

EXPERIMENTS WITH THE SHIELDED VALVE (See Page 60)

Popular Wireless

Every Thursday
PRICE
3d.

No. 275. Vol. XII.

INCORPORATING "WIRELESS"

September 10th, 1927.



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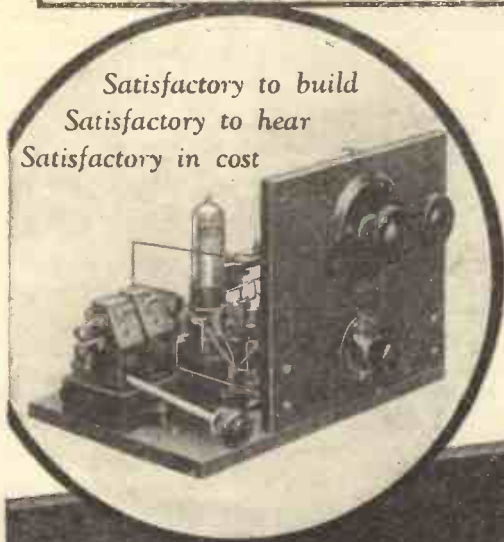
- Radio and the Villages
- Saving 19/- in the Pound
- ARE YOU IN TROUBLE WITH 5 GB?
- A Visit to 5 WA
- The New "Copper Cube"
- Fair Play for the Loudspeaker

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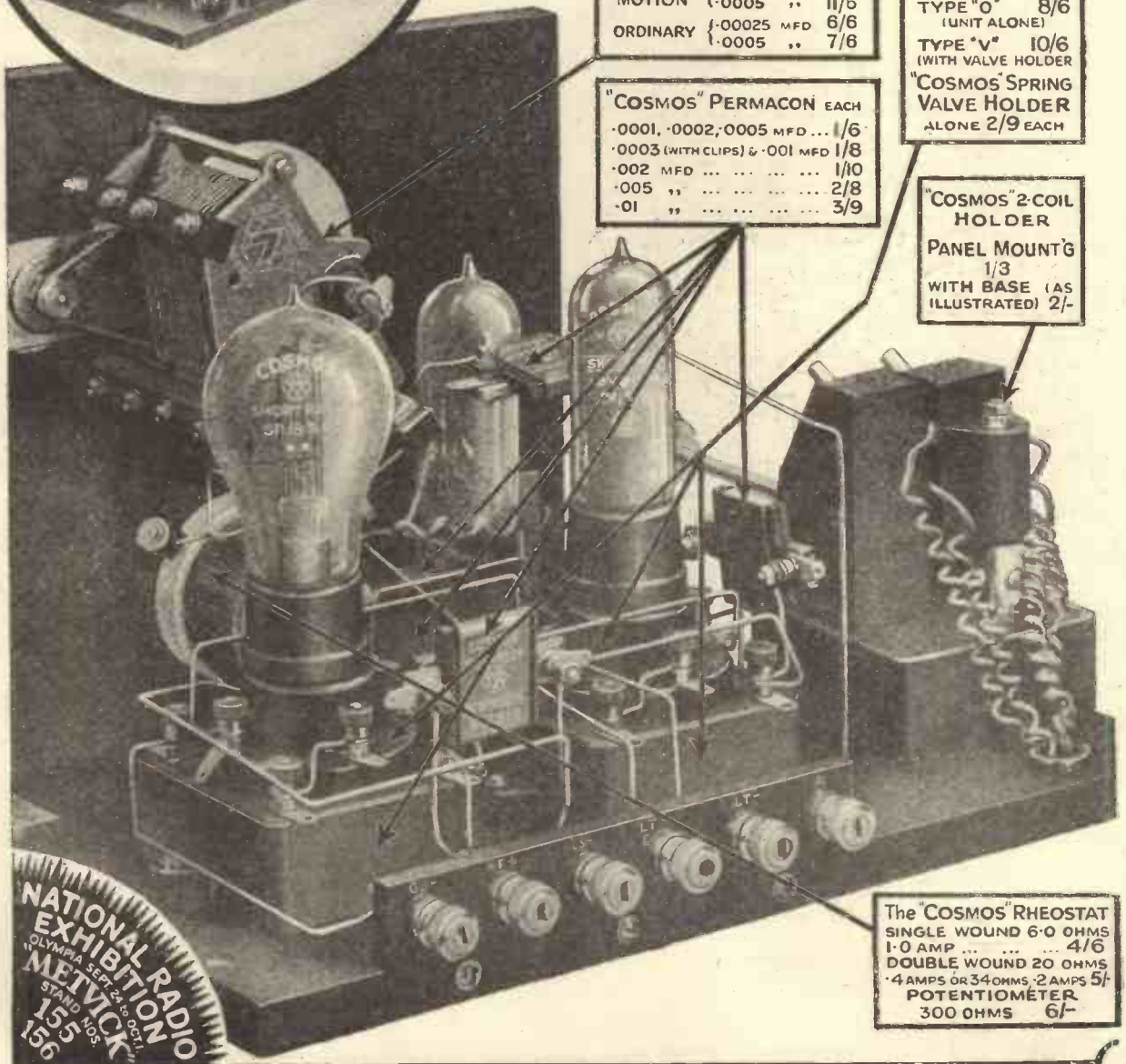
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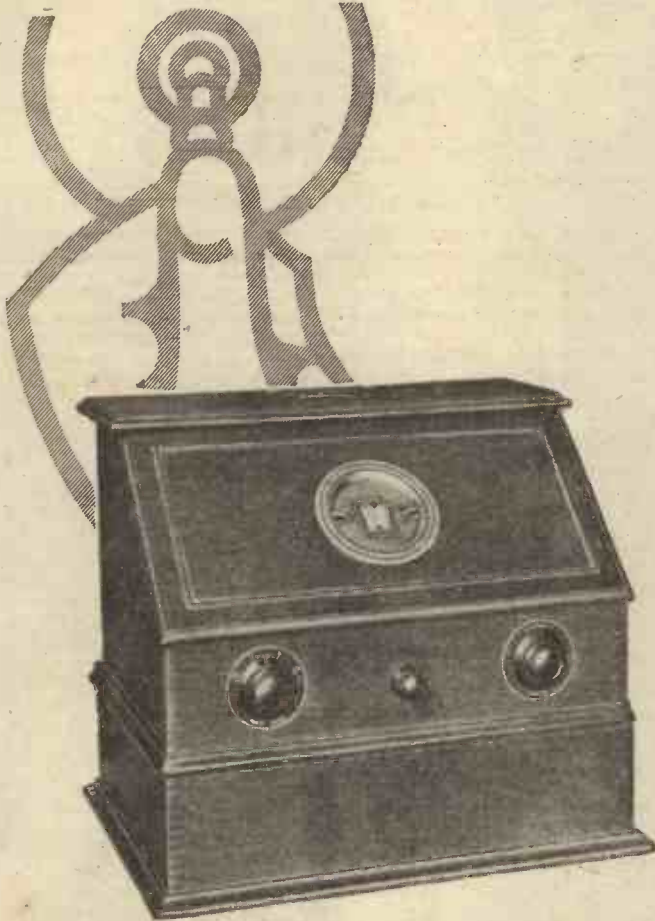


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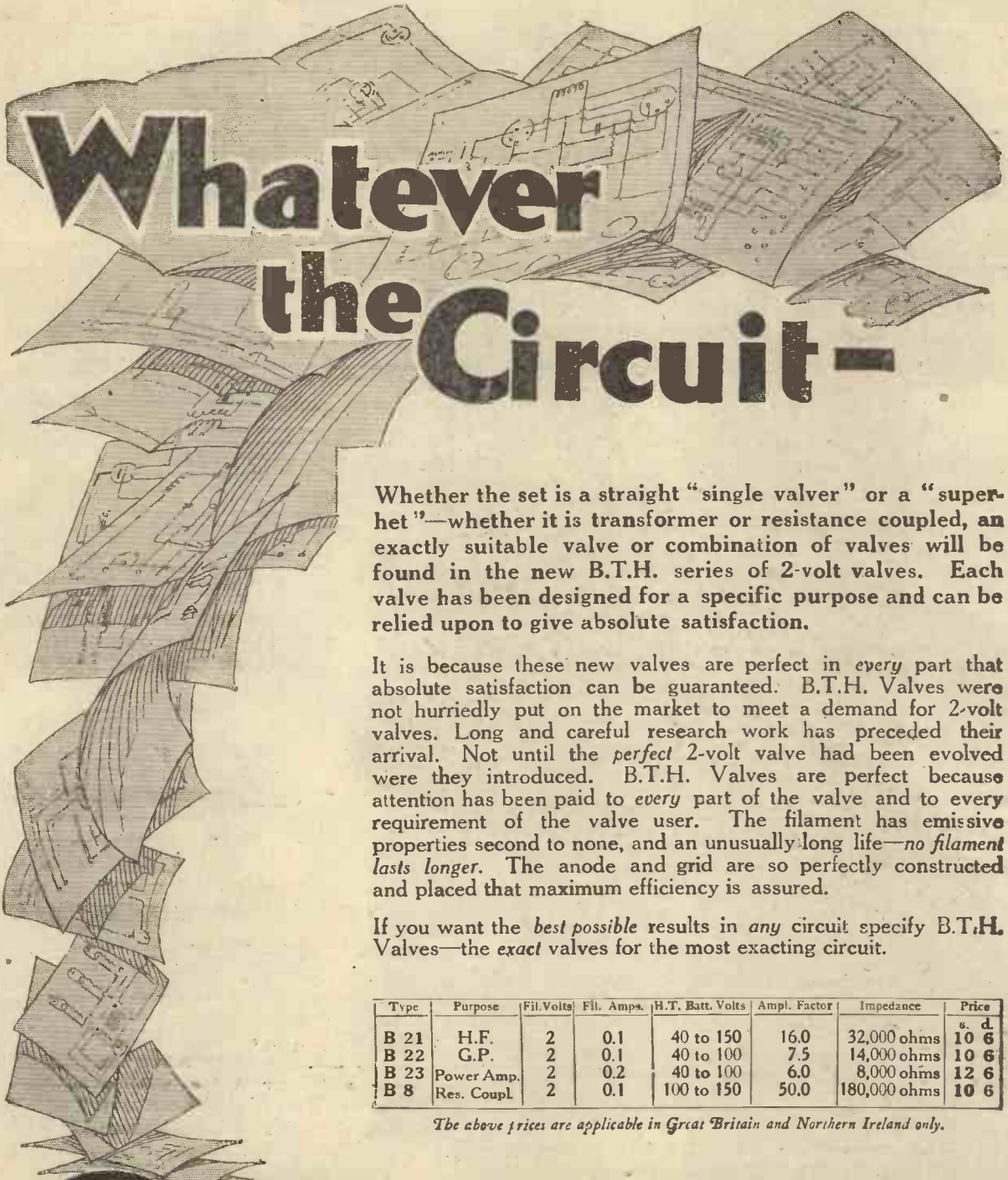
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RADIO NOTES AND NEWS.

What The Duce!—Hospital Wireless—Is It True?—Britain Invades America—Cheaper Components—The Season Begins—Short Waves—The P.O. Unbends.

What the Duce!

SIGNOR MUSSOLINI has, in my opinion, shown one of those inexplicable signs of pettiness which most great men reveal, in banning the use of certain English terms used in radio nomenclature. Italian naval men may not now say "buzzer," "choke," "tuning," etc. Not very complimentary to Senatore Marconi who, though an Italian, has enriched the language of wireless with quite a lot of similar "English" words. If a British Prime Minister tried to knock Italian out of musical terms he would never live it down.

Hospital Wireless.

LORD GAINFORD recently stated that in London there are about 122 hospitals with 16,000 beds fitted with head telephones for wireless reception, and that he had been told that since wireless had been installed the average length of time a patient stayed at hospital had decreased from three to two weeks. If the two facts are in reality correlated—and I think it is very like they are—we have yet another indication of the effect of the mind on health, which is worthy of serious examination.

Wireless and the Blind.

THIS seems to be a fitting place to refer to the needs of the National Institute for the Blind, whose Annual Report for the year ending March 31st, 1927, lies before me. During the year 362 radio sets and 180 pairs of telephones were received as gifts, and these, plus what donations were received for the purpose, have enabled the Institute to distribute 796 sets and 1,040 pairs of telephones—obviously a "drop in the ocean." If any readers feel like doing the equivalent of what our ancestors used to do, when they vowed to burn candles to the saints in return for some good thing which happened to them, they could do no better than help on the work for the blind by sending money or apparatus to 224, Great Portland Street, London, W.1.

Is It True?

I CONFESS I find well-nigh incredible the widespread report that it was proposed to broadcast in America a running commentary on the last scene of all in that

hideous Sacco and Vanzetti drama. And I cannot believe that either the broadcasting or the Government authorities would have allowed the thing to be done. I know they are not particularly squeamish about such matters in the States—but there are limits, surely, beyond which publicity, as it is practised there, will not go. I hope so.

Penny Wise, £1 Foolish.

A NOTTINGHAM man, when prosecuted for allowing a seventeen-year-old lad to instal and work a crystal set "licence free," said that "it was made out of a penny magazine." got no results, and had been thrown away. Of course, if they had followed the advice of a well-known threepenny wireless magazine, which modesty forbids me to name, they would not have tried for crystal results on an indoor aerial. It was this concealed aerial,

no doubt, which made the story look "fishy," and cost the experimenters £1 in fines.

Britain Invades America.

IT is sensational to learn that a British firm is shortly to take control of a chain of sixteen American and Canadian broadcasting stations stretching from the Rockies to the Atlantic. It's generally British concerns that get controlled. The Columbia Graphophone Co. is the invader, and I give them the blessing of one who appreciates honest commercial impudence of this kind. The idea of a British firm controlling stations in New York, Chicago, Boston, etc., is rare and refreshing, and I haven't been so tickled since a couple of effete Britishers showed how the Atlantic could be flown.

Cheaper Components.

FOLLOWING the reductions in the prices of valves sold by members of the British Radio Valve Manufacturers' Association, announced in "POPULAR WIRELESS, an official of the association states that it is quite possible that components, apart from valves, will become cheaper during the next few months.

Firms outside the association have been selling cheaper valves for some time, and are now making further reductions corresponding with those announced by firms in the association.

Pure Bosh.

I REGRET to announce that "The Old Stager"—a journalist who ought to know better—in one of these "superior being" articles about wireless and other preoccupations of the lower orders, says that radio "has killed the last opportunity for individual study." I fear we ought to cross out "stager" and write "fogey." I will wager my spectacles against his bath-chair that more home students will pass the London "Matric." next year than did this year. My dear fellow, radio is to moderns what croquet was to you years ago—a relaxation from work, and if they don't want it they don't take it.

(Continued on next page.)



A cage type of wireless aerial is to be seen above one of the oldest buildings in Ross-on-Wye, Herefordshire.

NOTES AND NEWS.

(Continued from previous page.)

A Wireless "Chestnut."

FAMILIAR to wireless men long since, this joke may be new to the "listening-in" fraternity. Skipper of tramp ship (trying to find his position on an old and dirty chart): "If that's a fly-spot, Bill, we're orl right, but if it's Sable Island, 'eaven 'elp us."

Who Got It?

DID any of our readers hear direct the attempt made to broadcast the speeches delivered by the Prince of Wales and Mr. Baldwin at the International Peace Bridge dedication at Buffalo on August 7th? The experiment was made by two short-wave transmitting stations of the General Electrical Company. Broadcast stations in London, Johannesburg, and Melbourne had been notified that experimental stations 2 X A F (32.77 metres) and 2 X A D (22 metres) would broadcast the addresses.

If any of our readers picked up the Prince's voice direct, I should like to hear from them.

Ariel's Selections.

SEPTEMBER 12th.—From 2 L O and 5 X X. Act 1 of "Don Quixote," from the Royal Opera House, Covent Garden. September 13th.—From Cardiff. "Footlight Flirtations," each item being an excerpt from a well-known musical comedy.

"That's the Stuff."

THE American Federal Radio Commission, which I have mentioned several times since its appointment, is beginning to "git up and git." Having announced that any American station which failed to keep to its proper wave-length would not have its licence renewed, the Commission has now written to twenty stations accusing them of not working on the terms of their licences. These stations, of which no less than seven are in New York, are required to show cause why their licences should not be revoked. Battle of Hastings 1066. Law and Order in America, 1927.

The Celestials Follow Suit.

ON top of this news comes the information that the Chinese have begun to regulate radio. It speaks volumes for the industry of "the Heathen Chinee" that in the intervals of his comic war he can find time to set up offices for the registry of receiving sets. Importers and retailers of radio apparatus also must register and be licensed—unless it rains, I suppose—and Wun Hi and Poo Tung must buy their "ladio leceivels" only from "legistered dealels." "You wanchee buy ladio? Can do! Show um licence!" Great Heaven!

The Season Begins.

SEPTEMBER is the magic month which begins the radio season, I suppose we shall all go to the National Radio Exhibition which opens on September 24th, for one week. There we shall find all the latest condensers with "gangs" and verniers and laws square and otherwise. We shall struggle from stall to stall wishing we were millionaires, and go home with nine pounds of pamphlets and a souvenir grid leak. Ain't life wonderful?

Notes for "Stretchers."

THE wave-lengths of the New Zealand broadcasting stations are: Auckland, 333 metres; Christchurch, 306 metres; Dunedin, 463 metres; Wellington, the new super-power station, 420 metres. The new station at Lille works on 285 metres. Anybody picked it up? A trans-Pacific (telegraphy) service has begun at Manila; wave-lengths from 600 metres to 2,701 metres.

Short Waves.

THERE is no doubt about the trend of interest amongst ether explorers.

Our short-wave features have brought an extra sack of letters. Anyone interested in time-signals will be grateful to the reader who sends me the following list: G.M.T. 3.20, Arlington N K L, 24.9 m.; 3.40, Honolulu N P M, 36.8 m.; 8.06, Issy les Moulineaux, O C D I, 32 m. (also at 20.06); 20.20, Arlington N K L, 24.9 and 74.7 m.; 10.40, Honolulu N P M, 36.8 m.; 11.30, Saigon H Z A, 25 m. (also at 19.00); 19.56, Issy les Moulineaux O C D I, 32 m. (also at 20.06); 20.20, Arlington N K L, 24.9 and 74.7 m.; 20.40, Honolulu N P M, 36.8 m.

Exhibition Note.

FROM September 17th to September 24th inclusive the Tenth Annual Model Engineer's Exhibition will be held in the Royal Horticultural Hall, St. Vincent's Square, Westminster. All interested in Television and Noctovision (seeing in the dark—like a cat) should make a point of visiting this show, for J. L. Baird will be there and will give a demonstration of these wonders.

Mobile Aerials.

I WAS interested in the "P.W." cover of this week where a couple of motor-cyclists—one driver, one pillion, or faller-off—are using a radio set with the bike as an

SHORT WAVES.

"Wireless Notes: Are you keeping a log?" ran the headlines in a Daily Paper.

No, but we're going to get one to use on the man who oscillates next door.

A lady is to tell us over the ether about "Woman and the Law." All we know at present is that the one lays the other down.—"Glasgow News."

Listening-in is an unbecoming luxury, a sign of blameworthy curiosity and a danger.—Daily Paper.

But what about Peeping Tom?

GOOD SET.

"A man opposits has a lond speaker, and we can get no sleep," complains a correspondent to a Morning Paper. Many wireless enthusiasts are wanting to know the make of this instrument.

WE WONDER.

The girl friend wants to know if "plugging the loud speaker in the jack" is the modern way of saying "beating up one's wife."—"Radio Program Weekly."

"Television: Face that sounds like a file," runs a headline in the "Liverpool Echo." We know many that look like one.

First Enthusiast: Why have you slang your aerial so low?

Second Enthusiast: I'm trying to pick up the low waves.—"News of the World."

There was an old man of Madrid, Far too much did he tickle the grid. Result, oscillation and sharp condemnation For that blooping old fan of Madrid.

A wise woman—the wife who, having heard her husband talk a lot about fading, always drew the curtains when the sun shone on the radio set.

aerial. The "aerial" is on the ground, insulated by its tyres—more or less—but it appears that the set worked well. Most metallic masses, such as bedsteads, fireplaces, meat-safes, etc., will answer if a good set is used. I am living in hopes of hearing that a New Yorker has received jazz-music, using his gold-stopped teeth as an aerial. We can swallow anything nowadays—even false teeth!

3 L O's Troubles.

OUR little cousin (3 L O—Melbourne) recently invited suggestions for a name for a baby girl. One reply received was as follows: "Refurring too thu com-pertishan for babie's names commensed by u i desiar two congratcherlate u onn yore enturprize and too sai that i wish to sugest thu name of NOTA thu sed nam haffing a uphonick sownd and standing fore N (named) O (over) T (thu) A (are) and being also short fore nota-i-ity that thu sed babio has obtaned thru u."

Uphonick speling, eh?

Short Wave Notes.

ACCORDING to numerous reports, 2 X A D is a star turn; beginners in short-wave work might try it first. Wave-length 22 metres. Messrs. E. E. Gilby and S. C. C. Wall, Kingsthorpe, Northampton, gave some short-wave results in a contemporary, and Mr. F. Dales, 34, Uppgate, Louth, wrote to them, but his letter was returned by the P.O. Mr. Dales is inclined to doubt their bona fides. Personally, I think their published address was insufficient, and hope that they will see this note and let our reader hear from them.

Short-Wave Notes (continued).

THE new station of the Radio Corporation of America, 3 X L, referred to on page 861 (August 31st) has a wave-length of 60 metres. A Bexley Heath reader tells me that Malabar, Jave (17.4 metres) can be heard most afternoons from about 2 p.m. B.G.T., the voice transmissions being identifiable by peculiarities common to P C J J. Mr. G. Smith (Birmingham), using the "P.W." General Purpose Two-Valve set, is getting first-class short-wave results, and says it is the finest all-round lay-out he has met. Go to the top of the class, Mr. Smith!

The P.O. Unbends.

IT is pleasing to learn that the Post Office has offered its congratulations to the designers and builders of the now completed Empire Beam radio system, and a source of satisfaction to all right-minded Britishers to know that this poor backward old island now possesses wireless facilities years ahead of any other country. And the stations themselves are wonders of scientific ingenuity well worth visiting. The advent of the Marconi beam is a big step towards "Sixpence per word to anywhere within the Empire," I hope.

"P.W." Round the Stations.

ARE you all following Mr. G. V. Dowding's shrewd articles on the B.B.C. Stations? His first, describing his visit to Daventry, was a "corker," and contained much food for thought. If any of you missed it, just take note that I read it twice—which is something for a man who has to read wireless stuff all day and half the night.

ARIEL.

RADIO AND THE VILLAGES



UNDER the heading of "Dug-in At Savoy Hill" a paragraph recently appeared in the "Broadcast Notes" of POPULAR WIRELESS commenting strongly upon the fact that insufficient contact was being maintained between the central organisation of the B.B.C. at Savoy Hill and the provinces.

My recent investigations have proved, to my own satisfaction, at least, that the future of broadcasting lies in the villages and hamlets of this country rather than in the big towns and industrial centres. My chat with Sir Henry Rew, chairman of the Village Clubs Association, and well known as an authority upon all matters relating to rural life and conditions, only served to strengthen this conviction.

"Sole Form of Entertainment."

Driving through the byways of Kent on my way to Sir Henry's country house at Wormshill, it was quite obvious from the number of aerials displayed in the cottage gardens that here—as in rural districts in all parts of the country—the proportion of those possessing wireless sets of one kind or another is infinitely greater than in London and its suburbs. This alone serves to show where the harvest of the ether is most eagerly reaped, and it was one of the first points which Sir Henry made.

"Though I do not pretend to be an authority on wireless," he said, "I think I may be permitted to know something about the requirements of country people. I have been connected with them all my life, and through my Association I have been in touch with some two to three thousand villages in England and Wales.

"To many of these people, among whom there is such a large proportion of enthusiastic listeners-in, the introduction of broadcasting has meant a widening of their outlook so tremendous that it has almost amounted in many cases to a complete change in the way they regard life. Many have no adequate conception of what London is really like, yet they have danced to music played in one of its most famous hotels; thousands have never been into a theatre or music-hall, but now they hear plays, revues, and variety programmes every night; a vast number who can read very little are now in touch with the latest news and the latest views. That, in a nut-

By SIR HENRY REW, K.C.B.
(In a special interview with "Ariel.")

shell, is what wireless has meant in the countryside.

"It has provided country people with their chief opportunity of getting away from their narrow lives and outlooks; every word that comes to them through the ether is of the utmost importance.



Sir Henry Rew, who is chairman of the Village Clubs Association.

"In various newspapers and magazines I have read articles putting forward suggestions as to what the wireless programmes should include, but all of them have dwelt with the subject from the town-dweller's point of view—from the aspect of those who can switch off their sets and be in the picture-palace, the theatre, or the public library a few moments later. It is obviously not to such people that Broadcasting should endeavour to adapt itself most, but to those to whom it is the sole form of

entertainment and the only real authority upon all sorts of topics.

"Up amid what I imagine to be the hurried and worried atmosphere of Savoy Hill, it is probably a difficult matter for the broadcasting authorities to get themselves into the frame of mind where they can appreciate the point of view of the villager, but it is a point of view which they should strive to grasp, certain that their efforts will meet with a very wide measure of appreciation.

"Directed in an intelligent and responsible way, wireless is the most potent power for good at the present day, but allowed to run amok, its influence may be equally harmful.

"I think it would be a very good notion if the B.B.C. were to send one or two of their officials out into the country districts for the purpose of grasping the mentality of the people. It is so necessary to *know* your public when undertaking any kind of social work.

"And what is the programme that makes the greatest appeal to the villager?

"Don'ts" For The B.B.C.

"News probably makes the greatest universal appeal. Everyone likes to know what is going on at the moment, not only at home, but all over the world. A large number of emigrants to the outposts of Empire have left homes in obscure villages and hamlets, and a family with a son in, say, Canada, feels that any item of news about that country is keeping them in closer touch with him.

"We have been told so often that 'the English are not musical' that we have almost come to believe the truth of a statement which is entirely untrue. Even the humblest folk know what they like, and what they like is usually pretty good. Dance music is also popular.

"Upon this vexed question of talks, there are varied opinions, but I can give the B.B.C. one or two useful 'don'ts' in this connection. Firstly, chats upon agricultural matters and subjects connected with their work are not welcomed, and I should advise Savoy Hill to leave lectures on natural history out of their programmes. The countryman has very definite ideas about birds and animals, which in many

(Continued on page 75.)

"TALKS."

ARE WE TO HAVE EDUCATION AND "UPLIFT" FROM 5 G B?

By THE EDITOR.

THERE is a rumour—let us hope it is unfounded—that, after all, "talks" may be broadcast from 5 G B. Certain it is that certain influential members of the B.B.C.'s programme board are in favour of this revision of policy; and certain it is that the great majority of listeners will be far from pleased if Sir John Reith and the B.B.C. governors allow the change in 5 G B's policy to be made.

It is not so much a question of the popularity of "talks" as the importance of differentiating as much as possible the broadcasts from 5 G B from those of other stations. As a matter of fact, there is every indication that "talks" this winter will reach a much higher level and will prove, on the whole, of greater interest than heretofore.

The Need for Discretion.

It will be remembered that when Parliament discussed the question of controversy in broadcast "talks," no definite restrictions were made; in fact, the issue was left open, and it was tacitly understood that the B.B.C. was to experiment in the matter. There are indications that the B.B.C. has not forgotten this, and that "talks," in the near future, will not be the milk-and-water affairs we have become accustomed to—and dismally resigned to.

Naturally, the B.B.C. cannot take a deep plunge and begin the broadcasting of talks on subjects likely to arouse a storm of controversy in the Press and elsewhere. There are some subjects about which they will find it safer and more discreet if they leave well alone when hunting for controversial matter.

Religious controversy, for instance, need not be encouraged by the B.B.C.; but there is no earthly reason why they should not broadcast matters of political controversy—so long as a sense of impartiality is retained in regard to allowing "all sides a fair hearing."

A Milk Diet.

The Postmaster-General once informed the House of Commons that, after the present B.B.C. had existed for six months, a report would be made with a view to stabilising the future. The new B.B.C. has been in existence for more than six months, and so far no report has made its appearance.

It may be that the P.M.G. has discovered that the new régime requires a longer period under observation before a suitable report can be framed, or it may be that the uneventful flow of policy from Savoy Hill has lulled him into the belief that all is well. So far, it must be admitted, the B.B.C. have arranged programmes admirably conspicuous for their innocence, tact, and general innocuousness.

But such a state cannot be maintained for ever. A public service and entertain-

ment concern like the B.B.C. cannot feed its patrons on a milk diet for ever. A vegetarian diet of programmes is all very well, but the majority of people catered for in this fashion are inclined to become anæmic.

A little red-blooded controversy, then, would make a welcome tonic, for there is nothing so stimulating as a real good argument. If the B.B.C. engineers good arguments, fairly, and without partisanship, it will be doing excellent work.

More "Ginger."

In the autumn we are to have a broadcast course on "What Society Means"—leading up to a consideration of world citizenship as the ultimate aim of human organisation.

This topic will naturally arouse the interest and perhaps the ire of those who believe in the supremacy of nationalism—but if the B.B.C. handles the topic properly, it can cause no bitterness except from the intolerant and the narrow-minded, who always shy at an argument which does not favour their line of thought.

Anyway, the prospect of more "ginger" in the "talks" is a welcome one, and we hope the B.B.C. will be successful. If they leave 5 G B alone, and if they see to it that someone with a sense of fair play,

broadmindedness, tact, and a knowledge of what is of general public interest and what is not, is put in charge of the "talks" department, the success is assured.

Radio Plays.

The B.B.C. have lately devoted a good deal of private interest in the matter of broadcast plays, and it is both pleasing and interesting to hear that several well-known authors have been commissioned to write plays for broadcasting during the coming autumn and winter.

Mr. Jeffery Farnol is to undertake a mystery play, the first two instalments of which will be published and the final part broadcast. Mr. R. A. Roberts, the actor, will give the piece in brief and perform the dénouement before the microphone. Mr. Farnol is also collaborating with Mr. R. E. Jeffrey, director of dramatic productions at the B.B.C., in adapting his novel "The Amateur Gentleman" and two others for broadcasting. Mr. Reginald Berkeley is to write another play for radio production. His play, "The White Château," which has been produced on both the stage and in the cinema, was one of the most successful dramatic ventures of the B.B.C.

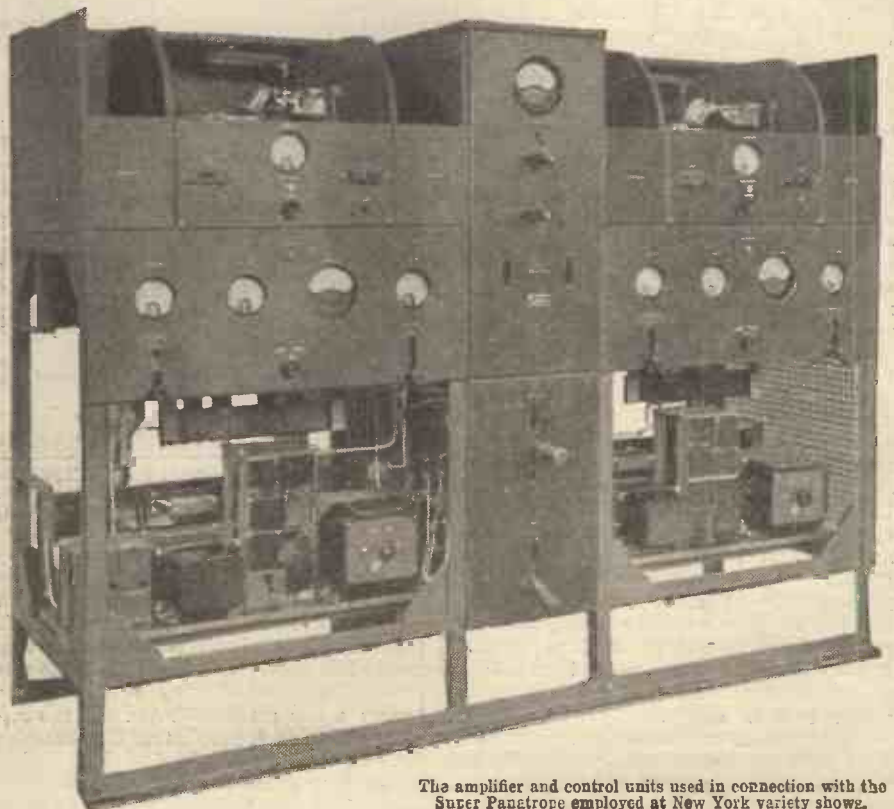
Some well-known English and foreign novels are to be adapted for radio production by Mr. Cecil Lewis.

On the whole, excellent signs that the winter programmes will be full of interesting items—on the radio drama side at any rate.

THE RADIO EXHIBITION at OLYMPIA.

See "P.W." for the most comprehensive details commencing in the issue on sale Sept. 22nd.

"THE MOST COMPLETE REVIEW
OF THE EXHIBITION."



The amplifier and control units used in connection with the Super Panatropé employed at New York variety shows.



FAIR PLAY FOR THE LOUDSPEAKER

THE transmissions from the B.B.C. stations and from many of those on the Continent are now so excellent in point of quality that reproduction which falls little short of perfection is obtainable if the apparatus used is up to the mark. Not so very long ago we could not reproduce the deep bass notes for the very good reason that the transmitting apparatus was incapable of sending them out for us to receive.

Their absence was then not much commented upon, for two reasons. The majority

When properly designed, and used with a good loudspeaker a broadcast receiver is capable of providing a true rendering of the music and speech transmitted from the broadcasting stations. All listeners should read this article.

By R. W. HALLOWS, M.A.

of armour-piercing shells and those who manufacture shell-proof armour plate. For a good while improvements in transmissions were just a little ahead of those made in reception, and very few receiving sets were really able to bring out all that was actually coming in.

Causes of Distortion.

To-day, however, the two sides of wireless stand virtually upon an equal footing, and the modern well-designed receiving set can, if properly treated, reproduce all of the transmission. Since the transmission now contains what is practically a faithful copy of the sound waves occurring in the studio, this means that every sound produced in the studio can now be reproduced by the receiving apparatus situated many miles away in the listener's home.

Can be reproduced. But is it? In many, perhaps in the majority, of cases one must admit that the loud speaker is not doing justice either to the transmissions or to the receiving set. Naturally, if the receiving set is itself faulty no loud speaker can make up for its defects. But there is no reason in these days of good components and excellent valves why the receiving set should not be thoroughly up to the mark. On the high-frequency side distortion can occur for only two possible reasons.

If selectivity is too great some of the sidebands may be cut out; this, however, is

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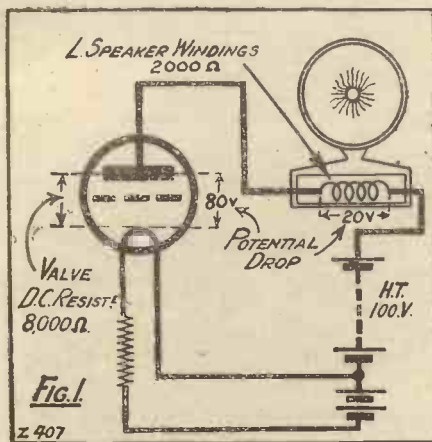
the upper harmonics. These were reproduced by the receiving set and reached the ear of the listener.

Now, the human hearing centres have the curious property of supplying the fundamental to some extent when only its harmonics reach them. Thus it was that though the low notes were really absent the listener unconsciously filled them in to some degree for himself. A similar process with regard to the eye and the visual centres may be observed by laying a sheet of paper across a line of print so that only the upper halves of the letters are visible; not the slightest difficulty will be found in reading the words.

Receivers Left Behind.

Still, the "imaginary bass" filled in by the ear and the hearing centres was not sufficient. People began to notice the absence of the real thing more and more, especially when more ambitious broadcasts were made. The organ was at one time one of the very worst of musical instruments from a wireless point of view, since, as transmitted, it sounded as if it had no pedal notes at all. Even the best of organs, in fact, gave one the impression of a steam calliope blaring away on a merry-go-round at a fair. Improvements in both transmitting and receiving apparatus followed rapidly.

The contest was not unlike that between the makers



of listeners were still so thrilled by the very idea of receiving music from a distance with no visible connecting link between the transmitter and the receiver that they did not worry greatly about the question of quality. The second reason is rather a curious one.

Lack of Fundamentals.

No note produced by any musical instrument is a pure sound due to a simple wave of sine form. A note always consists of a fundamental and its harmonics, which in the case of certain instruments may be very numerous. The actual sound wave corresponding to any particular note from a given musical instrument is thus a complex one. Though the transmitter could not deal with the very low frequency of a deep fundamental note it could and did handle the higher frequencies due to



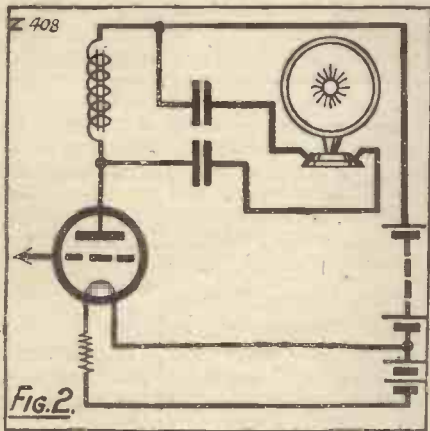
Bringing the set up near the oscillation point, or using too much selectivity, is one way of receiving a programme.

FAIR PLAY FOR THE LOUD SPEAKER.

(Continued from previous page.)

not likely to occur except possibly on the high wave-lengths. The other possible cause of distortion is to be found in the excessive use of reaction, the set being worked too near the point of oscillation. The signs of oscillation are now so well-known that distortion from this cause is unlikely when the set is operated by any sensible person who desires good quality, at any rate when the local station is being received.

Both the grid-leak-and-condenser and the anode-bend systems of rectification are



liable to give rise to certain minute deformations of wave shapes, but these are so tiny that they cannot be detected by even the most sensitive human ear. On the low-frequency side we have three forms of coupling to choose from.

Faithful Reception.

So great are the advances made of late in transformer design that no audible distortion need be produced in a set which uses a single note-magnifying stage coupled in this way. Where more stages are required there is a choice between resistance-capacity coupling—for which we now have special valves and wire-wound resistances of high value—and choke-capacity coupling. The last method is, to my mind, the best of all, provided that chokes are used with values suited to the impedance of the valves which they follow.

But whatever method is used the receiving set can be made to supply at its output terminals a faithful electrical copy of the sound waves occurring at the broadcasting studio. It is in the subsequent process of converting these electrical impulses back again into sound waves that so many defects are apt to be present.

Fig. 1 illustrates a very common method of treating both the receiving set and the loud speaker unfairly. An instrument whose windings have a direct current resistance in the neighbourhood of 2,000 ohms is connected directly to the output terminals of the set, with no intermediate filter circuit or transformer. This practice is a survival from the old days when power valves were almost unknown.

The general-purpose valve then in use had a high internal A.C. resistance and

passed a very small amount of plate current. Since its internal resistance was high an additional 2,000 ohms of resistance in the plate circuit did not unduly cut down the anode potential; in any case, the loud-speaker reproduction with a general-purpose valve in the last holder was necessarily of such poor quality that there was little need to bother about details.

Output Impedance.

But consider the case of a modern power valve in which the plate-filament resistance is low. Here matters are very different. Let us suppose that this resistance has a value of 8,000 ohms. If we connect up a high-resistance loud speaker we add a further 2,000 ohms in the plate circuit, bringing up the total resistance to 10,000 ohms. When the battery voltage is 100, what is the actual steady plate potential in this case? Twenty per cent of the whole potential drop takes place across the loud-speaker windings, and only eighty per cent between the plate and filament of the valve. In other words, the plate is not 100 volts positive with respect to the filament; the potential difference between the two is only 80 volts.

Several undesirable results follow from this. In order to obtain a long, useful portion of the characteristic the plate potential must be as high as is permissible with the particular valve in use. Lowering the plate potential is equivalent to moving the whole characteristic to the right, which means that the useful portion is considerably shortened. Now, if the user of a receiving set neglects the potential drop across the windings of a high-resistance loud speaker, he probably applies to the grid of the last valve the negative potential recommended by the makers for a plate potential equal to his battery voltage. By regarding plate voltage and battery voltage as being of the same value, and biasing his grid accordingly, he takes the working point far too low down on what is left of the useful portion of the characteristic and thus obtains the distortion that is due to bottom bending. Even if the grid bias is reduced the valve cannot produce a large volume of sound from the loud speaker, since the straight portion of its characteristic is now too short to enable it to deal with grid swings of the necessary amplitude. If the resistance of the loud-speaker windings is known, and if a milliammeter is available, the actual steady plate potential of the valve is easily calculated. By Ohm's law volts equal ohms multiplied by amperes. Supposing that the milliammeter connected into the plate circuit of the last valve gives a reading of 12 milliamperes and that the loud speaker resistance is 2,000 ohms, then the voltage drop across its windings is $2,000 \times .012$, or 24 volts. This figure subtracted from the total H.T. battery voltage gives the plate potential.

Use a Filter.

And there are other reasons why it is inadvisable to use a high resistance loud speaker connected directly into the plate circuit. Most people nowadays realise that there is no point in allowing its windings to carry the whole of the steady plate current; but it is not so generally realised that the plate circuit impedance of the last valve is just as important as those in the plate circuits of other low-frequency amplifiers. Unless its value is right repro-

duction is bound to be faulty. By making use either of a filter circuit, as shown in Fig. 2, or an output transformer as indicated in Fig. 3, the correct output impedance can be obtained, with an enormous improvement in results.

To give a concrete example, there is on the market at the present time a very popular loud speaker which is specially designed for an output impedance of 3,500 ohms. One commonly sees these connected directly into the plate circuits of power valves with impedances ranging from 6,000 to 8,000 ohms, and in such cases complaints are often heard that the instrument, though it brings out the bass of music well, lacks brilliancy on the treble passages and makes speech sound a little woolly. In their advertisements the makers do not emphasise the fact that with a power valve of the impedance mentioned above a 1.7 to 1 output transformer should be used in order to obtain the best results. When such a transformer or a suitable filter circuit is employed the improvement in quality is extraordinary. The "cardboardiness" previously noticeable disappears altogether, and the instrument is now at its best. This same loud speaker, which has a comparatively low resistance, can be used directly in the anode circuit of a super-power valve, though it is inadvisable to do so owing to the strain placed upon its windings by the heavy flow of direct current that occurs.

Plenty of H.T.

Many loud speakers, probably the majority of them, are at their best only when there is ample H.T. voltage, and therefore a good flow of current, in the plate circuit of the output valve. Anyone



A typical horn type of loud speaker.

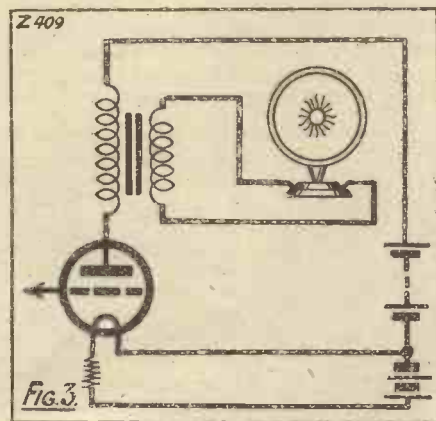
who cares to make the experiment is likely to find that even though he can obtain from an ordinary power valve all the volume of sound that he requires without overloading it, the reproduction is very much better if a super-power valve is used in the last stage of the receiving set. The reason is partly that the low impedance of the valve itself helps towards the proper bringing out of

(Continued on next page.)

FAIR PLAY FOR THE LOUDSPEAKER.

(Continued from previous page.)

the bass notes, and partly that the big, straight portion of the characteristic available enables the large grid swings that occasionally occur to be dealt with comfortably. These occasional big grid swings provide one of the peculiar problems affecting loud-speaker reproduction. A valve may be so adjusted that when an orchestra is playing the needle of the milliammeter placed in its plate circuit remains perfectly steady. When, however, a solo on the piano is given certain notes may cause



the needle to jump, showing that overloading is present. The amplitudes that may be produced by certain piano notes are sometimes surprisingly big. Out of curiosity I made a test one night recently with a view to ascertaining their approximate dimensions. During a certain piano solo a negative grid bias of $7\frac{1}{2}$ volts produced complete freedom from overloading except when two particular notes occurred. With the exception of these two notes, therefore, the maximum grid swing produced during this item was something less than $7\frac{1}{2}$ volts. A super-power valve was placed in the last holder when a second piece was played on the same piano, and the grid bias was gradually increased until overloading ceased. It was found that the two notes in question produced on the grid of the last valve swings of between 30 and 33 volts, for the valve was slightly overloaded with 15 volts negative grid bias but was quite steady with $16\frac{1}{2}$ volts.

Dry Battery Troubles.

An excellent rule to observe where the last valve is of the power or the super-power variety is never to use less than 100 volts H.T., and, if possible, to have the maximum stated by the makers to be permissible. Even though a valve may not be overloaded when its plate potential is of moderate value a very distinct falling off in quality occurs. The higher, in fact, the H.T. voltage, the better most loud speakers work, their reproduction becoming clearer and more genuinely musical as the voltage is raised. But do not be content with installing a number of H.T. units with a certain nominal voltage and leaving them alone until at the end of many months

signal strength becomes so weak and "atmospherics" so bad that a renewal cannot be avoided. Make sure that the H.T. potential is genuinely there by placing a high resistance voltmeter across the battery every now and then when the set has been working for at least half an hour. It is of no use to use a low resistance instrument at any time, for the readings obtained may be entirely erroneous. Nor does it serve any good purpose to measure the voltage when the battery has been on open circuit for many hours. Dry batteries pick up when they are rested, but fall off again rather rapidly when placed under load. Above all things, do not try to work power or super-power valves from small dry batteries made up of cells about the size of those used for flashlamp refills. By far the most economical and altogether satisfactory H.T. battery to use in conjunction with a loud-speaker set is something really large and heavy. Those that I use weigh about fourteen pounds for each 45-volt unit, and though they are hard-worked, one generally obtains at least a year's useful life from them. Should you have an accumulator battery, have it charged regularly. Where the H.T. battery is one of the wet Leclanché type only cells with large sacs should be used. Consider what is the effect of a steady and considerable drop in the battery voltage during an evening's reception.

Increasing Distortion.

When the programme begins the set is switched on and the battery, after its rest, is able to supply at any rate a large proportion of its original potential. The grid bias is adjusted to suit this, so that the working point is approximately in the middle of the straight portion of the curve. But as the evening goes on the potential falls, moving the characteristic gradually more and more to the right. The working point travels lower and lower down the characteristic, and bottom bending distortion appears and grows slowly worse and worse. The fall in potential also affects, as we have seen, the ability of the loud speaker to do itself justice, and the net result is that the latter part of the programme is very badly reproduced.

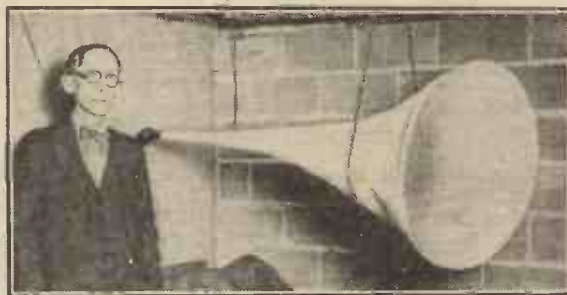
That is probably one reason why complaints are sometimes heard that the quality of a transmission is worse during the later items in the evening than during the earlier ones. There is another rather queer reason which has probably not occurred to many readers. At the beginning of the evening, when, especially in summertime, conditions are not too good, the set is switched on and the reaction adjusted in order to give the desired volume of sound. The grid swings reaching the output valve are then such that it is working just comfortably within its powers. As darkness sets in signal strength increases, which means, of course, that the amplitude of the grid swings grows. Unless the reaction coupling is loosened distortion due to overloading is bound to occur during the latter part of the evening. Short-range sets with fixed reaction, or no reaction at all, may require to be slightly detuned as the light fails.

Too often the loud speaker is not placed in a suitable position. I have seen those of the cone type standing within an inch or two of either walls or heavy curtains. In neither case has the instrument any chance of giving its best; the proximity of the wall may produce an unpleasant "boominess," whilst a curtain may give rise to a muffled effect. It is always as well to try various positions in any room to see which best suits the loud speaker in use. With those of the horn type it often pays to turn the bell of the trumpet not towards the middle of the room, but towards the angle made by two walls. In this way the sound does not appear to be coming from one comparatively small point, but is diffused, with a very pleasing effect. Should the receiving set be at all microphonic, do not place the loud speaker upon the same table—certainly not upon the top of the cabinet. In such cases the loud speaker should stand well away from the rest of the apparatus, and if it is of the horn type it should not be turned towards the cabinet.

Renovate the Speaker.

Do not expect your loud speaker to last for ever. Many instruments are still in use which were designed four or five years ago, when, as we have seen, both transmission and reception were distinctively defective. Some of them do surprisingly well, all things considered, but few old loud speakers are really up to the mark. It is advisable to send the loud speaker back to the makers every twelve or eighteen months to be looked over and adjusted if necessary. Those of the moving iron type require to be remagnetised at intervals, for horrible distortion can result from tired magnets.

In conclusion, I would ask the reader to make real quality in reproduction his watchword. The transmissions are now so nearly perfect that it is our own fault if we fail to obtain speech that is clear and natural, and music that is really music.



A plaster speaker horn made by an amateur enthusiast.

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TECHNICAL NOTES

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

ELIMINATING THE H.T. BATTERY

A CURIOUS AERIAL—E.M.F.—“PRE-AGEING”—CONSTANCY—INTERRUPTORS.

Eliminating the H.T. Battery.

FREQUENT attempts have been made to dispense with the H.T. battery, and, of course, where electric light supply is available, this may now be done quite successfully by the use of one of the various forms of “eliminator” which are on the market.

In some cases, however, where electric supply is not available, and also in the case of portable sets, it may be very useful to be able to obtain the H.T. supply from the L.T. battery. In this way the number of batteries required is reduced from two to one, and the L.T. battery is, in any case, comparatively easily recharged, or otherwise replenished or replaced.

For some considerable time past one of my assistants has been carrying out experiments with a step-up transformer arrangement for producing the H.T. supply, the primary of the transformer being supplied with interrupted D.C., or oscillatory current derived from the L.T. battery, the H.T. alternating current delivered from the secondary being rectified (by crystal, electrolytic, or other rectifier) and suitably smoothed by means of chokes and condensers.

I should mention, in passing, that the idea of producing H.T. current for the plate supply of C.W. transmitting sets by means of a step-up transformer or induction coil is not new, and an arrangement somewhat on that principle was employed during the war.

So far as I am aware, however, this method has not been used for receiving sets, for which the rectified H.T. current must be smoothed out to a very high degree of uniformity in order to avoid any unpleasant “background” in the received telephony.

If a vibrator interruptor is used in the primary circuit, the wave-form of the alternating current delivered from the secondary is such that (without certain special precautions) it is not at all easy to smooth out. By the use, however, of a special oscillatory circuit in conjunction with the primary of the transformer, and by a special condenser arrangement in conjunction with the secondary of a transformer, a fairly smooth D.C. H.T. supply may be obtained with this device.

As I said in these Notes two or three weeks back, however, it is always a question whether the device which replaces the H.T. battery is less bulky and expensive, equally reliable and more convenient.

A Curious Aerial.

Of all the many curious forms of aerial, one of the strangest I have come across for a long time is an aerial entirely enclosed within a vacuum! The aerial wire itself is wound to and fro upon two small four-armed crosses made of glass. These are supported

upon the ends of a glass rod and so constitute the “former” upon which the aerial wire is wound. The whole is then inserted into a long glass tube of suitable size and the two leading-out wires from the aerial are connected to platinum wires sealed through the glass, the tube then being evacuated by means of a vacuum pump and sealed off. It is claimed for this type of aerial that it is free from atmospheric disturbances and that any possible effects due to corrosion or other suchlike action upon the wire are obviated. The invention is ingenious and is an interesting one from a purely scientific point of view, but it does not appeal as being likely to meet commercial conditions.

E.M.F.

I noticed an interesting “battery tester” some time ago which, in general appearance and operation, rather



A neat three-valve set, having “ganged” tuning controls, built by one of our London readers.

resembled the little piston or telescopic pressure-gauges which one uses for ascertaining the air pressure in a motor-tyre (I believe these are known as Schroeder gauges): The battery tester consists of an outer metal cylinder in which slides a piston; the device presumably contains the equivalent of voltmeter windings, the central piston being the movable unit. There are two terminals connected to the instrument and when these are brought into contact with the terminals of the battery, the piston moves out of the cylinder to an extent depending upon the voltage of the battery. The part of the piston which then projects is marked “low,” “medium requires re-charge,” and “charged full.” Thus a glance at the indicator tells whether the battery requires attention or not. Incidentally, as this device is a voltage instrument, it is open to the objection urged by many experimenters that the voltage of a battery does not

necessarily give a true indication of its condition.

“Pre-Ageing.”

You might be surprised to know what a large amount of research work and investigation generally has been devoted to the subject of the composition and treatment of resistance alloys for manufacturing resistance elements. Apart from the mere production of an alloy of suitable resistance properties, the question of “ageing” is quite an important one. It is found that some types of alloy, which may be very efficient when freshly manufactured, deteriorate, either in their electrical or physical properties, with age and with use as resistors. It is not definitely known whether the effect is due entirely to the higher temperature at which the resistor may be called upon to work, or whether it is partly due to the passage of electric current through it. It is known that copper wire deteriorates in this way after prolonged use and may become very hard and brittle in the course of a few years, its electrical conductivity deteriorating at the same time.

Obtaining Constancy.

In this connection the resistors known in the United States as “Vitrohm” are specially “pre-aged” before being used for manufacturing resistance units. The precise process used for “pre-ageing” is a trade secret, but the wire is guaranteed to give constant service without appreciable change in its properties for years after being sent out. In making up a “Vitrohm” resistor the pre-aged wire is wound upon porcelain tubes and protected by fused-on vitreous enamel for the permanent protection of the wire and terminals. The watts dissipation per square inch of surface is claimed to be greater with “Vitrohm” wire than with any other type.

Interruptors.

Several readers have asked me at different times questions with regard to a subject allied to electrolytic rectification—that is, electrolytic interruption.

The simplest and best-known form of electrolytic interruptor consists of a vessel containing dilute sulphuric acid in which a strip of lead is used as the passive electrode, whilst the active electrode is a fine platinum wire (or a wire of copper or other metal terminating in a fine platinum wire tip). Usually the platinum wire is sealed into a capillary glass tube and just the extreme tip is left projecting. The glass tube serves to insulate the wire entirely from the electrolyte with the exception of the tip. When current is switched on, electrolytic action causes the deposit of gas at the tiny platinum tip and the passage of current is then prevented. When the current ceases,

(Continued on page 76.)



Are You in Trouble with 5 G. B.?

BROADCASTING plays such an important part in our daily life, that almost every change or alteration creates a new problem for thousands of listeners. When the 2 L O station shifted its transmission centre from the Strand to Oxford Street, thousands of London listeners noticed a very distinct difference in reception. Prior to this, the transference of 5 X X from Chelmsford to Daventry was accompanied by similar variations in strength.

But neither of these changes brought the striking consequences of the introduction into the middle of our shorter wave-band of "5 G B," the experimental station of the British Broadcasting Corporation, better known as Daventry Junior. Indeed, I would hazard the guess that when this article appears innumerable readers of "P.W." will still be "up against it," and will be echoing the words of the poet, "How happy could I be with either, were t'other dear charmer away!"

Facing facts as they are, there is no question that 5 G B is going to be a big problem to many listeners who possess old-fashioned sets, for the advent of the new station creates problems quite different from those brought about by the change of location of a main station, or a shift in wave-lengths. Thousands of sets—probably the great majority of receivers—will receive on the loud speaker one station very satisfactorily, and will only give others at weak or medium loud-speaker strength, if at all. The selectivity of the average set is, by modern standards, indifferent, but as the strength of reception from any but the local station is comparatively weak, signals from the latter are generally unaffected by interference from the former. For example, if your local station is working on 360 metres, and its distance is, say, ten miles off, signals will be so strong that you will hear nothing of a station working on, say, 400 metres.

Background of "Local."

But listen to the 400-metre station in such circumstances, and I will guarantee that in nine cases out of ten you will get a background of your local station, if it does not actually swamp everything. It is for this reason that the designers of receivers for our wireless journals have for some months paid a great deal of attention to high selectivity. The genuine experimenter demands selectivity, for he cannot do his work without it.

The ordinary listener who concentrates upon the local station either with a home-built receiver or with one of the factory-

* * * * *

Some interesting notes concerning the new Daventry Station and some useful hints on tuning it in free from interference.

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

* * * * *

built type; looks upon the selectivity problem as one technically interesting, perhaps, but of no special importance to him. Then suddenly, as far as the London listener is concerned, there come loud signals from 5 G B, offering at once an alternative programme. What happens when he tunes to this new station which is working on the same wave-length as that which Bournemouth previously occupied. 5 G B is there right enough, but so is 2 L O! In some cases, indeed, particularly if the listener lives north of London. 5 G B will obtrude itself upon the 2 L O transmission, particularly on crystal receivers of semi-obsolete types.

Accurate Measurements.

As soon as the 5 G B experiments began I took some pains to assemble accurate and sensitive measuring apparatus for the purpose of measuring the relative strengths of

reception, not by guesswork, but by actually recording the output current on a well-designed and sensitive crystal receiver. On a given day, when 5 G B was sending out just before the London and Daventry programme began, the following figures were obtained. Incidentally, I should say that the readings are not the maximum current obtainable on my aerial, but are strictly comparative and were all taken between two and four in the afternoon.

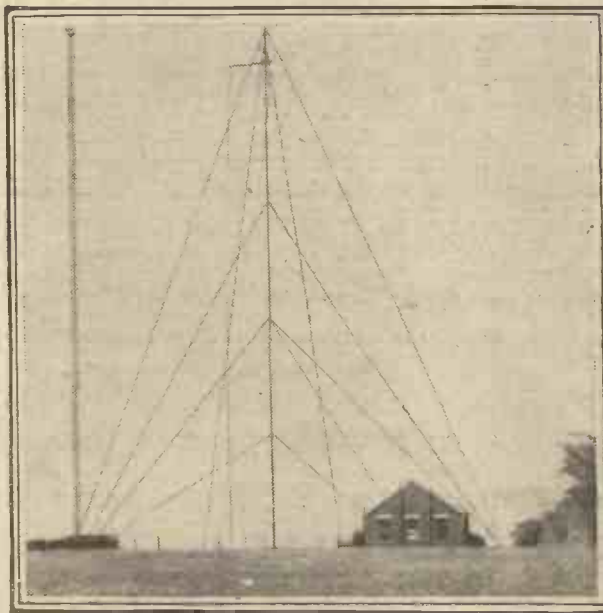
5 G B, 4.5 microamps, wave-length	491.8 metres.
Daventry, 2.7 microamps, wave-length	1604.0 metres.
London, 64 microamps, wave-length	361.4 metres.

The distance from 2 L O is seven miles, and from Daventry approximately eighty miles. The new station is thus nearly twice as strong at home as 5 X X.

Now, if in the past your set has not been selective enough to hear Bournemouth because of London interference, then you cannot expect to hear Daventry Junior without London. If you have been in the habit of listening to Langenberg with pleasure—thousands have done so recently, owing to the strength of signal and the excellent variety of music—you will find that in practically every case 5 G B will wipe it out entirely. This I rather look upon as a disaster, for the difference in

wave-length is nearly 23 metres, or in kilocycle separation '30. When conditions are good Langenberg can be just heard in my laboratory on a straight crystal set without any amplifier, and I regularly use his morning programme for test purposes on all kinds of sets. At the present time I am conducting careful tests with one of the most recent American six-valve sets, a factory-built product of the most modern design. Its selectivity is considered to fill all practical requirements in the United States, so that the reader will understand that its sharpness of tuning is far in excess of that of the average British set. By careful tuning I can just get rid of 5 G B on Langenberg!

There are two types of problems to face in
(Continued on next page.)



This is the 5 G B station, which is still of purely an experimental nature. One of 5 X X's masts can be seen on the left.

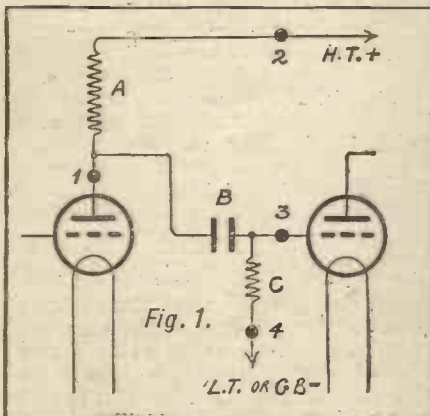
AN R.C. COUPLING UNIT.

By OSWALD J. RANKIN.

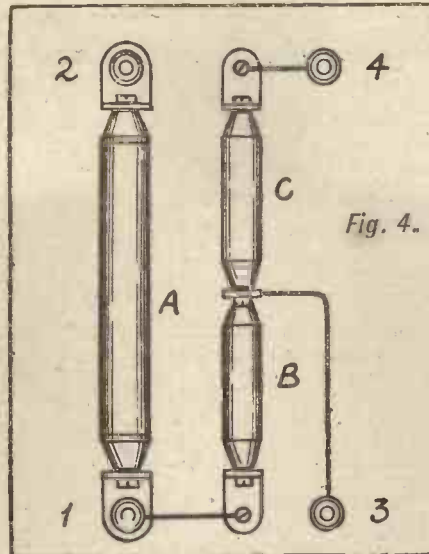
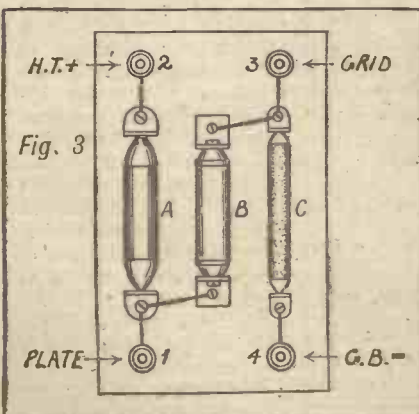
THE present craze for resistance-capacity-coupled L.F. amplifiers is due to the sudden appearance of the "R.C." valve, a specially designed valve which, when used in conjunction with the most suitable combination of resistance and capacity, gives practically the same degree of amplification as that obtained from a good L.F. valve coupled on the iron-core transformer principle. The purity obtained from an R.C. coupling is generally admitted to be without equal, the anode voltage need not be particularly high, the cost of the coupling unit is low, and the whole arrangement extremely simple and compact.

Easily Made Components.

On the one hand many authorities claim that this is the only possible method of



obtaining equal and distortionless amplification of all notes in the harmonic scale, using a cone type loud speaker, and on the other hand many declare that the L.F. transformer-coupled valve gives better results—i.e. a slightly higher degree of amplification, and an equal degree of tone purity. You may have seen a few of these lively arguments in the Correspondence columns. All this, of course, is rather misleading; it leads the amateur first in one direction and then in another, and in the end he gets nowhere. The whole trouble seems to be in connection with the values



of the resistances and condensers, and so, rather than wait indefinitely until someone discovers the ideal combination for any type of R.C. valve, and any value of anode current, I suggest that any reader who anticipates becoming an R.C. convert should get down to the job seriously and experiment.

It is just as easy to experiment with R.C. couplings as it is with transformer couplings. Fig. 1 shows an R.C.-coupled L.F. valve, where A represents the anode-coupling resistance, B the grid-coupling condenser, and C the grid leak, and it will be seen that by dissecting the circuit and providing terminals at the points 1, 2, 3, and 4, it can be arranged as a self-contained unit as in Fig. 3, and simply connected up in place of a transformer. The actual size of the unit will depend upon the dimensions of the components; in Fig. 4 the combined lengths of the grid leak C, and the condenser B, are equal to the length of the resistance A,



Fig. 2. The complete R.C. unit.

so that the width of the unit is considerably reduced by arranging the components as shown.

Actually, the terminal points 3 and 4 are in line with the components C and B, as is shown in the complete unit in Fig. 2.

A brass link connects one end of B to A, the other end of B being joined to the end of a clip which also accommodates one end of C. This clip is provided with a deep slot, so as to take the two fixing screws, and the foot is extended to the terminal point 3. The ebonite base of the unit described measures 4 3/4 in. by 1 1/2 in.

Suitable component values for commencing experiments are: 50,000 to 500,000 ohms for A; .01 to .001 mfd. for B; and .25 to 2 megohm for C.

ARE YOU IN TROUBLE WITH 5 G B?

(Continued from previous page.)

relation to 5 G B and general reception. If the listener with either a home or factory-built receiver merely desires to listen to one without interference from the other, and cannot do so at present, there is a simple way out of his difficulty and one which can be applied to any set—crystal, valve, home built, or ready made. That is the use of some form of trap in the aerial lead. The efficacy of traps varies considerably with different aerials and the trap which gives best results on one aerial is not necessarily the best on another, but the separation between the London wavelength and that of 5 G B is sufficiently large to make any ordinary trap efficient on any ordinary aerial. The trap I have found most generally effective consists of a centre-tapped coil (a 60 or 75) shunted by a .0005 mfd. variable condenser. The aerial lead is taken to the centre tap and another lead taken from the moving plates of the variable condenser to the aerial terminal of the set. It is convenient, of course, to fix up such a trap in a box, but there is no need to do so from the electrical point of view.

Making a Wave-trap.

The simplest possible way of making this trap is to take an ordinary board-mounting coil socket, screw it on a small piece of wood and fasten alongside one of the new adjustable condensers described in my article, "A Space and Money Saver," in the issue of POPULAR WIRELESS for August 20th. The two terminals of the adjustable condenser can be joined to two terminals of the coil socket, and the aerial lead can be transferred from the aerial terminal of the set to the centre tap of the coil. A lead should now be taken from either terminal of the adjustable condenser to the aerial terminal of the set. The earth lead is left as before.

If you want to listen to 5 G B and desire to get rid of London, connect your aerial lead first of all to the set in the normal way, ignoring the trap, and tune in London at best strength. Now, without touching the tuning adjustment, remove the aerial lead from the terminal, connect it to the centre-tapped coil, and take the lead previously mentioned from the trap to the aerial terminal of the set. With a screwdriver, turn the knob of the adjustable condenser until signals from London either disappear or are at their weakest. Having done this, leave the set so adjusted and tune in 5 G B in the usual way. You should now experience not the slightest interference from London. If you do so, try a slight readjustment of the small condenser.

You can, of course, use an ordinary variable condenser mounted in some convenient fashion for adjustment together with the centre-tapped coil, and tuning will be effected in the ordinary way on the lines just indicated.

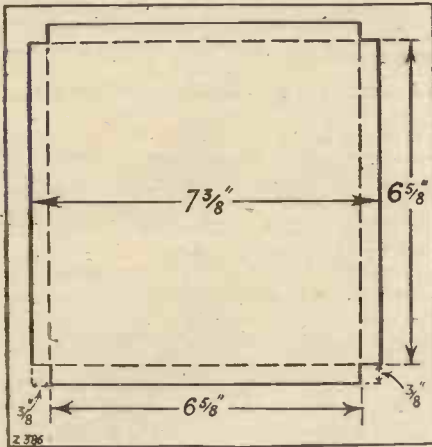
On those occasions where 5 G B must be eliminated, follow a similar procedure to that described, tuning in to 5 G B first of all, and after it has been eliminated, turning to the London programme.

THE NEW "COPPER CUBE."

Details of a system specially devised by the "P.W." Research Department for the purpose of simplifying the problem of screening in H.F. circuits and standardising layout as far as possible. Such a system renders neutralisation a much more satisfactory process than is often the case, and permits a definitely higher standard of efficiency to be attained.

By G. P. KENDALL, B.Sc.

THERE is a certain distressing experience which must sooner or later, I suppose, fall to the lot of every designer of sets for publication, and may even occur several times if his sets prove



The lid of the box is cut to these dimensions and the edges bent along the dotted line.

perfect copy of the original so far as the lay-out and the choice of components are concerned, but, alas for the shock the unfortunate designer gets when he comes to examine the wiring! True, the correct points are joined together, but in what a fashion! Critical wires bunched together at some points to make them look neat, and at others spun out to inordinate lengths by being taken from point to point by roundabout routes, in the course of which they run close to all sorts of undesirable companions, and so on and so forth. Horror-struck, the designer gazes at the dreadful piece of work, and wonders how he can best explain without hurting the feelings of the builder, who, after all, cannot well be blamed for what is really only the result of lack of experience, and absence of guidance from an older hand.

Eventually the task is done, and the designer is left to his reflections, which will very probably be unpleasant ones. He can scarcely help wondering whether, if one constructor can completely ruin a good design simply by wiring it inefficiently,

and all the time believing himself to have made a perfect copy, many others may not have got poor results in consequence of not quite such bad wiring. Indeed, if he is in pessimistic mood, he may even wonder whether *anybody* has succeeded in getting as good results as he did, simply because they may have made alterations for the worse in the run of the wires!

A Vital Point.

That is an exaggeration, of course, since no doubt the majority of constructors make a sufficiently close copy of the original wiring to obtain very similar results, but the fact remains that this is one of the great difficulties of preparing designs for home construction, namely, the difficulty of ensuring that even relatively inexperienced builders shall be able not merely to wire the set up efficiently, and so obtain good results, but to wire it in a manner very close to the original, so that the finished set shall behave in a very similar fashion. This last is an important point, for it must

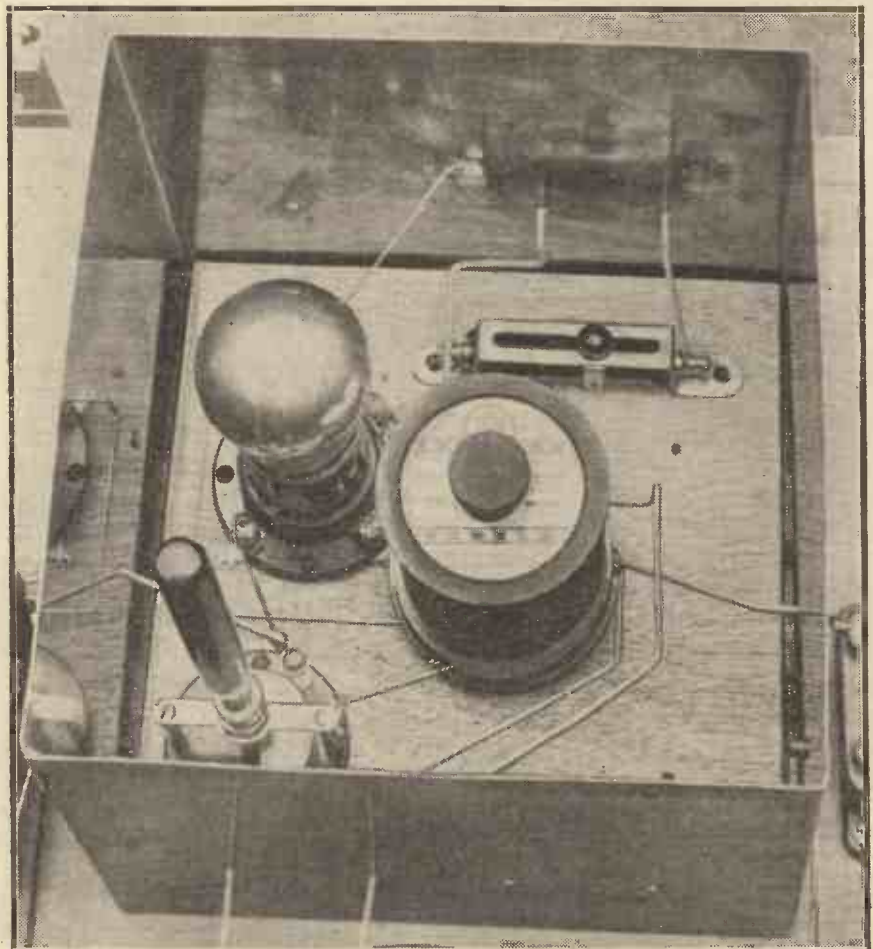
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very popular. It usually happens something like this: the designer meets, perhaps at a radio society gathering, a constructor who has built one of his sets, and who informs him rather bitterly that it is "no good at all," and, on being pressed for details, says that results are generally poor, the set won't neutralise properly, and that it is not nearly so good as the last set he had, which contained one valve less than the offending instrument. Further, the wiring has been checked, and all the components tested by several "local experts," who can find nothing wrong, and it is obvious that he feels very suspicious as to the genuineness of the original design.

What Happened.

So far, of course, the affair sounds a typical case of the kind dealt with by the Query Department every day, and may well be due to such a simple matter as the use of quite unsuitable valves, the presence of a component which is defective in some way which the "local experts" were unable to discover, or even merely to a series of badly soldered joints. No doubt by far the best plan for the unlucky constructor to adopt would be to get advice from the Query Department, but the designer, being full of faith in his product, and disliking to think that he may be suspected, however unreasonably, of publishing an unsound design, may not care to suggest this course, and may prefer to have a look at the set, especially when he learns, as he very likely will, that the owner has brought it to the meeting knowing that the designer would be present.

It is then that the really distressing part of the experience begins, for the set is duly produced, and, sure enough, it is a



One of the standard boxes actually wired up in a set. The exact position of the parts can be seen here.

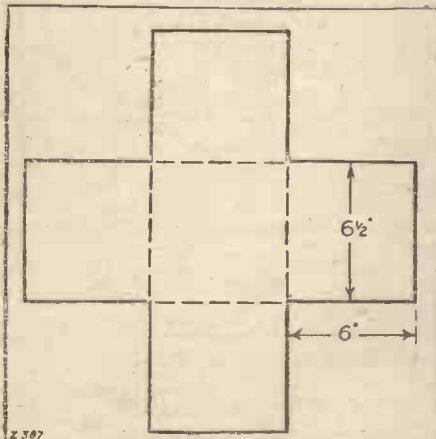
THE NEW "COPPER CUBE."

(Continued from previous page.)

be remembered that it is very largely the actual details of wiring which govern the behaviour of a set as regards the lesser points of its functioning. For example, it is quite possible to wire up two identical sets, quite efficiently in each case, yet with differences in the actual placing and spacing out of the wires which will produce very distinct differences in the behaviour of the two instruments: each may give good results, yet there will be these differences in what may be described as "manners."

Possible Simplification.

To devise some way of making a design a much more rigid affair, and more easily copied exactly, has long been highly desirable, and it has been realised that the ideal was a set so constructed that it could only be wired up in just one way; there



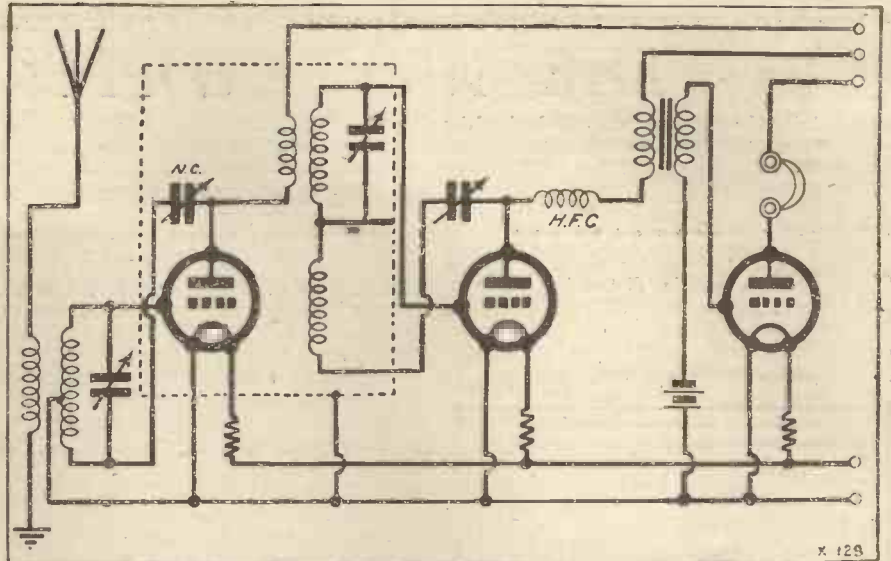
Those who like metal work can make their own boxes by cutting out a piece of sheet copper to these dimensions.

would then be a much better prospect of similar and satisfactory results being obtained by all those who built it, since it would then only be necessary to choose good and suitable components, be careful with the soldering, and use the right types of valves.

To achieve this ideal with a set composed of separate components spread out upon a panel and baseboard is very difficult, since there are all sorts of different ways of wiring up the parts to form a given circuit, some good, some bad, and some merely indifferent. Usually, it is endeavoured to help the constructor to make a good copy of the original arrangement by providing him with a wiring diagram showing what points to join together, and a series of photos making as clear as possible just how the wires were run in relation to each other in the original set.

A New Development.

This system has its limitations, however, and it is interesting to note that a method of constructing sets containing one or more H.F. stages (these are the critical ones, of course) which has recently been standardised by the "P.W." Research Department, promises to provide very considerable help in overcoming the difficulty. This scheme



The dotted line shows one of the standard ways of screening an H.F. stage.

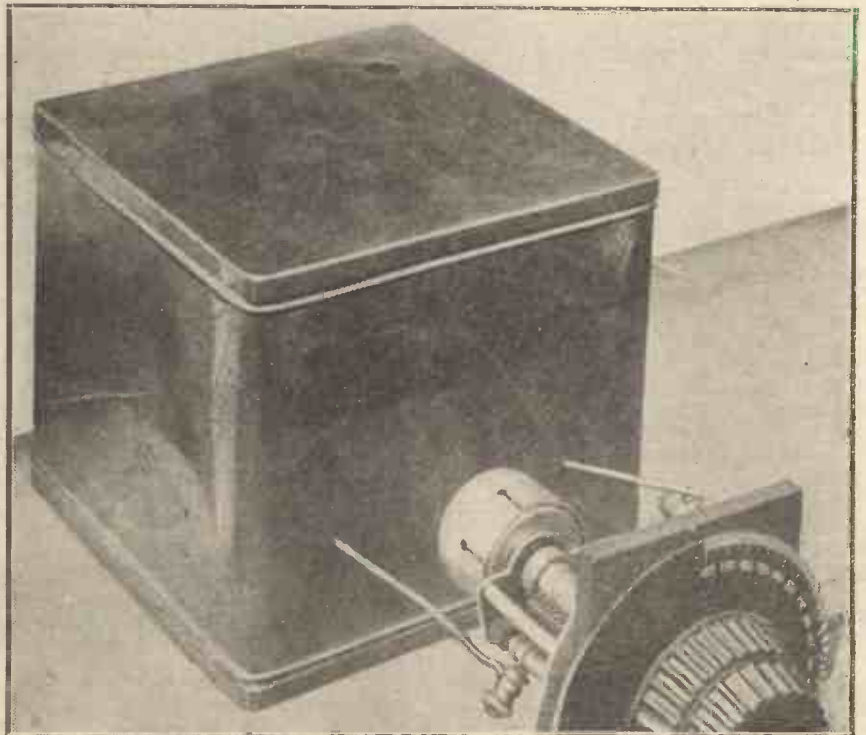
is the use of a standard metal screening-box, which has been developed for incorporation in many of our future sets, and although the primary object was to produce a device which would give the benefits of screening in its best form, this other very valuable feature has followed.

The reader will see how this has come about from the description and explanation of the scheme which follows.

Now, I should like to make it clear at the outset that there is nothing new in the system of screening adopted; what has been done is to take a well-known method and develop from it a standard component which can be used in a great variety of ways and in many different types of sets, either without modification of any kind, or with the slightest of changes to suit the particular application.

As a matter of fact, one of the oldest (and best) methods of screening is to use complete boxes or compartments, each housing a particular section of the receiver which it is desired to shut off from the rest of the circuit in the interests of efficiency, and this is still the most logical and complete scheme. It will be noted that I am making no attempt to go into the reasons for the use of screening, since it is much too large a subject to deal with here, and it must suffice to state that screening is becoming more and more important in H.F. sets, particularly those containing more than one stage, since it furnishes a means of obtaining very considerably greater efficiency, in better amplification, improved selectivity, and greater stability, at the same time rendering set designs much less

(Continued on page 76.)



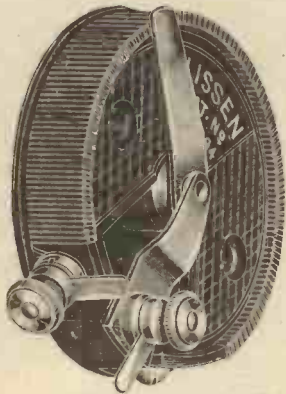
A commercial specimen of the standard box in use on an experimental board lay-out.



WHOSE TURN?

WRITERS of constructional articles in the radio journals keep one eye on the advertisement columns. Advertisers naturally expect their products to be used and mentioned in turn by these writers. So when you see certain makes of components definitely specified, remember that they are not necessarily the best. Users now know that they can replace every part named in any published circuit with the corresponding part in the LISSEN range. You will use all the energy available if you build with LISSEN parts and get louder, clearer signals from near and far in consequence.

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LISSEN Fixed Condensers are accurate to within 5 per cent of their marked capacities. They never leak, they never vary. You can't buy a finer condenser.

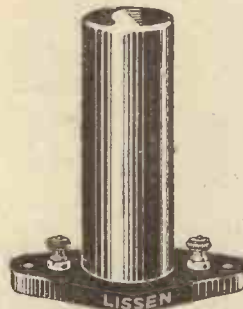


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 A pair of Clips is included free with every Grid Condenser.

**HERMETICALLY SEALED
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NOW 5/6

A new LISSEN H.F. Choke, made in section form, hermetically sealed so that the windings remain unaffected by atmospheric changes. A choke with high inductance value and very low self-capacity suitable for use in every case where an H.F. Choke is specified, and covering all wavelengths up to 4,000 metres, compact and neat in appearance, yet with no attempt made to secure appearance at the cost of efficiency. Here is a choke which upholds the LISSEN tradition of full value to the user.

LOW LOSS, LOW CAPACITY



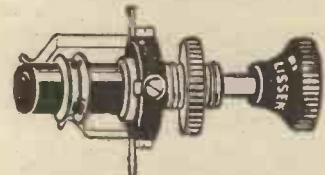
There is not a square inch of superfluous ebonite in this LISSEN Valve Holder. That means low capacity and low loss, and therefore stronger, clearer signals. Shown ready for baseboard mounting, but can also be used for panel mounting by bending springs straight. Patented. Previously 1/8. Now 1/-

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LISSEN Leaks are absolutely silent in use; their resistances never alter. This was proved some time ago by exposing them to the rain and sun on our factory roof. All resistances. Previously 1/8. Now 1/-

LISSEN SWITCHES



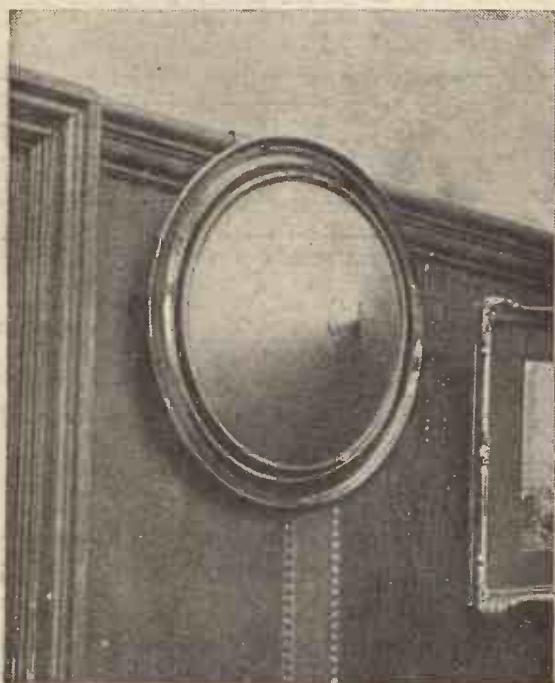
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IF you have alternating-current electric supply in your house and you wish to charge your low-tension accumulators, you employ a step-down transformer, which reduces the voltage down to a value somewhere near that of the batteries to be charged, and you then employ a rectifier of some sort for converting the alternating current into direct current which is necessary for charging the batteries.

The combination of the step-down transformer and the rectifier is familiarly known as a "battery-charger," and, up to the present, battery-chargers have almost invariably been made for *alternating* current only.

The reason for this is because, with alternating current, the *step-down property of the transformer may be used*, whereas *direct current will not operate a transformer*.

With a theoretically perfect transformer the amount of power, or the wattage, drawn from the electric mains by the primary of the transformer is equal to the wattage delivered from the secondary of the transformer. Thus, taking perfect conditions, if a transformer delivers 1 ampere at 10 volts on the low-tension side, it only draws 1/20th of an ampere at 200 volts from the mains. If the current were drawn directly from the mains, of course the 1 ampere used for charging would have to be drawn at 200 volts instead of at 10 volts, and consequently the total power drawn would be 20 times as much, namely 200 watts instead of 10 watts, the cost as calculated from the house electricity meter being 20 times as great. Therefore, whereas it might cost 1s. to charge the battery, using a step-down transformer, it would cost about 20s. to charge the battery to precisely the same extent if the step-down transformer principle were not used.

Terrible Waste.

The advantage of using the step-down transformer for charging low-tension accumulators is so universally recognised that no one would dream of charging his low-tension batteries (from alternating-current supply mains) otherwise than with a step-down transformer.

Where the electric supply, however, is *direct* current instead of *alternating* current, the step-down transformer cannot in the ordinary way be used, for, as everyone knows, if you pass direct current into one winding of a transformer nothing whatever is derived from the other winding.

Therefore, wireless and other users whose electric light supply happens to be direct current, are obliged to charge their batteries (unless they send them away to be charged) by drawing their current direct from the mains at the high voltage of perhaps 200 or 250 volts, and they are in the unfortunate position that they have to draw about 20s. worth of electricity for the purpose of putting 1s. worth of electricity into their low-tension battery, the other 19s. worth of electricity being thrown away in a series resistance.

It is true that in some cases a careful experimenter will connect his batteries into the electric-light main supply in such a way that they are "on charge" when the electric lamps of the house are being used.

SAVING 19s. IN THE £.

A Universal Charger which works
on A.C. or D.C.

By Dr. J. H. T. ROBERTS.

But this is usually very inconvenient, and involves a certain amount of technical knowledge not possessed by the average "listener," and also a good deal of care and attention. Interference with the main electric supply is, moreover, contrary to regulations, and is attended with a considerable amount of danger.

The New Arrangement.

If a device could be provided for the D.C. user which would enable him to take advantage of the step-down principle, it would put him in the same fortunate position as the person whose electric supply is alternating current, and he would be enabled to charge his batteries at a cost of say 1s., where it would otherwise have cost 20s. (or 6d. where it would have cost 10s.). This very desirable object can now be achieved by means of a simple device, recently invented and developed by the writer, which will be briefly described in the



A "P.W." "Every Purpose" two-valver, built by a "P.W." reader residing in North London.

present article and described in fuller constructional details in subsequent articles.

The essential point of this new arrangement is the interruption of the direct current so that when the interrupted direct current is fed into the primary of the step-down transformer, alternating current is delivered from the secondary or low-tension side of the transformer *precisely as though alternating current instead of direct current had been fed into the primary*. Thereafter, it is simply a matter of rectifying the A.C. current in the usual way and feeding it into the batteries which are to be charged.

For the automatic interruption of the direct current, the simplest device is a type of vibrator. In one of the models recently used by the writer, an open-core transformer is used and a vibrator of the Ford-coil type is mounted in such a way as to be actuated by the electro-magnetic field from the core of the transformer, after the fashion

of an electric bell. The H.T. current from the D.C. mains is passed through the interrupter and the primary of the transformer in series.

The low-tension winding of the transformer is connected through a suitable rectifier and through the battery in series. With the roughest possible "hook-up" it was found that a rectified current (using a single-wave tantalum rectifier) of over 1 ampere could be obtained with slightly less than 100 milliamps (that is, one-tenth of an amp.) input on the 200-volt side. This shows an immediate saving of 9/10ths of the electrical energy which would otherwise have been used, or, in the simplest possible language, if the charge of a battery with this device cost 1s. it would otherwise have cost 10s.

For the interruption of the primary current, various devices may be used, including the vibrator interrupter, rotary interrupter, electrolytic and so on. It is obvious that any type of rectifier may be used, such as the electrolytic, dry rectifier, crystal or such-like type, as well as the rotary and vibratory types. Now with regard to the rotary and vibratory types, since the frequency of the alternating current delivered from the secondary will be exactly the same as (or a multiple of) that of the interruptions, it is evident that the vibrator or rotor which is used to create the interruptions may conveniently be utilised also for the purpose of rectifying the low-tension A.C.

By a special arrangement of contacts I have used the same vibrator to create the interruptions and also to rectify the low-tension alternating current from the secondary, and a similar arrangement has been used with a rotary interrupter. Alternatively two entirely separate vibrators may be used, one to produce the interruptions and the other to effect the rectification; with an open-core transformer I have used two vibrators of this kind mounted at opposite ends of the core.

Very Important Advantage.

In subsequent articles a full description of this invention will be given; patents in connection with this invention were applied for a considerable time ago and should soon be issued, but I shall be very pleased, so far as I am concerned, for experimenters and constructors, who so desire, to make up this service for their own private use. According to statistics, more than 60 per cent of private houses in and around the principal towns through this country which are equipped with electric light are on the *direct* current system, and there is little likelihood of any change over being made for some years to come; a similar state of affairs holds for many places throughout the world. In any case, a very important advantage of this invention is that the battery charger is applicable for both *direct current and alternating current*. If you want to use the charger on alternating current you merely connect direct to the terminals of the transformer primary, which leaves the interrupter out of circuit. The charger is thus entirely universal and, so far as I am aware, this is the first time a universal charger for A.C. and D.C. has been produced.

BROADCAST NOTES.

By OUR BROADCASTING CORRESPONDENTS.

"The Liars," by the B.B.C.—B.N.O.C. Again—The "Proms"—That Morse on the Coast—Is Savoy Hill Over-reaching?—The Marcuse Programme.

"The Liars," by the B.B.C.

THE LIARS," considered to be the best of the dramatic works of Henry Arthur Jones, will be given through 5 G B on Tuesday, September 20th, and through 5 X X and 2 L O on the following night, Wednesday, September 21st. The author has approved the adaption of the play as arranged by the B.B.C. Dramatic work at Savoy Hill is making rapid progress. A series of six full-length plays is to be given fortnightly for school children during school transmission hours. These will include "The Tempest," "Twelfth Night," "She Stoops to Conquer," and "Abraham Lincoln."

Elizabethan Songs from Newcastle.

Newcastle Station will give a special recital of Elizabethan Songs and Ayres at 10 p.m. on Wednesday, September 14th. Miss Margaret Wilkinson (soprano) will take the leading rôle in two groups of sixteenth century songs. Mr. Shepherd Munn will introduce the songs with a short talk on the Lutenist School of Music.

B.N.O.C. Again.

On Monday, September 19th, Daventry Experimental (5 G B) will take "The Barber of Seville," relayed from the B.N.O.C. performance at Newcastle. Apparently the recent troubles between the B.B.C. and the B.N.O.C. have been smoothed out. There was acute bitterness because of the alleged betrayal of trust by the B.B.C. The B.N.O.C. and the British Opera Trust claim that they came to some kind of solemn agreement with the old B.B.C.

The bargain was that, in return for the mobilisation of all the political supporters of the B.N.O.C., on behalf of the continuation of unified control in Broadcasting and more Licence revenue from the P.M.G., the B.B.C. would subsidise the B.N.O.C. much more generously than in the past.

Well, according to the B.N.O.C., they carried out their part of the agreement to the letter, and then were left in the lurch by the B.B.C. The latter deny the existence of any agreement. There have been many bitter exchanges. Hence it is good news that there is actually to be a resumption of the broadcasts of the B.N.O.C.'s work. It is to be hoped, however, that this is not at a price exacted by the B.N.O.C.

The "Proms."

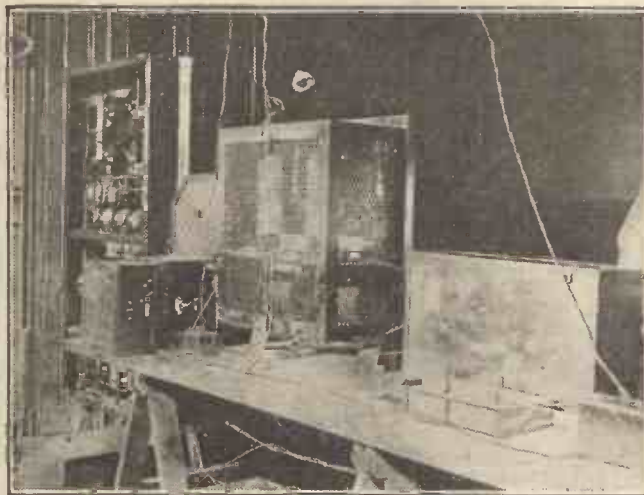
Now that the B.B.C. has at last given Sir Henry Wood a free hand, the result is that he is putting on the best season of Prom. concerts in his thirty-three years. The hall has been packed, and the programmes highly appreciated all over the country. Thus is disproved the claim that broadcasting and concerts are necessarily antagonistic. The flare-up about rehearsals was unfortunate.

Miss Daisy Kennedy's charges, followed by her dramatic collapse, were used for a bitter Press attack on the B.B.C. and Sir Henry Wood. Fortunately, neither Savoy Hill nor Sir Henry could be drawn into angry recriminations and the matter lapsed. It will be surprising, however, if Miss Kennedy is heard again on the wireless.

That Morse on the Coast.

5 G B is rightly welcomed as a great advance in Broadcasting; but of course it is of little or no use to South Coast dwellers, where the floods of Morse on 450 metres from the French shore stations completely spoil it. The persistence by the French in the use of this wave is a particularly irritating and ungracious procedure.

In view of the international agreements about the broadcasting wave-band all other



The apparatus used in connection with the broadcasting of one of the Dresden Opera Company's concerts, from the Victoria Hall, Geneva.

countries have given up the use of the 450-metres channel for Morse; France alone remains truculent and obdurate about it. The B.B.C. keep on saying that the difficulty will be put right at Washington. This is probably a false prophecy.

The only effective weapon or argument is reprisals. Let the B.B.C. blast two or three of the important French waves to "blazes," and then we shall get clear of the annoyance on 450 metres—not before. It is high time to face facts. French wireless is in a hopeless tangle. The Government may agree to all sorts of things at Washington, but probably will be unable to enforce anything.

Therefore we are back to the sound fundamental argument, so ably worked out by Mussolini, "Take what you want, hold it by your own strength, and use reprisals whenever necessary."

Four years of "yapping" about this French Morse off the South Coast is quite

enough. Give them notice that on a certain day we shall stifle their essential services, and maintain the partial ether blockade until they chuck the 450 channel. That's the stuff to give 'em!

Is Savoy Hill Over-reaching?

It is stated at Savoy Hill that a publication which they are now preparing will contain an authoritative outline of their whole system of organisation. This will be of particular interest to the group of younger M.P.'s of all parties who, just before the House rose, formed themselves into a vigilance committee to watch the B.B.C. on behalf of the public.

The preliminary enquiries of this committee have been conducted with great secrecy. There is a belief in some quarters that the B.B.C. is so powerful and vindictive and has so many ramifications to its organisation that it is unsafe for individual M.P.'s or even small groups of M.P.'s to challenge Savoy Hill unless they are ready to deliver a smashing blow that will be supported by the Press.

The present move is being taken ostensibly to reassert the supremacy of Parliament in the face of what some Members choose to regard as the greatest menace to the Constitution since the days of the early Stuarts. The burden of the complaint is that the over-organisation of Savoy Hill has resulted in attempts to go far beyond the province of entertainment.

Publishing on a vast scale, a dictatorship of the education policy of the country; a new religious teaching; and now an insidious but far-reaching attempt to influence the political reactions of the multitude in the direction of the "left." It is also freely stated that this is being done without the knowledge of the governors, who believe that all is well in the best possible of worlds.

Whatever may be the rights or wrongs of these serious charges, there is bound to be a

Parliamentary battle of savage vehemence.

The Marcuse Talk.

Some people were surprised at the amount of trouble the B.B.C. took to call attention to the recent talk by Mr. Gerald Marcuse from 2 L O and 5 X X on his plans for short-wave Empire transmission. The fact, of course, was that Mr. Marcuse, either on his own account or under pressure, said that the B.B.C. were right in the line they were taking in obstructing Empire Broadcasting. The friends of the new move have now another hurdle to get over.

Meanwhile some people at Savoy Hill continue to turn out ingenious but fallacious letters for "The Times." But a definite gain is recorded by the solemn promise of Captain Eckersley to have something working in October, and a service in the New Year. Now we shall wait and see. No one doubts his ability to get going. But will he?



The B.B.C. studios and offices at Cardiff.

5WA

* * * * *

Being an account of Mr. Dowding's
visit to the Cardiff Broadcasting
Station.

* * * * *

courtliness with one who wanted to probe into every corner, asking questions and taking photographs.

First of all, enjoining silence, Mr. Settle piloted me over to one of the doors leading from the vestibule, and gently opened it.

"I think we are the only station that does this sort of thing regularly," he whispered.

About thirty jolly little schoolgirls were seated in a very informal sort of school-room, and under the eyes of their mistress were listening to Sir Walford Davis chatting about music from a loud speaker. When Mr. Settle was observed there was a general raising of heads and a ripple of beaming smiles.

A Studio Rehearsal.

"Might have been picked out from thousands," he remarked in an undertone.

I agreed, for it was the prettiest, happiest little assembly I think I have ever seen. Mr. Settle explained that this Sir Walford Davis class was a regular feature at 5 W A, and was appreciated both by the school-children who attended it and Sir Walford himself, who was thus able to collect direct evidence as to the manner of reception of his various interesting chats on music. I learnt also that Sir Walford is extremely popular in his native country; is, in fact, quite a national institution.

Mr. Settle closed the door and led the way over to another one, and this also he opened gently, suggesting that here, too, was activity. He stood aside, and I peeped in. It was the main studio, fairly large and fairly bright. It was made much brighter on this particular occasion, at least, by a number of colourfully dressed

young ladies who were strewn over the carpet and on one or two chairs in comfortable but graceful attitudes. They appeared to be happy—most of them were talking.

"Rehearsing a play," explained Mr. Settle briefly. Later they were all cleared out in order to allow me to take a photograph. I felt myself to be a very prosaic interloper from the hard outside world in a sort of fairyland!

We then went along to another large but older studio. This looked a very ghostly affair, being crowded with a jumbled mass of out-of-use music-stands and other impediments of the broadcasting profession.

"Rather gloomy and shabby," I remarked, "but I expect you would have been glad of the space in earlier days."

NOTE THESE DATES!

5 X X and 5 G B and 6 B M were dealt with in the last two numbers of "P.W.," and the remaining articles in the series will appear as under:—

BIRMINGHAM	Sept. 17
MANCHESTER	Sept. 24
NEWCASTLE	Oct. 1
GLASGOW	Oct. 8
ABERDEEN	Oct. 15
BELFAST	Oct. 22
LONDON (2 L O)	Oct. 29

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Mr. Settle laughed. "Yes," he replied, "but even now we have only just sufficient room for our requirements. This studio is frequently in use, especially for band work." And then he continued in a smilingly reminiscent vein: "That reminds me of the four microphones—" He paused, but I pressed him to continue, for I scented some good stories!

"In the old Castle Street studio," he commenced, "there were, for a period, four microphones; one of which was hung but a few inches above the floor. This one was used in certain 'effects' requiring a particularly low position. The director was broadcasting something one evening—I forget exactly what it was—when the microphone he was using went out of

(Continued on next page.)

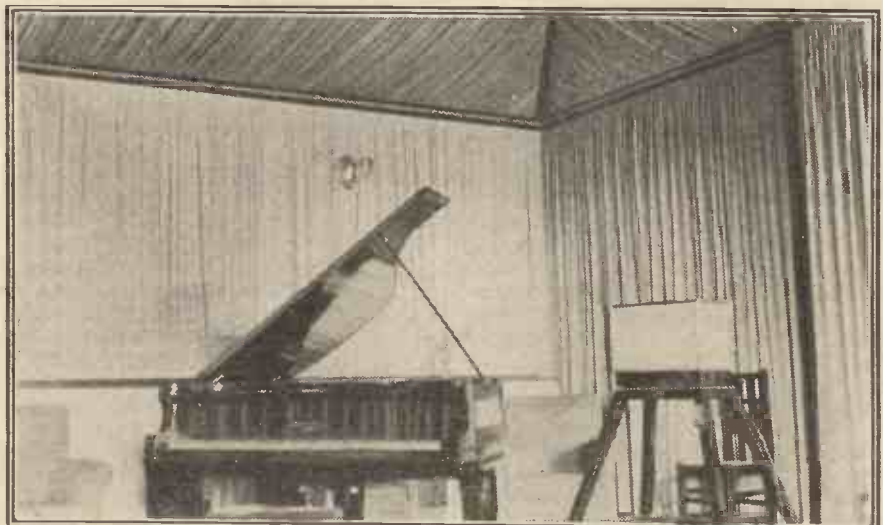
IT is an interesting historical fact that the first trunk telephone line in the kingdom was installed between Cardiff and Newport. And it is equally interesting to note that Cardiff's first broadcasting studio was located on the premises of the Castle Street Cinema, for the cinematograph and radio broadcasting may tend to run very parallel when television arrives. The station opened on February 13th, 1923, and it was not long before a removal to more commodious premises was found to be essential. A progressive service could not tolerate conditions that entailed the use of one fairly small room (it was actually but 18 ft. square) as both a broadcasting studio and a station director's office!

The present studios and offices of the 5 W A station are contained in, or I should really say on, a large building in Park Place which was once used as a private residence, and is now broken up into offices. The broadcasting people have the use of but a few rooms in this building, an extension being built at the back in what was once a pleasant garden. But even with this extension accommodation proved inadequate, and yet another extension was erected. Thus, two lumps, as it were, obtrude from the rear of the original building, and these occupy all the available ground space. Further development—if such is ever necessary—will, I suppose, have to be in an upward direction!

Bright and Cheery.

The Cardiff station struck me as being a very bright, joyous affair. The entrance is of necessity rather twisty and conventional, but one suddenly breaks into a wide vestibule which is pleasingly striking for its bright decorative arrangements of frescoes, friezes, and what-nots. The place also seems to hum with life, and one gains an impression that a great deal of interesting work is going on all the time. Doors open, and brightly dressed young ladies dash about, but one also gains glimpses of groups of earnest-looking people discussing businesslike documents and papers.

My guide on this occasion was Mr. Settle, the assistant station-director, and let me place on record his kindness, patience and



A corner of the main studio at the Cardiff Broadcasting Station.

5 W A.

(Continued from previous page.)

action. He swung round to another, only to find this was out of circuit. Anxiously he tore across to the third "mike" and, as luck would have it, this also was useless. In desperation he fell down on to his hands and knees and completed his 'turn' through the one that was nearly at floor level. He completed his broadcast quite successfully, and the hiatus was probably unnoticed by listeners, but—

Mr. Settle laughed heartily.

"He looked as though he were gnawing



The entrance to the building which houses 5 W A's transmitter.

a bone on the carpet," I suggested, also laughing, but my merriment did not allow me to overlook the fact that the incident indicated a most admirable devotion to duty on the part of the resourceful director.

"This same director—he left us, by the way, some time ago," continued Mr. Settle, "was a great man for realism in the studio. Another time he was taking part in a play in which he was supposed to drink a toast and, in a dramatic fashion, fling the glass into a fireplace. When the great moment came the glass went into the fireplace all right, but he had not polished off the wine, and this cascaded over his dress shirt as his hand went back over his shoulder with the glass!"

The Wrong Cue!

Among the several other good stories related by Mr. Settle, I think the following is also well worth recording.

During a broadcast of a military nature from the Cardiff station one of the actors uttered the words, "Ah! I hear soft strains of mysterious music!" This should have been the cue for the band to play "St. George for England" very softly, but the cue miscarried, and the reverberating, crashing tune of "It's a Long Way to Tipperary" blared in! It is recorded that the station director was carried from the studio in a prostrate condition!

I recalled to Mr. Settle's memory the

broadcasting from the Cardiff station of the heart beats of a man who was suffering from a sudden attack of heart trouble, and how his own doctor, in Bournemouth, knowing his patient, was able to listen by radio to these and successfully prescribe by telephone, and I asked him if anything else of a similarly dramatic nature had happened at 5 W A.

He thought awhile, and then:

"Personally," he said, "I consider the following incident much more dramatic, even although it might not be considered particularly spectacular. One evening, some few months ago, I was standing by to read the local news. A red light is shown when the general news bulletin is 'through,' in order to indicate that the ether is clear for local announcements. At the very minute I expected this red lamp to glow my telephone bell suddenly rang. I dashed across to it, and found that it was a call from the City Lodge Hospital. They urgently pleaded for an S.O.S. to be broadcast for volunteers for blood transfusion, as the life of one of their patients might be saved could this be successfully accomplished. And just as the voice on the 'phone concluded, and just after a hurried acceptance of the S.O.S. on my part, that red light flickered up. I tore into the studio, and was, to the second, on time with the local news, which I preceded with the S.O.S. You will understand," proceeded Mr. Settle, "that had this opportunity been missed it would have meant breaking right into the middle of an S.B. programme."

Realistic "Effects."

"Did the S.O.S. bring the desired results?" I queried.

"I should think it did!" replied the assistant station-director definitely. "Why, within half an hour eighteen people presented themselves at the hospital, while one man rushed round to the studio in order to obtain confirmation of the hospital's address without stopping to put on a collar or tie."

By this time we had wandered into a comfortable room situated at the back of the building.

"This is where I slept during 'the strike.' It is now used at times as an office."

Mr. Settle led me over to an open window. This overlooks a small, cobbled lane. Large apple-trees grace the outlook with their abundant foliage.

"I suppose you find this little lane very useful?" I queried.

"Rather! We frequently make use of it. For instance, during the broadcasting of the 'Pied Piper,' which we gave some time ago, we dropped a microphone out of this very window, and had Boy Scouts wearing clogs running up and down to give the sounds of the hundreds of children following the piper. Another time we had a number of regular soldiers marching up and down during the transmission of a programme of a martial character. And do you see those trees?" He indicated the miniature orchard within a few feet of us. "On several occasions we have broadcast the singing of birds in those trees during the children's hour."

"By the way," I said, "you are doing a lot of 'outside' broadcasts from Cardiff, aren't you?"

"Probably more than most stations," answered Mr. Settle promptly. "We are

doing O.B.'s from Bath, Weston-super-Mare, and other places to a greater and greater extent, and we find them most popular with listeners."

"How do you gauge what listeners really like and want?" I queried.

Mr. Settle was not offended by my rather abrupt question.

"First of all, by our postbag; then by what we hear from people we meet when lecturing or attending various meetings and social gatherings, and finally by what we ourselves, as ordinary people—we are ordinary people, you know"—this with a smile—"like."

A Divided "Audience."

"Your correspondence must be somewhat assorted," I suggested, "inasmuch as you have both English and Welsh listeners in large numbers."

"On the whole, I think we satisfy the majority of our listeners. Anyway, we are always doing our best," said Mr. Settle, rather non-committally, I thought.

"Are your Welsh programmes really popular?" I pressed.

"Well, when we broadcast a Welsh programme from a coal mine early this year, we received over four hundred letters of appreciation and practically no criticisms."

"That is interesting," I said, "for although 5 W A is regarded as a 'Welsh' station by many people, your purely English listeners must outnumber the Welsh by many hundreds of thousands."



5 W A's aerial is suspended from the Power Station chimney.

We continued the conversation on these lines for some time, but I am afraid most of it was of a rather controversial nature and should not be repeated.

"You should be rich in local talent," I subsequently remarked, changing the topic.

(Continued on next page.)

5 W A.

(Continued from previous page.)

"Very rich, indeed," agreed Mr. Settle. "But although there are innumerable fine choirs in Wales, unfortunately most of these have limited repertoires. You could run through a dozen 'things,' and in so doing cover the repertoire of practically every Welsh choir. Also, although the country abounds in people having fine voices, it is but the few who possess the necessary training needed for concert or microphone work."

"You make up your programmes in a similar manner to the other main stations, I suppose?"

"Yes: the five weeks' arrangement comes down periodically from London, and this includes a small number of compulsory simultaneous broadcasts—items such as 'Libretti Opera,' which we are bound to take. We then pick out one or two other programmes which we desire to take from other sources, and finally build up the rest of our programmes on this."

"What a job it must be!" I exclaimed. "But exceedingly interesting," added Mr. Settle quickly.

"Do you have outside 'aunties' and 'uncles' for the children's hour?" I asked.

"The 'uncles' are on the staff, and this duty is split up in a similar manner to that of announcing; but our 'aunties' are regularly engaged outside artistes," he explained, offering me a cigarette.

We were at that moment standing in the control-room, where an engineer was glued to telephone receivers, checking the activities of an operating microphone. This control-room is rather small in size, and the long bench covered with amplifiers and switchboards occupies practically half of it. There are, as at all the other stations, two complete sets of apparatus, and it is but a moment's task to change over from one to the other. It is from here that radiate telephone lines to the transmitting station and to the various other points from which O.B.'s (outside broadcasts) and S.B.'s are collected.

The Transmitter.

After having a look at the small "talks" studio, and having very interesting conversations with various other members of the staff, I extended my thanks to Mr. Settle for his kind reception, and, together with Mr. Davies, the assistant engineer-in-charge, I went over to the transmitting station which is situated at the Canton Street power station. The aerial is erected between two tall chimneys, and the apparatus is tucked away in a section of the main building.

Power stations, by the way, are very

popular with the B.B.C. people, for they are sources of current, and generally have nice large chimneys upon which aeri-als can be suspended in high positions with the minimum of expense and trouble.

"How is 5 W A getting over these days?" I asked Mr. Davies.

"Very well indeed," he replied, as he steered me across a maze of railway lines in order to show me the aerial from a reasonable distance. "We are constantly received in the Channel Islands on ordinary sets, while we have been heard in America on a one-valve receiver. But an even more interesting incident than this, I think, was that an explorer in the centre of Africa picked us up on a portable set."

In the Control Room.

"And I trust he picked up something appropriate from you," I added. "For instance, a gardening talk would have been very interesting to him, and possibly helpful!"

"Rather! 'How to Destroy Weeds' would have been invaluable information," laughed my companion.

In the transmitter-room was a loud speaker, and this was in operation, delivering a rather mangled version of the current transmission. The broadcast is checked for purity at the control-room end, however, and here telephone receivers are in use. But I could not help wondering why the B.B.C. people do not demand the closest possible approach to perfection even in

detector valve in the second socket from the right in his receiver—perhaps he has been lucky and a friend has told him this—he must have the greatest difficulty in discovering which valves are the right ones for this job and which are not.

The advertisements of valve manufacturers tell him little. Lists of valves are lists of—to him—meaningless numbers and letters. What can "P.M.I L.F." or "P.425A," and so on, mean to him? All he wants is a valve for the second socket from the right.

The American Scheme.

United States valve makers have just agreed to a scheme which will solve this difficulty to some extent. In future they are to colour the bases of their valves according to the purposes for which they are most suitable. Thus:

- Green: Detectors.
- Maroon: High and low-frequency amplifiers.
- Orange: Power amplifiers.

The valve sockets of receiving sets are also to be coloured, the detector valve socket, for instance, being green.

Obviously, it will be a very simple matter for the listener to be sure that he is using the correct valve, and thus getting best value for his money, and doing justice to the makers. He will merely buy a green-base valve—in this instance—and put it in the green socket.

British manufacturers would do well to get together and formulate a similar—but better—scheme, if they are really anxious to increase the popularity of broadcast receiving in homes where the people do not wish to be bothered with technicalities.

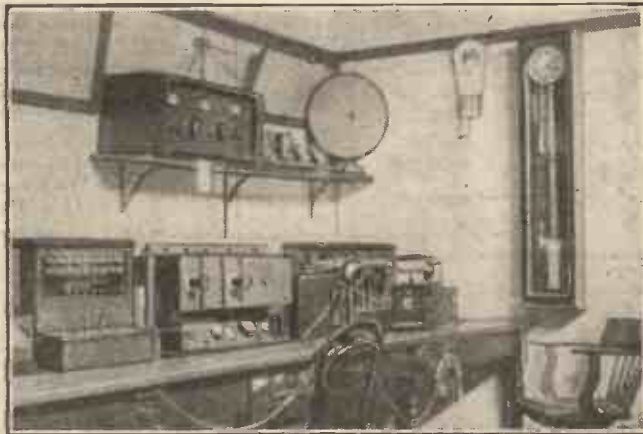
Much Simpler.

For the American agreement is a poor application of a very fine idea. It is a drastic mistake, for instance, to have a common colour, maroon, for both high and low-frequency amplifier valves. Several classes of valves, moreover, are not included in the scheme; but it would not do to have colours for every type. That would only lead to more confusion. But the valve makers will do the public a service if they will decide upon colours for the chief types and for the holders corresponding to them in the receiving set. One might suggest some such scheme as this:

- Green: Detectors.
- Yellow: Low-frequency amplifiers.
- Red: High-frequency amplifiers.
- Blue: Power valves.
- Brown: Resistance low-frequency amplifiers.

And, while they are at it, let the manufacturers agree upon a common classification system for valves. All detector valves taking a filament current of point one ampere at two volts, for instance, might be known as 2 D1. The different makers could still put their trade names in front of the symbol.

The colour idea is not, of course, an absolutely new one for, at least, one of our own leading valve manufacturers adopted a colour scheme of classification some four or so years ago. But the idea of colouring the sockets of manufactured receivers is fairly original, and it appears to be so sound that it is to be hoped that it will receive the serious attention of all concerned in this country.

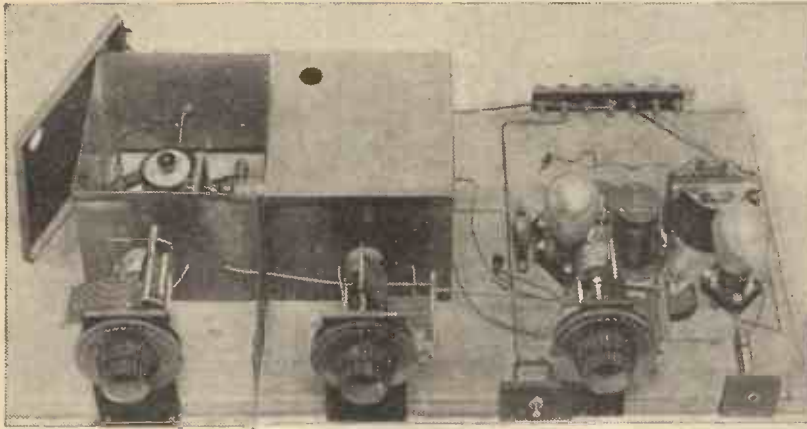


The control-room at 5 W A has duplicated apparatus arranged on one long bench. Above is seen one of the complete sets of amplifiers, switchboards, etc.

their "rough" checking gear. There is just the faintest suspicion of "hook-up" at all the B.B.C. stations I have visited, with the possible exception of Daventry (5 X X).

VALVE CONFUSION
A Colour Classification Suggestion.
By **LESLIE W. A. BAILEY.**

THE ever-widening variety of valves is a source of much confusion to the average broadcast listener, who bothers little about the technicalities of wireless and knows less. British valve makers classify their valves in different ways. Even if the listener knows, for example, that he must have a 4-volt

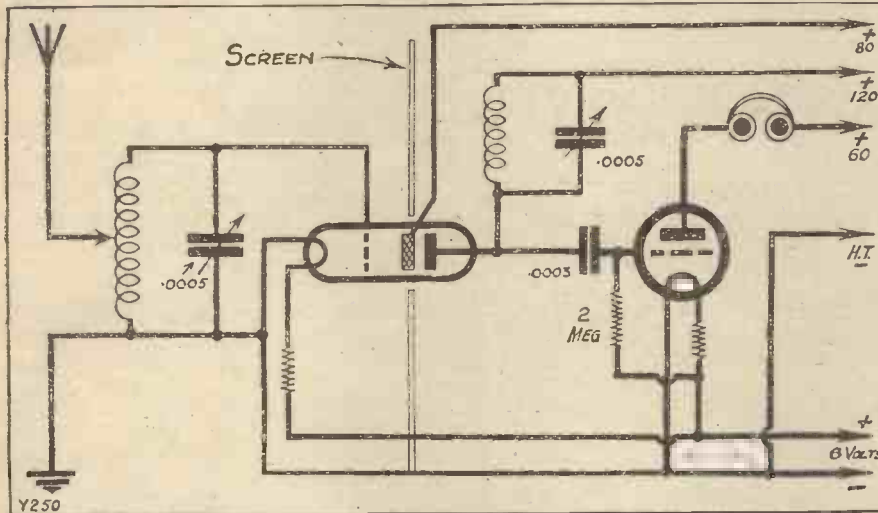


EXPERIMENTS WITH THE SHIELDED VALVE.

WE have so often been promised something that was to revolutionise the science of radio that a "wait-and-see" attitude is more or less inevitable towards new developments of a startling nature; so many of those which in the past seemed likely to make radical changes have proved to contain hidden and unsuspected limitations, and have accord-

Full practical details of these valves in use in sets, by
G. P. KENDALL B.Sc.

first tests which were made were intended quite as much to find out what difficulties were likely to be met with under amateur



ingly merely taken a useful place among other new inventions, instead of superseding all rival methods of achieving a certain end. Those who remember the excitement in some quarters over the super-regenerative circuit will perhaps best appreciate this point.

It was therefore with a good deal of conservatism that the first tests were undertaken in the "P.W." Research Department of the new shielded valve, the Marconi and Osram type S.625. This new valve is obviously a development which may prove of extreme importance, and one, furthermore, over which it would be easy to lose one's sense of proportion, for it opens up possibilities of H.F. amplification on a scale hitherto impossible with apparatus such as the ordinary amateur can use, with inherently stable H.F. valves requiring no neutralising or other special dodges to prevent them from "spilling over," and giving an enormous amount of amplification per stage.

Obviously, if all this could be done without any special snags being encountered which would limit the usefulness of the valve, very far-reaching effects upon our H.F. methods are to be expected, and the

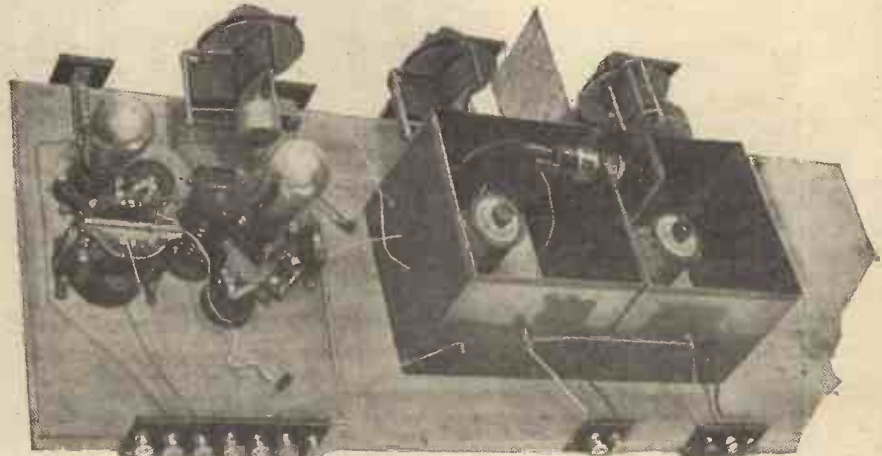
conditions as to ascertain what results could be obtained from the valve when working at its best. We shall see a little later what the conclusions were which were derived from these tests.

The essential feature of the valve, as the reader may have learned elsewhere, is

the introduction of a fourth electrode, which takes the form of a fairly fine-mesh grid placed between the plate and the true grid, and which acts as an electro-static screen, preventing "feed-back" from the anode circuit to the grid circuit through the plate to grid capacity. This feed-back, of course, is inevitable with the ordinary three-electrode valve, and is one of the main reasons why H.F. valves generally exhibit a strong tendency to oscillate and require to be stabilised by neutralising or in some other way. If it can be got rid of an important step will have been taken towards an H.F. amplifier which is inherently stable without the use of any special devices such as neutrodyne circuits.

Such an H.F. amplifier (by the term "H.F. amplifier" is meant that part of a complete set in which incoming signals undergo amplification at high frequency) could then be produced without a great deal of difficulty (unless many stages are attempted) by tracking down and eliminating all the principal causes of feed-back external to the valve. These, of course, are mainly a matter of stray magnetic coupling between coils in plate and grid circuits, and capacity coupling between wires and components, and by using proper screening arrangements they can be reduced nearly to vanishing point. The type of screening required is not merely the use of screened coils, but the complete isolation of each H.F. stage as a whole, and such screening has been found highly beneficial even when ordinary valves are used. There are other causes of feed-back, but they are of lesser importance, and will receive mention later.

(Continued on page 62.)



In the tests two standard copper boxes were used for screening purposes.

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EXPERIMENTS WITH THE SHIELDED VALVE.

(Continued from page 60.)

We see, then, that given a valve in which capacity feed-back between plate and grid has been cut out it is quite feasible to eliminate, or at least reduce to harmless proportions, the other main causes of feed-back, and so produce a

Let us see now what must be done in actual practice to ensure stability when a single stage is used. What we must aim at is this: we must shut off the whole output circuit of the H.F. valve, and everything which follows it, from the input circuit and everything preceding it in the set. In other words, we must shut off the anode circuit of the valve from the grid circuit, or at any rate take such precautions to reduce interaction between those parts of the set as will suffice to keep it stable. Just how elaborate those precautions require to be

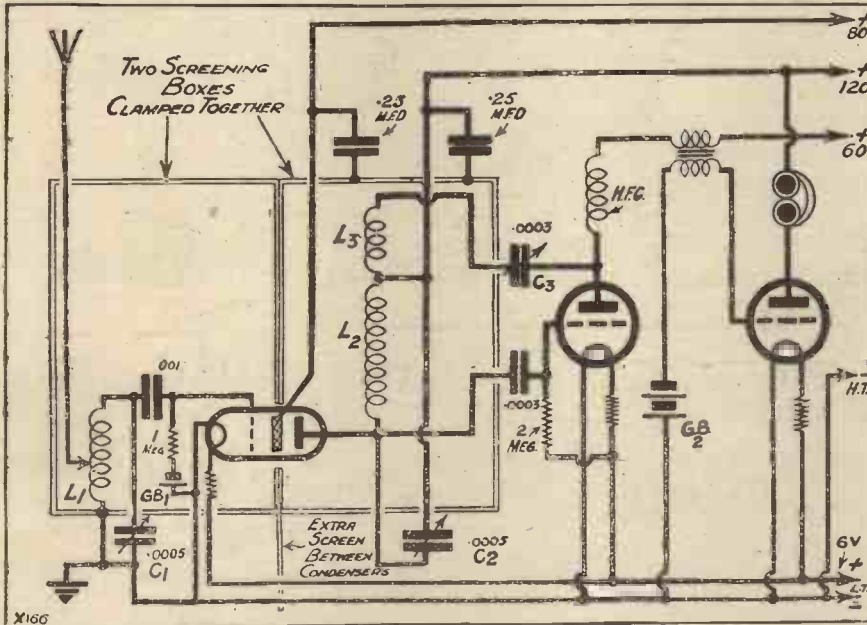
in the case of a single H.F. stage, consists of the aerial circuit, with all its tuning arrangements, and in fact everything up to the grid of the valve. The output circuit comprises the anode circuit of the valve and all the rest of the set which follows thereafter. We must imagine the set divided into these two parts, the dividing line passing through the valve itself between plate and grid, and we must seek to prevent anything on one side of the line from interacting directly with anything on the other. On this line, of course, comes the screening grid inside the valve, and what we must do is to complete, in effect, the division outside as well, and so have our set in two halves sufficiently isolated from each other to stop the feeding back of enough energy from plate to grid circuit to produce a serious tendency to instability.

A Practical Method.

Such a division of the set into two isolated sections could be done by building it in on either side of a vertical partition of sheet copper, stretching right across the set and acting as a screen between the two parts. If this screening partition were connected to earth and were of adequate size quite a fair degree of isolation would be obtained, and it is quite practical to construct a set on these lines, using one of the new valves, especially if due precautions are taken to arrange the coils so that their fields do not jump over the partition and interact with each other. The placing of the valve itself is an interesting point in such a scheme of construction. The S.625 is a tubular valve, with a cap at each end, one carrying the filament and grid pins, and the other those for the plate and screening electrode, and it is advisable to place it partly through a hole in the partition, half on one side and half on the other.

The whole scheme as applied to a 2-valve set is shown in the form of a circuit diagram on page 60, where the division of the set into two sections is indicated by the double line denoting the screening partition. Following the simple tuned anode circuit of the H.F. valve is a plain grid-leak-and-condenser

(Continued on page 65.)



completely stable H.F. amplifying arrangement of great possibilities. Not merely will it be stable and at the same time free from the complications of neutrodyning, but the characteristics of the shielded valve are such that an extremely high degree of amplification is obtainable with a suitable circuit. As regards this latter point, it is interesting to note that the circuit recommended for use with the S.625 is one of the oldest and simplest of H.F. amplifying arrangements, namely the tuned anode, which is now regarded as practically obsolete in so far as its simple unstabilised form with a three-electrode valve is concerned.

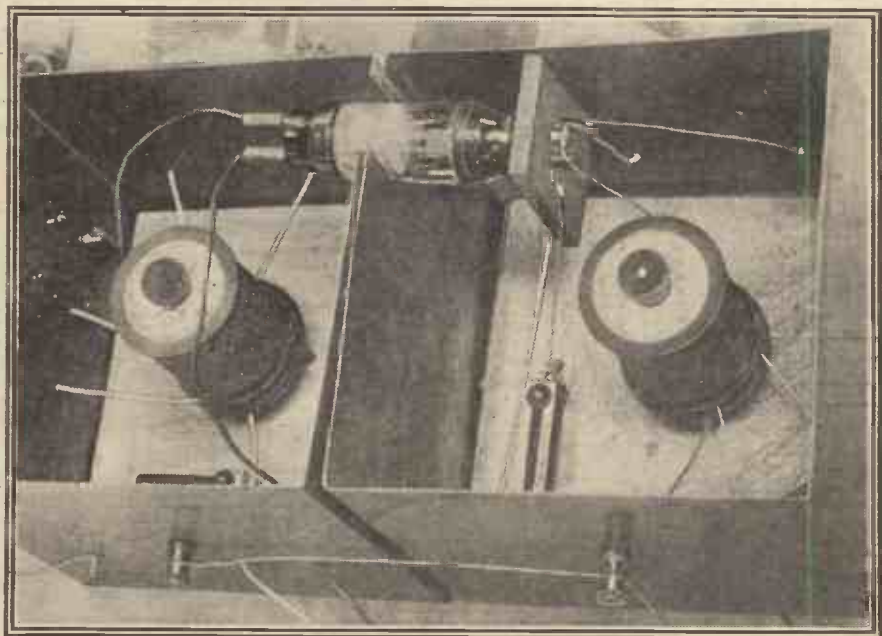
Careful Screening Needed.

A perfectly simple and straightforward arrangement is used, and reaction can be applied to the anode circuit in the ordinary way. The whole secret of success with this valve appears to lie not so much in the details of the circuit as in the adequateness of the precautions taken to eliminate the various causes of feed-back outside the valve. It must be remembered that when one of these valves is used the magnification obtained should be very much greater than that given by an ordinary H.F. stage, and consequently only very slight feed-back will be needed to make the whole circuit oscillate. Obviously, then, the precautions taken to eliminate unwanted interaction effects must be very much more thorough than would be required if we were merely dealing with the magnification given by an ordinary valve, and they will become enormously more important if more than one stage is used.

will naturally depend upon the number of H.F. stages in use; with only one, for example, considerably less thoroughness will serve than in the case of two.

What Is Required.

Let us be quite clear before proceeding just what is meant by the shutting off of the output circuits of the H.F. valve from its input circuits. The input circuit, in



The valve was fitted in a special holder so that the grid and filament end was in one box and the plate end in the other.



THE **MH**
BALANCING
CONDENSER



Put the Best into
your new set.....
you'll get the Best out of it!

HIGHLY
RECOMMENDED
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MH SIX POINT PUSH-PULL SWITCH. Self-cleaning contacts. Unusually strong, having contacts giving excellent connections; a wide variety of uses, fully efficient in every way. Price 4/6 each.

MH THREE POINT PUSH-PULL SWITCH. Similar to that described above, but has only three points. Price 3/6 each.

MH GRID LEAK. Guaranteed accurate in all values, supplied with two clips. Price 2/6 each. Mounted on ebonite base, with terminals. 1/- extra.

MH FIXED CONDENSERS. Accurately made, and guaranteed to remain accurate under all atmospheric conditions. Rapidly interchangeable and a great boon to the experimenter. Price from 2/6 each. Two clips supplied with each Condenser.

MH VERNIER DIAL, enabling finest control to be maintained. The essential for Long-Distance reception. Total absence of back-lash, smooth adjustment of capacity over the whole range of condenser. Of fine appearance. Not only of great utility, but ornamental to any panel. Price 5/6 each.

Due consideration to the parts you use in making up your Receiver will be amply repaid in the end. To obtain life-like tone, perfect clarity and good volume, without interference from foreign noises, it is essential that each part is made scientifically to carry out its particular function. Every **MH** component is so made and designed. They are guaranteed in every way and will give absolute satisfaction in working.

DON'T SPOIL A GOOD SET. SPECIFY **MH** COMPONENTS.

THE **MH** BALANCING CONDENSER

Its unique design incorporates the following advantages in a compact and highly finished unit at the moderate price of 4/9.

1. High insulation resistance, so that no losses are added to the circuit.
2. High breakdown voltage, to eliminate risk of burnt-out valves and ruined high-tension batteries.
3. Calibration to allow of resetting to suitable values.
4. Precise adjustment, to enable the critical operation of balancing to be effectively and easily performed.
5. Ease and adaptability in fixing for either baseboard or panel mounting.

The **MH** LOUD SPEAKER FILTER will, in nine cases out of ten, improve the quality of reception, while it is, in addition, a device for protecting the Loud Speaker since the anode current is prevented from flowing through the windings, thus avoiding demagnetization and possible burn-outs. Price 27/6 each.

Ask your local dealer for **MH** Products and prevent disappointment.
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NEW COMPONENTS for 1928

These new 1928 Bowyer-Lowe components represent the latest phase in component design and performance. It is only after exhaustive tests and trials in the Bowyer-Lowe laboratories and works, when absolute accuracy and the highest standard of performance are assured, that they are offered to the public.

Square Screening Box



SQUARE SCREENING BOX

Matt finished aluminium, supplied with baseboard and fixing screws. Packed flat and can be assembled in a few minutes.

List No. 283. 6/-

LOW FREQUENCY TRANSFORMERS AND CHOKE

Bowyer-Lowe Low Frequency Transformers made two years ago are still giving excellent service, but the large amount of copper and iron necessary for the construction of an efficient transformer made them expensive. Owing to recent developments we can now supply this transformer at an economic price and for those who want the best possible reproduction there is no other choice. Supplied in two ratios for first and second stage.

List No. 284. Ratio 3-1 22/6

List No. 285. Ratio 6-1 25/-

Also in Multi ratio giving 1.8, 3, 3.66, 4.5, and 6 to 1.

List No. 286 27/6

Also Low Frequency Choke. 20/-

List No. 287

JACK SWITCH

Fills the need for a simple and positive On and Off switch, is similar to our jacks in construction, and fits the panel in the same manner.

List No. 281. 3/-

VARIABLE RESISTOR

Better than the panel rheostat and an advance on the fixed resistor, for use on the baseboard of the receiver and graduated so that settings may be repeated. Wound under tension on a non-shrinking former and providing maximum air cooling. Base is of Bakelite, made in two resistances.

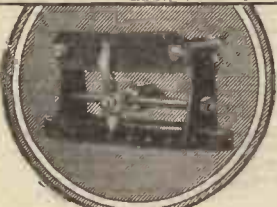
List No. 289. 5 ohms 3/-

List No. 290. 30 ohms 3/-

Jack Switch



Variable Resistor



Whiteline Valve Holder



A great advance over all previous types of springy valve holder. Inter-electrode capacity is at a minimum and always constant, making it ideal for the Super-Het and short-wave receivers. Initial amplitude of vibration under shock is large, yet

damping is quick and gentle. Made of Bakelite, supplied with marked terminals, soldering tags and fixing screws. Base 1 1/2 in. square overall with projection adjacent to plate leg of valve "Whiteline" for safety.

List No. 282 2/3

SIX SOCKET BASE

Has sockets to the standard "Southern Cross" arrangement, and is for use in the Square Screening Box or when the six pin coils and transformers are to be used without a screen. Provided with six terminals correctly numbered. Made of Bakelite.

List No. 291 3/6

MARK II WAVEMETER

Covers all wave-lengths between 150/2000 metre. Fitted with a buzzer, self-contained battery, and a lamp to indicate resonance for transmitting and other uses where more convenient. Tuning is very sharp. Two coils with calibration charts are contained in case. A high class instrument which every serious experimenter should possess.

List No. 226—

In oak case .. £6 0 0

In walnut case .. £6 10 0

TWO SPEED DIAL

Manufactured under Burndep't Patent 243,218.

This dial is of polished Bakelite 3 1/2" diam. concealing a double reduction friction epicyclic gear, giving a reduction of 18 to 1 or a direct drive. Entirely free of backlash or noise—all the moving parts being floating and self compensating for wear. The Station recorder is provided with renewable scales and is readily detachable.

Fits 3/16" or 1/2" spindles. List No. 253. Complete with Station recorder 9/-

UNIVERSAL H.F. CHOKE

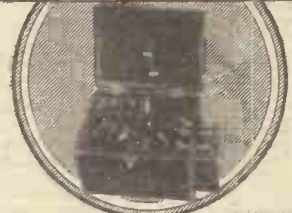
The ideal component wherever a H.F. Choke is indicated. By virtue of its special sectional winding not only is the distributed capacity kept at a minimum but it will efficiently operate over a very wide range of wave lengths from the shortest to the longest.

List No. 288 Price 9/-

Six Socket Base



Mark II Wavemeter



Two Speed Dial



Universal H.F. Choke



WRITE TODAY FOR A NEW COMPLETE LIST OF PRODUCTIONS

A NEW SUPER HETERODYNE RECEIVER for amateur construction covering all wave-lengths from 35 to 2,000 metres, also the latest in SHORT WAVE RECEIVERS will be shown on our Olympia Stand.

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Bowyer-Lowe
APPARATUS

BOWYER LOWE CO LTD LETCHWORTH

NATIONAL RADIO EXHIBITION OLYMPIA STAND NO 124

EXPERIMENTS WITH THE SHIELDED VALVE.

(Continued from page 62.)

rectifying valve without reaction, and even so simple a circuit as this has remarkable distance-getting properties. A point which will be noticed in this circuit, and which has not previously been mentioned, concerns the connection to the shielding electrode. For this to act as a static screen between plate and grid one might imagine that it should be connected directly to earth, but actually to obtain the proper conditions for the working of the valve a positive potential must be applied to it from the H.T. battery. It is still, of course, earthed through the battery. The normal voltage on the shielding electrode is 80, with 120 volts on the plate.

Only the bare outline of the circuit is given on page 60, and for the various refinements and additional precautions desirable in practice the reader is referred to page 62, which shows the actual arrangement used for most of the tests made in the "P.W." Research and Construction Department. Here a more effective system of screening is shown, being the one used in the experimental layout illustrated in the photographs accompanying this article. It consists in the use of two rectangular copper boxes with detachable lids, one containing the grid circuit of the valve and the other the anode circuit, the two boxes being clamped side by side. Holes were cut in each and the valve mounted so as to have half in one box and half in the other, as the diagram indicates.

Standard Boxes.

The boxes used were of the standard type now produced by many firms to a specification prepared by this department, intended for the separate screening of H.F. stages in normal receivers. (These boxes have already been incorporated in several highly successful receivers, and further details will be found elsewhere.)

In front of each box was mounted the condenser tuning the coil inside the box, and between the two condensers another screening plate was placed. This last was found to produce a distinctly perceptible increase in stability, and although not really required with a single stage would probably be a valuable precaution when two stages are used.

Reaction was provided upon the anode circuit, the capacity controlled form usually called Reinartz reaction being used. Following the H.F. stage was a grid condenser and leak rectifying valve, then one transformer-coupled L.F. amplifier, making three valves in all. The coils used for the tuned circuits were of the standard 6-pin type, L_1 being an "aerial coil" and L_2 a "split primary" transformer, of which the secondary was used as the anode coil, L_3 being the reaction winding which is standard on these coils. A little negative grid bias is recommended for the S.625, and was found beneficial in practice, a suitable method of application being that illustrated, employing for the purpose a grid condenser of .001 mfd. and a grid leak of 1 megohm taken to a single cell bias battery, G.B.1. As a precaution against feed-back produced by the "coupling" effect of the resistance of the H.T. battery,

by-pass condensers of about $\frac{1}{2}$ -microfarad are advised across the H.T. leads to the valve, and these would appear to be highly important when more than one stage is used, but merely desirable and not essential with only one.

A good deal of experimental work has been done on such points as this, and the general conclusion arrived at is that in one stage it is not difficult to isolate input and output circuits sufficiently to produce satisfactory stability. Liberties must not be taken, such as trying to use the valve in an existing set without shielding, but given reasonable precautions it is not difficult to get stability and very high amplification indeed. One good stage with an S.625 seems nearly equal to two ordinary H.F. stages of a fairly efficient neutralised type such as is now in common amateur use. Provided that the screening is properly done no serious snags seem likely to be encountered with one stage, but two in cascade undoubtedly call for very great care indeed, since the magnification given is very high and very slight feed-back can cause hopeless instability. The box system of screening seems quite essential in this case, each stage being completely shut in.

SOME "COPPER CUBE" TIPS.

NOW that the standard screening boxes are coming into general use there are one or two points concerning which the constructor must be warned. First, it must be remembered that the box is normally connected to L.T. negative and earth, and therefore care must be taken to see that no bare H.T. leads touch it at any point, either permanently or while alterations are being made in the set.

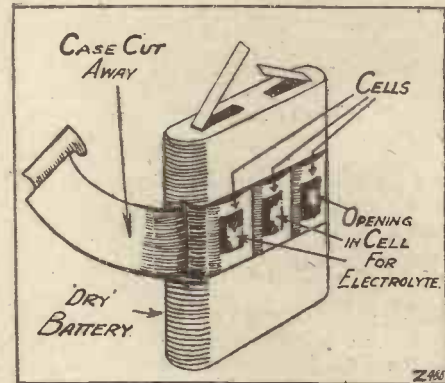
Further, do not forget that if you have one hand on the box while making some adjustment inside the set, you will get a shock if you touch any of the H.T. leads, i.e. anything in the anode circuits of the valves. With this in mind it will be seen that care must likewise be taken in handling the lid of the box to see that it does not touch anything else in the set as it is slipped into position.

A BATTERY REVIVER

AFTER charging up a wet H.F. battery there is often a little of the electrolyte over, and this can be used up with advantage, and also an interesting experiment carried out by those who have a few minutes to spare.

A few exhausted flash-lamp batteries can be charged up to form a grid battery, or can be added to the H.T. battery when a little extra H.T. is helpful, such as for out-of-door loud-speaker work, etc.

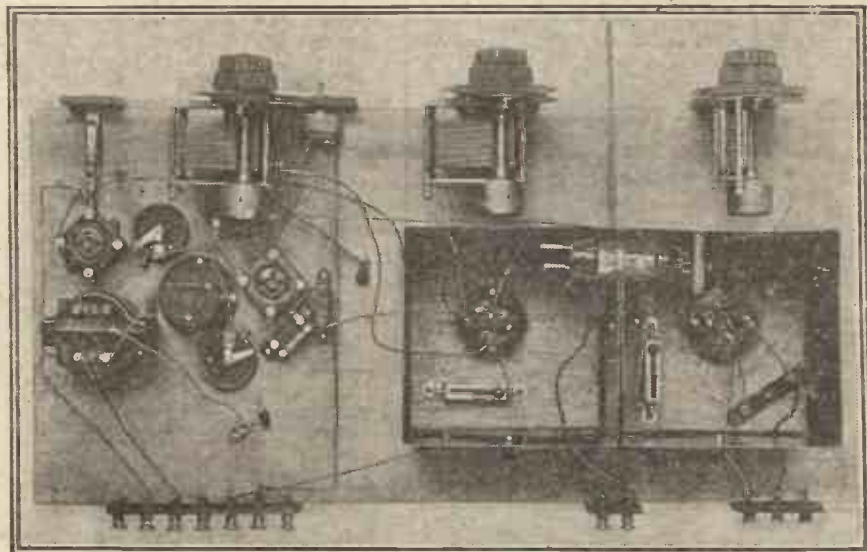
A strip is cut from the case about half-way up, 1 in. wide, so as to lay bare the three cells. Then cut each zinc in the



form of a door (see illustration). Care should be taken not to cut the sac. Lay the battery flat and pour a little electrolyte into the holes, and let it soak in. Repeat this a few times. After a short time the batteries should give between 3 and 4 volts.

The holes can be sealed over with pitch, and the battery bound with insulating tape or waxed paper.

The above applies to H.T. batteries, but the case is usually damaged in getting the cells out. Each cell should be treated separately and put in a suitable case, with separations for each cell, and soldered up. The charge does not usually last long, but a little extra battery life is thus obtained.



On the board lay-out used for the tests an extra screening plate between the tuning condensers gave a perceptible increase in stability.



Apparatus Tested

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department 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 unbiassed guide as to what to buy and what to avoid.—EDITOR.

THREE "L. & P." COMPONENTS.

THE outstanding feature of the two-way coil holder, recently sent us by the London and Provincial Radio Company, Ltd., of Colne Lane, Colne, is that it is fitted with a dial similarly to a variable condenser. This, of course, is most useful, and it has always been a source of wonder to us that such a practice is not more universal. It is just as necessary to calibrate a reaction control as it is to calibrate a tuning condenser, but calibration is quite impossible with many coil holders.

The "L. & P." coil holder has many other good points. It is of the "Backwards and forwards" type, the moving block being actuated by means of a worm gearing, so that it cannot move independently even when holding a large and heavy coil. Its connecting points are all rigidly mounted, the flexible connections from the moving block being integral with the con-

struction of the component. Very little metal appears to have been used in its assembly, although this is of a very robust nature. The action is smooth and the drive, including that of the dial, is absolutely positive.

The "L. & P." coil holder is soundly designed and soundly produced and strikes us as being reasonably priced at 10s. 6d. Its official description, by the way, is "Coil Holder with Sealed Reaction Indicator."

The "L. & P." Push-Pull Switch is now to be retailed at 1s. 3d. It is a neat little component. Designed for simple "on-off" switching it has efficient self-cleaning contacts and that definite "click-click" action so essential for a switch of this nature. It has no looseness and its nicked terminals are tightly and accessibly fixed. The switch is, of course, suitable for one-hole panel mounting and the way this is arranged for is rather better than the usual

method. At the price of 1s. 3d. it should appeal to discriminating constructors.

Together with the above two components the same makers also sent us one of their single-coil holders for baseboard mounting. This also is well designed and produced, and retails at the very reasonable figure of 10d.

"LAKER" STEEL MASTS.

We recently received a leaflet describing the products of Messrs. J. and J. Laker Co., of which the most important is the "Laker" Steel Mast. This is supplied in four sections and can easily be erected in small gardens, as its guys only cover an area of 4 ft. 6 in. radius. The height of the mast is 30 ft., and it is sold complete with all fittings at 22s. 6d.

C. D. M. FIXED CONDENSERS.

C. D. Melhuish, of 8, Gt. Sutton Street, Goswell Road, E.C.1, recently sent us some of his patent fixed condensers. These appear to us to be very high-grade productions. Their casings are of good quality bakelite and mica dielectric is employed. And there are several other points concerning the design and assembly of these condensers which indicate expert forethought. On test we found these C. D. M. condensers, as they are called, perfectly satisfactory. Their insulations are very high, and they do not break down at voltages well above those at which most commercial condensers are tested. Also they are well within their specified 5 per cent error margins. Values, up to .002 mfd. retail at 2s., and the .0025 and .006 mfd. at 2s. 6d.

(Continued on page 68.)

Igranic Low Loss Square Law Variable Condenser.
 .00015 mfd. 17/- .0003 mfd. 18/6.
 .0005 mfd. 21/6. .001 mfd. 25/-.

Igranic "Lokvane" Square Law Variable Condenser.
 Prices 8/6, 9/6 and 10/6.

Igranic Low Loss Dual Variable Condenser (Square Law Type).
 Capacity .0003 mfd. (Dual) 22/6.
 " .0005 " " 27/-.

Variable—but always consistently excellent

Would transmitters build the Igranic Square Law Condenser into their apparatus had it not such instrument precision? That is a standard to which few condensers dare to aspire. It is this standard you should bear in mind when next you buy a variable condenser—you have only to say "Igranic" to get it. All condenser needs are provided for in the Igranic range. There are Square Law types of Igranic and Igranic-Patent design—the Igranic "Lokvane"—the Igranic Dual—a special Low Loss Transmitting model and the Balancing and also the Micro-Condenser.

Write for the booklet R.57 which describes them.

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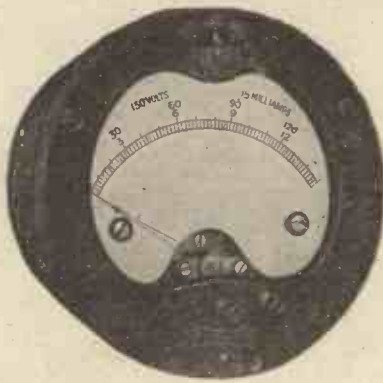
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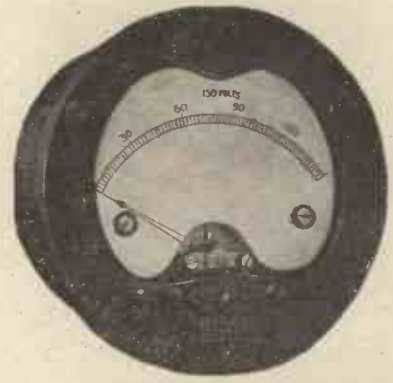
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APPARATUS TESTED.

(Continued from page 66.)

A TOGGLE SWITCH.

Perhaps some "P.W." readers have wondered what a "toggle" switch is, so that a brief explanation might not be out of place, seeing that we have to review a small toggle switch due to Cason Mouldings of Lower Edmonton, N.9. The word toggle means something that applies force at right angles to its direction of movement. Thus a



These Osram valves arrived by post in a slightly battered condition—

toggle switch has a small lever which, moving up and down, makes and breaks a contact in a backwards and forwards direction. Most switches used in house lighting are toggle switches. And the Cason toggle switch for panel mounting is not unlike a switch of this nature, only it is tiny, and has no removable metal cover, but consists of a small insulating moulding

through which projects a small red lever. The device is well made, and has a positive and efficient action. We particularly like the clear "on" "off" lettering—the disadvantage of the push-pull type of switch is that it cannot have this! The Cason "Toggle" at 1s. 3d. should interest most constructors who are looking for an "on-off" switch which their households can operate without mishap.

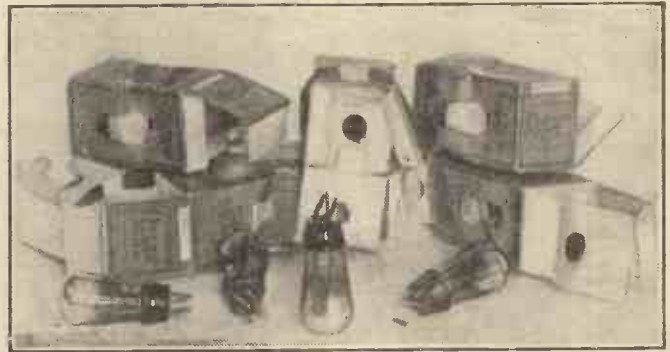
A NEW LISSEN COMPONENT.

We recently received one of Messrs. Lissen's new B.B. rheostats. This is designed for baseboard mounting and, although it has a maximum resistance of 35 ohms, the wire employed is sufficiently substantial to stand anything in the way of current usually used in a radio receiver. The component is exceedingly well made, and has the normal Lissen high grade finish. The movement is smooth and offers sufficient resistance to enable permanent settings to be obtained. Two very accessible holes are provided for mounting purposes, and the terminals are also easy to get at and are fitted with soldering tags. In fact, it is an article which will appeal strongly to all discriminating constructors, and will, as a matter of course, find its way into many "P.W." sets.

AN H.T. BATTERY.

Messrs. Hook & Willis, Ltd., of Goding Street, London, S.E.11, recently handed in one of their "Obeta" H.T. batteries. It is a sixty-volter and retails at 8s. 6d. It appears to be well made and, so far, it has held its voltage quite well. But it is too soon to say much about its electrical efficiency, this can only be proved by a test of time. We could put it on a constant slow charge, but this is hardly the right sort of test for a dry H.T. battery. A proper test is to place it in commission in the way most H.T. batteries are used, i.e. on a set in use for two or three hours a day, and take voltage readings at frequent intervals. This we do with all H.T. batteries sent in to us for test, and if anything untoward happens to the "Obeta" we shall in due course report it.

We believe that these "Obeta" batteries are made in Germany.



—but although the boxes were torn and the pins of some of the valves badly bent not one of the filaments was damaged!



CLARKE'S "ATLAS" RADIO SPECIALITIES

SELECTIVITY. AMAZING RESULTS!

You can get marvellous selectivity without ANY alteration to your set by using Clarke's "ATLAS" Low Loss Coils. The famous twin wire winding ensures lowest H.F. losses, together with maximum distance and signal strength.

"Radidea," of the Allied Newspapers, Ltd., says:

"There is no doubt that Clarke's Atlas Centre-Tapped Coils make even the straight set more selective. Stations of 5 metres above or below the local station wavelength could be tuned in with ease and without interference. Daventry is easily separated from Radio Paris on almost any set. It is interesting to note that the *tappings are taken at the true electrical centre and not merely at the centre of the windings.*"

The coils are all standard fitting. No special bases are required.

PRICES:

General Purpose Coils: Nos. 25-50, 2/6; No. 65, 3/-; Nos. 75-150, 3/6. Centre Tapped Coils: No. 40, for 200 to 400 metres, and No. 60, for 350 to 600 metres, 4/3 each. Special Coil for Daventry, etc., 6/6 each. "X" Coils: No. 60, tapped at the 7th and 12th turns, 5/6 each. No. 250, tapped at the 28th and 50th turns, 7/6 each.

OUR GUARANTEE.—We will refund your money in full if, within 7 days, you are not satisfied with the results obtained from Clarke's "Atlas" Coils.



ADD A VALVE— OR HALF A DOZEN IF YOU LIKE!

So far as High Tension is concerned, it won't matter, once you've installed one of

CLARKE'S "ATLAS" H.T. BATTERY ELIMINATORS

There's a model for every need and for every purse. Each one removes the bogey of failing H.T. current for ever. By simply plugging into the nearest lamp socket, you have a smooth, constant H.T. supply until the power station runs out! There are variable voltages and grid-bias tapings on most models, and there is nothing whatever to burn out or go wrong.

PRICES:

Direct Current Models from £3 5s. to £6 10s.
Alternating Current Models from £5 10s. to £9.

Royalties and Values Extra on Alternating Current Models only.

As with everything "ATLAS," each H.T. Battery Eliminator carries the "ATLAS" guarantee.

LOW TENSION UNIT for Alternating Current. For 100/125 and 200/250 volt mains. Comprising a specially constructed Rectifying Unit and a Floating Storage Battery. In Art Metal Cabinet. Can be used with an "Atlas" H.T. Eliminator from same source of supply.
Prices: 2-volt £4 15s.; 4-volt £4 19s. 6d.; 6-volt £5 4s.

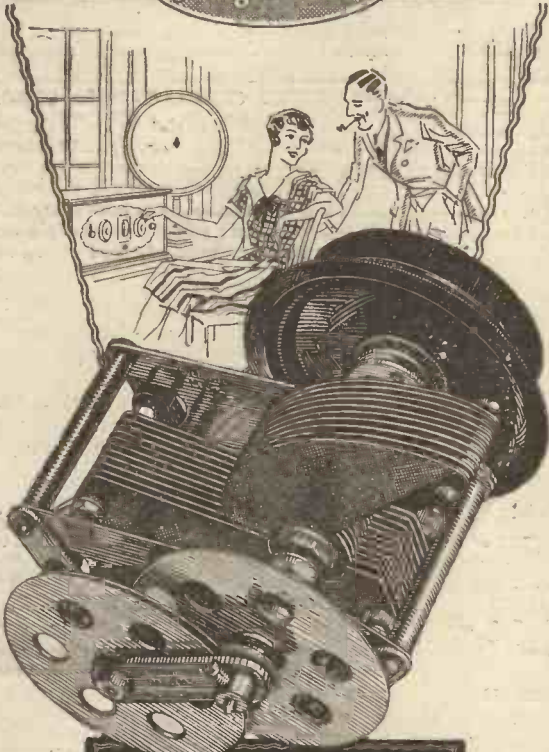
SEND FOR FOLDER 24 FOR FULL DETAILS.

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H. CLARKE & CO. (M/cr.), LTD., Atlas Works, Old Trafford, Manchester.

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because the shaped vanes and unique gearing spread stations slowly and evenly—without backlash—over the entire scale. The balanced “feel” of the “GECophone” Condenser Dial is a positive joy to all lovers of precise radio instruments.

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.0002 - 17/6	.0005 - 19/6	.0005 - 22/-	
.00025 - 17/6	.001 - 27/6		

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

Questions and Answers

LOUD-SPEAKER CONNECTIONS.

D. R. (Salford).—"I have decided to fit a filter-unit (choke and 1 mfd. condenser) across the output of my 2-valve set, which works two loud speakers in different rooms. I

understand that when such a unit is used it does not matter which way round the loud speakers are connected, and there is no advantage in carefully keeping the side of the speaker marked + towards the H.T. plus lead. Is that correct?"

Yes. When a filter unit is used it is quite immaterial which way round the loud speaker is connected.

MAKING CENTRE-TAPPED COILS.

K. T. (Abingdon, Berkshire).—"I should like to use a centre-tapped aerial coil to get greater selectivity with my 3-valve set (which is a Det. and 2 L.F., transformer, resistance coupled). But as it is mounted very compactly into an expensive cabinet (sketch enclosed) I cannot use the ordinary centre-tapped coils because space is very limited and they won't go in. The present aerial coil is of the spider-web type, wound on an eleven slot cardboard disc—45 turns for low waves, and 200 turns for 1,600 metres. Would it be all right if I soldered in a tapping to the middle of the coil and took this to the aerial terminal?"

Yes, this would greatly improve the selectivity of the set, and in the circumstances it would be better to centre-tap your own coils than to try others which might introduce spacing troubles. We should fix a spade terminal to the tapping on the coil, and make the aerial terminal a double one, so that the aerial lead can be fastened to the front in the ordinary way, and the centre tapping to the A terminal on the back of the panel.

LITZ WIRE FOR LOW WAVES.

T. W. (Newark, Notts).—"I have found that coils wound with Litz seem definitely superior to those wound with other types of wire, providing the wave-length is not low. But on short waves, below 200 metres or so, the ordinary wire seems just as good as the Litz. Is this experience a common one?"

(Continued on page 72.)

Miss EDITH DAY

the famous Musical Comedy Star pays tribute to the

Outstanding Qualities of the

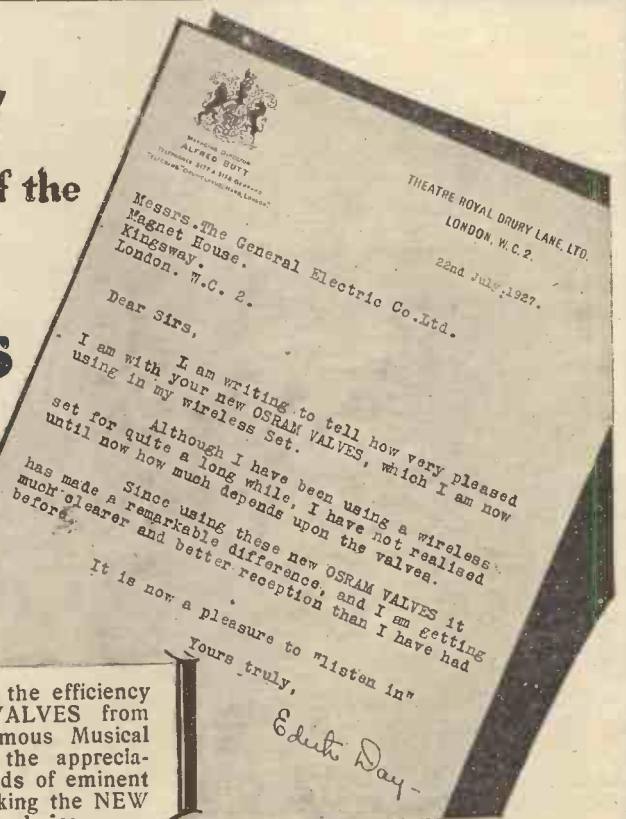
New

Osram Valves

with the New Filament



This striking testimony to the efficiency of the NEW OSRAM VALVES from Miss Edith Day, the famous Musical Comedy Star, exemplifies the appreciation expressed by thousands of eminent listeners who are now making the NEW OSRAM Valves their choice.



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COLOURED CONNECTING WIRE

Increased sales and improved manufacturing methods have enabled us to reduce the cost of this popular connecting wire. From September 5th, prices are as follows:—

Quantity	Old Price	New Price
10 ft. Coils	1/2	10d.
Packet of 4 2 ft. lengths (assorted colours)	1/-	9d.

Supplied in six colours (white, black, red, green, yellow and blue). GLAZITE is the quickest, easiest and cheapest way of wiring every set. From all radio dealers.

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We teach by post (in all parts of the world) all the Commercial professions and the Technical trades. We have expert tutors for every department, but my special department is giving personal advice to those people who have an ambition to make progress in the world. There are so many people who are in a rut, or think they are in a rut, simply because they cannot see the way to further prosperity. It is my business to show them and to put them on the right path where they can achieve their ambition.

If they have no ambition I cannot help them, I can only pity them, but to anyone who has an ambition I may be able to give valuable advice, if not, I will say so honestly, but if I can help them, then I will explain exactly how. I will point the road clearly. No matter what your present position may be, if you wish to improve it write to me at this address, tell me how you are employed, what is your ambition, I shall then reply to you by return, and you will be under no obligation whatever.

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LOW LOSS TWO RANGE COUPLER

Local and Daventry.

This Tuner is constructed on Low Loss Principles with Solenoid and Bankwound Coils, acknowledged to be the most efficient form of coil winding. It is so arranged that a two-contact Pull-Push Switch shorts the high wave coil, leaving only the low wave coil in circuit.

14/6

See STAND 81, National
Radio Exhibition, OLYMPIA,
SEPT. 24th to OCT. 1st.

Crown Works, Cricklewood, N.W.2
Phone: Hampstead 1787.
Manchester: Mr. J. B. Leves, 23, Hartley
Street, Levenshulme.
Phone: Heaton Moor 475.



RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 70.)

Quite common. Most experimenters who favour Litz have found that its advantages are only in evidence when it is used for coils tuning to normal broadcasting wave-lengths. Below 200 metres "solid" wire coils are usually employed.

WINDING AN H.F. CHOKE.

N. A. C. (Reading).—"I am going to make a 1,200-turn H.F. choke, and I already have the necessary fine wire on hand, and a former 3 in. long. I should like to keep its self-capacity nicely low, so far as can be with rough and ready methods of winding. Would it be better to wind the turns on in spaced layers, or to simply commence at one end of the former and work towards its other end, laying on the turns as evenly as possible?"

The best method of keeping the self capacity reasonably low with ordinary methods of winding is to make the coil in spaced sections. First of all mark off the former across the space where the wire

THE TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," Fleetway House, Farringdon Street, London, E.C.4.

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

will be into twelve equal sections. Then wind the first one hundred turns in a pile in the first section, the second hundred in the second section, and so on until all the turns are on and the former has been filled.

LENGTH OF COIL FORMER.

G. E. C. (Cardiff).—"If 250 turns of No. 30 enamelled wire are laid as closely as possible

along a cardboard tube former, how can I find out how many inches long the winding will be?"

If you consult a wire table you will find that the diameter of No. 30 enamelled wire is given as .017 in. This is the "thickness" of one turn, so 250 turns will be $.017 \times 250 = 4.25$ in.

This, of course, would be the length occupied if the 250 turns were laid on perfectly. We should allow $\frac{1}{4}$ in., instead of $\frac{1}{2}$, as little bends and inequalities are bound to occur in practice.

"AN INTERFERING BUZZ."

T. A. (Goodmayes, Essex).—"As my friend who lives across the road can get good results from an indoor aerial he persuaded me to make a crystal set like his. I've bought the 'phones and everything, but now it's connected up all I can hear is a loud strong buzz which never stops.

"It is very disappointing to me, and I want to know how to stop it."

The trouble lies with that indoor aerial you mention. The reason that you get a loud buzz is that your set is picking up interference from electric mains—probably from the electric-light wiring.

When putting up your indoor aerial you ran the aerial or earth wire too close to the house-wiring, and consequently you are hearing the dynamos or other electrical machinery which supplies the power to your house. Re-arrange the aerial wire—and if necessary the earth wire, too—so that it is well spaced from all the house-wiring. The buzz will then disappear.

AMAZING AMPLIFICATION.

C. P. O. (Southampton).—"Is it true that a multi-valve wireless set amplifies the signals received until they are about fifty thousand times greater? And if so, how is this enormous step-up obtained?"

It is quite true that the amplification obtained is frequently as great as 50,000. Recent tests with a six-valve set (3 H.F., Det. and 2 L.F.) showed that the first step-up in this class of receiver was the inductive aerial coupling, which gave a magnification of 2: the first and second H.F. stages gave a magnification of 6 each, the detector stage 2, first L.F. 32, and second L.F. 12.

It will be seen that although most of the amplifications are comparatively small ones, their cumulative effect is very great, the actual figures obtained by multiplying out being 55,296 in the instance of the set quoted above.

GRID CONDENSER VALUES.

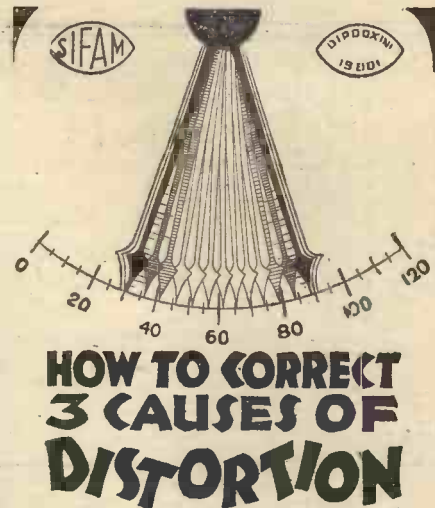
D. N. (Gidea Park, Essex).—"I am making up a set from the 'P.W.' Blueprint No. 9 (H.F. amplifier with tuned anode coupling and reaction on the anode), and I see from the list of components that a grid condenser of .0002 mfd. capacity should be used for this set. I already have a .0003 mfd. condenser on hand. Will this do, instead?"

Yes, it will probably be found that the .0003 mfd. condenser will work just about as well as the .0002 which is recommended.

SIZE OF PANEL REQUIRED.

F. R. (Boscombe, nr. Bourne-mouth).—"Finding I have all the parts to make up a crystal detector with one valve L.F. amplifier, I am

(Continued on page 74.)



Try this Experiment.

Place the Sifam Milliammeter (Price 25/-) in the H.T. leads, and if signal strength varies through distortion the needle will rock violently backward and forward. This indicates that your set is distorting through L.F. Transformers, inaccurate H.T. or L.T. current, or incorrect grid bias.

The Sifam Pocket Voltmeter is another of these guaranteed accurate instruments that saves its cost (9/6) in a few weeks. Avoids waste of current and banishes the inconvenience of sudden breakdowns.

Ask your dealer to show you complete range, or write to (Dept. P.),

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NEW MODEL POCKET VOLTMETER

HIGH RESISTANCE
4,000 OHMS.

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Double reading 0-6.
120v. Patent dead-beat damping.
Finest value in precision instruments.

Remember!

TEST YOUR SET TO-NIGHT

WITH A

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and it won't let you down to-morrow.

M.B.I.L.

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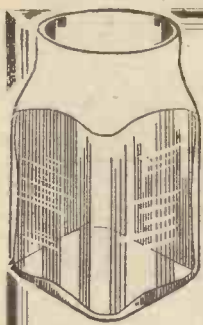
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For use with the ETON Primary H.T. Battery

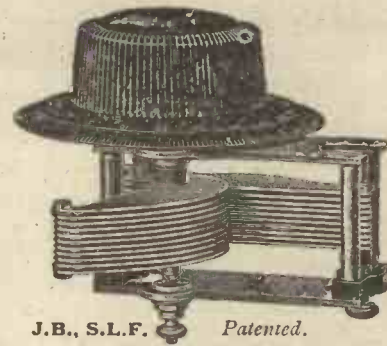
The ETON Glass Jar, being made from a special glass having a non metallic base, is unsurpassed. Therefore, perfect insulation is obtained even with 120 volt batteries. Smooth action over long periods is guaranteed. All component parts of ETON cells are made from the finest materials only. Complete instructions and other information are contained in our 6d. manual. To secure this extremely useful 20 pp. booklet just send us a 14d. stamp. H.T. troubles vanish when you use ETON H.T. Batteries in the special ETON Glass Jar.

Every genuine ETON Jar bears the Monomark BCM/N.O.T.E.

The Eton Glass Battery Co., 46, St. Mary's Rd., Leyton, E.10



THE MARK OF ALL GOOD CONDENSERS



J.B., S.L.F. Patented.

With the precision of a gun—that's the way J.B. Condensers are designed and manufactured! Each and every part a perfect section of the perfect whole. And the finish of J.B. Condensers! Well, try one in your own set and see the difference in results.

Look out for the Perfect Five at Stand 85 at the Exhibition.

Prices, J.B. S.L.F. complete with 4-in. Bakelite Dial. '0005 mfd., 11/6. '00035 mfd., 10/6. '00025 mfd., 10/-. For Short Wave Receivers, '00015 mfd., 10/-.

J.B. True Tuning S.L.F. complete with 4-in. Bakelite Dial for coarse tuning and 2-in Bakelite knob for slow-motion device. '0005 mfd., 16/6. '00035 mfd., 15/6. '00025 mfd., 15/-. For Short Wave Receivers, '00015 mfd. 15/-. The J.B. True Tuning S.L.F. is fitted with a Double Reduction Friction Drive which completely eliminates all possibility of backlash. Ratio 60-1.

J.B. NEUTRALISING CONDENSER, 3/6. Finished in polished nickel plate for baseboard mounting. Absolutely reliable and cannot short circuit. Requires a minimum space. Self-locking. Dustproof. Smooth ultra-fine adjustment.



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|--|--|
| 1. DETECTOR VALVE WITH REACTION. | 16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (with Switch for Last Valve). |
| 2. UNIDYNE DETECTOR VALVE WITH REACTION. | 17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (with Switching). |
| 3. 1-VALVE L.F. AMPLIFIER. | 18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch. |
| 4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER. | 19. H.F. DETECTOR AND L.F. (with Switch to Cut Out the Last Valve). |
| 5. H.F. (Tuned Anode) AND CRYSTAL, WITH REACTION. | 20. DETECTOR AND 2 L.F. AMPLIFIERS (with Switches for 1, 2, or 3 Valves). |
| 6. H.F. AND CRYSTAL. (Transformer Coupled, without Reaction). | 21. THE 2-VALVE LODGE "N." |
| 7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode). | 22. "THE GUARANTEED REFLEX." |
| 8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction). | 23. THE 1-VALVE "CHITOS." |
| 9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode). | 24. THE "SPANSACE THREE." Three-Valve Receiver employing 1 Neutralised H.F. Valve, Detector with Non-Radiating Reaction Control, and 1 L.F. Valve. |
| 10. H.F. AND DETECTOR. (Transformer Coupled, with Reaction). | 25. 2-VALVE REINARTZ (Det. and L.F.). |
| 11. DETECTOR AND L.F. (with Switch to Cut Out L.F. Valve). | 26. A "STRAIGHT" 4-VALVER (H.F., Det., and 2 L.F. with Switching). |
| 12. DETECTOR AND L.F. UNIDYNE (with Switch to Cut Out L.F. Valve). | 27. A "MODERN WIRELESS" 4-VALVER (2 H.F., Det., and L.F.). |
| 13. 2-VALVE REFLEX (Employing Valve Detector). | 28. A "MODERN WIRELESS" 5-VALVER (H.F., Det., and 3 L.F.). |
| 14. 2-VALVE L.F. AMPLIFIER (Transformer Coupled, with Switch to Cut Out Last Valve). | |
| 15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled, with Switch for Cutting Out Last Valve). | |

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The Gambrell Neutrovernia

has established itself as the finest neutrodyne condenser obtainable. It can be used for any of the three purposes mentioned above. Capacity approx. $2/38$ m/mids. Will not short. A uniform increase or decrease in capacity is given by each turn of the knob.

Can be mounted three ways—on base-board, on panel, or through panel.

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Assured with our new Insulating Liner, Jars, 1/3 doz. plain; 1/6 doz. waxed; Special Zincs, 1/- doz.; High-Capacity Sacs, 1/6 doz.; Perforated Liners, 4d. doz. Post Free on three dozen Units and over, including special divided carton suitable as a container. Send 6d. for sample complete unit, particulars and instructions. We stock Seamless Moulded Cone Parts, also the Wonderful Rolls Portable Set.

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ALL SPORTS

Every Thursday 2d.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 72.)

going to knock up a set of this kind on a flat panel. What size should the panel and box be?"

You would need a panel about eight inches square for ordinary components to have plenty of room, but if rather small components are used this might be reduced to 7 in. x 7 in. or even smaller, according to the parts. The box should be about 4½ in. deep.

INTERFERENCE FROM TRAMS.

T. E. (Unthank Road, Norwich).—"I get a lot of interference from the trams, and am told that a counterpoise earth would cure this, a friend having discovered that the trouble is picked up by the earth wire.

"Unfortunately, it is quite impossible for me to use any sort of counterpoise, and I cannot get permission to run even a single wire under the aerial. Would loose coupling the set do any good?"

If you use a loose-coupled aerial arrangement and any form of direct earth, it will be necessary to disconnect filament from earth to gain any advantage from loose coupling. As this may make the set unstable and may not be easy to alter without disturbing the wiring, we should try dispensing altogether with the direct connection to earth. Leave the set and wiring just as it is at present, but remove the earth wire and in its place join up a coil of insulated flexible aerial wire. It does not make much difference how long this coil is, but generally 50 ft. or so will give good results. Coil it up and place it on the floor below the set, and you will probably find it makes quite a good "counterpoise," the far end being left free and without any connection to it.

WHAT ARE MICRO-MICROFARADS?

A. R. F. (Stoke Newington, London, N.16).—"Several times lately in reading wireless articles I have come across the term 'micro-microfarads.' I assume that if micro-farad means a millionth of a farad, the meaning of micro-micro-farad is a millionth of a millionth of a farad. So that 'a condenser of 30 micro-microfarads' is really a condenser of .000030 mfd. Why then should it not be called a .00003 mfd. condenser—surely this would be less confusing than 30 micro-microfarads?"

You are quite right in assuming that micro-microfarads are millionths of a millionth of a farad. They could just as well be expressed in the usual way as a decimal fraction of a microfarad, i.e. 1 micro-microfarad equals .000001 mfd.; and although up to five noughts may be necessary to express such small capacities, this would seem to be less confusing than the alternative method of expressing the ordinary condensers in mfd., and the smaller ones in micro-microfarads.

THAT ACCUMULATOR PROBLEM.

C. S. R. (Broadstairs, Kent).—"This accumulator business is what I am puzzled about. It's like this. I've bought the accumulator, loud speaker, H.T. battery, aerial, etc., and I've made the set (which is a 3-valver) and between ourselves I'm now just about spent out! Everything is of the best, so I've had to spend a few of the best to do it!

"I must say I feel I've got my money's worth and could not do without the set—in fact, that is just the trouble. When the accumulator is being charged we miss the programmes so much that I would like advice about getting a second accumulator.

"I can't afford to pay for another first-class 40-actual big fellow, like the one I have (2 volts) so I've made inquiries about the cheaper ones. And my idea is to use a cheap one to carry on with for just a few days whilst the main accumulator is being charged.

"What I want to know is whether reception will be just as good with a small accumulator as with a big one? And if not, what are the disadvantages of having a small one, instead of paying more? And what type would be suitable in the circumstances?"

The sole disadvantage of a small accumulator, as compared with a large one, is that it does not last so long without being re-charged.

(Continued on next page.)

The HOME for your WIRELESS SET

OUR STANDARD CABINETS

are DUSTPROOF and house the whole apparatus, leaving no parts to be interfered with. All you do is

UNLOCK & TUNE IN.

Made on mass production lines, hence the low price. Provision is made to take panel, from 16 by 7 up to 30 by 18 in.

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DX-PLUG-IN COILS

From 1/- D X COILS, LTD., London, E.8.

AMPLIFIERS: 1-VALVE, 19/-; 2-VALVE, 30/-
2-Valve All-Station Set, £4. Approval willingly.
Wet H.T. Batteries—Jars, Zincs and Sacs complete,
3/6 per doz. (18 volts). Post 9d. extra. Sample 6d.
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It will cut out interference from powerful or local transmissions. Distant stations can be received at full strength when trap is in use. Designed by C. P. Allinson, A.M.I.R.E., this is the only effective wavetrapp. CONSTRUCTONE No. 2 gives full details, photos and drawings for the construction and installation of this unit.

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

In your own case this will hardly be a disadvantage, because you only require the small accumulator to carry you over the short periods when the large accumulator is being charged.

As far as reproduction of the programmes goes, you will find that a small 2-volt accumulator, of low cost, will give exactly the same results when connected to the set as a big accumulator. Of course, it would not run the set for such long periods, but although its hours of service without recharging are shorter, its work over the shorter period is just as good as that of a more powerful battery.

You omit to mention the type of valves you are using, but we presume that these are of the ordinary dull emitter type. Assuming that the first two valves take a filament current of about 1 amp. each, and the last valve a little more than this, the very maximum current required for an average evening's entertainment would be three ampere hours—probably two ampere hours would be much nearer the mark.

This means that a small portable 2-volt accumulator, of the 10-actual-ampere-hour type, would last several nights—at least three, and with economical usage five nights or so. During this time you could have the main accumulator charged, so we think that such a small portable type accumulator would meet the case exactly.

Get into the habit of recharging it as soon as it shows signs of getting low, and you can then keep it standing by ready to carry on for you as soon as the main accumulator shows signs of running down.

SEPARATING 5 G B's PROGRAMME.

F. S. (Buxton, Derbyshire).—"The set is very loud and good, and I don't want to alter the wiring. But at present I get a trace of Manchester's programme behind 5 G B. If I use a centre-tapped aerial coil, instead of the old type, will it give the additional selectivity?"

Whilst it is not possible to say definitely without knowing more about the set, we should confidently expect the use of a centre-tapped aerial coil would enable the two programmes to be separated completely, at your distance from 2 Z Y, or even at much shorter distances.

SHORT-WAVE SCHEDULES.

"SHORT-WAVE EXPERIMENTER" (St. Mary Cray, Kent).—"I have recently had the pleasure of picking up 2 X A D and 2 X A F on a 2-valve set, and should like to know the times at which these stations start and finish. Is this information available?"

As both stations are used experimentally, the times of transmission are frequently altered. But station 2 X A F has a habit of transmitting a schedule at 6-45 p.m. each Saturday. If you can pick this up you will find it gives the times for the ensuing week. (It is sent out in Morse and telephony.)

RADIO AND THE VILLAGES.

(Continued from page 43.)

cases are quite erroneous, and to attempt to set him right is only another way of inviting him to call you a fool!

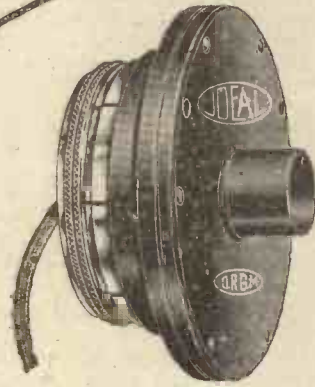
"In our village clubs we find that the loud speaker does not always make for that harmony and good-fellowship which we try to foster. Between those who want it switched on and those who want it switched off, between those who like an item and those who hate it, relations often get rather strained. Wireless is not a thing for community entertainment."

After having said good-bye to Sir Henry, I made some progress on my journey back to London. Stopping for tea at a little cottage where an aerial proclaimed the old woman to be a listener, I asked her what she thought of broadcasting.

"Well," she answered, after several moments spent in deep thought, "I don't ever think—I just listens!"

Oh, what peaceful calm and quiet content would reign in the official breasts at Savoy Hill if only that admirable sentiment were universal!

A BETTER LOUD SPEAKER & TUNING COIL



The finest unit for building a home-made loud speaker.

With this wonderful unit you can assemble at home an excellent, powerful loud speaker, or you may attach the "Ideal" unit to your gramophone.

An ingeniously applied stoppage device prevents the diaphragm from being overtwisted when the adjustment ring is by chance turned too far or too fast, whereby it often happens that the delicate diaphragm is bent or injured. Great volume of sound can be obtained, thanks to the possibility of the precise fine adjustment.

The metal parts of the unit are of highly polished nickel finish, the magnets are of choice Swedish iron, and the diaphragm of genuine best English Stalloy sheet material.

The "Ideal" loud speaker unit is one of the best ever made.

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Telephone: Museum 8630 (3 lines)
Telegrams: Distancing, Wesdo, London.

Manchester Office:
6, Booth St. East, C-on-M Manchester.
Telephone: Ardwick 3709.

WHAT IT IS

The Multidyne all-wave coil is a plug-in coil combining a number of coils suitable for listening-in on all wave-lengths, from 160 to 4300 metres. An adjustment lever of insulating material operates the multiple switch gear which switches off at both poles every winding not in use. The windings are the "frameless" twisted basket type. High self-induction, low self-capacity, no oscillation.

WHAT IT DOES

The Multidyne coil entirely dispenses with an expensive collection of coils and the trouble of changing them. The lever projecting beyond the container avoids hand capacity effects and affords immediate changing from one station to another with beautifully sharp resonance at the multiple couple. The method of marking on the dial the divisions of stage and wave-length make this operation as simple as it is effective. It is marvellously efficient as a reaction coil, because accurate ratio with all wave-lengths is instantly obtained by moving the lever.

Both maintain our reputation for the
production of components
that are efficient

SO WE LABELLED THEM
Blue Spot

TRADE MARK "RED DIAMOND"
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 REGD.
THE RECOGNISED DETECTOR FOR ALL CIRCUITS USING CRYSTAL RECTIFICATION.



RD40 2/-
 Shield for same, 6d.

By Insured Post 2/3 or 2/9, with shield. Can be mounted on brackets or through panel. Once set always ready. Not affected by vibration. Each one is tested on broadcast before despatch, and is perfect. Of all high-class Radio Dealers or Sole Makers:-

RADIO EXHIBITION, STAND 210, JEWEL PEN CO., LTD.,

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HEADPHONES REPAIRED

Rebound and re-magnetised 4/- per pair. Loud Speakers repaired 4/- Transmitters rebound 5/- each. All work guaranteed and tested before delivery. Write for Trade Prices. Phone: Clerk, 1795. MASON & CO., 44, East Rd., City Rd., N.1.

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Transformers, Phones, Loud Speakers repaired to maximum efficiency. All one price, 4/- post free. A 12 months' guarantee accompanies each repair. Your transformer can also be rewound to multi-ratio type. Write giving particulars. Trade invited. REPAIRS, 118, LINKS ROAD, FOOTING, LONDON, S.W.17

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COMPLETE SETS, LOUD SPEAKERS, COMPONENTS, Etc.

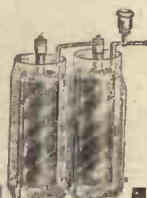
Send list of requirements, and I best monthly terms will be quoted by return.

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 Best British Batteries.
 60-v. 8/-, 108-v. 15/-, Post free.
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This "STANDARD" Wet H.T. Battery will solve all the difficulties you experienced last winter, and will end the everlasting expense of experimenting to find a better battery. **SELF CHARGING, HOME ASSEMBLING, IMPROVED RECEPTION, SILENCE, PERMANENCY,** are a few of the important factors of this **WONDERFUL BATTERY.** OUR BOOKLET GIVES FULL DETAILS IN SIMPLE FORM, AND IS FULL OF INTERESTING HINTS.
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 With Detachable Terminal... 25/1
 Trays for above, 7/-
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INSTRUCTIONS FOR USE AND MAINTENANCE
 PRICES OF COMPLETE SETS & COMPONENT PARTS
STANDARD WET H.T.



TECHNICAL NOTES.

(Continued from page 48.)

the layer of gas is absorbed, and the current is able to start once more, coming to a stop again, and so on. The interruptions automatically produced in this way may, in certain circumstances, attain quite a high frequency—several hundreds or even thousands per second. An electrolytic interruptor is sometimes used in conjunction with induction coils, but for some reason which is not very definitely understood, electrolytic interruptors do not seem to work satisfactorily unless carrying a current of several amperes.

A Chemical Earth.

A new type of "earth" consists of a cylindrical container about 12 in. in length and 4 in. in diameter, made of copper sheet and containing a compound of copper salts. The cylinder is provided with a clip at the top by means of which the earth lead on the set is attached, and it is entirely sealed with the exception of two small holes at the bottom. The moisture from the earth enters at these holes and re-acts with the copper salts, forming with the copper cylinder an "earth" which maintains its contact and has been found to be particularly effective when buried two or three feet even in comparatively dry ground.

The Groundhog.

In this connection I notice another new kind of earth known by the curious name, Yale "groundhog." This consists of a flat plate of metallic perforated material, which contains some hygroscopic substance by means of which it attracts and holds moisture. According to reports on this "earth," it has been found to be as effective as a well-grounded waterpipe, and it has the advantage that it may be used in conditions where a waterpipe is not available.

Shielding from A.C.

In cases where wires carrying alternating current have to be passed in close proximity to the set, and where A.C. hum is consequently experienced, a simple way to overcome the trouble is to wind the flex with tinfoil strip, so as to cover it completely on the outside with a metal covering. This metallic covering may be kept in place by winding a bare copper wire over it (the direction of the winding of the wire being opposite to that of the metal tape: for example, if one is a right-handed wind, the other should be a left-handed wind) and then connecting this wire securely to earth. In most cases it will be found that this earthed shield completely cuts out the A.C. hum.

THE NEW COPPER CUBE.

(Continued from page 52.)

sensitive to those slight changes of lay-out and the run of wires which are so liable to occur when a published design is copied by an amateur constructor, however painstaking he may be.

Attempts have been made to secure the desired effect by screening the coils alone, but this is only a partial solution of the problem, and is apt, moreover, to lead to considerable losses in the coils. In deciding upon a standard scheme, therefore, the more effective arrangement of a box or compartment screen was adopted, and the final product was a metal case of fixed dimensions designed to house almost all the vital parts of one complete H.F. stage, since this is the natural "unit" in which to work. Photographs of some commercial specimens of the standard box accompany this article, and will show how the various requirements have been met.

The Specification.

The box itself is rectangular, being 6½ in. square and 6 in. deep, with a loose lid giving access to the interior. Within is a wooden false bottom carrying the various components necessary for one H.F. stage, and in the standard form these comprise a valve socket, filament resistance, neutralising condenser, and six-pin coil socket. In the lid of the box a hole is provided through which the handle of the neutrodyne condenser projects in order that it may be adjusted from outside.

In the middle of one of the sides of the box there is a special earthing terminal, and in each side there is a row of small holes through which leads can be brought out. The positions of these holes are standardised, so that the necessary connecting leads will emerge at definitely fixed points which can be marked on wiring diagrams, and thus the constructor will be able to feel much more sure of the exact positions of the important wires when working to a design.

There are four holes in each side, but, of course, only a few of these will be used in any given set, the others remaining blank, or, in special cases, being closed by the insertion of a small brass screw and nut.

Condenser Omitted.

The only component of a complete H.F. stage not included inside the box is the tuning condenser, and although there is some slight advantage to be gained by screening this and its connecting wires, it was decided to omit it, in view of the fact that there is such an enormous variation in the size and shape of these on the market.

It would be practically impossible to standardise an arrangement to suit them all. There were other practical reasons, also, why this should not be done.

I think the reader will by now have begun to see what a much more rigid and definite affair the H.F. part of a set design will become when these boxes are used, and how much easier to copy exactly it will be. Furthermore, constructional work is very much simplified when the assembly of the H.F. side is merely a matter of fixing boxes in position.

As regards the actual practical details of the uses of the new box in sets, this is a matter which must be left for the future.

A Big Step Forward

- in the
Design of H.F. CHOKES

The New **RI** CELLULAR
MULTI **Varley** LTD
H. F. CHOKE

UNIQUE ADVANTAGES.

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- (4) Complete freedom from resonant peaks.
- (5) Greater amount of latitude in application, because, in commencing its choking effect it comes well through the threshold line of oscillation.

For Horizontal or Vertical Mounting.

Price 9/6

Visit our STAND No. 143 at the National Radio Exhibition, Olympia, Sept. 24th—Oct. 1st.



BI-DUPLEX WIRE-WOUND.

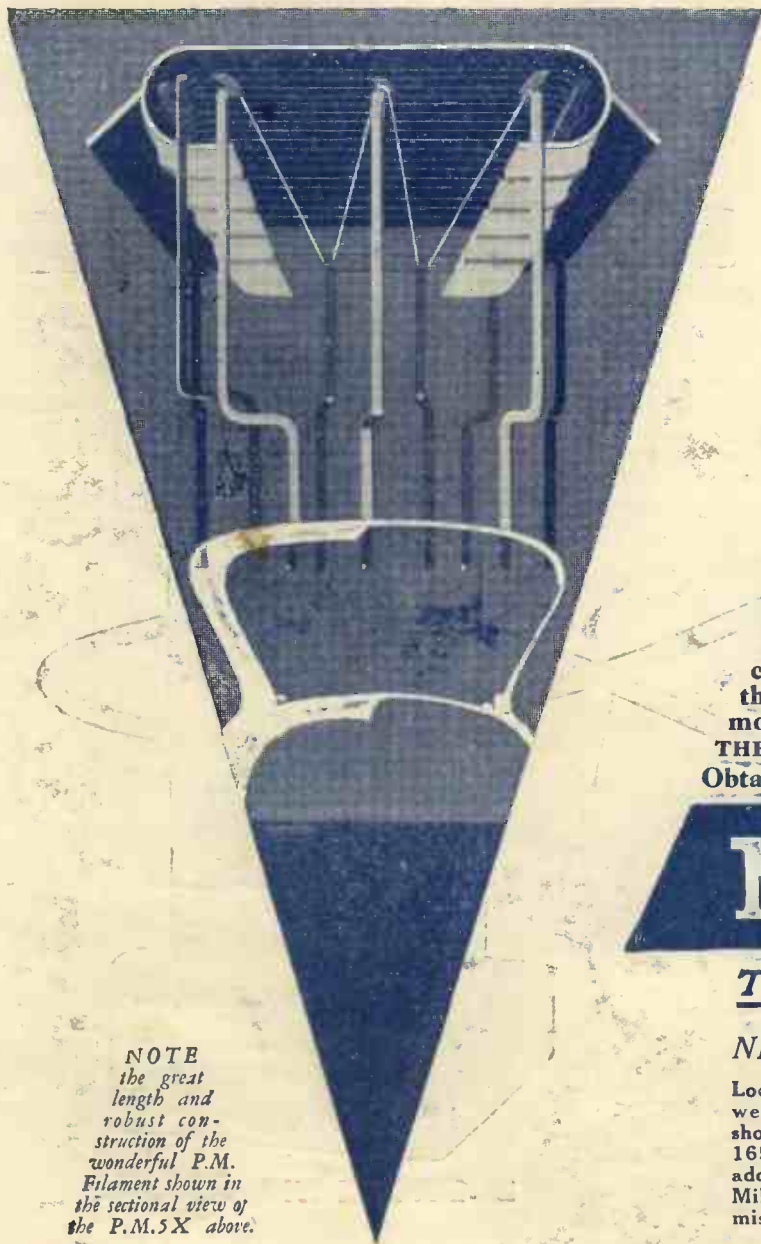


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NEW P.M. DEVELOPMENTS

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