applied too liberally.

Too much L.T., of course, weakens the



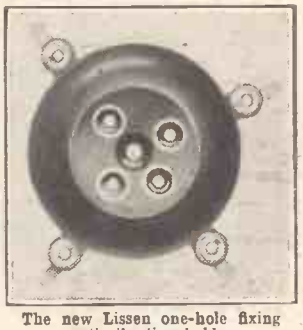
Two of the rigid type of holders—the Burton and Igranic.

filament very considerably, causing too high an emission and too high a temperature, tending to make the filament weak.

Loss of Emission.

Too much H.T. means that too great an emission is provided by the valve and a bombardment by the electrons of the residual particles of air in the vacuum sometimes causes the valve to become "soft." This increases the bombardment and the emission goes up probably for a short time and then rapidly falls, and the valve is useless.

Too little grid bias has the same effect as too much H.T., and while discussing this point it may be as well to mention that under no circumstances should the grid bias of any valve be altered while the set is running — that is, while the H.T. and L.T. are on.



The new Lissen one-hole fixing anti-vibration holder.

The L.T. may be on by itself, but the H.T. must certainly not be on as well, while the grid-bias socket is changed from one voltage to another. While the plug is out of the socket the valve grid is in the air the emission rushes up and quite a considerable amount of damage can be done to the filament in a very short time by this means.

If we want our valves to last a long time and to get absolutely the best results up to the last with them, we must look after this point of grid bias, H.T., and L.T., and see that the valves are not overloaded.

Over-loading by too much signal strength, that is, by tuning the receiver in too strongly to the local station or to a strong transmission, does not harm the valves.

Distortion.

It merely causes distortion due to the fact that the valve cannot take the grid swing applied to it, but it does not harm it in the same way as excessive H.T. or L.T., or too little grid bias.

Some of the pentode valves particularly are prone to lose their emission if too much H.T. is supplied, and, furthermore, the pentode valve has its electrodes very closely placed together so that excessive H.T. is liable to cause a breakdown inside the valve, due to the H.T. voltage causing a jump across from one electrode to another. This usually results in a burn out of the filament making the valve totally useless.

The Ediswan 6-volt power valve—the P.V. 610.

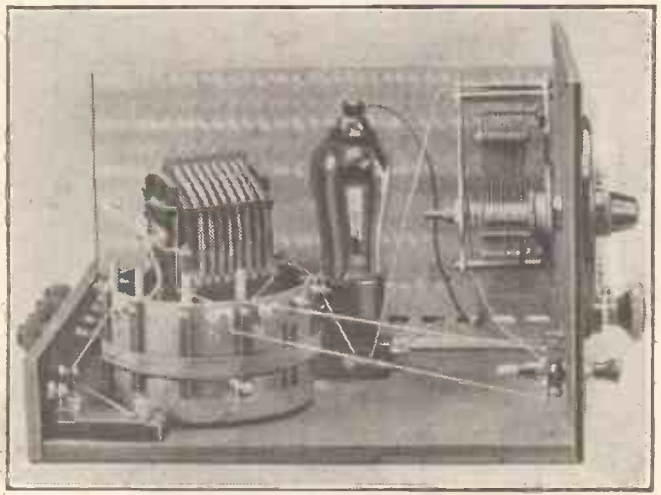
Follow Directions.

Finally, let me say that although the makers of valves list their own valves under various titles it is of tantamount importance when building a receiver that the constructor should follow as closely as possible the directions laid out by the writer of the article describing the set, and especially his instructions as regards the types of valve for the particular positions in the circuit employed.

A careful study of the foregoing will show that it is not such a terrible task as it might appear at first glance. A little careful thought at the outset may save a great deal of bother later on.

It is only by choosing valves to suit the circuit in which they are to be used that maximum results, both in sensitivity and in quality, in any wireless receiver can be obtained.

THE SCREENED-GRID VALVE IN PRACTICE.



Note how the screening is arranged when a screened-grid valve is employed. It is essential to prevent interaction between the valve's grid and plate circuits.

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Blue Spot Metal Chassis (complete with cone) - - - - - Price **12/6**

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Overall depth with No. 66K Unit - - - - - - -	$4\frac{1}{2}$ „
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BUILD up your own loud-speaker equal to anything you have yet heard with the famous Blue Spot 66K unit and the Blue Spot Metal Chassis, complete with cone in position. Simplicity itself to assemble—and takes five minutes.

To affix the unit, to bolt the chassis to a baffle board, or to a cabinet of your own choice completes an inexpensive speaker giving results little short of amazing.

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Distributors for Northern England, Scotland and North Wales: H. C. RAWSON (SHEFFIELD & LONDON) LTD., 100 LONDON ROAD, SHEFFIELD; 185 PRINCESS STREET, MANCHESTER.

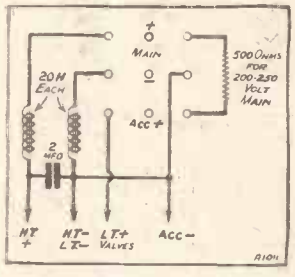
COMBINED "MAINS SWITCH."

The Editor, POPULAR WIRELESS.

Dear Sir—Re. Mr. Joseph Fuller's "Combined Switch," published in a recent number, it may interest you to know that a similar arrangement has been in use here for the last three years. It has proved so foolproof and reliable that the latest model sets are being fitted with it.

In place of the lamp, however, we fit a wire-wound resistance, as this can be fixed outside the cabinet without fear of its being damaged; a zinc (perforated) cover is fitted over the resistance and earthed for safety

For use with sets incorporating "anode feed" to each valve a three-way cable serves to carry all the current, H.T. and L.T., the chokes being included with the switch-gear in a metal safety box.



Respectfully,
"RADIOSMITH."

THE "CHITOS" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am just writing to tell you of the splendid results of the "Chitos" Two, which I built in portable form.

On Easter Monday I took my portable out on to the Dyke Hills, which are about six miles out of Brighton. With an aerial fixed to a small tree, I picked up three foreign stations, namely, Berlin, Paris and Toulouse, and London and 5 G B at amazing strength.

I can now say without the slightest doubt that if it had not been for the helpful aid of "Popular Wireless," at my age, which is fifteen years, I should not know as much about wireless as I do now.

Wishing "P.W." further success,

Yours faithfully,
C. H. BUNN,

Brighton, Sussex.

S.G.'s AS DETECTORS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Might I be permitted to suggest to your correspondents who use S.G. valves as detectors that in doing so they are not making use of any revolutionary principle, since the use of a triode for rectification has been general for some years now. Whether the top terminal is ignored or connected to the screen the valve merely functions as a triode, so why pay 22s. 6d. when very efficient detector valves are available at 10s. 6d. ?

I should also like to be so unkind as to suggest that the 3 L.F. "Titan" set belonging to C. C. S., Rock Ferry, is on the verge of L.F. oscillation, and that he is not getting the straight-line amplification that he imagines, but that he is getting much greater amplification of the very low frequencies. I say this since he admits that very low notes cause motor-boating to occur.

Probably the loud speaker which he uses is deficient in its bass reproduction and the hump in the R.C.C. amplifier characteristic due to L.F. reaction causes better results to be obtained with this amplifier than with a transformer amplifier with possibly a better frequency characteristic.

Yours faithfully,
B. R. BETTRIDGE.

Somerset.

CORRESPONDENCE.

COMBINED "MAINS SWITCH."

THE "CHITOS" TWO—S.G.'S AS DETECTORS—A TRANSFORMER ENTHUSIAST—AN L.F. CIRCUIT.

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.

A TRANSFORMER ENTHUSIAST.

The Editor, POPULAR WIRELESS.

Dear Sir,—Being a transformer fanatic it behoves me to gird on my armour to sally forth to do battle with C. C. S.

It seems to me that C. C. S. has written while still glowing with that feeling which comes to all true fans—a crime for which I can forgive him—namely the possession of a good DX receiver. He has allowed this, however, to warp his judgment and in this coma he truculently asserts views about transformers to which in saner moments he would not subscribe.

I am using a 1-v-1 receiver with a higher gain H.F. stage than the "Titan" 3. Valves: Ediswan S.G. 610, Cossor 610 H.F., Cossor X.P. or Mullard P.M. 26. The transformer is an A.F. 5 feeding an Ultra Air Column loud speaker, through a suitable output circuit. Using 150-v. H.T. the output valve is fully loaded on a large number of stations, the operation of the set is checked with milliammeters in the detector and output-plate circuits.

The quality given by this combination is I should imagine equal to anything in the R.C.C. line under similar conditions of test. It may be well to state that the set is decoupled by means of resistances and chokes as laid down by the Tallis House technical maîtres.

It is also a debatable point whether with only a pressure of 120-v. the valves specified by C.C.S. in the L.F. stages can cope with the signals, judging by the efficiency of the S.G. valve and H.F. stage. Distortion might very well be present due to valve overloading, in fact, C. C. S. inserted a post detector volume control and used fewer coil turns—evidently he had some!

In any case why use three L.F. stages? I notice, however, there are quite a number of these queer creatures about. If I used another stage our walls would emulate those of Jericho (acknowledgment to "Ariel")!

In conclusion, if three stages can give better quality than one—well—Pop! Fzzzz!! Yes, Mr. Editor, I need it.

Yours sincerely,
W. A. E. ROWETT.

Cornwall.

AN L.F. CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am enclosing herewith a copy of the L.F. circuit, which I have been using for some time, and which gives better results both as regards volume and quality, than any other circuit using ordinary valves that I have yet tried.

After realising the advantages of "choke" output systems it seemed to me that this was the logical method of inter-valve coupling, and although I have not seen a published circuit like this I am certain that your "Technical Hounds" (see "Ariel") must have worried it before now, and discovered some snag which is not apparent to me.

I should be very grateful, therefore, if you would let me know just what the objections are, but in the meantime I shall retain the circuit as drawn as I feel convinced that it is the best yet.

Awaiting the favour of a reply, I remain,

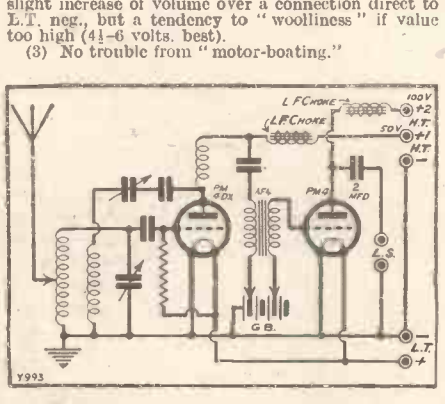
Yours faithfully,
H. PRATT.

NOTES.

(1) The tuning unit is now the "Titan" coil.

(2) The neg. bias on trans. primary seems to give a slight increase of volume over a connection direct to L.T. neg., but a tendency to "woolliness" if value too high (4½–6 volts. best).

(3) No trouble from "motor-boating."



(4) Remarkable increase in strength of low notes (drums, bass viol, etc.), and greater clarity in speech.

The L.F. chokes are L.F. trans. secondaries, the H.F. choke 1,000 turns of transformer wire on a thread bobbin, and L.S. Blue Spot 66K, home made, as is the "Titan" unit.

Leicester.

[There are no objections against the shunt feed method, and it is quite a common practice. A form of this scheme has been adapted by Messrs. R.I. in connection with their new transformer. Mr. Pratt's circuit necessitates the use of the extra components, a choke and a 1 mfd. condenser, and when the anode current is high and the transformer not well designed the improvement may be noticeable.—ED.]

SHORT-WAVE NOTES.

By W. L. S.

A NEW country appears to have entered the field of short-wave broadcasting, in the shape of Mexico. The Consul-General of that country has just forwarded the information that X D A (owned by the National Telegraph Co. of Mexico) now transmits with 20 kw. on a wave-length of 32 metres.

A Super Dead Spot!

The station is established for the purpose of communicating with Europe and other distant parts, broadcasting messages "so that those who receive them will be able to know the true situation in this country."

I have had kind letters since last week from Malta, South China, and Australia; proof that some interest is taken in short-wave work in most parts of the world! Malta appears to be a reasonably good spot for the reception of Australia and New Zealand—rather peculiar since I believe French Morocco and Australia are "dead" to each other.

Incidentally, while on this subject, I do not know whether I have mentioned before that since the first contact between New Zealand and South Africa, some years back, there has been no other! Surely a "super-dead" spot.

Turn and Turn About.

It is very peculiar to notice the enormous difference between two parts of the same country or continent in this way. The Australian 6th district (Western Australia), for example, is very rarely heard in this country, although there are numerous active transmitters there. When they do come through it is usually at quite a different time from the other Australians.

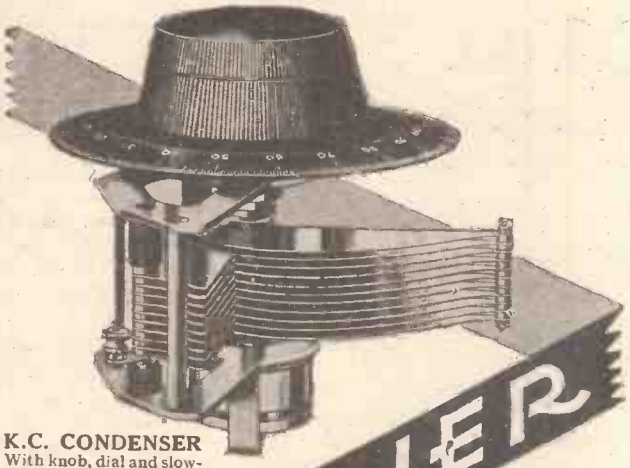
Another very peculiar effect that I have noticed this spring in the early mornings is that the 6th and 7th districts of U.S.A., instead of coming through together, as last year, seem to get to this country on separate mornings. Either on my early morning watch I hear scores of "6's" and no "7's," or vice versa.

The 6th district is, of course, the further south of the two, the 7th comprising Washington Idaho, Oregon, etc.

Have You Heard Them?

How many listeners in this country have heard Oakland, California (W 6 X N), on 23 35 metres? I have logged him once, relaying K G O, but he is none too strong. Another elusive station is Fort Wayne (W O W O) on 22·8 metres. Both these stations are situated at a favourable part of the wave-length scale for coming through well, but they do not often seem to be audible.

Incidentally, I should be more than pleased to hear from readers who have received stations that they do not think have been logged before, since such claims are always interesting even if they cannot be admitted.



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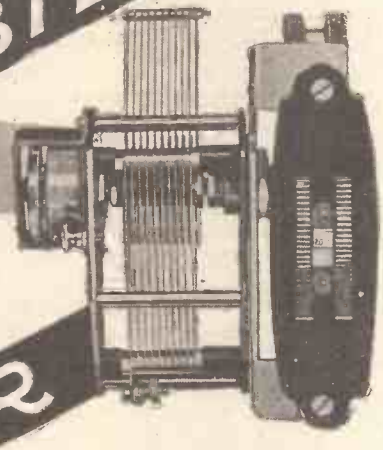

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With Drum Control and slow-motion device, ·0003 or ·0005 ... **15/6**
Triple K.C., each condenser ·0003 or ·0005 ... ... **38/6**
Triple K.C. Combinations of ·0003 and ·0005 ... . **40/-**

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A small variable condenser for panel mounting ·00005, ·0001 or ·0002 - - - - **5/6**

SELECTIVITY

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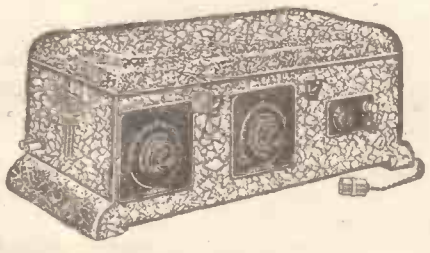


"EKCO ALL-ELECTRIC STRAIGHT THREE"— Special Features: P.625 Super Power Valve giving great volume, superb tone and sufficient power to operate Moving Coil Loud-speaker. Volume Control. Pick-up Sockets for ready attachment of gramophone pick-up. No coil changing. Low to high waveband by simple pressure of switch.

Just "Plug-in—That's all!"

FROM THE TECHNICAL EDITOR'S NOTE BOOK

Tested and Found—?

UNIQUE TRICKLE-CHARGER.

DR. NESPER, LTD., of Colindale Avenue, Hendon, N.W.5, recently sent us a sample of the Dr. Nesper 4-volt trickle-charger. It is one of the smallest and neatest devices of this kind that we have yet seen. It is supplied for A.C. mains of 100 to 125 volts or 200 to 240 volts.

The Dr. Nesper Trickle-Charger.

The 4-volt type is available for 2- or 4-volt accumulators, and costs 29s. 6d.; the 2-, 4-, or 6-volt type is priced at 38s. 6d.

You can stand this little charger on the table or hang it on the wall. A lamp-holder plug and flex and spade terminals for the accumulator are fitted. This trickle-charger uses a selenium rectifier which is of a perfectly permanent character. There are no adjustments to be made.

The charger gives a steady output of ·25 amperes, as stated, without giving off a smell or becoming heated. We have subjected the device to extended tests, and find it safe and sound in operation. It would appear that the valve and fluid types of A.C. chargers have yet another formidable rival.

LOOPING THE LOOP.

It certainly seems that the little things in radio count. For instance, we published an article a short while ago entitled "Looping the Loop," and this dealt with the making of nice loops in the ends of leads in order to neaten and to facilitate wiring up. The publication of this article—quite a short one—was followed by the reception of scores of letters, one from no less than the G.E.C. people.

Accompanying this letter was a sample of the Osram Music Magnet Loop Former and Gauge, and this is indeed an excellent device. Although it sells for only two shillings you can do anything with wire with it, except eat it. You can make right-angle bends and loops in the ends and loops in the middle of any lead.

The instrument is so designed that you can make the leads complete with loops exactly of the size required for the particular job. You run the gauge—a kind of slotted slider—along until it registers exactly opposite the one terminal which requires the connection, the first gauge point being a line against the other terminal. A twist of a forming key and the loop is made. The Osram Music Magnet Loop Former and Gauge is a fascinating device to handle and it certainly makes wiring up an added pleasure.

FERRANTI, L.F. AND OUTPUT TRANSFORMER.

Messrs. Ferranti Ltd. inform us that in future all their L.F. and output transformers will have their primary and secondary terminals reversed from what has hitherto been their standard positions. Looking at the transformer from the primary side, the plate terminal will in future be on the right-hand side and, in the same way, observed from the secondary side, the grid-bias terminal will be on the right-hand side. This alteration, whilst in no way affecting the performance of the component, will, say Messrs. Ferranti, lead to an appreciable simplification of wiring.

SOME JUNIT PRODUCTS.

We recently received some of the new products of the Junit Mfg. Co., Ltd. The Junit terminal mount is designed to replace the ordinary terminal strip, and is an attractive alternative. A neat ebonite plate, drilled and nicely finished, is provided with a projecting bracket portion (a section of the moulding) for attachment to the baseboard.

The Junit H.V. valve holder is something that is entirely new. It is so fashioned that it can be mounted either vertically or horizontally, and for this reason should be of some considerable interest to constructors of portable sets. A modern note is struck by the provision of an additional terminal for the connection to a screened-grid valve.

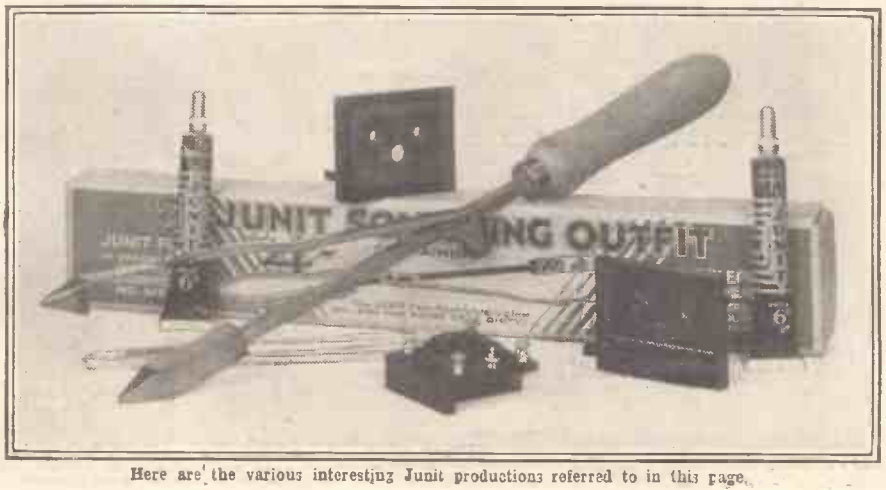
Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality, under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended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

The Junit soldering outfit at 4s. appears to us to be excellent value for money. The principal feature of this outfit is a full-sized Junit Peerless soldering iron, an ingenious tool that in itself eliminates most of the snags of soldering. With a touch of the thumb on a milled knob you can lift the thin copper sheath off the bit and put this in the flame for heating.

When the bit is hot enough the small sheath can be flicked back again with a touch of the thumb and a perfectly clean, well-tinned point is there ready for use, even though the fire used for the heating was a dirty coal one.

Two nice big tubes of Junit flux, which is a non-corrosive material, and an ample supply of Junit Giant solder also figure in this handy outfit. And even the solder is of a special character, and does not tarnish, but retains its brightness. Taking everything into consideration, this Junit soldering outfit is an ensemble of attractiveness.

It is seldom that one gets so many novel "lines" in one carton.



Here are the various interesting Junit productions referred to in this page.

A BUSINESS ROMANCE

P.R. VALVES started in a tiny room 5 feet by 10 feet. Think of it—hardly room to swing a cat in—yet we had a queue of eager buyers. It's easy enough to sell a new departure, but the STUFF'S got to be good to stand the test of a discriminating buyer. But we had the goods and played the game.

In 4 months we grew out of our cubby hole—and feeling fearfully rash we took a shop and basement and started our factory after 4 MONTHS!

A YEAR NOW AND AGAIN we are up against it—in the summer too crowded out with parcels and goods waiting for the mail van and carters.

Good value and consideration for our friends—for satisfied users are our greatest assets—have pushed us out of our former premises—forced us to get out with real cold feet. In consequence we have acquired a five-storey building at No. 14, Newgate Street—the centre of London—OUR PRIDE

P.R. HOUSE

14, NEWGATE STREET, LONDON, E.C.4

where we will establish ourselves on June 24th.

We are also introducing, for the first time, OUR NEW SERIES of VALVES—**THE GOLDEN SUPER P.R.**—the golden valve with a golden tone.

By a special process, employing an extremely rare element in minute and precise quantities, in the coating of our Golden Series, we have been able to turn out a valve of extraordinary efficiency. Although the L.T. filament consumption has been kept more or less to our standard to secure robustness, the emission has been increased by over 50 per cent. For selectivity and volume, we believe a better valve cannot be obtained anywhere with such a low consumption of H.T. and L.T. The glass bulbs are of a distinctive golden colour and each valve has a golden guarantee band.

Thanks to our tens of thousands of kindly people, who by word of mouth have helped us more than they realise—and many, many thanks for the letters from those considerate friends who have been so good as to write us their appreciation of our services and efforts. Believe us, all of you, it bucks us up no end on a dull day to receive the kind appreciation of our efforts to please.

All our products are sold on seven days' trial—if you are not satisfied return them—undamaged, of course—and we will refund without question.

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THE GOLDEN VALVE with A GOLDEN TONE

LIST OF P.R. SUPER GOLDEN SERIES.

	Type.	Fil. volts.	Amp.	Imp. ohms.	Amp. fac.	
4/6 EACH Postage 4d.	GPR 2	2	·095	24,000	13·5	H.F. Det.
	GPR 3	2	·095	12,000	9	L.F.
	GPR 4	2	·095	40,000	32	R.C.
	GPR 9	3·5-4	·09	22,000	14·5	H.F. Det.
	GPR 10	3·5-4	·09	10,000	9	L.F.
	GPR 11	3·5-4	·09	44,000	41	R.C.
POWER **7/6** Each Postage 4d.	GPR 17	5-6	·14	20,000	17·5	H.F. Det.
	GPR 18	5-6	·14	11,000	9·5	L.F.
	GPR 19	5-6	·14	75,000	41	R.C.
SUPER-POWER **12/6** Each Postage 4d.	GPR 20	2	·15	6,000	7	Power
	GPR 40	4	·15	6,000	7	,,
	GPR 60	6	·15	6,000	7	,,
	GPR 120	2	·3	3,000	4·5	Super Power
	GPR 140	4	·2	3,500	4·5	,,

2 valves or more, POST FREE.

H.R.H. THE PRINCE OF WALES says: "SUPPORT BRITISH INDUSTRY."

P.R.

THE ONLY VALVE WITH A WRITTEN GUARANTEE AS TO PERFORMANCE AND LIFE.

THE GUARANTEE IS YOUR PROTECTION.

Sent C.O.D. if desired.

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	Type.	Fil. volts.	Amp.	Imp. ohms.	Amp. fac.	
3/6 EACH Postage 4d.	PR 2	2	·095	28,000	13	H.F. Det.
	PR 3	2	·095	15,000	8	L.F.
	PR 4	2	·095	60,000	32	R.C.
	PR 9	3·5-4	·063	24,000	14	H.F. Det.
	PR 10	3·5-4	·063	15,000	8·7	L.F.
	PR 11	3·5-4	·063	65,000	40	R.C.
POWER **6/6** Each Postage 4d.	PR 17	5-6	·15	24,000	17	H.F. Det.
	PR 18	5-6	·15	15,000	9	L.F.
	PR 19	5-6	·15	80,000	40	R.C.
SUPER-POWER **10/6** Each Postage 4d.	PR 20	2	·15	7,000	6	Power
	PR 40	4	·15	8,000	6	,,
	PR 60	6	·15	8,000	6	,,
	PR 120	2	·3	3,800	4	S.P.
	PR 140	4	·2	4,000	4	S.P.

2 valves or more, POST FREE.

GUARANTEE. All valves despatched under guarantee of Money Back in Full if not satisfied within 7 days. All valves carefully packed and breakages replaced free.

Tell us your set—we will send correct Valves. Matched Valves 1/- extra. All orders executed by return of post.

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. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional 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 CHOKE COUPLING PUZZLE.

F. W. (Hanwell).—"I have got a big L.F. choke and big fixed condenser, with the idea of making a choke output circuit. But the sketch which was given me seems wrong, for it shows the loud speaker connected to the condenser so that apparently the current could not flow in it. What are the proper connections?"

In order to provide the choke output, all you have to do is to disconnect the loud speaker from its terminals on the set and join the choke across them. Now join one side of the large fixed condenser to that side of the choke which has been connected (internally) to the plate of the valve, and the remaining terminal of the condenser to one side of the loud speaker. The remaining side of the loud speaker is now joined to the nearest point of the set's wiring which is connected to the filament of the last valve (probably H.T. negative or L.T. negative, or earth).

If you draw a sketch of this arrangement you will find that the steady H.T. current now passing through the windings of the choke will pass *direct* to the plate of the valve. There is, however, an alternative path to the plate from H.T. negative, via the fixed condenser and the loud speaker; for although the fixed condenser is an active barrier to any direct current getting through this way, the varying currents caused by the speech or music have great difficulty in "overcoming" the impedance of the choke, and therefore such variations of current find a much easier path through the condenser to loud speaker.

Being alternating currents, they can "pass through" the condenser if it is a large one without serious loss, and in this journey they operate the loud speaker just as well as if it were placed direct in the plate circuit of the valve. If you try this method we feel convinced that you will be delighted with the results.

"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.

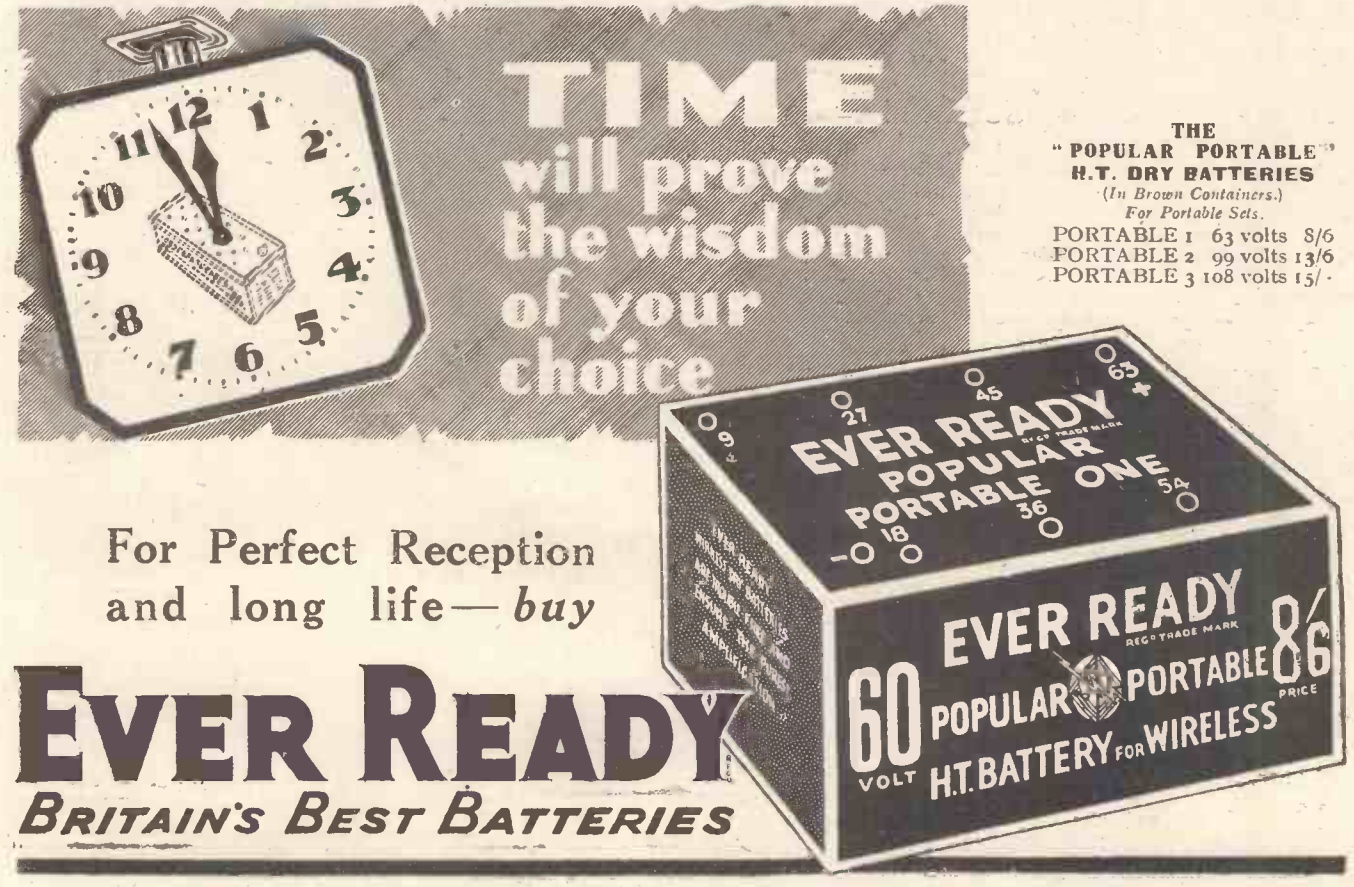
A postcard will do: On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

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

TUNING IN ON THE "THROTTLE" THREE.

The "Throttle" Three is the name of the powerful and efficient set described in "P. W." last week, and below are further details for the

(*Continued on page* 428.)



TAKE THE ADVICE OF THE EXPERTS *fit*

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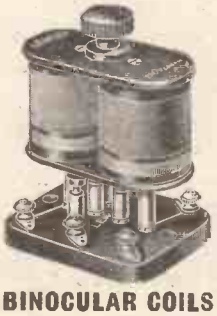

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LEWCOS Radio components are available at 7, PLAYHOUSE YARD, GOLDEN LANE, LONDON E.C.1.

LEWCOS COILS are available for the MULLARD S.G.P. MASTER 3.

235/550 metres, Ref. A.M.5 **10/-**
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Six-Pin Bases Ref. S.P.B. **2/9**

CENTRE-TAPPED COIL
(*Pat. No. 271,384*)

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RADIO PRODUCTS

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gives Home Constructors an opportunity to build their own LOUD SPEAKER!

With the new LOEWE RADIO Cone Unit you can make in your own home a high class cone loud speaker. It will adapt itself to any type of cabinet, and whether it is simple or intricate in design is a matter for the builder to decide. With every Unit, complete instructions, working drawings, etc., are supplied for making the Cone Diagram and the Cabinet as recommended by LOEWE RADIO. Most of the Unit is enclosed in robust moulded casing. Plugs fitted to leads are also supplied. All enthusiastic home constructors should buy this pleasingly efficient unit without delay! Full details from

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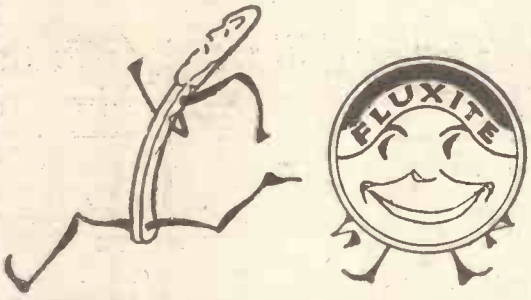
Telephone: Tottenham 3911/2.



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See our exchange offer (applies to this set only).
KIT OF PARTS IN STOCK.

1 Aluminium Panel (drilled to carry tuning condensers, switch, reaction condenser, rheostat and panel brackets) Colvern 5/6	Mullard Permacore...25/- Panel Brackets ... ...2/6 Mullard ·01 ... ...3/- 2 Spades ... ...6d. Set of Links ... ...1/3 Bebe ·0003 ... ...8/-
Juno Piano-board ...2/-	Sovereign, 50 ohms...2/6
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2 Drum Dials, pr....21/-	1 W.B. Valve Holder 1/3
Benjamin Switch ...1/3	4 B.-Lee Terminals...2/-
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Climax H.F. Choke...7/6	Flex & Screws 1/9

Exact to Mullard specification.

TOTAL £6.16.7.

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Send your cheque (less amount you value your goods at). Immediate delivery.

Mullard S.G., 22/6, 2 or 4 volts, Detector, 10/6. Pentode, 25/-. Speaker Unit, 38/6. H.T. Batteries, L.T. ditto. ALWAYS IN STOCK. Sufficient cash for POST and PACKING MUST BE ENCLOSED.

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2 National £15 models, £11.16.0 and £12. 1 Ormond £15 model, £11.11.0. Various others in stock.

ORMOND
S.M. Drum Dial, 5/-; Rheostats, 6, 15, 30 ohm, 2/-; Midget ·0001 max., 4/-; Log. ·0005 and 4 in. Dial, 6/-; Log. ·0003 and 4 in. Dial, 5/9. S.L.F. No. 3 same price. We always stock all ORMOND PARTS.

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Lewcos C.A.C.5, 10/6; C.A.C.20, 12/6; C.S.P.5, 10/6; C.S.P.20, 12/6. P4 to 14, 3/- each; P16 to 22, 4/- each. Touchstone Coils, 30/- pair. C.T. Coils, 3/6, 5/3. Q Coils: Q.A., 15/-; Q.S.P., 21/-; Q.A.R., 21/-; Q.A.A., 15/-; Q.S.G., 21/-. All Lewcos Products.

Ultra Short Wave Coils for Cossor New Melody
7/6 PAIR (Post 6d.)

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DARIO RADIO-MICRO
2-v. or 4-v. G.P. .. 5/6
Super-Power 7/6
Super H.F., 2-v. or 4-v. ... ... each .. 7/6

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H.F., Det., R.C., 5/2 each; Power, 6/9. 2-v. or 4-v. Post 4d. (10/- Free).

CLEARTRON
SCREEN GRID
2-volt, 12/6; usual types, 4/-; R.C. or Power 6/-. Post 3d. each.

VALVES
Mullard, B.T.H., Marconi, Ediswan, Osram, Cosmos, Cossor, Six-Sixty, Det. H.F., L.F., R.C., 10/6 ea. Power 12/6. S. Power 15/-, S.G. 22/6. Pentode 25/-.

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QUOTATIONS FOR SETS OF PARTS OVER 25/- IN VALUE (where possible)

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With fitted 10 in. Floating Cone & 12 in. Square Baffle Board. Takes all Bal. Armature Units. **7/11**

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SPECIAL COUPON P.W. 8/6/29
For every **30/-** you spend you can buy for **3d.** extra one of the following Lots on this coupon only. ·0005 variable 4" slow-motion dial, 16-volt Grid Bias, Binocular H.F. Choke, ·0001 Reaction with Knob, Special Indoor Aerial complete, Set of 12 Plugs and Sockets (red and black), 2 Fuse-holders and Bulbs, 4- or 5-way L.T. Battery Cord, 100 ft. best Copper 7/22, 100 ft. Insulated Aerial.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 426.*)

handling of this receiver, as promised in our last issue.

There is no reason why an H.T. eliminator should not be used with the receiver, but if such is employed it is advisable to employ an output filter. A filter circuit is also advisable when a super-power valve is in use, and is in any case a desirable refinement.

The coils for the lower of the two broadcast bands are aerial 35, grid 60 and reaction another 35 or a 50. These are the sizes which will usually give best results, but there is no reason why other slightly different sizes should not be tried for the aerial and reaction positions.

On the long waves the aerial coil may be a 100 on 150, the grid coil a 250, and the reaction a 75 or 100. As in the case of the lower waves, the sizes of the aerial and reaction coils may be varied slightly.

The operation of the set is quite simple, but there is one point in which it will vary from the control of an ordinary set. That is, the reaction condenser will appear to work reversed. This is because when the capacity of the reaction condenser is increased, so the by-pass of H.F. current from the plate of the detector valve to earth increases.

Therefore the set will cease to oscillate as the condenser is turned towards its maximum. If you are used to an ordinary set this may seem a little confusing at first, but you will soon become accustomed to it.

Two aerial terminals are provided, and when the aerial is joined to the terminal A1 a ·0002 fixed condenser is connected in series with the aerial lead. This condenser will sometimes improve selectivity on the shorter waves and will also make the set oscillate more easily.

When receiving on the 5 X X band the aerial should always be joined to the A2 terminal, as the ·0002 fixed condenser would probably weaken signals on the long waves.

The results obtained were better than those usually given by a Det. and 2 L.F. set of the transformer-coupled type. Those of you who know what enormous magnification a set of this type can give will therefore appreciate how good the results were.

Apart from the method of controlling reaction, the circuit is quite a straight one, and the extra strength must be put down to the by-pass effect already mentioned. If you use the set fairly near a powerful local station it may be desirable to use a wave-trap should much interference be experienced. A suitable one was described in full in POPULAR WIRELESS No. 355.

No trouble should be experienced due to L.F. instability with the decoupling resistance that is incorporated, but should motor-boating or bad distortion arise, try reversing the connections to the primary or the secondary (or both) of one of the L.F. transformers.

The addition of an output filter if not already in use would also be helpful, and it is as well to make sure that the H.T. battery is not running down and therefore causing the trouble.

QUESTIONS ABOUT VALVES.

H.F. VALVE FOR SELECTIVITY?

C. F. (London, N.W.).—"What is the best way of making a set selective? A wave-trap or an H.F. valve added?"

It is common nowadays to talk of the addition of high-frequency as an aid to selectivity because experience has proved that this is the effect it has in most cases; but it should not be forgotten that this extra selectivity is more or less incidental, and selectivity is not the real reason for adding H.F. stages.

The real purpose of H.F. amplification is to magnify weak signals. This it does, but it must be remembered that it magnifies *all* signals in the aerial with absolute impartiality, and therefore within its limits it will magnify the signals from the local station as well as those from abroad. This is not really what is wanted in the case you raise.

A wave-trap, on the other hand, is a really selective device. When accurately tuned to the local station, it selects these signals in preference to all others, and it does, therefore, discriminate in favour of the foreign or distant weak stations. For this reason a wave-trap is generally preferable in the vicinity of a high-power station. It is economical, it is easily made, it is efficient, and it will really fade out signals of the station to which it is tuned, leaving all other signals comparatively unaffected.

WHY DOES A VALVE SET HOWL?

E. T. F. (Sutton, Surrey.)—"What is it that actually causes the howl in a valve set when reaction is pushed too far? My own set will howl as piercingly and as strongly as

(*Continued on page 430.*)

BROWNIE WIRELESS

9'6

POPULAR TRANSFORMER

When planning your new set ensure perfect amplification by including a BROWNIE POPULAR TRANSFORMER. The core iron and the windings which are the very finest obtainable are assembled in the famous Brownie Factory; while all the delicate parts are protected by an attractive moulded Bakelite casing which seals the whole transformer against any atmospheric interference. Send P.C. to Dept. 22 at address below for free booklet, "*Wireless Without Worry.*"

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	s.	d.
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Transformer	15	6
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Two 2mf. Condensers at 4/- ea. } Tested 500 volts	8	0
Two 1mf. Condensers at 3/- ea. }	6	0
One ·5mf. Condenser A.C.	2	0
Valve, specially suitable	10	6
Complete Set of Clix Plugs & Sockets	2	6
Blue Print and Instructions	2	6
Complete Kit, including Blue Print and Instructions	£3	5 0
Model 4/100. Price, complete with Valve	£3	10 0

Output: 10 ma. at 100 v.; 8 ma. at 120 v.
Seven days' approval against cash.
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SCREEN 1		GRID–4
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PENT. GRID		
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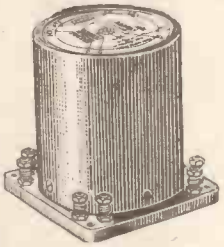

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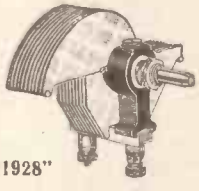

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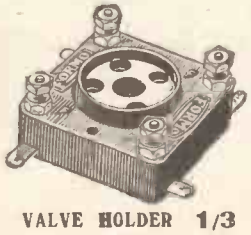
COILS SG 1 & 2.
10 6 each

FORMO-DENSOR 2/-
In four variable capacities



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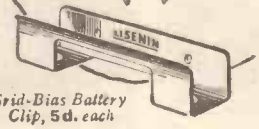

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 428.)

a musical siren, yet apparently there is no particular instrument inside causing this. So where does the howl come from?"

In order to understand where the howl comes from we must remember that all noise is due to vibrations in the air. If these vibrations were perfectly regular, following one another at a given frequency per second, the noise would have a characteristic note depending upon that frequency.

Low notes (such as the bass notes of an organ), are invariably caused by comparatively slow motions of the air—i.e. the particular instrument which is causing the sound is moving air backwards and forwards at the rate of only a few hundred times per second. Very high notes, on the other hand, such as those of the piccolo, are due to the air being moved backwards and forwards at a very fast rate—that is to say, the frequency of such an instrument is thousands per second.

All musical sounds are caused by regular movements of the air in this way. The sound of the note varies from low to high, according to whether the frequency of the vibration is low or high. Having grasped the fact that sound will be caused when the air is vibrated several hundred or thousand of times per second, you will be able to appreciate the fact that the diaphragm of the loud speaker or of telephones is quite capable of setting up an audible sound.

This can either be a low howl, or a piercing whistle, if the electric currents cause it to be moved at the required frequency corresponding with these sounds. The howl which is associated with a receiving set due to too much reaction being used is generally caused by the interaction or "beat" note of two separate sets of electrical waves, which, taken singly, are of far too great a frequency to affect the diaphragm.

Thus, if the frequency of a broadcasting station's carrier-wave is 1,000,000 times per second, and your receiving set is adjusted to have a frequency of 1,000,500 times per second, the two different currents will fall into step 500 times per second, and, consequently, a beat note will be heard in the telephone at a frequency of 500 per second. This would make an audible sound, and if the frequency of your tuned circuit were altered, and that of the station remained constant, the note would go up and down accordingly, and you would hear a sound going up and down according to whether the beat frequency was increased or decreased.

So you will see that such a howl is caused by an electrical interaction between two non-audible frequencies, which, mingled together, form a third frequency, which *is* audible. This effect, falling into the range of audibility, appears as a howl, or shriek, or growl, from the telephones or loud speaker.

THE PLATE SUPPLY.

E. C. W. (South Wales).—"I have constructed a three-valve set which has Reinartz reaction, followed by R.C. and transformer-coupled amplifier. I am getting good results, but I have had the misfortune to run through a new H.T. battery of 100 volts in a fortnight. What is the cause of this?"

We think that the only explanation of this running down so quickly is that you have been shorting it. This does not mean to imply that its positive has necessarily been connected to its negative by a piece of wire or metal externally, for the short may be a fairly high resistance one, taking part through a fault in the insulation of the set.

For instance, if you are using a large fixed condenser across the high-tension battery we should certainly recommend you to disconnect this and test its insulation. If the condenser is not faulty it is possible that there is a mistake in your wiring, or else that some of the insulation somewhere else in the set is defective. The most likely component to give trouble of this kind is a fixed condenser, but faulty leads, or a faulty switch—indeed, any defective insulation—may give rise to the trouble.

If you are unable to trace any fault of this type, we should get the set overhauled by someone experienced in radio troubles. Failing this, we are

(*Continued on page* 432.)

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8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
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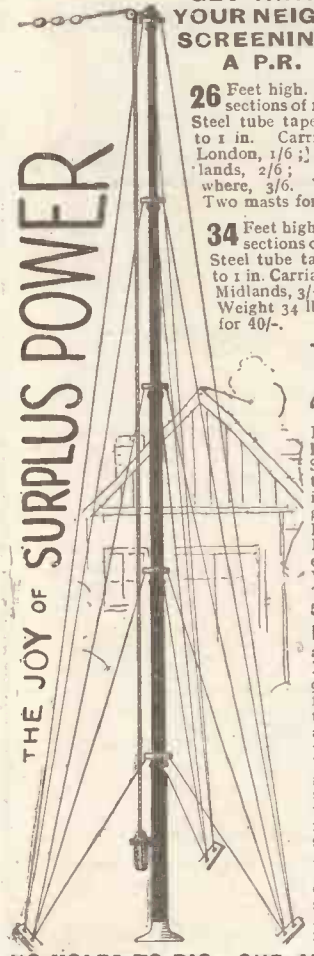

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 430.)

afraid you will have to make another application to the Query Department, including a diagram of the connections of the set, so that we can tell you the likeliest places to look for this trouble. Finally, we would remind you of the importance of seeing that the new H.T. battery registers the correct voltage when it is purchased.

WHAT L.T. BATTERY IS REQUIRED?

B. G. A. (Northampton).—"I thought of getting a four-valve set, preferably with a switch to cut out the last or the third valve when not required, but I am a little bit uncertain about the circuit. It will be a three- or four-valver. To estimate the total cost, etc., I should like to know what kind of L.T. battery I shall require for a set of this description. Various people seem to have different ideas about the method of choosing a battery, and I should be glad of some hints on the correct way of estimating its recharges."

The question of which is the best L.T. battery to use is decided by the choice of valves. The L.T. supplies the filament current to the valves, so first of all you should find out the total filament current consumption of the set.

Probably if you are using 2-volt valves you will find that the first valve takes about ·1, the second about ·1, and the third about ·1, whilst the fourth valve may take ·15 amp. Adding these values together it will be seen that the total consumption of the set will be ·45 amp—roughly speaking, a filament current of just under half an ampere. Although this is not heavy, it is quite a fair-sized current, so you will need a fair-sized accumulator to provide it. Although the very small ones are capable of handing out half an ampere, they could not do this for several hours each day without constant recharging.

You can get an idea of the current-supplying capacity of the battery required by considering the low-tension battery rated at "30-actual ampère hours." This means that the battery will supply one ampere for thirty hours, so we can assume (though it is not always strictly correct) that it would supply half an ampere for double the time—i.e. for 60 hours. If, therefore, you use your set for about five hours per day, on an average this battery would last you twelve days without recharging. If, however, you are going to use the set much less than this, a smaller battery may suit your purpose.

TECHNICAL NOTES.

(*Continued from page* 408.)

Electronic Emission.

The life of a dull-emitter filament, however, may for practical purposes come to an end even though the filament be perfectly intact and apparently in good condition. As you know, the electronic emissivity of a dull-emitter filament depends mainly upon the presence in the metal of certain impurities artificially added.

During the operating life of the filament these impurities are gradually used up and consequently there is an inevitable decline in the efficiency. This decline, however, in the case of a good quality filament, is comparatively slow, and if the operating conditions are carefully observed, a long and useful life should be obtained.

But if the specified conditions as regards operating temperature (which in practice means filament current) are not properly observed, and if you run the filament continuously at a temperature distinctly higher than the intended temperature, then the decline in the efficiency is very much hastened and although the filament may, to all appearances, be perfectly good and sound, the valve may function very poorly in comparison with what it did originally.

Distortion.

There is a great temptation to raise the temperature of a dull-emitter filament above the normal, because in that way an

(*Continued on next page.*)

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TECHNICAL NOTES.

(Continued from previous page.)

increased volume of reproduction may often be obtained (usually with plenty of distortion), and it requires a certain amount of self-control on the part of an operator, particularly if he happens to be more or less a beginner, to avoid the temptation to "ginger up" the volume by turning up his filament rheostats just a little.

I advise all amateurs to check up the filament-current passing through each valve from time to time—say every month—with a reliable ammeter; if you do not possess a good ammeter you can no doubt borrow one for the purpose, as the test should not take more than half an hour or so.

Brightness.

Whilst the current passing through the valve is of the rated amount make a very careful mental note of the brightness (or dullness, if you prefer it) of the filament and thereafter content yourself to operate the valve under those conditions, without trying to force a little more out of it.

Of course, it is better to possess yourself of a suitable ammeter of your own rather than to rely entirely upon visual memory of the appearance of the filaments and, moreover, in many modern types of valve it is impossible to see the filament anyhow, so that you are bound to rely either upon the application of a definite voltage to the filament or upon an indicating instrument to show what current is passing.

Dull-emitter filaments, more particularly in smaller valves consuming a current in the region of one-tenth of an ampere, are, as a rule, rather fragile, and therefore mechanical shocks to the filaments should be carefully guarded against.

I suppose everybody uses anti-microphonic holders in these days—at any rate one ought always to be used—and care should be taken when inserting and withdrawing the valves, especially when withdrawing. I have known perfectly good valves to have their filaments fractured by being carelessly pulled out of the valve holder.

Precautions.

To sum up the foregoing precautions, you should be very careful to run your filaments at the right temperature so as to avoid rapid loss of emissive power; you should naturally take great care to avoid accidental short-circuits or the access of the H.T. into the filament circuit; and you should be very careful to prevent jars or mechanical shocks from reaching the valve.

Diameter of Filament.

I mentioned above that some modification might be necessary with regard to the statement as to the burning-out of the dull-emitter filament. Although the filament as a whole operates at a temperature far below the melting point, nevertheless, if there happens to be any inequality in the diameter of the filament (as is sometimes the case) the thin point will naturally be at a higher temperature than the rest of the filament.

This means that, owing to disintegration, the thinner and hotter part will lose diameter more rapidly than the rest of the

(Continued on next page.)

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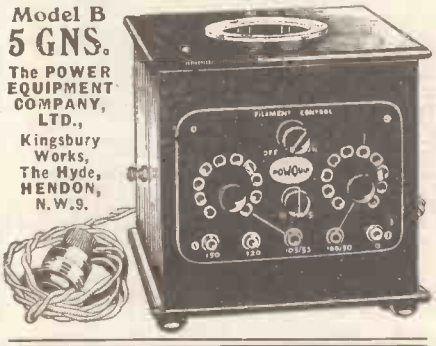

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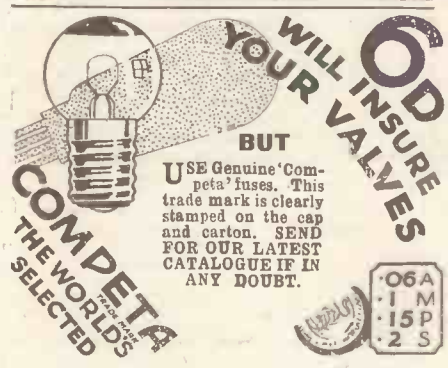

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TECHNICAL NOTES.

(Continued from previous page.)

filament, and therefore the discrepancy will, in course of time, become more pronounced instead of less pronounced, that is, the difference in temperature between the thin spot and the rest of the filament will become greater instead of less as time goes on.

The result may be that eventually, although the temperature of the filament as a whole is kept more or less to the normal value, there may be a "hot-spot," the temperature of which is far above the normal, and in course of time the filament either burns out or breaks at this thin part.

Frequency and Wave-length.

The simplest way to understand the relation between frequency and wave-length is to assume that the velocity of radio waves is *constant* or, at any rate, *independent of frequency*. This means that electrical oscillations of a frequency of, say, 1,000,000 per second produce waves which travel at the same velocity as those produced by oscillations at the rate of 2,000,000 or 3,000,000 or any other number per second. Whether this assumption is absolutely accurate it is difficult to say, but it is known that even if the velocity of radio waves varies at all with the frequency, the variation must be exceedingly minute, and can certainly be ignored for all ordinary purposes.

Constant Velocity.

Anyway, let us take it that all radio waves, of whatever frequency, have the same velocity. Then all we have to remember is that the frequency and the wave-length are inversely proportional to one another; for instance, if waves of a frequency of 1,000,000 vibrations per second have a wave-length of 300 metres, then waves of 2,000,000 vibrations per second will have a wave-length of 150 metres; 3,000,000 vibrations per second, a wave-length of 100 metres, and so on.

You can easily visualise this by thinking of the waves sent out on the surface of a pond by an object moved slowly up and down in the surface of the water. This object will produce waves which will travel out over the surface of the water at a certain definite rate.

At the end of one second the object will have vibrated up and down a certain number of times (which we call the "frequency") and the first wave will have travelled a certain distance which (since it is the distance travelled per second) represents the "velocity."

Velocity and Wavelength.

The number of waves between the point of disturbance and the point to which the first wave has travelled will obviously be equal to the number of times the object has moved up and down during the period of one second, that is, it will be equal to the frequency.

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White Print No. 27 :: :: A Constant Reaction Three-Valver.

This week we publish the twenty-seventh of our White Prints. This page may be easily and safely torn out—along the dotted line overleaf—and the "White Print" filed. In due course you will thus have available an encyclopædic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

MANY schemes have been devised in the past for reaction circuits which give constant adjustment over the whole tuning range, and some of them have been fairly effective. The attraction of a set incorporating such a scheme is obvious: having once adjusted the reaction to the desired sensitive state, it "stays put" over the whole tuning range, and searching is merely a matter of turning the tuning dials.

Many people seem to prefer to have a reaction control which requires adjustment on every station picked up, but to the man who wants a really easily-handled receiver the constant-reaction scheme has many advantages. A good deal of attention has been devoted to the problem in the past, but most of the schemes evolved have suffered from one grave drawback, i.e. they made the set rather complicated.

Simple But Effective.

The one chosen for the White Print series, however, is a noteworthy exception to this rule. Due to the Technical Editor, Mr. G. V. Dowding, it is strikingly simple, has practically no effect on the cost of the set, yet gives surprisingly effective results. Instead of employing the ordinary panel-mounted reaction condenser, Mr. Dowding places two small compression-type adjustable condensers on the baseboard, and by juggling with these a little you can soon find a setting which keeps the set in its most sensitive state uniformly over the whole tuning range.

The special reaction circuit required is extremely simple, but space will not permit us to explain its working here. The interested reader will find a detailed account in "Modern Wireless" for September, 1928.

The remainder of the set is an efficient form of screened-grid H.F. stage, detector, and one L.F. to complete the three-valve circuit. It is intended for the ordinary upright type of S.G. valve, and 2- 4- or 6-volters can be used throughout the set as desired. The H.F. stage is very similar to those of the 1928 Solodyne (a "Modern Wireless" set), and uses special coils which can be obtained under this name.

COMPONENT LIST.

- 1 Panel, 14 in. × 7 in.
- 1 Cabinet, to fit with baseboard, 12 in. deep.
- 2 ·0005-mfd. variable condensers.
- 1 On-off switch.
- 3 Sprung valve holders.
- 1 L.F. transformer.
- 1 H.F. choke.
- 2 ·0003-mfd. compression-type adjustable condensers.
- 1 Standard "P.W." screen, 6 in. × 10 in.
- 1 ·0002-mfd. fixed condenser.
- 1 ·2 to 1 mfd. Mansbridge type condenser. (Any capacity between these figures will serve.)
- 1 2-meg. grid leak (and holder, if required).
- 1 Aerial coil and 1 H.F. transformer for medium waves, and another pair for long waves. (These are 1928 Solodyne coils.)
- 2 Holders for the above.
- 1 Terminal strip, 12 in. × 2 in. or 14 in. × 2 in., according to length of slot in cabinet.
- 10 Terminals.
- G.B. plugs, wire, screws, flex, etc.

They are of the semi-fieldless type, and provide a separate tapped aerial winding in the one case, and an H.F. transformer with reaction in the other.

The tapped aerial winding provides different degrees of selectivity, which are obtained by connecting the aerial to A_1 (lowest selectivity) or A_2 (more selectivity but usually slightly less volume). These are the 15- and 20-turn points on the aerial winding, the 10-turn point not being used in this set.

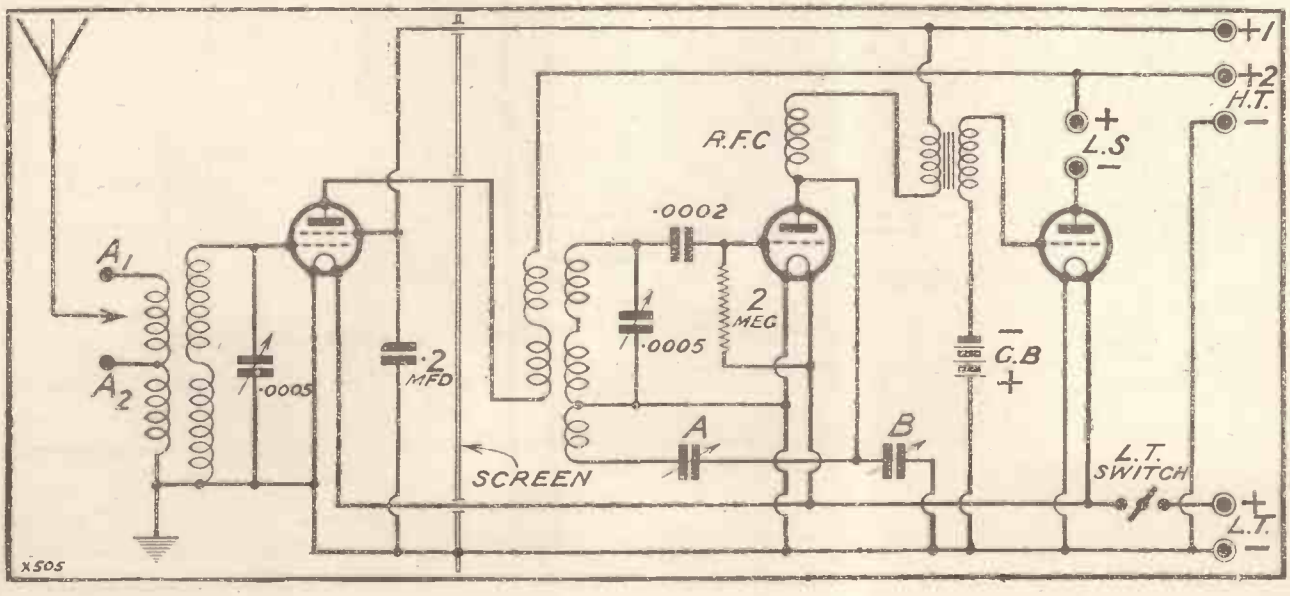
The various H.T. leads are grouped in this set so that only two separate positive terminals are required. Of these, H.T.+ 1 supplies the detector and the screening electrode of the H.F. valve. Voltages from 60 to 80 should be tried here, noting which gives the best volume on distant stations (re-adjust reaction to suit, of course). Terminal H.T. + 2 feeds the plates of the H.F. and L.F. valves, and the full 120 volts must be used.

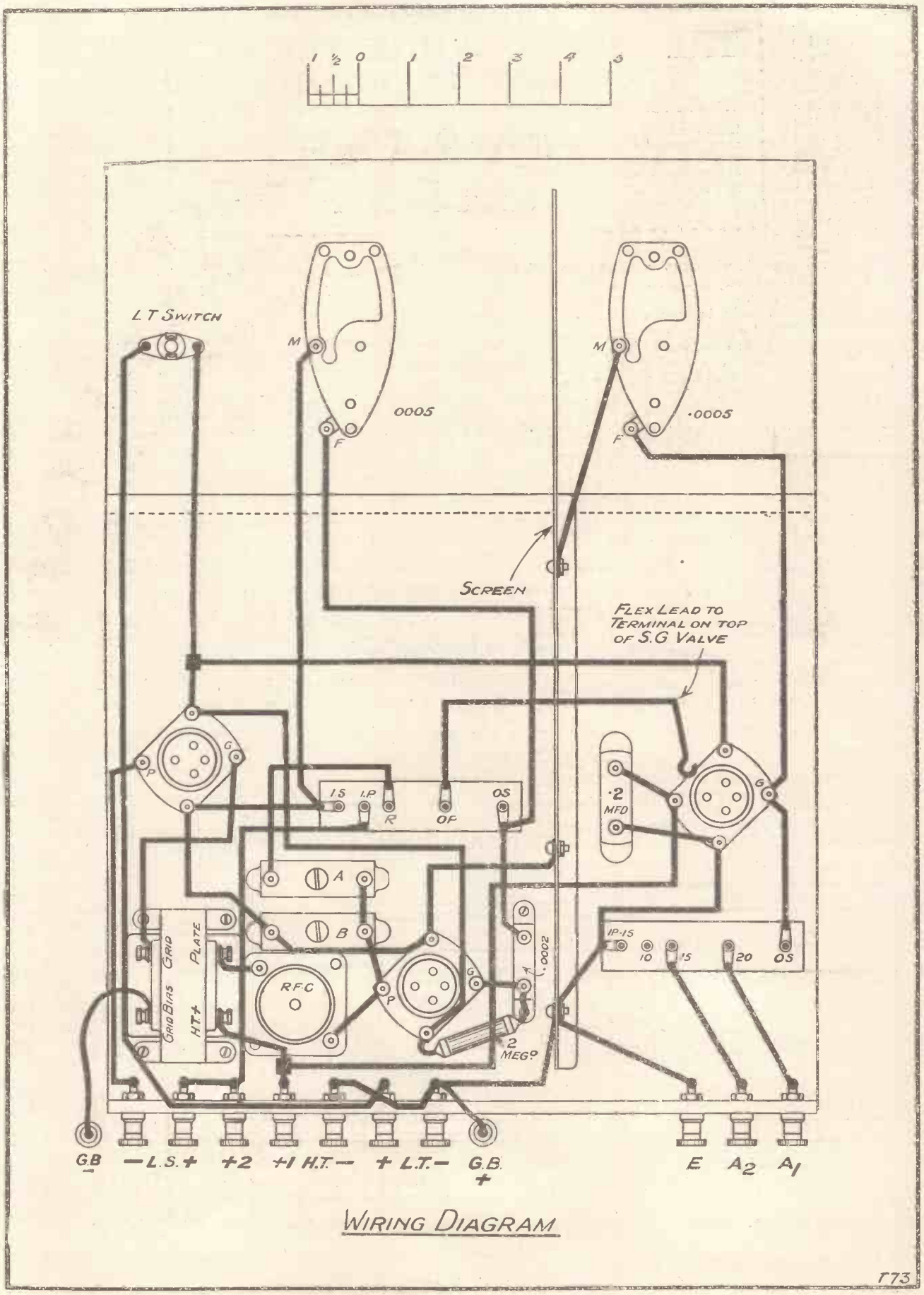
Valves And Adjustments.

Valve types in this set are just the usual ones, i.e. a screened-grid H.F., one of the H.F. type (about 20,000 ohms impedance) for the detector and a power type in the third socket.

The only preliminary adjustment is that of the reaction circuit, and this is most important. Try first of all with condenser A nearly at its minimum and B at a little less than maximum. If the set is not then sufficiently near the oscillation point to be highly sensitive, increase A a trifle. Next, see whether the set breaks into oscillation at the top or bottom of the tuning range.

If it oscillates at the lower end increase B a little, while if it oscillates most easily at the top reduce A a trifle in proportion to B. By trying various combinations of A and B you should soon find one which keeps the set in a uniformly constant state over the whole tuning range.





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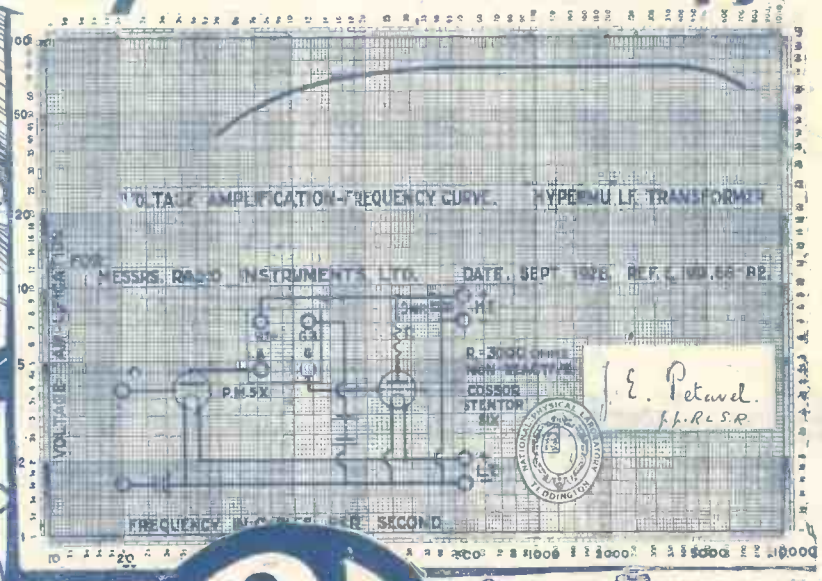

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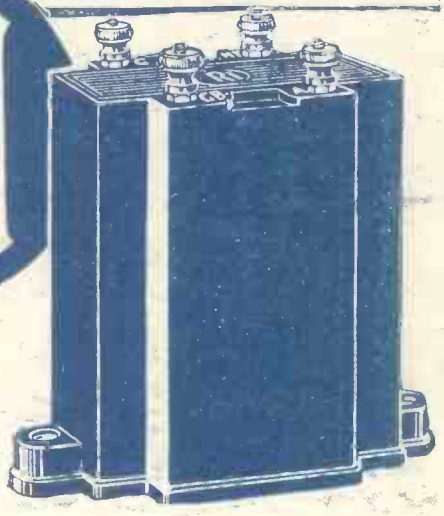

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R/R