

HOW TO BUILD THE "H.D.L." THREE

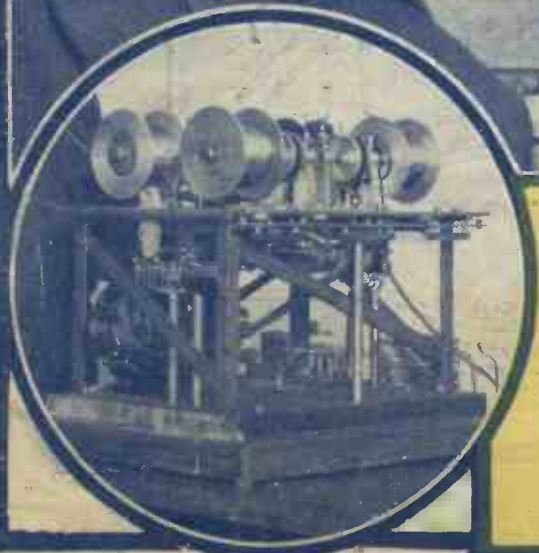
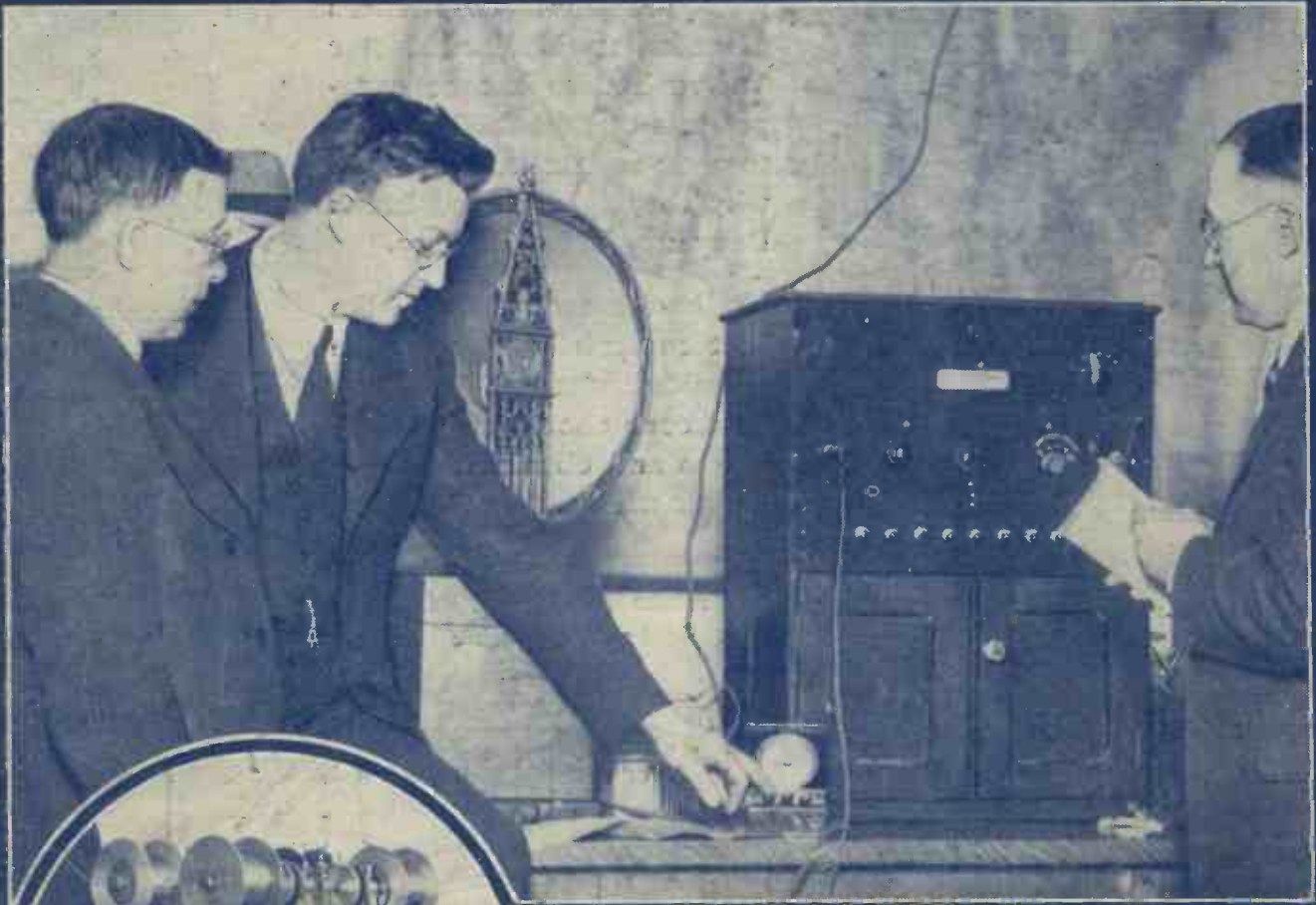
Popular Wireless

Every Thursday
PRICE
3d.

No. 248. Vol. XI.

INCORPORATING "WIRELESS"

March 5th, 1927.



Special Features in this Issue

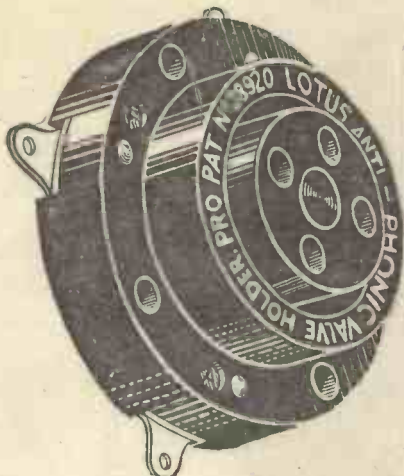
- An Interesting Method of Measuring H.F. Resistance
- Short-Wave Condensers
- Volume Control
- Dry or Wet H.T.?
- Getting It Right
- Oh, Those Curves!
- Radio Depth Sounding
- Rugby Radio: The Chief Engineer's Reply

Our cover photograph shows a demonstration in progress of the Record-O-Phone which records sounds from a radio-receiver in an electrical manner.

(Inset) A "close-up" of the instrument.

LOTUS

THE "MASTER" VALVE HOLDER

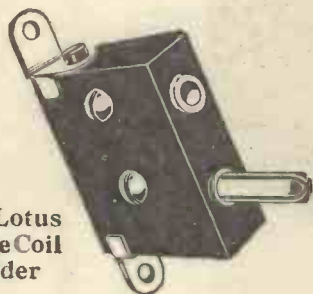


RECOMMENDED BY
Mullard
 THE MASTER VALVE

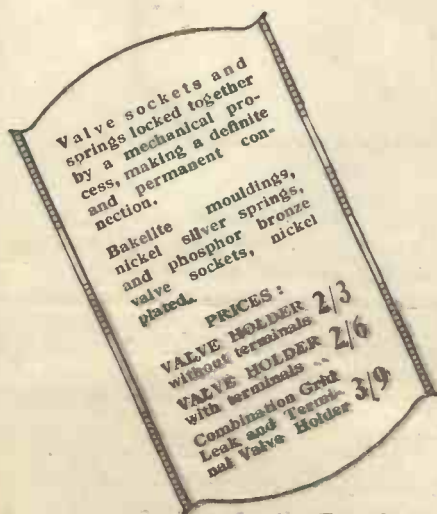
IN evolving the skilful circuits described in "Radio for the Million," the makers of the famous Mullard Master Valves had to choose components that would do justice to their reputation. That is why they recommend Lotus Buoyancy Valve Holders.

Made with every care of the best materials, they can be relied on under any conditions to absorb shock, protect the valves and eliminate microphonic noises.

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*Fit them on any set you
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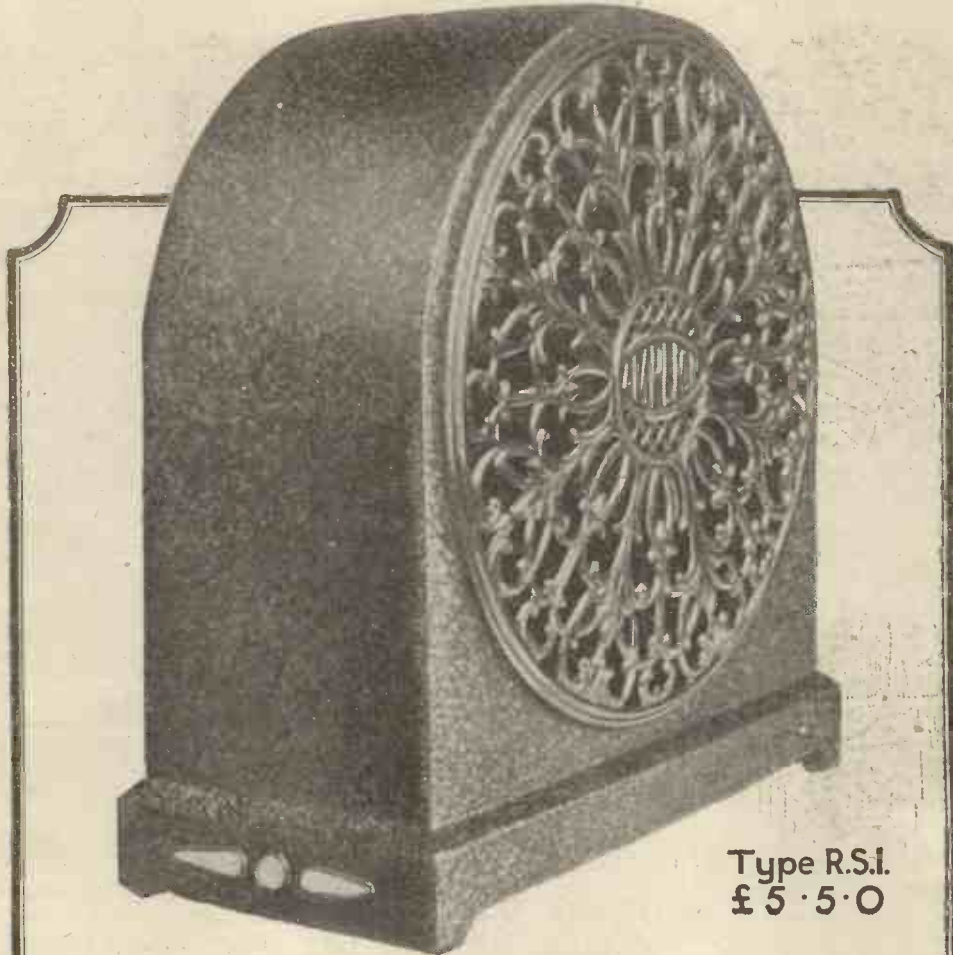
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These instruments are renowned for purity of tone and represent unequalled value for money in cabinet-type loud speakers.

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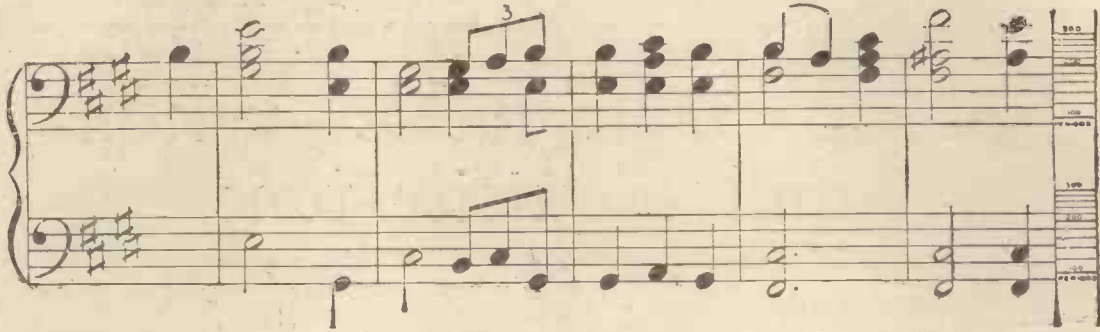
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In the lower lines of music the size of each note is strictly proportional to the amplification obtained with the transformer, curve IV below. It will be noted that the amplification is inferior and inconstant, with the result that some notes are almost lost, and others distorted.



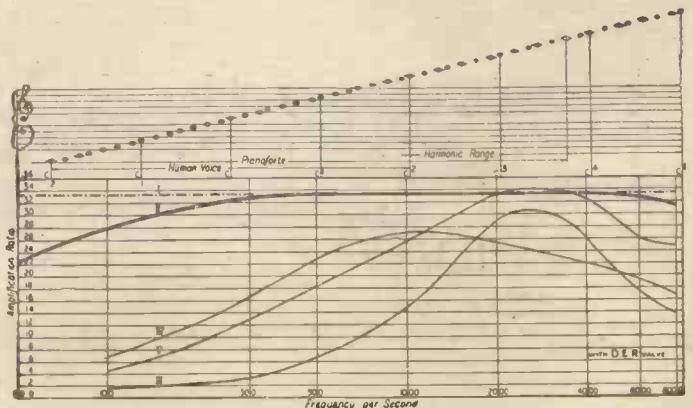
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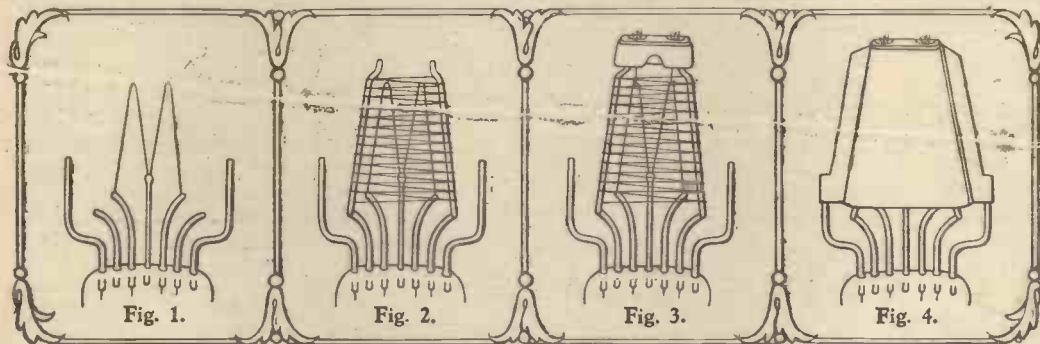


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Another Cossor

—new series of 6-volt Valves giving remarkable volume and exquisite tone



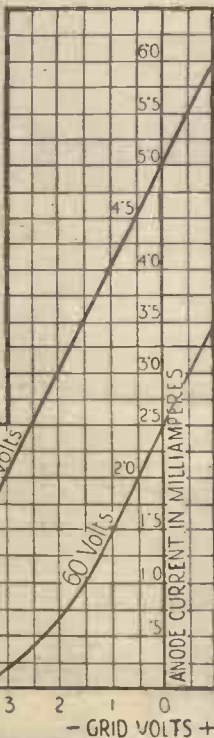
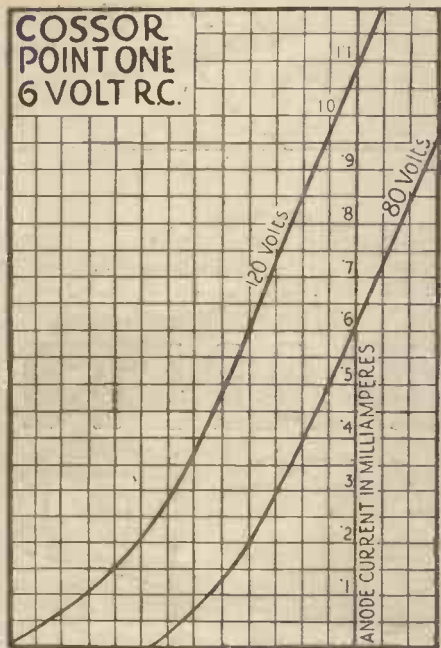
Embodying the principles of Co-axial Mounting

Cossor Valves are now available for 2-volt, 4-volt, and 6-volt Accumulators in a wide range of types.

WHEN Cossor introduced Co-axial Mounting at the commencement of the present season it was acknowledged to be one of the greatest improvements in Radio. At one blow it abolished the main cause of lack of uniformity in valve manufacture. These same successful principles have been retained for the new Cossor Six-volt Valves. Look at the illustration above which shows how Co-Axial Mounting is successfully achieved.

In Fig. 1 see the twin filament of exceptional length. And the grid, its wire securely welded in 28 different places—which is so rigid that microphonic noises are utterly impossible. Note the seonite-insulator in Fig. 3, holding immovably in position the ends of the grid and also providing a bridge for the two shock-proof filament supports. And finally, see how the anode is locked in position in accurate and life-long alignment with the grid and the filament. All three units are secured to each other and individual movement is impossible.

Throughout its whole life the characteristics of the valve can never change through filament sag or accidental blow. How important this is, will be appreciated by every serious experimenter. All Cossor Six-volt Valves in the same class must be identical in every respect—there can be no variation.



Cossor 6

Achievement

UNFETTERED by any electrical or mechanical limitations this wonderful new series of Cossor 6-volt valves give a volume and a richness of tone never before achieved in Radio. Experts have been amazed at the rare beauty and power — the vitality and mellowness of broadcast music which these valves can create.

And small wonder — for Cossor, after the three years spent in bringing the Cossor Point One 2-volt Valve to an extraordinary degree of perfection, comparable only with valves of higher voltage, now brings to the six-volt field a wealth of experience and technical skill.

Cossor 6-volt Valves are unique in every way — and as such they set new standards of performance. All records for volume, purity of tone, and sensitivity have been broken. Hearing is believing! Let your Dealer demonstrate them to you to-day. For you must hear to realise to what heights of realism Radio music has now attained.

Every valve has a Kalenised filament

A LARGE share in the success of these amazing valves must be placed to the credit of the Kalenised Filament. Operating without visible glow — yet giving off a perfect torrent of electrons — the Kalenised filament is revolutionising Radio. It has cut to shreds the previous high costs of Receiving Sets maintenance. Half a dozen of these new Cossor Six-volt Valves cost less to run than one bright emitter. And because it operates practically without heat, its life is immeasurably longer.

Finally, do not forget the famous Cossor aeroplane test, when a dozen Cossor valves were hurled 500 feet from an aeroplane without harm to their Kalenised filaments.

Only a high emission — coupled, of course, with perfect control — can give volume and natural reproduction. The Kalenised filament gives off an emission unequalled in its intensity — that is why these new Cossor Six-volt valves attain such a remarkably high standard of efficiency.

Compare these curves :

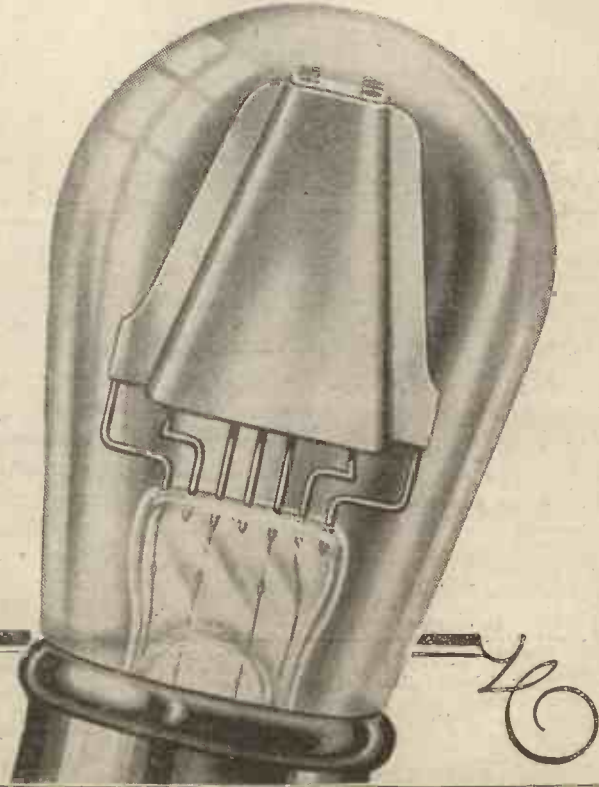
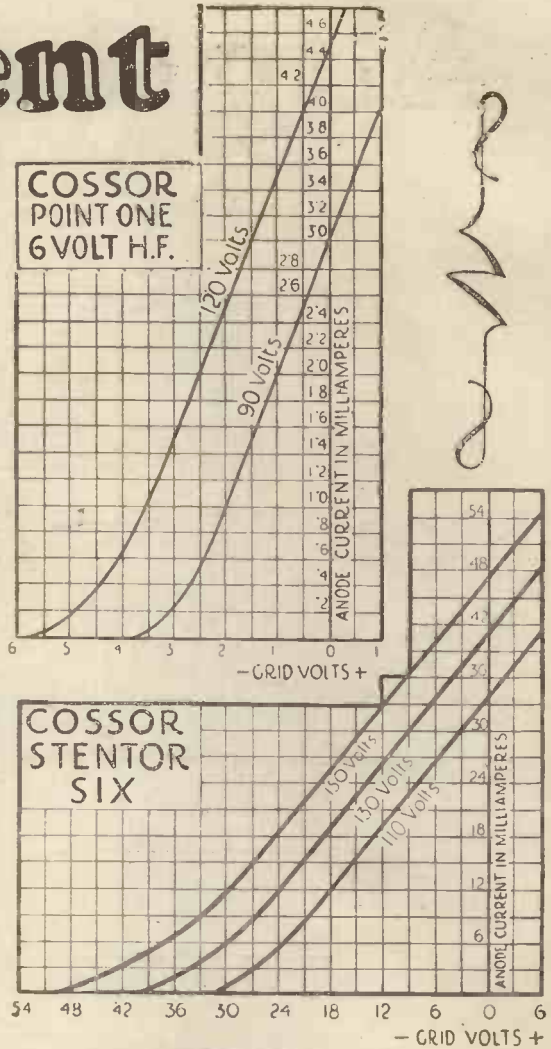
IF you cannot try out a Valve, the next best thing is to study its curve. The curves shown here speak for themselves. Note, for example, the steep slope of the H.F. valve — clear proof of its ability to handle weak signals from distant stations. Compare also, the curve of the wonderful new Stentor Six — observe how well it can cope with the large changes of grid voltage

without distortion. As a super-power valve the Stentor Six is without equal. And finally, remember the prestige enjoyed by Cossor valves. Every experimenter speaks well of them. Their long service and low current consumption — their superb tone and high standard of efficiency — have won a great reputation, which these new valves will considerably enhance.

Four types for all requirements :

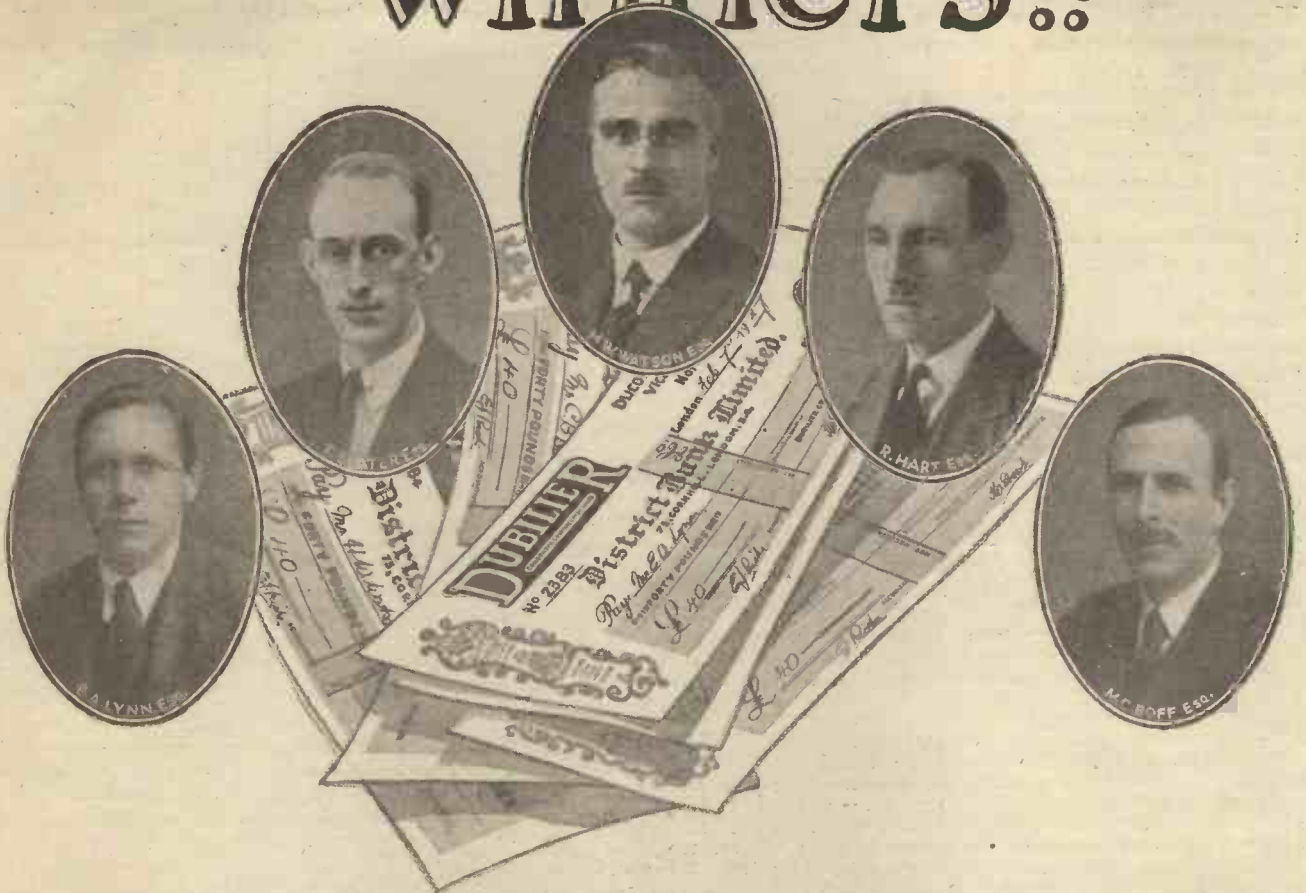
- 610 R.C. For Resistance or Choke coupling 14/-
- Impedance 80,000 ohms. Amp. factor 50. Consumption 1 amp.
- 610 L.F. For 1st stage Frequency amplification 14/-
- Impedance 8,000 ohms. Amp. factor 8. Consumption 1 amp.

- 610 H.F. and Det. For H.F. amplification or Detector use 14/-
- Impedance 20,000 ohms. Amp. factor 20. Consumption 1 amp.
- 610 P. Stentor Six Super Power Valve 22/6
- Impedance 3,000 ohms. Amp. factor 3'5. Consumption 1 amp.



volt Valves

Winners!!



The Dubilicon Competition

The Dubilicon.

An extremely useful condenser containing 8 separate capacities from which many hundreds of resultant capacities may be obtained. Indispensable for experimenters

Price 30/-

The result of the highly successful Dubilicon Competition can now be announced.

Each of the five gentlemen whose portraits appear above correctly worked out the number of different capacities obtainable from various arrangements of the first five capacities of the Dubilicon Condenser.

The correct number was—475.

The Prize of £200 has accordingly been divided between the five winners, each of whom receives a cheque for £40 together with our hearty congratulations.



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RADIO NOTES AND NEWS.

Signs of Spring—DX Transmission—Another Splendid "Shake"—Weighty Waves—
 Obsolescent Valves—Good-bye, Uncle!—A Disclaimer—DX Telephony.

Signs of Spring.

YES, I am very much afraid that Spring is once more close upon us. The indications are as plain as the cold in your nose. The wandering dog now begins to take real pains to get into the front garden, because he knows the crocuses are above ground. Summer Numbers are now being prepared and the technical staffs of wireless journals are careering over the sodden countryside in chest-protectors, with new models of portables.

DX Transmission.

NO doubt feeling quite in tune with polar conditions one of our prize contributors, Mr. C. W. Goyder, of Mill Hill, just walked over to his set and called up the South Pole. He was answered by a whale—I mean a whaler—the "Sir James Clark Ross," and they conversed easily for some time. Verily it is a privilege to live in an age like ours, when a lad in England can communicate by magic with men seeking their bread down by the Great Ice Barrier.

Another Splendid "Shake."

MR. W. HULME SMITH, a Leeds man residing in Bombay, transmitting on 50 watts, was received by an amateur in California. This implies excellent work at both ends and what is specially interesting is the fact that the wave-length was 320 metres. I often wonder what the mid-Victorians would have made of

Weighty Waves.

A NEWCASTLE lecturer stated recently that wireless waves have weight, and can be weighed. Now we know why our aerials sag. But how does one persuade a wave to stay long enough to be weighed?

Obsolescent Valves.

NEWS from America inspires me to warn amateurs not to carry a stock of valves, even of the new current-less filament type. Professor Craig, of Georgia, has, he claims, rendered valves, batteries and transformers unnecessary. I find this news rather sickening because (1) I possess two apparently immortal valves, and (2) I love reading the advertisements of transformers;

Bombay is a fine warm place, and the docks will remind you of home.

And Another.

MR. C. C. N. Wallich, Station Director of Plymouth, is en route for Calcutta, where he will be director of the station. Luck to you also, sir! Brother Page has the best of it, in my opinion, "Bombay-side," as they call it, being much more respectable in climate than "Calcutta-side."

A Resignation.

MR. G. S. RULE, director of the Newcastle Station, has resigned in order to get on with literary work. May he never see a rejection slip. Uncle Caractacus (2LO) did the same. Evidently proximity to wireless stations stimulates the pen-finger.

A Disclaimer.

MESSRS. A. J. STEVENS & CO. (1914), LTD., the well-known makers of A. J. S. sets, ask me to state that the rumour that they intend to give up the manufacture of radio apparatus is unfounded.

DX Telephony.

MR. W. K. ALFORD (2DX), of Amberley, Surrey, has succeeded in working two-way speech with Sacrotan Island, Hong-Kong. Wave-length, 44.8 metres; input, 42 watts. His transmitter is crystal-controlled and is equipped with an Osram L.S.5B and an Osram D.E.T. 1. Readers who contemplate going out after records had better hurry up and begin.

Inductive Interference.

IN view of the recent discovery that electric messages establishments are capable of interfering with reception, it is interesting to note that the Radio branch



Mr. W. D. Hogan, a well-known Dublin radio experimenter, carrying out tests on the Dublin-Cork Express, during the course of which journey some very interesting data was collected.

they are about as lyrical as Tennyson. Still, I wouldn't let my scruples stand in the way of the professor and progress for a moment.

Good-bye, Uncle!

MR. LESLIE B. PAGE, Station Director at Hull, is on his way to Bombay to take up a similar position at the station there. Best o' luck, Mr. Page.

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

of the Canadian Department of Marine and Fisheries organised as far back as February, 1925, a section to deal with Radio interference.

A Section Worth Its Salt.

ONE engineer and three electricians toured in a special motor-truck and investigated interference. In three months 203 cases were examined, and of these 124 were remedied at once and most of the others later. Three more trucks were commissioned, and the results have been highly beneficial to listeners and to the "trade." The Radio branch has published a pamphlet describing how various causes of interference can be located and the trouble tackled. This is an unique service and a feather in the cap of Commander C. P. Edwards, the chief of the branch.

The Tempter.

D. C. (S. Croydon) asks us to produce and publish an article entitled "Coils for Rugby and How to Make Them," thus suggesting that he is going out of his way to eavesdrop on the transatlantic telephone service, unless he is thinking of Rugby's ordinary telegraph service, which I doubt. Much as we wish to assist our readers I fear we cannot thus tempt them to intercept signals, more particularly public telephony, which are not intended for them. Not that we see much harm in it, but we think it would be a point of etiquette properly resolved to let such an article alone.

KDKA Times.

ADX man who has specialised on this station gives the following data: Times of transmission (Eastern Standard Time): 7.15, 8.0, 9.45 and 11.55 a.m. Also at noon, and 3.45, 6.15, 8.0, 9.15, 10.0 p.m. On Tuesdays also at 11.55 p.m.; on Thursdays also at 11 p.m. Sundays at 10.45 a.m. and 4.0, 4.45, 6.30, 7.45 and 10.15 p.m. The wave-length is 63.5 metres.

Something Wrong Somewhere.

YOU remember my notes a week or two ago about the Irish gentleman who said he put up an aerial 2,500 feet long, earthed it, and then received the North American stations on a 7s. 6d. crystal set? Well, an Addiscombe friend, to cure my scepticism, brings up the story of America being received by owners of crystal sets, 8,000 miles away in South Africa. I referred to this story in my notes during January.

Caution—Not Scepticism.

THE snag in the Irish story is, in my view, due to a printer's or typist's error. Anyway, if it is thought that an "earthed" aerial increases the range of a detector I suggest that some of my K.C.W.'s might try it and let me know if they hear anything. Moreover, if any special virtue is supposed to lie in the use of an aerial 2,500 feet long, suspended vertically, for the reception of short and medium wave-lengths, I should be glad to learn it. Why cannot people with 8-valvers get Sydney, N.S.W., if a crystal set can get America? Answer: Because they don't "earth" their aeri-als.

"Somewhere A Voice," etc.

THE news that many letters reach Savoy Hill from people who (think they) have fallen in love with the owners of voices heard by wireless, sheds yet another light on the mysterious human heart. Who are these people, who, on hearing an unknown voice, sit down and write tender thoughts to its owner? Does one see them in buses or bump against them in the crowd? Ah, well! When the voice is accompanied by a television screen view of the vociferator a number of instantaneous cures will be reported.

Warsaw Radio.

THE new station in Poland, at Fort Mokotow, 7 kilometres south of Warsaw, is now in action on 1013 metres with a power of 10 kw. to the main oscillator valve. This transmitter is said to be phenomenal, and can be picked up in this country on a two-valve set.

Invention Wanted.

MR. BAIRD is no doubt a fine, persevering fellow, who is going to give us wireless pictures of "uncles" trying to pronounce Ponsonby or flat-iron; he claims also to be able to give us eyes like a cat's. What I am more interested in, however, is whether he has anything which can be bought for a shilling and carried in the waistcoat-pocket, capable of helping a man to find the matches in the dark.

SHORT WAVES.

2 L O will broadcast "The Fog" . . . This is a play. We have already had enough of the real thing.—"Star."

The majority of listeners are in sympathy with my idea, but as they themselves do not possess licences they withhold their support.—"Daily Chronicle."
AND their licence money!

Shakespeare on the Children's Hour:

"Uncle me no uncle."
"Sweet aunt, be quiet."
—"Sunday Pictorial."

Thinking-In. An Experiment in Mass Telepathy.—Headlines, "Daily News."
Brain Waves?

The chief clerk came in late. Second time in a week. The boss groused:
"Don't you ever do anything on time?"
"Y-yes, sir," stammered the chief clerk.
"I bought my radio set that way."—"Radio."

The Governors of the University College of South Wales and Monmouthshire have decided to approach the B.B.C. to try and get a broadcasting station for Wales.—"Provincial Paper." Personally, we should think twice about provoking these Mammals in this manner.

Radio-frequency, writes one of our contemporaries, is a term applied to the appalling number of times a broadcasting station can put over a dud number.

A programme the other evening included a representation of the chirping of a bird. So life-like was the sound that in one household, it is related, the family cat took a header into the loud speaker. A clear case where a listener sought that which an entertainer would gladly avoid—"News of the World."

One of our readers writes to say that he made very good contact with a damp piece of earth—when he slipped in the mud.

Phyllis, your smiles would seem more fair
Than any rays the sun could scatter;
I'd listen to you anywhere
If it were not for one small matter.
Your voice would sound so sweet to me
If you would only cease to say
How you had just got Budapest
Or Daventry.

—"London Opinion."

Laugh and Grow Fat.

UNIFORMED ether searchers in America must have been considerably startled a little while ago if they picked up a certain station at Omaha, Nebraska, where a laughing contest was in progress. Over a hundred Champion Guffawers from seven states subjected the microphone to probably the worst trial it ever had. Some of the entrants had to be tickled before their chortles would start. This was, I think, the most foolish broadcast ever put over—and that's saying something. Are they really so hard-up for ideas in Omaha, I wonder?

Wisdom for the Masses.

AFTER ploughing laboriously through a "highbrow" article on the "Effect of a large number of receiving aeri-als on the propagation of wireless waves," I found that the general conclusion, so ponderously worked out, was simply that the "aerials in the London area have a very marked absorbing effect on the waves passing over them." Bless my soul! Why, that's what the things are put up for! These mathematical physicists won't believe anything until they have got it down in x and y .

Big Business.

SO the Post Office admits having lost last year £1,299,214 on the telegraphs. So that is why the Government is letting it play with imperial wireless, I suppose. An absolute monopolist—and it cannot make the telegraphs balance their budget. The fact is, the P. O. ought to have stuck to carrying the mails. Why, I hear it rumoured that there is even a deficit in the Dog Licence Department because they spent £2,000,000 in teaching Female Learners how to tell a pup's age by biting its tail.

Delayful Darlings.

ONE thing the P. O. might have done and didn't, is to have made all those delayful darlings, its messenger boys, listen to the broadcast of the Paddington to Plymouth railway run. Fifteen minutes for 226 miles. It would have explained the idea of speed to them. One never hears of a Boy Bikest (P.O., red, for the use of) being collared for speeding.

Sharp Criticism.

A WRITER in a Manchester paper described a contrivance for putting his receiver on or off by the sound of the voice. When he shouts "music" the set begins to operate, but when he shouts "rubbish" the set goes out of business. Very clever! But what a criticism of the B.B.C. programmes! Either music or rubbish. Come, come! What about the Time Signals?

Wireless on Motor-cars.

CAPT. PLUGGE, the well-known motorist, has fitted his car with a "last word" radio equipment. I am sorry to note, however, that his set has eight valves, because it tells me at once that for my car I shall need at least three dozen, besides a boy to keep putting them back in the sockets as fast as they are jolted out. I doubt whether I should be able to compete with my car's own broadcast noises without the aid of a Public Address equipment—even then I should need to wear a diver's helmet as well as the 'phones.

ARIEL



Dry or Wet H.T.?

THE wireless receiving set of to-day is, on the whole, a straightforward and satisfactory piece of apparatus. Provided that we buy our components from reputable firms we have very little trouble with them. Valves are extraordinarily good, and the small filament current requirements of those of to-day have straightened out the difficulties that used to be experienced in the past over the matter of the L.T. supply. The one weak point in the modern receiving set lies in the H.T. battery. It may be asserted confidently that it is the cause of a very large proportion of the troubles that we experience, that it is a very fruitful source of instability, particularly in L.F. amplifiers, that it produces more "atmospherics" than does Nature herself, and that it unduly swells our annual expenditure on running costs.

It is, perhaps, a little unfortunate that in the case of the H.T. battery we think so much in volts; we test the H.T. battery by placing a *volt* meter across it, we buy it as a 108-volt or 66-volt or 45-volt unit, and we always speak of the plate *voltage* of the various valves in the receiving set. For this reason we are a little inclined to forget that this battery has to supply the current which flows through the valves, the inter-stage couplings and the windings of the telephones or the loud speaker. Yet the current drain upon the H.T. battery is exceedingly important. To twist an old proverb: Take care of the milliamps. and the volts will take care of themselves! If I were allowed only one measuring instrument I would choose a milliammeter every time.

Preliminary Considerations.

The very first thing to consider when an H.T. battery is being chosen is the average current that will be drawn from it. If you do not possess a milliammeter you can form a rough estimate of your requirements by taking it that each general purpose valve will draw on the average from 1 to 1½ milliamperes, whilst a power valve, if properly biased, will pass from 6 to 8. Thus the current consumption for a four-valve set—containing one H.F. valve, a rectifier, and two note-magnifiers, the last being a power valve—would be from 9 to 12½ milliamperes. These figures are for a set with transformer or choke couplings with normal medium-impedance valves. Where resistance capacity coupling is used, or if the amplifying valves are of the high-amplification factor type with a much bigger impedance, the figures will be con-

siderably less. The power valve is, however, the most important factor, its consumption being greater than that of all the others put together, especially should this be of the recent super-power type.

With a set of this kind, and, in fact, with any set fitted with a power valve, it is absolutely hopeless to use dry H.T. batteries made up of cells of the same size as those used for pocket flashlamp refills. The maximum amount of current that these small cells will supply for any reasonable length of time is not more than 5 milliamperes at the outside. It is, in fact, false economy to use such batteries for anything bigger than a 3-valve set fitted with general purpose valves. For the larger set that is in fairly constant use a really heavy H.T. battery should be chosen if the dry-cell type is to be used. The kind of battery that I have in mind is one made up of cells weighing some four ounces apiece. Its initial cost may seem rather high, working out to some £2 10s. per 100 volts. A battery of this kind has, however, a capacity at a 12½ milliamperes discharge rate of about 9 ampere hours, and it should therefore have a useful life of about a year. Small batteries of good make cost a little less than £1 per 100 volts, and their life seldom exceeds three months when they are used with a big set. Over a year's working, therefore,

With the advent of the super-power valve and its heavy demands upon the H.T. supply the usual size of H.T. battery is quite inadequate. Therefore the listener has to decide whether he will use large capacity H.T. dry batteries, or if he will go a step farther and use accumulators or Leclanché cells. The pros and cons of the various types at the constructor's disposal are weighed up in this interesting article.

By R. W. HALLOWS.

the more expensive battery is by far the cheaper in the end.

There are two alternatives to the dry cell unit. There is, first of all, that made up of small wet Leclanché cells, and then there is the secondary or accumulator battery. With both of these again the cells must be of such size that they are well up to the load that will be imposed upon them. The handiest kind of wet Leclanché cells are those of the sac type. Usually no porous pot is used, the depolariser being contained in a bag surrounding the carbon positive electrode. Where the set contains more than two valves, and for any set which employs a power valve, cells of good size should be chosen.

Large Capacity Advisable.

There are certain very tiny wet cells on the market, but these will not stand up to a load of much more than 5 milliamperes, and their use is not economical owing to the frequent recharging that they require, and to the fact that both zincs and sacs have to be renewed after comparatively short periods of work. The most satisfactory all-round cell of this kind is that which weighs when empty from three to four ounces. These cost about fifteen pence apiece when bought in quantities, and they are capable of supplying from 15 to 20 milliamperes for periods of six months or more at one charge. Where wet Leclanché cells are used it is desirable that they should have coverings, for otherwise trouble may be experienced both through the splashing of the solution when the battery is moved

(Continued on next page.)



Wet and dry H.T. batteries. Though the former may be a little more bulky, it has many advantages over the latter.

DRY OR WET H.T.?

(Continued from previous page.)

about and through the "creeping" of the salts. The cells should not be allowed to touch one another in the battery box. It is as well to stand them on a kind of grating made of strips of stout glass arranged edge-wise and to provide partitions separating them from each other.

A useful size of accumulator H.T. battery is that with a capacity of not less than 1.5 ampere hours at a 12½ milliampere discharge rate. Smaller cells, though somewhat cheaper in the first instance, are again more expensive in the long run, partly owing to the frequency with which they must be recharged and partly because they are so easily ruined by either charging or discharging at too high a rate. I would recommend the choice of cells with a normal charging rate of not less than ½ ampere.

The Question of Expense.

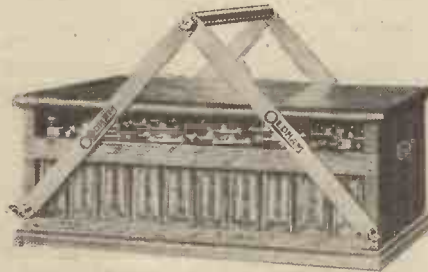
Let us see how three H.T. units, the heavy-cell dry battery, the wet sac-Leclanché battery, and the accumulator, compare as regards expense. We will take it that in each case the voltage required is 100. The dry-cell battery will cost £3 10s., and will require renewal each year. The cost of the sixty-six cells needed for the sac-Leclanché battery at fifteen pence apiece will be £4 12s. 6d. Recharging, at a cost of about 3s. 6d., will be needed every six months or so, whilst both zincs and sacs will have to be renewed at intervals. How often such renewals are required will depend mainly upon the treatment that the battery receives. We will assume that on the average it takes place every two years. A typical accumulator H.T. battery costs £3 15s. for 100 volts. With a capacity of 1.5 ampere hours at a 12½ milliampere discharge rate it will give 120 working hours, or in other words one charge will last for six weeks if the set is used 20 hours weekly. On the average nine charges a year will be needed, costing about 3s. apiece, or £1 7s. in all. The useful life of such a battery, provided that it receives decent treatment from both user and charger, can be taken as three years. Comparing the three kinds of battery over a three-year period the expenses, then, are:

<i>Dry-Cell Battery.</i>	£	s.	d.
Three renewals at £2 10s.	7	10	0
<i>Sac-Leclanché Battery.</i>	£	s.	d.
66 cells at 1s. 3d.	4	12	6
Six charges at 3s. 6d.	1	1	0
66 zincs at 2d.	11	0	
66 sacs at 5d.	1	7	6
	£7	12	0
<i>Accumulator Battery.</i>	£	s.	d.
Initial cost	3	15	0
27 charges at 3s.	4	1	0
	£7	16	0

At first sight there is therefore practically nothing to choose in point of economy between the three types. There are, however, several points to be borne in mind. At the end of the three years both the dry-cell battery and the accumulator will be done for, and the balance sheet for the

next three years is a repetition of that for the first period. The sac-Leclanché battery, however, is by no means done for, and the only expense to which its owner will be put during the second three years are those involved in recharging and in replacing the zincs and sacs. In the long run, then, the sac-Leclanché battery makes the best showing as regards expense. It is, in fact, a permanent battery which can be renewed indefinitely, though the life of the others is limited.

Nor must it be forgotten that the accumulator is distinctly more vulnerable than either of the others. A brief short-circuit, for example, though it may seriously injure the dry battery, will not, as a rule, put it completely out of action; if given a rest it may continue subsequently to work quite well for a long time. If a short occurs with the wet primary battery, its chief results will be to reduce the life of the sacs and to make recharging necessary somewhat earlier than would otherwise have been the case; no permanent or irreparable harm is likely to be done. But the damage to an accumulator battery by a similar short may be vastly more serious. It will certainly curtail the total life of the battery very greatly, and it may even put some of the cells altogether out of action through the buckling of their plates.



A popular form of 60-volt H.T. accumulator.

Nor are either of the primary batteries at the mercy of the "experts" that are to be found at too many of our charging stations. The normal charging rate for accumulator H.T. batteries is of the order of ½ ampere or less; yet one frequently finds criminals who cheerfully tackle the work though possessing no instrument that will read to less than half an ampere. Not long ago, suspecting that an H.T. battery of mine was not receiving proper treatment, I paid a visit to the charging station whilst it was undergoing a refill. It was being charged at the rate of just over one ampere! Do what I would, I could never obtain proper treatment for this battery, and it is hardly surprising that its working life was something less than six months. Unless you have in your neighbourhood a genuinely reliable charging station, the only way of securing a decently long life for accumulator H.T. batteries is to keep them in condition at home by means of a "trickle" charger. This is, of course, possible only if you have electric light in your house; if you have not, primary batteries will probably be by far the cheaper in the long run.

Supposing that you have facilities for charging the accumulator H.T. battery as it should be charged, will it be wise to choose this type rather than one of the others? The answer is that in many cases it will—with several "ifs." You cannot install an accumulator H.T. battery and forget about it

as is the case with the dry battery. It needs a good deal of attention. First and foremost, you must remember to charge it regularly whether it is in use or not. It must never be allowed to stand in a run-down condition, and it is of the utmost importance to keep the acid level right. In living-rooms a considerable amount of evaporation from the cells takes place, and "topping" up with distilled water must be done at frequent intervals. You must also keep the tops of the cells dry and free from dust. If you attend to all these things and have reasonably good luck in the matter of avoiding short-circuits, you will have little to grumble about in the accumulator battery as a source of H.T. current.

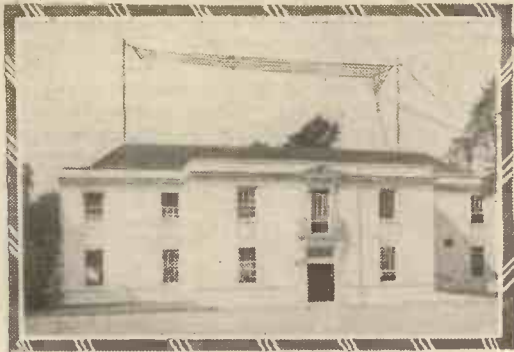
Steady Current.

Apart altogether from questions of running costs and of the trouble involved in its upkeep there are many important points in favour of the accumulator. In the first place, its current is to all intents and purposes steady from the time when it is brought into service until a falling-off indicates that a recharge is called for. Matters are very different with primary batteries. All the time that they are in use the potential is steadily dropping, and the current delivered is therefore decreasing. The drop will be a very tiny one in the case of a battery in good condition, but it is there all the same. During a period of rest the battery picks up, and when it is once more switched on its potential is very nearly what it was. Then another drop sets in, reducing the potential to a point rather lower than that reached on the last occasion. The actual discharge curve of the primary battery, including working periods and rest periods, may therefore be described as a descending series of zig-zags; that of the accumulator is approximately a straight line with a sharp downward bend at its far end when the battery is run down. Thus, provided that the accumulator is in good condition, you can always tell what your plate voltage is simply by counting the cells and multiplying their number by two. When a primary cell battery has been in use for a month or two you can discover its voltage only by means of a voltmeter, which should not be applied across its terminals until it has been delivering current at the normal rate for half an hour or so.

Cause of L.F. Instability.

Now, the drop in potential in the primary battery is due to increasing resistance within its cells. In the accumulator the resistance remains constant until the run-down stage is reached. Even in a new primary H.T. battery of good make the resistance per cell is at least .25 ohm, which means a total D.C. resistance in a 100-volt battery of between 16 and 17 ohms at the best of times. When the battery has been in use for some time the resistance will be a great deal more. The average resistance for an accumulator H.T. battery is not more than about .1 ohm per cell, or 5 ohms for a 100-volt battery; and this resistance does not increase appreciably so long as the battery is in working order. Battery resistance is one of the most fruitful sources of instability in L.F. amplifiers. We strive to combat its effects by shunting the H.T. battery with a large capacity, but my experience is that no condenser will cure a really bad battery.

(Continued on page 51.)



The Mill Hill School Science Laboratories, where the famous amateur station G 2 S Z is situated.

My Most Thrilling Message!

An interesting article giving the most memorable radio experiences in the lives of some of our leading wireless scientists, including Senatore Marconi, Admiral of the Fleet Sir Henry Jackson, and Capt. P. P. Eckersley.

By "ARIEL."

TWENTY-FIVE years ago a young man was seated in a cold, barrack-like room. Chilly wintry winds whined outside, whilst cold hands adjusted delicate instruments. Although delicate, yet these instruments seem crude to-day, however, at that time they formed the most perfect wireless set known to science.

Outside in the cold gusts an optimist was busily engaged flying kites. It was, indeed, a pastime uncommon in Newfoundland in December. Only a madman or the greatest wireless enthusiast the world has ever known would play with kites and delicate instruments under such unfavourable conditions. But then a kite made a delightfully cheap aerial support, and after all they worked much better than balloons. If you doubt this statement, ask Senatore Marconi. He ought to know, for he was there!

An Epoch-Making Achievement.

One thousand seven hundred and forty miles away more optimists were playing at being witches. The shadows of two great masts reared themselves 200 feet into the misty hazes of an English winter near the Cornish coast

At ten-minute intervals the faces of those optimists were lit up by a weird fitful glow as the ripping crash of a giant spark flashed from electrode to electrode, shaking the ether in a way it had never been shaken by man before. Optimists is indeed the correct word to use for men like these. Had not wise men proved that the curvature of the earth was an insurmountable barrier to wireless waves? Did not the cable companies pray that this was true? Wireless waves must perforce move in straight lines, naturally, then, they would get lost in the eternity of space.

Yet here were a few enthusiastic experimenters trying to prove that theory wrong. Perhaps it was fortunate they chose winter and not summer for the tests. Otherwise, as we know now, the experiments might have ended in temporary failure and the following message by cable would not have been so readily sent to the little party of optimists in Cornwall: "Signals are being received. Weather makes continuous tests very difficult." Put briefly, the most thrilling message the world has ever known had been transmitted and received; but let Senatore Marconi himself tell us:

Experiments at Sea.

"The most thrilling wireless signals I received since my first successful reception across a few yards of space in 1895 were the 'S—S—S' signals I received at Signal Hill, St. John's, Newfoundland, from

Cornwall, 25 years ago, which definitely proved that wireless communication across the Atlantic Ocean was possible."

The opinion of Senatore Marconi and his fellow workers at that time was that "the rest is a mere matter of patient development."

To-day we reap the benefit of all the developments which have followed since those dots were successfully flung across the distances separating two great continents.

Admiral of the Fleet Sir Henry Jackson modestly remarks that the word thrilling does not in his case refer to any particular

detected message and atmospherics with an exasperating impartiality.

The long suffering ether was forced into vibration by a rending spark jumping between two rapidly oxidised electrodes. South-coast towns still hear these ether agitations when some prowling French trawler catches a fish. The aerial was coupled to the instruments magnetically and statically, in those days one hoped for the best with an optimism born of enthusiasm.

A Double-Duty Aerial.

Carrying these instruments in improvised wireless cabins, three of His Majesty's ships steamed slowly out to sea and scattered until they were 40 miles apart. The receivers had been tuned to the wave-length of the transmitters, a job that meant considerable trial and adjustment in those days. What did these three ships hope to do?

Presently the two Morse inkers on the receiving ship commenced working. Each inker was connected to the same aerial by special tuned circuits that responded to two different wave-lengths. It was the first effort to sort out two messages sent simultaneously and received on the one aerial. Would the circuits do their job? And in any case, would there be enough energy to work the inkers? In 1901 L.F. valves could not be added *ad lib.* for there were no L.F. valves to add!

"Click—click!" went the Morse inkers. But the click of one was not the click of the other. It was rather thrilling to see two totally different messages coming out of the inkers from two ships 40 miles away sending on different wave-lengths. For the first time in history an aerial had been made to do double work!

Birth of Broadcasting.

"Unfortunately," in the words of Admiral of the Fleet Sir Henry Jackson, "I had no time for further developing this apparatus, as very shortly afterwards I was appointed to an administrative post at the Admiralty, and had then no opportunity of doing any practical work with wireless telegraphy for some time."

Captain P. P. Eckersley has some very vivid remarks to make on the subject of thrilling messages. "I have had many thrilling experiences with wireless," says the Chief Engineer of the B.B.C., "as, for instance, the first time I achieved duplex

(Continued on next page.)



A recent photograph of Senatore Marconi.

message. Many of his messages have been of great interest, but more on account of their wording than for any other reason. In fact, he has to take us back to the autumn of 1901 before any outstanding message can be recalled from a purely experimental aspect.

Imagine an autumn day on the Mediterranean at a time when even variable condensers had not been invented. Imagine a little glass tube full of iron filings that served as detector. A rather erratic instrument called a Morse inker wrote down the

MY MOST THRILLING MESSAGE!

(Continued from previous page.)

telephony, the first time I heard speech from aeroplanes; but I think I give the palm to the time when I first heard opera transmitted by wireless. The circumstances were as follow:

Broadcast Opera.

"I had been operating the Writtle station for some considerable time, and I looked upon broadcasting more or less as a hobby for a quite specialised type of maniac. Then the great B.B.C. started, and I must say I looked upon it only as material which would enable me to write some more parodies. The whole thing appeared to me to be a colossal joke. Then I heard that they were going to transmit opera! You will appreciate that opera had never been done in this country before, and that, furthermore, the microphone used for the opera was of a quite advanced type for those days; in fact, it was a broadcast microphone as opposed to an ordinary commercial microphone such as we had been using up to then for broadcast work. Indifferent, and still in a spirit of mild and amused tolerance, I put on the 'phones and tuned in London at eight o'clock, or thereabouts, somewhere at the end of the year 1922. Directly I put on the 'phones my whole attitude to broadcasting changed, and I have never forgotten the thrill with which I suddenly sensed the feeling of a large auditorium and was transplanted from the prosaic interior of the Writtle hut into the front row of the stalls at Covent Garden. When the music itself came on I sat absolutely amazed for three-quarters of an hour, and from that day to this my belief that broadcasting has a great artistic future has never wavered."

Mr. Goyder gives us a description of his most thrilling message which was the first trans-world communication. No greater distance has been or can ever be covered until we communicate with other worlds.

"During 1923 the transmitting range of British amateurs was rapidly increasing. Early in 1924 we were in constant touch with our confrères in America, though working only with stations on the eastern coast, a distance of 3,000 miles. Brief connections were occasionally made with stations in Central U.S.A., but with the Pacific coast never.

First Across the World.

"In 1924 the possibility of communication with New Zealand, with our low-power sets, was regarded with as much scepticism as communication with Mars to-day. During the autumn of that year it was my practice to transmit on Sunday mornings between 5 and 7 a.m., this being the most favourable time to get American stations. On October 18th, that autumn, I had just finished working with an American station, and was searching round, when I heard a peculiar note calling me slowly, with great determination. It was early dawn. The call persisted. Instead of the customary three minutes' duration, the call continued for six, then for ten minutes, until it finally signed Z 4 A A.

"I was thoroughly mystified, both by the peculiar note, the long call, and my ignorance of the country owning the letter Z. I replied briefly, and changed over. Then the strange station started up with great vigour, and with various exclamations understood only by radio amateurs, following with this address: Waihemo, Dunedin, New Zealand!

"The first two words puzzled me enough, but my excitement on hearing the last was only limited by the thought that humorous individuals in London with low-power sets had masqueraded before as far-distant stations.

"However, in three hours came a cable: 'Congratulations on first trans-world message. Bell Z 4 A A.' That was the first exchange of messages over the greatest distance on this earth—12,000 miles.

"It must be rarely that we have the good fortune to meet personally the friends we make over the air thousands of miles away, but Mr. Bell, Z 4 A A, was visiting England last summer, and on several occasions worked with his home station in New

Zealand from my own, communicating with his sister there. He is back again on the other side of the world, and I was in touch with him only a few days ago!"

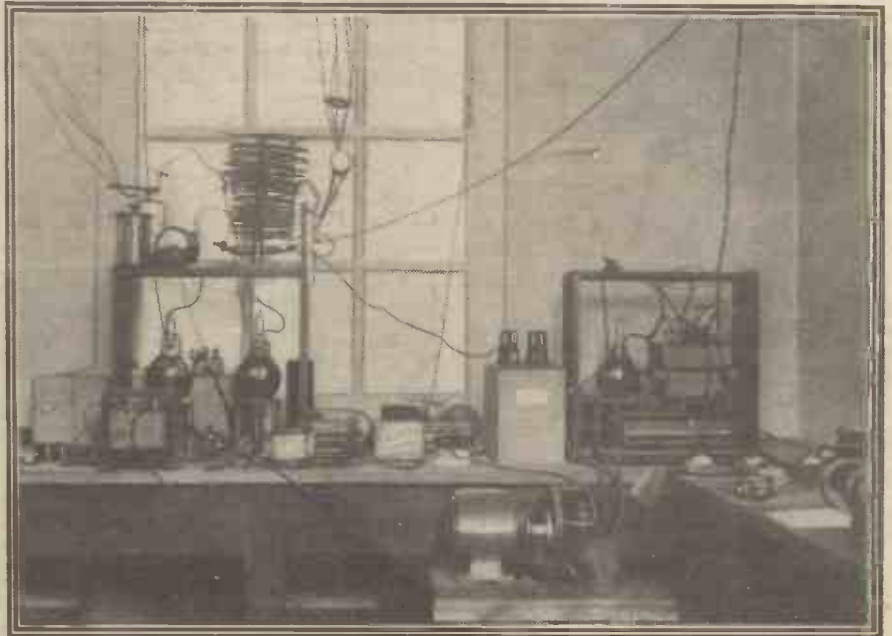
weather forecast from 2-L O, which, naturally, will have absolutely nothing to do with my programme.

However, here is the programme, interspersed with brilliant originality.

1. Time Signal. Nine o'clock. To make this out of the ordinary the last stroke should be muffled. This is very clever, and several people in Wigan will probably laugh hysterically, and write to the B.B.C. about it.

A Useful Item.

2. Topical Talk. "How Money Can Be Lost in the Theatre," by Cyrus Gunt. Mr. Gunt, the great theatrical magnate, is an authority on the subject, as the following will show: Mr. Gunt in 1906 lost £4,000 in "Blink Eyes," in 1908 lost £3,000 in "Katie," in 1909 £8,000 in "Mary Threw the Looking Glass," in 1920 lost £14,000 in "The Black Hole of Calcutta," in 1924 £19,000 in "The Ribaldry of Eve," in 1926 £7,000 in "Lumme." He once made a clear £100 out of a touring show, but this should not be held against him.



The interior of G 2 S Z, which is operated by Mr. C. W. Goyder.

Zealand from my own, communicating with his sister there. He is back again on the other side of the world, and I was in touch with him only a few days ago!"

THE PERFECT BROADCASTING PROGRAMME.

How I Made It So.

By "EARTH."

THE following programme is the result of months of hard labour (Pentonville, Borstal and the Southern Railway), and no expense has been spared in trying to make it the outstanding event of the football season. Even now I can see the cold forlorn evenings of March, when thousands of Soccer enthusiasts, with their glorious mud-splashed faces, listen (or not, as the case may be) with rapt attention to the

3. "The Sinking Fund," a Three-Act Play by a well-known Company Promoter, who made all his money in tin.

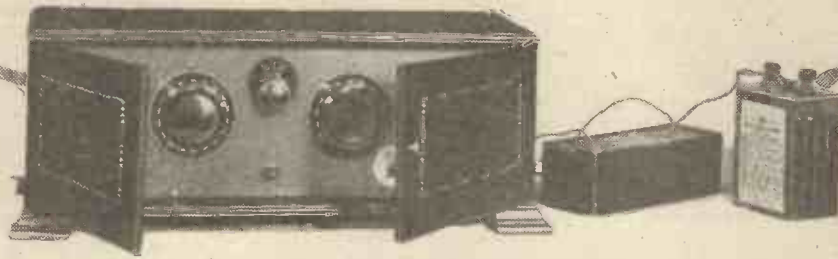
4. A Musical Interlude. Relayed by F. Saxe's Drivers, from the Little Carlton Cab Rank in Piccadilly. "The Little Parade," slow waltz. "Berkeley Square" One-Step (and no farther). "Death, Where is Thy Sting?" "All Streets One Way, and Otherwise." "The Merry-Go-Round." "Grand Finale."

5. The Postmaster-General, conducting his wonderful Mail Voice Choir, composed of three Basses, one top tenor, two pints and one Guinness.

6. "Where the Englishman Fails." A serious heart-to-heart talk on modern politics.

7. "Hail, Playmates." A cheery song of welcome, sung by the B.B.C. announcers, celebrating the birthday of Uncle Bob, who has been chiefly instrumental in making the Children's Hour such a wonderful entertainment for grown-ups.

The "H.D.L." THREE



FROM correspond-
ence received it
appears that a
great number of
listeners who wish to
pick up their local
station and perhaps
Daventry on the loud
speaker have a prejudice against using two
stages of L.F. amplification, because they are
afraid that purity of reproduction will suffer,
and yet find that they are too far away for
the transmissions satisfactorily to operate a
detector and one L.F. It is for the benefit
of such listeners that the set which is to be
described was designed. There is nothing
outstanding in the circuit, but the set has
been designed with a view to making it as
simple as possible to construct and operate,
and to answer those requirements of the
large number of would-be listeners who are

**This is a perfectly straightforward
three-valver employing, as its name
indicates, one stage of high- and one
stage of low-frequency amplifica-
tion. The components have been
carefully chosen with a view to ob-
taining the very best results. It is a
household receiver-de-luxe.**

By K. D. ROGERS.
(Assistant Technical Editor.)

the final output being obtained via a stage
of note magnification. A study of the

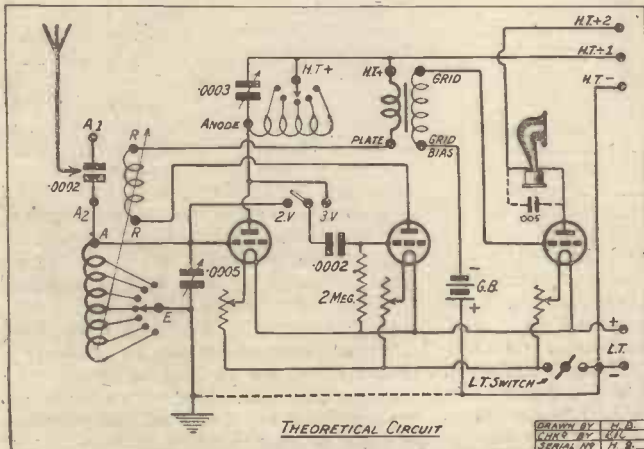
theoretical circuit will show that the only
difference between this circuit and that of the
usual straight 1-v-1 is the inclusion of the
two-way switch to cut out the first valve
when required, and the use of constant aerial
tuning, which proves an advantage where
large capacity aerials are being employed.

In order to make the receiver as simple
as possible to operate, an on-and-off switch
controlling the filament current is pro-
vided, so that once the receiver has been
tuned to the required station all the action
necessary for switching the set on or off can

be performed by
operating this switch.
Another feature
which makes the
"H.D.L." Three an
ideal receiver for general
family use is the doing
away with plug-in coils

or similar interchangeable tuning arrange-
ments, and substituting them by tapped
aerial and anode inductances. It should
also be emphasised that whereas in the
usual H.F. and detector receiver where a
switch is employed for cutting out the first
valve another switch has to be included
to reverse the reaction connections every
time the valve is cut in or out, in this re-
ceiver the use of the R.I. reactive tuner
enables this reversing switch to be dis-
pensable with. The reaction control is
obtained by a knob on the panel face con-
trolling a rotor inside the tuner, so that
either reaction or reverse reaction may be
obtained.

(Continued on next page.)



The circuit employed is quite conventional, being a well-tested and efficient arrangement.

beyond twelve or so miles from their local
station, and who regard purity of repro-
duction as the first essential of broadcast
reception.

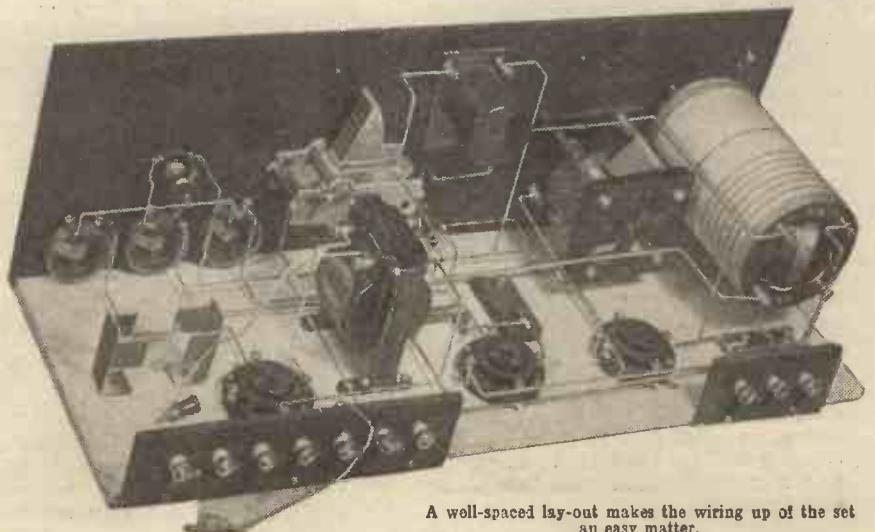
It may be argued that for such cases
a detector and two L.F. amplifiers on the
resistance-capacity method of coupling would
fill the bill, but it has been found in many
cases that such a receiver does not always
give the satisfaction it might when con-
structed by the average listener. For
one thing, if real purity is to be obtained
special valves, special resistances, and
condenser values all have a most important
bearing on the success of the receiver, while
a rather high H.T. voltage has to be
maintained.

Special Features.

In the "H.D.L." Three the need for that
little more "punch" that is felt by so
many listeners is supplied by the use of an
H.F. valve, which, of course, does not
detract in any way from the purity of
reproduction. Following this valve is an
ordinary tuned anode coupled detector stage,

LIST OF COMPONENTS.

- Panel 21 x 7 x 1/4 in., and baseboard to suit.
- Cabinet to fit. (Caxton.)
- 1 Retroactive tuner. (R.I., Ltd.)
- 1 Reactive anode unit. (R.I., Ltd.)
- 1 A.F.3 L.F. transformer. (Ferranti.)
- 1 .0005 S.L.F. geared condenser.
- 1 .0003 Eureka Ortho-Cyclic condenser.
- 2 S.P.D.T. push-pull switches. (Lissen.)
- 2 .0002 fixed condensers. (Lissen.)
- 1 2-megohm leak. (Lissen.)
- 3 30-ohm rheostats.
- 3 Valve holders.
- 1 3-terminal strip.
- 1 7-terminal strip.
- 2 Grid-bias battery clips.
- 2 Dial indicators.
- Wire, screws, etc.



A well-spaced lay-out makes the wiring up of the set an easy matter.

THE "H.D.L." THREE.

(Continued from previous page.)

Both the aerial tuner and the anode unit cover wave-lengths ranging from about 200 metres to 4,000, so that all the broadcasting with the exception of that being carried out on the ultra short waves can be received, provided, of course, that the transmissions are within the range of the receiver. The L.F. stage is quite normal, being coupled to the detector by means of what must be one of the finest transformers on the market and one which can be thoroughly recommended. Grid bias is provided for the L.F. valve.

So much, then, for the actual circuit employed in the set. Its construction is not a difficult matter, and one which can be undertaken without the slightest hesitation by anyone, whether or not he has

The panel-drilling diagram gives the exact positions on the panel for the majority of the holes that have to be made, but in the case of the tuner the constructor will find that a template is provided with the instrument, and having marked out the top hole (2½ in. by 2½ in. from the left and top of the panel) he should finish the drilling by means of the template. A similar procedure should be adopted with regard to the drilling necessary for the anode unit.

All drilling should, of course, be undertaken with metal working drills, starting on the face of the panel. It is advisable also before mounting the components, either on the panel or the baseboard, and before drilling the holes for the mounting screws, to place the baseboard in position in the cabinet, and then place the panel in position



The "H.D.L." Three has a very handsome appearance.

All the components should now be mounted and the terminal strips can be cut, if they are not purchased ready made. These should measure 3 in. by 2 in. by ¼ in. for the one having the three terminals, and 8 in. by 2 in. by ¼ in. for that having the battery and loud-speaker terminals. These strips should also be mounted in a manner similar to that taken when mounting the panel in order that they may exactly correspond with the slots provided at the back of the cabinet.

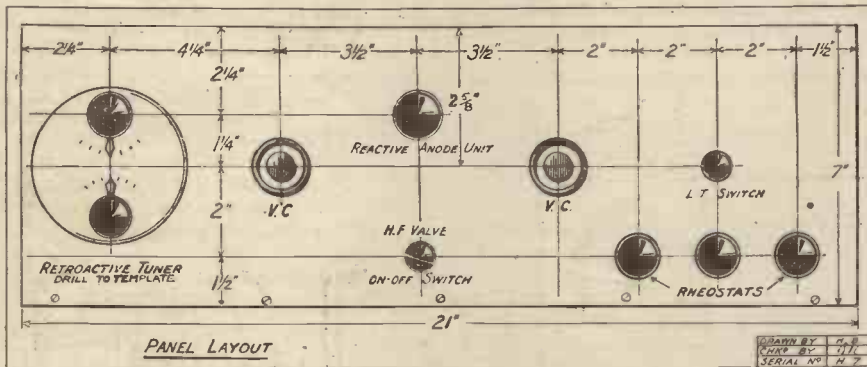
A Point to Note.

When all the mounting has been completed the set can be wired up, using either 16 gauge square tinned copper wire or else 18 gauge round wire. The former is somewhat easier to work with and makes for a neater appearance, but is sometimes difficult to obtain if the constructor lives some distance away from a reliable radio store, and from the point of view of efficiency there is no reason why the round wire should not be used.

The wiring diagram gives the actual connections on the set photographed, and if this is followed carefully there should be no possibility of the constructor making any mistakes.

There is one point about this diagram and the theoretical diagram which needs a little explanation, and that is the dotted connection shown between L.T. — and earth. This is portrayed as a dotted connection simply because it will rest with the individual constructor as to whether he will connect his positive or negative L.T. terminal to earth. The reason for this will be explained later, so that when wiring up the set he should either make a flex lead between the earth terminal and one of the L.T. leads, or else join earth and L.T. — or L.T. + terminal by an external wire when testing the set.

(Continued on next page)



No unnecessary knobs appear on the panel face and all the terminals are mounted at the back.

previously built a wireless receiver. The panel measures 21 in. by 7 in. and is ¼ in. thick. This is provided with a baseboard of 21 in. by 7 in., while all terminals are mounted at the back on two terminal strips. This allows a very neat appearance, as will be seen from the photographs of the complete receiver.

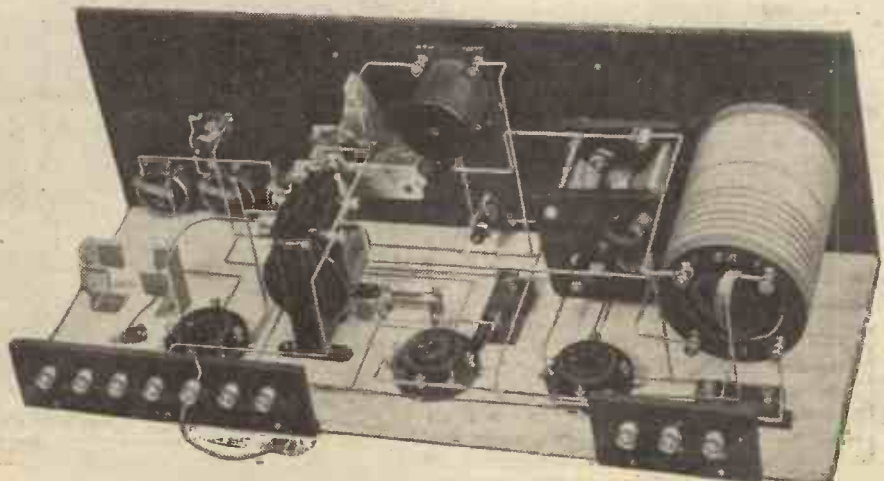
Constructional Details.

There is no need for the set to be mounted in the elaborate cabinet shown, and a plain one without doors would, of course, do just as well; but if the set is to be used as a family receiver it is a great advantage sometimes to be able to close it right up so that dusting operations, etc., have no likelihood of altering the tuning setting of the set. And, in any case, it is worth while making such a set as handsome a piece of furniture as possible. The cabinet can be obtained from the makers with panel and baseboard to fit and ready slotted at the back for the terminal strips.

For the actual construction the components mentioned in the list will be required, and although in most instances any reputable make of component can be used successfully, in some cases it is advisable for the constructor to follow the list as closely as he can, the tuning units and the L.F. transformer being essential for successful operation of the set. Different variable condensers can be used if the constructor wishes, provided that they are of similar capacity to those mentioned. In any case no divergence should be made from the layout diagrams.

against the baseboard and the fillets in the cabinet, so that the five holes for the mounting screws from the panel into the baseboard may be correctly drilled.

The need for this may not seem quite apparent, but it will be found that it is much easier to get these fixing screws in position with the panel and baseboard in the cabinet than when they are outside on the workshop bench. In this way, provided that holes are drilled not more than three-sixteenths up from the base of the cabinet, it becomes an extremely simple matter to fix the baseboard and panel together.



Another photograph of the interior of the set viewed from the aerial end.

THE "H.D.L." THREE.

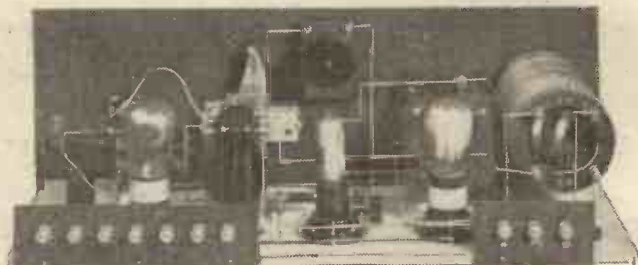
(Continued from previous page.)

On the completion of the wiring it should be carefully checked both for mechanical strength and correctness of connections before the set is "hooked up" for test.

As regards valves there is not much to

say, except to emphasize the advisability of using valves suited for the positions which they are to occupy in the set. If the best is to be obtained from the receiver, it is essential that a valve suited for H.F. amplification

(Continued on page 52.)



With valves and grid battery in position the "H.D.L." is ready for testing.

POINT-TO-POINT CONNECTIONS.

Shaft contact of switch to one side of each rheostat. Other side of each rheostat to one filament socket of corresponding valve holder. Remaining filament sockets to L.T. positive.

Shaft contact of H.F. valve on-off switch to one side of grid condenser. Other side of grid condenser to grid socket of 2nd valve holder, and to one side of grid leak. Other side of leak to L.T. positive.

"A1" terminal to one side of .0002 fixed condenser. "A2" terminal to other side of .0002 fixed condenser, to "A" terminal of tuner, to the moving plates of the .0005 variable condenser, to the short contact of the H.F. valve on-off switch, and to the grid socket of the first valve holder.

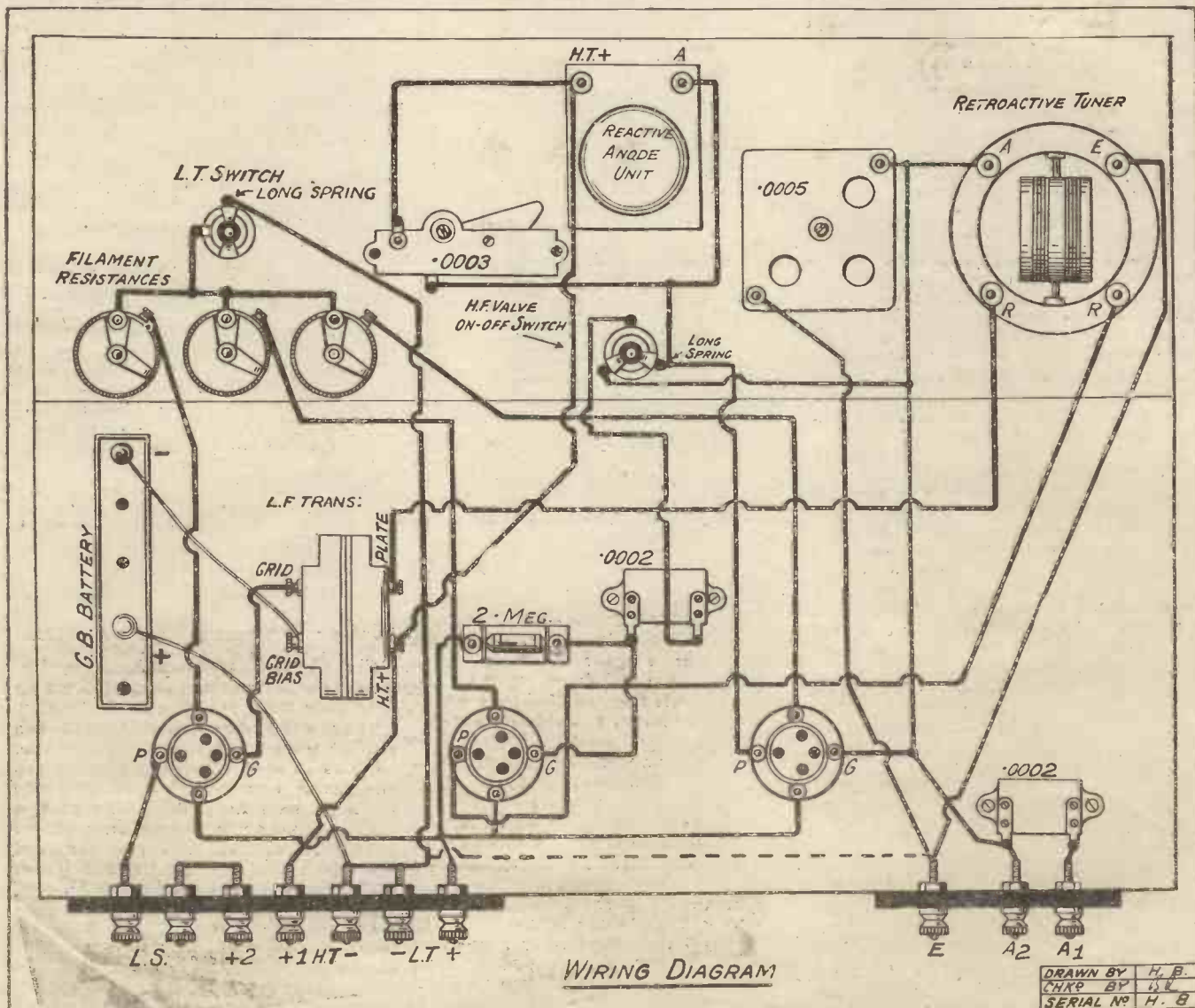
Earth terminal to fixed plates of the .0005 variable condenser, to "E" terminal of tuner, and either L.T. positive or negative. (See text.)

L.T. negative to H.T. negative, to G.B. positive, and to the long spring contact of L.T. on-off switch.

Plate socket of 1st valve holder to "Anode" terminal of Reactive Anode Unit, to fixed plates of .0003 variable condenser, and to the long contact of the H.F. valve on-off switch. H.T. + terminal of Anode Unit to moving plates of .0003 variable condenser, to "+ H.T." terminal of L.F. transformer, and to H.T. positive 1.

Plate socket of 2nd valve holder to one "R" terminal of tuner. Other "R" terminal to "Plate" terminal of L.F. transformer. "Grid" terminal of transformer to grid socket of 3rd valve holder; "Grid bias" terminal to G.B. negative.

Plate socket of 3rd valve holder to one loud speaker terminal. Other loud-speaker terminal to H.T. positive 2.



Used in conjunction with the photographs of the interior of the set this diagram will facilitate the wiring up process. All leads should be checked from the point-to-point list given above.

DRAWN BY	H. B.
CHEK BY	W. L.
SERIAL NO	H. B.

TECHNICAL NOTES.

A Weekly Feature Conducted by

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

(Staff Consultant.)

A COMMON fault with almost any kind of receiving set is the occurrence in the 'phones or loud speaker of crackling and other sounds which are often put down to static or other kinds of atmospheric disturbance. In nine cases out of ten, however, they are not due to anything external to the set, but are due to faults within the set itself.

In some cases the disturbing noises are very loud and persistent and are a source of great annoyance. In other cases they occur intermittently; perhaps when the set is first switched on in the evening there will be no such extraneous noises, but after a time they will gradually increase.

The first thing to do is to find out definitely whether the interfering noises proceed from a source outside the set or not.

Disconnecting the Aerial.

One of the simplest ways to do this is to disconnect the aerial from the set and see whether this has the effect of putting a stop to the noises. If it does so, it is certain that the noises are not in the set itself. They may be due to atmospheric disturbances, or to local interference, such as the working of nearby electric motors and so on, the radiation from which is being picked up by the aerial.

If, however, the noises do not stop when the aerial is disconnected they are probably (but not certainly) in the set itself. If they are due to some outside disturbance, this may be picked up by the high-frequency coils or other H.F. parts of the circuits, but in that case it is most probable that a very noticeable reduction in the disturbance will occur when the aerial is disconnected. There should be little difficulty in judging whether the disturbances come from outside or not.

If it is found that disturbances are reaching the set *via* the radio-frequency stages or the detector, due to a coil acting as a small aerial, then it is best to resort to shielding.

Shielding.

It will generally be found also that when the interference is proceeding from outside, manipulation of the tuning controls of the set will have the effect of varying the loudness of the interference.

A simple way to make a shield for the set is to line the interior of the cabinet with tinfoil or copperfoil. This may be secured in position by means of very small screws, or it may be pasted in by means of shellac varnish. The back of the panel also should be shielded as well as the top and bottom of the cabinet. In securing the tinfoil or copperfoil to the back of the panel it will as a rule be necessary to dismantle the components which are mounted on the panel; at any rate, this will almost certainly be found most convenient. It is hardly necessary to say that the greatest care must be taken, with so much conducting material about, to avoid any possibility of short-

circuits between the shield and any parts of the set. In this connection, the shield itself may be covered over with a layer of the thinnest ebonite sheeting; this will have the effect of preventing any possibility of the parts of the set coming into electrical contact with the shield and it will not interfere with the shielding action.

Earthing Shield.

Of course, all the parts of the shield—that is to say, the sheets of tinfoil or copperfoil on the sides of the cabinet and on the top and the bottom—must be electrically connected together and to earth. A simple



The first commercial long-distance wireless telegraph office to be erected in America. It was built in 1922.

way of doing this is by means of some flexible wire such as telephone cord, using soldered contacts.

Loss of Efficiency.

Unfortunately, shielding is not without its drawbacks, for it entails a certain loss of efficiency in the set. This is more particularly the case if the shield is in close proximity to the high-frequency parts of the circuit. It is always desirable to space the H.F. coils apart, but this precaution becomes especially necessary when the set is surrounded by a metal shield in the way we have just been discussing. A good rule is to keep the coils at least two inches from the shield and four inches from each other. In some commercial sets, using shields, the shield is employed as the earthed battery lead.

In passing, it is always desirable to have the battery leads to the set as short as possible, as if these are unduly long they may pick up interfering radiation and become a source of trouble. The battery leads should never be longer than six feet, whilst if it is impossible to use leads as short as this, it is a good plan to bypass them.

Placing Coils.

The correct placing and spacing of the tuning coils of a receiver often means all the difference between success and failure. It should be remembered that there is not only magnetic but also capacity coupling between the coils, and although the magnetic coupling may be largely overcome by placing the coils with their axes at right-angles to one another, if the coils are not sufficiently spaced apart this simple precaution does not overcome the capacity coupling. A simple way to ascertain the position of zero coupling, or at any rate of minimum coupling, is as follows:

Connect the aerial and earth to the first coil. Connect the other coil to the grid circuit of an amplifier detector circuit and use headphones for listening to signals. Then arrange the two coils until the signals received are at a minimum; if the two coils are fairly close together the position for the minimum signal strength will be critical.

This adjustment of the coils is particularly important with a set using stages of high-frequency amplification and with neutrodyne circuits.

Double Transmission.

Mr. C. W. Horn, the Radio Superintendent of the Westinghouse Electric Company, U.S.A., who has been largely concerned with the development of broadcasting in America and who is responsible for the operation of several of the well-known American broadcasting stations, has given some rules for the avoidance of interference and ether congestion as follow:

A sufficient number of stations properly placed; wave-lengths fixed rigidly by means of quartz crystal control; simultaneous transmission from two or more stations in regions where "fading" is noticeable or where atmospheric and physical conditions cause undue distortion of signals.

He gives his opinion that the synchronisation of two transmitting stations 100 miles apart, in order to broadcast the same programme simultaneously on exactly the same wave-length, is one of the outstanding accomplishments of radio engineers in the past year. The two stations in question are WBZ, Springfield, Mass., and WBZA, Boston, which are kept absolutely in step on a wave-length of 333.1 metres. To the listener the effect is as though the programme came from only one transmitter, although in reality the incoming waves emanate from the two stations and travel by different paths. In this way heterodyning is avoided and fading reduced to a minimum.

Synchronising.

The problem of synchronising these two stations was at first rather a serious one, for it involved the fixing of the two transmissions at a frequency of about 900,000 cycles per second. In the first section of the standardising apparatus an oscillator was used of fairly low frequency, controlled either by means of a standard tuning fork or by means of a quartz crystal circuit. These comparatively slow oscillations were conducted, by a specially compensated land-line, from Springfield to Boston. At each station harmonics of the fundamental frequency of the oscillator were separated and amplified for broadcast modulation.

(Continued on page 51.)

OH, THOSE CURVES!

An amusing, but instructive article which shows to what a very great extent curves, or graphs, tend to influence our radio practice, and suggests some novel ideas for improving the method of their distribution.

By BERTRAM MUNN.

WHEN a man buys a transformer nowadays, he asks the salesman: "What sort of a curve has it?" "Ab-so-lute-ly straight!" says the salesman, even if it isn't. On further cross-examination he will, perhaps, admit that the curve of so-and-so's choke is a "bit straighter." Finally, when he is tackled about resistance capacity coupling, he will say: "Well! That, of course, is dead straight!" You wonder if he is, too.

If you buy a valve made by a reliable firm you get its curve given away with it. You take it home and study it. That curve will tell you just how the valve will behave or misbehave itself under certain conditions.

All Very Disturbing!

We have grown so used to these valve curves now that we have almost come to love them. They seem the one safe, reliable, solid thing about wireless. Your set may howl, go dead, or pipe thinly and harshly at you, but you have only to examine the curves of your valves to know that they at least are reliable—immutable. They are doing what they should do if used as you are using them. If, for instance, you catch your L.F. valves anode bending, they will rectify—a ghastly offence against the ethics of good reproduction.

Now Mr. Scott-Taggart comes along and kicks the ground from beneath our feet by declaring that these static curves are not quite the thing. What we want are dynamic curves. A static curve—which we knew and loved so well—is but a dull, soulless clod. A dynamic curve is a thing of life and movement.

What is the use of looking at a man's face in repose? To understand him properly we must see his expression in a moment of emotion—such as when he is being pursued by an Alsatian. He is then dynamic.

No sooner have we dried our tears over the loss of our old love than Captain Round rounds on Mr. Scott-Taggart and says, in effect: "Quite so! But there are thousands of expressions per face. In the same way there are thousands of dynamic curves per valve. What is the use of publishing dynamic characteristics when every circuit used is different?"

An Oblate Spheroid!

Another searcher after truth then tells us that the curve is really an ellipse, representing even then the behaviour of the valve only under definite conditions. To show the valves' full capabilities we should require an infinite number of ellipses.

Obviously, we cannot do this in two dimensions. We are therefore compelled to enter the third dimension of space and what we really want as our dynamic curve is a solid object—an oblate spheroid. What is an oblate spheroid, you ask? The answer is the oldest in the world. The answer is—a lemon.

It is, indeed, a strange and touching example of the omnipotence of nature

that through wireless and broadcasting and valves we should return once more to one of the succulent fruits of the earth!

"Miserable and Obsolete Curve."

Now, everyone knows that valves are much too expensive. What happened when cigarettes were too expensive? To encourage people to buy them the manufacturers began giving away with each packet a small picture of some celebrity, such as a footballer, a cricketer, or a well-known murderer.

Valve manufacturers should adopt the

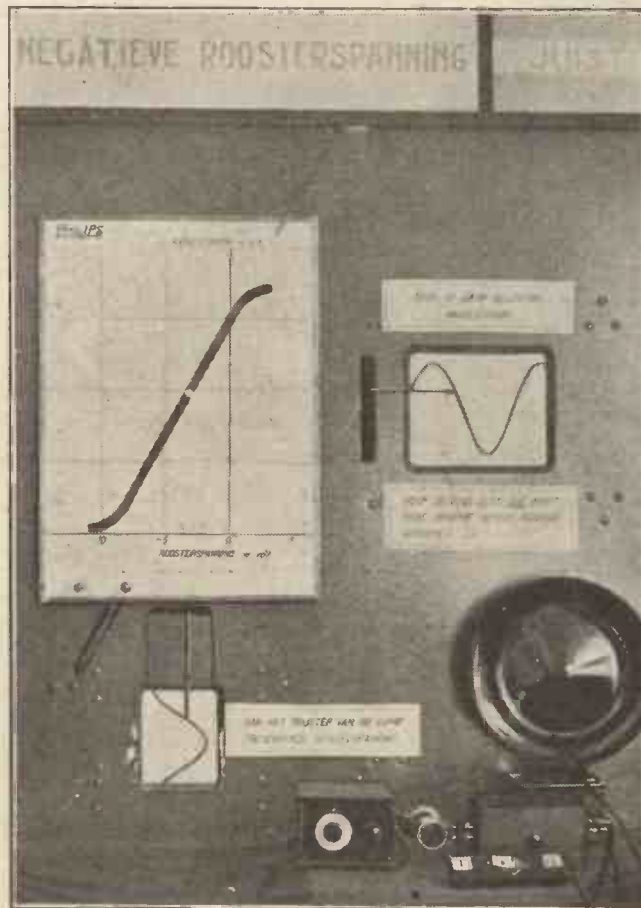
We must, however, have our dynamic curves now that we have been told all about them, and there is a very simple way out of the difficulty for all enterprising valve manufacturers. At one fell swoop they can provide us not only with those curves but also with a universally useful commodity of value even to listeners.

The Problem Solved.

There is no reason why our dynamically curved oblate spheroids cannot be made in the form of tablets of soap—scented or unscented. It would give those curves just that human touch to which allusion has already been made.

We buy our valve. With it we get a nice little tablet of soap—stamped D.E.2, H.F., etc., and coloured blue for H.F., green for L.F., and red for Power. We carefully study the tablet of soap. If it is a good soap—and we don't wash or bath too often—it should last as long as the valve. If it doesn't, what matter? You can't have your cake (of soap) and eat it. And we should all be a cleaner and better race for it, anyhow.

The B.B.C. provides us with clean, wholesome stuff for our minds. Why shouldn't valve manufacturers do the same for our hands?



The use of curves is a very necessary thing where valve design is concerned. This photograph shows a corner of the valve-testing department of the famous Philips Radio Valve Co., of Holland.

same methods. Instead of that miserable little scrap of paper, showing us that still more miserable and obsolete curve, they could, of course, give lemons away with their valves. But, here, the difficulty would be to find lemons of the correct shape. In time they might grow them, but, even then, such dynamic curves would be perishable commodities. A bruise would alter the whole characteristic of a valve. Besides, some people—such as cornet players—dislike lemons. No! Lemons will not do.

L.F. valve. The amplification factor is a direct expression of the amplifying power of a valve.

High impedance is not a desirable factor in a valve designed for resistance-capacity work. A high amplifying factor is what is required and the lower the impedance the better.

With the advent of power and super-power valves, H.T. battery consumption is becoming as serious a problem as L.T. battery consumption, and requires very careful consideration.

VALVE HINTS.

A "SUPER-POWER" valve is a valve capable of handling large inputs. Generally speaking, it will not amplify quite as much as an ordinary

IN a recent article I described the Rugby Radio Station as out of date. We have had in reply to this article many interesting letters from readers—far too numerous to quote in detail. One

reader, who writes from Birmingham, states that he has for some time been endeavouring to record the messages transmitted from the Rugby Station, and he encloses specimens of the Morse he has received on his Morse Inker.

We cannot, of course, reproduce any part of this message, as it would be illegal to do so; but our correspondent says he has often recorded hundreds of yards of "tape" from the Rugby Station, from which no sense can be made, although the messages have been sent in "plain English." No criticism can be levelled at our correspondent's receiving set and Morse Inker, because he encloses other specimens of tape which he has received from other British and Continental Commercial Transmitting Stations.

In the tape specimen sent to us, as our correspondent points out, we notice several errors, and often sense can only be made of the message by presumption. For instance, one word which should have been "half" reads "leaf," due to the omission of one dot in the letter "h." This is a minor detail, but it is one of many which, in the aggregate, make so many of Rugby's transmissions full of irritating errors which can only cause amusement to operators in other parts of the world, and annoyance to those who have to receive Rugby's messages as part of their duties on distant ship or shore stations.

More Evidence.

Curiously enough, just as the article on Rugby was published, a wireless operator—the brother of a member of the staff of POPULAR WIRELESS—in writing a letter home commented very caustically upon Rugby, and included in his letter many criticisms identical with those which we made in our recent article.

We have also received a copy of the "Rugby Advertiser," dated February 18th, which contains a long quotation from our article on "Rugby—the Radio Parasite," together with a reply by Mr. H. Faulkner, Engineer in charge of the Rugby Radio Station. A representative of the "Rugby Advertiser" brought our article to Mr. Faulkner's notice and asked him to comment on it. Mr. Faulkner in reply said:

"It is obviously written without any knowledge and is not worth worrying about, so far as I am concerned."

We venture to disagree. The article was written on very good evidence, and POPULAR WIRELESS is not in the habit of publishing articles of such a strong nature without justification. Mr. Faulkner, however, has quite a good excuse when he says:

"I don't get reports from different parts of the world as we are simply an engineering proposition here and we send the stuff. However, I have had several letters from Australia, New Zealand and India in which the press (from Rugby) is received regularly on indoor aerials with single valves. Bordeaux," points out Mr. Faulkner, "is on

RUGBY RADIO. THE CHIEF ENGINEER'S REPLY.

Some further notes on the subject of the Rugby high-power station, which has been described as a "Radio Parasite."

the Mediterranean and has a very wide wave-length, so that near to Bordeaux with a non-selective receiver one would not expect to receive us."

When we said in our recent article that Bordeaux could be received more satisfactorily and more reliably than Rugby we had in mind a case which was brought to our notice of Rugby being received in the Indian Ocean at very indifferent strength, while Bordeaux was received without the slightest trouble whatever.

Mr. Faulkner continues as follows:

"We claim we have a good transmitter and it is undoubtedly the most powerful in the world. You cannot expect it to get on any receiver in any part of the world, and if it is received on an unsatisfactory receiver one cannot say it is unsatisfactory. Since it is received in those places I think the station can be said to be very satisfactory."

This is not very logical. Receivers on modern ships are quite adequately fitted for

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the reception of Rugby and other high-power stations, but it is curious that Rugby is received with more difficulty than any other high-power station in the world, judging from the reports we have received from wireless operators at sea.

An Interesting Circuit!

Mr. Faulkner admits, however, that he cannot understand interference from Rugby. He claims that his receiver is the nearest one to the station, and he receives Daventry perfectly free from telephony or telegraphy working there. Mr. Faulkner says he has a very simple receiver. We should be very interested to see the circuit!

"Messages are transmitted by automatic machines," he continues, "and undoubtedly slips are made at times. But they have nothing to do with us at Rugby. I think the article has gone a little too far to get anywhere near the truth."

On the front page (he is referring to our cover) is a photograph of certain people having a telephone conversation to

America through this station, and another photograph of a man having a conversation from America to Rugby. In addition, there is correspondence which relates to beam interference, and the beam system seems to be

really the system being boosted in the article on the Rugby station.

"They refer to ship's traffic which could not be run by beam service, which they say is cheaper and has better range. Beam stations could not possibly do the service they are criticising. With a beam one could not reach any ship in the world. They state that there are thousands of pounds of licence money being withheld; that is simply tommy-rot. They forget, in addition, the strategic value of the station. The outcry in the popular press before this station was built was that we had no means of communicating with anywhere in the world, and now they don't want to pay for it."

"Tommy-rot"!

Thus concludes Mr. Faulkner's reply to our article. He dismisses the question of listeners' licence money as "tommy-rot," and disclaims any responsibilities for the slips which he admits are made in the transmissions from Rugby. He says that beam stations could not possibly do the service carried out by Rugby. Rugby service to ships at sea, we admit, could not be carried out by beam stations; but Rugby service to ships at sea we criticised adversely because of what we considered to be bad management at Rugby itself, and the fact that, like the beam, it is not capable of reaching distant ships in various parts of the world. The reference to our front-page photograph is obviously meant to indicate that Rugby is doing its duty in a very fine way in connection with the transatlantic telephone service. But the transatlantic service is not going to pay for Rugby. Tax-payers and others don't want to pay Rugby's bill, because the outlay is not rewarded by the expected results.

What About The Beam?

The outcry in the popular press before Rugby was built was admittedly of a strength which suggested we had no means of communicating with anywhere in the world. Have we now? Before Rugby was built the possibilities of the beam system had been demonstrated, and many experts agreed that Rugby should not be built until the beam had been proved satisfactory or not. The beam has now been proved satisfactory, and it is a well-known fact that a beam station capable of communicating with Australia, India, South Africa, Canada, and other parts of the Dominions could fill those strategic duties of Rugby much more satisfactorily and at much less expense.

However, we do not think that any of the criticisms we made in our recent article should necessarily be regarded as being levelled at Mr. Faulkner, as engineer in charge of Rugby. The criticism is wider than that, and it concerns itself with those who are in charge of the management of the Rugby station, and those who were responsible for its design and erection.

DECIDE YOURSELF

Practically every well-known radio manufacturer advertises. You have only to look through the pages of this publication to appreciate that. Naturally each, expects their products to be used and mentioned in the sets described in the publications. So when you see radio parts mentioned it does not follow that they are the best you could use. Decide what parts are best yourself. Compare LISSEN with any other makes for results, quality and cost. You will not find any superior to LISSEN in these points. Use LISSEN every time.

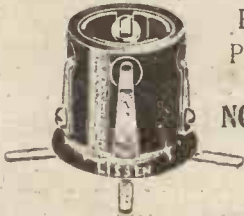
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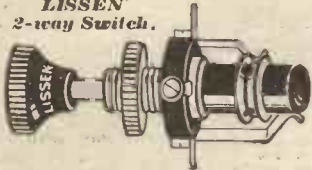


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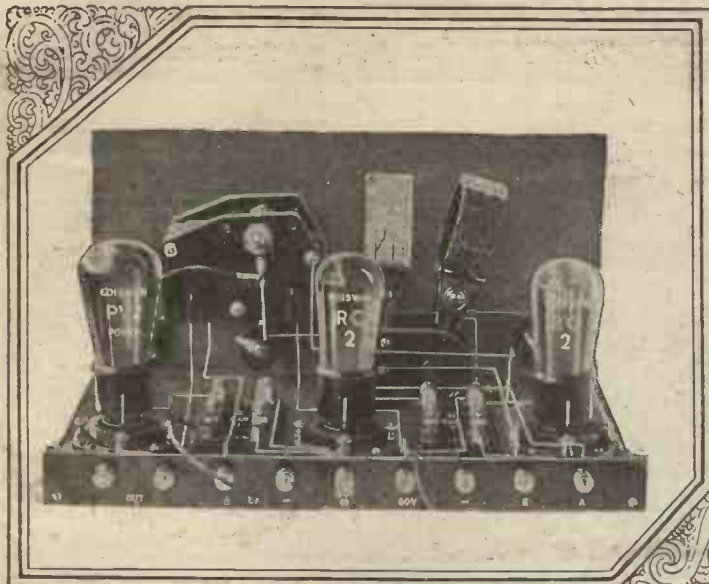
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L. 273



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Never has there been such national endorsement of a radio receiver never before have the superior advantages of Resistance-Coupling been so vividly convincing.

The tonal quality of the R.C. Threesome is a revelation. The deep, rolling bass notes of the organ come through unimpaired the voice of the announcer is that of one

The VALVE
with the window

With a filament glow so dull that an inspection window had to be provided the new EDISWAN Quarter-Watt, POINT ONE ECONOMY Valves are rapidly making history. Tonal purity, volume, strength in construction, current economy, and exceptionally long life . . . these are the features which make the new Ediswan Quarter-Watt Point One Economy Valves the nearest approach to perfection and for wireless reproduction at its best. Ask your dealer about these new types.

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PLEASE USE BLOCK LETTERS

VOLUME CONTROL.

An extremely useful and practical article by an expert on the design of loud-speaker circuits.

By BAYNHAM HONRI.

THE tendency of modern receiver design is towards simplicity in operation, maintenance and appearance. Manufacturers have realised that the non-technical public is frightened by the receiver with "knobs on." With recent improvements in components, various refinements

frequency condensers it is possible to dispense with vernier tuning of any kind.

Inefficient Switching.

The variable grid leak is now popular only with experimenters who do not object to the extra control. Magnetic reaction,

seems to be doomed. It is this last item with which this article is concerned.

For some considerable time many of us have been dissatisfied with our L.F. switching. Some systems of switching cut out the last valve when one less L.F. stage is required, usually connecting the loud speaker in the anode circuit of a quite unsuitable high-impedance valve, and so causing distortion.

A great improvement was effected by the use of low impedance valves in all L.F. stages, or, alternately, by keeping the last valve always in circuit and eliminating the intermediate stages. This latter method was essential when resistance capacity coupling was used. (See Fig. 1.)

Overloading the Speaker.

Many of us found that while one low-frequency stage did not give us enough signal strength, two stages gave the loud speaker what the Americans call "bananas." A continuously variable volume was really wanted, with a gadget which gave one complete control of strength independent of the alteration of tuning of a set. The use of a high resistance potentiometer makes this possible, though it has the disadvantage that all the L.F. valve filaments have to burn even when (perhaps) one would be necessary in the old way. In these days of 0.1 filaments, however, this ought not to be an objection.

In the case of transformer coupling, the potentiometer should be connected across

(Continued on next page.)

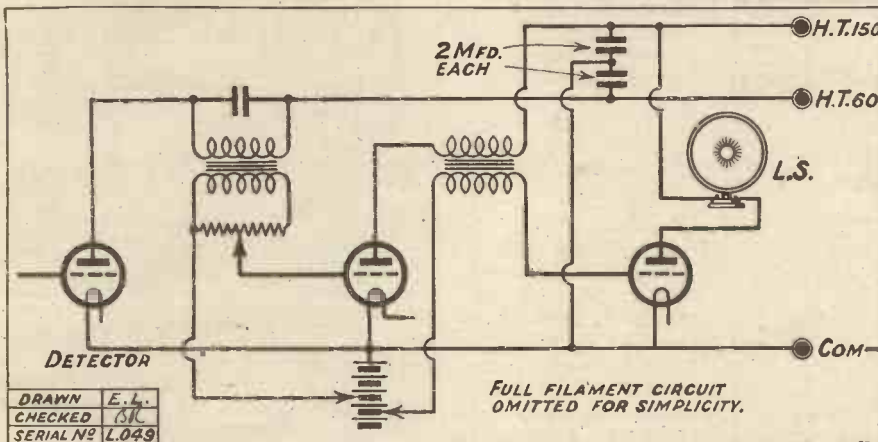


Fig. 1. A useful method of controlling the volume when transformer coupling is employed.

have proved to be unnecessary and have gradually disappeared from the front panels of broadcast receivers.

Vernier dials for condensers rendered the separate vernier condenser obsolete; in fact, in many cases, by using straight line

with its ugly array of coils on the front panel, is being superseded by the Reinartz connection, neutrodyne and super-hets. Separate filament resistances for each valve have already "gone out," and now the switch or jack for cutting out L.F. valves

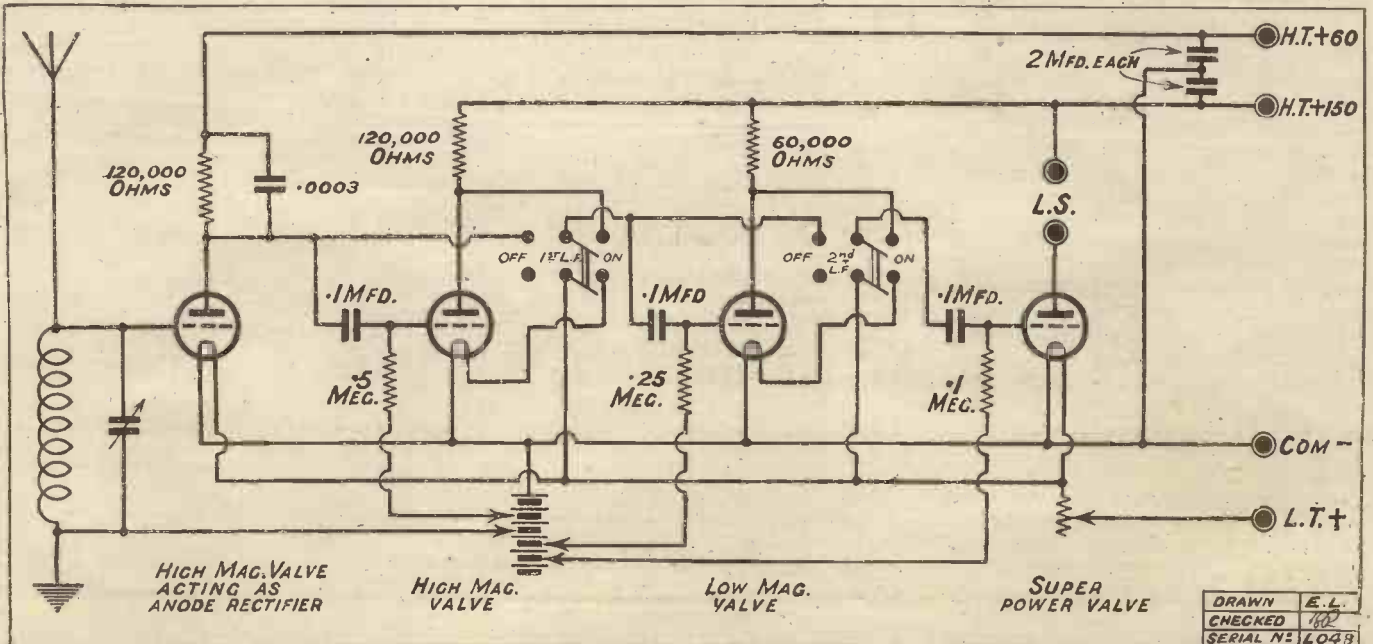


Fig. 2. Where L.F. valves are to be cut out, the last valve must remain in the last stage, or the impedance of the output circuit will be upset.

RADIO DEPTH SOUNDING.

A recent development of an ingenious American idea.
BY A CORRESPONDENT.

AN interesting application of radio currents has recently been put into practice in America. The idea underlying the scheme is several years old, but nevertheless it is only within comparatively recent times that the invention has been made to prove reliable and successful.

This application of radio currents is concerned with the sounding of ocean depths. As the reader will know, the first

method employed for the determination of the depth of the sea consisted of the rather primitive operation of lowering a weighted cable over the side of the ship. Subsequently Lord Kelvin effected a radical alteration in the methods of ocean depth sounding. Kelvin devised an apparatus for projecting a sound down to the bed of the ocean. Now, the velocity of sound waves through water is known with very great accuracy, so that by measuring the time taken by a sound wave to travel from the sea level to the sea bed and then to be reflected back to the surface of the water again, it was possible to sound very great depths indeed.

Novel Method.

The latest method of ocean depth sounding is a sort of modern modification of Kelvin's method. Essentially, this method, as worked out by American experts, consists in projecting the sound set up by a radio oscillator through the water to the bed of the ocean.

The oscillator is situated in the aft of

the ship, and this apparatus develops vibrations of a very high frequency in a specially constructed diaphragm which is in contact with the surface of the water. These vibrations travel down to the bed of the ocean, from whence they are reflected back again to the surface, and are picked up by a sensitive microphone situated in the front portion of the ship.

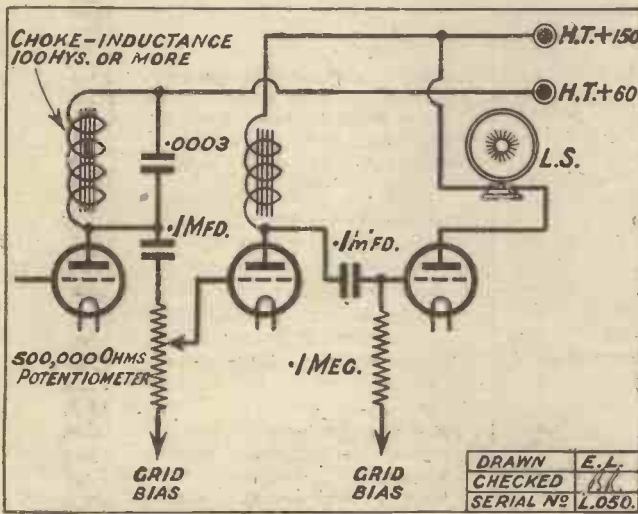


Fig. 3. A choke circuit that can be recommended.



A handsome three-valver constructed by one of our West Country readers.

By this method it has been possible to make very accurate estimates of great ocean depths. It is an advance on Kelvin's method, for vibrations of definitely determined frequency can be transmitted down to the ocean bed, and the receiver can be tuned to pick up these selectively, and to reject all extraneous sounds.

VOLUME CONTROL.

(Continued from previous page.)

the secondary of the first (low ratio) transformer, the moving arm going to the grid of the next valve, as in Fig. 2. For resistance or choke coupling, the connection in Fig. 3 should be used.

Certain methods of controlling volume consist of variable resistances shunted across the loud speaker or the secondary of the first L.F. transformer. This arrangement is quite incorrect, for the variable loading will effect the tone as well as the strength, cutting off all the high audio-frequencies when the resistance is decreased.

There are not many potentiometers on the market having the correct value (.1 to .5 meg.) for use as a volume control, and it may be necessary for the reader to make his own.

A Tapped Control.

An easy way out of the difficulty is to connect a number of grid leaks in series, which take the place of the resistances in Figs. 2 and 3, tappings between the grid leaks being taken to a number of switch studs. The moving arm of the switch goes to the grid or the first L.F. valve.

From six to twelve grid leaks may be

used, the larger number used giving, of course, the finer control. Each grid leak should have a value of from 50,000 to 100,000 ohms, the latter value being used when only five or six grid leaks are in the circuit.

The circuit of a complete L.F. amplifier with a tapped volume control is given in Fig. 4. If you wish to cut down the cost of

the grid leaks, you may make your own, using a rolled up piece of blotting-paper (about the size of a "manufactured" grid leak) which has previously been soaked in Indian ink. I have made a number in this way and have been surprised at the resistance value always turning out to be around 60,000 ohms, which is exactly the right value for this particular job.

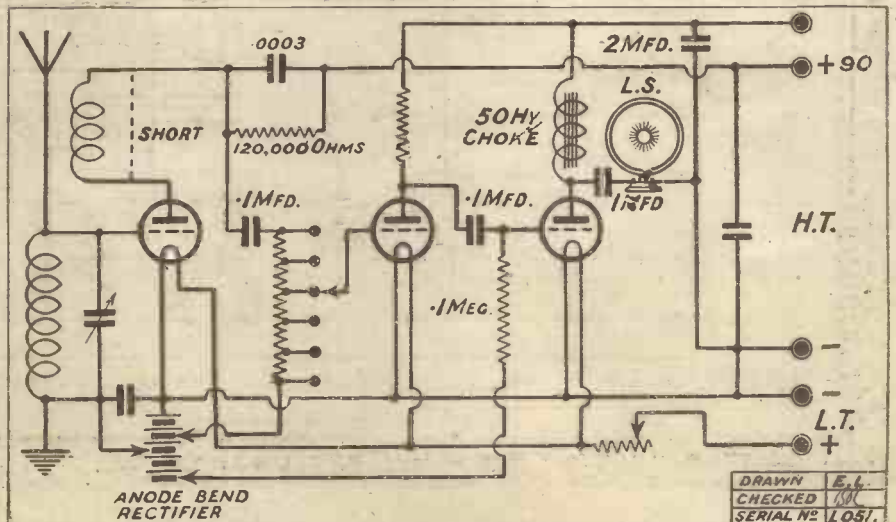
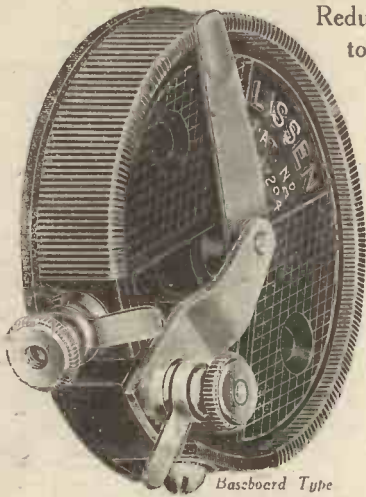


Fig. 4. A complete and efficient loud-speaker circuit with volume control.

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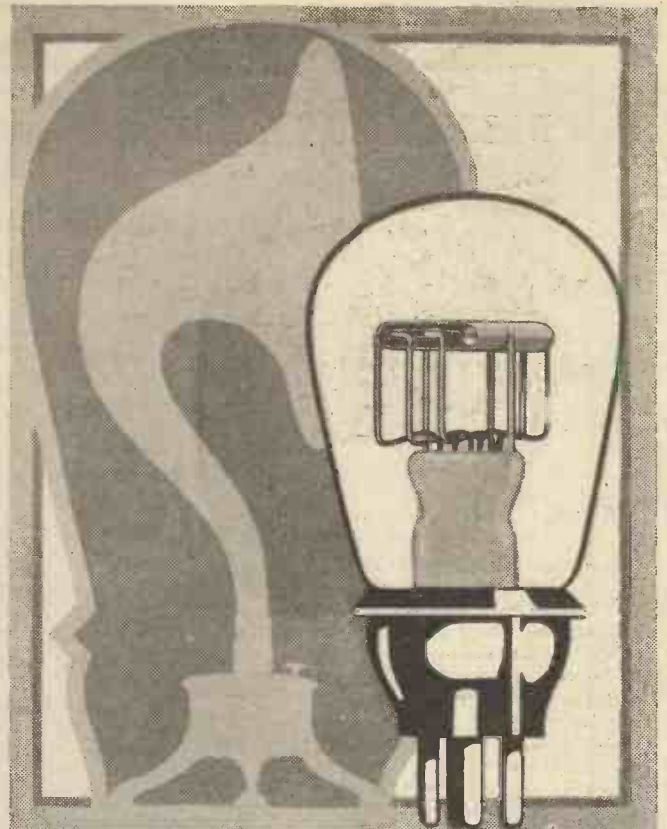
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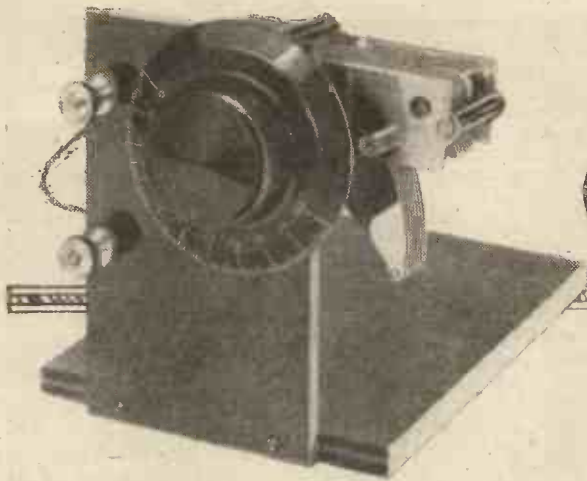
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Short Wave Condensers



In view of the popularity of short-wave reception these few notes on the question of suitable values for variable condensers will be of interest.
 By K. E. B. JAY.

ON short waves a loose-coupled arrangement of tuning inductances is a *sine qua non*, either so-called aperiodic aerial coupling or auto-coupling being suitable. These arrangements are made necessary by the fact that the aerial would damp the grid circuit of the valve to such an extent that it would be impossible to maintain oscillations at the required high frequency.

Now many people, though keeping to the arrangement outlined above, spoil an otherwise good receiver by putting too great a capacity of tuning condenser across the grid coil; keeping to values of .0005 mfd. or .0003 mfd., as on broadcast wavelengths, is bound to spoil the efficiency of a short-wave set. The maximum permissible capacity is about .0001 mfd. and nothing larger should be used across the grid coil of any short-wave set.

There are several reasons for this, but the two most important are as follow:

First. As the capacity between the grid and filament of the valve is increased, so the potential across them diminishes, and since the thermionic valve is essentially a voltage-operated device it is obvious that the signal strength in the telephone decreases also. Thus it is apparent that for a given signal on a given wave-length the received signal strength would be louder with a large coil and a small condenser than with a small coil and a large condenser. So it is obviously desirable to use a grid tuning condenser having a small maximum capacity. This argument might be said to apply to broadcast work as well, but here a comparatively large capacity change is required to produce a useful frequency change, whereas on short waves a small variation of capacity produces a large change of frequency, which brings us to our next point.

Rapid Frequency Change.

Second: On high frequencies a very small change of tuning capacity produces a large frequency change, and, therefore, when using a large variable condenser a very small movement of the dial will produce a very large change in frequency, and tuning will consequently be extremely critical.

Some will object to the use of small variable condensers on the ground that the tuning range covered would be inadequate, but this is easily overcome by the use of tapped coils. Since most short-wave coils are wound with bare wire,

and space-wound, it is a simple matter to arrange a small clip of brass to slip on to any required turn. In the case of covered wire, it is only necessary to twist a small loop in the wire, bare the loop and slip the clip on to any required loop. Of course, one cannot use a tapped coil in a cabinet, except by bringing the tapplings to a selector switch on the panel, a highly inefficient procedure; but this does not matter very much, since no short-wave receiver should ever be put in a cabinet, as this increases dielectric losses enormously. Nor must one attempt to cover from, say, 30 to 90 metres with one single, big, tapped coil, since on waves below about 75 metres

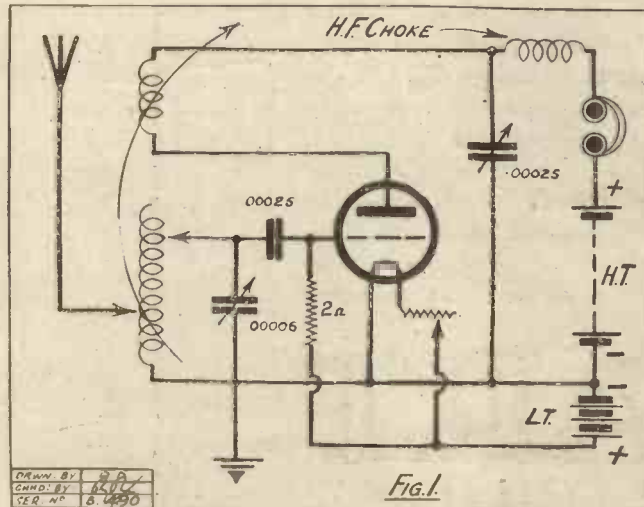
of the whole arrangement would be too high, possibly about .00001 mfd.

Most writers strongly advocate the use of low-loss condensers, but the many advantages of these components are often lost because the maximum capacity is too high. I do not think that there is any good low-loss geared condenser on the English market having a capacity of less than .0002 mfd., though several eminent American manufacturers offer low-loss condensers having three or five plates. Since a sufficiently large condenser contains only three or five plates it is quite possible for the home constructor to make very efficient low-loss components himself that should prove eminently satisfactory.

Metal End-Plates.

It is useful to have metal end-plates on condensers, provided they are connected to the rotary vanes and thence to earth, since they form an additional protection against hand-capacity effects. Metal end-plates should always be well spaced from the vanes of the condenser in order to keep the minimum capacity low.

Another essential point when working at very high frequencies is that there shall be no backlash or end play in the condensers, because if this is the case the condenser cannot be adjusted accurately for when, on tuning in a station the fingers relax their grip on the knob the moving vanes will move and the station will be lost. Similarly if the bearings are loose, the wave will shift all over the place when the knob is turned and all possibility of fine adjustment, so essential to good results, is lost. Vernier



A simple form of short-wave circuit that has given good results.

the dead end losses would be enormous. Separate coils for from 18 to 23 metres, 30 to 46 metres, and for 75 to 90 metres, would cover the most interesting wave-bands, and these coils should be tapped in order to cover the appropriate wave-bands with a small condenser.

It might be thought that a large variable condenser with a vernier in parallel would be satisfactory if the main condenser were adjusted to minimum capacity, but this is inefficient since the minimum capacity

dials are useful but not necessary on low-capacity condensers, but where they are used the above remarks are of particular importance.

It is also very desirable to use straight-line frequency condensers. These condensers spread the stations evenly round the dial, and consequently tuning is not crowded; but since they are often expensive and difficult to obtain, the next best thing is the straight-line wave-length or square law condenser.



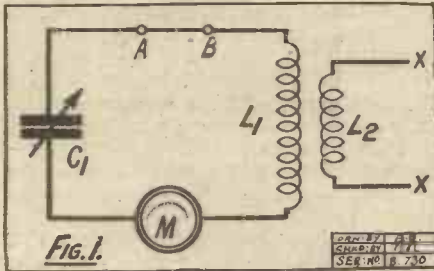
"HI! LET GO: YOU'RE PULLING DOWN MY AERIAL."

An Interesting Method of Measuring H.F. Resistance



ONE of the most fascinating branches of wireless study is that relating to H.F. resistance, with all its bearing upon set efficiency and design. Accurate measurements of this kind have only been taken within the last few years, and even to-day comparatively few experimenters are equipped with the necessary apparatus to conduct their own tests. This is probably due to the impression that most of the methods call for elaborate and expensive apparatus, together with a certain mathematical knowledge in order to arrive at the results.

The calculation of the direct current resistance of coils or transformers, H.F. or



L.F., is extremely simple, requiring nothing more than a knowledge of Ohm's law, a battery, and one or two simple instruments, but just so soon as we attempt to measure the resistance of a coil at radio-frequencies, we find that there the whole aspect of affairs has changed. It is thus possible to have half a dozen coils each with the same resistance to direct current—let us say of two ohms in each—yet one of these coils may have a radio-frequency resistance (at, say, a million cycles) of 60 or 80 ohms, while another may have a resistance as low as 15 ohms.

Comparative Tests.

In a simple circuit consisting of an inductance coil shunted by a condenser, the variable condenser, if of good modern design, has a probable H.F. resistance of only a fraction of an ohm, so that we may consider the coil and the connecting wires to contain practically the entire H.F. resistance of the circuit. Obviously, then, if we can reduce the radio-frequency resistance of our coil, we shall increase the efficiency of our set both in regard to signal strength and sharpness of tuning.

Most readers would be surprised if they were told the great variation in H.F. resistance between different makes of plug-in coils. Manufacturers make a great play of the very small self-capacity of their coils (although, compared with the H.F. resistance, it is a relatively unimportant matter),

Some preliminary details of an ingenious, but simple method of measuring the H.F. resistances of components.

By PERCY W. HARRIS.
(Editor of "The Wireless Constructor.")

and almost without exception remain silent on the subject of H.F. resistance. Picking from among the various makes of plug-in coils a number of coils of approximately the same inductance, it is quite possible to find some with three times the H.F. resistance of others. Again, the H.F. resistance of modern radio-frequency transformers is but a fraction of that of the types in use a few years ago.

An experimenter can be said to require a device for measuring H.F. resistance for two purposes. First of all, he wishes to know as accurately as possible the H.F. resistance of a given coil, and secondly, in his experiments, he wishes to know whether certain changes he has made have increased or decreased the H.F. resistance. For the latter purpose precision instruments are not required, so long as relative values are readily obtainable, and indeed most of the work the ordinary experimenter is likely to want to do can be carried out with apparatus capable of giving an accuracy within ten per cent. This may strike the reader as being a wide margin of error, but those who have done most work on the subject will tell you that an accuracy of measurement comparable with that obtainable in arriving at direct current resistance is impossible.

The purpose of this article is to describe a simple way of applying what is known as the "resistance variation" method, which gives quite a fair degree of accuracy and has the great advantage of being very simple to work out. The apparatus needed can be divided into two parts—the oscillator and the measuring circuit. The oscillator can take one of many forms, and as its purpose is to set up oscillations of a frequency to suit the measurements, means

must be provided to vary the frequency. Furthermore, it must be calibrated, otherwise we shall not know at what frequency our measurements are taken—an important point, as the H.F. resistance varies with the frequency.

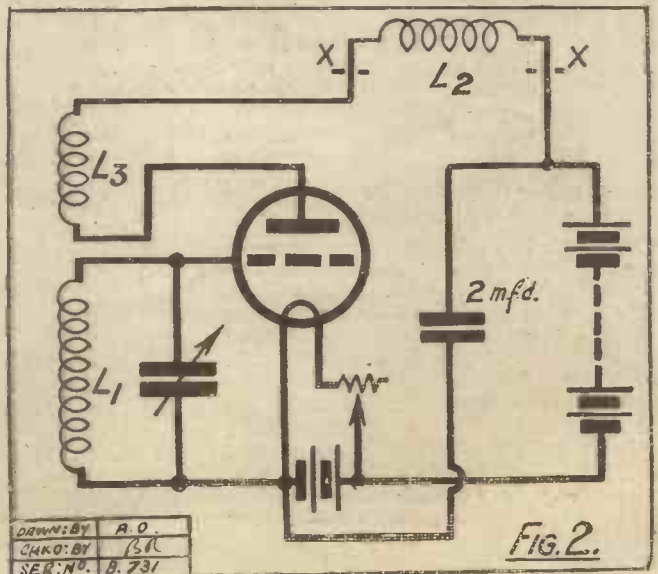
Now let us consider Fig. 1, which shows an oscillatory circuit containing a variable condenser, C_1 , an inductance of unknown resistance, L_1 , a meter marked M (about which more in a few moments) and a link between points A and B. As mentioned previously, the H.F. resistance of a good variable condenser of modern make is very low, and for the purposes for which the experimenter is likely to use a measuring set such as this, can be neglected. Similarly, the H.F. resistance of the short leads used is negligible, so that we have only to consider the H.F. resistance of the coil and of the meter.

The Thermo-galvanometer.

Now the meter in such a set as this is a very important instrument and must be specially designed for radio-frequency work. The instrument I use is a Weston Electric Thermo-Galvanometer model 425, which has a scale reading from 1 to 100, the full deflection of the instrument being 115 milliamperes. The scale is equally divided and so arranged that four times the reading is given by double the current, and so on.

This particular thermo-galvanometer has a radio-frequency resistance at ordinary broadcast frequencies of ± 5 ohms, the value

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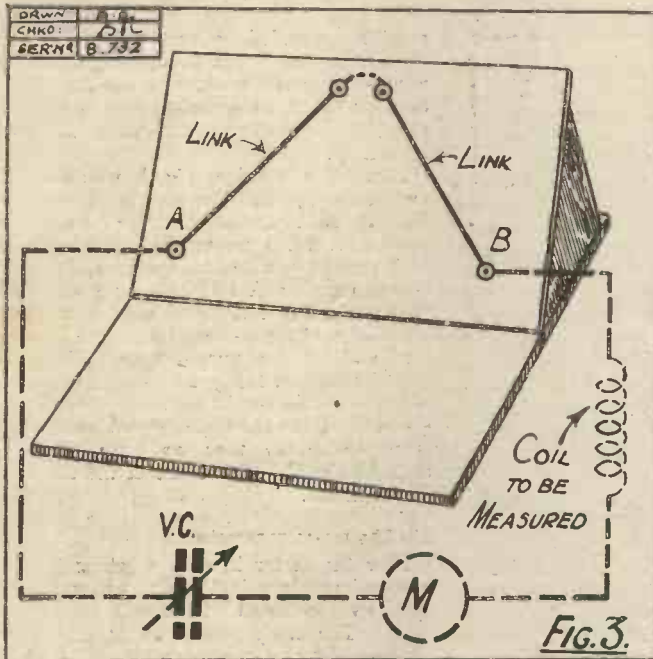


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CHECKED BY B. C.
SER. NO. B. 731

AN INTERESTING METHOD OF MEASURING H.F. RESISTANCE.

(Continued from previous page.)

being marked on the instrument itself. Thus if in our measurements we get the total resistance of the circuit (consisting of C_1 — M — L_1 and the link A and B) of 14.5 ohms, we can estimate the resistance of L_1 to be approximately 10 ohms. The method of



measurement is as follows: Terminals A and B are joined with a piece of heavy gauge wire (say No. 16 copper). The coil L_2 from the oscillator is brought sufficiently near L_1 to set up a current in the circuit which will bring the needle of the meter well up on the scale, say, to 30 or 40. Coupling between L_2 and L_1 must not be too close, otherwise the accuracy of the readings will be seriously affected. This means that quite a strong current is necessary in the oscillator coil, and in practice I use a D.E.5 valve with 120 volts on the plate. With such a valve and H.T. voltage, the current set up in the coil L_2 is sufficiently strong to give the reading we require with the two coils well separated.

The Resistance Units.

A reading of, say, 40 is now obtained on the meter, the oscillator being adjusted to the frequency desired, say that corresponding to 360 or 400 metres. Now without altering the disposition of the parts of the apparatus, we remove the link between A and B and substitute for it a known H.F. resistance. Fortunately, if we use very fine wire the radio-frequency resistance of the straight wire will not be appreciably different from its ordinary D.C. resistance, and we can make our resistance of any value we desire by simple measurement.

For example, the resistance of No. 42 S.W.G. Eureka wire at ordinary room temperature is 1.49 ohms per inch, and the

resistance of No. 47 Eureka is 5.95 ohms per inch. Let us assume that the distance between A and B is eight inches. If we take a length of six inches of No. 42 Eureka and solder it to two pieces of stiff wire, the total length of which with the resistance wire comes to slightly over eight inches, we have a resistance of roughly nine ohms; by using three inches of wire and correspondingly longer stiff wires soldered to it, we can make another eight-inch length with only half the H.F. resistance. Several of these lengths can be made up with different wires, as required. As these wires are very fragile, it is best to make them up in

the form of Fig. 4, that is to say, protecting the thin wire by a glass tube, the thick wires being fitted into the ends of the glass tube with sealing-wax or other similar compound.

Fig. 3 shows the form of stand I use for such links, so that the length of the circuit is the same, whether the shorting link or the known resistance is in position.

Simple Formula.

Now, if we have a choice of several resistances, we can "chop and change about" until the resistance we insert in the link brings the reading on the meter down to a quarter of that we have obtained with the shorting link in position (do not forget this means half

of the actual current). The value of the inserted resistance is then equal to that of the rest of the circuit (coil, condenser, connecting wires and thermo-galvanometer).

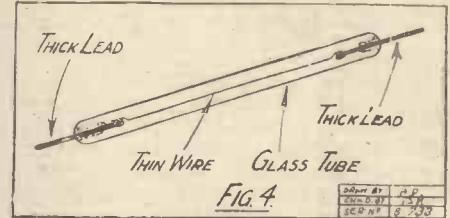
There is another method, still simpler in the handling, but involving a little calcula-

tion. This uses the formula $R = \frac{R_1}{\sqrt{\frac{d}{d_1}} - 1}$

where R = the unknown resistance, R_1 the inserted known resistance, d the deflection with the terminals shorted, d_1 the deflection with resistance inserted.

By using this formula one or two resistances can be used for measuring many different unknown resistances.

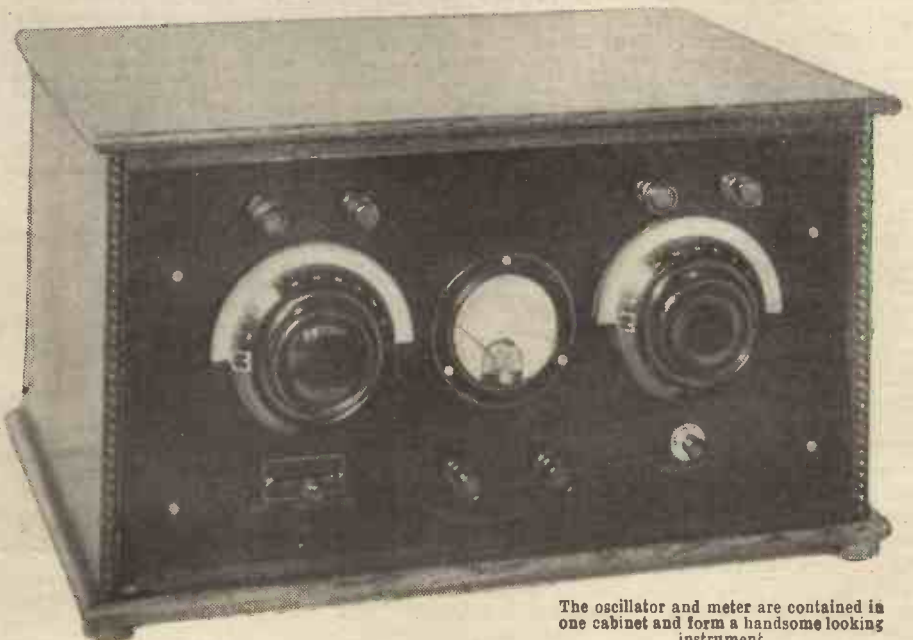
The calibration of the oscillator is quite easily carried out by tuning an ordinary



wireless receiver to a station of known wave-length and then swinging the oscillator dial until the zero point of a beat note, between your oscillation and the carrier-wave of the station, is heard. By tuning to a few different stations of known wave-length it is easy to plot a tuning curve for the oscillator which will be quite accurate enough for most experimental work.

It is highly important that the position of the various parts of the apparatus, the length of the leads and the coupling between the coils should remain perfectly constant throughout the whole tests, and that the connecting wires should be short and of low resistance. The slightest movement of the coupling coil will alter the reading and vitiate the results. For this reason it is a good plan to take the reading first with the shorting link between A and B, then with the known resistance inserted, and again with the shorting link in position to make sure that nothing has been changed.

The oscillator, too, should be supplied either from a large cell H.T. dry battery or preferably from H.T. accumulators, so as to maintain a steady anode current (which will reach a figure of some 30 milliamperes or so).



The oscillator and meter are contained in one cabinet and form a handsome looking instrument.

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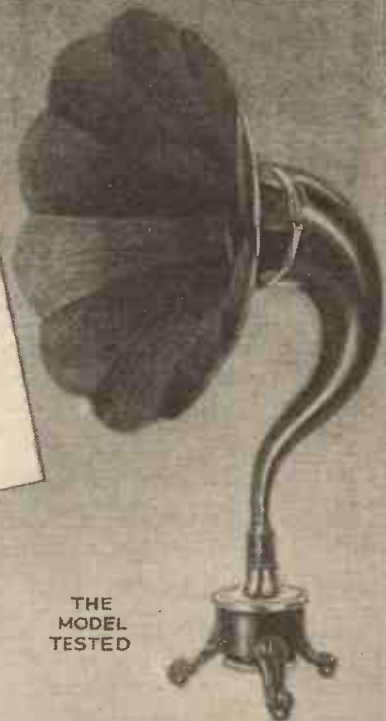
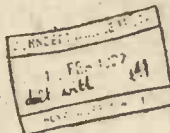
Dear Sirs,

On Thursday last the above Society held a test of loud speakers, some fifteen models were tried ranging in price from 50/- to 15 guineas, all speakers were placed behind a curtain and a vote taken.

It may interest you to know that the Burndept Ethovox five guinea model with wooden horn was placed first for tone purity and volume.

Yours faithfully

H. R. Amoor
Hon. Secy



THE MODEL TESTED

This independent test —

proves conclusively that "Ethovox" Loud Speakers justly merit their title "The World's best Loud Speakers." It is only necessary to add that the loud speaker used was an ordinary stock model supplied through the usual trade channels.

The model referred to in the letter as costing 5 gns. now costs only 4 gns., which makes it more than sound value. A similar "Ethovox" Loud Speaker can be supplied by your Local Dealer.

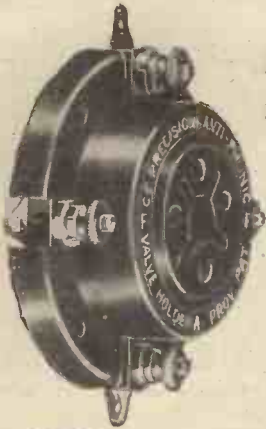
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C.E. PRECISION RHEOSTATS, efficient and velvety, 50 and 30 ohms, 3/- each; 7 and 15 ohms, 2/9 each. Dual Rheostats and Potentiometers, 3/9 each.

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IMPORTANT. When sending particulars of your requirements please state clearly make, type, and price of component.

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The selectivity obtained with this condenser is such that there is no previous standard by which it can be compared.

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GETTING IT RIGHT.

Quite a number of listeners appear to be still unconscious of the fact that there is a right and wrong-way of connecting up a loud speaker, and that these instruments should be carefully adjusted if satisfactory results are to be obtained.

By G. P. KENDALL, B.Sc.

DO you know how to tell whether you have got your loud speaker correctly connected as to positive and negative? Considering that there is a simple and almost infallible way of finding out, it is rather surprising how few people take the trouble to do so. Many, no doubt, do not know of the simple test in question, others rely on the blind method of connecting the red and black tags to those terminals which they have identified as positive and negative on the set, but I fear a still larger number just don't worry.

Now, these last users of loud speakers are running risks, more serious than they imagine, of doing damage to an expensive instrument. If the last valve in the set is a power valve, its anode current will be considerable, and if this current is running through the loud speaker windings in the wrong direction for hours on end, the chances of weakening and even almost completely de-magnetising the permanent magnets of the mechanism are considerable. Moreover, certain loud speakers give definite quality when connected the right way round, especially when a good-sized power valve is used and signals are strong.

We see, then, that it is important which way round we attach the loud speaker leads to the set, and it may be asked why it is not sufficient merely to note which tag is red and which black and connect them respectively to the positive and negative loud-speaker terminals on the set. Well, if you are *sure* you know which is the L.S. plus terminal on your set and *sure* the loud-speaker manufacturer has made no mistake, it is probably good enough so long as you can attach the loud speaker directly to the set and do not use extension leads to another room.

Check the Connections.

In my experience, however, it is advisable to check *both* these points, because it is quite easy to make a mistake about the terminals if one's technical knowledge is not very great, and loud-speaker makers *do* sometimes send their products out with the leads wrongly attached. The checking is very quick and easy, and since it is often essential when extension leads are used I think everyone should know how to do it.

The method depends on the effect of the direction of flow of the current through the loud speaker on the clearance between the magnets and the diaphragm or reed. This clearance is adjustable in the great majority of cases, a large screw, lever, or knurled ring being provided on the base of the instrument, and the procedure is to start with this clearance fairly large, that is, with the magnets fairly well separated from

the diaphragm. Now, when the loud speaker is actually working, proceed to adjust the clearance so that the diaphragm comes nearer and nearer. The reproduction will, of course, grow gradually louder as this is done, until a point is at length reached at which the diaphragm (or reed as the case may be) starts to rattle against the pole-pieces of the magnets and sets up objectionable noises.

Beyond this point the diaphragm usually drops firmly against the pole-pieces, and although it can still vibrate sufficiently to reproduce feebly it no longer "rattles," and so the speech and music becomes once more fairly clear but, of course, weak.

Adjusting the Diaphragm.

To make the test, bring the diaphragm very carefully nearer and nearer to the magnets until it *just* begins to rattle, and then even more carefully turn the adjusting device back until the rattle just, and only just, ceases. (This is most easily done with only moderately loud signals.) Next reverse the leads to the loud speaker and note what happens. If the rattle starts again and you have to turn the adjuster back a little further to stop it and set clear reproduction once more, the new connections are the right ones. If, on the other hand, reproduction remains clear, there is no rattling, and you find you can set the adjustments further forward without starting it, the previous connections were correct, and you should return to them.

In so many words, those connections are correct which make the loud speaker start to rattle most easily. This simply means

that when the anode current flows in the *right* direction through the windings, it helps to draw the diaphragm down towards the magnets, and so it is necessary to bring the adjusting device a little further back to obtain the desired clearance.

It should perhaps be mentioned in conclusion that there is a class of loud speaker of growing importance, namely the cone type, which is not usually provided with an adjustable clearance of this kind at all, and so the method cannot be used. These instruments are often used, however, with output transformers or filter circuits, and so the problem of connections does not arise. When it *does*, the only course is to identify the plus and minus of the output terminals on the set or amplifier (the minus is the one which is wired to the anode of the last valve) and trust to the maker's marking of the loud-speaker tags.

It will perhaps be helpful to conclude with some general hints on adjustment. Now, to get the *lowest* results from the loud speaker, it is correct to adjust it so that the diaphragm is as close as possible to the magnets. (By "as close as possible," of course, it is meant that the diaphragm should be brought as near as it can without starting to "rattle.")

In this state the loud speaker is in its most sensitive condition, but it does not follow that the utmost possible purity of reproduction is being obtained. As a matter of fact, better quality is often produced by increasing the clearance a little further, and tolerating the slight loss of volume which results.



The average loud speaker has an adjusting screw either above the diaphragm or behind the speaker unit.

BROADCAST NOTES.

FROM OUR BROADCASTING CORRESPONDENTS.

The Grand National—B.B.C. and Spiritism—St. Patrick's Day—Centenarians' Birthdays—Scheevoight—Edith Day for the Mike—Reginald Berkeley Again—Farewell to the Bonnet Laird—The B.B.C. and Community Singing—Running Narrative of the Sun's Eclipse—Four Hundred Years Hence—The Varsity Sports—The Stand-by Station.

The Grand National.

THE B.B.C. are going to a great deal of trouble over the Grand National, which will be the first big race broadcast in this country. It takes place at Aintree on March 25th. After careful surveys of the course it was decided to abandon the proposal to place microphones at various points and to endeavour to link up the accounts of several narrators. Successful dovetailing would be quite impossible in the four and a half minutes that it takes for one circuit of the course. Nevertheless, five microphones are to be used. The broadcast will begin with an introductory and descriptive talk from a microphone at the back of the press-stand, from which a good view can be obtained of the paddock, saddling enclosure, parade ring, etc.

Another microphone, suspended over the front rails of the press-stand, will provide atmosphere sounds. Just before the race is due to start the race-reader will take up the description in front of still another microphone, placed near Lord Derby's private box in the most favourable position available for following the race. The race-reader will carry on from the "Off" to the finish, approximately nine minutes.

When the first three horses have returned to the paddock, the descriptive mike will come into operation once more, giving an account of the unsaddling with a background of sounds from another mike suspended over the unsaddling enclosure. A mobile microphone in front of the weighing-in room will attempt to pick up an interview with the winning jockey. This is by far the most delicate and elaborate outside broadcast ever undertaken by the B.B.C.

B.B.C. and Spiritism.

There is great indignation among the Christian spiritists because of the alleged contemptuous refusal of the B.B.C. to allow Sir Arthur Conan Doyle to give a talk on psychic research. Questions are to be asked in the House.

St. Patrick's Day.

The special programme being arranged for St. Patrick's Day, March 17th, will not be taken by Mr. Plunket Greene, as previously announced. It is likely that the arrangements will be in the hands of Lord Dunsany, supported by Sarah Allgood.

Centenarians' Birthdays.

The B.B.C. is partially reviving an interesting practice very popular in the early days. This is the broadcasting of special birthday greetings to all who reach the age of 100. It is to be done in the Children's Hour in future, but only by request. The B.B.C. cannot undertake to find out who are reaching this venerable age.

Scheevoight.

Scheevoight, the eminent Finnish conductor, who is to take a Queen's Hall Concert in May, will probably be heard by listeners from a special B.B.C. concert.

Edith Day for the Mike.

Edith Day, the famous "Rose Marie" artist, is shortly to appear in a special broadcast version of "Going Up."

Reginald Berkeley Again.

It is understood that negotiations are in progress for another specially commissioned broadcast drama by Reginald Berkeley. The suggestion now relates to an Easter Play of the "Miracle" variety. Those who remember the piquant incidents of the previous associations of Mr. Berkeley with the B.B.C. will look forward with special interest to the outcome of the present negotiations. There is no doubt that "The White Chateau" (incidentally, first correctly appraised in POPULAR WIRELESS)



This is 5 M O, an amateur's transmitting station that perambulates around the north country.

was the best broadcast drama yet transmitted. But there is also no doubt that its production involved more difficulty and trouble than any other dramatic effort on the part of the B.B.C. Thus, if the present negotiations succeed, a good play will probably eventuate, but trouble is bound to occur. But this is all to the good. It adds to the general interest and increases the probability of the ultimate success of the play itself.

Farewell to the Bonnet Laird.

The "My Part of the Country" talks of the "Bonnet Laird," which have been an interesting and popular feature of broadcasting for several years, are to be dropped. Many listeners will regret this decision, but it is perhaps inevitable. The Corporation must ring the changes, and no feature or artist is sacrosanct.

Variety is essential. The other branches of the entertainment industry are long familiar with the necessity for superseding even successful artists after a long run.

The B.B.C. and Community Singing.

The Community Singing Movement sponsored by the "Daily Express," and taken up by a number of newspapers outside London, is in danger of lapsing. Naturally newspapers cannot be expected to keep at it after they have extracted the maximum credit value. Therefore, unless the B.B.C. steps into the breach in the autumn, the Community Singing Movement will become a matter of history. Many listeners would prefer to see this movement subsidised by licence money rather than that inefficient opera should be supported from the same source.

Community Laughing.

The B.B.C. is about to undertake a series of tests in community laughing. It is proposed to get Mr. Cyril Maude to conduct these experiments. This idea is aimed at improving the morale of the general body of listeners. It has no party political significance.

Running Narrative of the Sun's Eclipse.

The total eclipse of the sun on June 29th will be made the subject of a novel running narrative by a scientist.

Four Hundred Years Hence.

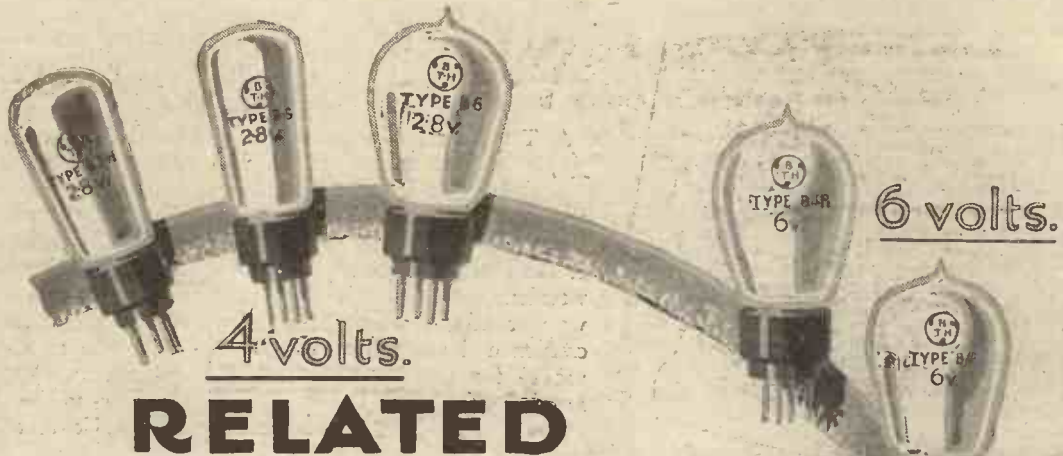
This is the title of Cecil Lewis's special programme from London on Thursday, March 24th. Mr. Lewis promises some useful imaginative effort, and not a little matter calculated to outrage the Victorian conception of ordered society. He hopes, in this broadcast, to regain the ground lost by "Lord Jim," which did not succeed as a broadcast. Incidentally, the new policy of chunks instead of snippets, exclusively announced on this page a fortnight ago, is meeting with stronger disapproval than the previous policy of snippets.

The Varsity Sports.

The inter-varsity sports at Queen's Club will be broadcast as a running narrative on the afternoon of Saturday, March 26th.

The Stand-by Station.

There is a revival of the agitation for the beginning at once of an alternative London programme through the stand-by transmitter at Marconi House. It is objected by the B.B.C. engineers that there is no wave-length available; to which the rejoinder is "take away one of the country waves, and give London the service it deserves." There is growing impatience among London listeners at the alleged favouritism of the B.B.C. towards country stations, particularly those in Scotland. It is pointed out that the whole of Scotland should not have as good facilities as Greater London, which in every material respect, including Scottish population, is more important than the bleak areas north of the Tweed. But not unnaturally, this view is challenged.



RELATED

ARE all your valves related? Or have you merely fitted different types in the various stages irrespective of the make?

The latter is an important point, and to ensure the best possible reception each valve should be closely related—in make as well as in type.

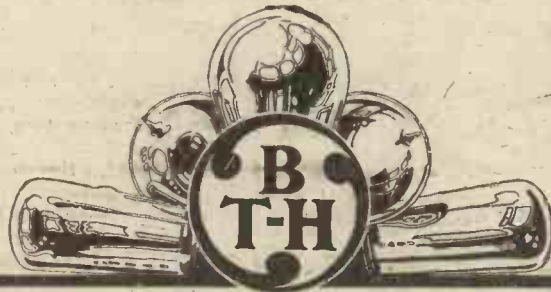
A valve has certain definite duties to perform in conjunction with its companion valves, and it can only carry out those duties satisfactorily by working as one of a picked team, except in one valve sets where it functions as an individual unit. B.T.H. valves work exceedingly well either alone or in combination with other makes of valves, but for the best possible results we strongly recommend an "all B.T.H." team of "related" valves.

You can build up to this high standard of radio perfection by replacing other makes of valves as they cease to function, and you will find this course fully justified by the results obtained from your B.T.H. "team."

Two combinations of "related" valves we recommend are:—

Valve	Purpose	Fil. Volts	Fil. Amps	Anode Volts	Amplification Factor	Impedance	Price.	
for 4v	B5H	H.F.	2.8	0.06	40-120	17.5	55000 ohms	14 0
	B5	Det.	2.8	0.06	20-80	7	17000 ohms	14 0
	B6	Power L.F.	2.8	0.12	40-120	8	12000 ohms	18 6
for 6v	B4H	H.F. & Det.	6	0.25	60-150	20	28000 ohms	14 0
	B4	Power L.F.	6	0.25	40-120	6.5	6000 ohms	18 6

When buying valves look carefully for the B.T.H. monogram. Every good dealer carries stocks, but if temporarily short of any particular type he can obtain supplies within a few hours. Avoid substitutes, which are usually unsatisfactory.



RADIO VALVES

Use B.T.H. Valves for efficient team work

The above prices are applicable in Great Britain and Northern Ireland only.

2750

The British Thomson-Houston Co., Ltd.



New!

— the **Brown**
Sphinx Loud Speaker
— after Gizeh's
ancient wonder.

AT Gizeh, in Egypt, stands a monument which has defied the ravages of centuries of time. The ancient Egyptians must have marvelled at the daring originality of the wonderful Sphinx. It is this wonder of old which **Brown** craftsmen have taken as the model for the latest **Brown** Loud Speaker. See the new **Brown** Sphinx

Loud Speaker at your Dealer's. Note the cunningly shaped, Sphinx-like outline. See the artistically grained and highly polished surface. But hear it speak! You've never heard such a rich, mellow tone. The artistes it reproduces might be in your very room, so lifelike is its reproduction! Sixteen - and - a - half inches in height, it costs £12 10s. 0d.

ORIGINALITY is the keynote of this **Brown** Sphinx Loud Speaker. Original—but not at the expense of tone or volume. They are superb. You'll marvel when you hear it! Price: £12 10s.

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THE Transformer
for use with
K.L.I. Valves

A special feature of the Igranic - Patent Filament Transformer is that, irrespective of whether one, two, three or four valves are being operated, the output voltage remains constant within the limits of 3.5 to 4 volts specified by the valve manufacturers. Heavy current carrying rheostats are therefore unnecessary. Totally enclosed in metal shroud, entirely preventing A.C. "hum." In two patterns for 100-110 and 200-220 volts, for one, two, three or four valves.



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149, QUEEN VICTORIA ST., LONDON
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1,000,000,000 S.T.'s HAVE TIMES RAREFIED VACUUMED!

THE amazing high vacuum inside the bulb of every S.T. baffles the imagination. If you broke open a thousand million S.T. valves you would only get enough ordinary air to fill a single valve bulb!

The vacuum is exactly 1,000,000,000 times more rarefied than if no exhausting process had been employed to get this result. Every particle of air has to be drawn out not only from the space in the bulb but from the pores of the glass and the metal electrodes and wires which occlude (i.e., absorb) gases just as a sponge holds water. Special features of the Barguet process come into operation before, during and after manufacture of every S.T. to ensure that the metal and glass are freed from these deep-seated molecules of gas. The result is a vacuum that really lasts. Even a torodium filament would be helpless if the absorbed particles of gas gradually oozed out into the bulb and so spoil the vacuum on which the emission and free passage of electrons, and the life and performance of the valve so vitally depend.

Fit S.T.'s—the valves with the perfect vacuum—and not only will you be amazed at the glorious volume of vivid, clearcut music which you can get from station after station, but you can be calmly confident that your valves will give long and faithful service or be instantly replaced by S.T., Ltd.

Send us your name and address and the test certificate cut from an S.T. valve box and you will receive a year's free subscription to the great new journal, the "ELSTREE RADIO NEWS."

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2-VOLT.	4-VOLT.	6-VOLT.
S.T.21 (H.F.) 0.1 amp. ..14/-	S.T.41 (H.F. and Det.) 0.1 amp. .. 14/-	S.T.61A (Res. Cap.) 0.1 amp. ampli- fication 40.. 14/-
S.T.22 (L.F. and Det.) 0.1 amp. ..14/-	S.T.42 (Power) 0.1 amp .. 18/6	S.T.61B (H.F. and Det.)0.1 amp.14/-
S.T.23 (Power) 0.15 amp. ..18/6	S.T.43 (Super Power) 0.25 amp. .. 22/3	S.T.62 (Power) 0.1 amp. ... 18/6
		S.T.63 (SuperPower) 0.25 amp. .. 22/6



Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." Test-room under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

A NEW BRETWOOD VALVE HOLDER.

MESSRS. BRETWOOD have placed an anti-microphonic valve holder on the market which embodies their well-known ball-socket type of contact. It is a very substantial component and is provided with both rigidly secured soldering tags and with neat terminals. The springing is good and, although it feels stiff, it proved to be perfectly adequate on test. The holder is priced at 2s. 4d.

B.T.H. L.F. TRANSFORMER.

If we have not used B.T.H. L.F. transformers more often in our various sets, it has not been for the reason that we did not consider them to be efficient. As a matter of fact, we fear we have rather neglected this make of the component, although the neglect has been quite unintentional. We were reminded of this the other day by the arrival of two of these very transformers

from the makers. Actually we have had a B.T.H. L.F. transformer in use in a set for some time, and very good results it has given, too. It has a ratio of 1—4, and we use it as second stage preceded by a resistance-coupled amplifier. It has been in use in a first stage following a crystal, and here, too, it operated very efficiently.

The B.T.H. transformer is of the enclosed type, and it is a distinctive and well-made article. It retails at 17s. 6d., a price which is more than reasonable, for it is a first-class component. "P.W." readers will shortly make its acquaintance in a rather special transformer Mr. A. Johnson Randall is designing.

ANOTHER S.T. VALVE.

S.T. 61A.—Fil. volts, 5-6; fil. amps., 0.1; anode volts, 150 max.; impedance, 70,000 ohms; amplification factor, 40. This new S.T. valve has been specially

designed for resistance-capacity coupling and is a "high mu" valve of the highest qualities. In straightforward stages of resistance-coupled L.F. it gives very good results, and we find on test that it makes an excellent detector. We tried it in both anode-bend and grid leak and condenser rectifying stages, and in both cases it operated with a high order of efficiency.

The 61A can also be used in H.F. circuits. The makers particularly recommend its use when the tuned anode method of coupling is employed. And it is worth pointing out that in many cases increases in both selectivity and sensitivity result when a modern valve of this type is used for that purpose instead of either a high impedance, low amplification factor valve or one of medium characteristics, as is frequently the practice.

"ATLAS" CENTRE-TAPPED COILS.

Messrs. H. Clarke & Co. (Mer.), Ltd., of Manchester, recently sent us samples of their new "Atlas" centre-tapped coils. These are of the familiar "Atlas" design, but are provided with extra and ordinary terminals neatly mounted on the inner sides of their upper structures. These terminals are connected to tappings taken at centre points of the windings.

Three sizes are available: Nos. 40 and 60 at 4s. 3d. each, and a "Daventry Coil" at 6s. 6d. The object of these "centre-tapped" coils is to provide a means of obtaining greater selectivity in the case of a set employing a single-circuit aerial-tuning arrangement, using plug-in coils. The

(Continued on page 40.)

Fitted 2½ Years ago—

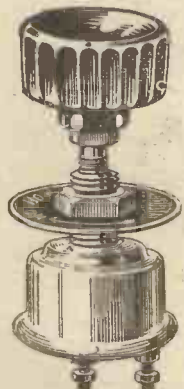
Still going strong!

Mr. G. K. Raffther, of Blanford, Stirlingshire, says:

"My three old pattern Microstats were purchased about 2½ years ago and have been in practically constant use since—they

still continue to give the same efficient service as when new."

This is typical of the comments we continually receive on the Famous Microstat, of which over 700,000 are in use.



Standard Model.
Panel Mounting. Price 2/9

"MICROSTAT"

FILAMENT CONTROLS

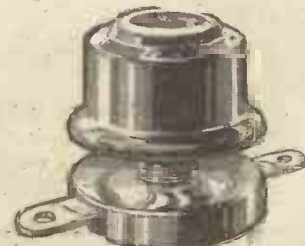
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You can set it to just the correct Filament Emission—leave it, and it "stays put." The Filament thereafter is controlled by the ordinary pull-push switch or Master Rheostat.

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Dear Sirs,

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Yours respectfully,

G. M. GITTENS.

P.S.—You can make use of this if any advantage.

This is only one of the many unsolicited testimonials which we constantly receive.



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Write for a copy of our Catalogue 650 on the CARE and MAINTENANCE of radio batteries. It will also assist you in the selection of the correct size of battery to use for any radio purpose.

SIEMENS

BROTHERS & CO., LTD., WOOLWICH, S.E.18



Does your radio set rewrite the music?

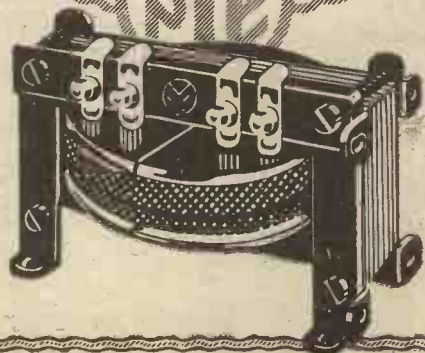
SUPPOSING you were a musician and listened to radio concerts with the score in your hand . . . how much would you find your radio set had re-written . . . how many notes it had played too piano—how many too forte?

FIT PYE L.F. Transformers. Then you will get reproduction as it should be . . . clear, pure and lifelike, high and low notes amplified uniformly. The PYE frequency-efficiency curve certified by the National Physical Laboratory is practically a straight line and is unrivalled by any other published authoritative curve. PYE Transformers create no parasitic noises, and voltages up to 300 can be used with perfect safety. Made for horizontal or vertical fitting. Each one tested by an actual measurement of amplification and each one definitely guaranteed.

Ref. No. 651.	Ratio 2.5 : 1	17/6
„ „ 652.	„ 4 : 1	17/6
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FLUXITE

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FLUXITE SOLDERING SET
—complete

All Hardware and Ironmongery Stores sell FLUXITE in tins, price 6d., 1/4 & 2/3. Another use for Fluxite—Hardening Tools and Case Hardening. Ask for leaflet on improved methods. Fluxite Ltd. (Dept. 324), Rotherhithe, S.E.16

7/6



APPARATUS TESTED.

(Continued from page 33.)

aerial lead is taken to the tap terminal on the "Atlas" coil, instead of to the aerial terminal on the set.

On test we found these coils worked well and provided the greater degree of selectivity claimed. In the case of the 60 coil, we are of the opinion that the tap could be shifted down ten or so turns with advantage, although, of course, a compromise between selectivity and loss of signal strength generally has to be made in the case of these tapped aerial coils.

A CHEAP VALVE HOLDER.

The Excelsior Motor Co., Ltd., King's Road, Tyseley, Birmingham, recently submitted an Excelsior valve holder. It is a remarkable component. Seldom have we seen such an example of simplicity of design. A single insulating mounting and four pieces of metal, and the result is a panel mounting valve holder. If the metal which forms the combined sockets and soldering tags might be just a trifle springier, this is a small point and the component leaves little else that can be criticised. It is mounted underneath the panel, the legs of the valve passing through holes in this and engaging the metal socket clips of the holder.

The device retails at 1s. complete with nuts and screws and drilling template. It is unfortunate that its sphere of usefulness

is limited, for sets are seldom built these days with valves above-panel.

ORPHEAN LOUD SPEAKER.

Unlike a great many of the loud speakers that we have tried lately, the "Orphean De Luxe" is not a loud speaker that looks like something else—such as a clock or an ornament. It is built upon a simple and straightforward design, which suggests that its makers rely upon its performance and the service it will give rather than upon any appeal due to a novel appearance.

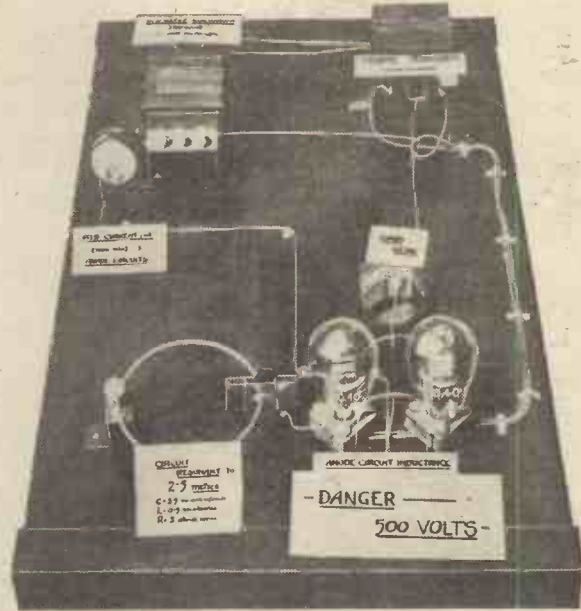
It was, therefore, with considerable interest that comparative tests were made between the Orphean de Luxe and a number of other loud speakers—including some old favourites and some of the "novelty" class.

Tone was found to be well above the average, there being a pleasing "roundness" on music, due to good reproduction over a wide musical scale. The instrument renders speech clearly and crisply. Its sensitivity is assisted by the generous size of the diaphragm adjustment control, which is concealed below the base, and is readily accessible between the claw-feet. The finish is good, all the details giving promise of satisfactory service.

The Orphean De Luxe is made in England by the London Radio Manufacturing Co., Ltd., Station Road, Merton, S.W.19, and at £3 10s. it represents very good value for money.

CONE TYPE LOUD SPEAKERS.

It will probably interest many readers to learn that several of these instruments of various makes are now under observation.



A short-wave oscillator exhibited by The Mullard Radio Valve Co., Ltd. at a recent exhibition.

Rid your loud-speaker
of "Tinny" Sounds!

with the "BLUE-SPOT"

TONE CLARIFIER

INSTALLED between your receiver and the loud speaker, this instrument will entirely rid the metal horn of its "tinny" sounds in an amazing manner. It can easily be fitted to any receiving set, whether a detector set or a valve set. It is accurately adjustable to the finest degree in 6 stages. By turning the adjustment ring the scale will show the figures 0-6. When set on "0" the clarifier is switched off, whilst the figures 1-6 indicate the degrees of clarification. By very simple adjustments this indispensable accessory will give you reproduction more clear and distinct than you thought possible—at the cost of only

9/6

For use with ANY Set
without alterations!



Ask your Dealer or write to one of the following addresses for LIST "F.2" of "Blue Spot" Specialities.

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South Wales: Watson Bros., 48, Dock Street, Newport.

Midlands: Foster-Boynston Co., Ltd., 70, Lombard St., Birmingham.

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THE BEST AMPLIFIER AND THE CHEAPEST IS THE NEW NON-VALVE

BAR AMPLIFIER

Patent No. 248581-25.



COMPLETE
AMPLIFIER

PRICE
38/-

POST FREE.
DRY BATTERY - 4/- extra.
Microphone and other parts of
Amplifier also supplied separately.

GIVES REALLY GOOD LOUD-
SPEAKER RESULTS FROM
CRYSTAL RECEPTION OF
AVERAGE STRENGTH WITH-
OUT ANY ACCESSORIES
EXCEPT A 3-VOLT DRY
BATTERY. THE ONLY MEANS
FOR INCREASING THE
STRENGTH OF WEAK
RECEPTION IN HEADPHONES
WITHOUT USING VALVES.

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The New Wilson Electrical Mfg. Co., Ltd.

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DULIVAC VALVES

7/-

GENERAL
PURPOSE



13/-

POWER

ARE THE BEST IN THE WORLD

They give greater power, purer tone and more economical consumption at a lower cost.

1.8 volt, general purpose, 0.2 amps. 7/- 1.8 Volt, Power, 0.3 amps. 13/-
4 volt, general purpose, 0.6 amps. 7/- 4-Volt, Power, 25 amps. 13/-

From your dealer or direct from **M. & A. Wolff** 9-15, Whitecross Street - E.C.1

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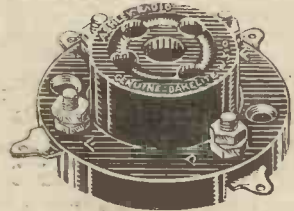
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Holder



In the light of developments in the majority of modern Valves it is no longer necessary to purchase specially constructed, but doubtful, non-vibratory holding devices, the stage has been reached analogous to that which led to the vetoing of similar gadgets in the development of the filament lamp.

The new Ashley Valve Holder possesses every required refinement. Constructed throughout of genuine bakelite and non-oxidising metal, the valve sockets are surrounded by air throughout 90% of their length. Sockets and connections are stamped complete out of one piece of non-oxidising metal, provision being made for wiring to terminals or soldering to tags. Moreover, a special safety groove is provided to ensure the valve legs engaging with the corresponding sockets.

PRICE
1/3d.
each

*Ashley
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Use in every stage
(except detector) and
save 1/6 per Valve

Ashley Wireless Telephone Co. (1925) Ltd.
Finch Place, London Road, Liverpool

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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 and 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.

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.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked: "Patent Advice."

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

They should be written on one side of the paper only, and **MUST** be accompanied by a stamped addressed envelope.

Queries should be asked in the form of numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the questions in the answer.)

Details of the "P.W." BLUE PRINTS are published fortnightly in the advertisement pages of "P.W."

BACK OF PANEL DIAGRAMS can be specially drawn up to suit the requirements of individual readers at the following rates: Crystal Sets, 6d.; One-Valve Sets, 6d.; One-Valve and Crystal (Reflex), 1s.; Two-Valve and Crystal (Reflex), 1s.; Three-Valve and Crystal (Reflex), 1s. 6d.; Four Valve Sets, 1s. 6d.; Multi-Valve Sets (straight Circuits), 1s. 6d. Except **SUPER-HETERODYNE DIAGRAMS**, all of which, irrespective of number of Valves used, are 2s. 6d.

If a list of point-to-point connections is required an additional fee of 1s. must be enclosed. Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.) Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1s. 6d. per diagram, and these should be large and as clear as possible.

No questions can be answered by 'phone. Remittances should be in the form of Postal Orders.

Questions and Answers

THE PROGRAMME COLLECTOR.

G. A. O. (Culter, Aberdeenshire).—"Being about to assemble the "Programme Collector," as published in your issue of Jan. 29th, I notice in Fig. 2 (theoretical diagram) that A2 is taken direct to the grid of the first valve and to one side of C4.

Should not the grid connection go to L1 instead of A2?"

Yes. The theoretical diagram should show A2 connected to C4 and to a flexible lead. The grid connection should not go to A2, but to the top end of L1.

(Continued on page 44.)

"FKCO" "THE FIRST—THE BEST—THE PICK OF THE BUNCH!"

Derives Current for Wireless Receiving Sets from Electric Supply Mains (D.C. & A.C.) by just attaching adaptor to Electric Light Lampholder!

SAFE! SILENT! SOUND!

ALL High and Low Tension troubles, mess and expense saved—by just attaching adaptor to electric light lampholder! Valves of different filament current and voltage can be used! No batteries or accumulators whatsoever required! Running costs approximately 1d. per hour! The "FKCO" Silent "Background"!!

THE SENSATION OF 1927!



"FKCO"

COMBINED H.T.—L.T.—G.B. UNIT FOR D.C. MAINS

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Price £15 : 15 : 0

ILLUSTRATED FOLDER describing the 10 "FKCO" Models for each A.C. and D.C. Mains at Prices from 42/6. POST FREE. Obtainable from all the Leading Wireless Stores or direct from:—

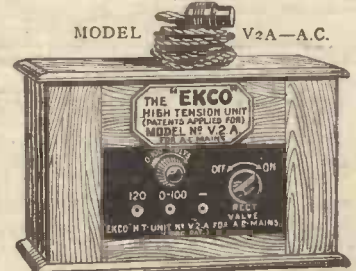
MODEL "C"

PROVIDES:

(a) H.T.—1 Variable voltage 0-100.
 1 Fixed " 0-120.
 120.

(b) L.T.—Current for any number of valves of different type or voltage on your receiver, provided each valve does not require a filament current of more than 35 amps.

(c) G.B.—Tappings at 0, 1, 3, 4, 6, 9, 12, 15, 18, 21.



Size 12" x 6" x 7"

(British Letters Patent Nos. 262567 and 148129.)

PROVIDES HIGH TENSION

1 Variable Voltage 0-100
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PRICE £7 : 15 : 0
 Royalty 12/6 extra; A.O. Model only.



Size 6" x 6" x 3 3/4"

(British Letters Patent No. 262567.)

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ONE OF 43

No. 3. Double Circuit, 3/-

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The following details are convincing proof that they are the best obtainable:—

1. Girder frame, ensuring rigidity.
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Bowyer-Lowe Jacks and the full series of 43 components produced by Bowyer-Lowe are illustrated and described in "Bowyer-Lowe Radio," 1½d. post free on request

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Sold by Test

Every Wireless Dealer cannot stock every make and type of Loud Speaker, but both they and you can obtain one of our



LOUD SPEAKERS FOR SEVEN DAYS' FREE TRIAL

without expense or obligation. Test one on your own set at home. For purity of tone, for volume, for finish and appearance there is no finer value offered.

R. Waldo Emerson, Winner of the World's Championship at the Amsterdam International Competition says:

"I should like to add my appreciation to the numerous letters you must receive regarding your 'Orphean' Loud Speaker. I must say they are more than value for money, as the volume and tone they produce are wonderful."

ASK YOUR DEALER TO GET YOU ONE.

Call his attention to this advertisement.

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ORPHEAN	
Model De Luxe.	
Height ..	24in.
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PRICE 70/-	
ORPHEAN	
Model No. 12.	
Height ..	21in.
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"almost the same as an added stage of L.F!"

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LEWCOS Inductance Coils

FOR BEST RESULTS USE W.B. ANTI-PHONIC LOW LOSS VALVE HOLDERS

PRICE With Terminals **2/3**
With Tinned Soldering Tags **2/-**

If unable to obtain from your dealer write direct.
Manufactured by **WHITELEY, BONEHAM & CO., LTD.,** Duke Street, **MANSFIELD, NOTTS.**

BECOL Makers of the ORIGINAL world-famous BECOL LOW LOSS FORMER

As used in sets that took the first four prizes at the 1926 "Manchester Evening Chronicle" Wireless Exhibition and the set that won the Gold Medal at the 1926 Amsterdam Exhibition.

Size: 3 inches diameter to outside of wings. Prices:
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Up to 36 in. lengths.

NOTICE:—Do not be put off with an imitation. Ask for BECOL and use the Former with a reputation.

Write for List "C."

Ebonite Rods, Tubes and Sheets. Panels guaranteed free from surface leakage.

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Trade enquiries especially invited.

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"ONE OF THE BEST."
Wireless Trader, Feb. 19th.



This H.T. Model de Luxe 1 (D.C. Mains) incorporates a stabilising device, allowing individual adjustment to be made to comply with the varying conditions of D.C. Mains. This feature assures a smooth silent supply hitherto unobtainable.

Three Positive Terminal Tappings are provided, and 10 different Voltages are available on each Terminal.

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**RADIOTORIAL
QUESTIONS AND ANSWERS**

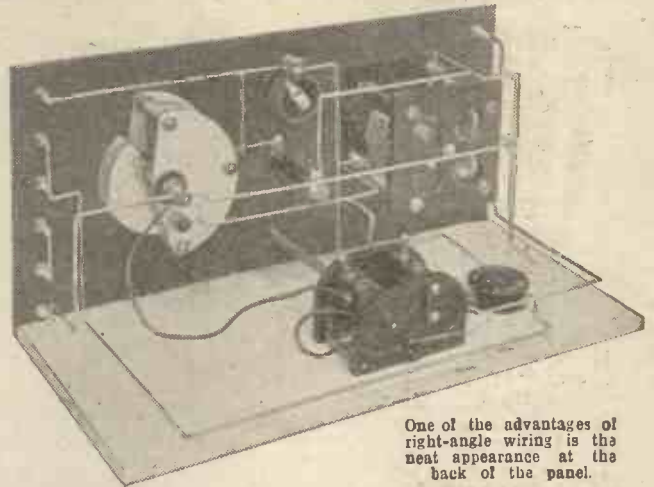
(Continued from page 42.)

RIGHT-ANGLE WIRING.

"RIGHT-ANGLE" (Valetta, Malta).—"What are the advantages of wiring with right angle bends?"

The chief advantage is the orderly appearance given to a complicated back-of-panel wiring job, when all the wiring is neatly bent at right angles. Leads are easy to trace, and the appearance of the completed set is much improved, as compared with one having wiring taken straight from point to point.

Another advantage, illustrated by the accompanying photograph, is that interaction between the wiring is reduced to a minimum owing to the fact that wires crossing close to one another do so at right angles. In this way full advantage is taken of the air-spacing between the circuits, and there is no difficulty in keeping magnetic interaction between the circuits at a minimum.



One of the advantages of right-angle wiring is the neat appearance at the back of the panel.

QUALITY OF FOREIGN STATIONS.

S. D. (Wallsend).—"Using a three-valve set (straight H.F., Det. and L.F.), I am able to rake in a lot of foreign stations upon the loud speaker, but the quality of these always seems far below that of the B.B.C. transmissions. Is this caused by the H.F. amplification, or are the transmissions abroad not so good as ours?"

Unless you have an exceptionally good set you probably introduce quite an appreciable amount of distortion in getting the signals loud enough to

listen to comfortably upon the loud speaker. Besides this, it is generally admitted that the British transmissions are of far higher quality than those of most Continental stations, owing to the tendency of the latter to over-modulate.

THOSE ALTERNATIVE PROGRAMMES

"HIGHBROW" (Beaconsfield).—"Is it correct that the B.B.C. have decided to establish

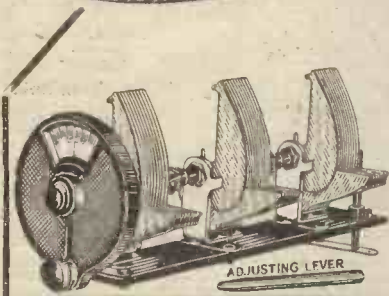
only three or four powerful stations in this country in future, each sending out a different class of programme, instead of the present system of a large number of comparatively low-power stations?"

A scheme for "regional stations," fewer in number and greater in power than the present stations, is under consideration by the B.B.C. In this connection, it is expected that test transmissions will, before long, be transmitted from a new Daventry station, working upon about 400 metres; and probably the result of these tests will largely decide future developments

(Continued on page 46.)



ONLY FORMO USERS KNOW
Quality and Efficiency with Economy



- Single Condensers 7/6
- Twin Gang ... 24/6
- Triple Gang ... 33/6
- Vernier Dials... 6/-

Crown Works,
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Telephone: 1787 HAMP.



10/6
"FORMO"
Shrouded Transformer

- Screens complete with 6 pin base .. 9/-
- Split Primary Aerial Coil 250/550 .. 5/6
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- Reinartz Coil 250/550 .. 7/6
- Mullard Rodney 250/550 9/-
- Mullard Nelson 250/550 9/-
- All types of coils in stock.

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If you wish to make wireless instruments which are unbeatable in price, quality, or efficiency, this is the book you must have. Everything about wireless is so clearly explained that any beginner can make the most efficient sets obtainable.

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are given for making Complete Crystal Sets, Single Valve Sets, One and Two-Valve Amplifiers, Dnal Amplification Sets, Two, Three and Four-Valve Tuned Anode All-Wave Receivers; also the very latest Fly-Valve Resistance Capacity Receiver. The exact cost of each set is clearly stated.

NO SOLDERING. NO DRILLING. 176 PAGES
NO KNOWLEDGE REQUIRED.

The chapter on testing wireless components is PRICE 1/3 POST FREE alone worth the price of the book.

SATISFACTION GUARANTEED.

If book is not approved of, return same post paid within seven days and your money will be refunded.

SAXON RADIO CO. (Dept. 14), SOUTH SHORE, BLACKPOOL

VALCO MAGIC!

WILL MAKE YOUR BROKEN VALVE AS GOOD AS NEW.

ALL TYPES OF VALVES REPAIRED AT HALF LIST PRICES (minimum charge 5/-).

Satisfaction Guaranteed or Money Refunded.

An unsolicited testimonial from one of our many satisfied users will appear each week.

BRIGHTON, 30/12/26—Many thanks for Valve which is working better than when it was new.—W.W.

Weco, S.P.'s and low capacity types not repairable. Minimum D.E. current 0.15 amps when repaired.

VALCO LTD., Dept. "P.W.," TABOR GROVE, WIMBLEDON, S.W.19.



NOW BUYS A BRITISH GUARANTEED VALVE

VOLTRON OPENS A WIDER MARKET NOT ON PRICE, BUT ON PERFORMANCE

VOLTRON Valves are rapidly claiming the market which has hitherto been enjoyed by the foreign valve. For the first time in the history of valve manufacture a valve of British quality and efficiency is offered at the price of the foreign article.

Valve sets immediately become available to thousands of crystal-set users who had hitherto refrained from using valves on the score of expense. Thousands more who had longed for super-efficient long-range sets are now equipping and operating multi-valve sets with Voltrons at trifling cost.

The real test of a valve is its performance, and men who know and appreciate the outstanding superiority of Voltron Valves do not hesitate to express their satisfaction.

Mr. S. Burdes, 10, Chance Street, London, E.2, writes:—

"I am writing you to express my utmost satisfaction I am having from using one of your Voltron Valves. The valve is positively non-microphonic, the volume and purity a revelation I am using a 30-ohm rheostat, but the resistance is only turned on half when full signals come through. I thank you for the production of such an excellent valve."

Remember every Voltron valve carries a printed guarantee. Please send for the technical folder—it is free.

Please state whether H.F., Det. or L.F. type required.

THERE'S ONE FOR EVERY STAGE.

Type 202	1'8—2 volt '2 amp.	5/9
LC2	1'8—2 " '06 "	7/6
LCA	3'5—4 " '06 "	7/6

DULL EMITTER POWER VALVES.

Type LS2 (P2)	1'8—2 volt	9/-
P4	3—4 "	10/9
P6	5—6 "	12/-

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VOLTRON

Building the Combine Five?

WE GUARANTEE YOU GOOD RESULTS.

If you are building a set, you cannot do better than avail yourself of the famous Pilot Service. Under this Scheme you are absolutely guaranteed success, and our Technical

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Set of 3 special interchangeable coils, 250/550 M., with 5-pin bases **15/-** the set

	Other Parts required:	£	s.	d.
5	Ormond S.L.F. Variable Condensers, .0005 mid., Friction Control Model	3	0	0
2	Keystone Neutralising Condensers, B.M.	10	0	0
2	Varley Anode Resistances, 100,000 ohms, with Holders	15	0	0
1	Varley Anode Resistance, 500,000 ohms, with Holder	17	6	0
1	Keystone H.F. Choke	8	6	0
1	Pye Telephone Transformer	1	0	0
1	Geophone 4-1 L.F. Transformer	1	2	9
1	Icronic "On and Off" Switch	1	2	6
1	Icronic Patent Rheostat, 20 ohms	2	8	0
2	Dubblier Fixed Condensers, .006 mid., Type 610	6	0	0
1	Dubblier Fixed Condenser, .01 mid., Type 610	4	0	0
1	Dubblier Fixed Condenser, .0005 mid., Type 610	2	7	8
2	T.O.G. Fixed Condensers, 1 mid.	2	7	8
1	Dubblier 2 megohm Grid Leak	2	6	6
1	Dubblier .25 megohm Grid Leak	2	6	6
5	W.B. Anti-microphonic Valve Holders	11	3	0
1	Special Tapped Resistor	7	0	0
1	Pair Peto-Scott Aluminium Anglo Brackets	2	0	0
2	Terminal Strips, 2 x 2 x 1/4", complete with two Terminals each	1	6	0
1	Terminal Strip, 7 x 2 x 1/4", complete with Terminals	3	6	0
2	Coils, Keystone Connecting Wire, Screws, Nuts, etc.	1	10	0
		£10 10 6		
1	Red Triangle Ebonite Panel, 26 x 8 x 1/2", matted and drilled	15	0	0
1	Polished Mahogany Cabinet, with Baseboard 8 1/2" deep	2	5	0

DELIVERY FROM STOCK.

If a complete kit of components is ordered, Marconal Royalties amounting to 12/6d. per valve holder are payable.

Send six penny stamps for the new edition of the "Pilot Manual." Fully illustrated, it contains details of many up-to-date Sets. Useful information on assembling, soldering and testing also included.



THE PILOT MANUAL

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Those Hard-to-Get Things.

Relays, Wheatstone Bridges, Micro-Galvos, Univ-Shunts, Res. Boxes, Thermo and Electro-static Meters, Cell Testers, Capacity Meters, all at low prices.

The DIX-ONE METER

is a beautifully finished Moving Coil instrument of wonderful precision and delicacy. Measures microamps to 20 amps, millivolts to 2,000 volts, and 50 ohms to 50 megohms. INSTRUMENT ONLY 50/-.



"VIOLINA" LOUD SPEAKERS

are elegant furniture, as delightful as a violin. Model-de-luxe hornless mahogany cabinet type for lid of set or on wall. Liquidation stock of brand-new original 5-guinea Violinas, fitted 2,000 ohm Viola reed reproducer, 25/-, packing and carriage, 5/-.

HEAR-EASY PHONE EARPADS, List Price, 2/- pr. Sale, 6d. pr. Free to Blind. Half-price to Hospitals.

SALE OF RECEIVERS by MARGONI CO. and other Leading Makers. M. Crystal Cabinets, with phones, 15/6. The Bargain of the Year. The R.H.10 1-Valve and Crystal Reflex Sets, with Osmar Valve. As new, in Cabinet, with lid, 30/- Usual price, £5. A number of 2, 3, 4, 5 and 6-Valve Sets at Bargain Prices.

TEXAS CONE LOUD SPEAKER with the Golden Voice. 3-guinea Model, bronze, for 30/-, complete with cord.

A thousand other Bargains in our Spring 4d. Catalogue.

ELECTRADIX RADIOS, 218, Upper Thames St., London, E.C.4.

USE THE TRANSFORMER THAT THE PRESS ACKNOWLEDGE TO BE "BETTER THAN MANY AT TWICE ITS PRICE."

THE SOPRANIST SHROUDED TRANSFORMER

USED WITH SATISFACTION THE WORLD OVER.

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6/- EACH

The Cheapest Transformer obtainable to-day for baseboard or panel. Guaranteed for twelve months. Made in ratios 5 to 1 and 3 to 1. Obtainable from all leading Dealers or from the Advertisers direct 6/6 post free.

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GAMBRELL

**Components
For Maximum Efficiency.**

COILS. COIL HOLDERS.
NEUTROVERNIA CONDENSERS.
SWITCHES. TRANSFORMERS.
WAVEMETERS. BUZZERS.

*Illustrated Booklets and Folders
will be sent Free on request.*

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78, VICTORIA STREET, LONDON, S.W.1.

WIRELESS.—Capable, trustworthy men with spare time who wish to substantially increase income, required where we are not fully represented. Applicants must have practical knowledge of installation of Set and Aerial, be a householder or live with parents, and be able to give references: state age and experience. Address: Dept. 10, General Radio Company, Limited, Radio House, Regent Street, London, W.1.

MAHOGANY CABINETS.

Polished, moulded, hinged lid, 8" baseboard 1" polished ebonite panel and back strips. Many testimonials. 13 x 6s, 22/6. 12 x 8, 22/6. 16 x 8, 26/6. 21 x 7.30/-. (Any size pro rata.) Also 2 Compartment Model Illustrations on application. J. H. TOOMEY, 137, Riverside Rd., Highbury, N.5. Carr. Paid.

Radiodomies

the most handsome and up-to-date terminal indicators. Keep terminals tight. All wordings. Ask your dealer for them or write for list to

MONEY HICKS & MILLS
2, Gray's Inn Road, W.C.1
and Wimbledon. Rd. Du. 716954.



Only
2d.
each

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 44.)

with the regional scheme. The new Daventry station will not, of course, interfere in any way with the working of 5 X X, which is to continue on 1,600 metres.

SHARPNESS OF TUNING.

J. D. (Edinburgh).—"What is the real definition of 'sharpness of tuning'?"

Sharpness of tuning is a measure of the rate of diminution of current in transmitters or receivers, with detuning of the circuit which is being varied.

If d_1 is the decrement of the free alternating current in the circuit; and d_2 the decrement of the exciting E.M.F., then the sharpness of tuning is arbitrarily defined as $\frac{\pi}{d_1 + d_2}$.

WHEN JAMMING BEGAN.

"OPERATOR" (Tilbury Docks, Essex).—"When was the first paid wireless message sent, and who sent it?"

Lord Kelvin sent the first paid wireless message to his friend, Sir George Stokes. It was handed in on June 3rd, 1898, when the great scientist was inspecting the newly established Marconi wireless station at the Needles, Isle of Wight.

THE 1927 TRINADYNE.

"A TRINADYNE TRINITY" (Forest Gate, London, E.).—"What sort of an H.F. choke should be used in the 1927 Trinaryne? It seems to be an H.F. choke in the theoretical diagram, but looks like a resistance in the wiring diagram and photographs."

As explained by the author in column 3 (page 1484 "P.W." No. 246), an ordinary anode resistance of 500,000 ohms is employed for the H.F. choke.

DISTORTION ON LAND LINES.

L. D. E. (Blackheath, London, S.E.3).—"Is there any fitment or gadget on the market that will help to overcome distortion due to

land-line troubles, when the B.B.C. are doing S.B. from distant stations?"

So far as we can trace, nothing of the sort is on the market. As the B.B.C. or P.O. engineers always "correct" land-lines before bringing them into use for simultaneous broadcasting, there is nothing that can be done by the listener. Distortion during S.B. work is more likely to be caused by the additional number of controls involved than by defects inherent in the land-lines.

INTERNATIONAL TIME SIGNALS.

"CRYSTAL SET" (Torquay).—"At what times, and upon what wave-length are the International Time Signals now transmitted from the Eiffel Tower?"

F.L. now sends out the International Time Signals on 2,650 metres at the following times: Morning 09.31 to 09.36 G.M.T.; Night, 10.26 to 10.30 G.M.T. (The signals are transmitted by the spark method, and should easily be received at Torquay.)

LOUD-SPEAKER EFFICIENCY.

P. G. (Chakrata, India).—"Is a loud speaker an efficient instrument, as regards its ratio of output to input? I have been told that L.F. transformers, for instance, give out nearly all the power that is put into them, but that loud speakers do not, and therefore are highly inefficient. Is this true?"

Yes, it is true that whereas transformers give back a very large percentage of their power input, all loud speakers only give a very small output, as compared with their input. In the transformer practically all the power reappears, but in the loud speaker practically all the power is lost.

BEST CONNECTING WIRE.

T. W. T. (Handsworth).—"I am making a really first-class receiver for loud-speaker work upon the local station and Daventry. What is the best and most convenient gauge of wire to use for the internal connections?"

Variations in the actual wire will have but little effect upon results, as all that is required in such a set is good conductivity and the requisite mechanical

(Continued on page 48.)

The children drink food in



BOURNVILLE COCOA

It has delicious
flavour too
and is—
food below
pre-war price

'Keep fit on Cocoa'

See the name 'Cadbury' on every piece of chocolate

ANYONE
CAN
FLUSOLDA

FLUSOLDA

THE SIMPLEST TRYING IN SOLDERING

SCRAP YOUR SOLDERING SETS



1/3
PER TIN

USE FLUSOLDA—No Mess, no Flux, no Acids, no Trouble

Just a hot iron, a smear of Flusolda, and presto!—the cleanest, neatest wireless or domestic soldering is accomplished.

ASK YOUR DEALER FOR A TIN TO-DAY

and you will see why this new fluid solder is creating a revolution in soldering methods throughout the country.

**At the Ideal Homes Exhibition, Stand No. 90, Main Gallery Hall,
we are demonstrating Flusolda. PAY US A VISIT.**

Made by the Transport Supply Co., Ltd., Warrington, Lancs.



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OF FLUSOLDA FAME

A FREE BOOK FOR CONSTRUCTORS

is given away with every copy of the
SPECIAL DOUBLE NUMBER

of

"MODERN WIRELESS."

Don't miss

Reading About

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Five"—

The Last Word

in

Five Valvers.



No one interested in wireless should miss securing a copy of the **SPECIAL DOUBLE NUMBER OF MODERN WIRELESS** (now on sale everywhere), containing unprecedented value in constructional articles. It also includes a 16-page Presentation Book fully describing the construction of the very latest in set design, The "Combine Five." This receiver is the outcome of the collaboration of practically all the leading radio set designers in the country, and each one of such recognised authorities as

- C. P. Allinson, A.M.I.R.E.
- H. J. Barton-Chapple, Wh. Sch., B.Sc. (Hon.), A.C.G.I., D.I.C., A.M.I.E.E.
- J. F. Corrigan, M.S., A.I.C.
- G. V. Dowding, Grad.I.E.E.
- C. E. Field, B.Sc.
- Percy W. Harris, M.I.R.E.
- G. P. Kendall, B.Sc.
- A. Johnson-Randall.
- J. H. T. Roberts, D.Sc., F.Inst.P.
- K. D. Rogers,

has specialised on one specific section of the receiver. The

result is a set that embodies everything that is best in up-to-date radio practice.

Among the many other receivers that are fully described in the pages of the same issue of "Modern Wireless" are The "Elfin Four," a compact and efficient long-distance loud-speaker receiver; the Reinartz Three Valver, an easily controlled and economical set capable of bringing in a large number of broadcast stations; the "Skyscraper" amplifier, a two-valve amplifier for addition to the popular receiver which appeared in the last issue of "Modern Wireless," a heterodyne wave-meter specially designed by Mr. E. J. Simmonds, M.I.R.E., F.R.S.A., the "Sparrow" Two, an easily made and efficient two valver; and an experimental crystal set that should appeal to all radio enthusiasts. Among other special articles are: "An Hour With H.F. Transformers," by Percy W. Harris, M.I.R.E., "Modern H.F. Practice," by C. P. Allinson, A.M.I.R.E., "Simplifying Wireless Calculations," by H. J. Barton-Chapple, Wh. Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E., and "Zero Beat Reception," by Capt. H. J. Round, M.I.E.E. (Chief Research Engineer of the Marconi Co.). Be sure not to miss this exceptional number of

MODERN WIRELESS

NOW ON SALE.

1/6 SPECIAL DOUBLE NUMBER.

BUY BRITISH AND EMPLOY British Labour DRY BATTERIES

"ALL RED"

— IMPROVED —
STANDARD 4½ - VOLT

PRICE

5/-

DOZ.

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PRICE

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Neatly Packed Twelve in a Box.

BRILLIANT WHITE LIGHTS.
SATISFACTION GUARANTEED.
DELIVERY BY RETURN.

Send Cash with Order and mention
name of your dealer.

ALL BATTERIES will REACH YOU
in
PERFECT CONDITION
within
48 HOURS OF MANUFACTURE
containing the
MAXIMUM AMOUNT OF ENERGY.

"ALL CLEAR"

— IMPROVED —
4½-VOLT INTERCHANGEABLE
UNITS

for Building H.T. Batteries.



Plug-in Socket on every Unit!

No Soldering Required.

PRICE

6/-

PER DOZ.

Carr. Paid in
Great Britain.

ALSO "ALL CLEAR" H.T. BATTERIES
GUARANTEED — NO CRACKLING!

60 VOLTS 7/- } Carr. Paid in
100 VOLTS 12/- } Great Britain.

Write for full Price List.

Manufactured Throughout by

THE GENERAL BATTERY CO. LTD.

47, Campbell Road, LONDON, N.4.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 46.)

strength. Round or square-section copper wire of No. 16 or 18 S.W.G. will be perfectly satisfactory.

ADDRESSES WANTED.

The following readers have submitted queries bearing either no address or an insufficient address. Will they please communicate with the Query Department, so that their replies may be despatched:

W. Wyatt.	D. W. Lang.
S. C. Stevens.	— Coldwell.
F. Bayliss.	H. B. Dowell.
H. M. Girling.	T. R. Parry.
D. Young.	J. S. Laker.
C. V. Preece.	M. J. Caton.
R. E. Ward.	A. E. Hart.
C. A. Parry.	C. M. Mansell.
S. Bryant.	A. Moore.
G. W. Strugnell.	

LOW-LOSS COILS.

V. R. B. (Dovercourt).—Is there any appreciable advantage in using a low-loss coil for the aerial tuning in an ordinary crystal set?

No. The advantages of low-loss construction are outbalanced by the heavy damping which necessarily exists in such a circuit.

AN INEXPENSIVE ONE-VALVER.

J. W. L. (Bedford).—What kind of valve and what H.T. and L.T. batteries are necessary for the "Inexpensive One-valver" described in "P.W." No. 245?

Any ordinary receiving valve may be used for this set. (See the "P.W." Valve Guide, "P.W." No. 239, and advertisements.) In the advertisements of any particular make of valve, or upon the case in which the valve is packed, will be found the maker's own recommendations as regards H.T. and L.T. to use in order to get the best results with that particular valve. These instructions should be followed, but it will be noticed that practically the valves will work well within wide H.T. limits. The 2-volt class is the most economical, both as regards first cost and upkeep.

ELECTRIC SHOCK FROM SNOW.

R. N. E. (Birkenhead).—Arriving home late one night, I went to tune in my one-valve set and received a nasty shock from touching the aerial terminal. A light snow had been falling. Is it possible that this was the cause? If so, how can I prevent it occurring again, as I should not like my wife, who frequently uses the set, to have a similar surprise?

It is quite possible for a charge to accumulate upon an aerial due to snowflakes, if the aerial is not directly connected to earth. Evidently you were using a condenser in series with your aerial coil, and the snowflakes were electrified, so each one that touched the aerial imparted a slight charge to it. Had the condenser not been there these charges would have leaked away to earth, but as it was, no path was provided for the charge until you touched the aerial terminal, and so "earthed" the aerial through your body.

You should arrange an earthing switch outside the house, so that in future electric charges are conducted straight to earth when the set is not in use.

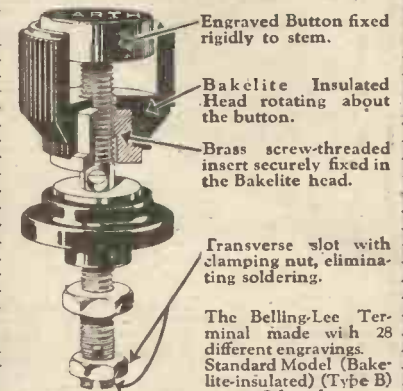
BETTER RESULTS WITH EARTH LEAD DISCONNECTED.

"A NEW READER" (Atherton, Lancs).—I am using a one-valve set, made up from the "P.W." 6d. Blue Print No. 1, and although I can hear 2 Z Y all right, I find it is much louder if I take off my earth lead. Why?

Your trouble is due to mistuning. If you have a very long aerial, try the effect of shortening it, or else use a smaller tuning coil in the aerial coil holder. If you are using the set in the "Parallel" position change it over to "Series," as instructed upon the blue print. If your earth-lead is a long one, wandering round the house before it reaches the earth-connection, try to shorten it by using a nearby earth, such as a water-pipe.

From your letter we judge that the earth connection is a very poor one, and probably results will be twice as good if you can improve it. If you have a small fixed condenser on hand, of the order of .0001 or .0002, try joining this in series with the aerial. Any one of these suggestions should effect a marked improvement.

THE HEAD DOES NOT COME OFF



The Belling-Lee Terminal made with 28 different engravings. Standard Model (Bakelite-insulated) (Type B) 9d. each.

Patent No. 248921. Popular Model (non-insulated) (Type M) 6d. each.

Regd. Design No. 715424.

Illustrated Catalogue free on request.

If you cannot get these at your dealer's, send your order to us enclosing his name and address.

BELLING-LEE TERMINALS

Belling & Lee, Ltd., Queensway Works, Poulers End, Middlesex

RADIO REGISTERED PANELS

Inches		Inches
7 x 5 1/4		6 x 6 1/4
7 x 6 1/3		8 x 5 1/2
8 x 6 1/4		9 x 6 1/7
10 x 8 2/1		11 x 8 2/3
10 x 9 2/4		12 x 8 2/3
12 x 10 3/4		12 x 9 2/10
14 x 12 4/4		14 x 10 3/5
		1/2 in. thick
		Post Free

Money back guarantee that each and all Panels are free from surface leakage. Megger test Infinity.

Callers cut any size. Quotations by post, or 'phone Clerkenwell 7853. Samples and prices post free to the Trade.

CROSSONIA CO., 10, South St., MOORGATE, E.C.2

T. W. THOMPSON & CO.

Electrical and Mechanical Engineers,
39 & 43, London St., Greenwich, S.E.10

Telephone: Greenwich 1259.

55 volt 20 amp. Crompton Dynamo, 4 pole, shunt wound, ring oil bearings, complete with pulley, £8.
55 volt 15 amp. Crompton Dynamo, 4 pole, shunt wound, ring oil bearings, £7/10.
40 volt 20 amp. Crompton Dynamo, 4 pole, shunt wound, ring oil, as new, £8/10.
30 volt 10 amp. C.A.V. Dynamo, shunt wound, ball bearings, 4 pole, £5.
25 volt 8 amp. C.A.V. Dynamo, shunt wound, 4 pole, ball bearing, £4.
50 volt 5 amp. Crompton Dynamo, shunt wound, ring oiling, £4.
110 volt 10 amp. Crompton Dynamo, shunt wound, ring oiling, £4.
65 volt 25 amp. Crompton Dynamo, 4 pole, shunt wound, ring oil bearings, complete with pulley, £7/10.
110 volt 20 amp. Verity Dynamo, 4 pole, shunt wound, ring oiling, equal to new, £10.
110 volt 15 amp. Siemens Dynamo, shunt wound, ring oiling, as new, £9.
110 volt 30 amp. Lundell Dynamo, shunt wound, ring oiling, as new, £12.
Large Stock of Starters, Shunt Regulators, etc., from 10s. each.
Special Line of Ex-Government Battery-Charging Resistances (variable) from 1 amp. to 6 amps., 110 volts and 220 volts d.c., £1 each. Cost £7.
Large variety of all machines in stock. Please write enquiries.

T. W. THOMPSON & CO.,
39-43, London St., Greenwich, S.E.10

SETS OF COMPONENT PARTS

ALL-WAVE VALVE REINARTZ. "A.W." Feb. 5 '27. Two 4 Triode Coils, 2 0003 Sq. Low Loss Variable Condensers, Igranic 3-Spring Jack, Phone Plug, Varley H.F. Choke, Lotus Valve Holder, 1g. Pac. 30-ohm B.B. Rheostat, 3 Coil B.B. Sockets, 0003, 0001 Fixed, 1-meg. Grid Leak, Dumetion Holder 3 Engraved Terminals, Tinned Copper Wire. Above Lot, 36/- Post, 1/-.

Set of Igranic Short-Wave Coils, 10/-.

M.C. THREE. "A.W." Feb. 5 '27. 2 0005 Variable Condensers, Geared or with S.M. Dials, at 16/-; 2 004 and 1 001 Fixed Dubilier at 3/-; 9/-; T.O.C. 0003, with a 2-meg. Grid Leak, 4/10; 0001 Ormond Reaction Condenser, 7/6; 3 Lotus Valve Holders, 4/6; 1 Varley H.F. Choke, 9/6; B.T.H. Transformer, 2-1 (L.F.), 17/6; 3 Resistors, 3/9; 2 Special Coils, ready for use, 4/-; 11 Belling Lee Terminals, 4/2; Terminal Strip, drilled, 1/-; Push-Pull, Benjamin, 1/6. See above lot sent, post free, £4/4/10.

M.C. THREE. Aerial & Transformer Coils wound on Paxillon Formers, ready for use, 4/- pair. Post 6d. extra. Made by Weatite.

RADIAX. Monotone Transformer with reaction, 10/6; Ditto, 1 0002/000, 12/6; 6-Pin Base (of above), 2/6.

USE THE RADIAX COIL DESIGNED FOR THE C.A.B. CIRCUIT. Get the Monotone 3 Construction Envelope, containing the most complete and explicit assembly instructions ever published. The set on test gave 60 stations—44 on Loud Speaker. It has one tuning condenser and two L.F. Stages—Real Power and Range combined in a 3-Valve Set. Its design and appearance are beautiful, and it is in every way at least a year ahead of anything previously published. Construction Envelope, 2/7 post free.

HIGH EFFICIENCY COILS AND TRANSFORMERS. All wound exactly to designer's specification, with 27/42 wire, and complete with Ebonite Supports and Base.

EVERYMAN'S THREE.—Aerial Coil, 15/-; Transformer, 16/6. Complete Set, 30/-. **EVERYMAN'S FOUR.**—Aerial Coil, 14/-; Transformer, 15/6. Complete Set, 29/-. **EVERYMAN'S FIVE.**—Aerial Coil, 12/6. 1st Transformer, 15/6. 2nd (Detector) Transformer, 16/6. Complete Set 42/-.

LEWCOX, BOWYER - LOWE, MAGNUM SCREENED COILS. AT LIST PRICES. **GAMBRELL L.F. TRANSFORMERS.** Each Stage 1, Ratio 3 to 1 25/6; Stage 2, Ratio 1 to 1 25/6.

NEUTROVERNIA CONDENSERS (Latest Model) for Panel or Baseboard Mounting, 5/6.

GAMBRELL CENTRE-TAPPED COILS. These are universal coils, their use not being limited to centre-tapped circuits.

STANDARD GAMBRELL COILS. a/2 4/10, a 4/10, A 5/1, B 1/3, B 5/6, O 5/8, D 6/3, E 1/6, E 7/9, F 8/6, G 10/-. Centre-tapped coils, 6d. extra.

GAMBRELL CENTRE-TAPPED COILS. B.P.C. 6/-; 5XX, 8/3. "TUNNEL" LOW-LOSS COILS (Tandoc Patent). Accurately calibrated. Standardised Polarity 25, 35, 50, 75, 1/6 each. 30, 40, 60, 100, 3/8 each. 150, 2/3 5XX 17s. 2/6. 200, 2/9, 250, 3/3, 300, 3/9. Post extra (5/- worth free).

TWO VALVE LODGE "N." 1 variable Con., 3-plate, 00005 mfd.; 1 Special L.F. Transformer, 2 Single Coil Holders; 1 Rheostat; Fixed Condensers, 0001; 1 variable Grid Leak; 2 Coils, 150-45/80. Components, including Silver-tone L.F., as specified, 35/-; post 1/-.

Panel and Cabinets stocked. "P.W." Blue Print No. 25.

2-VALVE REINARTZ DET. & L.F. 2 B.B. Coil Holders, 0003 Fixed Grid Leak, 2 A.M. Valve Holders, 1 Varley H.F. Choke, 1 L.F. Transformer (Igranic list Stage), 005 and 001 Fixed, 2 Terminals, 0005 and 0003 Variable Condensers, Wire, Screws, and Transfers, 1 pr. Angle Brackets. LOT SENT POST FREE FOR 55/6.

RADIO FOR THE MILLION (Mullard Receivers). FRANKLIN P.M. ROYAL P.M. WELLS P.M. GENVILLE P.M. All parts in Stock. Set of 4 Blue Prints, with Book of Instructions, Free to customers.

PARTS FOR NELSON P.M. As specified by Author. 4 A.M. Valve Holders, 2 Coil Holders, Variable Condensers, 2 0005, 2 0003 S.L.F. with 4" dial, Gambrell Neurovernium, Mullard 10,000-ohm Anode and Clips, all Fixed Condensers and Leaks, Mullard Everest 100 Ohm Stand, 1 Varley Choke, B.T.H. Transformer, P. & P. Switch, Fil. Rheo., Split Primary H.F. Transformers (long and short wave, 6 pin base), 2 Aerial Coils, and Gambrell B. & E. (secondary) centre tapped Coils.

INCLUSIVE PRICE, £24/10/0. Carriage 2/-, If with slow motion Dials, 13/6 extra. **Component Parts for FRANKLIN P.M.** (all Tests as specified), 48/-. **INCLUSIVE PRICE, 48/-.** PARTS IN STOCK FOR THE ELSTREE SIX, SOLIDYNE, MEWLEK, ELSTREELEX, 1927 FIVE AND ALL THE CHIEF CIRCUITS

Solidyne Components As specified, £10/15/6. Less Panel, Cabinet, Valves. **LITZEN WIRE** is the best for Tuning Coils, Variometers, and H.F. Transformers. Each individual strand is silk-covered with an overall covering of silk. 20 yds., 5/6; 25 yds., 6/6; 50 yds., 12/6; 60 yds., 14/6.

NEUTRALISING COILS. Peto-Scott, 5/-, 6/3, 7/6. Ormond, 4/-. Bowyer-Lowe, 7/-. Magnum, 5/- Service, 2/6, 3/6. McMichael, 2/6. Reaction (Ormond) 0001, 4/-.

SCREENED COILS, Etc. COLVERN R.P. TYPE FORMER Diameter 2 1/2" Height 2 1/2" Broadest with Base...5/6 Long Wave with Base...5/6 6-Pin Base...1/6 Former only Plain Ribs...4/6 Dotted Threaded Ribs...4/6 Long Wave Threaded...4/6

COLVERN FEATHER WEIGHT FORMER Diameter 2 1/2" Height 3" Former with Base...6/6 6-Pin Base...1/6 Former only...4/6

PRICES OF WOUND H.F. TRANSFORMERS B.B.C. Waveband...9/6 30, 40, 60, 100, 3/8 each. Long Waveband...2/6 Screens and Base...8/6 Aerial Coil...5/6 Reinartz Coil...9/6

RADIAXO THREE (Wireless Constructor, March, 1927).

All parts as specified with
2 Ormond S.L. Variable... 29/6
3 Coil Sockets... 5/3
T.C.C. 0003 and Clips & 2-meg. Leaks... 5/10
3 Benjamin Valve Holders... 8/3
3 Fixed Resistors & Bases... 7/6
On & Switch... 1/6
Geophone 1st Stage L.F... 24/-
Brandes 2nd Stage L.F. 17/6
Engraved Strip, with Terminals & Nuts... 3/6
2 B.L. Terminals for Front Panel... 1/6
4 Gross Pinch-on Spades 1/-
Quantity Rubber Flex 6d.
LOT SENT POST FREE £4/15/0.

EDISWAN R.C. THREESOME Set of Parts: 2 Units, 7/- ea.; 2 Pair Valve, 18/6; 2 R.C.2. at 14/-; 3 Lotus V.H. 2/6; 2 Rheostats at 2/8; 9-v. Grid Bias, 2/-; Lotus 2-way L.H., 7/-; 0003 Tuning Condenser, 8/11. The lot, post free, £3 18s. 6d. With cheaper (but good) rheostat, valve holder and 2-way. The above lot, 72/6.

"A.W. BALLOT THREE" By J. H. Reyner, A.M.I.E.E. Suppliers, Feb. 19 '27. LIST OF COMPONENTS: 1 0005 S.L.F. Variable Condenser (Ormond); 1 Slow Motion Dial; 1 Vernier Condenser, panel mounting (Ormond); 1 Filament Rheostat, 25 ohms (Igranic); 1 Two-pole Change-over Switch, lever pattern (Wilkins & Wright); 1 On-and-Off Switch (Benjamin); 2 L.F. Intervalve Transformers (C.A.V. All Purpose); 2 Valve Holders (Benjamin or Lotus); 1 Valve Holder, with 0003 grid condenser and 2-meg. Leak (Benjamin); 2 Fixed Resistors to suit valves (Burne Jones); 1 0001 Fixed Condenser (Dubilier); 1 H.F. Choke (R.I.); 4 Terminals, Marked, Aerial, Earth, L.S.; 1 Terminal Strip carrying seven terminals; Wires, Screws, etc. THE ABOVE AS SPECIFIED SENT POST FREE FOR £4 6s. CAN ALSO SUPPLY WITH SLIGHTLY LESS EXPENSIVE COMPONENTS (including CAV Transformer) for the same at 75/-.

CABINETS. Large stocks of really useful Cabinets kept, or made to order. Solid oak. Glass finish. American type, hinged lid. Baseboard. 8" x 6" x 8" deep...6/11 (By post, 8/3). 10" x 8" x 8" deep...8/11 (By post, 10/3). 12" x 8" x 8" deep...10/6 (By post, 12/6). 14" x 7" x 7" deep...12/6 (By post, 14/6). 16" x 8" x 7" deep...16/11 (By post, 18/11).

MAGNUM. Neutralising Condenser, 5/-; Single Coil Mount on Base, 1/9. Aperiodic H.F., 10/-; B.B.C. or SXY H.F. Transformers, 7/- each.

MAGNUM RAZOR-SHARP WAVEMETER. As described by Mr. J. H. Reyner in R.P. Envelope, No. 14. Complete set of parts including coils covering 180-2,000 metres, £4/4. The instrument, ready wired and tested, £5.

Coils can be supplied as follows: No. 1: 80-200 metres, 10/-; No. 2: Coil, 600-2,000 metres, 10/-; 3-Pin Coil Mount, with brackets, 4/-.

EIGHT COILS IN ONE BLUE SPOT MULTI-PLYNE. All-wave lengths covered 160 to 4300 metres. For use with either valve or crystal sets, as primary or secondary or reaction coil. Its selectivity is amazing—no dead-end effects, coils not in use shorted and entirely out of the circuit. Price 13/6.

Slow Motion Dials: "Pilot Kilograd," 4/3. Burton, 4/11. "American," 4/3. **CRYSTAL AND ONE VALVE AMPLIFIER (L.F.),** in handsome polished cabinet, tested for use, 22/6. Post 1/6. (With D.E. Valve, 30/-). Or Complete Set, with H.T., L.T., aerial Equipment, 5XX coil, 45/11. Post 2/-. Extraordinary Offer.

ASTOUNDING 2-Valve AMPLIFIER IN L.F. amplifier in handsome handsome with valves, polished box. H.T. and L.T. 1 valve, 18/11. Units, 44/6. Carriage 2/-.

ALL CIRCUITS, PARTS, COILS AND SETS STOCKED. HEADPHONES, all 4,000 ohms. N and K Standard Pattern, 7/11 pair. N and K Genalac new lightweight, 11/6, 13/6, Dr. Nesper, 10/6 and 12/11. Teufelchen, adjustable genuine (20/- model), 14/11. Brunet, 1/5, 2/9, 1/5, 15/8, 3 models. ERICSSON (Continental) E.V., 7/11 pair. (Post 6d.).

B.P.T.H. HEADPHONES.—Brow's Featherweight, 20/-; B.T.H.'s A Type (Sterling), 30/-; B.T.H.'s 15/-; Sterling, 20/-; VALVES.—Cosmos S.P. 18, Red or Green, 14/-; New Blue Spot, 14/-; All Mullard, Ediswan, Osram, Marconi, Coscor, Bright D.E. and Power, 8/-, 14/-, 15/8, 2/8, 2/6, 30/-, 22. Mullard BM 1, 2, 3, 4, 5, 6, 8.

ORMOND SQUARE LAW LOW LOSS. 0003, 9/6; 0005, 9/6; 0001, 11/6 each less no vernier; Friction Geared, 0005, 15/-; 0003, 14/6; 00025, 13/6. Straight Line Frequency Friction Geared, 0003, 19/8. S.L.F., 0005, 12/-; 00025, 11/-; S.Q. LAW LOW-LOSS. DUAL, 0005, for Elctree Six, 18/- each. Ormond Friction Dial, 2 Filament Rheostats, 18/6; 2/8; 6 ohms or 30 ohms, 2/-; Potentiometer, 400 ohms, 3/6. L.F. Shrouded, latest model, 15/-.

GANG DUAL 0005. ORMOND, with dial .. 32/- CYLOND, no dial .. 50/- ORMOND, with dial .. 40/- CYLOND, no dial .. 70/- IGRANIC, no dial .. 75/- BOWYER-LOWE, no dial 70/-

IGRANIC TRIPLE HONEY COMB INDUCTION COILS. 60, 8/2; 70, 9/8; 100, 2/9; 150, 3/9; 200, 4/-; 250, 4/6; 300, 4/9; 400, 5/6; 500, 7/-; 700, 9/6; 1,250, 14/-; 1,500, 16/-.

ALL PARTS STOCKED. **S.T. VALVES** RESISTOR PANELS. RADIO MICRO (Guaranteed genuine) 3.5-v. 06-8, G.F. .. 5/11 1.8-v. 2-a. G.P. .. 5/11 3.5-v. 3-a. Power .. 8/8 3.5-v. 1-a. .. 8/6 1.8-v. 2-a. .. 10/6 Post 1/- each per valve.

WEST END DEPOT FOR "MAGNUM" (Burne-Jones) SEE K. RAYMOND'S NAME ON PREMISES. THIS WILL ASSURE YOU GETTING THE GOODS I ADVERTISE. PLEASE ASK: "IS THIS K. RAYMOND'S?"

L.F. TRANSFORMERS. Ferranti A.F.3, 25/-; A.F.4, 17/6; Eureka Concert, 25/-; 2nd Stage, 21/-; Baby 1st or 2nd, 15/-; Reflex, 15/-; Formo shrouded, 10/6; Success (Black), 21/-; Royal 20/-; Ormond newest model, 15/6; Water's Supra, 10/6; Crook, 5/-, 3-1, 4/6; Marconi, 10/6; Ideal, at stages, 25/- each; C.A.V., 15/-; Pye, 22/6; Gambrell, 2 stages, 25/6; Ideal Junior, 18/6; R.I., 25/-; Multi-Ratio, 25/-.

World's Most Wonderful "WYRAY" Crystal The Crystal with the Power of a Valve.

00005 Vernier for Lodge N Circuit, 3/11; Formo Tuning Gang, 4/-; 4" Dial, 24/6; Ditto, Triple Gang, 33/6; Formo Plugs, 1/6. All Jacks stocked. All Mullard components, McMichael new H.F. Choke, 9/-; 3-way Geared Coil (Standard), 6/6. R.I. Choke (H.F.), 12/6; Cosmos H.F. Choke 6/6; B.T.H. L.F. Transformer, 2-1, 4/-; 4-1, 17/6; Igranic Preset Resistor, 6, 10, 30 ohms, 1/6. Rodney P.M. Magnetic Reaction Coil, B.B.C., 9/6.

KAYRAY S.L.F. CONDENSERS

With handsome 4" TRIODINE 7/6 dial and knob. By Post 7/11. LOW LOSS SQUARE LAW. This variable Condenser is simply marvellous value. It cannot be equalled in price or quality. 0003 .. 4/11 each 0005 .. 5/11 With VERNIER 1/- extra.

THIS MAGNIFICENT 2-VALVE SET (D. and L.F.) as shown, in Handsome American Type Cabinet, 12 by 8 Panel. ALL PARTS ENCLOSED. Complete with 2 Dual Emitter Valves, Tandoc latest Coils, L.T. and H.T. Batteries, Aerial Equipment, 4-way Leaks, 4,000 ohm Phones, OR Lissensola, OR Loud Speaker. Marconi Fax Pack, 5/- Carriage and Packing, 5/-

PETO-SCOTT COPEX "POPULAR MODEL" Copper Coil Screen and Base. This screen and base is made from high-grade copper—the best metal for screening coils. Terminals are arranged in such a manner that it is impossible to "short" them when replacing screen. Perfect electrical and self-cleaning contact. Screen and interchangeable 6-pin base, 9/6. (Patent No. 259459) Keystone Neutralising and Balancing Condensers. Board mounting, 5/-; Panel mounting, 6/3. Balancing with 2 sets of fixed vanes, 7/6.

VARLEY BI-DUPLEX WIRE-WOUND TAPPED RESISTANCES. 10,000 ohms, 4 Tappings, 15/-; 150,000 ohms, 6 Tappings, 19/6. Varley Bi-Duplex Wire-Wound Resistances are made in a complete range of sizes up to 500,000 ohms, prices from 4/- to 16/-.

THE Varley Multi-cellular H.F. Choke, complete, 9/6. The Varley Multi-cellular H.F. Choke for circuits of the Split Coil type, complete, 12/6.

COLVERN COILS. BASES AND SCREENS. FINSTON SCREENED COILS. B.B.C. Aerial Coil, 5/6. Split Primary H.F. Transformer, with reaction, 7/6. SS. H.F.T., 7/6. Reinartz 7/6. 5XX above, 5/6. 7/6, 11/-, Screen and 6-pin Base, 9/-; Finston Monodial Coils 9/- each. SS. H.F.T., all British Six, 10/6 each B.B.C., 14/6 each 5XX.

SPECIALS. 00005 Vernier for Lodge N Circuit, 3/11; Formo Tuning Gang, 4/-; 4" Dial, 24/6; Ditto, Triple Gang, 33/6; Formo Plugs, 1/6. All Jacks stocked. All Mullard components, McMichael new H.F. Choke, 9/-; 3-way Geared Coil (Standard), 6/6. R.I. Choke (H.F.), 12/6; Cosmos H.F. Choke 6/6; B.T.H. L.F. Transformer, 2-1, 4/-; 4-1, 17/6; Igranic Preset Resistor, 6, 10, 30 ohms, 1/6. Rodney P.M. Magnetic Reaction Coil, B.B.C., 9/6.

CALLER'S COLUMN NOT SENT BY POST.

EBONITE GRADE A. Stock sizes, 6 x 6 and 7 x 5, 1/3; 8 x 6, 1/8; 9 x 6, 1/9; 10 x 8, 2/8; 12 x 6, 2/8; 12 x 8, 3/8; 12 x 9, 4/-; 14 x 7, 4/6. ALSO CUT CUBES 3/6 sizes while you wait at 1d. per sq. inch for 5/10th; and 4d. each for 1 in. Special cheap panels for Crystal Sets.

H.T. BATTERIES. All kinds of rubbish on the market, so buy here where only guaranteed and reputable makes sold. Adico, Polo (highest test awards), 60-v., 6/11; 100-v., 12/11. Dr. Nesper (the name is enough), 60-v., 7/11; 100-v., 13/6. For those that want a cheaper but still reliable, H.T., try the "K.K." 60-v., 5/11; 100-v., 10/11. Ever-ready, Siemens's stockers, 2 1/2, 2 1/2, Adico, 1/8. Hellesla 2/3; Hellesla 2/8. Hellesla 4, 1/6; Super L.T., 10/6 (and worth it!). H.T. 66-v., 12/8; 99-v., 21/-; Flash lamp, 4s.

Adico 4/6 doz., 6d. British 5/- doz.; Dr. Nesper, 4/8 doz. CABINETS.—American type, solid polished hinged lid and baseboard. 8 in. x 6 in. x 7 in. deep, 6/11; 10 in. x 8 in. x 8 in., 8/11; 12 in. x 8 in. x 8 in., 10/6 and 12/6; 14 in. x 7 in., 13/6; 16 in. x 14 in., 16/11. Any size made to order in a few days.

HEADPHONE CORDS. Good quality, 1/8, 1/6, 2/6. 50 Station Cords, 2/6. 100 Station Cords, 2/6. 200 Station Cords, 2/6. 7-way, 3/6. 10-way, 4/6. 12-way, 5/6. GEARED COIL STANDS. 2-way, 2/3, 2/6, 2/11. 3-way, grand value, 5/11. All Back of panel, 2/11. All ebonite and best quality. Only needs sealing. Penton, Newey G.E.C. Lotus, Polar stocked. AERIALS.—100 ft. 7/22 Hard drawn, 1/11. Extra heavy, 2/2. Phosphor 40 strands, 1/2; Electro-steel, Special INDOOR Aerials, phosphor, with ebonite separators and rubber rings (12 ft. x 8 strands), total 100 ft., 4/6. O.V., 2/6. Rubber Lead-in, high quality, 10 yds., 1/6; 10 yds., 1/3; 10 yds., 1/6. Extra heavy, 2d. and 3d. yd. R. & B. Twin Flex (best), 6 yds., 10d.; 12 yds., 1/6; 36 yds., 4/-; Ins. Hooks, 10 for 1d.; Egg Insulators, 10 for 1d.; Ins. Staples, 4 a 1d.; Earth Tubes, Copper, extra value, 2/8. Climax, 5/- (also at 2/6).

WITCHES.—On porcelain SPDT, 1/3; SPDT, 1/-; 0-1d. Superior articles, Nickel, Panel Ebonite handle, DPDT, 1/6. SPDT, 1/-; Push and Pull, 3/1d and 1/- All Lissens stocked. REMAINS, Etc.—Nickel W.O. Phone, PHAR, 1/- doz.; 3 for 4d. Brass doz., 10d. doz.; 1d. each. Nickel Valve Legs, 2 for 1d. Stop Pins, 2 a 1d. Spade Tags, 6 a 1d. Soldering, 3d. doz. Ormond coils, 2d. doz. Washers, 12 a 1d. 2 and 4 B.A. Rod, 3d. ft. Only the best sold here. Screw Spades, 3 for 1d. Pins doz. Valve Pins, 1/3. Service Menu.

PERMANENT DETECTORS.—Alberty, 3/8. Red Diamond (a taper), 2/-; Lion Micro, latest cannot be equalled, 2/6. Browns, 3/-; Enclosed Kay Ray, 1/-; 2/3. Crystal, 29, Burne-Jones 4/-, Mic Met, 4/6.

RED & BLACK WANDER PLUGS, 2d. and 3d. pr. Spades, 3d. pr. Pins, 2d. pr. Plug, 3 Socket, 3d. Six Wander Plug, 2d. Igranic, 3d.

COIL PLUGS.—Ebonite on Base, 6/4d., 7/6. Lotus 8d. Burne-Jones, 1/9. Low Loss, 8/1d. Panel, 6/4d. Various stocked.

CALL HERE FOR LISSEN, B. WILKINSON, RADIO-MICRO, COSMOS, MULLARD, EDISWAN, MARCONI, COSCOR, OSRAM, JACKSON'S (J. B.), DUBILIER, McMICHAEL, SUCCESS, BEARD & BOWYER-LOWE, LEWCOX, IGRANIC, EUREKA, ORMOND, UTILITY, FORMO, EDISON-BELL, FERRANTI, R.I., POLAR, NEWNEY, P. & M., MAGNUM. WE HAVE THE GOOD CALL AND SEE THE ALL LINES IN DEMAND STOCKED. SPECIAL TERMS RADIO OLDS, GENUINE EXPERIMENTERS. BE SURE YOU ARE AT RAYMOND'S

PLEASE MAKE OUT YOUR LIST FOR ORDERS OVER 20/- IF REQUIRING COMPONENT PARTS FOR ANY SET AND WE WILL GIVE YOU A FIXED INCLUSIVE PRICE.

K. RAYMOND 27 & 28a, LISLE STREET, LEICESTER SQUARE, W.G.2

HOURS .. 9.15 to 7.45 **Back of Daly's Theatre.**
SATURDAY .. 9 to 8.45 **Nearest Tube, Leicester Square.**
SUNDAY .. 11 to 1 **Phone: Gerrard 4637.**

CORRESPONDENCE.

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.

DX ON A TWO-VALVER.

The Editor, POPULAR WIRELESS.
Dear Sir,—I think it might interest some of your readers to learn that, using a two-valve Reinartz, 0-V-1, I have logged exactly 100 telephony stations in the past fortnight, including WJY, WYG, CKCL, WBG, KDKA, Moscow, Plymouth, Prague (on loud speaker), etc. I think this must be very nearly a record. I wonder if any of your readers could beat it. The set itself is a two-valve version of the set described in "Wireless" as "30-3,000 on a 3-valve set." Only very best components have been used, with a large and high aerial and a good earth. I have previously tested almost every type of set, including a 7-valve Super Het., but for sheer DX this set wins. Incidentally, it carries two more L.F.s (transformer coupled, 0-V-3), with which it seems to get almost anywhere on the loud speaker. It cuts out Manchester at 13 miles, and gets London or Hamburg, only 10 miles different. In conclusion I am most satisfied, and may I take this opportunity to wish your new "Combine" the best of luck.

Yours sincerely,
JOHN H. FELL.

"Hazlemere, Knutsford, Cheshire."

WET H.T. BATTERIES.

The Editor, POPULAR WIRELESS.
Dear Sir,—We are much interested in the very practical article in "P.W." on wet H.T. batteries. As actual manufacturers of this type of battery, we would like to give you some of our experience regarding them.

We find it more satisfactory to paint the jars and connections with a non-metallic paint, as paraffin wax tends to crack after a time, allowing "creeping" of the salts.

Your correspondent suggests having a tight-fitting lid to prevent evaporation. We would remind him that a small quantity of ammonia gas is liberated from the solution. Although this is not sufficient to become unpleasant, there is always the likelihood of this attacking the lid, unless sufficient ventilation is provided.

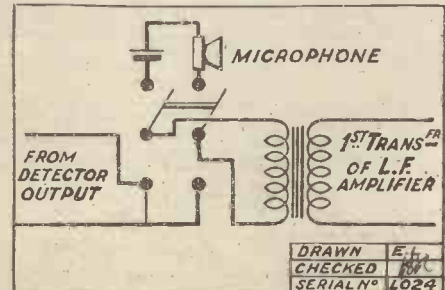
We find a strength of solution of 4 to 6 oz. of sal ammoniac per gallon of water to be the most satisfactory.

Yours faithfully,
THE "TROMBA" ELECTRICAL CO.
17, White Hart Lane, (J. PRICE.)
Tottenham, London, N.17.

AN INTERESTING EXPERIMENT.

The Editor, POPULAR WIRELESS.
Dear Sir,—It was with great pleasure and interest that I read your article in the Christmas number of "P.W." on "Radio Hints for Christmas Parties." Now this is how I carried it out.

My wireless receiver is a five-valver, available as 1-v-1, 2-v-1, 1-v-2, and 2-v-2 all on one panel. I have no spare L.F. amplifier, and only one loud



DRAWN BY E.H.
CHECKED BY J.C.
SERIAL NO. 1024

speaker; so, in convenient places on the panel, I mounted a D.P.D.T. switch and two terminals, and wired up as per diagram above.

Then, with the aid of one dry cell and the microphone of an ordinary house telephone which I had by me, I was able to carry out a "local broadcast" stunt with the greatest success. But the best of it is that I can break into any programme or announcement at any moment, have my fun, and then back to wireless proper, by just throwing over this switch. Only a little imagination is required to see what fun may be had when friends are visiting, not only at Christmas-time, but all the year round.

Yours faithfully,
JAMES H. GREGORY.

2, New Street, Matlock.



The 'PEERLESS' Junior RHEOSTAT

Sales now over 1/2 MILLION

Study the life of your valves and fit only the components that will function properly. In the "Peerless" Junior Rheostat are found features which make it exceedingly popular—its sales figures are now well over the half million. This Rheostat has an OFF position provided, while definite stops make short circuit impossible. The resistance element is immune from damage. Will safely carry current of two valves.

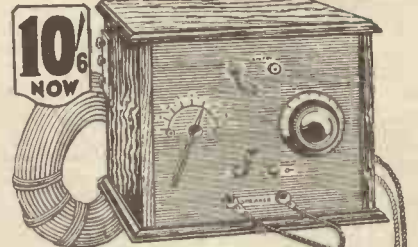
Complete with nickelled dial and one hole fixing. Three types. Size, 1 1/2" dia. 4" high, 6, 15 or 30 ohms.

2/6

From all dealers or direct

The Bedford Electrical & Radio Co Ltd
22, Campbell Road, Bedford.

GRAVES 2-VALVE LOUD SPEAKER BARGAIN.



This highly efficient 2-Valve Loud-Speaker Set is the finest wireless value ever offered.

It gives a volume and quality of tone unattained by any instrument of a similar price and is the essence of simplicity. Fitted with coils covering all the British wave-lengths, including Daventry.

THE CABINET is of beautifully polished Oak, & all components are of the highest quality. Dual Emitter Valves with patent valve holders, 60-volt H.T. Battery, 2-volt accumulator and complete Aerial Outfit, LOUD SPEAKER of exclusive design with unique magnetic system and improved mica diaphragm. Price £7:17:6

TERMS: Our Bargain Price is for deferred payments. Send 10/6 now, & complete purchase in 11 monthly payments of 10/6. If you wish to pay cash, 5 per cent discount is allowed Catalogue Post Free. Up-to-date Crystal & Valve sets at keenest prices. J. G. Graves Ltd. Sheffield

Fullest Approval

Of proved efficiency



LECLANCHE POROUS POTS.

Genuine miniature porous pots for Wet H.T. to fit 2 1/2 x 1 1/4 Jar, registering 1-4 volts; 3/- per doz. Non-conductive Glass Jars, 1/- doz. Waxed, 1/3 per doz. Sacs 1/6 doz. Zincs 1/- doz. Send 1/4d. stamp for Price List and Instructions. Carriage and Packing extra.

Trade Inquiries:
THE ETON GLASS BATTERY CO.,
(Dept. P), 46, St. Mary's Road, E.10.

HEADPHONES 3/9 ONLY

We have only 400 pairs of these 'phones left; they are ALL BRITISH manufacture, light aluminium headbands, 4,000 ohms, 7 feet cords, and were made specially for broadcast reception. Every pair brand new and tested before despatch. These are to be cleared at the exceptionally low price of 3/9 post paid. Write now and secure your pair, as this offer cannot be repeated.

C. WILDE, WIRELESS DEALER,
WILLESBOROUGH, ASHFORD, KENT.
Write for particulars of the Ranger Two 2-valve wireless set, at £6 15s. Od. complete.

VALVES, BATTERIES

RADIO MICRO D.E. 3-v. .06 S/S. RADIO MICRO BIVOLT 2-v. .2, 7/6. FRELAT Type K. 2-v. .3 amp. 4/11 each. FRELAT Type D.K.P. 2-v. .3. Power, 3/6 each. SILVER STAR. 4-v. .06, 7/- each. TRIOTRON 2-v. .2 amp. 5/- each. TRIOTRON Power 3-v. .1 amp. 7/6 each. HIGH TENSION BATTERIES, 60-v., guaranteed 3 months, 5-volt tapping, 7/- each.

ALL GOODS SENT POST FREE. TRADE INQUIRIES INVITED. WRITE FOR TRADE LISTS.
W. SEGAL, 53, Russell St., London, E.1.

CABINETS!

Write for Illustrated Price List of Cabinets. Let us quote you for your own designs and sizes.
F. DIGBY, 9, BANBURY ROAD, SOUTH HACKNEY, E.9.

ACCUMULATORS ON EASY PAYMENTS

High-Tension Accumulators built up from 20-volt sections (15/- each). Example: 60-volt H.T. 45/- CASH, or 12/6 DOWN and 6 monthly payments of 6/- Carriage Paid. Satisfaction or money back. Write for Lists to DEPT. 11, COVENTRY DIRECT SUPPLIES LTD., 23 Warwick Row, COVENTRY. Any Wireless Goods supplied on easy payments.

TECHNICAL NOTES.

(Continued from page 16.)

Tracing Troubles.

Reverting to the subject of crackling noises in the set, the commonest cause is either a decrepit or faulty H.T. battery, or a bad contact, probably in one of the valve-sockets. Occasionally it will be found that the filament of a valve may be sagging and touching the grid, but this is very much less likely to be the cause of trouble than the two causes just mentioned. The commonest cause of all is a bad H.T. battery, and if trouble arises due to this, the cells should be carefully gone over with a low-voltage (but high-resistance) volt-meter, in order to discover the whereabouts of the faulty cells. If a battery is only beginning to give trouble in this respect, the evil day may be to some extent put off by shunting a large-capacity condenser—say, two microfarads or more—across the highest H.T. tapping.

DRY OR WET H.T.?

(Continued from page 10.)

Where two or more stages of L.F. amplification are used, and especially if a high magnification per stage is aimed at, the accumulator H.T. battery will probably give more satisfactory working than one made up of primary cells.

It may be said that the accumulator battery is inherently quieter than the primary. In each Leclanché cell, wet or dry, hydrogen bubbles are continually forming round the positive element when the cell is under load. If unchecked these would rapidly polarise the cell and put it out of action for some time; actually the depolariser, which consists of manganese dioxide, keeps them within bounds. A subsidiary chemical action takes place within the cell, the hydrogen combining with the manganese dioxide to form manganese and water. Though on the whole the hydrogen is effectively dealt with by the depolariser, bubbles do form round the carbon electrode, causing small fluctuations in the resistance of the cell. There is thus a very slight wavering in the output which may cause tiny sounds to be heard in the telephones.

To sum up, the best advice that one can give to those in doubt upon the H.T. battery question, is this: Whatever type you decide upon, do not go in for anything cheap; either accumulators or primary batteries should be made up of robust solid cells of good size. If you want a battery requiring the minimum of attention, and if you do not strive after a very high degree of amplification in your L.F. stages, then you will probably find that the dry battery will best meet your needs. If you do not mind taking a little trouble over your H.T. unit, but have no facilities for accumulator charging, then the sac-Leclanché will be the wisest choice.

Where complete stability and the greatest possible silence are required with a large receiving set incorporating two or more note-magnifying stages, the accumulator battery will in most cases be found the best; do not, however, install such a battery unless you can charge it yourself or can rely absolutely upon the charging station to which you entrust it.

High Tension 60 volt 3 a.h.

SIZE OF PURE LEAD PLATES ONLY TWO INCHES SQUARE. When fully charged gives the extraordinary and Guaranteed Capacity of a 3 a.h. actual.

World's record for Lowest Price. Minimum Weight, Portability, compactness. Glass Containers individually rubber insulated and all stand on a rubber mat. Ideal for Hot Climates and can be sent Overseas with first free partial charge without Acid.

TUNGSTONE PATENTED CELL CONNECTOR

NOT USING WOOD SEPARATORS and having Machine-Pasted Pure lead Plates thicker and heavier than usual, it produces extraordinary electrical results. Negligible internal resistance; no frothing or foaming, crackling or parasitical noises in Wireless Phones or Loud Speaker. No self-discharge. No abrupt voltage drop. Tungstone 60 volt is more efficient than 100 volt Dry Battery. Tungstone Plates will last years and can be replaced at small cost. Other parts indestructible. The perfection of reproduction is confirmed by many wireless specialists.

Charging High Tension on Low Tension Charging Plant.

All H.T. Tungstone Accumulators are fitted with a Patent Equipment whereby each series of 12 Volts can be coupled in parallel so that these H.T. Batteries of whatever voltage can be charged at local Garages and Charging Stations on a 12-16 Volt Low Tension Charging Plant.

Charging Terminals are provided on the front of the Cabinet arranged in two rows, the top row being Positive and the bottom row Negative. When in use these charging terminals are connected in pairs so that all cells are in Series.

TUNGSTONE High Tension 60 Volt Battery 3 a.h. is sold in the United Kingdom on monthly payments over extended period. Apply for particulars. Further interesting information on points of this advertisement are to be found on pages 58, 59, and 67 to 73 of the Illustrated Booklet "Photography tells the Story" which will be sent free on application to the— T.A.44

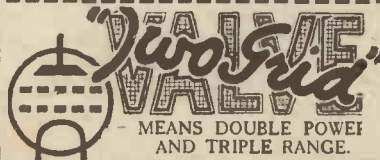
TUNGSTONE ACCUMULATOR CO., LTD.,

St. Bride's House, Salisbury Square, Fleet Street, London, E.C.4

HEADPHONES REPAIRED

Re-wound and re-magnetised 5/- per pair. Loud Speakers repaired 5/-. Transformers re-wound 5/- each. All work guaranteed and tested before delivery. Write for Trade Prices. Phone: Clerk. 1795. MASON & CO., 44, East Rd., City Rd., N.1

WET BATTERY PARTS DIRECT TO PUBLIC STANDARD SACKS, 1/- per dozen; TREBLE CAPACITY SACKS, 1/8 per dozen; ZINCS (Connected) 9d. per dozen. Orders above 5/- post free. Samples 6d. DIRECT BATTERY CO., Bellvue Avenue, Bellvue Road, LEEDS.



The Dempsey-Tunney Fight on ONE "TWO GRID" VALVE, and confirmation from the American station, Full programmes from KDKA and WGY on TWO "TWO GRID" TETRODES. Send card for these and other testimonials, also Radio Press reports and details of new Tetrode Power Valve. 50 to 100 per cent. INCREASE IN POWER AND RANGE OF ALL SETS, WHETHER H.T. or H.T.-LESS. NO ALTERATION NECESSARY. NO EXTRA BATTERIES. ANELOY PRODUCTS. ETON WORKS, EAST DULWICH, S.E.22.

60-VOLT BRITISH MADE H.T. BATTERIES 5/6

(Part Postage 6d.)

These are made from best materials, under new process, and every battery is guaranteed made within a week from date of sale. We hold many testimonials for these batteries after 9 and 10 months' usage.

H. & H. BATTERIES, 225, Green Street, Bethnal Green, London, E.2.

WIRELESS WAREHOUSE

Buy your Wireless parts direct from the Warehouse at Warehouse prices.

Every known component in stock.

Write NOW for list.

BUSH HOUSE, 35, Shudehill, MANCHESTER

BUY HYDRA CONDENSERS.

You will be amazed by the quiet working of your set. Its job is to absorb all crackling noises that arise out of the H.T. Battery when it is getting old. We ought to know how to make a condenser. We have been 20 years at it. In building an eliminator you must use a Hydra Condenser.

Tested on 500 volts, and guaranteed not to vary more than 5 or 10 per cent. from rated capacity. Obtainable up to 10 mfd.



Full details and prices of a mfd. direct from—

Louis Holzman
109 KINGSWAY LONDON W.C.2 TEL. HOLBORNS 6209

THE "H.D.L." THREE.

(Continued from page 15.)

should be inserted in the first valve holder, one designed for detecting in the second, and a good L.F. power valve in the third.

It will have been noticed that a grid bias battery is held in position by metal clips inside the receiver itself, and this battery should have a voltage of not less than 4½ to 9 volts, especially if a power valve of the 6-volt type is to be used in the last stage. In the photographs it will be seen that a P.M.3 is in the first stage, a Cleartron detector in the second, and a P.M.4 in the last, while a grid bias of 4½ volts was found necessary. On test such valves as the B.4 and the D.E.5 series were found to give excellent results, though the bias had to be increased to 6 volts if the H.T. on the last valve exceeded 72 volts. For extra volume the H.T. can be carried up to 120 volts with advantage on the last stage, but it should not exceed 60 to 70 on the other two stages.

Results Obtained.

It is the question of valves which decided that dotted connection between earth and the filament battery, so that on testing out the set with the valves chosen by the constructor he should try first the earth joined to L.T. — and then earth to L.T. + to see which gives him the best results. It may be found that the set is a little unstable when the earth is joined to L.T. — if certain valves are used in the H.F. position. Such was the case, for instance, when the B.4 was employed.

The operation of the set is exceedingly simple, the two tuners being set with their switches on corresponding studs, the rest of the tuning being done by means of the variable condensers. Reaction control will be found to be smooth yet certain on all wave-lengths, but it must not be forgotten that when the H.F. valve is switched out (H.F. switch pulled outwards) the reaction control will operate in a reverse manner from that when the H.F. valve is being used, and, furthermore, the rheostat controlling this valve should be turned off when the valve is not being used.

Results obtained on an average aerial, 12 miles from 2 L.O., were surprising, inasmuch as the set was not designed for DX work and so was not made particularly selective. It has, however, on frequent occasions been possible to tune in at fair loud-speaker strength Glasgow, Belfast, Newcastle, Birmingham, Bournemouth, Hamburg, Madrid, Radio-Paris and Hilversum, besides 2 L.O. and 5 X X and several unidentified Continentals. On 'phones, of course, the "bag" is still larger.

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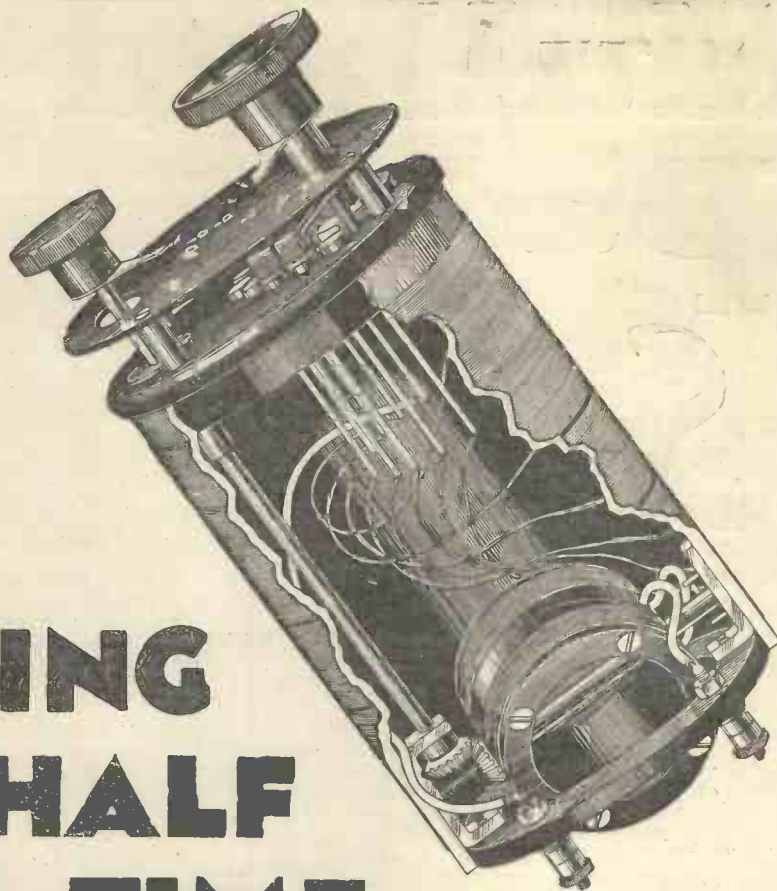
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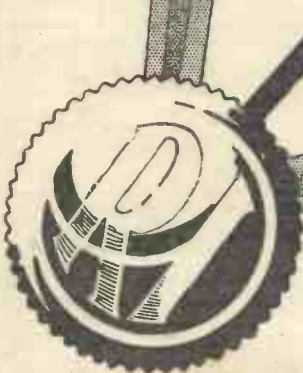
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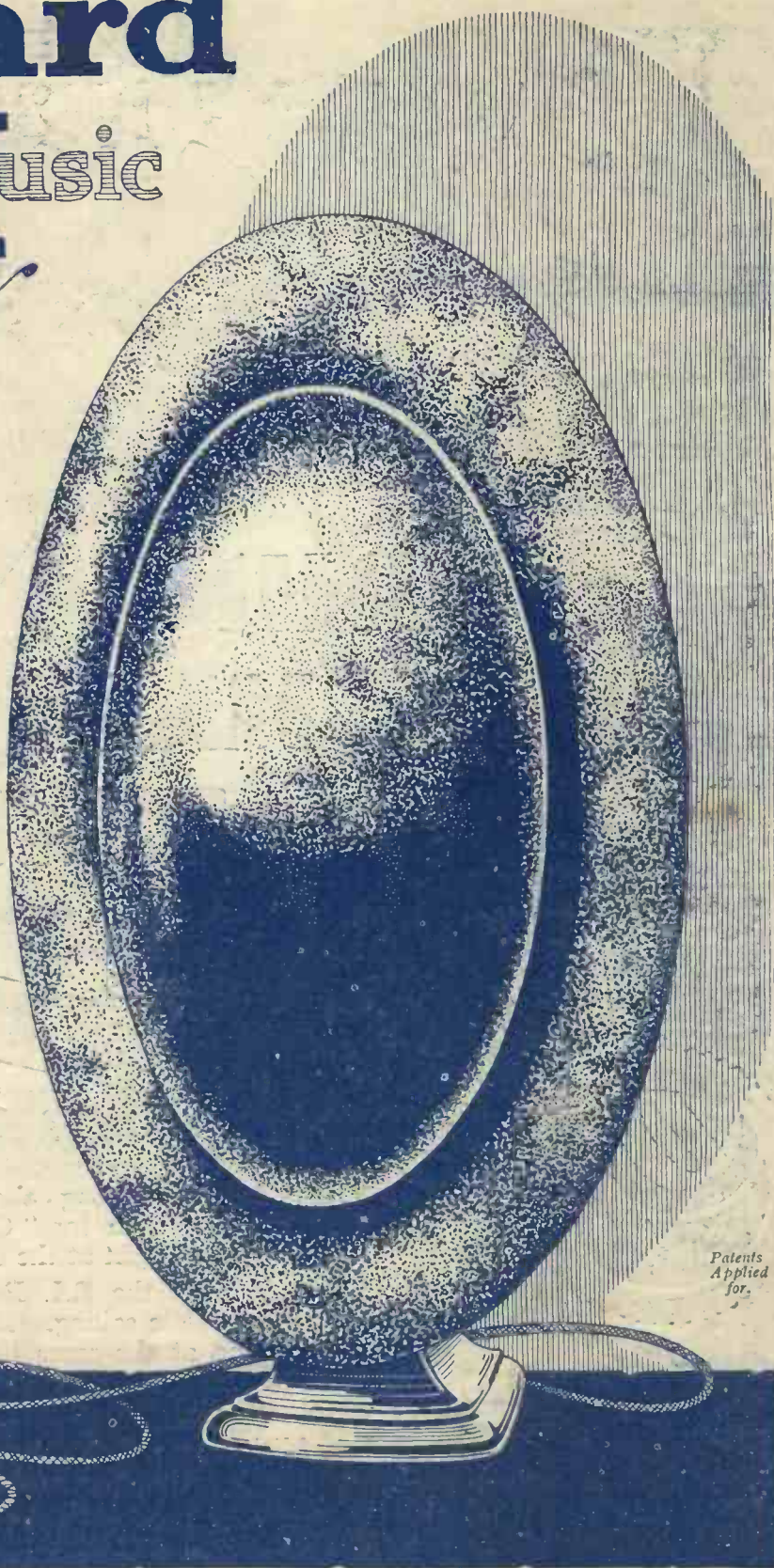
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