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# Popular Wireless

Every Thursday  
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No. 195. Vol. VIII.

and Wireless Review

February 20th, 1926.

Scientific Adviser: SIR OLIVER LODGE, F.R.S., D.Sc.



**FEATURES IN THIS ISSUE.**

**THE CONSTRUCTION OF**

A Two-Valve Reflex Set. A Det.-2 L.F. Loud-speaker Set.  
A Crystal and 2 L.F. Receiver. A Det.-L.F. Two-Valve Set.

The Art of DX Work. Broadcasting and the Theatre.  
Short-Wave Jottings. The Crystal Telephone.

Mr. Cyril Maude, the famous actor, listening to U.S. broadcasting in his American flat, is the subject of our cover photograph this week.

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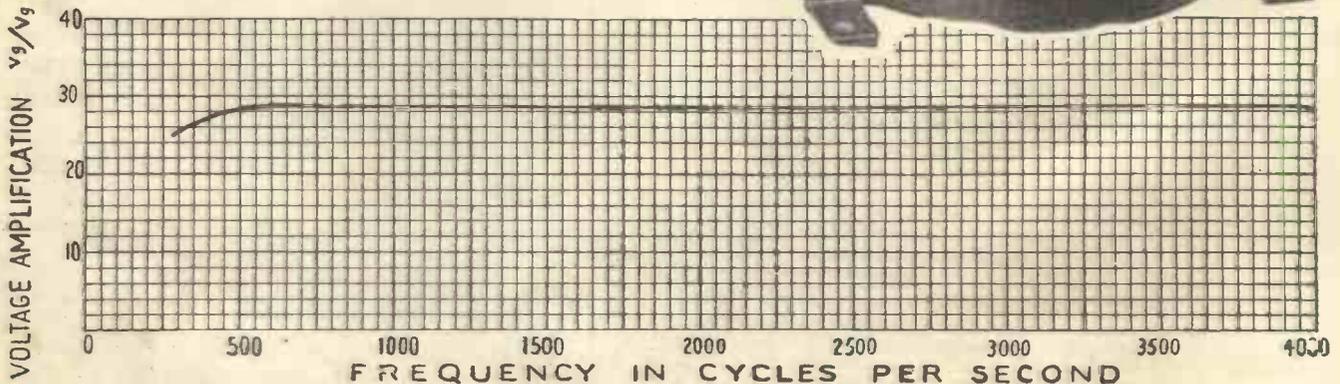
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 " B " 4 to 1  
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 Ratio 3 to 1  
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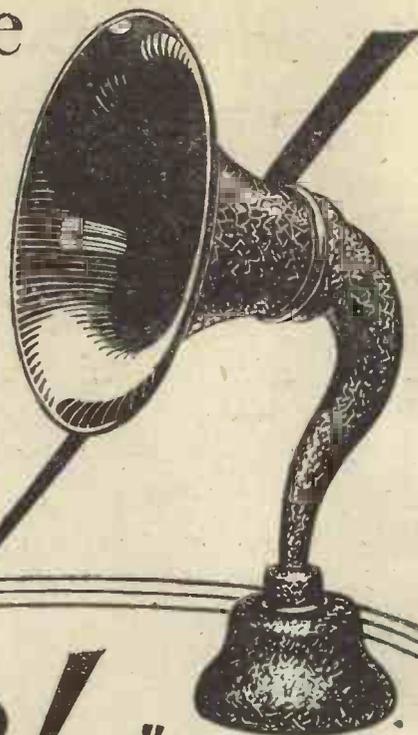
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# "BEST WAY"

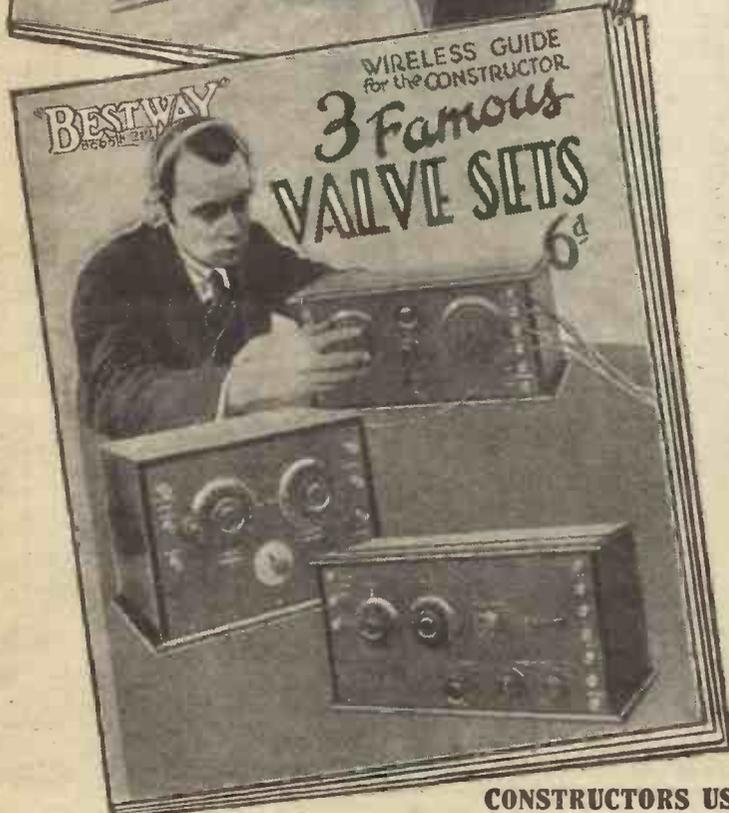
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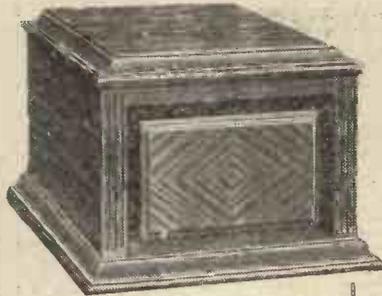
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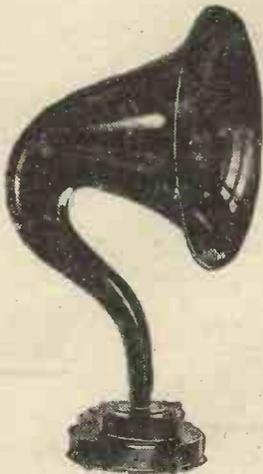


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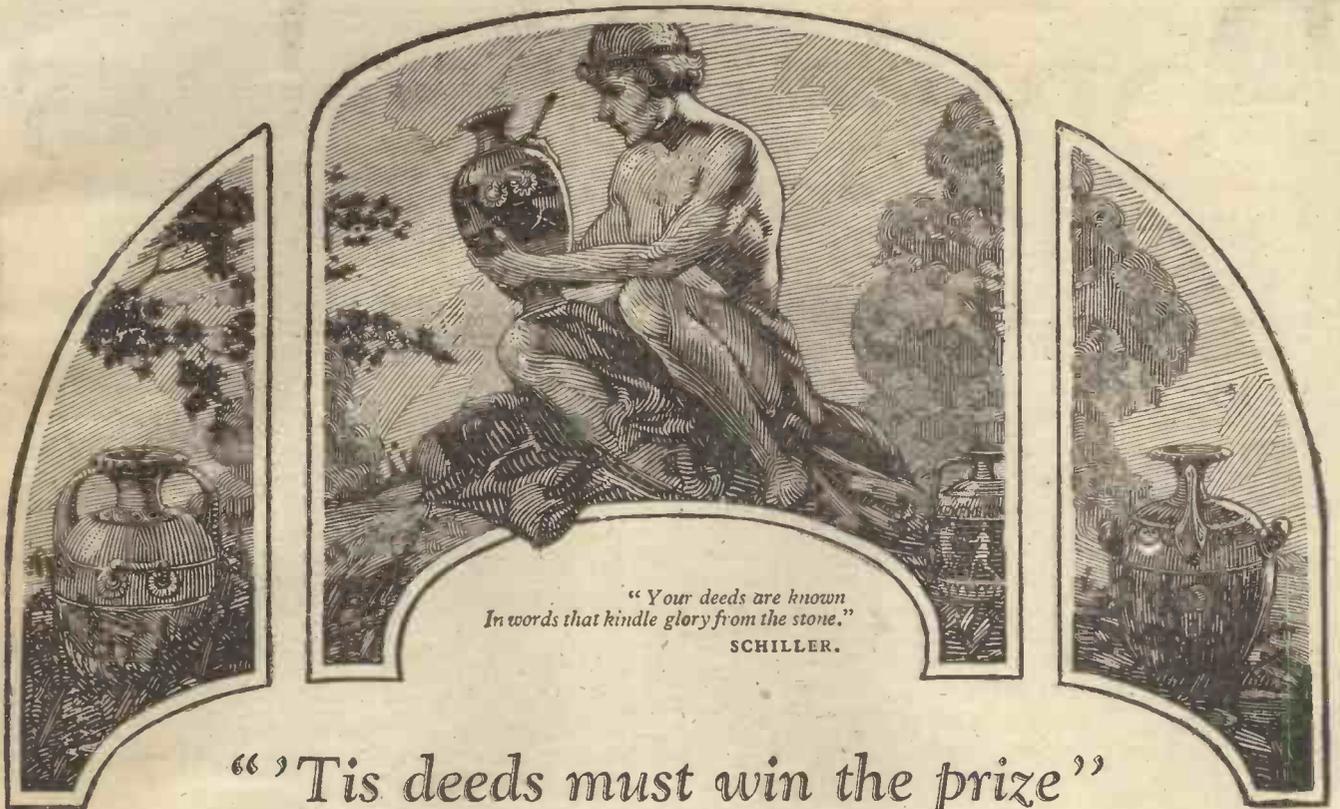
Afterwards there followed the marvellous Brown Gyro Compass—a wonderful instrument capable of pointing true North under all conditions without the aid of magnetism. And then, finally, the Brown Loud Speaker—the first British Loud Speaker ever used for Wireless. Sponsored by such supreme technical skill and daring originality, it is small wonder that Brown Loud Speakers have won for themselves in all corners of the globe a reputation for sensitiveness and mellowness of tone as yet without equal.

Time and again the insistent demand for Brown Wireless apparatus has necessitated expansions of factory space. Invariably the demand for Brown products is far ahead of available supply. But at no time has the standard of workmanship been relaxed. In spite of the ever-growing demand for Brown Loud Speakers not a hair's breadth deviation from the recognised Brown standards of performance would be tolerated.

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**I**N years to come, when the story of the Valve is written, certain developments will stand out like landmarks and win imperishable fame for their inventors.

First, the discovery of the electron theory. Later, Dr. Fleming's great contribution to the cause of Radio—the original two-electrode valve and the father of all valves. Afterwards, the addition by Dr. Lee de Forest of the grid, which resulted in the three-electrode valve. And then Valve development halted for several years. A long straight filament enclosed by a spiral grid—the whole being surrounded by a tubular anode.

This was the standard Valve until the year 1922. Obviously it had many disadvantages. A large proportion of its electron emission inevitably escaped from each end of the anode and served no useful purpose. This clearly caused a very serious loss in efficiency.

The spiral grid—owing to its lack of rigidity—was a fruitful cause of microphonic noises. The straight filament—tightly stretched to prevent sag—readily fractured and the Valve became useless. In 1922 there appeared a new Valve—one destined to win immediate recognition—the Cossor.

For the first time there was used in any Valve an arched self-supporting filament. A grid so rigid as to be utterly vibration-proof. And a hood-shaped anode which enclosed practically the whole of the electron stream. All of which were entirely original and exclusive features.

In three short years Cossor has triumphantly vindicated that its unique principles of design are correct. More than one of its features have been adopted by other makers. But Cossor users are not misled—for Cossor results are obtainable only by the combination of *all* these features.

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- W.2. (With red top) For H.F. use 14/-  
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- W.3. The Loud Speaker Valve 18/6  
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**For 2, 4 or 6 Volts.**

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# Popular Wireless

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## RADIO NOTES AND NEWS.

British Beam Stations—Receiving California Direct—Broadcast Thrills—Perpendicular Shakespeare—"P.W." Broadcast from New York—Short-Wave Experiments.

### The Heart's Desire.

"WHAT I want is a good one-valve set, capable of giving all the B.B.C. stations at loud-speaker strength," says a Bermondsey reader. I am afraid that what he really wants is jam on it!

### British Beam Stations.

WE ought soon to be hearing of results of the beam stations. It was announced early in January that the South African and Canadian stations designed for communication with this country were practically completed, and Bodmin and Bridgewater, the "opposite numbers" in England, are certainly straining at the leash. I hear that, including one of its own at Dorchester, the Marconi Company now has in hand no fewer than seventeen short-wave transmitting stations.

### Receiving California Direct.

IN a recent issue of "P.W." I referred to a Scottish reader's feat in picking up KGO, the Oakland-California station, and I expressed the opinion that this must be something of a record. Now I am informed by Mr. T. C. Parry, 89, Wollaton Road, Beeston, Notts, that he has actually received confirmation of the direct reception of this station. The occasion was December 16th, 1925, at 10.25 p.m., whilst the B.B.C. stations were on the air. What makes it all the more noteworthy is the fact that owing to the vast distance covered, the programme picked up at 10.30 p.m. at Beeston was being sent out by KGO at about 4.30 p.m. that afternoon! The set used was a modified Reinartz (detector and note-magnifier). Well done, Beeston!

### 2 BNR.

THE call sign 2 BNR has been allotted to Mr. Leslie Marshall, 58, Pernau Street, Belfast. Mr. Marshall informs me that he will be pleased to conduct tests with any amateur working on the 45, 90, and 150/200 metre wave-bands.

### "The Quest of Elizabeth."

FROM all the criticism evoked by the broadcast play, "The Quest of Elizabeth" (which shocked the daily press, whatever effect it may have had upon the nerves of listeners), one fact

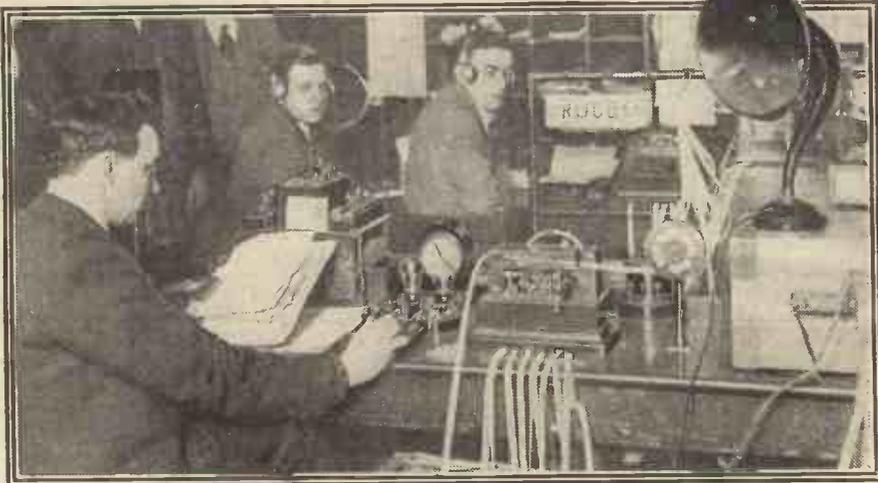
the ending was "cut" by the B.B.C. without his permission. He told an "Evening News" representative: "By leaving out these concluding passages the whole point of the play was lost." Maybe it closed on the wrong note from his point of view, but it proved the power of the broadcast "thriller," anyway.

### Birmingham in Good Voice.

FOR some reason Birmingham has not been easy to tune-in in the London area lately. But one evening recently I picked up that station doing a musical broadcast, and it came through with surprising clarity and sweetness. I am wondering if this is due to the new studio arrangements, for a few months ago Birmingham was easy to get, but often was hardly worth listening to, owing to a sort of muffled harshness in both speech and music. Has any other London listener, who is interested in 5 I T, noticed a marked difference?

### A Short-Wave Coincidence.

A SUNBURY-ON-THAMES reader writes as follows to Mr. E. J. Simmonds, of Gerrard's Cross (2 O D):



New Rugby station gets to work. G.P.O. operators in London controlling the transmissions

emerges clear. The B.B.C. can certainly produce realistic drama.

Before the play started I had a suspicion that it would be a much-talked-of broadcast, so I listened carefully to it. And about half-way through it I had to abandon a critical attitude, and instead settle back in my chair to enjoy the thrill. It proved to me that broadcast drama can be quite as exciting as the stage variety.

### Broadcast Thrills.

CAPTAIN REGINALD BERKELEY, author of the play, has explained that

"Having for some time been on the look-out for a suitable short-wave set with which I could experiment, I decided to build the one described by you in POPULAR WIRELESS (November 21st, 1925). By a curious coincidence your own station (2 O D) was the first one logged. Within ten minutes of completion of the set, using 12-turn secondary and 8-turn reaction, your own signals could be heard all over the house."

(Continued on next page.)

## NOTES AND NEWS.

(Continued from previous page.)

## Europe's Crowded Ether.

**O**CCASIONALLY one is tempted to believe that too much fuss is made about the interference to broadcasting caused by other stations; but some figures just brought to light show that things could not in reality be much worse. Taking round about 300 metres as an example, at least twenty stations have been found working regularly within three metres of one another.

## The Only Way.

**S**IX foreign broadcasting stations, and six British and foreign radio-telegraph stations claim 300 metres as their own. Sheffield and another Government station stick to 301 metres, and on 302 metres there are four or five regular Government transmitters. Above this, both broadcasting and telegraphic transmissions from several stations are quartered upon 302 metres, and so on throughout the wave-length scale! It looks as though the "Higher Power and Fewer Stations" slogan expresses the only way out of the mess!

## Helsinki Calling.

**R**ECENTLY I raised the question of tuning in to Helsingfors, and since then I have had letters from two different readers in the Finnish city, both of whom read "P.W." regularly! (Isn't it amazing how "P.W." gets about?)

One of these readers gives me this interesting tip. "It would be better to write the name of our town "Helsinki" instead of Helsingfors, because that is how the announcement sounds in the Finnish language."

## Selective New System.

**I**NTERESTING possibilities are opened up by the latest ship-to-shore experiments of Mr. D. B. S. Shannon, of Sutton Coldfield. With a portable transmitting and receiving set he succeeded in wireless conversations up to distances of 70 miles, with the extraordinarily low power of five to seven watts input. The apparatus is so selective that transmissions from the ship's own aerial did not interfere with the low-power working.

## Super-Het. versus Neutrodyne.

**T**HIS is the title of to-night's debate at the Golders Green and Hendon Radio Society. The subject will be opened by Mr. J. H. Reeves, M.A., and there will be a demonstration, so for Londoners who are anywhere near N.W.11 it wouldn't be a bad plan to drop in at the Club House, Willifield Way, at 8 p.m.

## Perpendicular Shakespeare.

**S**EVERAL Midland listeners have written to ask me who is the mysterious broadcaster who "talks tosh," in the middle of the night or early morning. For instance, one morning at 6.35 a.m. he came on and announced "Conservatory, Arizona, Jamaica, Kilocycles!" and he announced this jargon not once but dozens of times. Another time he will come on and remark "Perpendicular, Intermediate,

Shakespeare, New Zealand." One perturbed listener goes so far as to suggest that a madman is on the air, but there is a much simpler explanation—"Rugby Testing!"

## "P.W." Broadcast from New York.

**I**HAVE just been reading a copy of the talk to British radio enthusiasts, delivered on January 28th from the New York broadcasting station W.G.B.S. by Mr. Lawrence W. Corbett, "P.W.'s" correspondent in New York. It's a great pity that conditions were so unspeakably bad, for it was a cheery discourse, full of interesting details of broadcasting conditions on both sides of the Atlantic. We must hope that the next time Mr. Corbett is on the air to "P.W." readers, the ether won't be quite so leathery, or "puddeny," or whatever it was that was the matter with it, during the International Test.

## The Cologne Ceremony.

**D**ESPITE the report that the broadcast ceremony of the evacuation celebrations at Cologne was badly jammed, a good many "P.W." readers were successful in getting the programme. One South

## SHORT WAVES.

"These staggering inventions have such a way of getting out of hand."

"The aeroplane, for instance. We gaped in amazement and applauded its early flights. A few years later it was dropping half-tons of high explosive on our roofs."

"Or wireless—a godsend to ships at sea—now one of the greater domestic worries. Contacts going wrong, faulty reception, long dreary talks about dust and things that we don't want to hear!"—"Daily Mirror."

"Even ten minutes' vigorous, clear transmission of great music daily on simple but perfect lines to all schools, might in itself change the whole face of musical taste throughout the country in from ten to fifteen years."—Sir Walford Davies.

"2 L.O. has taught us a great deal about what may be compressed into fifteen minutes in the way of really authoritative talk."—"The Star."

Coast listener heard every word without Morse interference, and a Norfolk listener says, "I heard the proceedings quite clearly, and there was not the least interruption whatever."

## Too True.

**W**HEN Mr. J. C. W. Reith, managing director of the B.B.C., was giving evidence before the Government's Broadcasting Committee in the House of Lords the other day, he said "We consider it impossible to exaggerate the importance of the financial question."

That is exactly the feeling of all married men, and of most of the single ones!

## Reykjavik Calling!

**H**AVE you heard Reykjavik? This is a new station, right in the heart of Iceland's greasy mountains, and it has been testing at 11 p.m. nightly on 430 metres.

Judging by recent weather reports, the signals will have to pass a regular barrage of depressions before they can leave Iceland for sunnier climes!

## Is this the Record?

**A** LISTENER in Adelaide, South Australia, has informed Mr. J. L. Cannon, 14, Woodcroft Avenue, Broomhill,

Glasgow—the owner of 6 B Q—that signals from that station were picked up in Adelaide on December 20th at good 'phone strength upon a det. and two-L.F. set. Now, it happens that at the time Mr. Cannon was using a portable set with an L.S.5 valve, and 250 volts on the plate (40 m/a). This represents a power of only ten watts, and, unless somebody can knock the bottom out of this challenge, Mr. Cannon claims it as a record for a low-power portable set.

Can any reader beat 6 B Q to the Antipodes?

## Too Good to be True.

**T**HAT amusing "spoo" letter in "P.W." correspondence columns a fortnight ago, about "Oscillating Crystal Experiments" has caused lots of fun. The sender of it has been kept busy answering inquiries from readers, most of whom doubted his word, but didn't want to miss anything good that was going! He tells me he is doing his best to deal with the deluge, and concludes his letter with a fine parting shot by saying, "Some time I must get a wireless set! Yours really and truly, etc."

## Peru on the Loud Speaker.

**S**OME readers wrote to me about the matter, saying they did not quite believe in Peru on the loud speaker with a crystal amplifier, but evidently "Mr. Fergusson" was on a good thing, and could I give them the circuit?

One Liverpool reader entered into the joke so thoroughly that he actually supported "Mr. Fergusson's" claim, and swore that he himself was in the crowd that listened to the "massed bands"!

All I can say is that he ought to have called at the house and had a talk to the owner, just to see who could tell the biggest!

## Short-Wave Experiments.

**M**ANCHESTER WIRELESS SOCIETY is anxious to carry out tests on 23 metres, using call signs 6 M X, 5 M B, 5 W X, and 2 Y O. Transmissions can be arranged for any time day or night, and the power varied from 5 to 250 watts. Information is also required as to the possibility of working with other stations on 8 metres, and comparing circuits with a view to obtaining information about this wave-length. The following are the addresses of the members working the stations: 6 M X, 2 Y O—Y. W. P. Evans, Esq., 66, Oxford Road, Manchester; 5 M B—W. H. Lamb, Esq., 808, Stockport Road, Manchester; and 5 W X—R. Hallam, Esq., 81, New Street, Altrincham, near Manchester.

## A Loud-speaker Tip.

**A**NORBURY reader sends me the following tip, which looks interesting. "As an improvement upon the new Radiolux Amplion Loud Speaker, I tried placing it on a sheet of glass on cork insulators. Although very nice tone without it, we think it a great improvement with the addition of the glass plate."

(I can't say I've tried this with the Radiolux, but I remember trying in on a T.M.C. Junior, with excellent results.)

ARIEL.

I HAVE not as yet made wireless a hobby, but I am greatly interested in it as a scientific force to be reckoned with. As yet I have not succumbed to "listening-in" as the most desirable way of spending an evening. The vast possibilities of wireless have, I feel, only been hinted at up to the present. No development of the future can astonish me.

Broadcasting is the greatest opposition to existing entertainments which has occurred within my experience. As a world-wide entertainment appealing to an audience of millions its potentialities are incalculable.

The Editor of POPULAR WIRELESS has asked me what I think of its publicity value to theatrical enterprise.

**Different Points of View.**

In my opinion the theatrical manager should not look upon broadcasting from this point of view at all. Were the B.B.C. to say to me, you may talk about your plays to our millions of "listeners," I should consider that a valuable method of publicity for which I should be prepared to pay.

But when, however, they ask me, or any other purveyor of entertainments, to broadcast a play, or other entertainment, in its entirety, or in part, for the amusement of "listeners," they do so because they consider it will be of interest to their "listeners." It is to be a part of their programme of entertainment, and as such it should be paid for.

Some time ago I consented to the broadcasting of "Little Nellie Kelly" for a fee which, at that time, I considered satisfactory. The projected broadcasting was stopped by the owners of the theatre with whom I had a contract for the presentation of the play, and it also brought a protest from Mr. George M. Cohan, the author and composer.

I was compelled to cancel the arrangements which I had made. I strongly disapproved of the action of the body of managers which interfered with me in regard to the broadcasting of "Little Nellie Kelly." I am all for liberty of action, and my views are not necessarily those of my colleagues.

**Worth Paying For.**

To ignore broadcasting seems to me as futile as was Canute's attempt to stop the waves. Although I realise that broadcasting is a most powerful opposition to theatrical entertainment—or should I say because I realise it?—I believe that theatrical managers would be well advised, instead of trying to ignore it, to endeavour to benefit by it.

Broadcasting is only one of the several scientific developments which have provided entertainment to keep people away from the theatre.

The gramophone and the moving picture have had their effect upon the box offices.

The sensible theatrical manager and owner of theatrical properties has turned these opposition entertainments to his

# BROADCASTING AND THE THEATRES.

## FACING THE FACTS.

### Common Sense versus Prejudice.

By C. B. COCHRAN (the famous Theatre Manager).

In this exclusive article Mr. C. B. Cochran gives his views on the relationship between two great entertainment industries—the Theatre and Broadcasting. Mr. Cochran does not "beat about the bush" in this article, and he makes suggestions which are essentially based on sound common sense as opposed to unsound prejudice.—The Editor.

own account by making them, to a certain extent, by-products of his own industry.

In the early days of the moving picture the managers were invited to lend their



A recent photograph of Mr. C. B. Cochran.

plays for screen production, because of the advertisement to be gained therefrom. Whether screen representation of a play hurts it or helps it is beside the point, although I think it has been proved conclusively that it is detrimental.

The main thing is that the rights of the play were wanted, because the play was

teners." The B.B.C., I believe, understand this, and would probably be treating theatrical people more generously to-day, but for the bull-headed attitude of the managerial associations in the early days of wireless.

Broadcasting entertainments, to be popular, must rely largely on the theatrical industry and as a compensation for their rivalry, theatrical managers should derive considerable benefit by letting out their material for broadcasting purposes.

I am far too fond of the theatre to enjoy broadcasting or any other mechanical reproduction of plays or music. But I and every theatrical manager must face the fact that there are hundreds of thousands of people to whom the theatre is geographically or financially out of reach. These people have found in broadcasting a wonderful entertainment which they can enjoy by their own fireside at a very small cost.

**A Word to the "Uncles."**

While marvelling at the really extraordinary reproduction of voices and instrumental music which can be enjoyed by listeners by means of head-phones and loud speakers, one is bound to admit that the reproduction is not as yet, at any rate, a perfect substitute for the real thing—the soul is missing.

I came across a letter in a paper the other day, complaining that too much time was taken up by announcements. The correspondent pointed out that when Kreisler played at a concert, or George Robey sang at a theatre, it was not thought necessary to give a long harangue concerning his pedigree and attainments before he commenced his entertainment.

I agree with the correspondent that the various "Uncles" employed by the British Broadcasting Company have too much to say.

Another criticism that I hear generally is that too much time is taken up by weather reports and news items which have already appeared in the evening papers. Unquestionably there are remote spots reached by wireless which are not reached by the evening papers, but I should imagine that a majority of listeners get an evening paper of some sort.

I have the greatest admiration for the way the B.B.C. has coped with its many difficulties, and despite many faults the general result of their first year's working must be considered admirable.

**NEXT WEEK**

**A "P.W." Super-Het.**

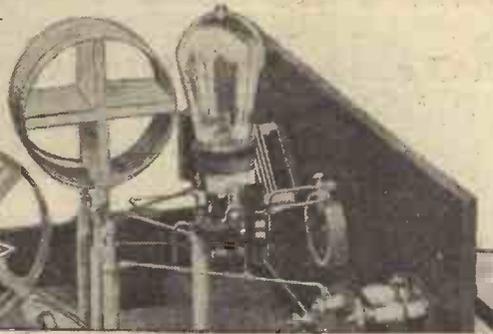
**A Duo-Coupled Crystal Receiver**

Full constructional details, with photographs and all "P.W.'s" usual helpful guides—"point-to-point" check lists, etc.—concerning these two unique sets will be given.

**ORDER YOUR COPY NOW!**

# Short Wave Jottings

by 2OD



E. J. SIMMONDS, M.I.R.E., will write weekly under this heading.

CONDITIONS on the wave-band 20 to 40 metres have been most unsatisfactory during the past month; signals being very freaky day by day, and many usual signals being entirely absent.

For example, the writer listened in at 02.00 G.M.T. for the special short-wave calibration signals to be transmitted from U.I.X.M. Conditions were so bad, however, that no trace of these signals could be detected—in fact, no U.S.A. amateur signals were heard at all during this period,

O A 6 N (36 metres), O A 4 Z, and O A 3 E have all been heard and worked easily.

All these stations use a wave-length around 35 metres, which, indeed, seems the band for all long-distant reception in this country.

Other stations heard are: Palestine 6 Z K, Brazil 1 C C, Brazil 1 A B, Brazil 1 A C, and O C D J on 30 metres.

Another station of interest is P O W (Nauen, Germany), operating on 25 metres pure C.W. and calling P K X, (Java) also using high-speed, automatic. During daylight the signals from this station are of enormous intensity, but after nightfall they become very feeble, a remarkable instance of the curious effects noticed by all observers on these high frequencies.

During daylight such transmissions will be received by nearby receivers

with perfect clarity and good strength, but after nightfall such telephony transmissions appear weak and distorted to nearby receivers, although, say, 5,000 miles away these same transmissions are being perfectly received.

## 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.

### A NEW READER'S VIEWS.

The Editor, POPULAR WIRELESS.

Dear Sir,—To-day (Thursday) I purchased a copy of your POPULAR WIRELESS—and I might state that it should receive great popularity.

With reference to your "Blueprints for nothing," I must agree that they are most excellent and more than value for the money; and, one of the many good points about the "prints" is that lists of components and accessories are shown, which is most useful to a novice like myself.

I am, or was, an

electric cable maker and have seen a few prints; hence my remarks on them.

With regards to "P.W.," I must again state that it is "IT"; and, further, I like the way in which you give "Point-to-point connections" and the "Panel drilling lay-outs" which, again, is most useful to a novice. As I have already stated, I am a "rookie" at the "game"; but I am able to follow all the "prints," explanations, etc., quite easily, because they are so clear, and no "padding" is inserted.

I have had about three copies of a certain weekly wireless paper; but this week I decided to purchase "P.W.," and now intend to obtain a copy every week. I must not divulge the name of the "certain weekly wireless paper." However, "P.W." beats it. Sh! *Verb. sup.*

When I do begin to construct, I do not think that I shall get "tied in a knot" with your "prints," etc., etc.

I might add that I possess a short-wave tuner, Mark III (calibrated wave-meter) with perikon and carbondum-steel detectors. Probably I shall read something about "tuners" in the "P.W." one day!

With best wishes and every success to you all and "P.W."

Yours sincerely,  
GEO. LEWIS.

39, Becket Avenue,  
East Ham, E.6.

### THOSE OSCILLATING CRYSTALS!

The Editor, POPULAR WIRELESS.

Dear Sir,—I cannot resist writing to you to suggest that Mr. Henry Furgusson made a mistake when he sent his letter on oscillating crystals to you ("P.W.," Feb. 6th.—Ed.). He should have directed it to the "Merle Blanc" for the competition as reported in the Foreign Radio News. (Page 1328, "P.W." No. 103—Editor).

I am getting very good results with the "Four Electrode Flewelling." London unbearable at full strength on 'phones, Bournemouth at fair readable strength, with London quiet, Daventry just comfortable, also Brussels, Hamburg, Madrid and Radio Paris.

Yours faithfully,  
V. G. SIMPSON.

P.S.—Perhaps Mr. Furgusson will put a few more amplifiers on and we in London will be able to hear this wonderful set for ourselves.  
52, Bellefields Road, Brixton, S.W.9.

### RECEPTION CONDITIONS.

The Editor, POPULAR WIRELESS.

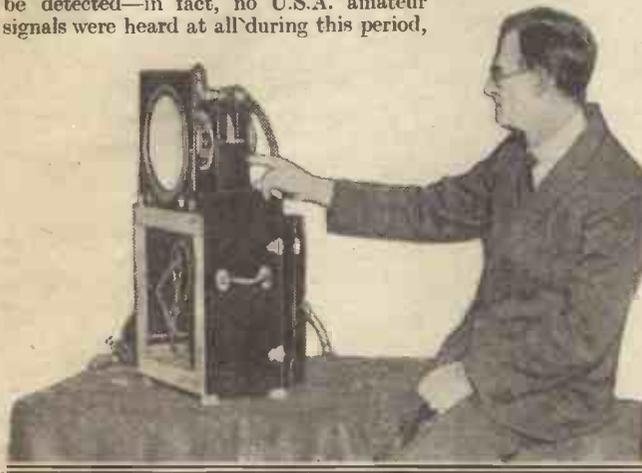
Dear Sir,—In reply to your request ("P.W." 30/1/26, p. 1254) for experiences in DX work, mine may not interest you, but here goes.

One frequently hears it is not worth while from a musical point of view when really good reception is absolutely necessary: I used to feel that way myself, but I have come to the conclusion that it is—very much so, in fact, in a great many cases. I have been very successful in bringing in Continentals with a purity that leaves nothing to be desired, but it's a thing that of course I cannot guarantee on any given occasion. Still, if one station is washed out, with all the stations to choose from, there is usually something that will come in quite well. For purity I use one transformer only, while for the sheer love of getting something a second one does bring up signals that are barely audible otherwise.

I have used a frame aerial with a good deal of success, O-V-2 transformer coupled, perfectly straightforward with such details as a common H.T.—and L.T.—, a condenser across both primaries, a Eureka second stage 3½ to 1 in the first stage, with an Iccnic first stage (5-1) in the second. Valves Mullard .06 high amplification factor as detector, low ditto in the L.F. stages. Small coil in series with loop to couple to reaction coil. All rheostats in negative lead. At Twickenham (9 miles from Selridge's and west of it) this brought in the north-country stations well, but two transformers did not improve quality. Continentals were not good for some reason, and I could not do anything with the frame east and west with 2 L O working, as she drowned everything.

Twickenham,

W. C. C. HUGHES.



Dr. N. W. McLachlan and new type of loudspeaker he has invented.

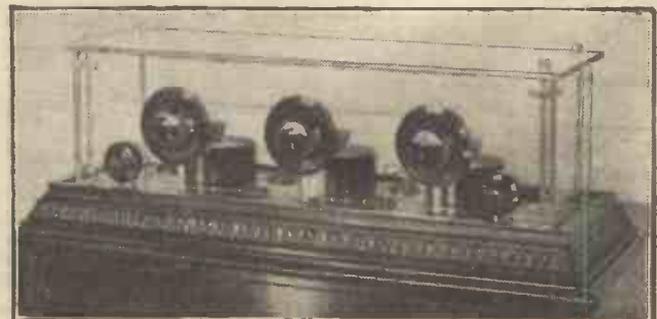
although under normal conditions scores of amateur stations in all districts can be logged with ease.

W I Z on 43 metres, using 20 k.w. of power, only produced a signal of R.7 intensity, which will illustrate the bad conditions obtaining. It is of interest to note that the latter part of December and early January each year has always been a period of bad signal strength. Observations have been directed to this phenomenon for some time, and doubtless some reason will emerge during the course of further investigations.

### A Logbook Analysis.

New Zealand stations can be heard each morning from 07.00 for about 1½ hours, Z 4 A C (37 metres), Z 2 A C (36), and Z 2 A Q being logged during this period.

Australian stations come in irregularly, A 3 B D (34 metres) heard at 18.50 G.M.T. and again at 20.40 G.M.T., also others at 15.00 G.M.T. It is of interest to note that Brazilian I P was heard at 17.10 G.M.T., which is remarkably early for this district. During this period two-way communication has been established with N A J D of Manila, Philippine Islands, and Philippine I H R can be heard daily at 15.00 G.M.T. on 37 metres working two-way schedules with this country and U.S.A. South African stations come in about 19.00 G.M.T. and



A commercially produced receiver employing glass panels which has recently made its appearance on the American market.



The Set described and designed by the "P.W." Technical Staff. The diagrams for this circuit are on a Blue Print given away with this issue.

THE circuit employed in this receiver is probably the most popular three-valver yet devised, and is used in a great many homes for both loud-speaker work and reception on telephones. As arranged in the set described here either one, two or three valves can be employed by means of two S.P.D.T. switches, while

set, the photographs of which appear on this page, and it is for these components that the panel drilling diagram is given:

Peto-Scott .0005 variable condenser, "R.I." L.F. transformer 25/-, Eureka (2nd stage) L.F. Baby Grand, three Precision rheostats, Goltone grid leak and condenser, one Yesly two-way coil holder, two Nesthill S.P.D.T. panel-mounting switches, one .001 Watmel fixed condenser, one .002 fixed condenser (Watmel), 12 W.O. terminals, 12 flush-mounting Peto-Scott valve sockets, and 1 panel (12 x 10) and case to fit.

If different components from those stated are employed, the constructor will have to modify the panel-drilling diagram to suit the components he has chosen, but the general lay-out of the receiver can be seen from the photographs and the wiring diagram given on the blue print.

**Mounting and Wiring.**

It is advisable to purchase the panel and cabinet at the same time in order to ensure that they fit properly. If these are obtained separately the constructor may find it a difficult task to trim the panel in order to make it fit the case—especially if this latter is not absolutely true. It is also advisable to use really good ebonite, as this makes for easier working besides increasing the efficiency of the set.

When the components have been mounted (metal working drills having been used for the holes), the set should be wired up in accordance with the blue print diagram, using stout copper wire (preferably of 16-gauge square section) or Glazite.

It will be noticed from the photographs that the connections on the original set were soldered, and this procedure is advised if the constructor knows how to handle the soldering iron; if, however, he feels doubtful about his capabilities in this direction it will be better to use finer wire, say

18 or 20 gauge, with an insulated covering (Glazite), and to fix the wires by tightly screwing them down underneath the terminal nuts, etc.

When the wiring has been completed it should be carefully checked from the blue print and the point-to-point list of connections. After this the panel should be cleaned up and all traces of loose wire, insulation, beads of solder, flux, etc., should be removed. This is especially important, because these little odds and ends have a nasty habit of hiding amongst the condenser vanes and setting up no end of trouble by causing bad contact or partial shorts. When this has been done the transfers can be affixed to the panel and the set wired up ready for test.

As regards accessories, the type of accumulator (L.T. battery) employed will depend upon the kind of valves to be used and vice versa, so that for the benefit of listeners some useful details of valves will be given. It must be said, however, that if the maximum results are to be obtained from the set, power valves must be used in the L.F. stages, and these preferably of the 6-volt type (dull emitters). It will thus be seen that in order to get the best out of this receiver a 6-volt accumulator is extremely valuable, and if the constructor does not already possess an accumulator he will do well to purchase one of that voltage, having a capacity of about 40 ampere-hours (actual).

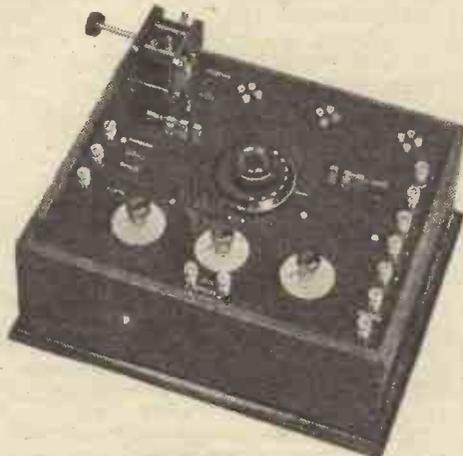
**The L.T. Battery.**

Those who already possess accumulators of different voltages need not despair, however, for excellent results can be obtained with the detector and 2 L.F. receiver by using valves suitable for those accumulators, providing the right classes of valve are employed.

It will be understood that for optimum results it is essential that the valve used in any one position of the receiver must be one designed for the particular task which it has to perform. For instance, the first valve must be one suitable for detector purposes, while the next two must be designed for carrying out L.F. amplification, especially the last one, which has to carry a considerable amount of power.

Of the 2-volt class of valve the following can be recommended as detectors:

*(Continued on next page.)*



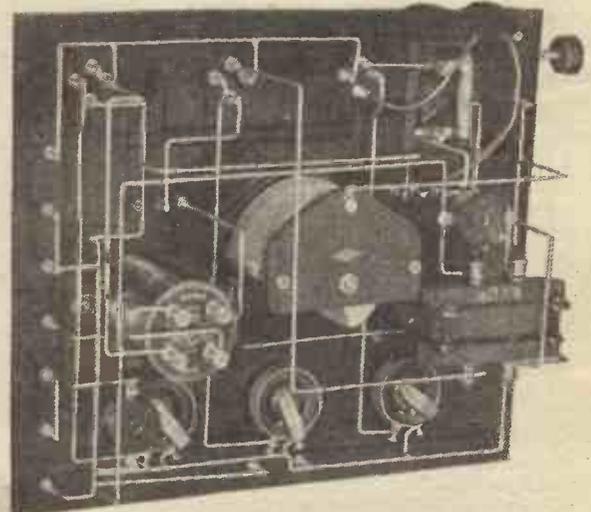
This photograph of the complete set shows the neat layout of the panel.

the use of plug-in coils makes the set universally adaptable for wave-length range.

**The Components Used.**

The set is capable of picking up a great number of stations on the headphones, using either one or two valves, while with careful handling it is not too much to expect several B.B.C. stations comfortably audible on the loud speaker when three valves are in use. It is extremely simple to handle, there being only two controls (tuning condenser and the reaction), though care must be taken when using the latter that the set does not oscillate violently and cause interference to neighbouring listeners.

The construction of the receiver is not a difficult matter, and no "snags" will be experienced if the blue print diagrams and photographs published with this article are carefully followed. For the benefit of constructors we may state that the following components were used in the building of the



A study of this photograph, in connection with the blueprint, will make clear the back-of-panel connections.

# A "DET.-2 L.F." LOUD-SPEAKER SET.

(Continued from previous page.)

A.R.D.E., W.1., D.3, S.P.18, etc. While for the first stage of L.F. the W.2, D.3 (L.F.), D.E.6, P.V.6 D.E., etc., can be recommended. The last stage really needs a power valve and we advise the use in this case of such valves as D.E.6, P.V.6 D.E.

Of the 4-volt type, bright emitters can be used, or any general purpose valve, in the first stages, though, again, in the last stage we advise a power valve. Of the dull emitters suitable for use with a 4-volt accumulator may be mentioned (detectors), B.5, A.R. .06 (red), D. .06 (red), D.E.3; (L.F. valves, first stage), D. .06 (L.F.), B. 6, D.E.3, etc. Last stage, D.F. A.2, P.M.4, D.F.A.0., D.E.4.

### The Valves.

Of the 6-volt types any bright emitter valves can be used for the first stage, but we advise the use of dull emitter and power valves for the second and third stages. Such valves as the D.F.A.1, D.F.A.3, B.7, B.4, P.V.5 D.E., D.E.5 and D.E.5A., and D.E.8 L.F. being suitable. The B.4, P.V.5 D.E. and D.E.5 valves can also be used with advantage in the detector stage.

As regards coils, these may be of any of the well-known types of plug-in coils such as the Atlas, Tangent, Igranic or Lissen makes; or home-made basket coils may be employed if desired.

The sizes for broadcasting and details of the series-parallel three-terminal system which is incorporated in this set are given on the blue print.

When operating this receiver it should be noted that when either one or two

### POINT-TO-POINT CONNECTIONS

Aerial parallel terminal to fixed plates of variable condenser, socket of fixed coil holder, and to one side of grid leak and condenser, the other connections of which are taken to the grid socket of first valve holder.

Aerial series terminal to moving plates of variable condenser. Earth terminal to plug of fixed coil holder and to L.T. negative, which is also joined to H.T. negative, grid-bias positive, and to one side of each rheostat. The other side of each rheostat is taken to one filament socket of its respective valve holder; the other filament sockets being joined together, and to L.T. positive.

Plate socket of first valve holder to plug of moving coil holder, socket of moving coil holder to centre contact of first S.P.D.T. switch. Right-hand contact of first S.P.D.T. switch to O.P. of first L.F. transformer. The I.P. terminals of both L.F. transformers are connected together and to the top H.T. positive terminal.

I.S. of first L.F. transformer to grid socket of second valve holder, O.S. to L.T. negative lead.

Plate socket of second valve holder to centre contact of second S.P.D.T. switch. Right-hand contact of switch to O.P. of second L.F. transformer. I.S. of second transformer to grid socket of third valve holder. O.S. to grid-bias negative. Plate socket of third valve holder to bottom 'phone terminal, and to the left-hand contacts of both S.P.D.T. switches. Top 'phone terminal to bottom H.T. positive terminal. A .002 fixed condenser is connected across the 'phone terminals, and a .001 across the primary of the first L.F. transformer.

valves are switched out by means of the S.P.D.T. switches their respective rheostats must be turned off at the same time. It must also be noticed that two H.T. positive terminals are provided, so that there will be three plugs to be inserted in the H.T. battery, one at the negative end and two at varying positions towards the positive end. The battery itself should be capable of providing about 100 volts, and in operation it will probably be found that the first positive plug will have to be in the 60 or 70 volt position, while the second positive plug will be tapped in at a higher voltage.

### Provision for Grid Bias.

Grid bias is provided on the last valve, and this is effected by means of two wander plugs joined to terminals in the centre of the bottom of the panel. A 9-volt battery tapped in 1½ volts should be available, the negative plug being placed at the negative end, and the other one varied in position while the set is working till best results are obtained.

If further sensitivity is required an H.F. amplifier could be added to this receiver; though it would be advisable to rebuild it and build up a straight four-valve set, using 1 H.F., Det. and 2 L.F. This would only be in the event of the listener requiring really long-range results on the loud speaker, which results would be (from a musical point of view, or as a source of entertainment) very disappointing, and we think the constructor will find that he can get all he requires on the three valves. It will not be necessary to add any L.F. stages to the set; this would be impracticable unless resistance coupling were employed.

### Transformers and Variable Condenser.

If the constructor already has on hand similar components which he would like to incorporate, but which are not of the makes previously mentioned, the following hints will help him to decide if his apparatus is suitable for this set.

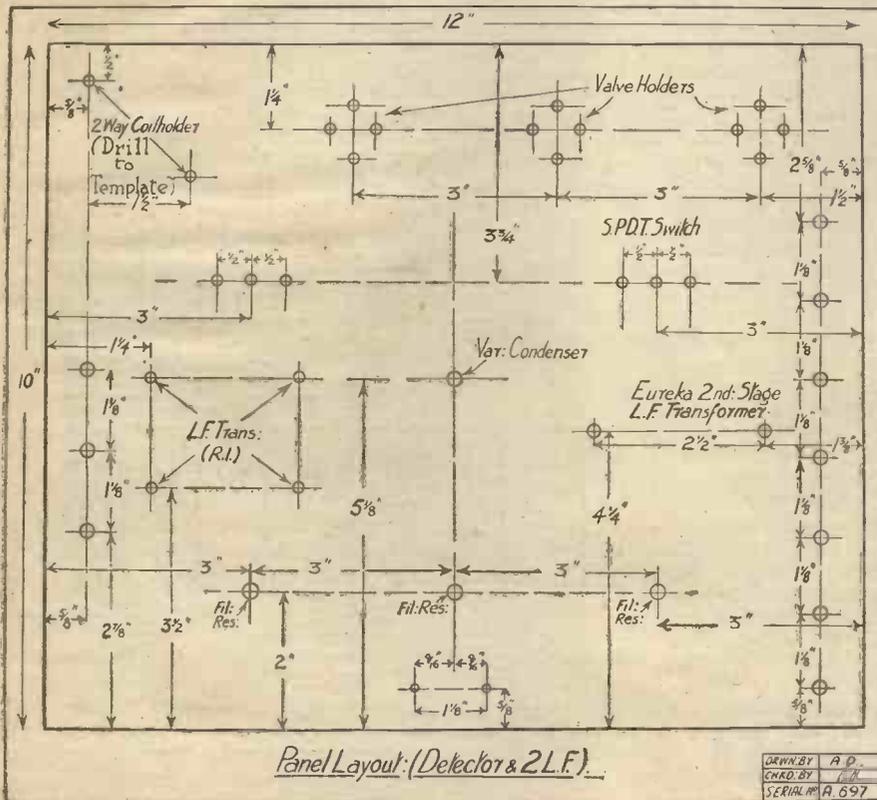
The flush-mounting valve legs, for instance, could be replaced by the ordinary type, which project up from the panel (or by a complete valve holder if desired) without affecting results; and carbon-compression rheostats can be used in place of the wire-wound variety, if desired.

The variable condenser can be of any type, and if square-law, or vernier, or both, so much the better. It is important that the respective L.F. transformers are designed for first-stage and second-stage work, for if two first-stage transformers (with a high ratio) are used together, distortion is bound to ensue.

### The Aerial Employed.

A last word about aeriels. It is essential for good results that the set be used on moderately efficient conditions—i.e. with a good outdoor aerial. If an indoor aerial is employed results will naturally be decreased both as regards range and signal strength, and the handling of the set will become slightly more difficult.

A frame aerial is certainly not advised, as even a poor indoor aerial provides better results than would a frame. So that if the constructor is limited in space and cannot erect an outdoor aerial we advise him to use the indoor type, consisting of two or more wires stretched across the room, and not resort to the frame. This latter will make the set very difficult to handle, tuning will be sharp, and signal strength and range will be decreased by at least 80 per cent.



Panel Layout (Detector & 2 L.F.)

DRAWN BY	A.D.
CHKD BY	L.H.
SERIAL NO.	A.697

# A TWO VALVE REFLEX SET

An economical receiver which will appeal to the more advanced constructor.



The Set designed and described by the "P.W." Technical Staff. The diagrams for this circuit are on a Blue Print given away with this issue.

**T**HIS is a very handy receiver for the experimenter who has already tried a reflex circuit employing a crystal detector, and who wishes for a more stable and selective arrangement. The principle of reflex—or dual—amplification is now very well known, but as it is not usually found in conjunction with a valve detector, it will be advisable to say a few words

seen that the connection is made through a .0003 fixed condenser, whilst the earth to the filament connection is by direct lead. As the impulses are high-frequency ones, the .0003 fixed condenser is not an obstacle to their passage, and so the varying potentials across the A.T.I. are applied to the valve's electrodes.

A similar current is, therefore, created in the anode circuit of the valve and flows via the filament, H.T. battery, phones, anode coil and condenser, to the plate. As the battery and telephones would afford an unwanted H.F. resistance in the circuit by-pass condensers are placed across these components.

### Amplifying at High Frequency.

The .0003 anode condenser, in conjunction with a suitable tuning-coil, can be tuned to the broadcasting in the same way as the aerial circuit is tuned. This tuned oscillatory circuit in the plate of the valve affords a very high impedance, and acts like a coupling resistance. Across its two ends a varying potential is set up, and this difference of potential is applied to the grid of the second valve through the second .0003 fixed grid condenser.

Similar but magnified currents will, therefore, flow in the plate circuit of this valve via the primary of the L.F. transformer and the reaction coil (R). This reaction coil (R) is coupled to the anode coil (A) in a two-way coil holder, and affords a means of further strengthening the H.F. currents flowing in that circuit.

It will be noted that, in order to by-pass the H.F. currents across the high impedance of the primary of the L.F. transformer, a .001 fixed condenser is connected there. To the grid of the second valve is connected a grid leak (variable), and in conjunction with the grid condenser this enables the valve to act as a detector. In addition, therefore, to the H.F. component by-passed by the .001 condenser across the primary of the transformer, rectified (L.F.) current will flow in this valve's plate circuit. Such L.F. current cannot pass through the fixed (.001) condenser, so it will reach the plate via the transformer primary.

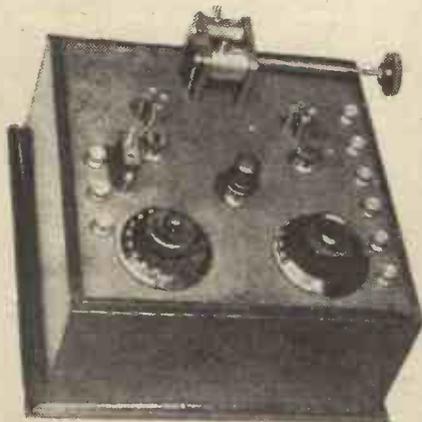
### Additional Amplification.

These currents through the primary will set up corresponding voltages across the ends of the secondary of this L.F. transformer. These ends are connected to L.T. negative and to the grid of the first valve (via the radio-frequency choke). An inspection of the diagram will show that at this stage L.F. currents are being impressed across the first valve's grid and filament, in addition to the H.F. currents supplied by the aerial-earth circuit.

The valve, therefore, will amplify these L.F. currents in addition to performing the functions already described, and so L.F. currents also will flow in the plate circuit of the first valve. As the telephones are inserted directly in this circuit (in series with the anode coil and condenser) the rectified currents will be audible there.

This brief explanation shows that the first valve acts as H.F. amplifier, and also as L.F. amplifier after the signals have been detected by the second valve. The second valve is a straightforward detector.

The purpose of the radio-frequency choke which is inserted between the secondary of the L.F. transformer and the grid of the first valve, is to choke back any of the weak H.F. impulses supplied by the aerial-earth system. Otherwise these would tend to stray via the secondary and, as the whole functioning of the receiver depends upon

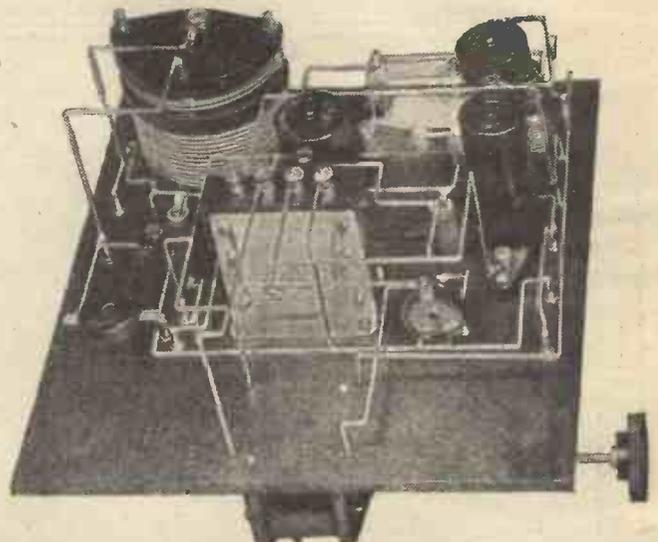


The spacing of the components and lay-out of the panel are well illustrated by this photograph.

about the way in which the circuit functions. For this purpose the theoretical circuit on the blue print (No. 13), which is given away in this issue, will be the best means of explaining the action of the receiver.

### How the Set Works.

Suppose, for instance, that the aerial lead is connected to the terminal marked "S," and the earth lead to the terminal marked "E." Oscillations are induced into the aerial by the distant broadcasting station, and cause an H.F. current to flow down the aerial through the .0005 tuning condenser, through the aerial tuning coil, and so to earth. The currents flowing through the tuning coil cause a difference of potential between its ends, and this difference is imparted to the grid and filament of the valve. In the case of the grid end it will be



This view of the back of panel wiring should be compared with the wiring shown on the blue print.

them, it is important that they should be conserved as far as possible, and efficiently applied to grid and filament.

(Continued on next page.)

## A TWO-VALVE REFLEX SET.

(Continued from previous page.)

Such a reflex receiver is theoretically capable of giving double amplification on the first valve, the second valve acting as detector, and the whole circuit being theoretically equivalent to a three-valve receiver comprising of first stage of H.F. amplification, one detector, and one L.F. In practice this high degree of efficiency is never attainable, but a good reflex receiver of this type will often give about two-and-a-half-valve efficiency.

### The Radio-Frequency Choke.

The obstacle to the general adaptation of the principle is the fact that such a reflex receiver is invariably rather flat-tuned, so that when installed close to the broadcasting station interference is rather more troublesome than would be the case using a straight three-valve set, comprising H.F., detector, and L.F. Nevertheless, there is no doubt that the reflex principle is an economical one as far as volume-for-valves is concerned, and with this set it should be possible to work a small loud speaker when situated well within the range of the broadcasting station.

Turning now to the construction of this particular receiver, it will be seen from the photographs that the panel lay-out is of pleasing appearance, with the tuning controls situated accessibly at the front of the receiver, aerial and earth to the left, and the battery and output terminals to the right.

Particular attention is drawn to the radio-frequency choke, which on the blue print is shown as a honeycomb coil. It does not seem to be generally realised that an ordinary plug-in coil, having a very large number of turns, can be used instead of the purchased H.F. choke, or vice versa.

### POINT-TO-POINT CONNECTIONS.

Aerial parallel terminal to fixed plates of .0005 variable condenser, to plug of aerial coil holder, and to one side of .0003 fixed condenser, the other side of which is taken to the grid socket of the first valve holder.

Aerial series terminal to moving plates of .0005 variable condenser. Earth terminal to socket of aerial coil holder and to L.T. negative, which is also connected to one filament socket of each valve holder; the other filament of each valve holder is connected to one side of the corresponding rheostat, the other side of both rheostats joining the L.T. positive to H.T. negative lead.

Plate socket of first valve holder to plug of fixed coil holder, to fixed plates of .0003 variable condenser, and to one side of 2nd grid condenser, the other connection of which is taken to the grid socket of the second valve holder, and to one side of the variable grid leak. Other side of variable grid leak to L.T. positive lead.

Socket of fixed coil holder and moving plates of .0003 variable condenser are taken to the bottom 'phone terminal. The top 'phone terminal is connected to H.T. positive.

Plate socket of second valve holder to the socket of the moving coil holder, plug of which is taken to O.P. terminal of L.F. transformer. I.P. of transformer to H.T. positive, O.S. to L.T. negative lead, and I.S. to one side of high-frequency (R.F.) choke. Other side of R.F. choke to grid socket of first valve holder.

A .001 fixed condenser is connected across the primary of the L.F. transformer, a .002 across the 'phones, and a .05 across the H.T.

To show how this can be accomplished in the receiver under consideration, a Lissen H.F. choke has been mounted upon the panel in place of the honeycomb coil shown on the blue print. It is quite immaterial whether the choke or the plug-in coil is employed, but, of course, if a purchased choke is used, it must be a high-frequency choke; or if a coil, this must consist of a very large number of turns (three to five hundred is best, though good results are generally obtainable with a 250 coil.)

### The Parts Used.

The actual components used in this receiver included the following: Aerial condenser (.0005), Wates K type; anode condenser (.0003), Bowyer-Lowe "Popular"; H.F. choke, Lissen; filament rheostats, Lissen Minor; grid leak, Bretwood; L.F. transformer, Ripaults.

The fixed condensers shown include a .05 connected across the H.T. battery (T.C.C.), two "A.J.S." (.001 for primary, and .002 for 'phones) and two Walmel .0003's. The

panel and case and the coil holder were obtained from Messrs. Peto-Scott, Ltd., and the total cost of the parts for the receiver amounted to between £4 and £5.

The drilling of the panel is done as shown by the drilling diagram which is reproduced on this page. Then the wiring is carried out according to the wiring diagram of the back of the panel, which is given on the blue print, the wire used for the connections in the original set being number 16 square-section tinned copper.

### Series or Parallel Tuning.

If the H.F. choke is used instead of a honeycomb coil, there is no alteration in the connections, which are identical for both components. It might, however, be advisable in cases where the plug-in coil is used to reverse the coil connections, or otherwise some interaction may take place between the coil and the A.T.I.

When the wiring has been finished, and, indeed, during the whole operation, great care must be used that no dirt or impurities are adhering to the panel, or efficiency will be greatly impaired. No attempt will be made to describe the wiring in detail as the blue print is self-explanatory, and the receiver is not one which the inexperienced novice is likely to require.

The series-parallel arrangement of the two aerial terminals enables the set to be used with equal facility either for long or short waves, providing, of course, that suitable coils are plugged in.

All reflex sets suffer from the disadvantage that further H.F. or L.F. amplification is difficult to add.

A final point to remember when using any reflex receiver employing a valve as detector, is that unwanted interaction

### SOME IMPORTANT DETAILS.

Do not forget that:—

Care must be taken when mounting components, as, owing to their number, they have to be fitted rather close together.

Sufficient space should be left between the choke and condenser to allow the wiring to the coil holder to be carried out satisfactorily.

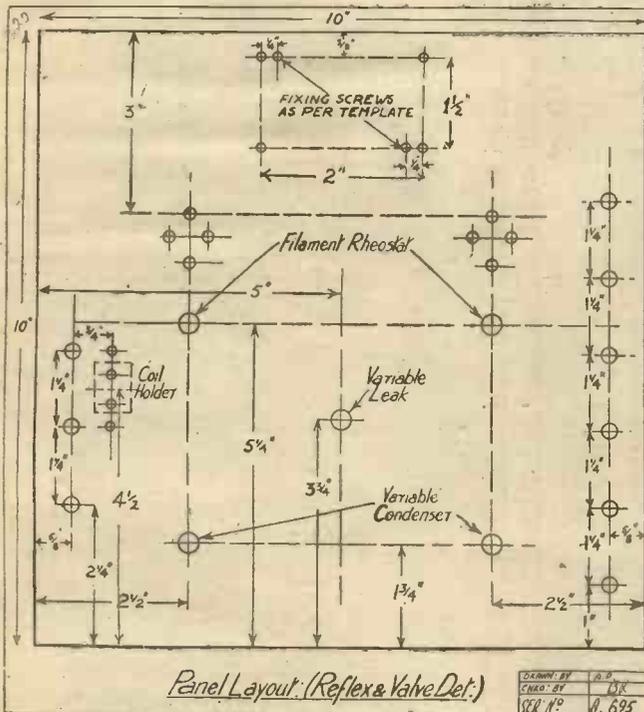
If necessary the .5 T.C.C. condenser should not be mounted until the neighbouring wiring is completed, in which case plenty of room must be left to mount the condenser.

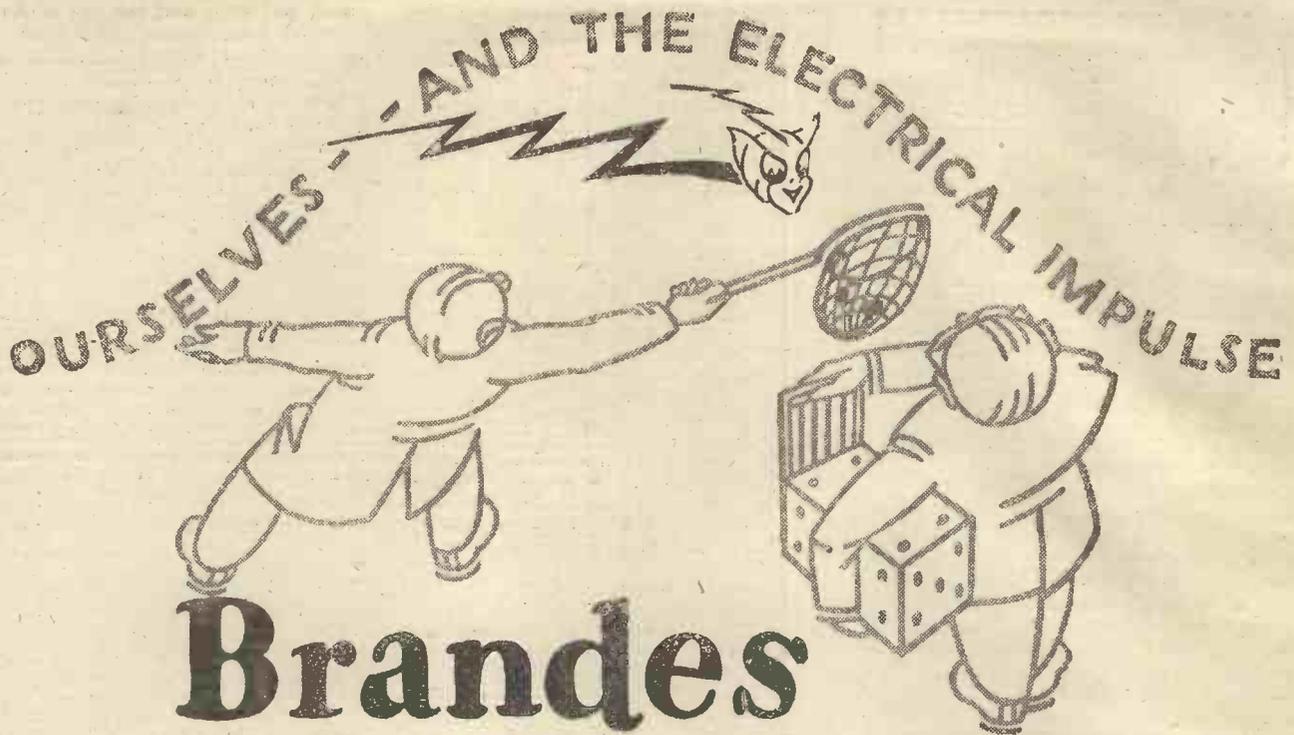
Note that the rheostats are placed in different L.T. leads; 1st rheostat negative, 2nd rheostat positive.

Wiring of 1st valve is rather complicated, and should be carefully checked when finished.

between the circuits must not take place. It is imperative that the grid-circuit wires should be spaced well away from the plate-circuit wiring, or the receiver is sure to howl. For this reason shrouded L.F. transformers are to be preferred to the unshrouded type.

The tendency to howl will also manifest itself if incorrect values of H.T. and L.T. are used, so good rheostats should be chosen, and the valve-makers' specifications regarding the correct H.T. and L.T. should be read carefully. "General-purpose" valves are generally chosen for the first (reflex) position, whilst any valve that detects well will do for the second, as this valve is a straightforward detector.





"HULLO! What do you fellows want me for now?"  
 "Come along, you young imp. Our laboratory experts want a word with you?"  
 "Shades of Geneva! They want my advice again. Still, take the net and cage away, and I'm with you. You Brandes people have a little more understanding than most; you consult me with due humility. Others, without any knowledge of what I demand, force me to speak. I become refractory; their instruments reproducing radio sound talk less naturally in consequence. You know, they really ought to study me a little more. Here I am, at the beck and call of every soul interested in radio, from a high power station to myriads of embryo Senatore Marconis. I recommend a study of radio

acoustics, which means the study of transforming myself, the electrical impulse, into audible sound. I, being the electrical energy, walk right into the receiver of Tom, Dick or Harry, carrying the voice from the studio. To be able to talk just as naturally as the people in that studio I must have the correct scientific elements built into the instrument which reproduces the sound. You chaps have been the only radio builders to consult me to that end. I know you've worried me for seventeen years, but I appreciate the tactful consideration which went with it. I hope you have benefited by my advice; by what I hear of Brandes instruments, you have. Well, lead on to the laboratory, gentlemen; I have an appointment at 2 LO after lunch."

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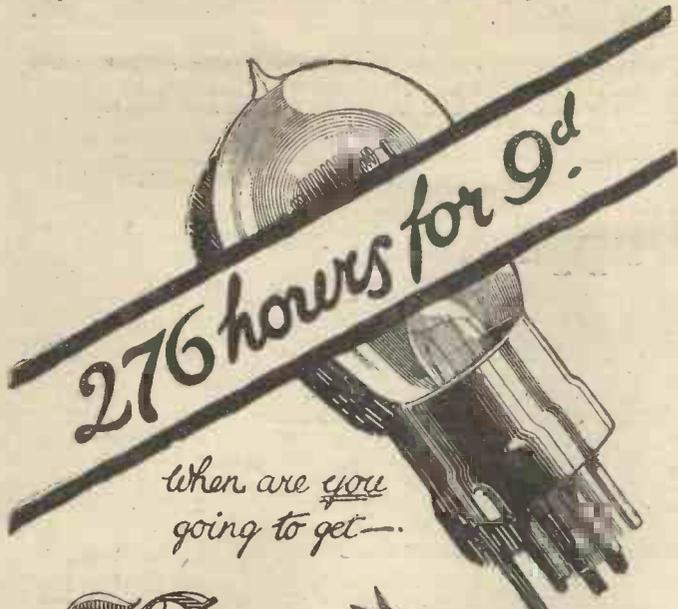
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The electron emission of the D.E.2 L.F. OSRAM VALVE is exceedingly liberal, and, as the internal resistance is markedly low, the D.E.2 L.F. proves a most sensitive *Detector* for picking up distant stations. The anode current it passes also makes this type excellent as an L.F. amplifier for providing full mellow tone and plenty of volume.

The D.E.2 H.F. OSRAM VALVE is specially designed to provide the utmost sensitivity to weak signals when used in the H.F. stage; and in addition gives surprisingly increased volume in a choke or resistance-coupled amplifier. *Use a D.E.6 OSRAM VALVE in the last stage.*

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#### Characteristics H.F. Type

Filament Volts .. 1.8  
Filament Current .. 0.12  
Anode Volts .. 40/120  
Impedance .. 45,000 ohms  
Amplification Factor .. 12

Price 15/6 each

# Osram Valves

for Broadcasting

THE G.E.C.—YOUR GUARANTEE.

#### Characteristics L.F. Type

Filament Volts .. 1.8  
Filament Current .. 0.12  
Anode Volts .. 20/80  
Impedance .. 22,000 ohms  
Amplification Factor .. 7

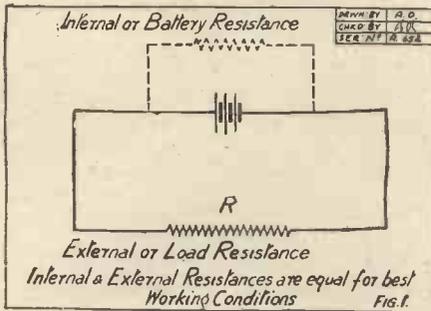
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ALTHOUGH not usually stated in this particular form, the "fifty-fifty" rule is one of very wide application in radio technique. The beginner will find it stated in various forms and disguises. In most cases it is assumed to be axiomatic, and as such is glibly passed by without further explanation or proof.

One frequently reads, for example, that it is desirable to match the impedance of the 'phones to that of the crystal or valve; that a step-down transformer must be used with low-resistance, though not with high-resistance 'phones, even in a crystal set where there is no question of passing excessive current through the 'phone windings; and that batteries should be connected in parallel for supplying a low-resistance circuit, and in series for a high-resistance circuit.

**A Simple Example.**

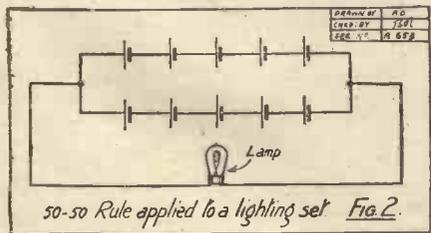
All these are different practical applications of the simple theory which, in popular language, can be termed the fifty-fifty rule, but which is more academically expressed



as follows: If a source of direct or alternating current having internal resistance is connected to a work or load circuit, then the maximum power is expended in the load (i.e. one gets the most useful working conditions) when the latter power is equal to the power consumed in the source itself.

In other words the optimum condition is that 50 per cent of the full power should be consumed in doing useful work on the load, and the remaining 50 per cent in doing "wasteful" work in the input or source of supply.

The simplest example is perhaps to be found in connection with ordinary accumulators or cells. Suppose a battery B, Fig. 1, of 6 volts, when on open circuit, and an internal resistance of 5 ohms, is



used to send a current through an external resistance of R ohms. For what value of R will there be the greatest consumption of power in the resistance or load R?

When the battery is supplying a current I, there is a back voltage of 5 I volts (i.e. the internal resistance multiplied by the current) due to the passage of this current

# THE "50-50" RULE.

## A CLUE TO A PUZZLING SUBJECT.

By **SEXTON O'CONNOR.**

through the battery itself, leaving a voltage of  $6-5 I$  volts for driving the current through the external load R.

Because I has a negative sign it is evident that the more I is increased (by diminishing R) the less is the voltage across R; whereas if I is cut down (by increasing R), then the voltage across R grows.

The power consumed in the external or load resistance is the product of the current through it, and the voltage across it— $I(6-5 I)$  or  $(6 I-5 I^2)$ , and by giving various values to I and calculating the result in each case it will be found that this expression has its maximum value when  $I=0.6$  amperes.

**"Useful" and "Wasteful" Resistances.**

As the total voltage available is 6 volts, the total resistance (i.e. internal and external) of the circuit must be 6 divided by 0.6, or 10 ohms. But as the battery itself was originally taken to have an internal resistance of 5 ohms, the external resistance R must clearly also be 5 ohms.

In other words the "useful" or load resistance R and the "wasteful" or internal resistance are fifty-fifty when one is getting the most power into R—which in this case means heating it to the highest possible temperature.

The same problem can be put in a different form. Suppose that it is desired to light a 5 ohm lamp L, Fig. 2, with maximum brightness, and we have available for the purpose 10 cells B, each giving 2 volts, and each having an internal resistance of 2 ohms. Should the cells be connected in series or in parallel, or should some be in series and some in parallel? Applying the fifty-fifty rule the answer is that the cells must be arranged so that their combined internal resistance is equal to the external resistance of the lamp,—i.e. 5 ohms.

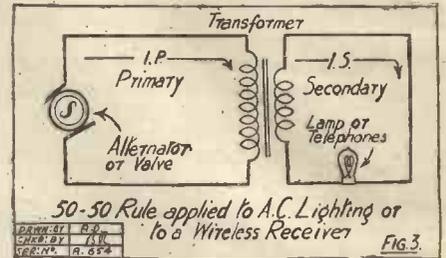
**In "Alternating" Circuits.**

This condition is fulfilled when the cells are arranged in two rows of five, as shown. The internal resistance of each row is then  $5 \times 2 = 10$  ohms, but as the two rows are in parallel their total effective resistance is halved, or falls to 5 ohms. The terminal voltage of the battery connected in this way is 10 volts, and the current supplied to the lamp will be 1 ampere.

If all the cells had been connected in series, the total voltage would have been 20, the internal resistance 20 ohms, and the total resistance of the circuit 25 ohms, giving an effective current of 0.8 amps., or less than that obtained by the previous arrangement. Again, if all the cells had been connected in parallel, the terminal voltage would be only 2 volts, the internal

resistance only  $\frac{1}{5}$ th of an ohm, and the total resistance  $5\frac{1}{5}$ th ohms. This, however, only gives an effective current of approximately 0.4 amps. or less than half that obtained by applying the fifty-fifty rule.

The same argument holds when alternating instead of direct currents and voltages are concerned, but here it is simpler to consider the power as supplied by a transformer as the latter affords a more ready



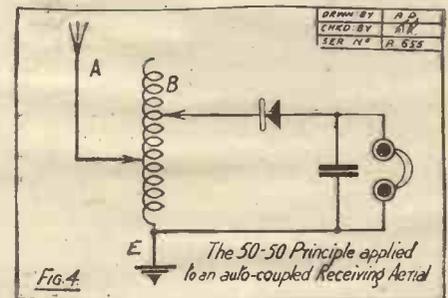
means of adjusting the voltages to the desired optimum values.

Assume it is required to supply a 5-ohm lamp, Fig. 3, with alternating current from an alternating current source D, of 20 volts and 20 ohms internal resistance. What kind of transformer will give maximum current (or maximum power consumption) in the lamp? If there are n times as many turns in the primary winding as in the secondary, then the current I.S. in the secondary circuit, will be approximately n times the current I.P. in the primary circuit.

The lamp of 5 ohms resistance in the secondary circuit consumes a power equal to the product of the resistance and the square of the secondary current, or  $5 I.S.^2$ . This, expressed in terms of the primary current, is  $5 n^2 I.P.^2$ .

**Application to Wireless.**

Now, again, applying the fifty-fifty rule by equating the primary or internal power consumption to the secondary or useful load consumption we get  $5 n^2 I^2 = 20 I^2$ ,



or  $n=2$ . From this it is clear that if the load has less resistance than the source, the best working condition is obtained by interposing a step-down transformer, there being in this particular case twice as many turns in the primary as in the secondary.

Now if the A.C. source of Fig. 3 is replaced by a valve amplifier, for which the internal resistance or impedance is in the order of many thousand ohms, and the lamp or load by a pair of telephones, then for best results, following the fifty-fifty rule, the impedance of the valve and telephones should be as nearly as possible equal, so that if the

(Continued on next page.)

## TECHNICAL ODDS AND ENDS.

FROM A CORRESPONDENT.

### Making "Pleated" Loud Speakers.

TO fold paper like a fan for a paper loud speaker, first cut the paper to size, mark off along each edge gaps of 1 in., then join with a pencil line. Now turn the paper over and mark off similar gaps, which when joined together with lines divide the gaps on the first side exactly in two, thus obtaining  $\frac{1}{2}$  in. gaps, the first being on top, the second  $\frac{1}{2}$  in. away coming underneath, third on top again, and so on, leaving a margin each end for gluing together.

Obtain an ordinary scholar's ruler and a wooden meat-skewer, place the ruler accurately along the line with the left hand, and with the right lift up the paper and draw the skewer towards you, pressing the paper against the ruler. That gives you a very good crease. Continue procedure all the way across, working right to left, then turn over and do likewise, these second creases coming between the first, and to make the fan it simply has to be gathered together.

### Winding Toroidal Coils.

To wind a Toroidal Ultra Coil with the turns evenly spaced for the set, as described in POPULAR WIRELESS, No. 179, October 31st, 1925, take a 2-in. diameter former and wrap round it a sheet of note-paper, so that the former can easily be withdrawn when the winding is finished. procure a piece of medium thickness string and double it, and tie a knot about 6 to 9 in. from the loop end, then lay the knot on the former, the end that the winding starts, and wind one turn of wire over one piece of string as close as possible to the knot. Draw the string back over the wire and lay down the other piece of string; then wind another turn, and repeat until the right number of turns are put on. Now tie the two ends of the string together, when the turns of the coil will be laced together.

Slip out the former and tie the coil round the 2 in. cardboard tube,  $1\frac{1}{2}$  in. long (as directed in "P.W." October 31st), and tie with the loose ends, cutting off the surplus string after tying. Should it be desired to have even greater accuracy of spacing, the outer loops of the coil can be held in place by tying a strong piece of cotton or thin string to the outer side of the first loop of the coil and going round the outer coil, giving the cotton or string a twist round each loop. After correctly spacing the loops, finish by tying securely to the starting point.

### Avoid Twisted Flex Connections.

One of the most fruitful sources of trouble in wireless work is twisted flex. Being greatly beloved by electricians for portable lamps, etc., it has slipped into more or less general use for loud-speaker leads. For this purpose it is quite well suited—provided the leads are short and are carrying a large output—but in other parts of a wireless set twisted flex leads are apt to give rise to some very puzzling faults.

In many cases where telephone leads are extended to other rooms, the self-capacity of the leads is sufficient greatly to diminish the volume of sound. The mere untwisting of the flex and spacing apart of the leads will in many cases double the strength of signals; but many of the faults due to flex are more subtle and difficult to trace than this.

One curious instance recently noticed was that of flex helping to prevent a one-valve set from oscillating. A short length of flex—only four or, at most, five feet in length—was used as a battery lead. The set was a one-valve Unidyne, which

refused to oscillate, although apparently there was no reason why it should not do so. When the length of twisted flex was replaced by two separate leads the tendency to oscillate was greatly increased.

### Self-Capacity Troubles.

Most of the instances in which the peculiar behaviour of twisted flex is noted appear to be due to the fact that the twisting of the leads increases their self-capacity. It occasionally happens, therefore, that where additional capacity is required the use of twisted flex is actually an advantage; but generally the reverse is the case, and some obscure fault will be caused by the presence of unwanted capacity effects.

In all cases where twisted flex is used, it is a good plan to try the effect of separated leads instead. If found to be satisfactory the flex can easily be replaced, but in a great many cases there will be no desire to replace it.



Regulating the first broadcast from the new studio at 5 IT. The photograph shows the engineers at work in the modulating room.

## THE "50-50" RULE.

(Continued from previous page.)

telephones are low-resistance a step-down transformer must be used. A strict proof of the rule in this case is somewhat involved owing to the inductive character of the telephone impedance.

Another application of the fifty-fifty principle may be seen in the case of a receiving aerial, A, Fig. 4, directly coupled to a crystal detector circuit. Here the alternating source is the aerial, and the load is the crystal, the telephones being shunted by a condenser of low impedance to the H.F. current.

The internal resistance of the source in this case is the radiation resistance of the aerial together with the H.F. resistance of the aerial A, coil B, and earth connection E. The external or useful load resistance is that of the crystal. Without giving actual values to all these quantities, the application of

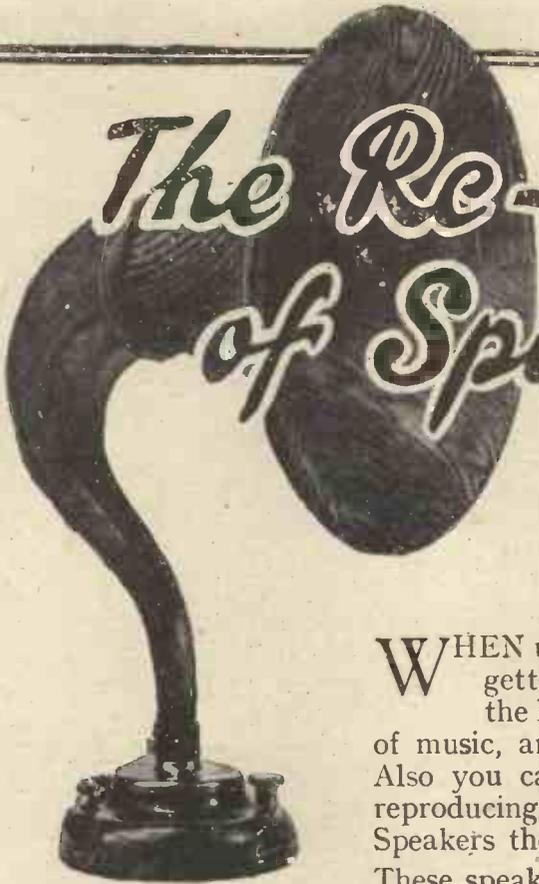
the fifty-fifty rule shows that if the crystal is of very high resistance, it should be connected across the whole of the tuning coil. In fact, it is sometimes desirable even to connect it across the secondary of a step-up transformer.

### 'Phones in Parallel.

On the other hand, if the crystal is of a comparatively low-resistance type, such as Hertzite, it will give louder signals when connected across only a part of the tuning coil, this being of course the equivalent of a step-down transformer.

In the circuit of Fig. 4, there are two separate transfers of energy: (1) the transfer of H.F. energy from the aerial to the crystal, dealt with above, and (2) the transfer of L.F. energy from the crystal to the 'phones.

Without specifying exact figures, when a low-resistance galena crystal is employed, it will be found in general that several high-resistance 'phones connected in parallel (so as to reduce their combined resistance below that of a single 'phone) will give better results than when they are connected up in series.



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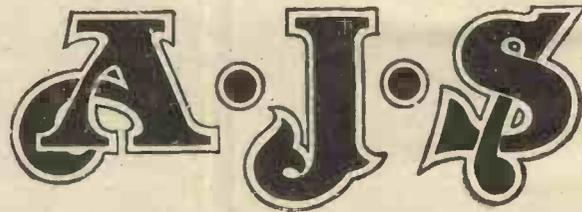
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## Bridging the gap

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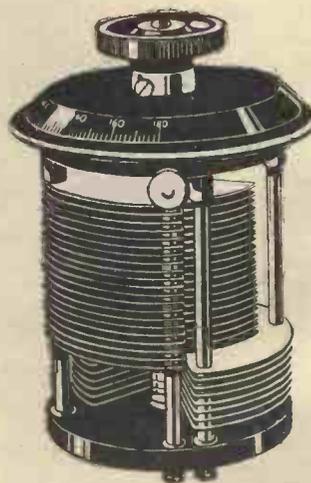
The Duwatcon, however, has been specially designed to overcome this difficulty. It is so constructed that when used in the series position its *normal* maximum wave-length is obtained at about 120° on the scale. Further rotation of the knob, however, causes a further increase in the wave-length until, when the movement is completed at 180°, the wave-length is slightly greater than that which would be obtained by switching the condenser to "parallel" and turning the knob to zero again.

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Even KDKA loses its glamour when we realise that it is merely a noise, and nothing like the beautiful modulation at the transmitting end. Let us first consider the types of sets available for long-distance

# THE ART OF DX WORK.

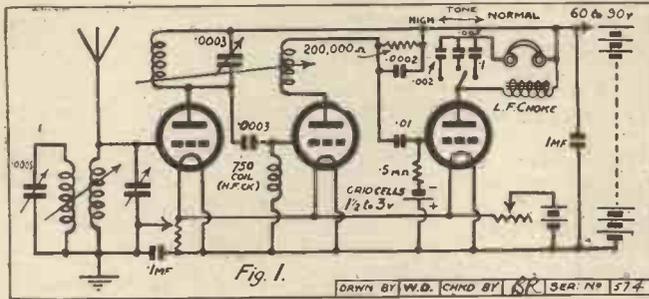
## Some Suggestions.

By **B. HONRI.**  
(B.B.C. Engineering Staff.)

be deprecated, and the valves should always be worked at their rated filament voltage.

Reaction is used, and this is most satisfactory and stable when coupled to the tuned anode coil. When strong reaction is being used the tone of the reception will be lowered. This may be corrected by adjusting the tone circuit on the last valve. The smaller the series condenser in this circuit, the higher will be the tone.

For loud-speaker work one or two more low-frequency stages may be added. Fig. 2 shows a suitable circuit with switching



reception. Let me say straight away that a single-valve set should never be used for long-distance reception. It is impossible to search for stations on a single valve without oscillation, and as the oscillation of the set is not loud enough to deafen the operator, it is likely he will cause considerable annoyance to other listeners in his neighbourhood.

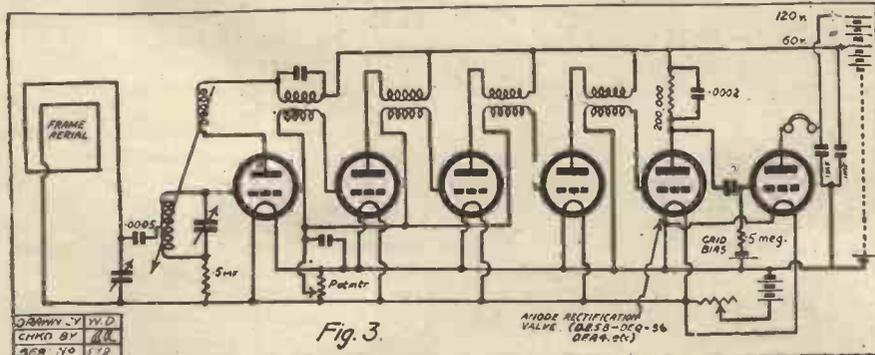
### Important Considerations.

For distant 'phone reception with an outside aerial, high-frequency detector, and one low-frequency set is an exceedingly good arrangement. (Fig. 1.) Moreover, this set will give quality unobtainable with reflex circuits on both local and distant stations. The wave-trap is exceedingly simple, and will cut out local telephony easily on all stations excepting those very close in wave-length to the local station. Distortion is eliminated in this circuit by using anode rectification (instead of the conventional grid leak and condenser), the use of resistance-coupling low frequency, and the tone adjustment.

The valves used may be S.6 or D.E.Q. for the high-frequency and detector stages, with a D.E.V., B.6, or similar valve in the last stage. The above-mentioned valves all take 3 volts on their filaments, and so a common filament rheostat may be used in connection with a 4-volt accumulator. Tuning by adjustment of the rheostat is to

arrangements, full particulars of which were given in "P.W." dated January 16th.

The super-heterodyne and the neutrodyne are gaining in popularity, and they undoubtedly are the most sensitive circuits for long-distance reception. Here, again, anode rectification should be used where possible, and resistance coupling in the low-frequency stages.



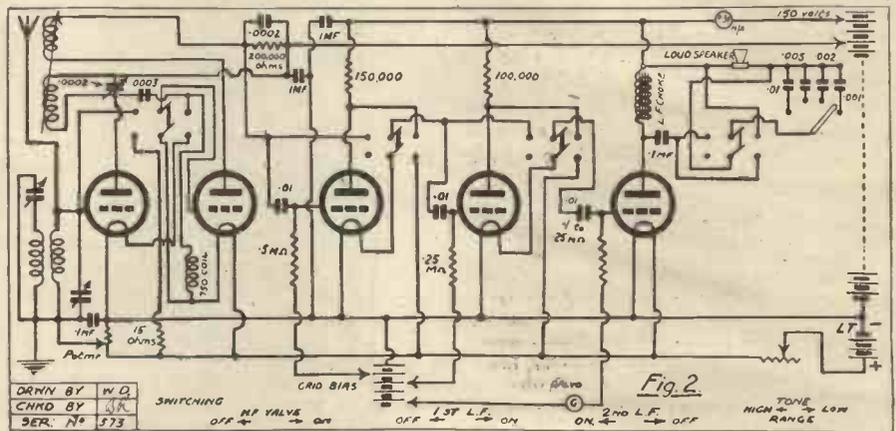
### Super-Het Improvements.

I know of one American neutrodyne receiver on which reception was ruined by bad low-frequency stages. As soon as the low-frequency transformers were ejected and resistance coupling was used, the quality of reception became excellent.

The second detector of a super-heterodyne should always be arranged for anode rectification. This may be done by omitting the grid leak and condenser, and using a high magnification valve (D.E.Q., D.F.A.4, S.6, etc.) as a detector. Using the Tropadyne circuit, this arrangement is shown in Fig. 3. Used with care, super-heterodynes will give exceedingly good quality with amazing sensitivity and selectivity. They should *always* be used with a frame aerial, as (apart from causing interference) there is much more freedom from atmospherics than when an outside aerial is used.

### Valve Characteristics.

In connection with the construction of super-heterodyne sets it is advisable to try and make the set work with the potentiometer near the negative end. If the constructor does not do this, he will have to pay dearly for a huge anode current with constant renewals of high-tension batteries. Surprising though it is, the required condition may be entirely obtained by carefully spacing out the components, especially the intermediate transformers, and minimising capacity effects in the wiring. The



directions given with several of the American kits do not lay sufficient stress on this point. The valves used on the intermediate stages should have a fairly low impedance if the transformers have a step-up ratio, and should all be of the same type.

It has often been stated that American "tubes" have different characteristics from British valves, and that British valves are unsuitable for working with American intermediate transformers. This is quite wrong. British valves are made in many types, and several of them have *exactly* the same characteristics as the Yanks' "tubes." And, apart from the valve-base, British valves are, on the whole, far better and more uniform. Thus, the D.E.5 and B.4 are similar to the U.V.201A., the B.5 to the U.V.499, etc.

When the owner of a long-distance set has had a few days' "play," pulling in unintelligible *very* distant stations, it is well to get down to some standard dozen best stations and note the dial settings. Choose stations which are the most free from ship spark interference—which is still extremely bad—and stations which are at all times worth hearing.

Quality in reception, however, should be our watchword for the future, and the long reign of "Distortoflex" circuits must come to an end. Let us all, therefore, study the first principles of the wonderful valve with one common end in view—the elimination of distortion, broadcasting's greatest enemy.

**T**HE B.B.C. seems to be unlucky. The criticisms levelled against Captain Reginald Berkeley's radio play, "The Quest of Elizabeth," have been generally caustic and, perhaps, unduly severe. But anyone who listened to this play will, we think, admit that it was not quite suitable for broadcasting purposes. At the Grand Guignol Theatre in Paris it would have been dismissed as wishy-washy, for undoubtedly there was a strong streak of sickly sentiment which, despite the harrowing theme of the play, cloyed rather badly. And if London had a Grand Guignol theatre, it would have probably brought tears to the eyes of many people in the audience, and badly scared anyone who was "due for an operation."

#### The B.B.C.'s. Censorship.

But despite these criticisms, which we feel are justified, a good deal of the criticism levelled at the B.B.C. and at Captain Berkeley has been rather harsh. The play was not as bad as all that, and those who object to Captain Berkeley's effort seem to have taken the matter to heart very strongly.

The curious part about the agitation caused by this play is the fact that it had been broadcast eight times by various provincial stations before it was broadcast from 2 L O, and, according to a B.B.C. official, no complaints had been received. It would seem that the B.B.C. official who warned listeners that the play was "harrowing," unwittingly put his foot in it, and we feel that this warning was primarily the cause of the outburst of hostile criticism which followed after the play had been broadcast.

Captain Berkeley has resented the fact that the B.B.C. "cut" his play without consulting him, and the B.B.C. maintain that they have the right to exercise censorship over any play broadcast, irrespective of the author. As a matter of courtesy the B.B.C. might have consulted Captain Berkeley, although their excuse was that there was no time to do so, but we feel that their position is rather analogous to that of the editor of a paper, as the editor may exercise his prerogative to alter or cut any article without consulting the author. Perhaps it would be as well, in the future, if the B.B.C. made it quite clear to budding radio playwrights that they reserve to themselves the right to alter and delete, as they think fit, the manuscripts of any radio play accepted for broadcasting.

There are bound to be further controversies about radio plays, and we feel that our sympathies go to the B.B.C., because they are endeavouring to find plays which are interesting, gripping and entertaining, and it is an undoubted fact that originality, in whatever form, will always arouse hostile criticism.

However, both the B.C.C. and Captain Berkeley have obtained a considerable amount of publicity out of the affair, and now that explanations have been given on both sides, perhaps the matter will be allowed to drop.

In giving evidence at the last sitting of the Government Broadcasting Committee of Inquiry, Mr. Reith stated that many months ago the B.B.C. put forward a new distribution scheme. He said that, having regard to the facilities available, the present system of broadcasting was the only possible way of accumulating all possible resources

## CURRENT TOPICS

By THE EDITOR.

Captain Berkeley's Play—The Question of Censorship—B.B.C. Activities—Revenue and the Post Office—An Unsatisfactory State of Affairs.

to bring about the next logical step, namely, fewer stations and higher power—and it was a mistake to expect that the new scheme would be less costly even though very efficient otherwise.

Mr. Reith also stated that it was impossible to exaggerate the importance of the financial question. The B.B.C.'s activities were being very considerably curbed by the limitation of revenue imposed under Section 7 (2), of the Supplementary Agreement for October 1st, 1923.

It is evident that the B.B.C. do not agree with the Post Office with regard to the interpretation of this clause. The B.B.C. urge that no matter how great the licence revenue, not only can it be used to advantage in the development of the service, but any limitation seriously hinders its progress. Mr.

It has been estimated that the Postmaster General will have received the sum of £750,000 in respect of licences apportionable to the twelve months April 1st, 1925, to March 31st, 1926, and assuming the B.B.C. receives 7s. 6d. of every 10s. licence fee, the amount to which it is entitled is, therefore, £562,000, thus leaving £62,000, in addition to the £187,000, the latter sum being the Post Office proportion of the licence fee for the same period; and as the number of licences in force on December 31st, 1925, was 1,645,000, it may be assumed that the Post Office during the forthcoming year will receive not less than £800,000 in licence fees.

Mr. Reith urged that the proportion payable to the B.B.C. be increased to 9s. This would leave £80,000 for Post Office expenses, which, we think, would be more than adequate.

At first sight Mr. Reith's proposals arouse the natural ire of taxpayers, especially when he states that the B.B.C. can make use of an almost unlimited revenue; but the B.B.C.'s position is somewhat different. It is not like the Chancellor of the Exchequer demanding it; no doubt the Chancellor could make use of unlimited revenue; but if the B.B.C. were given an unlimited



This completely self-contained American portable set is extraordinarily compact, as readers will agree when it is stated that an eight valve super-het circuit is employed.

Reith was emphatic that there is no limit to the amount of revenue that can be efficiently employed.

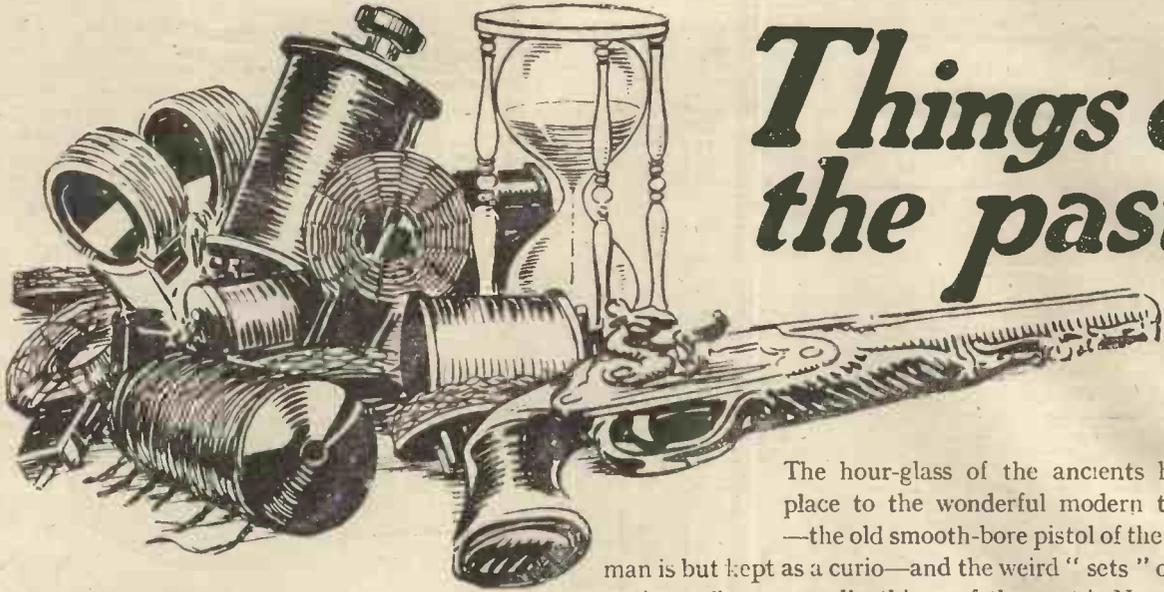
In other words, the B.B.C. can spend every penny they can get hold of, and in this respect they are not far behind some Government offices we have in mind.

#### More Money To Spend.

Their revenue has been limited to £500,000 a year. As a result of this restriction they have had to cut down expenditure as, with the natural and inevitable increase of the B.B.C.'s activities, it was found increasingly difficult to keep within this limited yearly revenue. Mr. Reith strongly urged that the committee agree that no financial restrictions should be placed upon the B.B.C. if the benefits of the service are to be fully exploited in the public interest.

revenue they would be able to provide, more frequently, broadcasts by the world's most famous artistes; they would be able to improve their service in many different ways, and everything would undoubtedly react to the benefit of listeners.

We sincerely trust that Mr. Reith's proposal that the Post Office should disgorge £62,000 will be seriously considered by the Committee, and that, also, his suggestion that the B.B.C. receive 9s. out of every 10s. licence fee be seriously considered. The position as it is to-day is not at all fair either to the B.B.C. or to the hundreds of thousands of listeners in this country. The Post Office is holding money which listeners have spent for the specific purpose of obtaining the best broadcasting. And they naturally want to get value for their money—not the gratitude of the Post Office.



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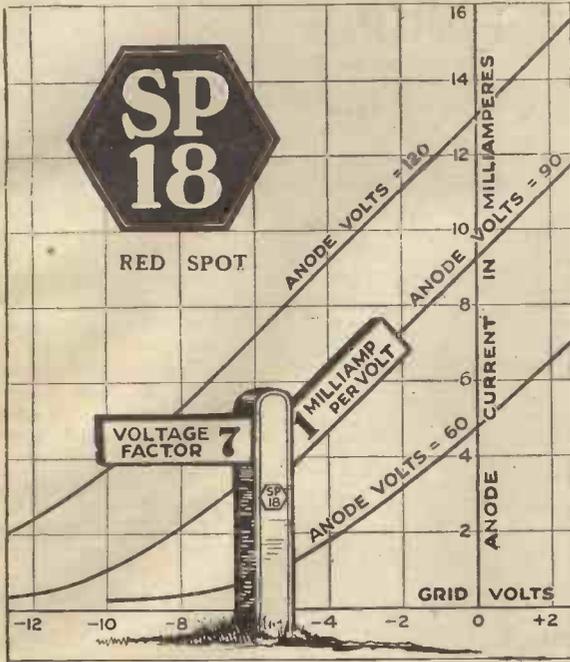
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THE ordinary electro-magnetic telephone receiver has attained a degree of popularity which is altogether remarkable when we consider seriously the many shortcomings of that instrument as a converter of electrical energy into sound vibrations. For one thing, the electro-magnetic telephone only converts approximately one thousandth of the total energy which it receives into sound waves, and again, owing to the purely magnetic pull which is exerted on an appreciable portion of the diaphragm's surface, such instruments are very often productive of greater or less degrees of distortion.

In its original form, the ordinary electro-magnetic telephone receiver was a comparatively insensitive instrument, requiring currents of considerable magnitude in order to actuate its diaphragm. The instrument, however, quickly became modified, with the result that its sensitivity and the naturalness of its reproduction of speech and music currents were made very much greater. Concurrently with the improvements which were effected with the ordinary type of electro-magnetic telephone, the principle of the reed 'phone was introduced, and instruments designed according to that invention enhanced to some degree the sensitivity, and more particularly the purity of reproduction obtainable from sound-reproducing instruments.

**A New Principle.**

Despite, however, the admitted shortcomings of the electro-magnetic telephone receiver, inventors and experimenters seem to have pinned their faith to this type of instrument, and, in general, to have ignored the many possibilities of obtaining sound reproduction by any other method. In view of this fact, it will be a matter of interest to many "P.W." readers to have set before them the theory and constructional details of a new type of telephone-receiving instrument which is actuated not by electro-magnetic forces, but by heat influences, and which, therefore, does not admit of the factors which ordinarily produce distortion in the electro-magnetic receiver.

Particularly will the details of such an instrument interest crystal experimenters, for the telephone receiver to be described is in effect a *crystal telephone*, its working principle being the production of thermal disturbances at the point of contact of two carefully chosen crystals.

The crystal telephone, which is now being described in constructional detail for the first time, is the invention of Mr. Leslie Miller, an experimenter well-known in radio circles. Amateur readers of "P.W." have the full permission of the inventor to construct the crystal telephone, and to use it in any way they like. It must not be imagined, of course, that, at the present stage of its evolution, this crystal sound-producing instrument is an absolutely perfected device. On the contrary, the crystal telephone has several imperfections which have yet to be eliminated. For instance, the present form of the instrument

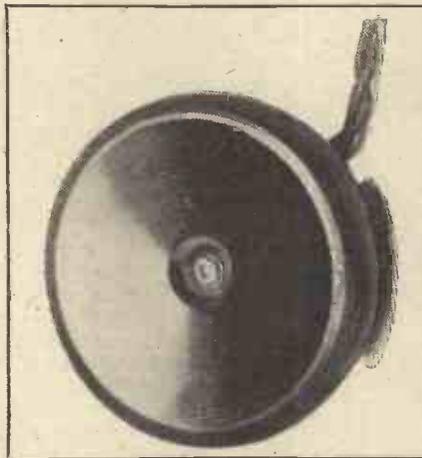
**THE CRYSTAL TELEPHONE**  
OR  
**"LOOSE CONTACT THERMOPHONE."**

By **J. F. CORRIGAN, M.Sc., A.I.C.**  
(Staff Consultant.)

Our readers will be very interested in this and the following article, in which Mr. Corrigan describes a crystal 'phone any amateur can make for himself.

**PART I.**

is not sensitive to radio signals coming from greater distances than about 6 miles from a transmitting station of the power of 2 L O, the receiving set itself being employed on an



The external appearance of the new telephone receiver is similar to existing types.

ordinary amateur aerial of restricted dimensions. The use of valves in the receiving set, of course, increases the effective range over which the crystal telephone will operate, and thus, by employing a highly efficient multi-valve receiver, the range of the instrument can be considerably increased. In fact, under special circumstances, the sensitivity of this instrument can be made to attain extraordinary proportions, and really good and reliable signals have been received from America with it, using, of course, an efficient valve receiving set and a commercial aerial.

Before describing the construction of the telephone, however, let us deal, in the first place, with the theoretical considerations which underlie its action.

The crystal telephone, or "loose-contact thermophone," as it has been called, is an instrument which reproduces sounds through the agency of heat disturbances which take place at the point of contact of certain sulphides, oxides, minerals, and even metals

themselves. Thus the invention of the telephone adds still further to the many sided electrical properties of the radio-sensitive mineral or crystal, and possibly the underlying cause of its action will be found to be closely allied to the rectifying function of the crystal.

It is well known, of course, that a microphone, consisting of a loosely adjusted carbon contact, connected in series with a battery will convert into electrical impulses

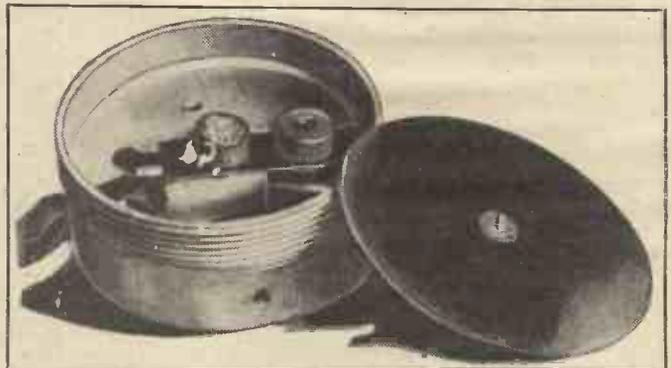
any sound vibrations which may be allowed to impinge upon its diaphragm, but the fact that the reverse of this effect can occur does not seem to be so well recognised. However, a carefully adjusted carbon microphonic contact will convert into sound waves any electrical impulses which are passed through it.

This action constitutes the main principle of the crystal telephone, and it is from this fundamental fact that the present instrument has been evolved.

**Beautifully Clear Reproduction.**

The crystal telephone, as it stands at present, consists of a crystal contact which is arranged inside the earpiece of an ordinary wireless receiving headphone. A very delicate means of adjustment is provided for the contact. Through the crystal contact is passed a small constant current which is provided by means of a local battery of low E.M.F. Many different types of crystal contact may be used in the instrument, the best, however, being a contact between a hard and a soft variety of ordinary galena (one of the proprietary brands of that material), or between galena and fused marcasite (sulphide of iron), or further, between galena and tellurium. Excellent results are also obtained by using a crystal of graphite for the acting contact.

Arranged in this manner, the crystal telephone is attached to the 'phone terminals of a crystal or valve receiver oper-



A crystal telephone employing an ordinary stalloy diaphragm.

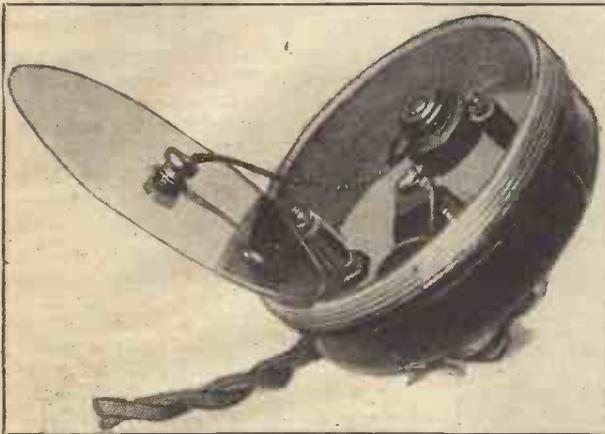
ating on an efficient aerial, and beautifully clear, although not loud, signals are heard in the 'phone. The main characteristic of the crystal telephone is the extreme tonal purity of the reception, and, in fact, its tone-producing qualities have merely to be heard once in order to be fully appreciated.

(Continued on next page.)

## THE CRYSTAL TELEPHONE.

(Continued from previous page.)

The theoretical action of the instrument is fairly simple in general principle. The local current merely acts as an amplifying agent. The impulses of current which enter the 'phone from the receiving set heat up the point of crystal contact very slightly. However, although this heating effect is only slight, it is sufficient to cause the two crystals to cohere at the point of contact where the heating effect is localised. This forms a conducting area, and thus allows the current to pass more freely. Thus, under the influence of a series of



A more efficient crystal telephone employing a mica diaphragm.

impulses, the crystal contact alternately expands and contracts, and this successive expansion and contraction is passed on to the diaphragm, thus reproducing the sounds which were originally transmitted.

### A Revolutionary Combination.

Even without the use of the local amplifying current, faint sounds can be heard in the 'phone. This indicates that, under these conditions, the crystal contact is performing a double function—it is rectifying and amplifying at the same time. In fact, it is hoped at some future time to devise an instrument in which this effect can be perfected. Such a telephone receiver would be revolutionary in nature, for, besides doing away with the necessity of using a local amplifying current, the use of a crystal rectifier in the receiving circuit would also be eliminated.

The "Miller" crystal telephone may be made by any interested amateur who has in his possession a single earpiece 'phone. The magnets should be removed from these, and also the spacing washers of the diaphragm.

The details of the crystal telephone construction are indicated at Fig. 1. Here it will be seen that a small crystal cup is soldered on to the centre of a strip of brass of about  $\frac{3}{8}$  in. width. This brass strip is firmly secured at its one end by means of a screw which passes through it, and which is insulated from the metalwork of the 'phone earpiece by means of an ebonite bush.

Difficulty may be experienced in obtaining a crystal cup of sufficiently small

dimensions to fit on the strip, and in this case it will be advisable to use a small section of brass tubing of about  $\frac{1}{8}$  in. diameter for the purpose, or else a brass cap off the carbon from a flashlight battery.

In the base of the 'phone earpiece is fitted a small metal screw, with a securing nut attached to it. No ebonite bushing must be provided for this screw. Connections are now taken from this latter screw, and from the end of the metal strip upon which the crystal cup is soldered.

### Constructional Details.

Now as to the diaphragm of the instrument. It is simplest to use for this purpose the metal diaphragm with which the 'phone was originally fitted. A small fragment of the necessary crystal is very carefully sharpened down to as fine a point as possible by the aid of a small nail file, and this is then embedded in a minute blob of solder which is dropped on to the exact centre of the diaphragm, any surplus solder being carefully filed away after the crystal fragment has become firmly fixed in its setting.

A means of adjusting the crystal contact must now be provided. The exact method of effecting this may be left to the discretion of the amateur, but probably the most convenient method consists in making a small tapped thread in the base of the earpiece, and by providing an adjustable screw for this, so that when the screw is slightly turned it causes an upward or downward movement of the metal strip holding the crystal cup.

The diaphragm is now replaced, and the earcap gently screwed on. It will be seen that, under these conditions, the fragment of crystal attached to the centre of the diaphragm will make contact with the crystal in the cup, and that the degree of contact can be varied by adjusting the screw at the back of the 'phone earpiece. Consequently, current entering into the 'phone passes through the diaphragm, through the crystal contact, and back into the receiver, or, of course, in the opposite direction.

### The Crystals to Use.

A photograph of the crystal telephone constructed in the above manner is shown, as is also a similar receiver employing a lighter and more efficient mica diaphragm. If a mica diaphragm is employed, it will be observed that an added constructional complication is required in the form of a small length of flexible cable attached to the diaphragm crystal mounting, and, at the other end, to one of the input terminals of the 'phone. Also, the mounting of the crystal on a mica diaphragm is a matter which calls for considerable technical skill.

The beginner is therefore advised to commence his crystal telephone experiments with an instrument containing a metal diaphragm, after which, if he pleases, he may proceed to the construction of the

rather more efficient mica diaphragm instrument.

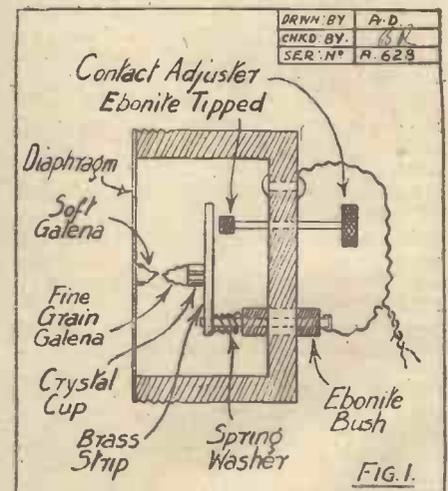
Having described the general construction of the crystal telephone, it is now necessary to dwell in some detail upon the type of crystal combination which must be employed in it. Strictly speaking, a contact of any two minerals or alloys will afford some measure of reception, but, in actual practice, it has been found that the best results are obtained when the crystal in the movable cup is composed of a flat piece of moderately hard galena, the small pointed fragment of crystal affixed to the diaphragm being of a harder and finer-grained variety of galena.

A zincite-bornite combination will also give good results. So also will a plate of soft carbon making contact with a hard galena point. A fused marcasite (iron sulphide) galena combination is also a very efficient audio contact to use.

### Scope for Experiment.

The whole success of the instrument lies in the choice of a suitably sensitive crystal contact, and whilst the contacts referred to above have been found to be successful under actual test, it must not be imagined that these are in any way final in nature. The crystal telephone at the present stage of its development is only in its earliest efficiency, and thus there lies a tremendous field of research, pregnant with many practical possibilities, in front of the crystal and radio experimenter who is willing to take up the investigation of this new sound-producing property of the crystal, and to develop it to its fullest extent.

In my next article I shall have further details of the crystal telephone to place before my readers, and I shall also describe a number of receiving circuits in which the telephone will readily function.



## PHOTOGRAPHS.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per photo.

# BROADCAST NOTES.

By O. H. M.

New London Radio Dance Band—The Musicians' Union's Ban—  
"The Quest of Elizabeth"—Topical Talks—Broadcasting Committee's Report—An Artisan Critic.

THE appointment of Sidney Firman to take over the new London Radio Dance Band (first suggested on this page) should not be interpreted as meaning the end of outside broadcast dance music. A friend of mine of the Savoy management tells me that a very interesting and important announcement is to be made on February 21st. But he would give no indication of the nature of this announcement, except that it would be welcomed by listeners generally. When I went to the B.B.C. for information about the mysterious February 21st, they were in one of their clam-like moods. So there the matter stands.

## The Musicians' Union's Ban.

One of the negotiators for the Musicians' Union explained to me the other day the real reason for the sudden transformation of atmosphere. Prior to actually meeting the B.B.C., the statements of the Musicians' Union representatives were anything but cordial. They believed they were up against a big corporation bent on securing something for nothing and prepared to go to the limit according to the usage of ordinary commercial competition. Having this in mind, it is not surprising that the Musicians' Union were inclined to brandish the big stick. But the first meeting with Mr. Reith, the managing director of the B.B.C., changed their whole attitude. They found him anxious to interpret the functions and obligations of the B.B.C. purely in terms of public service. In this pleasant atmosphere the ban was soon lifted, the programmes continued as usual, and negotiations developed satisfactorily, although it is too early as yet to speak with certainty of a favourable issue. One of the negotiators of the Musicians' Union spoke in the highest terms of Mr. Reith's ability and magnanimity.

I hear that the B.B.C. is contemplating a big operatic production to be given at the end of March. Plans are not yet complete, but, according to present expectations, the opera chosen will be performed for the first time in England and with a distinguished international cast.

A special Chopin Recital will be given by Sapellnikoff on February 22nd.

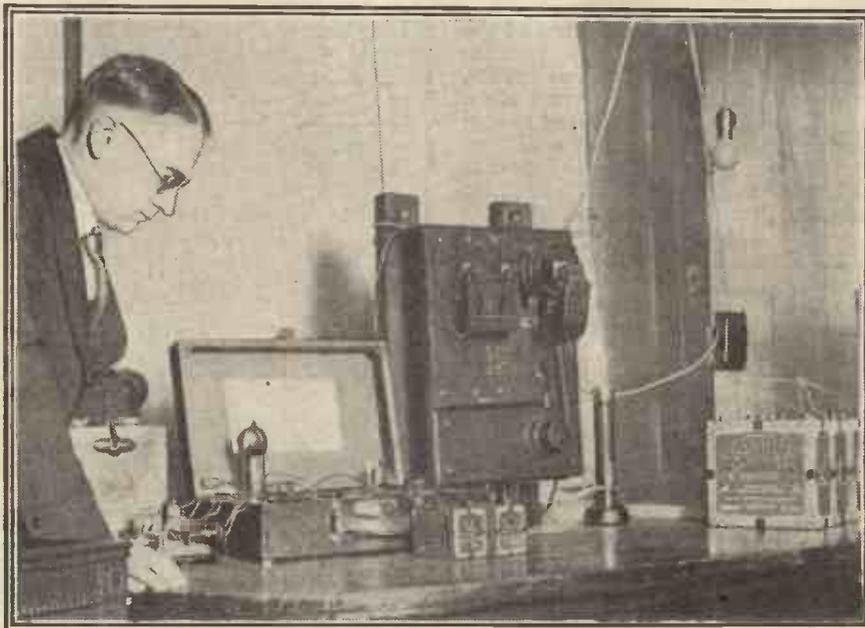
## The "Quest of Elizabeth."

It is a great pity that there has been such a tremendous fuss about Captain Berkeley's drama, "The Quest of Elizabeth," recently put out from London after eight successful provincial performances. Personally, although it is admittedly very well done, I doubt if the subject-matter is suitable for broadcasting. I do not mean that there should be unnecessary limitations in the selection of dramatic material. But painful experiences in hospitals having fatal results are much too close to a possibility to the majority of people to render them appropriate material for amusement.

To my mind, the whole thing would have been put right if the B.B.C. had re-cast

the second half of the play so that Elizabeth had recovered. My criticism is, therefore, that insufficient adjustment and excision were undertaken. I think the B.B.C. is quite right in reserving full freedom of action in censorship. Broadcasting is quite different from any other form of entertainment in the importance of censorship.

Even artistic considerations may frequently be sacrificed. Captain Frank Shaw, who has done more successful dramatic work for the B.B.C. than any other author, has



EXPERIMENTING WITH A PHOTO-ELECTRIC VALVE.

An American physicist engaged in research with the new "Shadow-tube," which works like a valve, but is controlled by any shadow falling upon it.

absolutely no fault to find with his treatment by the B.B.C. Dramatic Department. He goes so far as to state that the changes and adjustments made in his plays have uniformly improved them and thereby enhanced his reputation.

## Topical Talks.

It is good news that the B.B.C. has decided to change the time of its early talk on Saturday afternoon. Under present arrangements, there is a talk at four o'clock, which opens up the afternoon programme proper. Under the new arrangement the Children's Hour will start at four, and the talk will be wedged in at 4.45. While on this subject of talks, I still see very little sign of the regular introduction of topicality. An exception, however, must be recorded in the case of the special broadcasts arranged in connection with the gallant rescue of British seamen by the United States liner, "President Roosevelt." This was ideally handled from the broadcasting point of view. Let's have more of it!

It is significant of the International orientation of broadcasting to know that

the speeches at the League of Nations Assembly at Geneva, in March, are to be broadcast throughout Europe and Great Britain. This Assembly is being called for the special purpose of admitting Germany to the League, and as such will definitely mark the beginning of a new era both in European and world affairs. I sincerely hope that the land line to Paris will work better this time than it did in September. The energetic Arthur Burrows is already experimenting, so that at least nothing will be left undone in the way of adequate preparation.

## Broadcasting Committee's Report.

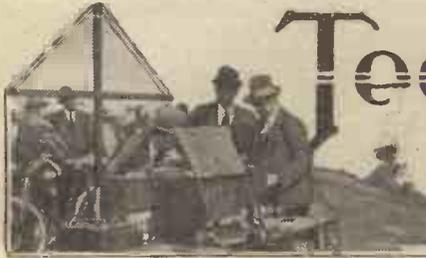
Having completed the reception of verbal and written evidence, the Broadcasting Committee is now engaged in drafting its report. This it is confidently anticipated will recommend the constitution of a permanent and representative broadcasting authority to take over the service at the end of this year. From the

questions put to Mr. Reith at the last public session of the Committee, it seems clear that there is little doubt in the minds of the members of the Committee on the score of the competence of the present staff of the B.B.C. I understand that the report will be tabled by the end of March. The legislation will be delayed somewhat because of the prior claim of a number of other measures of more urgent importance. But it is expected that the new arrangements will receive parliamentary sanction before the House rises for the summer vacation.

## An Artisan Critic.

I was very interested to hear that the B.B.C. had engaged an artisan as one of its regular outside critics. His reports have already proved to be of unusual value in reflecting the opinions of those who must always remain the majority of listeners. The idea of representative outside critics on a reasonably paid basis is very sound.

The appointment gives but added proof that the B.B.C. are doing their utmost to meet the requirements of their vast audience.



# Technical Notes

Conducted by our Staff Consultant, J. H. T. ROBERTS, D.Sc., F.Inst.P.

## L.F. Transformer Breakdowns.

PROBABLY there are few wireless experimenters who have not at some time or other had the misfortune to burn out an intervalve transformer. Although these transformers can be repaired, it is usually a matter which is apt to seem hardly worth while. It may be useful to know, however, that a burnt-out transformer can often be turned to good account as a choking coil.

Almost invariably it is only one of the windings which is burnt, the other one being intact. Tests should be made for continuity, and when the winding is discovered which is intact, this may be employed, as already mentioned, for the purpose of a choking coil. In the articles which are to appear in this journal on the subject of high-tension eliminators it will be seen that choking coils are required, and for this purpose a burnt-out transformer may very well be used.

## Choke Coupling.

Generally it is the secondary which is intact, and this may also be used in choke-coupled low-frequency amplifiers. The circuit for this purpose is similar to that of a tuned-anode high-frequency amplifier. A fixed condenser of, say, 0.002 microfarad is put in parallel with the choke and a grid condenser of 0.005 microfarad used in the grid lead, together with a grid leak of about 2 megohms connected to the L.T. negative.

The amplification obtained in this way, although not quite equal per stage to that obtainable by transformer coupling, is nevertheless somewhat superior to that obtainable by resistance coupling and does not suffer from the drawback of requiring a very high H.T. voltage.

## Variable Condenser Development.

An interesting new variable condenser has been placed on the market by the Cardwell Company, of U.S.A. which, although retaining the semi-circular shape of vanes, nevertheless gives straight-line-frequency tuning. The secret lies in the manner in which the plates are tapered in thickness, so that as the plates rotate they dovetail more closely or less closely owing to the varying thickness of both the fixed and moving vanes. In other words, the manner of variation required for the straight-line-frequency feature is obtained by variation of thickness instead of by variation of contour.

## An Automatic Set Control.

A clock, known by the name of "Radio-o-Larm," has been designed for the purpose of switching on and off a wireless receiver at specified times. The clock is connected to the wireless set in such a way that it makes and breaks the filament circuit and the H.T. circuits as required. One advantage

is that there is little possibility of the set being left on all night by mistake.

## Listening Through Bones.

It is well known that people ordinarily deaf may sometimes be able to hear by means of sound vibrations transmitted; through the teeth, for example, to the bones of the head.

Since the advent of wireless, owing to so many people who had difficulty in hearing having derived great satisfaction from listening to broadcast programmes by means of headphones, a good deal of research

bearings in that direction. He has found that a hot mixture of iron and an alkali metallic oxide such as potassium oxide will give off a continuous stream of ions. For example, a fused mixture of iron oxide with about 1 per cent of potassium oxide may be used.

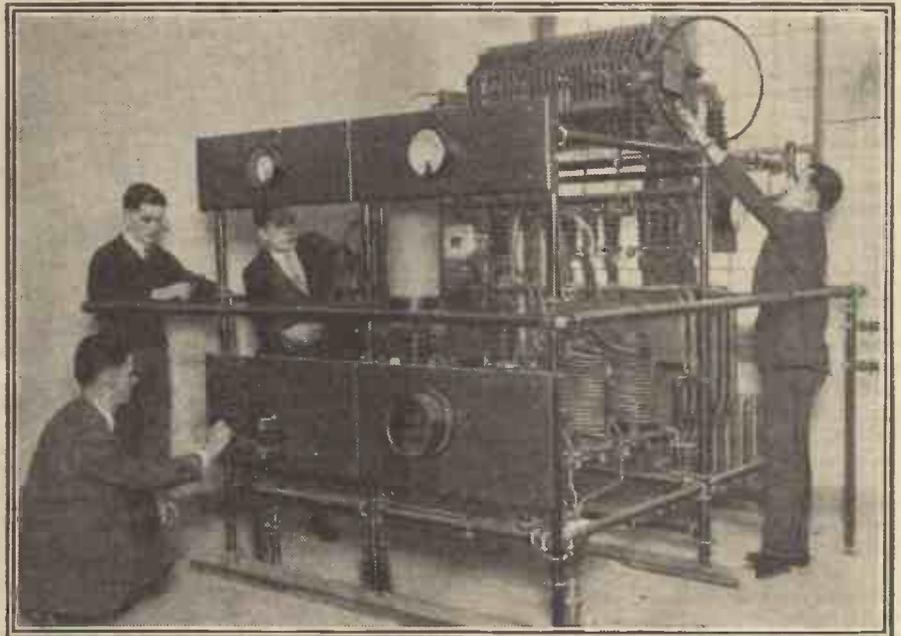
This mixture will give off some ions, but the ionic emission is very considerably increased if the oxide be reduced by means of hydrogen, so that the iron oxide, or at any rate part of it, is converted into metallic iron, and possibly some of the potassium oxide may be converted into metallic potassium.

A mixture of iron and caesium will yield a stream of caesium ions.

A wireless valve known as the "sodion" tube, which depends upon the electronic emission from an alkali metal, is already on the market, and therefore it is not fantastic to suppose that the new discoveries by Doctor Kunsman may have immediate applications to wireless purposes.

## Opposite Polarity.

It is interesting to note that if a valve were employed which depended upon ions



One of the transmitting panels at WJZ, which can now handle the super-power of 50 kilowatts.

along these lines has been instituted, and many important helpful devices for the deaf or partially deaf have been produced.

One of the latest of these, and one which depends upon a very interesting principle, has been produced by Professor Robert H. Gault, of U.S.A. He has found that certain parts of the body, in particular a portion of the palm of the hand, are very sensitive to sound vibrations, and by means of a specially-designed telephone receiver, which is adapted to be held in the hand in contact with the sensitive area, deaf people are enabled to receive broadcast programmes and any other messages telephonically transmitted with remarkable facility.

## An Important Discovery.

Doctor Kunsman, a well-known scientist, has recently made an important discovery which, although not applied by him to wireless, may nevertheless have important

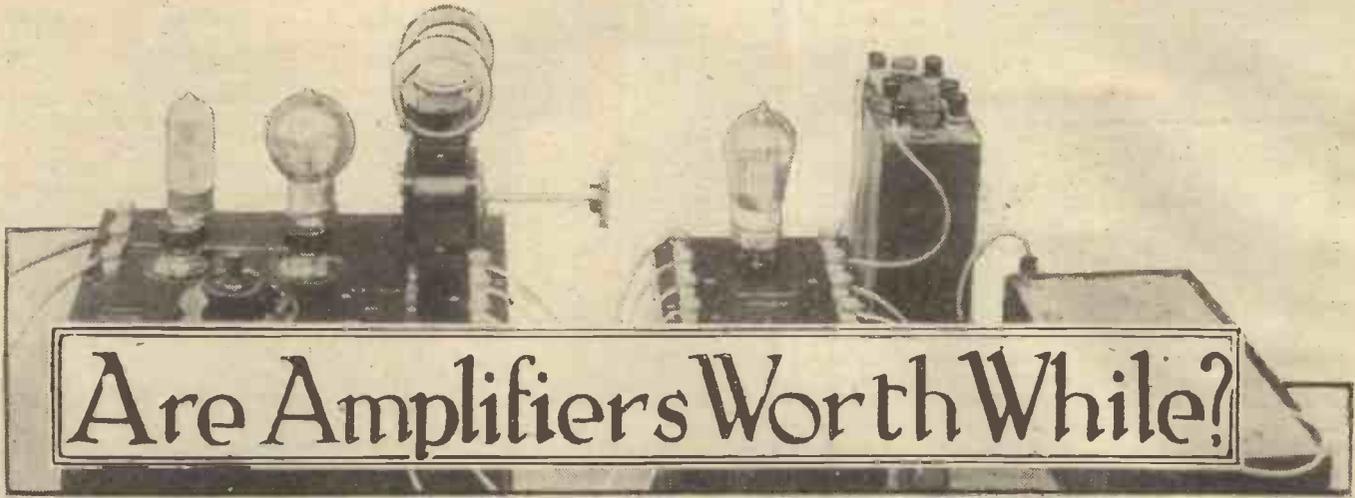
for the transmission of the thermionic current instead of upon electrons, some curious alterations in the *modus operandi* would be incurred.

In the first place, the ion weighs enormously more, usually some thousands of times more, than the electron and the consequent lag in the response of the valve would be much greater, although whether it would be sufficiently great to introduce any practical difficulties would depend upon various circumstances.

Another point is that assuming the ions to be positive ions (as they would be in the case mentioned above) the ionic stream would be of the opposite polarity to that in the present-day valves.

Many other interesting points, and some important possibilities, are raised by this new discovery.

(Continued on page 1433.)



# Are Amplifiers Worth While?

\*-----\*  
 By G. V. DOWDING, Grad.I.E.E.  
 (Technical Editor)  
 \*-----\*

ARE amplifiers relics of unit-set days? That is a question that is not quite so easy to answer as might at first be thought. For quite a long time the unit set was extremely popular; perhaps the multiplicity of inter-connections occasioned by the system had its appeal, but more probably the uncertain, albeit rapid growth of broadcasting stations had a great deal to do with it. In those earlier days, when British and Continental stations were, in a manner of speaking, springing up overnight, it was decidedly comforting to know that one had a set that could be added to at a moment's notice; a set, in fact, that could, to some extent, "march with the times."

## Two Main Alternatives.

I can well remember the days when amateurs commenced with modest "detector units" and subsequently added amplifier

required for rendering previously "unreceivable" stations audible, is it better to add an amplifier or scrap the existing set and build another and more powerful receiver? There is a third alternative, but I will deal with that later.

There are quite a number of factors to be considered before one can come to a definite conclusion, and they are all the more difficult to deal with inasmuch as both requirements and circumstances vary to an enormous degree.

Let me first of all take the case of a listener who has had very satisfactory telephone reception with a crystal set and who ultimately desires to operate a loud speaker. A one-valve low-frequency amplifier will not produce sufficient volume in the majority of cases; two valves will almost invariably be required even for a medium-sized loud speaker. A crystal set coupled to a two-valve amplifier will give excellent results, but so will a two-valve set. An amplifier requires batteries and will take up as much room and

purer quality of reproduction, but a two-valve set (det., L.F. with reaction) will have a far greater range of reception when telephone receivers are used, and thus might permit headphone reception from one or two other stations. Not that this latter may ever be regarded as a desirability in itself, but nevertheless the capability to do greater things is there. Owners of "Rolls-Daimlers" very seldom "go the limit," but it is gratifying to the majority of most of us humans to have that "could-if-we-wanted-to" feeling.

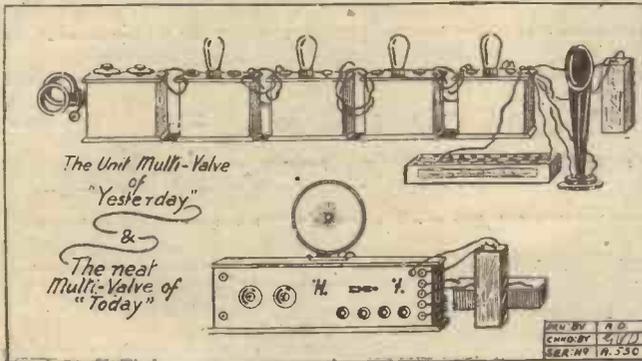
Further, crystals are inherently unstable devices; a valve set once adjusted will "deliver the goods" until its batteries begin to run down and seldom requires "inter-concert" readjustment. Still further, the cost of a two-valve set is no greater than that of a two-valve amplifier.

## An Amplifier's Adaptability.

The balance would therefore, so far, appear to be against the amplifier and in favour of the two-valve set and the scrapping of the crystal receiver, but there is just one other point to take into consideration. An amplifier is almost "automatic" in operation, but a valve set requires careful "tuning" if it is to give successful results. "Tuning-in" becomes quite a different business and, at first, it will be like starting all over again, but with a more complicated and peculiarly behaving instrument than a crystal set.

Finally, it must not be thought that I have forgotten to take into account the adaptability of an amplifier. To use such an additional piece of apparatus, it might be pointed out, is the better course because when not required it can be disconnected and placed on one side. Personally, I do not admit that this comes into the argument at all, because if the amplification should at periods not be desired, how much easier

(Continued on next page.)



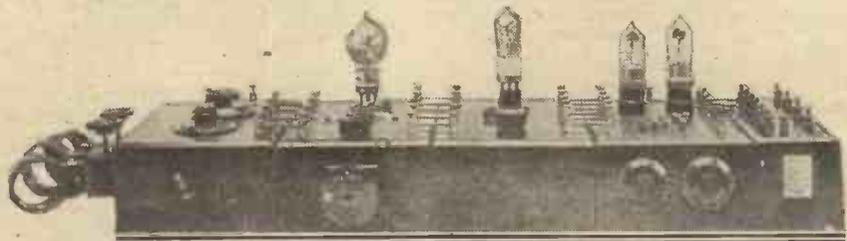
These two types of receivers almost form "milestones" in the progress of broadcasting reception.

units until an average receiver resembled a miniature goods train running across a large table or bench, because those days are situated but a year or two back in the calendar. Eventually most of those amateurs scrapped their unit sets and built nice compact multi-valve sets. Obviously they did not find externally added amplifying stages worth while. *Autre jours, autre mœurs!* But nevertheless the permanent addition of an amplifier in the form of a self-contained unit to a receiver is undoubtedly a method reminiscent of unit-set days.

The whole problem resolves itself into this. Granted that the need of amplification beyond that already existing in a set is necessary, whether it be for the purpose of increasing the strength of signals from an existing station, or whether it is

cost as much to run as a two-valve receiver. Additionally to this, there is the crystal set to occupy space and require adjustment.

On the other hand, the crystal set-cum-amplifier will deliver (sometimes almost inappreciably, it must be interpolated)



This is a very neat unit set and has distinctly pleasing "lines." It was constructed by Mr. W. T. Baddley, 34, Railway Walk, Birkdale, Southport, Lancs.

## ARE AMPLIFIERS WORTH WHILE?

(Continued from previous page.)

it would be to have it in the set and cut it out by means of a switch than to have to disconnect an amplifying unit.

Economically minded people should remember the claims of the dual amplification receiver in which a valve is made to do almost double work. Whatever disadvantages such "reflex" receivers possess, the fact remains that they permit the combination of a crystal and valve to be made that results in moderate loud-speaker signals within 10 or so miles from a broadcasting station, and this is more than a crystal set and a one-valve L.F. amplifying unit will do.

### The Use of Switches.

In the case of high-frequency amplifiers many of the above points are applicable, but additionally, such are seldom entirely satisfactory in operation. Given a crystal set of unfamiliar "innards" it is quite even chances whether an H.F. amplifier could be added with even moderate success. Certainly it would be necessary intimately to know the circuit employed in the crystal set and arrange the amplifier accordingly.

Turning to the possessor of a valve set desirous of increasing his range of reception or the strength of existing signals, we have a new set of circumstances to study. Above all others stands out the fact that the employment of another unit to carry out this necessitates a number of additional external leads. A purely aesthetic reason some might think, but I disagree. External leads are, at their best, untidy, but further, they are an element of danger. The careless "brushing" of one or other over a wrong terminal or the accidental "short" which can occur in numerous ways, and two, three, or more expensive valves are burnt out.

No; in the case of a valve set neat little switches which enable any number of the available valves to be brought into service at will are greatly to be preferred to the use of amplifiers. It is here, however, I wish to mention the third sometimes possible alternative referred to at the beginning of the article. It consists of adding a stage of amplification to the receiver internally. It may spoil the "lines" of an ordinary flat panel set, but frequently it will be found quite possible to accommodate an extra valve with its necessary transformer (shrouded) and filament resistance without undue "crowding." Some receivers are built on anything but generous lines in regard to space, and with these it would be quite out of the question, although "crowding" on the L.F. side is not the fearful bugbear it was now that we have scientifically designed shrouded transformers. In fact, two "Eurekas" can be mounted touching each other without trouble ensuing from that source.

### A Different Proposition.

Anyway, it is a point the constructor might do well to bear in mind when building his two or three valve set, more especially if he has, initially at any rate, decided on only one "L.F."

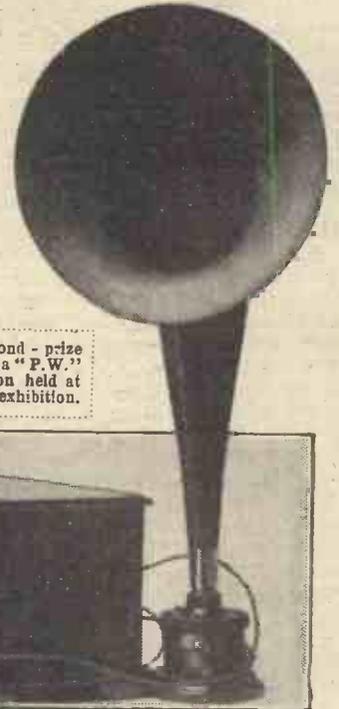
Of course, we are up against a different propositional together in the case of multi-valve sets, and while no doubt the majority of us would prefer a seven valve receiver

with switches controlling six, to a two-valve set and two or three amplifiers, only a fortunate few can build or buy the former at the commencement of their wireless lives. Further, the scrapping of a nice two or three valve set and the building of a four or five valve set might be an undertaking regarded by many as not worth its undoubted advantages against the comparatively simple task of building an amplifier.

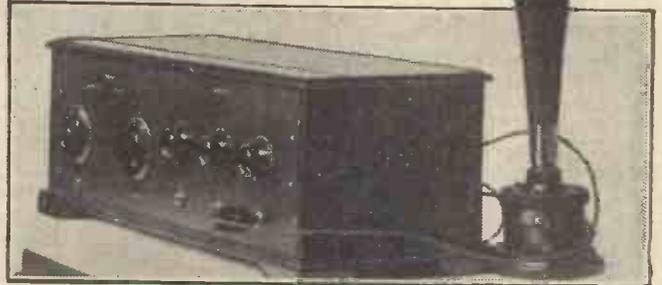
Obvious though it may be, a very important point to consider is that a multi-valve set with all its circuits arranged to work together with optimum efficiency will invariably give better results than detecting and amplifying units externally connected. Carefully built amplifiers designed for particular sets will give very creditable degrees of efficiency, but their absolute success is always more or less problematical, but, as I said before, circumstances vary, and hard and fast rules are difficult to lay down.

To experimenters amplifiers are at all times useful instruments to possess, but the broadcast constructor would do well to consider carefully whether reconstruction or addition is the better course to pursue. Sentimental reasons may sometimes prevent listeners from putting an excellent little set on the shelf, and perhaps others may think that they are getting results impossible to duplicate. A few of the latter may be right, but not many; doubtless thousands will include themselves in that "few," so when loud-speaker ambitions are, doubtless thousands will not consider any other

course than that of "adding an amplifier." Anyway, I trust all will pause just a moment to consider "pros and cons," financially and otherwise. I have, strictly speaking, been writing neither "for" nor "against," and I may have omitted to mention most important individual factors, so I must not omit to conclude by repeating: circumstances alter cases—especially those that contain wireless components!



The second-prize winner in a "P.W." competition held at a recent exhibition.



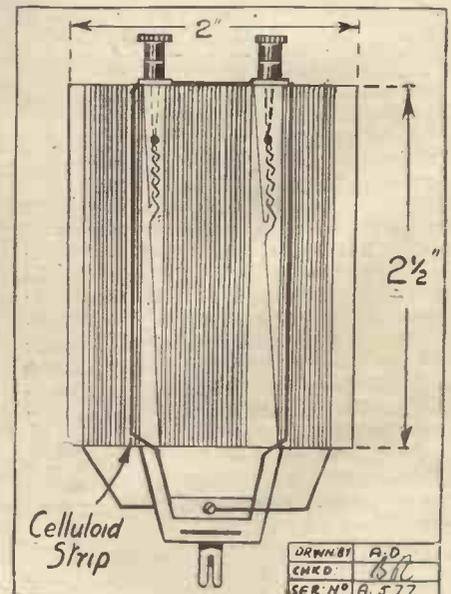
A 3-valve set constructed by Mr. Ivan Thyden, 3, Apsley Terrace, Acton, W.3.

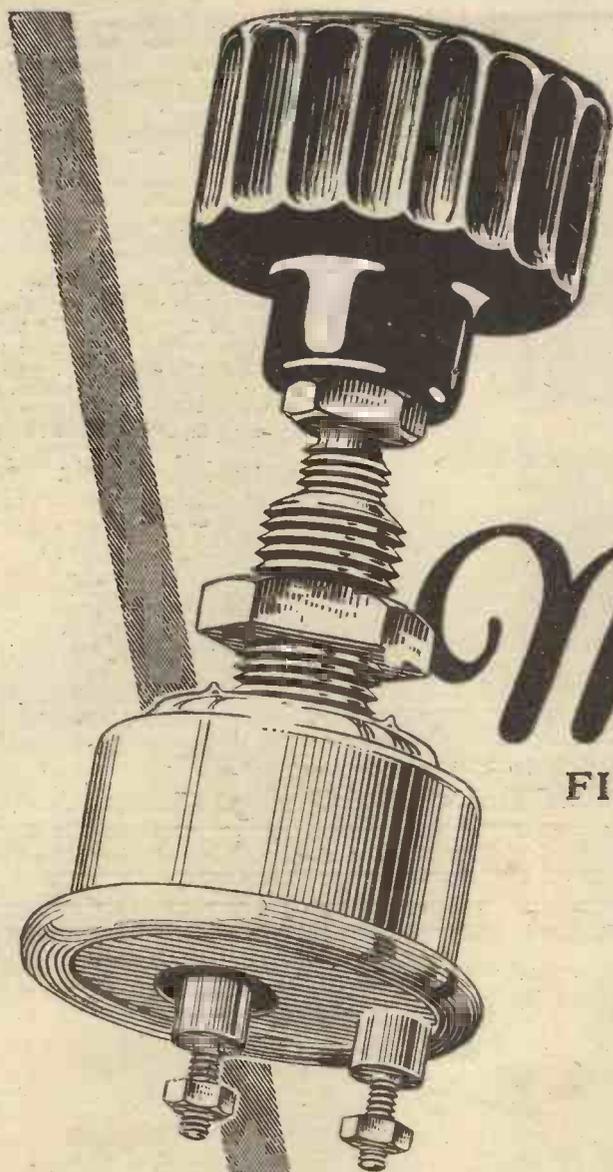
## HOW TO MAKE A CHEAP AND EFFICIENT "P.W." ULTRA PLUG-IN COIL.

THE following brief details for the construction of a plug-in "Ultra" coil may be of interest to home constructors. Obtain a cardboard or ebonite former about 2½ in. in diameter and 2 in. long. Starting close to one end, wind on 60 turns of 30 gauge D.C.C. wire, taking tappings at the twentieth and fortieth turns to inside of former, leaving a space of about ¼ in. between each section of winding for terminal shanks, as shown in diagram.

The coil plug is held in place by a strip of celluloid or fibre about 1 in. wide, passing round the former and held in place by the plug screws, the terminals at top passing through the strip and former and fixed with nuts on the inside. The tappings are soldered to the terminal shanks. The finished coil looks very neat, and is remarkably rigid.

Should a stouter gauge wire be used, a longer former will, of course, be necessary. The writer is using a coil of this description with the "P.W." Ultra Reflex Receiver, as described in "P.W." No. 150, and it is giving every satisfaction.





# A Precision-built rheostat for less cost than the crude wire type.

YOU will appreciate the outstanding superiority of the Microstat the moment you handle it.

# Microstat

## FILAMENT RESISTANCE

Note its rigid, sturdy construction, perfect fitting, silent action thread. No wonder it gives you such infinite graduation of filament control and such silent working.

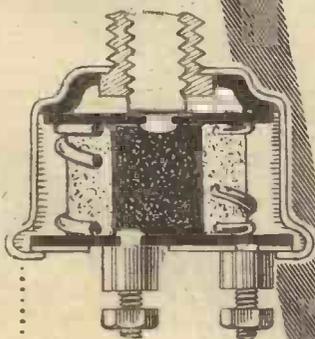
Many sets immediately improve in selectivity when Microstats are substituted for the old jumpy and noisy wire rheostats. Don't forget a Microstat as a Master-Rheostat, instead of a pull-push or tumbler switch, will add a great many hours to the life of your filaments.

No soldering, and, naturally, one-hole fixing.

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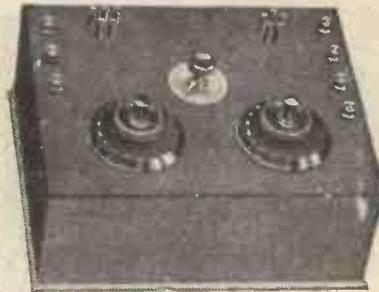
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# 63/9

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When complete set of parts are purchased at the same time as the panel a Marconi Royalty of 12/6 per valve-holder must be remitted with order.

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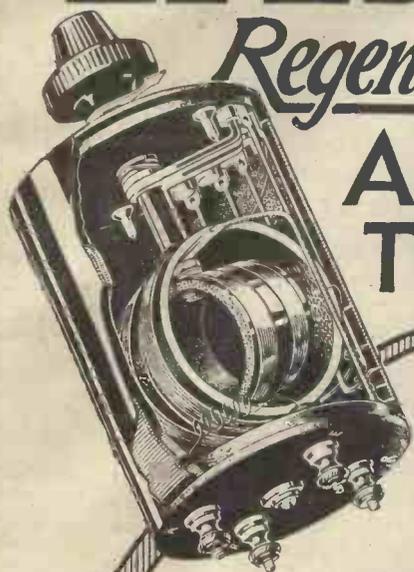
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*Regenerative*

## AERIAL TUNER



The Efesca Regenerative Aerial Tuner is the natural development of the extremely convenient series of Efesca One-Hole Fixing Tapped Coils. It is a specially designed form of Tapped Aerial Coil incorporating Aerial Reaction in a self-contained unit.

Reaction is effected by means of a rotor revolving in a separately wound section of the Aerial Coil, thereby effecting maximum and uniform reaction over the whole wave band covered by the coil. Wave-length range 150 to 2,600 metres in conjunction with a .0005 Variable condenser in parallel. Price, complete with Knob, Pointer and Scale, 32/-



Other components in the Efesca Series of One-Hole Fixing Tapped Coils are the H.F. Transformer and Anode Tuner (illustrated here), Aerial Tuner and the H.F. Reactance Coil.

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WE are pleased to be able to announce a reduction in prices of Ericsson SUPER SENSITIVE TELEPHONES.

Chosen *as standard* by the Admiralty in 1909 and the R.A.F. in 1917, and similarly adopted since by millions of listeners.

Incomparable in *tone*, sensitivity and workmanship.

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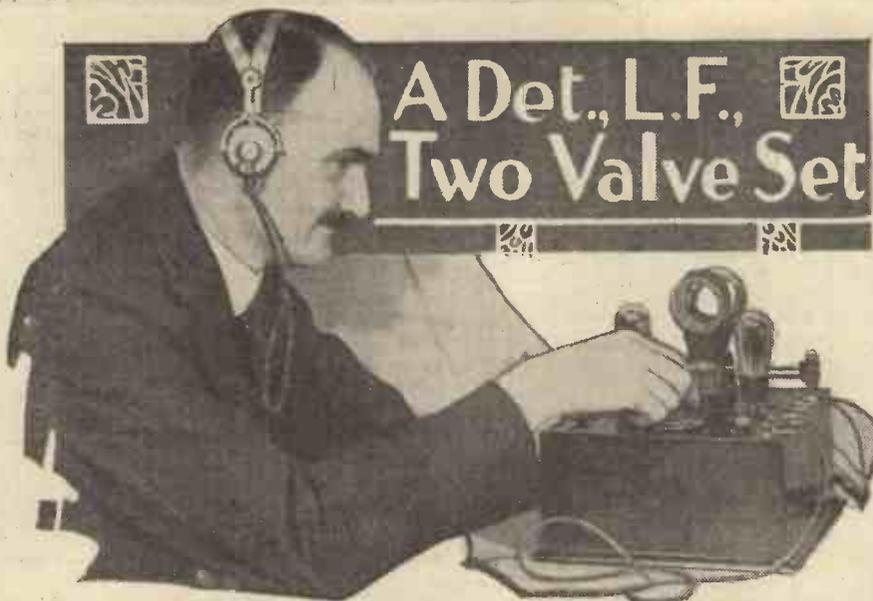
All Resistances { 120 ohms.  
2,000 "  
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At all good dealers.

Write for Lists treating on Receivers, crystal and valve, components, loudspeakers, etc.

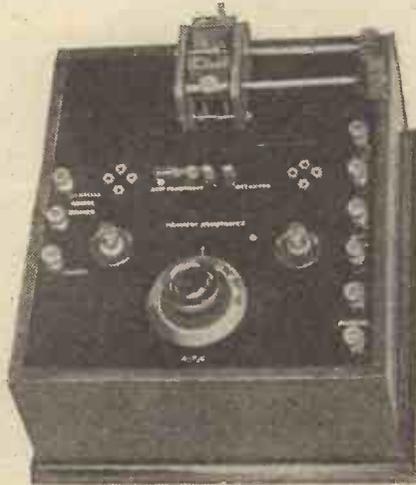
The British L.M. Ericsson Mfg. Co. Ltd.  
67-73 Kingsway, London, W.C.2

**Ericsson**  
SUPER SENSITIVE  
TELEPHONES



The Set designed and described by the "P.W." Technical Staff. The diagrams for this circuit will be found on a Blue Print given away with this issue.

**T**HIS receiver employs, as its title suggests, two valves, one as a detector and the other as an L.F. amplifier. This is by far the most popular arrangement of two valves. It is the "first" loud-speaker



A view of the complete receiver.

circuit, the most straightforward and economical broadcast set for the purpose. Reflex sets using one valve in a dual amplification capacity and certain "stunt" one-valvers are capable of operating loud speakers; but, nevertheless, for "household" broadcasting reception or for standard experimental work the "Det.-L.F." more than holds its own.

**Easy to Make and Handle.**

It has an excellent range of reception using telephone receivers, and it will operate a loud speaker comfortably up to 20 miles or so from the local station under average conditions. It will not work on a frame aerial; a good indoor aerial or an outdoor aerial is necessary.

It is as easy to handle as an ordinary one-valve set and almost as simple to construct. A switch is provided so that the L.F. valve can be cut out, the receiver then becoming an ordinary one-valve set with reaction.

No complications of any sort are introduced; tuning is carried out in the usual way with one variable condenser, while reaction control is provided by means of an ordinary coil-holder movement. Plug-in coils are used, their sizes being in accordance with the band of wave-lengths it is desired to cover.

There are no peculiar pieces of apparatus needed for this set; all the components are standard. It is not necessary to bind constructors down to particular makes. Ample panel room is allowed, but, of course, it may be necessary to diverge slightly from the measurements given in the accompanying panel-drilling diagram should other makes than those used in the original model be employed.

**The Components.**

Let us run down the list of components as they appear on the blue print and deal with them individually. The ebonite panel used was a "Radion," and a very nice piece of material it formed, being cut perfectly to size and provided with a glossy, leak-free surface. It was only  $\frac{1}{8}$  in. thick, not a  $\frac{1}{4}$  in., although if the constructor purchases an unbranded ebonite (he is strongly advised not to) he should choose the thicker size. The Radion panel costs 7s. 6d. The case was supplied by the Caxton people, and costs 5s.

Eight valve sockets, which are obtainable anywhere from 1d. to 2d. each, can be used instead of valve holders, and are just as neat in appearance. The Polar cam-vernier variable condenser, costing 11s. 6d.,

is an excellent component and provides smooth, easy tuning adjustments.

**Drilling the Panel.**

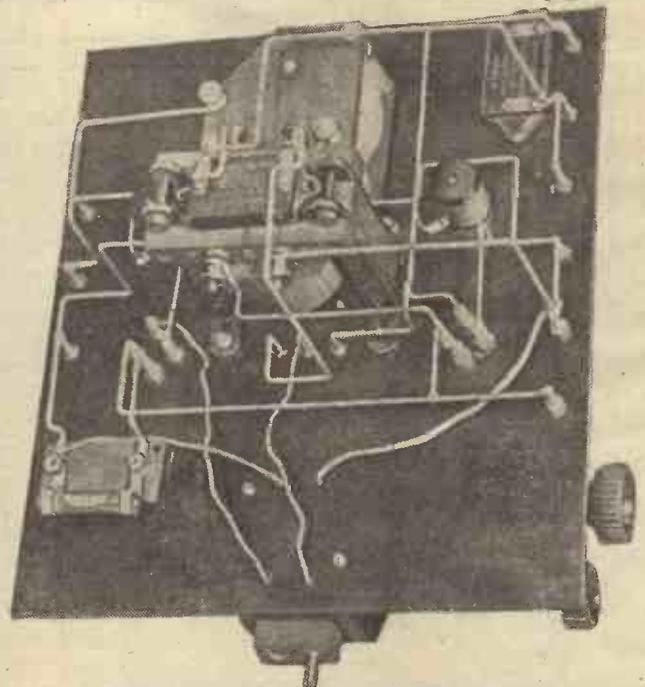
We used Goltone micrometer filament rheostats, a speciality of Messrs. Ward & Goldstone. They have resistances of 12 ohms and retail at 2s. 9d. each. The coil holder, as many readers will recognise from the photographs, is a Quality cam vernier, a product of the Goswell Engineering Co. It costs 9s. The L.F. transformer is an R.I.—25s. The Lissen grid leak and condenser costs 3s. 8d., the S.P.D.T. switch 1s. 6d., and the .002 fixed condensers (Dubilier) 3s. each.

Allowing 2s. 6d. for terminals, screws, etc., it will be seen that the cost of the complete set without accessories is well under £4. Cheaper components would bring the price down considerably, but constructors who seriously desire to economise are advised to do so carefully, avoiding suspicious foreign or unbranded products as far as possible.

The panel should be drilled in the first instance for the terminals and valve sockets only if other makes of components than those specified are used, in order that any slight modifications necessary can be made in the other drilling. The L.F. transformer occupies an almost "dead central" position on the panel, and it is held in position by countersinking screws and nuts.

**Mounting the Components.**

Four holes for carrying through the connections to the coil holder are required. The variable condenser should be mounted so that its moving vanes clear the transformer. Note when fixing the components how their various terminals will be situated; it is often possible greatly to simplify wiring or shorten the length of a lead by paying



This photograph will help the constructor during the wiring.

heed to this simple point. Our photographs will prove useful in this respect.

The switch requires just a little extra care in order to align the contacts properly

(Continued on next page.)

## A DET., L.F. TWO-VALVE SET.

(Continued from previous page.)

and get a smooth, even movement of the "knife" between them, but it is not a task that calls for expert mechanical skill.

Having mounted all the components, the wiring can be tackled. The two .002 fixed condensers and the grid leak and condenser are held in position by their connections and are not screwed down to the panel. The method is perfectly efficient, and the result will be quite satisfactory if square section wire or that excellent conductor Glazite is used.

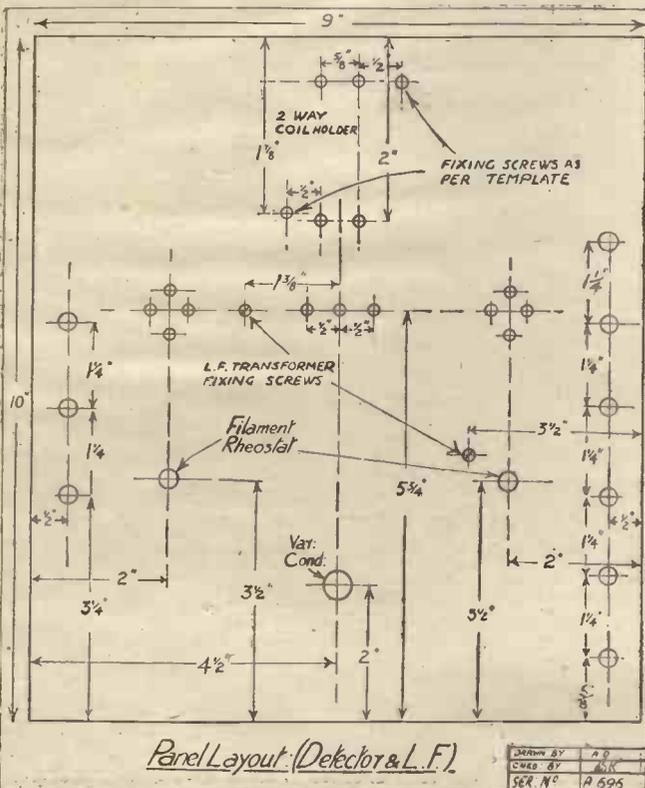
The routes actually taken by the various leads can be clearly seen in the photograph of the back-of-panel wiring which accompanies this article, while the blue print and the list of point-to-point connections should very materially assist the constructor in this part of the work.

### Concerning the Accessories.

It is to be hoped that builders of this straightforward little set will not take "short cuts" in the wiring and run leads round and under terminal screws in order to get the job done quickly. "Short cuts" of that nature do not prove good investments. Careful, solid soldering is the method that makes for permanency and freedom from trouble. "Bad joints" and slipshod wiring are the worst of wireless crimes—next to oscillating!

Transfers carefully affixed to the panel complete the task, and the set is then ready for use.

Two "general purpose" valves can be used. Suitable 2-volt dull emitters are



Panel Layout (Detector & L.F.)

## POINT-TO-POINT CONNECTIONS

Aerial parallel terminal to fixed plates of .0005 variable condenser, socket of fixed coil holder, and one side of grid condenser and leak, the other side of which is taken to the grid socket of the first valve holder.

Aerial series terminal to moving plates of variable condenser, earth terminal to plug of fixed coil holder and L.T. negative, which is also connected to H.T. negative and to one side of each rheostat.

The other side of each rheostat is connected to one filament socket of the corresponding valve holder, the remaining filament socket of each valve holder being taken to L.T. positive.

Plate socket of first valve holder is connected by means of a flex lead to the socket of the moving coil holder, and the same material is employed to join the plug of moving coil holder to the centre contact of the S.P.D.T. switch. Right-hand contact of switch to I.P. terminal of L.F. transformer, O.P. terminal to H.T. positive, I.S. to grid socket of second valve holder, O.S. to L.T. negative.

Plate socket of second valve holder to bottom 'phone terminal, left-hand contact of switch, and one side of .002 fixed condenser. Top 'phone terminal and other side of condenser to H.T. positive.

A .002 fixed condenser is also connected across the primary (O.P. and I.P.) terminals of the L.F. transformer.

D.E.R.'s, Cossor W.1's, B.T.H. B.3's, etc., or an Ediswan A.R.D.E. (red line) and an Ediswan P.V.6 D.E. Something between 50 and 80 volts H.T. will be required, according to the valves used.

A high-resistance loud speaker should be employed with this set; 2,000 ohms is about the minimum, and if telephone receivers are brought into service the same requirement applies.

Series aerial tuning (see blue print remarks) is advised for main station wave-lengths, the 75-turn coil being used in the aerial position and 50 in the reaction. For relay stations on lower wave-length these positions can be reversed.

### Tuning.

Parallel tuning is necessary for 5 X X, with a 150 or 200 turn coil for the aerial and a 150 for the reaction. If a 150 and 200 are purchased, either the one or the other is bound to be O.K. for the aerial; the remaining coil will serve for reaction, as the value of this is by no means critical and

can generally be varied within fairly wide limits.

Wave-length tuning is carried out by the variable condenser, although different degrees of reaction coupling will cause slight readjustments to be necessary. It should not be forgotten that maximum reaction occurs when the coils are close together, so in order to avoid undue oscillation it is advisable to start with as wide a separation as possible, gradually bringing the coils together and gently manipulating the variable condenser until the desired results are obtained. The slightest sign of roughness in speech or music, or a hollow, rushing sound, denotes oscillation, and the coils must be more widely separated again, otherwise serious interference with other listeners will be caused.

Built carefully and handled carefully, this 2-valve set will give every satisfaction in the way of both reception quality and reliability.

## TESTING THE EARTH CONNECTION.

(By a Correspondent.)

IT sometimes happens that there is a doubt as to which is the best earth connection, where the listener has a choice between, say, a long wire to an outside earth, a short wire to a small water-pipe, and a longer wire to the main water-pipe. Here is a test which will decide which of the three is affording the best contact with the earth.

All that is necessary is an old dry-cell and an ordinary flash-lamp. Choose an old cell that lights the lamp faintly, and then connect up as follows. One side of the lamp is joined to the earth-lead under test, the other side of the lamp to one side of the cell, and the other side of the cell to a temporary earth connection.

### Best Contact.

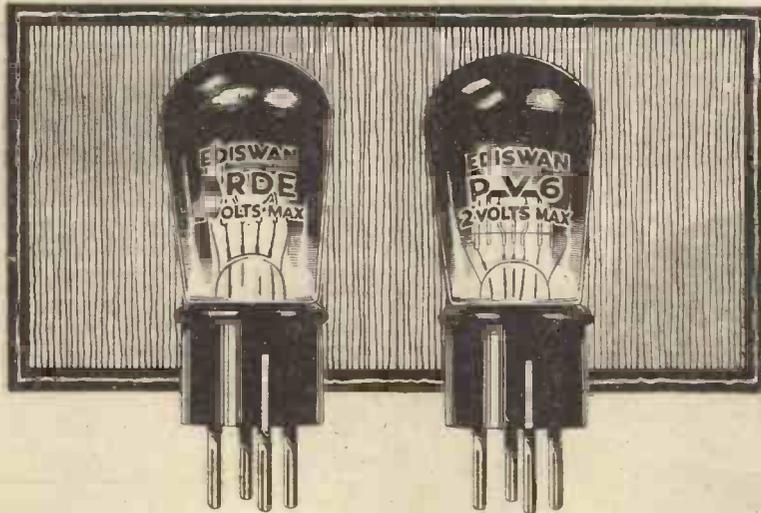
This temporary earth connection should be as good as it can possibly be, a very good method being to use three or four wires in parallel, or the long flex leads of the loud speaker. Any wire or wires will do provided the resistance is low, and they should for the purposes of test be connected to an irreproachable "earth." (This might be, for instance, a connection to the main water-tap, which, perhaps, can be reached temporarily, but not as a regular thing.)

Connect up as above, and send a current from the dry-cell along the temporary earth-lead, and back to the flash-lamp through the soil. To light the lamp it will have to pass down the temporary connection to the good earth, and from the soil to the earth-plate, water-pipe, or other buried connection, and up through the earth-lead under test.

The brightness with which the lamp glows will show whether there is a good contact between the soil and the earth-lead, and if several leads are compared in this way it is easy to tell from the lamp which one is making the best-contact with the soil.

EDISWAN VALVES ARE ENTIRELY BRITISH MADE.

THE PERFECT PAIR—



USE them *together*. It is the only way to get the real Edison quality of reproduction. Individually Edison valves are always better—very robust; very long in life; very reliable in service. But it is in co-operation that Edison valves give the most remarkable results. You can test this on your own set.

Ediswan A.R.D.E. is made to function either as a H.F. amplifier or detector (red line), or as a L.F. amplifier (green line). P.V.6.D.E. is specially designed for use when A.R.D.E. is used in the preliminary stages.

The following table indicates the combinations of Edison valves that give the best results—

Receiving.	Accumulator or Battery Volts.	Power.
AR	6	PV5
ARDE	2	PV6
AR '06	3	PV8

With these groups and Edison H.T. and L.T. Accumulators the ideal is attained.

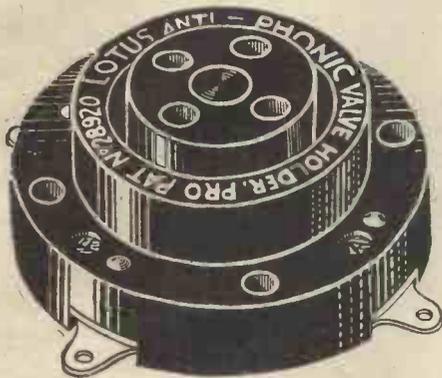
THE EDISON SWAN ELECTRIC CO., LTD.,  
123-5, QUEEN VICTORIA STREET, LONDON, E.C.4.

EDISWAN VALVES

The PIONEER VALVE

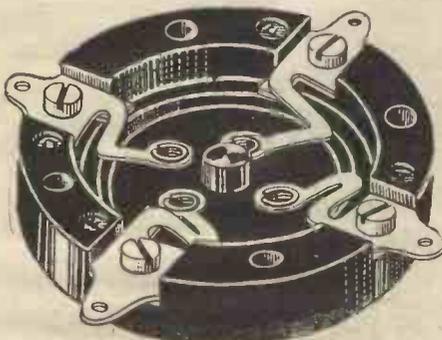
# Another "Lotus" Triumph!

THE delicacy of your Valve filaments are subject to microphonic elements from numerous sources. The LOTUS Buoyancy Valve Holder has been specially designed and constructed to counteract and dissipate these disturbances, and will, by its original and unique spring construction, absorb any shock, protect your valves and eliminate all microphonic noises.



TOP VIEW.

Valve sockets and springs are locked together by a mechanical process, making a definite and permanent connection. Bakelite mouldings, nickel silver springs and phosphor bronze valve sockets. Nickel plated.



UNDERSIDE SHOWING SPRINGS.

## The LOTUS Buoyancy VALVE HOLDER

Anti-Microphonic

Designed and made by the manufacturer of the LOTUS VERNIER COIL HOLDER and obtainable from all reliable Radio Dealers.

Garnett, Whiteley & Co., Ltd.,  
"LOTUS" Works, Broadgreen Rd., LIVERPOOL

2/3

BRITISH MADE, Using Only BRITISH MATERIALS.



## LIBERTY SUPERSONIC HETERODYNE RECEIVER

(British Patent No. 143583).

NOTE.—TWO CONTROLS ONLY. With each set is supplied a chart showing the settings for both controls for all chief RECEIVES any BRITISH, broadcasting stations, and all receivers CONTINENTAL and Principal are calibrated to receive such stations by AMERICAN STATIONS at will, these settings, on a frame aerial using not by accident. British standard Dull Emitter Valves, at loud-speaker strength, and guaranteed to cut out any unwanted station entirely.

250 to 3,000 metres.

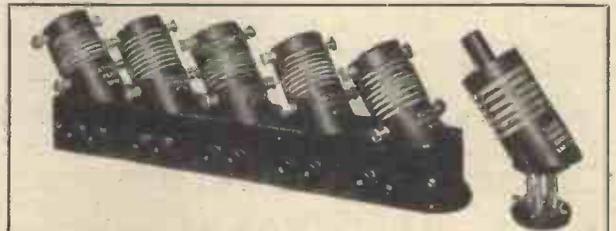
6 VALVE SET, Price £28 Plus Royalties.

8 £32

DEMONSTRATIONS WILLINGLY GIVEN AT ANY TIME.

## LIBERTY SUPERSONIC UNITS

(Provisionally patented).



Comprising four intermediate matched transformers, filter, long and short wave oscillator and balancing device, enabling all stations from 250/3000 metres to be received.

Each transformer matched to half a turn, also secondary windings of the filter.

Full description and illustrated leaflet on request.

NOTE.—Knobs controlling mechanical balancing device which enables the constructor to select his supersonic frequency peak and to match each individual stage to a frequency not merely a number of inductive turns. Any variations of valve capacities can be accurately rectified.

PRICE: 4 matched intermediate transformers, 1 filter, 1 long wave oscillator, 750/3000 metres, 1 short wave oscillator, 250/800 metres, including mechanical balancing devices. Also blue print, and wiring diagram showing all other accessories required and their positions. £5 Set Complete.

Sole Manufacturers—  
The Radi-Arc Electrical Co. Ltd.

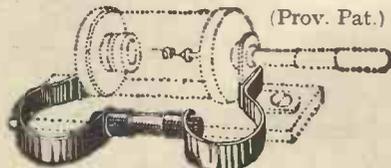
Bennett St., Chiswick, London, W.4.  
Telegrams—"Radiarc, London."  
Phones—Chiswick: 1834 & Gerrard 1706.

## "Leave the Catswhisker Alone." THE "KLIP-ON"

PERMANENT DETECTOR

(Prov. Pat.)

LOUD



LASTING

PUSH IT ON! THAT'S ALL!!

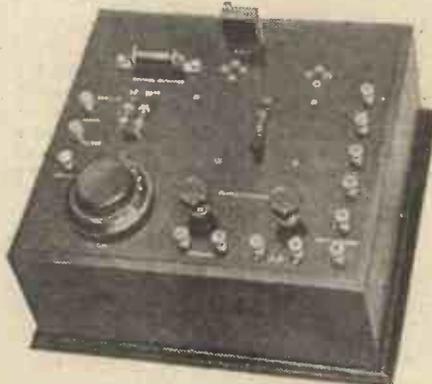
All metal parts, including Phosphor Bronze Springs, Silver Plated. Each 2/6

From all Dealers or direct from  
PARTRIDGES LTD., 140, Northwood St., Birmingham.



The Set designed, described and constructed by the "P.W." Technical Staff. The diagrams for this set are on a Blue Print given away with this issue.

A CRYSTAL detector, followed by two L.F. amplifying valves with the usual refinements of grid bias, etc., is probably the most satisfactory of all arrangements for local loud-speaker work. Such a receiver will have but the range of a crystal set for L.F. valves are used for magnifying existing signals. A crystal detector is,



The switches and other controls are perfectly accessible, as this photograph shows.

however, greatly to be preferred to a valve detector from a reproduction point of view. The words "crystal clear" have a wealth of meaning in wireless, for a crystal detector rectifies without distorting. An ordinary detector valve operating with a grid leak and condenser introduces distortion—not always very appreciably, but, at its best, it is liable to make the "modulations" a little tattered at the edges as it were.

**Range of Reception.**

Therefore, the combination of a crystal with efficiently arranged L.F. amplifying valves is an ideal one from a music-lover's point of view. From a "household" point of view it has its distinct advantages, too, for it does not introduce reaction and all its complications, while anyone who can operate a simple crystal set can handle such a receiver, for the valves brought in for L.F. magnifying purposes do not introduce further tuning controls. Having tuned in the "crystal set" part, the batteries having previously been connected, all that it is

necessary to do is to "light the valves" and all is ready for concert reception.

The receiver can be used for any of the broadcasting stations that are within its range of reception. 5 XX will "come in" up to a distance of between 60 and 100 miles, main stations up to about 20 miles, and relay up to somewhere around four and five. These are conservative estimates, of course, and can often be greatly exceeded under good conditions.

**Useful Switching.**

An outdoor aerial or a very good indoor aerial is necessary. We have shown that the set is easy to handle, now we must answer the further question that all constructors will ask: Is it difficult to build? Are there any critical factors that would render failure probable in the case of the inexpert assembler of wireless receivers? The answer in each case is in the negative. Providing that good components are used and that the few necessary constructional and wiring instructions are carefully followed, the constructor cannot go wrong. The information given on the blue print and indicated by the photographs is almost sufficient to convey everything necessary, and very little amplification will be required in this article.

To conclude these opening remarks it might be as well to summarise the capabilities of this crystal and two L.F. receiver by stating that if the constructor has previously had a crystal set in use, this crystal and 2 L.F. should do everything comfortably on a loud speaker that the crystal set was able to do on 'phones.

It will be seen

from the photographs that two switches are provided. These enable the receiver to be used with either one or two L.F. amplifying valves or without the valves at all. In this latter case, telephone receivers must be connected to the two terminals marked "phones," although it is unnecessary to disconnect the loud speaker or the batteries. Besides forming a useful stand-by enabling the owner to use the receiver as a crystal set in the event of battery trouble, it also proves very useful when tuning-in. The receiver can be adjusted as a crystal set and best results obtained in the way of wavelength tuning and crystal adjustment, and the valves switched on afterwards.

**Component Details.**

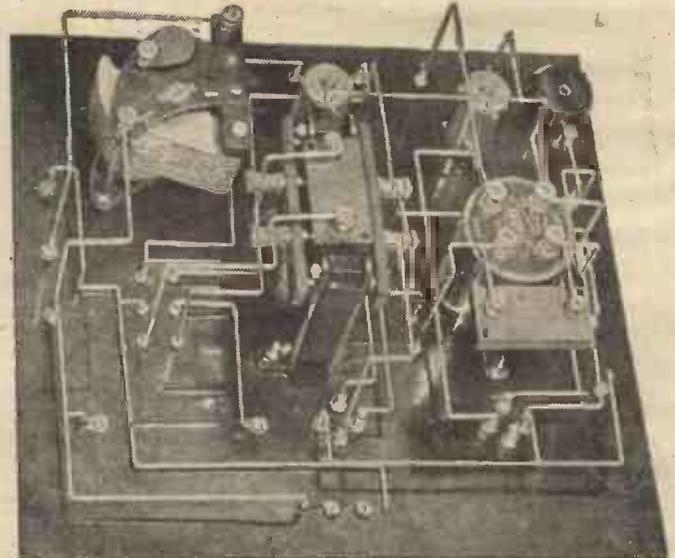
The following components were used in the original model, although slight diversions in favour of other high-class components or materials will not matter. "Radion" (panel, 1/8 in. thick, 9s. 2d.; Caxton case, 7s. 6d.; Lamplugh .0005 mfd. variable condenser, 12s.; Goltone L.F. transformer, 17s. 6d.; "Eureka" Baby Grand L.F. transformer, 15s.; two Lissenstat Major filament resistances, 15s.; "Efesca" crystal detector, 4s. 6d.; Watmel .003 mfd. fixed condenser, 2s. 6d.; Lissen .001 mfd. fixed condenser, 2s. 6d.; Lissen .002 mfd. fixed condenser, 2s. 6d. The cost of the complete set being well under £5.

A diagram accompanies this article showing the exact measurements for panel drilling as applied to the above-mentioned components. Wire-wound filament rheostats can be used instead of the rather expensive Lissenstat Majors, although these latter give beautifully fine control.

The Radion panel, if such is used—and by the way, it can be thoroughly recommended as an excellent piece of material—should be handled gently during the drilling in order to preserve its nice glossy, leak-free surface.

Pencil lines should not be used for marking out as they are liable to form "leaks" difficult to remove. Light scratches with a sharp instrument on the back of the panel should be made—not lines right across, but small crosses to mark centres. Metal working drills must be used and a reamer for enlarging holes if necessary.

(Continued on next page.)



A view of the wiring and under-panel lay-out.

## A CRYSTAL & 2 L.F. RECEIVER.

(Continued from previous page.)

The terminal holes should be tapped, if possible, and the terminals screwed tightly in for such an operation makes for real permanency. The transformers are mounted by means of countersinking screws and nuts. Two will be quite enough in the case of the "Goltone," and these should be arranged diagonally one on each side of transformer.

The fixed condensers are not mounted on the panel itself, they are fixed in position by their own connections; a method that is perfectly efficient if stout wire is used and, by the way, we recommend square section tinned copper. This is sold in lengths at about 2d. each and can be obtained at any wireless store.

### The Two Switches.

If the single way coil holder has no fixing holes provided two must be tapped in it, but if the constructor has no knowledge of this sort of work or no taps to carry it out with he must ascertain beforehand that the coil holder he purchases can be readily mounted.

The two switches both double throw, but one a single and the other a double pole, require careful mounting, but generally they are supplied with paper drilling templates which renders the task quite simple.

Valve holders can be employed if desired instead of separate valve sockets. Drilling for these latter require care if perfect centring is to obtain. Constructors are recommended to refer to the feature, "For the Constructor," in the "Radiatorial" columns. Here every week is given information of a vital nature. No. 1 of the series, for instance, provided valve socket drilling templates of exact size. The whole series, probably eight in number (it is not definitely fixed yet but will not be more) will be repeated as soon as the concluding number has appeared.

The wiring is perfectly straightforward. With the assistance of the blue-print diagrams, the photograph, and the list of point-to-point connections which accompanies this article, no difficulties should arise that cannot easily be dealt with even by the veriest tyro. Soldering is distinctly to be advised, but must be carefully accomplished. "Dry joints" arising from careless soldering cause trouble difficult to trace.

### Final Details.

The connections to the transformers can be made with neat loops in the ends of the leads with round-nosed pliers. The two leads to the coil holder should be carried through holes drilled in the panel for the purpose. The cleaning up of the panel to remove dust and traces of Fluxite is the last operation with the exception of fixing transfers on the front of the panel.

It will be noticed that two pairs of telephone terminals are provided—one pair we have styled "loud speaker." To these latter it is necessary to connect either loud speaker or telephones when the valves are used, the other pair being for the crystal only position of the switches. Either crystal alone or crystal and one L.F. valve or crystal and 2 L.F. valves can thus be used.

The grid bias is used for the second L.F.

### POINT-TO-POINT CONNECTIONS.

Aerial parallel terminal to fixed plates of variable condenser, to one side of crystal detector, and to plug of aerial coil holder.

Aerial series terminal to moving plates of variable condenser. Earth terminal to socket of aerial coil holder and to right-hand centre contact of the D.P.D.T. switch. The two bottom contacts of this switch are taken to the two terminals at the bottom of the panel "Phones for Crystal." The top contacts of the same switch are taken to the primary (O.P. and I.P.) terminals of the first L.F. transformer, across which a .002 fixed condenser is connected. The left-hand centre contact of the switch is joined to the other side of crystal detector.

I.S. terminal of the first L.F. transformer is connected to the grid socket of the first valve holder, and O.S. to L.T. negative, which also joins grid bias positive, H.T. negative, and one side of each rheostat.

The other side of each rheostat is joined to one filament socket of the corresponding valve holder.

The remaining filament sockets are joined together and to L.T. positive.

Plate socket of first valve holder to centre contact of S.P.D.T. switch. Top contact of S.P.D.T. switch to I.P. (or O.P.) of second L.F. transformer; other side of transformer primary to H.T. positive. I.S. to grid socket of second valve holder, O.S. to grid bias negative.

Plate socket of second valve holder to bottom "phones" terminal, bottom contact of S.P.D.T. switch, and to one side of .002 fixed condenser. Other side of condenser and top "phones" terminal to H.T. positive.

A .001 fixed condenser is connected across the primary (O.P. and I.P.) terminals of the second L.F. transformer.

valve and will need to be something between 3 and 9 volts. Special tapped batteries are sold for the purpose. Between 60 and 72 or so volts H.T. will be required and it is recommended that the second valve should be of the small power type such as the D.E.6 or P.V.6 D.E. (two volts), or B.4 (six volts). Any general purpose or special L.F. valve can be used in the first position such as the A.R.D.E. (green line), or Osram D.E. 2 L.F. Two of either of these two-volt types or two B.4's give good results.

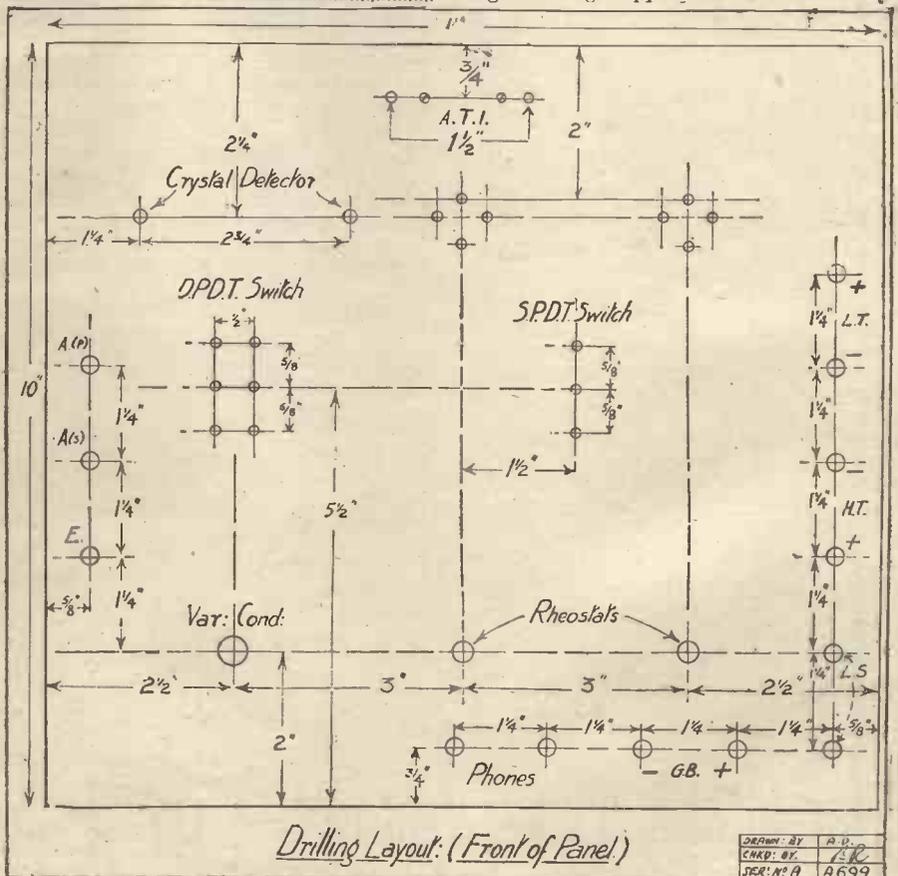
A 200-turn coil (parallel tuning, see blue print) will be required for 5 X X, and a 75 (series tuning) for main stations.

### Separate H.T. Modification.

Tuning is accomplished merely by rotating the condenser dial until the best position is ascertained. The Efesca detector needs little adjustment—other types of crystal detectors can of course be used. The adjustments of H.T. and grid bias voltages are not critical, and will be found more to effect quality of signals than volume, although, of course, optimum volume combined with clarity is the result of carefully varying these adjustments.

If grid bias is not used the two terminals arranged for introducing it should be connected together by means of a short length of wire.

A refinement the more advanced constructor may desire to introduce is separate H.T. to the last valve. It is not difficult. The connection from the top loud-speaker terminal to H.T. plus should be broken. The disconnected loud-speaker terminal can then be connected to another terminal mounted in any convenient position on the panel. This terminal will then serve as an additional H.T. plus and can be taken to higher voltage tappings in the H.T. battery.



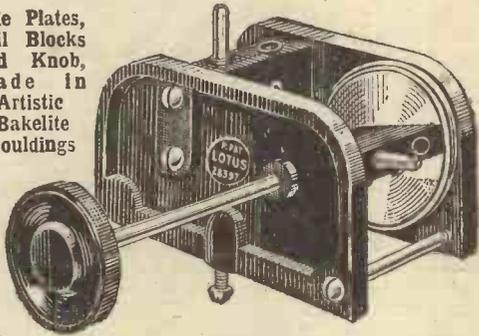
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Geared Vernier  
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Side Plates,  
Coil Blocks  
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made in  
Artistic  
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You have experienced that annoying and irritating fading away of volume after tuning your coils. This is due to the moving block falling. The Lotus Moving Block **CANNOT FALL**. The Vernier movement comprises three sets of enclosed precision machine-cut gears, and reduces the speed of the moving coil block by eight times.

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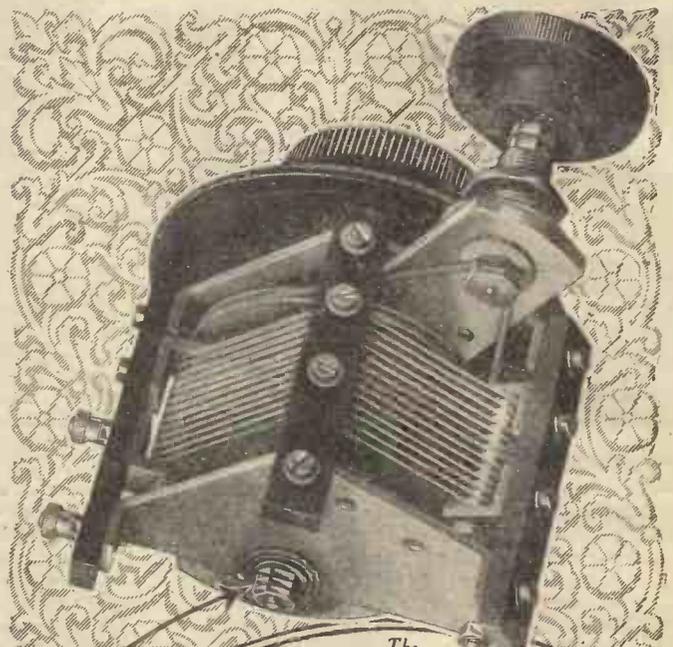
For Outside Panel Mounting:  
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CONDENSER

COMPENSATED  
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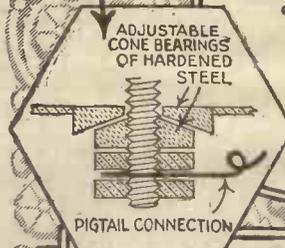
LOW LOSS

NO  
BACK LASH

with its ratio of 10 to 1 makes it possible to dispense entirely with the customary vernier and its attendant losses. Particular stations can be logged. Backlash is avoided not temporarily but permanently and movement is smooth, permitting fine adjustment. This model can also be arranged for remote control, as shown in the illustration below. Also supplied without slow motion feature when the condenser is one-hole fixed. Both models are constructed to eliminate hand capacity, for low loss, and to give a compensated square law effect. Cone bearings of hardened steel ensure constant calibration and a pigtail connection gives permanent positive contact.

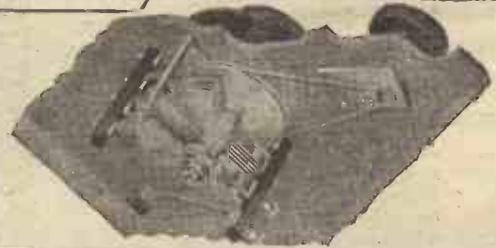
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ADJUSTABLE  
CONE BEARINGS  
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STEEL

PIGTAIL CONNECTION



# COSMOS



Traders and manufacturers are invited to submit wireless sets and component parts 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 COIL holder of refreshingly original design has been sent in for examination by the London Electric Stores, Ltd., 9, St. Martin's Street, London, W.C.2. The coils are mounted side by side, the moving block operating through an angle of 90°. The reaction coil, if the holder is used in the conventional way, falls right out of coupling. The movement is "vernier" throughout, and is smooth and free from "backlash." The positive screw motion prevents the coil moving independently of the control knob whatever the size and weight of the former.

The L.E.S. coil holder can be mounted directly behind or above a panel, or used for baseboard work in the American style, although, in this last case, an extension handle is necessary. The coil holder costs 6s., and the extension handle 9d. It is a

well-designed, nicely finished component, and can be thoroughly recommended.

Messrs. A. F. Bulgin & Co., of Cursitor Street, London, E.C.4, have sent us for inspection one of their Decko "Dialites." It is a neat, nickel-plated fitting which, designed to take a pea-lamp bulb, can be mounted on a panel by means of one-hole drilling. It provides sufficient illumination for a 20-in. panel, and is, of course, connected inside the set to the existing L.T. supply. The price is 2s. 6d. We consider a slight reduction could be made, and would increase the popularity of the little article.

Messrs. Alfred Graham & Co. inform us that Mr. William Blogg, until recently the sales manager of the Sterling Telephone and Electric Co., Ltd., has joined them,

and will shortly leave this country on a business tour in the East and Australasia, where, we are glad to hear, Amplion business is extensively developing.

Cleartron Radio Limited, makers of the now well-known range of American designed wireless valves, have requested us to point out that their entire staff of workers, technical skilled and unskilled, is British throughout. While the important line of American machinery and appliances was installed under the direction of an expert from the New York plant, the running of the British works was immediately thereafter turned over to the British staff, which has been exclusively employed since the Birmingham factory was opened.

Messrs. Autoveyors' famous "Three Electrode" variable condenser is now available in a final and perfected form. It is being manufactured and sold under licence by the well-known condenser people, Messrs. Radio Devices, Newdigate Street, Nottingham, under the name of the Devicon



A striking showcard issued by the Marconi-Phone Co.

(Continued on page 1424.)

# EDISON BELL RADIO

EVERY HOME SHOULD POSSESS THIS CHEAP AND EFFICIENT SET

WRITE FOR FREE CATALOGUES

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**SPLendid LOUD-SPEAKER RESULTS AT 30 MILES**

**READ THIS EXTRACT OF RESULT OF RADIO PRESS TEST**

*"With a very inefficient indoor aerial we obtained full loud-speaker strength, etc., and the makers' claim, loud-speaker results 30 miles, is well substantiated."*



**SPECIFICATION:—**

12x10x4" deep, highly polished base, fitted ebonite panel and nickel-plated fittings. A Grid Bias Battery is fitted in panel which enables good musical quality to be obtained. This set is supplied with Coils suitable for 300-500 metres. Coils for higher wave-lengths can be supplied at extra cost. This is a very efficient 2-Valve Set and will give good Loud Speaker results at 25 to 30 miles, it having one Detector and one Low Frequency Stage.

**THE EDISON BELL "GEM" 2-VALVE SET**

**PRICE £3 : 0 : 0**

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Manufactured by an ALL-BRITISH FIRM with over 30 YEARS' REPUTATION FOR QUALITY.

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**"GOLTONE" (REGD.)  
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SIMPLY PLUG INTO ANY CONVENIENT LAMP HOLDER. DIRECT CURRENT SUPPLY.

Provides a more effective, efficient, and cheaper method of High Tension supply.

The constant voltage results in greatly improved reception both in volume and clarity. In addition the convenience of always having a dependable High Tension supply is a most important feature. A wide range of intermediate tappings is arranged. Complete with Flexible Cord, Lampholder Adapter, Polarity Indicator, and Cords for connecting to Wireless Set.

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For Direct Current Supply only.

Of interest to all, our 40-page Radio Catalogue, free on request. Dealers should enclose Business Card for Trade Terms. "Goltone" Products are stocked by the leading Radio Stores. Write direct if unobtainable.

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of  
SOUND!  
PURITY of TONE!**

These are the characteristics of the "Goltone" Low Frequency Transformer which make it the "Popular" choice. Remarkable amplification with absolute freedom from noise and distortion. No Transformer gives better results.

Ratios 2 to 1 and 5 to 1.

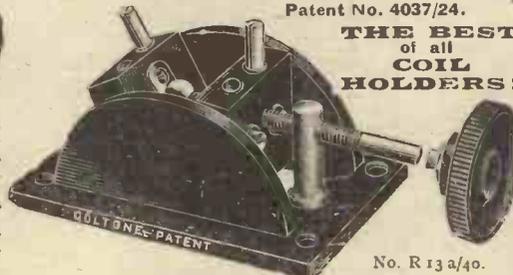
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Firmly refuse inferior imitations.

**"GOLTONE" Micrometer Regulating  
COIL HOLDERS.**

Patent No. 4037/24.

**THE BEST  
of all  
COIL  
HOLDERS!**



No. R13a/40.

Beautifully finished.

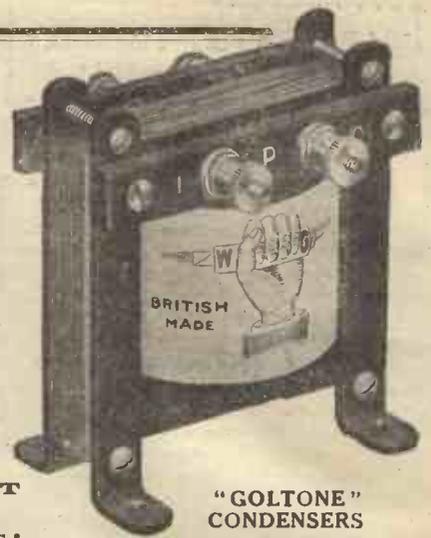
Give that precision and refinement to the receiving set so vital to maximum reception and selectivity.

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No component requires more careful selection than the Condenser, and the utmost care and precision is absolutely necessary. "Goltone" Condensers are doubly laboratory tested before despatch. Supplied in all standard capacities. Prices from 1/3 each.

Insist on "Goltone" make and refuse substitutes.



**An evening with a  
Remarkable New Circuit**

Although hundreds of wireless enthusiasts have responded to our advertisement which offered for sale the Ormsby Long Range Selective Circuit, there are undoubtedly many who are perhaps a little sceptical. To dispel all doubts concerning the extraordinary performance of this circuit, we give in illustrated form the results of an evening's actual test on 4 valves, under normal conditions with

a 75 feet aerial 25 feet high, eight miles from London.

This circuit is extremely selective without loss of volume and for purity of tone it is irreproachable. **500 MILES ON LOUD SPEAKER.**

This circuit will give loud speaker results 500 miles away and will **CUT OUT THE LOCAL STATION.**

The Circuit Envelope contains 2 simple wiring charts, layout and template for baseboard and valves, and full instructions for building. Send Postal Order for 2/6.

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CUT OUT LONDON.

8/20  
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PARIS speaker results

9/20  
ROME speaker results

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MADRID speaker results

Please state if for 3 or 4 valves, and write name and address clearly.



2/6

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You may have a tip-top aerial and a fine set, yet if the lead-in connection is faulty the results will be poor. The best way to attach the lead-in to the aerial is to twist the wires thoroughly together and solder with FLUXITE.

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## APPARATUS TESTED.

(Continued from page 1422.)

**Bridge Condenser.** Formerly the instrument was rather bulky, but the new model is most compact and differs but little in appearance from an ordinary variable condenser. It is suitable for panel mounting (one-hole fixing) and has "square law" vanes. Further, it embodies all the modern "low loss" features, including metal end plates, "earthed" moving vanes and minimum insulation.

Mechanically, too, the instrument is splendid; the movements of the two concentric knobs, one above the other, which are slightly tapered in order to facilitate adjustments, are smooth and free from "backlash." The general workmanship and finish represents instrument work of the highest class. The Devicon Bridge condenser is available in either one of two values, .0003 mfd. and .0005 mfd., at the price of 25s.

A leaflet describing the many ways in which it can be used is supplied with each one sold. It is, of course, a device for introducing refined tuning control and selectivity, and it can be used with any existing set as an additional unit without necessitating any constructional alterations or rearrangements of internal wiring what ever.

\* \* \*

We have received a further supply of Benjamin Clearer Tone Antimicrophonic Valve Holders, together with a long and

interesting letter bringing forward clearly the claims made for these components by their makers—The Benjamin Electric, Ltd., Tariff Road, Tottenham, London, N. 17.

"Many spring valve holders have one or more unsoldered joints between the soldering tag or terminal and the top of the valve socket. This is bad design, for in a 7- or 8-valve Super Het., this means about 30 to 60 unnecessary unsoldered joints, any one of which may give trouble which is very difficult to diagnose. A holder with *clamped or riveted joints* should never be used, as these are bound to work loose sooner or later and so ruin reception, the blame probably being given to a perfectly good high-tension battery."

The foregoing is only one of the many points brought forward by Messrs. Benjamin, but it is a very important one. The Benjamin product does not err in this or any other direction, even the price is beyond criticism—2s. 9d.

The firm in question hit the nail on the head when they state that there are "a number of holders on the market to-day where the design is intrinsically bad, both mechanically and electrically," and we are only too pleased to give prominence to their views in these columns.

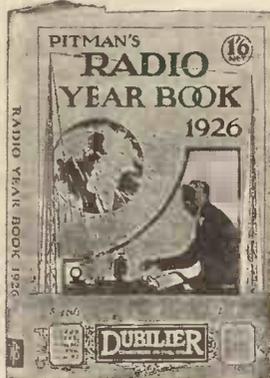
The publication of the 1926 edition of Pitman's "Radio Year Book" has been somewhat delayed owing to a certain trade dispute. It is now, however, on sale at most bookstalls and newsagents. It costs 1/6, and is really excellent value for money. It is packed full with interesting information and articles concerning both broadcasting in general and the activities of amateurs in particular. The Unidyne, the "P.W." Ultra Crystal Set and other items of POPULAR WIRELESS interest have their places in this admirable little volume.

The Radio News Bureau Ltd., 50-51, High Holborn, London, W.C.1., recently sent us a set of their wireless circuit envelopes. Each of these contains a blue print (actual panel size), photographs, diagrams and comprehensive working instructions. They are well prepared and suitable for either the tyro or the advanced constructor.



A bay in Messrs. Wates' factory where Pyramid H.T. batteries are made.

### NOW ON SALE EVERYWHERE



## THE 1926 RADIO YEAR BOOK

(Fourth Year)

The 1926 RADIO YEAR BOOK contains

nearly 200 pages of Entertainment, Information and Instruction with 70 Photographs of Prominent Broadcast Artists, many actually as they appeared at the microphone, 38 Instructive Drawings and Diagrams and useful lists.

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WE HAVE THEM: \_\_\_\_\_

The Marvellous Remler Condenser. A Revelation in Tuning, 31/9 each

Our Guaranteed Ebonite cut to any size while you wait. Ordinary surface, 4/6 lb.; Matt, 5/- lb.

The New Lissenola Loud Speaker Base, 13/6 each

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McMichael Special H.F. Plug-in Units, also Igranig Super Heterodyne Sets now in Stock

The Bruno Short Wave Tuner, 25-100 metres. Tuned with a .0005 Var. Con. Special Low Loss. 36/- each

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Sheffield, Jan 20 1926

MEMORANDUM FOR THE DIRECTOR

H. CLARKE & CO. LTD.

From J. Wilcockson,  
RADIO ENGINEER & MANUFACTURER.

GENERAL MANUFACTURERS  
OF ALL KINDS OF RADIO COILS

Dear Sirs

We have much pleasure in stating that we have decided to fit "Atlas" Coils in the "Retrosonic" Receiver which is to be on show at the "Broadcaster" Showrooms Bush House London on Jan 25. We find on test that your coils are exceptionally sharp in tuning and at the same time the magnetic coupling is high, consequently they handle the strong frequencies with ease. We shall draw the attention of the trade to this fact.

Thanking you,  
Yours faithfully,  
N. G. Roberts  
Consultant Manager.

In the choice of suitable components for the making up of an epoch-marking invention such as the "Retrosonic" Receiver, recently on show at the Broadcaster Showroom, Bush House, London, the one deciding factor is EFFICIENCY.

An extract from a later letter received from the inventors reads as follows:—

*"As our report of the performance of your "ATLAS" Coils was due solely to their outstanding efficiency, we have no hesitation in giving our permission to make whatever use you like of same."*

The letter referred to is, therefore, reproduced.

Here, once again, is impartial confirmation of the "ATLAS" slogan, "We make them good, good judges make them famous."

## "CLARKE'S ATLAS"

### LOW LOSS COILS

(Pat. No. 215,053.)

Write for new Radio Catalogue H.  
Sole Manufacturers :  
**H. CLARKE & CO. (Mc.) LTD., "ATLAS" WORKS, OLD TRAFFORD, MANCHESTER.**



## TIGER SINGLE COIL HOLDER



For panel mounting, No. T.C.101.  
Perfect insulation, only best English porcelain used.  
Brass Fittings. Price **9d.** each.

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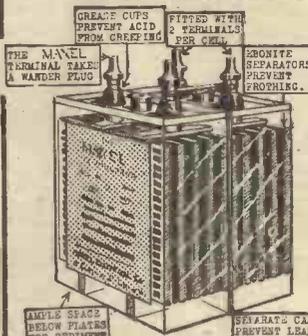
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# RADIOTORIAL

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

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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 contributions to be addressed to The Editor, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and 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 trader would be well advised to obtain permission of the patentees to use the patents before doing so.

**PATENT ADVICE FOR READERS.**  
The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any wireless inventions to patent, or who desire advice on patent questions, to our patent agent. 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.

**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 the 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 question in the answer.)

**IMPORTANT.**—If a wiring diagram, panel lay-out or list of point-to-point wiring is required, an additional fee of 1/- 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 1/- 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.

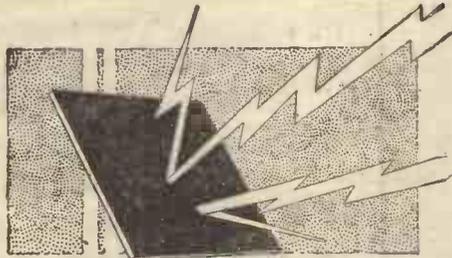
## Questions and Answers

L.F. HOWLING.

R. B. (Cricklewood).—I have a three-valve set, one detector and two low-frequency amplifiers. When I switch on the two-valve amplifier it becomes very noisy, and sets up a howl which I cannot prevent unless I reduce my high-tension current to practically nil. This stops the howling, but signals die away. How can I prevent this? I am using separate high-tension batteries.

As the two-valve amplifier is run from a separate high-tension battery, try the effect with the negative of this battery connected to earth. If this fails, try reversing the connections to the windings of the transformers, one at a time. If the above suggestions fail to stop the howling, disconnect the windings of the secondary transformer from the low-tension negative, or positive, as the case may be, and connect them to flexible leads terminating in

(Continued on page 1428.)



## 35,300 VOLTS!

How's that for a breakdown test? Every single sheet of Clayton Ebonite you buy is up to the standard indicated by Professor Low's test report, a short extract from which is here given:—

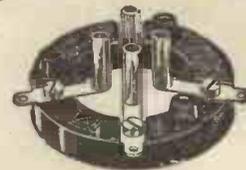
A portion of each sheet was turned down to about 1 mm. thick. Brass spheres of 3 cm. diameter were applied to each side of the thinned portion, and alternating pressure, frequency 50 cycles, was applied to the spheres and gradually increased until the material broke down under the stress. The results, in terms of breakdown volts per mm., are shown below:

Sample.	Volts per mm.
"A" .. .. .	29,700
"A1" .. .. .	35,300

(Signed) A. M. LOW (Professor).

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*PETER PAN*

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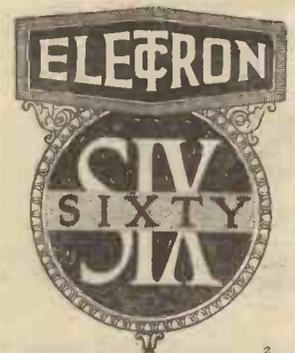
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There's the S.S.2 (Red Disc)—a 2-volt Valve for H.F. Amplification, suitable as a detector when followed by resistance or choke. Or again, the S.S.2 (Green Disc)—for L.F. Amplification—just the valve you want for small and medium-sized loud speakers.

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**BETTER BY SIX TIMES SIXTY**

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## RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 1426.)

plugs. They should then be inserted into the tappings towards the negative pole of a 9-volt tapped grid bias battery. Connect the positive of this battery to the negative of the low-tension battery. In this manner the grids are always given a fairly strong negative potential, which should certainly prevent the amplifier from breaking into continual self-oscillation.

### DISTORTION.

R. P. S. (North London).—I have a three-valve set employing a detector and two L.F. valves, the last L.F. being coupled by means of a choke made by using one winding of an L.F. transformer. My trouble is distortion taking place on loud signals. The valves used are A.R. .06, B.5 and D.E. 3—all .06 at 3 volts, and I have grid bias on the last valve. Variable H.T. on all.

Probably distortion is as much due to the last valve being unable to carry the energy as to anything else. The remedy in that case is of course obvious—use a power valve.

Without doing this, the next best thing is to turn your attention to the choke and see if this can be improved. Probably it does not really suit the circuit, but you should be able to reduce the distortion without purchasing another choke. A .001 mfd. condenser across the choke may help.

If the other winding of the transformer is O.K., try the two windings in series and also alternately separately. Also vary the coupling condenser, which should have a value of about .02 mfd.

Loading the unused winding by means of a .001 or .002 fixed condenser might help, though any loading will tend to reduce the signal strength slightly. This reduction will not, of course, be serious, as you are so close to 2 L.O.

A loud speaker not only delivers what is put into it, but also has an unhappy knack of magnifying any distortion that is present. (A great deal of the distortion heard from loud speakers is due to a distorted input, and not to the loud speaker itself, provided this latter is not being "pushed" and forced to carry too much.)

### CURRENT FOR BRIGHT EMITTER VALVES.

A. S. A. (Rotherhithe).—Why are dry cells not suitable for the L.T. supply of ordinary valves of the R type?

The ordinary valve will only liberate a sufficient supply of electrons when its filament is almost white hot, and a fairly large current is necessary in order to heat the filament to this degree.

Although dry cells can give a good intermittent current, they are not able to supply continuously for several hours a sufficient current for the bright-emitter valves, in the way that an accumulator does.

### COUNTERPOISE EARTH.

"COUNTERPOISE" (Manchester).—What is a "counterpoise" earth, and has it any advantages over the ordinary earth connection?

The "counterpoise" takes the place of a direct earth in cases where the latter cannot easily be made, or where it is undesirable owing to the presence of earth currents from neighbouring electric power plant.

It generally takes the form of a second multi-wire aerial of similar length to the other, placed directly underneath it, but near the ground (say, 7 ft. high). Insulation should be good, and the counterpoise often sharpens tuning of the set, as well as minimising local interference.

### SOLDER AND FLUX.

S. W. R. (Hungerford, Berks).—As there are several kinds of solders, which is the best for wireless work, and what flux should be used?

A good "fine" solder should be used (that is, a solder which contains more tin than lead). There are several fluxes which can be easily handled, but probably the best plan is to buy a good proprietary article and follow instructions carefully. Do not use an acid flux.

### OSCILLATION INTERFERENCE.

C. M. J. M. (Potters Bar).—What is meant by oscillation interference?

This is due to the effect of excessive reaction on a valve set in such a way as to cause the valve to oscillate and energeise the aerial. If reaction on the aerial is used, or if H.F. valves oscillate, a small

oscillating current flows up and down the aerial and sends off ether waves of a wave-length approximating to the wave-length to which the oscillating set is tuned. This wave "gets mixed up with" other transmissions (e.g. broadcasting transmissions), and upsets them, producing a beat note as the two waves get in and out of step, for they will not be of exactly the same wave-length. This beat note is heard in other listeners' sets in the form of a high-pitched whistle, which will drown or interrupt anything else being received.

### PROTECTING DULL EMITTERS.

R. W. P. (Chelmsford).—I have just purchased a dull emitter and wish to insert some device which will prevent me accidentally burning out the valve by connecting the H.T. circuit across it. I believe a resistance is all that is necessary. How do I find out what value the resistance should be?

The resistance used should be a non-inductive one, and its value in order to protect the filament can be

$$\text{found in Ohm's Law: Current} = \frac{\text{Voltage}}{\text{Ohmage}}$$

If the maximum current desired is .05 amps, and the H.T. voltage is 50, the total resistance of the circuit would need to be 1,000 ohms. There is only a small resistance in the battery itself, so it would be necessary to add the 1,000 ohms in series with it. Protection could alternatively be obtained from a fuse connected to the H.T. which is of such a value that a current in excess of the normal would cause the fuse to blow.

### LOADING A VARIOMETER.

H. P. (Bristol).—Will you please tell me the points at which I should connect a loading coil for a variometer-tuned crystal set, as I am desirous of getting 5 X X?

Loading a variometer set to receive the high wave-lengths is not generally as satisfactory as a condenser-tuned set. It is not sufficient to merely break the aerial circuit and insert the coil there. The latter must be placed in the aerial circuit at a point between the leads which go to the phones and crystal. In this way the difference of potential across the ends of the coil, and across the variometer, is applied to the detector circuit.

If, however, the detector circuit is connected only across the variometer—which is the case when the

(Continued on page 1430.)



## The Condenser for reflex circuits

In reflex circuits, more than in any other type of receiver, accuracy in the exact capacity of the fixed condensers used is essential for good results. Here is where Igranic-Freshman Condensers can help you. Designed upon an entirely new principle, the construction is such that variations in capacity are guaranteed within 5%. The plates are composed of highest quality brass and the finest selected Ruby Mica is used for the dielectric. The special method of assembly precludes the entrance of moisture and they will give the highest performance under all climatic and atmospheric conditions. The small space required, and ease of fixing, appeal to all radio enthusiasts.

Obtainable in the following capacities:—  
 .0001 mfd., .0002 mfd., .0003 mfd., .0005 mfd., .001 mfd., .002 mfd., Price 2/- each  
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THERE can be few amateurs who have not been troubled with broken leads, or said hard things about faulty connections. Of the whole set there is probably no part which is so often abused as the connections. "Lisenin" Positive Grip Plugs alleviate this evil. They are designed to take the smallest flex up to 5 m/m cable. Sleeves and indication discs red and black. N. Plated. **PRICE 6d.** Plug and socket complete, or Spade End Terminal. Obtainable of all dealers. \* Liberal Trade Discount.

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Plug and Socket or Spade End, 6d. each.

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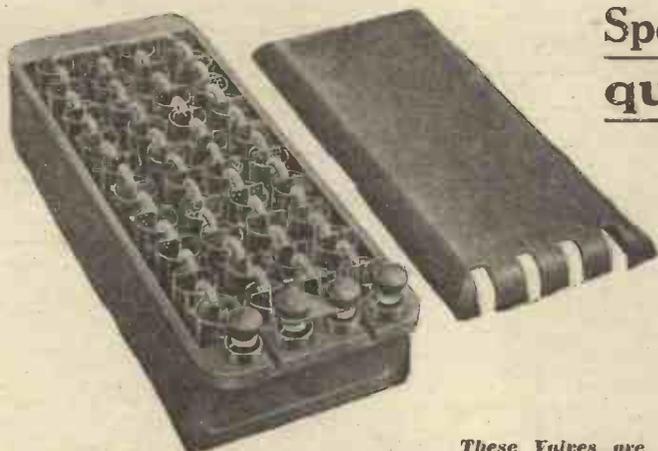
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says :—  
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Made to change over any number of contacts. The design ensures that self-capacity is negligible and contacts are rubbing and therefore self-cleaning.

Made in two styles—Knob and Lever Patterns.

Prices (each) Knob.		Lever.	
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No. W. 130/3	5/-	No. W. 147/3	6/-
No. W. 130/4	6/-	No. W. 147/4	7/6
No. W. 130/5	7/-	No. W. 147/5	10/-
No. W. 130/6	8/-	No. W. 147/6	10/-

\*This figure shows the number of poles changed over, e.g., W. 130/4 indicates Knob type 4 pole change over.

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Here is an excellent product—The Tangent Two-Valve Radiomatic Receiver. This is manufactured specially to work with the new Daventry Station, and we claim that—even though it be a bold claim we can substantiate it—the Receiver obtains most satisfactory Loud Speaker strength up to 100 miles.

The whole instrument is designed and constructed according to Gent's best traditions.

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## RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 1428.)

loading coil is connected to the aerial circuit outside the tuner—only a small part of the received energy is in a position to operate the detector.

### UNIDYNE QUERIES.

"UNIDYNE" (Clacton-on-Sea), F. C. H. (London, S.E.10), and others.—Are Unidyne queries now answered free, or are they charged for at the usual rate for ordinary queries?

The offer to answer Unidyne queries free of charge was withdrawn last year. They are now charged for in just the same way as queries dealing with sets which employ high tension.

### FORMULA FOR WAVE-LENGTH.

G. W. S. (Bath).—In the formula for wave-length quoted on p. 1223 ("P.W." 191) this is given as being =  $1885 \sqrt{C + L}$ . Is not this a misprint?

Yes. The + should be x, making the formula:  $\lambda m = 1885 \sqrt{C (mfd) \times L (mh)}$

### 1926 UNIDYNE.

"UNIDYNE" (London).—I have constructed the latest 1-valve Unidyne described in "P.W." No. 179, but regret to say that I cannot make it oscillate. The coils and choke are home made, and the valve is a U.C.5. Can you please give me any suggestions for improving results?

Before carrying out any of the following suggestions we advise you carefully to examine the wiring both for errors and "dry" joints. It is important that the grid wires should not run close to each other, as this will cause losses and perhaps prevent the set oscillating.

If all of these are O.K., the following tests can be carried out, preferably in the order given:

- (a) Try the effect of reversing the aerial coil.
- (b) See that the reaction coil is tapped at the 24th turn from the battery end, if not

(c) Reverse the two outside reaction leads and then try the effect of reversing the aerial coil again.

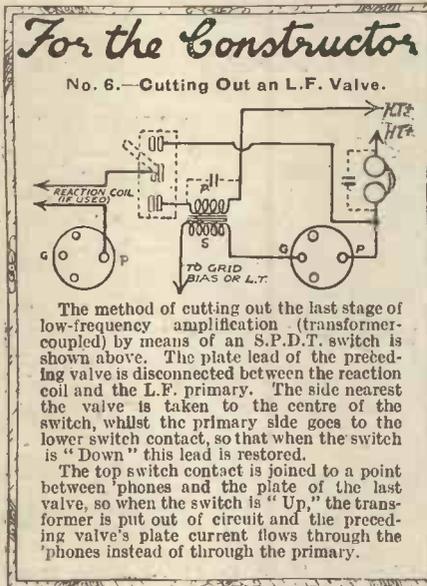
(d) Connect a .001 or .002 mfd. fixed condenser across the 'phone terminals. In many cases this has cured the trouble.

(e) Under no circumstances use twisted flex for the L.T. leads, as we have found that this prevents oscillation.

Should the set now oscillate, but the .0003 reaction condenser fail to control it properly, we advise you to reconstruct your H.F. choke as follows:

Wind 4 bunches of 40 turns per bunch for the first layer (of S.S.C or D.S.C. wire), then cover with insulating material (waxed paper is best).

Repeat for three layers, winding always in the same direction, and starting each layer over the beginning of the last one. This will give you 480 turns.



The 20 turns left over can then be distributed over the bobbin after covering the third layer with waxed paper.

It is important that the grid condenser has a capacity no larger than .0002 mfd., nor the grid leak a higher resistance than 2 megohms.

If none of these tests proves effective, we suggest you use 6 volts L.T. and keep the filament of the valve as low as is consistent with good results.

### THE INVISIBLE CONNECTION.

H. R. (Shoreham).—I have recently purchased a "two-circuit crystal set," but I am puzzled about the connections.

On tracing the wiring I find that aerial is connected to one side of the moving coil and the earth lead to the other side of the same coil. The second coil is connected to one side of the crystal detector and to one side of the 'phones, the other sides of 'phones being connected to the side of crystal detector not connected to the coil. A .0005 variable condenser is, of course, connected across the second coil.

What I cannot understand, however, is that there are no connections between the two coils. How, then, can the set work, for the aerial and earth are not connected to the second coil, but only to the first?

The reason the two coils are not connected together is that they are inductively coupled, the action being as follows:

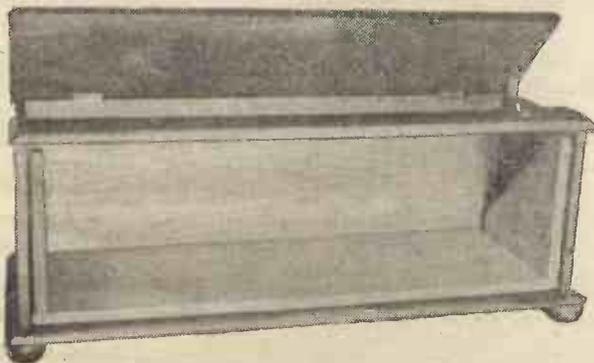
Energy from the broadcasting station is picked up by the aerial, passes down the lead-in wire, and sets up high-frequency oscillations in the aerial-earth circuit (which includes the first or "primary" coil). These H.F. currents in the coil are accompanied by magnetic stresses around the coil, and this "magnetic field," as it is called, is comparatively powerful for a space of several inches around the primary coil.

If, therefore, a second coil (called the "secondary") is placed close to the primary, the magnetic stresses will set up H.F. currents in the secondary, which exactly reproduce the original currents set up by the distant broadcasting station in the primary.

Consequently, if the two circuits are properly tuned and adjusted, the energy is passed across from the primary to secondary without any mechanical connection. The coils are said to be coupled together magnetically, or, as it is generally styled, "inductively coupled."

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39-43, LONDON STREET, GREENWICH, S.E.10.

Telephone:  
Greenwich 1259.

Agent for Brighton: A. S. HILL & CO., 8, YORK HILL, BRIGHTON.

## CLEARANCE SALE

### HIGH AND LOW NOTE FULLERPHONE BUZZERS.

A well-designed buzzer, having two notes. Price to clear, 2/- each, post 6d.

**MK. III. 2-VALVE RECEIVING SETS.** Wave-length 100-1,800 metres, consisting of 1 Detector and 1 L.F. Amplifier, Mk. III. Variable Condenser, Tuning Coil wound on ebonite stud tapped, Varicoupler, Condensers, Fil. Rheo., Transformers, Non-Capacity Valve Holders, Reaction, etc., etc. New 66-volt Siemens' H.T. Battery, 1 pair Western Electric Headphones, and 2 Marconi R. Valves. These sets will receive all British broadcasting, also Continental broadcasting. The finest sets to be obtained. Price complete, tested as above, in canvas covered mahogany box, £3 12s. Passenger train 3/-.

**H.T. BATTERIES, 66 VOLT.** High-grade make. All brand new. Guaranteed 7/6 each, post 1/-.

**MARCONI OSRAM R. VALVES.** Brand new. To clear, 3/6 each, post 6d. Standard type 4-volt.

**MK. III. STAR PRECISION VARIABLE CONDENSERS '0015.** A very high-grade Condenser, in ebonite case. 15/- each, post 9d.

**MANSBRIDGE CONDENSERS, 2 M.F., 2/6; 1 M.F., 1/3; 1/36 M.F., 4d.,** post 2d.

**MICA DIELECTRIC CONDENSERS, 1 M.F., 5,000 volt,** containing 150 sheets mica,  $4\frac{1}{2} \times 3\frac{1}{2}$ . 7/6 each, post 6d.

**WESTERN ELECTRIC AND SIEMENS' 4,000-OHM HEADPHONES.** These are the finest headphones to be obtained, designed specially for the R.A.F., with fur protecting headbands. Cost 25/- per pair. Our price to clear, brand new, in boxes, 7/6 per pair, post 6d.

**MAHOGANY POLISHED BOXES,** with box lid. Size 6 in. x 5 in. x 5 in. All new, 1/9 each, post 6d.

**MK. III. 3-VALVE AMPLIFIERS L.F.** Containing Interval Transformers, Fil. Rheo. stud tapping, etc., H.T. Battery, and 3 Marconi Amplifying Valves. Price complete, £3.

**AERIAL PANELS.** These contain high-grade aerial Ampmeter Condenser. Quick break rotary on-and-off Switch, 4-pin Plug, with four 6 ft. lengths of coloured H.T. Flex, mounted as Panel. Cost approx. 40/-. Price to clear, 6/6 each, post 9d.

**T.V.T. HIGH-TENSION GENERATORS.** 6-10 volt input, output 1,000 volts. Contains step-up Transformer with Vibrator, 1 M.F. Mica Condenser, and two other Mica Condensers, all complete in box. 15/- each, post 1/-.

**VOLTMETERS, 0-2,000 VOLTS, PANEL MOUNTING** type meter, with Shunts. Moving Coil. 45/- each, post 1/6.

**PLUGS & JACKS, 1/6 per pair.** Spare Plugs, 7d. each.

**CHARGING AND LIGHTING DYNAMOS.** Shunt wound, 30 volt, 5 amp, Ball Bearings, Carbon

Brushes, solid built Com. Drum Armature. Fully tested. To clear, 40/- each. Passenger train 4/6.

**PETROL ELECTRIC GENERATING SETS.** A.B.C. 50 volt, 20 amp., £20. Austin,  $3\frac{1}{2}$  kw., 110 volt, 32 amp., £40. Douglas,  $3\frac{1}{2}$  kw., 110 volt, 32 amp., £35.

**RADIANT HOUSELIGHTING COUPLED GENERATING SETS.** Complete Engine and Dynamo Switchboard and Accumulators, Tanks, etc. Brand new, in cases. Send for leaflet with illustrations and full particulars. Our price is ridiculous.

**D. III WATCH PATTERN MICROPHONES.** Useful for speech amplifying, etc. 2/- each, post 3d.

**MK. III. 2 VALVE TRANSMITTER.** Wave-length 100-1,800 metres. These contain high-grade tuner with two Variometers all wound on ebonite. Condensers and Wound Leak, Aerial Ampmeter, Morse Key, Lamp, etc., etc. Heavy panel in case. These, if necessary, can be converted into a high-grade 2-valve receiving set at small expense. All new. Cost £20. Price to clear, 30/-. Passenger train, 3/6.

**MILLIAMMETERS.** Moving coil, panel mounting, reading 0-50, 12/6 each, post 6d.

**MK. III PORTABLE FIELD TELEPHONES.** Magneto Ringing. Complete with Hand 'Phone, Receiver and Microphone, Magneto Bell Transformer, etc., in polished case, 12/6, carr. 2/-.

**MARCONI H.T. DIRECT CURRENT HAND-DRIVEN GENERATORS.** Output 600 volt 30 milliamp. A beautifully designed Generator, mounted in portable teak case. All geared with Terminal Board and Handle. Will give full output by slowly turning handle. Cost £40. Price to clear, all brand new, 70/-. Passenger train, 4/-.

**CHOKE COILS FOR SMOOTHING.** 1,000 ohms, 500 ohms, 250 ohms. Iron enclosed, 9d. each, post 2d.

**AERIAL AMPMETERS.** 1.5 amp. High-grade. Makers: Sullivan, Morriss, etc. All brand new. Price to clear, 5/- each, post 6d.

**MODULATION TRANSFORMERS,** as used in Government wireless telephony sets. All new, 7/6 each. Smoothing Chokes out of same sets, 6/- each, post 6d.

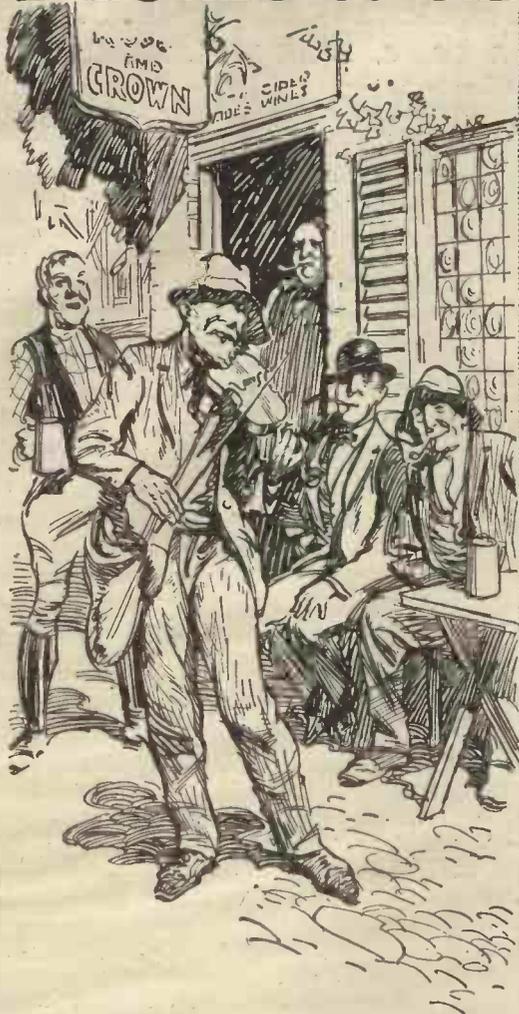
**SIEMENS' TELEPHONY MICROPHONES.** Brand new on universal extending arm, 7/6 each, post 9d.

**TELEPHONE CORDS,** 6-8 ft. long. All various colours. Price to clear, 6 Cords for 1/-, post 6d.

**TRANSMITTING SETS R.A.F.** These sets are high-class instruments, containing 1-in. Sterling Spark Coil, wound with 3 lb. 38 gauge Silk Wire, Ebonite Panels, high-grade Aluminium Spark Gap, mounted on ebonite, with Adjuster, Mica Dielectric Condenser, ebonite panel. Terminals and other sundry fittings. Cost £15 each. Price to clear, 10/- each, post 1/6. Useful to all experimenters for parts, etc.

N.B. - All orders dealt with in strict rotation. In the event of any dissatisfaction money refunded or the article replaced.

# Mellow as an old fiddle



PLAYER'S wealth of experience in all that pertains to the maturing of tobacco enables them to place their cigarettes on the market as they reach prime condition, while the extraordinary demand forbids staleness. The maturing and blending is so skilfully done that the natural fragrance of the Tobacco remains unimpaired.



20 for 11½<sup>d.</sup>  
10 for 6d.



P.1213

*It must be Players*

## TECHNICAL NOTES.

(Continued from page 1408.)

The mercury variable condenser has been mentioned in this journal on one or two occasions previously, but this type of condenser does not yet appear to have made its way upon the English market. It was on the American market—and for anything I know to the contrary it may still be—but I understand that certain difficulties have been experienced in the operation of the instrument.

### Very Compact.

For the benefit of those readers who are not familiar with the mercury condenser, let me explain that this consists essentially of a lens-shaped or very flat cylindrical cell within which mercury is contained up to about the midline. The mercury forms one of the electrodes and a semi-circle of tinfoil or other such-like material forms the other, the two being separated by means of an exceedingly thin sheet of mica or film of celluloid.

The mercury always remains at the bottom owing to gravity, and as the cell is rotated in a vertical plane the semi-circular tinfoil vane is brought into or out of engagement with the mercury. The great advantage of the mercury variable condenser is that, owing to the absence of ordinary solid friction between the moving electrode (the mercury) and the di-electric, the latter may be made exceedingly thin and consequently a capacity equal to that of the usual variable condenser may be obtained in a comparatively small space.

### Overcoming a Difficulty.

The main practical difficulty apparently, is that the mercury is apt to "stick" against the walls of the lenticular or cylindrical cell in which it is contained, and consequently the capacity of the instrument for a given setting of the dial may not always be the same. According to a recent patent issued to C. A. Friedrich, this difficulty is overcome by forming the cell in a special way so that the edges are very narrow and the sticking of the mercury is rendered impossible.

The idea of shunting the primary of an intervalve transformer by means of a variable resistance is by no means a new one, but nevertheless it is one which may in certain cases be found very useful. A reader writes to tell me that he has had much success in cutting down interference from local causes by following out this simple artifice.

A comparatively high-resistance rheostat or potentiometer resistance may be used for the purpose and whilst this will, of course, cut down the signal strength, it will in some cases be found to purify considerably the tone obtained from the loud speaker.

### The Rectalloy Charge.

The Rectalloy rectifier recently described in this journal appears to have met a very considerable want, for an enormous amount of correspondence and inquiries relating to the same have been received. A trickle charger based on this principle is now on the market, and I hear very good reports as to its performance. Many constructors have also bought the rectifying electrodes and made up their own transformers, etc.



## Crisp and Clear as the Crack of a Whip.

Distant Signals that are faint, are picked up, tuned to good strength, and whipped out, crisp and clear.

Those bird-like "cheeps" in the 'phones are turned into speech and music, unmarred by distortion, free from whisps and tags of other stations.

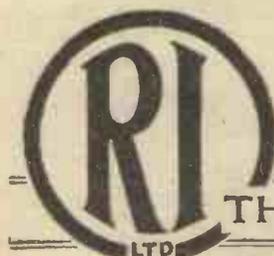
And all this the work of the

**R.I. REACTIVE ANODE UNIT,** made for the signals that are too weak, made to increase their volume, to produce that far-off programme with pristine distinctness in full, resonant tone, made for the man who wants greater range and selectivity without sacrificing the quality of the reproduction. There are five tappings which cover all wave-lengths from 200—4,000 metres, three of which serve to cover the broadcast band, giving excellent adjustment. The coil is wound on a grooved ebonite cylinder in such a way that the impedance of each tapping has been calculated to keep the reactance values approximately uniform for all wave-lengths.

This method of radio frequency amplification is perfectly stable, while for single stage amplification it is as efficient as and simpler to operate than an H.F. Transformer. If desired, it can be followed by H.F. Transformers where additional stages of radio frequency amplification are required.

**Price 25/-**

Concise explanatory diagrams of circuits supplied with each instrument.  
Write for the R.I. Blue and Gold Catalogue.



**THE MARK OF BETTER RADIO**

# Stop that continued vibration of the filament!

USE the Clearer Tone Valve Holder and float your valves—secure from the ever-present, tone - destroying vibrations caused by street traffic, indoor footsteps and the hundred and one other microphonic disturbances. So thoroughly does this new holder cushion the valve that foreign noises are completely dissipated.

The springs, though delicately adjusted, are immensely strong and the tightest valve can be inserted without fear of damaging them. Each spring has one turn only. Bakelite construction of the body of the holder ensures high insulation, low capacity and sturdiness.

each **2/9**



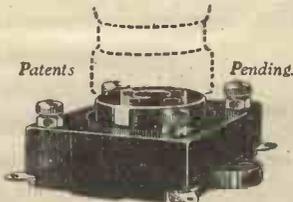
There are terminal connections for the experimenter and soldering tags for the permanent set.

**2/9**  
each.

The springs themselves form the valve pin sockets. No soldered joints—all one solid metal piece from tag to valve leg. No flexible wire connections.



The spring supports are not affected by stiff bus-bar wiring. For good reception with Dull Emitter Valves, Benjamin Clearer Tone Anti-Microphonic Valve Holders are essential.



BRITISH **BENJAMIN** MADE  
**CLEARER TONE VALVE HOLDER**  
(ANTI-MICROPHONIC)

From your Dealer or Direct from  
THE BENJAMIN ELECTRIC Ltd.,  
Brantwood Works, Tariff Road,  
Tottenham, N.17.

The Benjamin Battery Switch gives perfect current control, 2/- each.

## FOREIGN RADIO NEWS.

From Our Own Correspondents.

### Proposed New European Wave-lengths.

It is announced here that the proposed revised wave-lengths for European stations, consequent on the deliberations at Geneva and the subsequent tests, are as follows for the principal stations:

	Metres		Metres.
Amsterdam	1,055	Munich	414
Barcelona	325	Münster	287
Berlin	531	Nuremberg	298.5
Bremen	226.5	Oslo	380
Brünn	2,800	Paris, P.T.T.	458
Brussels	265	Paris, Eiffel	
Cassel	228	Tower	2,200
Breslau	282	Paris, Radio-	
Dresden	276.5	Paris	1,780
Dortmund	397.5	Prague	555
Elberfeld	504	Stettin	241
Frankfurt	382	Stockholm	427
Hanover	220	Stuttgart	368
Hamburg	317.5	Rome	425
Gleiwitz	251	The Hague	1,070
Königsberg	472.5	Toulouse	315
Leipzig	444.5	Vienna	530
Hilversum	1,060	Zurich	515
Madrid	392		

The British stations mentioned in this preliminary list are:

	Metres		Metres
London	365	Sheffield	301
Liverpool	315	Daventry	1,600

It is expected that a further list will be issued shortly, when all European stations will have been roped into the plan.

### A Radio Recruiting Week.

A special Radio Recruiting Week is being organised at Prague for the purpose of stimulating popular interest in radio and increasing the number of listeners. Lectures will be delivered on the subject in all schools, military barracks, and public institutions; posters will be placarded in every town and village, and use will also be made of the cinemas. Arrangements have been made with a number of newspapers and reviews to devote extra space to radio during the week.

### A Radio Musical Competition.

The Paris daily "Echo de Paris" is organising a musical competition in connection with radio broadcasting. So far there are over 600 entries, of which 410 are in the singing group, 63, violin; 97, piano; and the rest wind instruments or cello. Of the singers, 313 are women and 97 men.

After the pick of the contestants has been chosen by a series of selective trials by a jury composed of well-known Paris musical teachers and critics, the performances of the winners will be broadcast in the form of a number of special concerts. Prizes of considerable value are offered.

### New Buenos Ayres Station Opened.

The new Telefunken station at Monte Grande was opened a few days ago in very impressive and festive manner, in the

(Continued on page 1436.)

*Liberty*

### PERMANENT DETECTOR

The Original One-Hole Fixing Detector Stops Fiddling with Catswhiskers

Ever tested on actual broadcasting and is fully guaranteed. Tested and Unanimously recommended by the Wireless Press



PRICE **3/6**

50% More Efficiency  
50% Lower Price  
The 100% DETECTOR

Refuse inferior imitations. Insist on seeing name "LIBERTY". Fixing in panel (1-hole fixing) brackets or to existing detector terminals by 2 pieces copper wire.

THE "Liberty" Detector gives more sensitive reception Permanently than a catswhisker gives Temporarily. No hunting for that special spot lost by the slightest vibration. The "Liberty" is entirely unaffected by vibration, sensitive all over, and that loud spot cannot be lost. RADI-ARC Electrical Co. Ltd., Bennett Street, London, W.4.

**NOTICE** Good posts available in Wireless Telegraphy. Day, Evening, and Postal tuition. Prospectus free.—Manager, Wireless College, 63a, Tottenham Court Road, W.1 (Entrance Gough Street); and Radio House, Manor Gardens, Holloway, N.7. Museum 3177. North 3694.

**RADIO REGISTERED PANELS**

7" x 5", 1/-	8" x 5", 1/2
7" x 6", 1/3	9" x 6", 1/7
10" x 8", 2/1	11" x 8", 2/3
10" x 9", 2/4	12" x 8", 2/6
11" x 9", 2/7	12" x 9", 2/10
12" x 10", 3/-	14" x 10", 3/5
14" x 12", 4/-	1/2" thick Post Free.

Money back guarantee that each and all Panels are free from surface leakage, Megger test Infinity. Callers, cut any size, & quote by post, or Phone Clerk-enwell 7853. Sample & Prices, post free to the Trade.

CROXSONIA CO., 10, South St., MOORGATE, E.C.

### REPAIRS

Headphones Re-wound and re-magnetised, 5/- per pr. Any kind L.F. Transformer re-wound and repaired, 5/-. Loud Speakers re-found, 5/-. Write for Trade Prices. All work guaranteed and tested on our aerial. Phone: 1795 Clerk.

MASON & CO., 44, East Road, City Road, E.C.

### EASY PAYMENTS

Send a list of the parts you want and we will forward you a quotation on the hire purchase system. Example of terms—£2 10s. parts: 13/- deposit and 6 monthly payments of 6/8. Accumulators, Headphones, etc. Anything Wireless similar terms.

**LOUD SPEAKERS.** Any make to your selection. Examples: Brandes T.T. 4 monthly payments of 8/-. Brown's H.T. deposit 29/6; 6 monthly payments of 10/9.

H. W. HOLMES, 29, Foley Street, Great Portland Street, W.1. Phone: Museum 1414.

### 2-VALVE AMPLIFIER, 35/-

1-Valve Amplifier, 20/-, both perfect as new; Valves, 4/6 each; smart Headphones, 3/8 pair; new 4-Volt accumulator, celluloid case, 13/-; new 66-Volt H.T. Battery guaranteed, 7/-; 2-Valve All-Station Set, 24. Approval willingly. P. TAYLOR, 57, Studley Road, Stockwell, LONDON.

**Two Remarkable Coil Plugs**

Each 1/3. Postage 2d.  
"The Universal" Patent Expanding Plug is a marvel of efficiency and neatness. Expanding Band quickly and firmly mounts any size coil. Perfect Low-loss reversible Plug and Socket. Adds fine finish to all Home-made Coils. Send to-day to Gooaman, Utley & Harris, Broad Street Chambers, Broad Street, Sheffield.

"The Quik Fix" for Basket Coils, with detachable Pin and Knob, securely mounts all size coils, permits full action and quick adjustment. Low-loss reversible Plug and Socket. Solid Ebonite.

Trade Enquiries Solicited.



ALL Postal Communications 7, GRAPE STREET, Shaftesbury Avenue, W.C.2 Phone: GERRARD 2821 Back of New Princes Theatre.

WONDERFUL LOW LOSS STRAIGHT LINE FREQUENCY CONDENSERS THE CONDENSER OF THE FUTURE



Pig-tail connection to rotor gives silent working. Special Spring top Bush gives a firm but easy movement. Including knob and dial as sketch With vernier. 0003 .. 7/11 0005 .. 8/6 Including knob and dial. No vernier. 0003 .. 5/11 0005 .. 6/6 With geared dial, 12-1 ratio, 6/- each extra. POST 6d. PER SET.

Supreme SELECTIVITY: Each station has a CLEAR TUNING SPACE. CROWDING entirely ELIMINATED. SIMPLIFIED tuning. DISTINCT and DEFINITE Radio reception. PRECISION workmanship.

UNSOLICITED TESTIMONIAL. Messrs. Raymond, I am writing to let you know the wonderful change your new type condenser has made in my one valve straight set. On Sunday evening (with S.L.O. working) I was successful in receiving Radio Berne, Dublin, Hamburg and Newcastle at excellent phone strength. All these stations had previously passed me by. I can only say that if there is a 100 per cent. condenser on the market, yours is it. Harry B. Procter.

- COIL STANDS.—2-way Standard, 2/8; Cam. V. 4/8; Geared, 4/-, 4/6, 6/-; 3-way Standard, 5/-; Cam. 6/8; Geared, 7/8. H.F. TRANSFORMERS.—Barrel Type: Sterling, 6/8; Bowyer Lowe, 7/-; Magnum, 7/-; McMichael, 10/-; Do, Supersonic, 17/8; Energy Standard B.B.C., 3/11; 5X.X, 4/6. L.F. TRANSFORMERS.—Ferranti, 17/8; New Model, 25/-; Ormond, 14/11; Broadwood, 17/8; Royal, 20/-; Powpall, 14/6; Forno, 10/8; Cretz, 9/-; Walter Supra, 12/6; Lissen T.I., 21/-; T2, 15/-; T3, 12/6; Eureka Condens. Grand, 25/-; 2nd Stage, 21/-; Baby Grand, 15/-; Reflex, 15/-; Success L.F., Black, 21/-.

ORMOND. Square Law Low Loss, Ebonite or Skeleton ends. .00110/6, .0009 3/4, .0003 9/4. Above with vernier 1/6 each less no vernier.

- LYSEN H.F. TRANSFORMERS.—Karral type, B.B.C., 5X.X and Neutrodyne, 6/6 each. Made by Stirling's, Ltd. LOTUS.—Geared 8-1 Coil stands, 2-way, 7/- (with exhalides, 8/-); 3-way, 10/6. HEADPHONES.—4,000 ohms. Ericsson E.V. Continental. Lovely tones, exquisitely finished, 10/6 pr. DR. NESPER.—Adjustable; the perfect phone, 12/11 pr. N. and K.—Absolutely genuine, 12/6. New Light weight, 13/6. Both stamped on outside of case: N. & K. "BRUNET"—The old original. As good as ever; new design, 12/6 pr. TELEFUNKEN.—Adjustable; lighter than a feather, 15/11 pr. ADJUSTABLE "KAY RAY"—Limited number, fine value, 8/11 pr. BROWN'S A2 type, 30/-; B.T.H.: 20/-; Western Electric, 20/-; Sterling, 22/6; Do. Lilliput, 20/-; British Ericsson, 22/8; Brandegee, 20/-; Brown's "Featherweight, 20/-. West End Depot for MAGNUM. Baseband Coil unit, 1/8. 2 coil type L or R, 9/6. 3-way, 12/6. Neutrodyne Condensers, 4/6. Anti-cap Wind, 2/6. Vibro, 5/6. Brackets, 2/- pr. 21 x 11, 3/- 5 x 3. Tapped coil for Simplicity or T.A.T., 8/- each. Kennall Low Loss Cross former, 3/-, adaptor 1/- extra. Wave Trap for A.B.C., 5/6. H.F. Transformers Neutrodyne, also 300/800, 550/1200, 1100/3000, 2500/7000 each 7/-.

- MOUNTED COILS. FINSTONE LOW LOSS COILS.—35 1/8; 50, 1/8; 75, 2/-; 100, 2/6; 150, 2/8; 200, 3/6; 250, 3/8; 300, 4/-. Post 3d. each. STAR.—25, 1/3; 35, 1/6; 50, 1/8; 75, 2/-; 100, 2/6; 150, 2/8; 200, 3/6; 250, 3/8; 300, 4/-. EDISON BELL LOW LOSS COILS: 35, 30, 2/8. 75, 100, 150, 3/6. IGRANIC.—Honeycomb, 25, 33, 43; 50, 4/8; 75, 4/10; 100, 6/3; 150, 7/-; 200, 8/-; 250, 8/6; 300, 9/-; 400, 10/-; 600, 12/6; 800, 11/-; 750, 12/6; 1,200, 15/6; 1,500, 17/6. GRAN-COILS.—Highly finished and admirable instrument. No. 25, 1/8; No. 35 1/8; No. 50, 1/8; No. 75, 1/11; No. 100, 2/8; No. 150, 2/8; No. 200, 3/11; No. 250, 3/8; No. 300, 3/8; No. 400, 3/8. Don't forget these are mounted. VAR. GRID LEAKS.—Lissen, 2/6; Watmel, 2/6; Bretwood, 3/-; Anods Res., Lissen, 2/6; Watmel, 2/6; Bretwood, 3/-. VALVE HOLDERS.—Sterling, 4/3; Burndept, or Magnum, 5/-; 2/6; Benjamin, 2/8; Apex, 1/8; Aermonic, 1/6; H.T.C., 1/6, and 1/8; EXCELSIOR, 1/-. BRIDE "A" EBONITE.—Cut to size, squared edges, 3-16 in. 1d. sq. inch, 4 in. is 1d. sq. inch. Postage extra. VERNIER CONDENSERS.—3-plate, 3/11; 5-plate, 4/6; Michron, 2/8; Coherer, 2/6; Ormond, 2/6; Gambrell, 5/6.

- CRYSTAL DETECTORS.—Enclosed, Burndept, 4/-; Kay Ray Micrometer, 2/6; Permanent R.I., 6/-; One-hole Aing, 7/8; Kay Ray, 2/8; Liberty, 3/6. Lissen Loud Speaker Unit, 13/6. VALVES.—Bright, 8/- each; Mullard Red or Green Ring; Marconi R. 10 B.T.H.; Edison A.R., Cosor R. P. 14/- each; Mullard D3, Cosor W. V3, Edison ARDE, B.T.H., P3, Marconi DER, 16/6 each; Mullard 05, DE3, Cosor W.1, WR2, Edison R.T.H., B. Marconi DE3, 18/8 each; Cosor W3, Marconi DE4, 22/6; Mullard DE, "AO", "A1", Edison FV1, 2, 5, 8, B.T.H. B4, De, Marconi DE4, 5 D, etc. YOUR OLD VALVE ALLOWED FOR. All Sterling, Marconi, AJS, parts available can be supplied immediately. Marconiphone Ideal, L.F. 2.7-1, 4-1, 6-1, 30/- each. Make out your list for lowest quotations. Cash must be registered. All communications to 27, Lisle Street, Leicester Square, W.C.2, which is place of payment; orders accepted on these terms.

K. RAYMOND Hours of Business 9 to 8 DAILY 9 to 9 SATURDAY (LISLE STREET) 11 to 1 SUNDAY

TWO SHOPS—so you will ALWAYS find one OPEN 27 & 28a LISLE STREET, LEICESTER SQUARE, W.C.2 Phone: Opposite DALY'S GALLERY DCOR (BACK OF DALY'S THEATRE) GERRARD 4637 (BE SURE IT'S RAYMOND'S)

KAY-RAY VARIABLE CONDENSERS "DE LUXE" LOW LOSS MODEL SQUARE LAW With Vernier Without Vernier .001 7/11 .001 6/11 .0005 7/8 .0005 6/6 .0003 6/11 .0003 4/9 High-grade Ebonite ends, one-hole plus knob and dial. Post 4d. set.

RECOGNISED WEST END DISTRIBUTOR of the manufactures of Edison Bell, Jackson's (J.B.) Polar, Igranic, Peerless, Eureka, Blacum, Burndept, Lotus, Dubilier, Marconi, Dorwood, Sterling, Success, B.T.H., McMichael, Lissen, Woodhall, Utigny, R.L., Bowyer-Lowe, Ampillon, Formo, Brunet, Ormond, Nesper, P and M, and everything that is worth stocking. Every endeavour made to obtain goods not listed. COSMOS VALVES.—A45 Bright, 7/6. DE11, 12/6. SP18, red or green, 12/6. Allowance made for old valve.

THIS COLUMN IS FOR CALLERS ONLY

Post Orders Elsewhere. Nett Prices. CABINETS, AMERICAN TYPE, covered leather cloth 12x8x8, 8/-, 10x8x8, 10/9; 12x12, 11/6; 20x8x8, 12/6. All with base board, open front, hinged lid. Open boxes, imitation crocodile, 7x5x3, 1/4; 8x6x3, 1/6; 9x6x3, 1/11; 10x8x3, 2/6. Polished, 6x6 or 7x5, 3/3; 8x6, 3/6; 9x6, 3/9; 10x8, 4/8 upwards. ACCUMULATORS, high class, 2v, 40, 7/11; 60, 8/11; 80, 12/6; 100, 14/0; 4v, 40, 13/11; 60, 17/8; 80, 23/6; 100, 26/6; 60, 35/-. These are a very special line. EBONITE.—3-16 in. sq. in., 1d. for 1-in. Cut while you wait. Grade B for crystal sets. 6x6 or 7x5, 1/-; 8x6, 1/4; 8x8, 1/8; 10x8, 2/4. Many sizes stocked.

"NEWBY" 4-POINT CONDENSER.—Zero Loss, Lowest Alt. cap. 300 in. geared control. Sq. law tuning. .001, 20/-; .0005, 17/6; .0003, 15/-. NEWBY 2-WAY VERNIER COIL HOLDER. Fine adjustment. 2 tube set insulation. Heavy coils will not drop. 6/6. Post 6d.

NEUTRON VALVES.—H.F. or L.F.. .06, 12/6. Allowance made for old valve. Cleartron Valves.—C-8, C-15, each 12/6.

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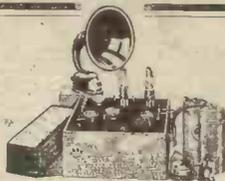
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## FOREIGN RADIO NEWS.

(Continued from page 1434.)

presence of representatives of all official bodies and leading commercial concerns.

The station is owned by the Transradio Internacional of Argentina, and is destined to replace the existing Monte Grande Station.

### Changes in European Stations.

The following alterations in some of the principal European stations have been announced.

The Zurich station, which up till now used half a kilowatt, has been increased to five kilowatts. The installation is already provided, but awaits the formal sanction of the Swiss postal authorities before being used.

Radio-Lausanne has started broadcasting on a 310 metres wave-length.

The opening of the Kiel relay station, which has been repeatedly postponed, was due to take place on February 15th.

The Sunday concerts that were one of the most popular features of Königswusterhausen have been suspended by that station, and will now be given by the A. G. Funkstunde instead. The latter station will from now on also broadcast dance music till midnight nightly after the close of the ordinary programme.

It should be noted that Prague station uses at present three different wave-lengths; the entertainment program, however, is always sent out on 368 metres.

### Peruvian Marconi Contract.

After prolonged and difficult negotiations, a twenty-five-years' contract has been signed with the Marconi people granting them a monopoly in radio stations and wireless telephone and telegraph communication in Peru.

Part of the plan is to build a powerful station in the neighbourhood of Lima to serve as a connecting link both with the big United States stations and with the Argentine.

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Big Demand for New Colour Book.

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Latest Standard Model General Radiophones (made by the well-known General Radio Co., Ltd.) Super Sensitive and Highly Efficient. Receivers matched in tone. Magnets of highly expensive Cobalt steel. Diaphragms triple tested. Beautifully comfortable, highly finished, weight 7 ozs. Fully guaranteed. Sent on receipt of 6d. deposit. If satisfied, send 2/6 on receipt and balance by instalments of 3/- monthly until only 2/1 is paid. Price, full cash with order (or within 7 days of receipt), £1.  
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A power valve for majestic loud speaker volume. The finest loud speaker valve ever produced.

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 BETTER RESULTS WITHOUT  
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Compare the price last. Make this test *before* buying: Go to your dealer—ask him to put on the best loud speaker he has in stock—then use the same horn on the LISSENOLA, and see if you can notice any difference.

A very successful type of speaker that can be made quite easily and cheaply from the directions given in almost any wireless journal is the Cone Diaphragm.



Make the Diaphragm yourself—then fit the Lissen Reed to the LISSENOLA and clamp it to the centre of the cone by means of the two nuts provided.

The purity of tone—and the volume—obtained will surprise and delight you. The illustration shows

one method of mounting a cone diaphragm speaker.

But for biggest volume of all, build a big horn from the directions and full-size exact patterns given with every LISSENOLA.

The illustration shows this effective horn, which can be covered with fancy paper and painted to resemble a factory article, and made by you for a few pence.



In addition, the LISSENOLA will fit the tone-arm of any gramophone, instantly converting it into a loud speaker.

Your dealer will gladly demonstrate and supply—or the LISSENOLA can be obtained post free by return from the makers—price 13/6, or with Lissen Reed 14/6.

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