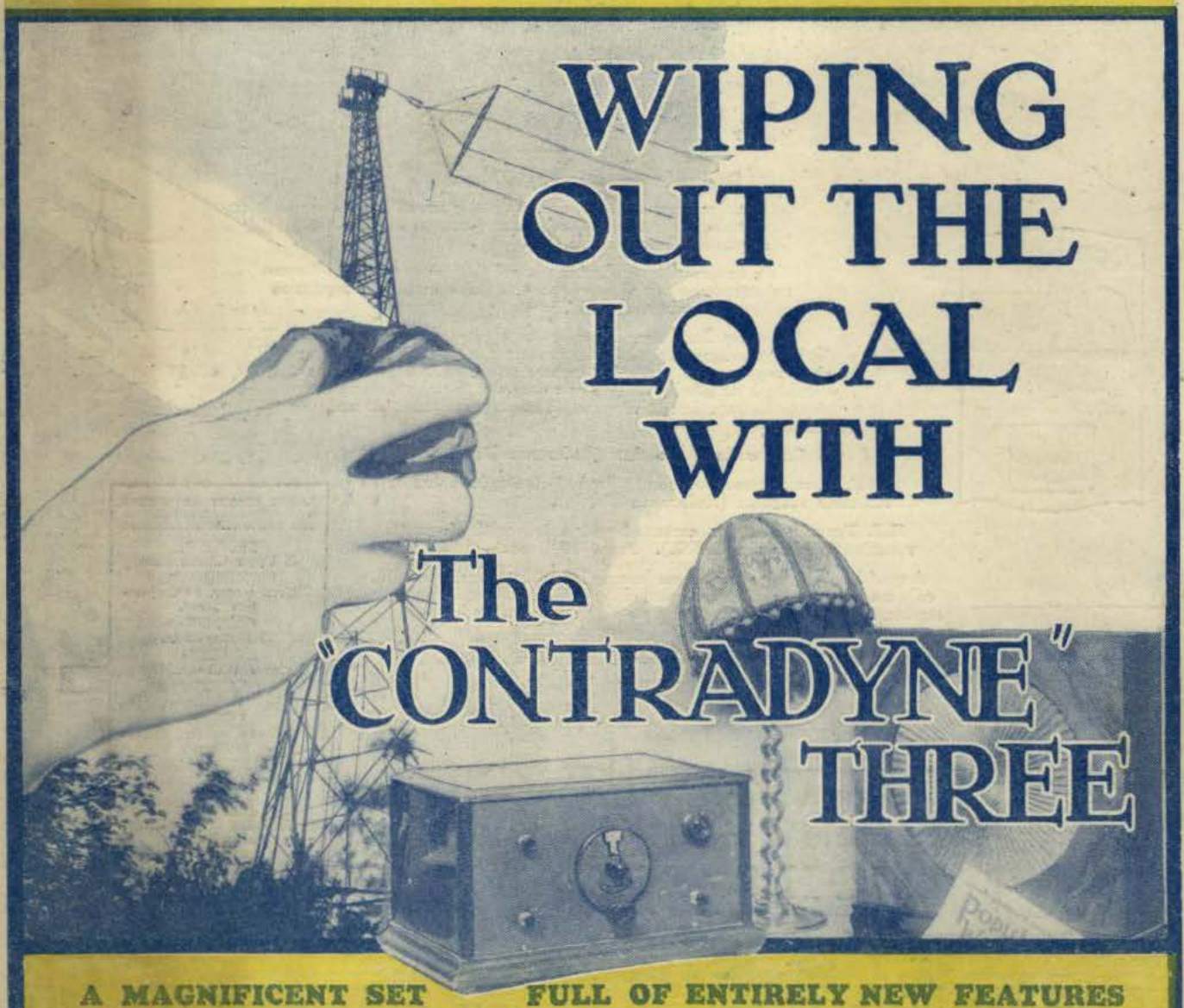
POPULAR WIRELESS, November 1st, 1930. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

LARGEST RADIO CIRCULATION IN THE WORLD

Popular Wireless

Every Thursday PRICE 3d.

No. 439. Vol. XVIII. INCORPORATING "WIRELESS" November 1st, 1930.



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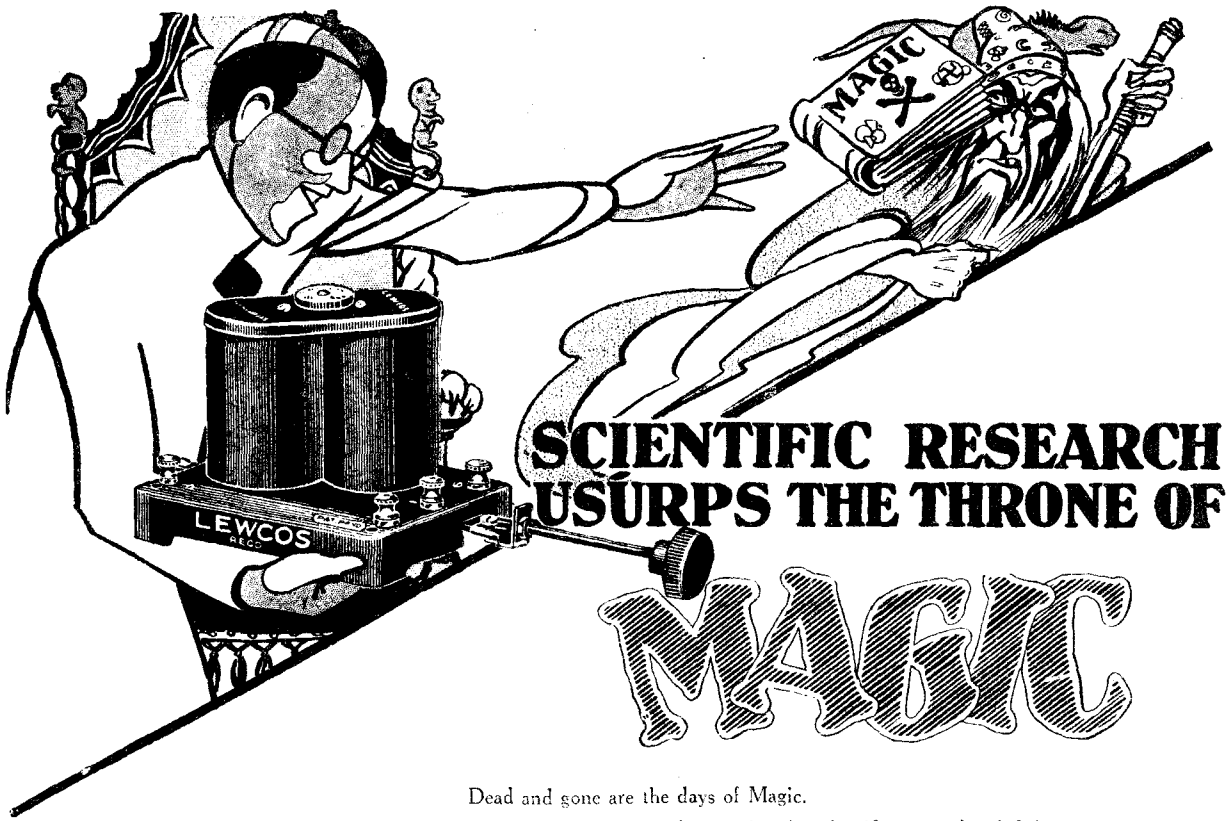

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The Lewcos Dual Range Binocular Coil, illustrated above, is designed to meet the demand for high efficiency astatic or field-less coils, having wave-length ranges of 235/550 metres and 1000/2000 metres, the wave-length range being selected by a simple push-pull switch which protrudes through the receiver panel. Three types are manufactured, as follows :

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Max. Filament Voltage	4.0	volts.
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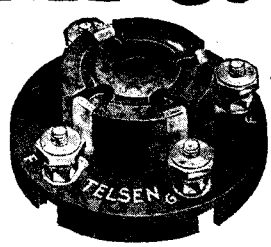

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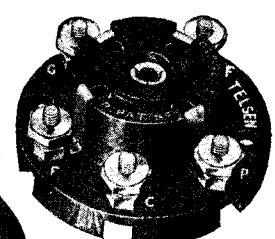

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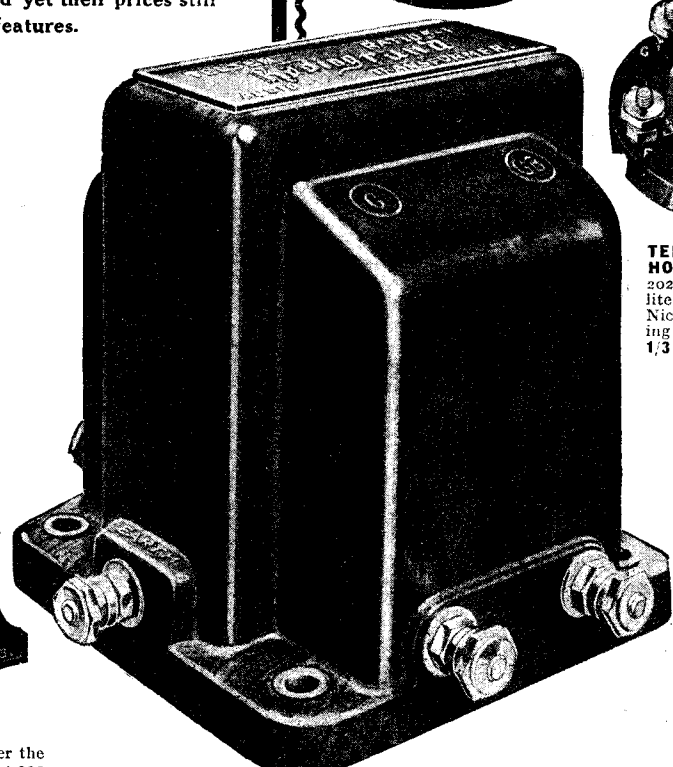

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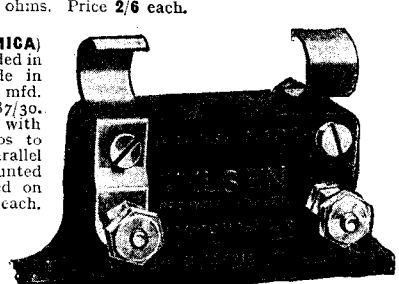

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TELSEN COMPONENTS

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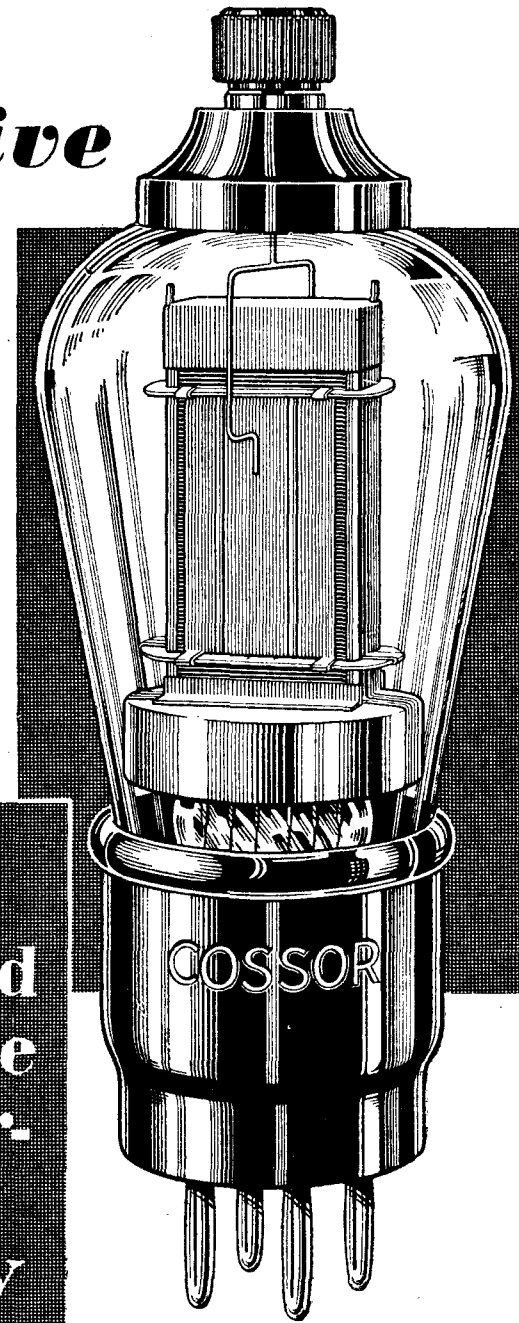
You'll get highest *effective* amplification *with this new Valve*

Greater *effective* amplification is definitely ensured by the New Cossor Screened Grid Valve. This is due to its minute inter-electrode capacity which has been reduced to the order of ·001 micro microfarads — lower than that of any other Screened Grid Valve on the market. Because of this and because grid current has been eliminated the use of this new Cossor Valve will considerably increase the efficiency of your Receiver.



The Screened Grid valve with the lowest inter-electrode capacity

Cossor 215 S.G. 2 volts, ·15 amp. Impedance 300,000 Amplification Factor 330. Mutual Conductance 1·1 m.a./v. Normal working Anode Volts 120. Positive Voltage on Screen 60-80 Price . . . 20/-

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Popular Wireless

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HOW'S YOUR PRESSURE? THE MIDGETS' DAY. "GOOD-BYE AND THANKS." A NEW IRISH STATION.

RADIO NOTES & NEWS

SHORT WAVES AS DOCTOR. THE UPHILL ROAD. "KEY TO THE ETHER." OTTAWA'S BIG BEN.

Remember the Fifth.

NOT radio broadcasting, not even television, or any wonder yet to be will, apparently, interfere with that senseless orgy of waste of money and material with which the frustration of the Gunpowder Plot is annually celebrated. The kids like it, of course, but then, as a general rule, they do not foot the bill. The significance of the whole affair, historically considered, is now completely overlooked in favour of noise, stench, and the burning of Guido Faux in effigy. Far better to celebrate Trafalgar Day with fireworks, if fireworks we must have! The B.B.C. have not, I think, done an O.B. of a firework party. Marvellous!

How's Your Pressure?

A LONDON scientist, Mr. J. H. Thompson, is reported to have found out that human blood pressure is definitely affected by music. He claims to have established by experiment that the repetition of one piece of music or of the same type of music lowers the blood pressure, and that a change raises it. Further research may therefore reveal the means by which the B.B.C. can improve the health and spirits of the nation, concocting its programmes scientifically as a doctor does his medicines, and giving items specially beneficial for those whose pressure is normally too high.

A Beginner's Hymn of Praise.

J. McL. (Seaham Harbour), has just started wireless, and had the usual "beginner's luck"—he picked the "P.W." "Economy" Three, and says that he gets a sufficient variety of foreign programmes to satisfy him at present. I was interested in his remark that his only trouble is caused by a foreign station with a bird-call. Has he found Turin's dickybird so soon? The ornithologist! If a testimonial is of any interest to any of you who are wondering which set to make, here is Mr. McL.'s: "When my local (5 N O) closes down, it is only a matter of turning the dial and choosing your programmes."

Soon I expect McL. will be hearing Ljubljana's cuckoo! It's worth picking-up!

News from Lisbon.

J. M. (Harrogate) kindly informs me that he has had a letter from a Portuguese amateur, Mr. Abilio Nunes dos Santos, of C T 1 A A, who states that he transmits on Fridays, 22.00–23.15 G.M.T., on 43 metres, and on Sundays, Wednesdays, and Saturdays, 22.00–24.00 G.M.T., on 320 metres. J. M. says that he has received the 43 metres transmission at strength R.9 on 0–V–1. So there's another bit of data for your notebooks, combers of the ether!

The Gas is Singing!

AS you know, I collect instances of (alleged) radio reception without receivers. Up to now I have bagged a shovel, a radiator, a pot of boiling beans, a copper roof, and sundry others. Now Signalman McCarthy, writing from Lucknow, India, tells me that there is an old gentleman in one of the hill stations of India who, though he has no receiver, boasts that he listens to the radio programmes from England and elsewhere *via his gas-bracket!* Well, I often used to hear the gas-jet "sing" in the days before the gas-mantle was in use!

ALL ABOARD THE SHAMROCK!

This is Mayor Mortimer of New York, with the radio set he presented to Sir Thomas Lipton when the "Shamrock" went to American waters with an eye to acquiring "The Cup."

An Accumulator "Tip."

"REGULAR READER," who has been interested in our discussion about the use of distilled water for "topping" accumulators, points out—and I think with good reason—that an accumulator should not have fresh *acid* added to it while it is in a discharged condition, for when a battery so treated is re-charged the specific gravity of the liquid will then be too high; the new acid should be put in if a test of the specific gravity—*when the battery is fully charged*—shows that to be necessary. I think that is chemically sound advice, and I am obliged to "Regular Reader" for the suggestion.

The Midget's Day.

I HEAR that prices of radio sets during the coming season in America will show great reductions, some of which result from the huge stocks which were left on manufacturers' hands after last year's terrific financial slump. The most interesting feature amongst the new designs is the "midget" type, which is said to be becoming very popular. The "midget" is generally shaped like a mantelshelf clock, and includes loud speaker and power unit. An average size is 18 inches high by 14 inches wide, and an average price is £12, including four or five valves.

"Good-Bye—and Thanks."

SO it's good-bye now to John Ansell, of the B.B.C., who has resigned in order to take up theatrical work. As conductor of the Wireless Orchestra at 2 L O he has given satisfaction to most of his listeners; he was a "reliable," and never let us down. He appeared to me to have just

(*Continued on next page.*)

RADIO NOTES AND NEWS

(Continued from previous page.)

that fine appreciation of what a popular orchestral concert should be which I should like to see exercised by others at Savoy Hill. I believe that Mr. Ansell, like most of the B.B.C. resigners, said that he had no difference with the Corporation in regard to his determination to leave its service. Well, good-bye, sir, the best of luck, and thank you!

A New Irish Station.

MARCONIS announce that the Irish Free State have ordered them to supply a broadcasting transmitter, to be erected in a central position in the State. It will have an aerial energy of 60 kilowatts, and will therefore rank as one of the most powerful broadcasting stations in Europe. Autumn of next year should see this giant at work. The same firm state that during 1930 they have either supplied or received orders for broadcasting stations for Beromunster, Bâle and Berne in Switzerland, Spanga (Sweden), Reykjavik (Iceland), Trieste (Italy), Warsaw, Lwow and Wilno (Poland), Brno (Czecho Slovakia), Viipuri (Finland), and Rome and Vatican City in Italy.

It Had To Come!

AN announcement of an invention for eliminating "atmospherics" was overdue, the last having been made over six months ago—and we always look for at least two per annum! However, better late than never! It is reported that a Genoese, Signor Bruni, has done the (so far) impossible, and that the Italian Broadcasting Company is helping him to try out the apparatus. All concerned will please forgive my good-natured scepticism. If Signor Bruni proves to be the inventor of radio's "long-felt want" he will be called blessed from here to Elysium.

Short Waves as Doctor.

ANOTHER claim to a discovery of importance emanates from two doctors of the West Pennsylvania Hospital Institute of Pathology, who are reported to have stated that by the use of short waves they have succeeded in weakening slightly the poison of the diphtheria bacillus. Pity the waves do not cure the common cold in the head! However, we must be thankful for weaker malignant bacilli of any kind, I suppose. I give my vote to radio experimenters like these two does, rather than to those who specialise in killing mice, etc.—though even that, wholesale, would have a sanitary effect!

For Discriminating Constructors.

DO you build? If so, do you make your cabinet, and if so, do you paint and grain 'em, French polish 'em, or inlay 'em with rare woods and ivory? Whatever you do to beautify the outside of the set's jacket, perhaps you may be fired with resolve to try your hand at imitating the latest dodge of a well-known manufacturer who paints the cabinets with celluloid; as a matter of fact the celluloid is dissolved and the solution is applied with an air-brush—no, I have *not* dropped an aitch! This "finish" is said to be harder than varnished paint and dries in a day, but is more expensive.

New Honour for Marconi.

CONGRATULATIONS to the Marchese Marconi on his latest honour, his election to the Presidency of the Italian Academy. I do not know whether he ever feels embarrassed with the numerous marks of esteem which have been showered upon him, or whether he can recollect how many he has received, but I am sure that this last one must have given him especial pleasure because it comes from his own country. In spite of his mother having been an Irish lady, Marconi has always been at heart an Italian, and a jolly good one, too.

Latest Motoring Sensation.

RADIO on the private car has hitherto generally been confined to reception but now a more aggressive policy has been conceived and an equipment, including a driver's microphone and loud speaker, has been devised for enabling the car to deliver audible signals to "cops" and road-users. Can't you imagine a man in a hurry and a huge seven-seater shouting to a timid lady in a "baby" gutter-hugger, or passing a few well-chosen remarks to a policeman—at a safe distance, for the thing can make itself heard for about a hundred yards?

SHORT WAVES.

INSTALMENT PLAN WIRELESS.

Radi-owe.—"Sunday Pictorial."

* * *

"My husband says he would much rather listen to the wireless than listen to me," said a woman in a London police-court.

He realises that every broadcasting station closes down sooner or later.—"Humorist."

* * *

AN INTERESTING NEWS ITEM.

We are given to understand that if a steam roller ran over a new type of portable wireless set, recently placed on the market, the owner would not be very upset.

* * *

Sandy had installed a wireless set in his house, and on the first Sunday he sat very soberly and silently listening to a minister preaching in a church. Suddenly he laid down his headphones, leant back in his chair, and burst into a fit of laughter.

"Oh, Sandy, Sandy!" cried his wife. "What's up wi' ye?"

"Wheest, Maggie!" he replied. "They're takin' the collection!"—"Tatler."

* * *

"Miss Minnie Powell, of the San Francisco's Babys' Aid Society, has installed a wireless set in the home, and many of the babies are equipped with ear-phones, as the radio is found to be very useful in producing sleep," we read in the "Birmingham Daily Mail."

Sufferers from insomnia please note.

* * *

THE MASTS OF MOORSIDE EDGE.

On Sunday a party of youths, taking their afternoon stroll, stopped to gaze up at the clouds. Said one of them:

"By Jove! I'd like to climb up there; it must be great to get a view like that, and if I had a chance I'd go up."

"Go on!" was the swift and crushing rejoinder. "Tha'd be dizzy if tha climbed up a brush handle."—"Leeds Mercury."

The Uphill Road.

THE way of the radio man is indeed hard sometimes, especially if he is trying to develop a new thing, and this is well illustrated by the trouble which organisers of "radio exchanges" have in their negotiations with town councils. I have repeatedly recorded the peculiar decisions and the still more peculiar reasons for those decisions emanating from town councils, and I think that Dundee deserves a line or two. Their Council is reported to have turned down an application for permission to install an exchange because it is not desirable to have wires crossing the streets. I think that the L.C.C. ought to have its attention drawn to this grave warning, for the City must be a perfect death-trap!

Marine Radio de Luxe.

WHAT is claimed to be the most advanced radio equipment ever placed aboard a merchant vessel was carried by the American liner, "Morro Castle," on her recent maiden voyage to Havana. The apparatus comprises a central receiving station of the superheterodyne type and an electric gramophone and from these music, either radio or "potted" can be distributed simultaneously to the public rooms of the vessel. A large "library" of records is carried, so that one way or another life on board can be one glorious feast of melody. Per-haps!

Cellaradio.

THE new B.B.C. studio, warehouse type, warranted rat-free, has created a lot of satisfaction amongst connoisseurs of transmission, because it is so big and its acoustic properties favour the "mike." They say that our warehouse studio is the largest in the world, and I expect that it is unique also because the rats had to be evicted before the paid pipers would go in. It is rumoured that there is great competition amongst the double basses for a seat in a certain spot said to smell of old port! Students of fungi and moulds should apply for specimens to the chief cellarer!

"Key to the Ether."

THIS booklet, given free with "P.W." for October 18th, has been the key also to our readers' affections, and kind words have been the order of the month at Tallis House. So many "bouquets" were received here that the infection spread and our Mr. Bird was actually overhead to congratulate our Mr. Rogers on our Mr. Rogers's smart appearance! Mr Rogers acknowledged the graceful tribute with a bow and commented favourably on the knee-hang of Mr. Bird's nether coverings. Isn't it all *too* nice? Well, the "key," like politeness, costs (you) nothing, and I hope none of you has missed it.

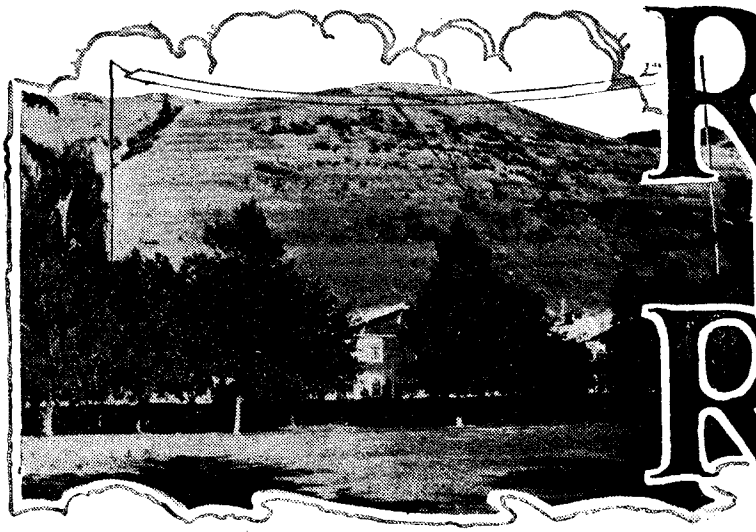
Our Conservative Navy.

I FELL into conversation recently with an electrician who, during the war served as a wireman—or something humble in the electrical line—in the Navy, and he amazed me by telling me that when he had his first soldering job and applied for some flux he was given the old-fashioned chunk of—what was it—sal-ammoniac?—and some spirit of salts. When he expressed surprise he was told that when in Rome he must do as the Romans do. I wonder whether things have improved since 1918!

Ottowa's Big Ben.

IMPRESSED by the way in which Big Ben booms the time to listeners, the Canadian National Railways is arranging a similar stunt for its huge hook-up of Canadian stations. The chime chosen is that of the clock in the Peace Tower of the Parliament buildings at Ottawa, and the 6 p.m. Sunday evening broadcasts from Ottawa will always commence with it in future.

ARIEL.



Radio in the Rockies

All about K U O M, a pioneer broadcaster of North-West America. From a SPECIAL CORRESPONDENT.

PERHAPS if you would care to glance for a moment at your atlas or map of the United States it might help you to appreciate in a single moment more information concerning the almost isolated position of Station K U O M than I could describe in ten times that period.

The chain of the Rocky mountains descends through the North-Western American State of Montana, cutting it almost into two equal divisions. Almost in the centre of this chain of the Rockies is the city of Missoula. It is a wild, apt-to-be-isolated city, this Missoula. Perhaps that is the reason why, after the preliminary inception of radio in the United States, Missoula decided to possess its own broadcasting station.

How It All Began.

At any rate, after two years' experimentation, the radio station of Missoula was officially opened for regular broadcasting on February 17th, 1925, and, with the single exception of a change-over period to a greater power during the summer of its opening year, K U O M, Missoula's broadcasting station, has been functioning daily ever since.

Station K U O M was conceived, developed, and put into regular operation by the authorities of the State University of Montana. It is still operated by its original owners, its transmitting plant and equipment being located on the *campus* of the State University of Montana in the city of Missoula.

K U O M's aerial power is of the order of 500 watts. Its aerial is of the simplest type comprising merely a double stretch of wire slung between two 150 ft. wooden masts. Yet so efficient is the transmission of this station that its broadcasts have been heard not only as far east in America as Maine and Pennsylvania, but also as far north as Alaska. Its signals have also been picked up in South Mexico, but, so far as official records go, the station has still to be heard in Europe.

All Over the States.

Perhaps K U O M's success in distance-getting is due to the natural elevation of its situation in the Rockies. Despite the fact that its aerial is to a great extent shielded by the rise of Mount Sentinel to 1,900 ft. almost immediately behind it, reception on the other side of the Rocky Mountains is said to be in no way diminished. Reception, of course, of K U O M on the Pacific coast, is commonly reported, the station being situated on the slopes of the Rockies facing "Pacificwards."

The transmitter at the Missoula station is of no strictly orthodox type. Rather it has been put together carefully and skilfully from components. Originally, the station's transmitter was designed and erected by Dr. G. D. Shallenberger, of the University Department of Physics, and whilst the original apparatus has been subjected to considerable modifications and alterations during the course of time, it remains, in broad outline, the same in pattern.

A Home-Made Outfit.

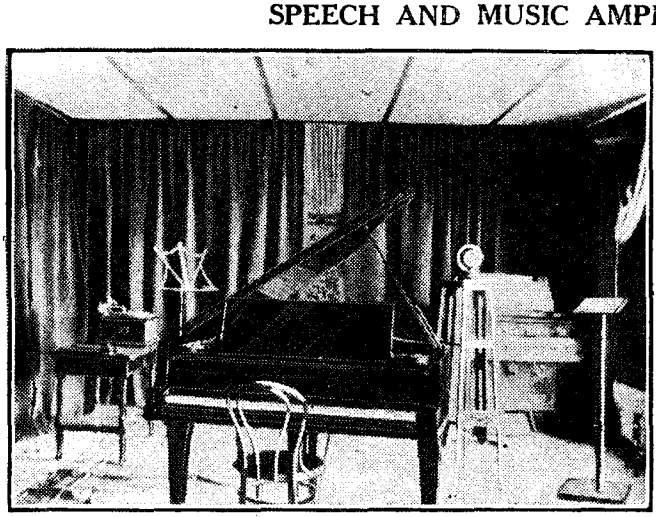
If anything, the present 500-watt transmitter follows Western-Electric design. It is of a simple three-valve type, its tuning coils comprising flat copper strips which permit of variable clip connections.

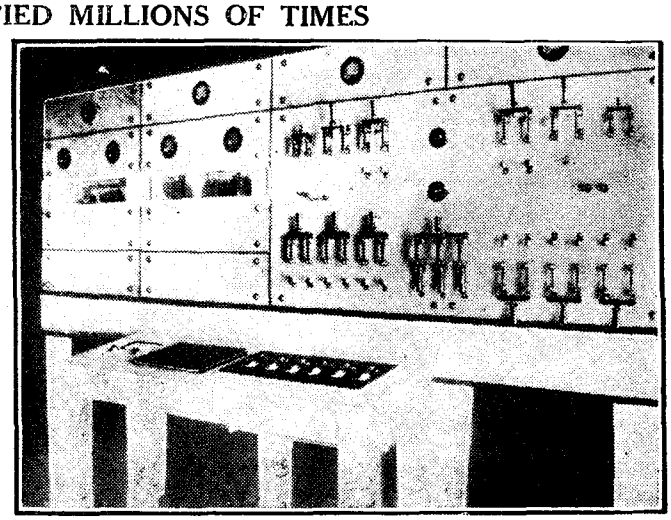
The entire transmitter is admirably self-contained and boxed in. Adjoining it is the main switchboard, a neat and clean-looking piece of workmanship which, I might add, is regarded locally as being something rather in the nature of a real work of art.

Anyhow, not only are the control meters of the transmitter itself situated on this

(*Continued on next page.*)

SPEECH AND MUSIC AMPLIFIED MILLIONS OF TIMES





The studio at K U O M and the main switchboard. Between these two the energy representing the speech and music is amplified millions of times by valve magnifiers.

RADIO IN THE ROCKIES.

(Continued from the previous page.)

switchboard, but on the same board are to be found the main power switches, aerial controls and switches, whilst mounted on a small desk in front of the switchboard are the modulator and studio controls of the installation.

For the Farmers.

The studio at K U O M is worthy, at least, of a passing note. It is of the wall-draped variety, the roof of this apartment being covered with tightly-stretched fabric which conserves the sound but yet serves to impart some desirable semblance of echo into the musical transmissions.

Programmes at the present time are sent out from K U O M on a wave-length of 244 metres.

Daily (except on Sundays, on which days a religious Service only is transmitted) a programme is broadcast consisting of market and weather reports, news summaries, matter on commercial and agricultural activities of the State of Montana and the North-Western States of America generally.

This commercial broadcast begins at 6.30 p.m. (U.S. Mountain States' Time). Later on in the evening come musical items, vocal and instrumental, popular talks of a *ten-minute* maximum duration (B.B.C. *do* kindly note!), and other miscellaneous items.

Whilst, of course, Station K U O M is, perhaps, chiefly valued by its surrounding population on account of the agricultural news which it affords, its entertainment and cultural broadcasts are hardly less prized.

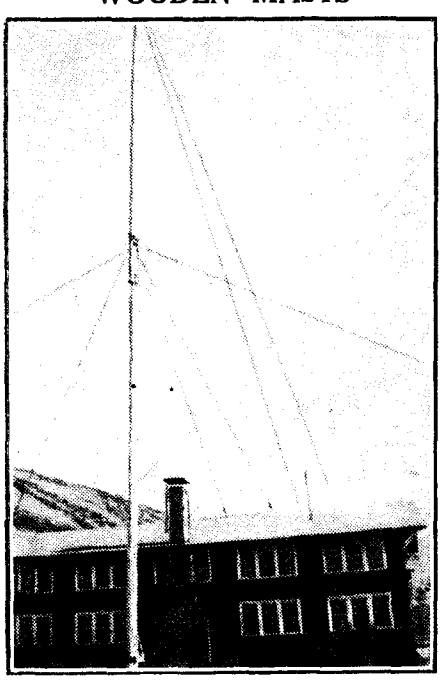
Station K U O M brought Radio to the Rockies. One of the pioneer stations of North-Western America, it has ever been anxious to put forward recreational, educational and really interesting programmes. Local opinion is unanimous on the fact that the Missoula Station has lived up to its aims.

Here, in England, of course, we cannot judge, because Station K U O M is probably entirely out of our reach.

A Great Little Station.

Nevertheless, one cannot help but admire that lonely little radio station in the heart of the Rockies which energetically and with the greatest enthusiasm has, during the last five years, flung out from its hilly situation broadcast news and entertainment for the benefit and interest of its mountain and agricultural listeners.

WOODEN MASTS



The aerial at K U O M is of the simplest kind, and is fixed between two wooden masts, but its radiation efficiency is excellent.

TESTING TIPS.

Always "Try a Change" if Possible.

IT is surprising how easy it is to overlook the most obvious tests for certain troubles which crop up in receivers. The following illustration will serve to bring home the point.

An enthusiast had a certain receiver, on which he could get the local station quite loudly. He could also obtain excellent results on long waves, but on the medium broadcast band he could hear only two or three continental stations very weakly, apart from the local station.

The reaction control was perfectly smooth right up to the point of oscillation all sorts of coils had been tried, the aerial had been taken down and completely renewed, the batteries were tested.

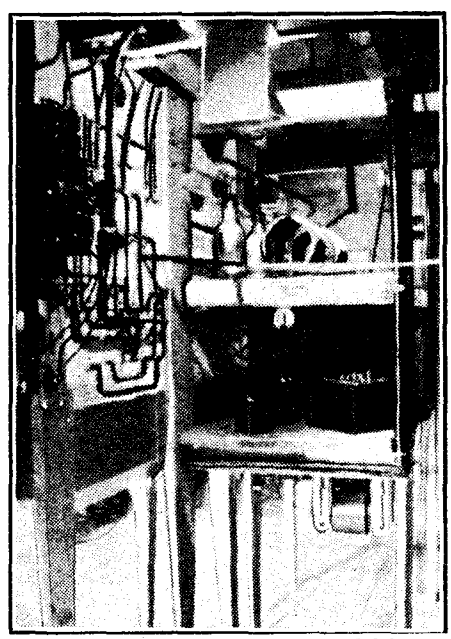
The Substitution Test.

"Have you tried your set on a friend's aerial and earth system?" he was asked. Like a bombshell the realisation broke in on him that he had been too engrossed in trying to find some mysterious fault that he had overlooked the obvious.

When you are up against a peculiar trouble, always make the most obivous tests first. For instance, if you cannot trace the cause of distortion and you are using a unit, try the set on a friend's batteries.

Or again, if your S.G. stage does not seem to have any pep in it, and there is no apparent fault, try another valve in place of the present S.G. valve.

HOME-CONSTRUCTED!



The K U O M apparatus was assembled from components in the same sort of way as a home-constructor builds a set.

A HANDY "OILSTONE."

AN oilstone of one variety or another is really an indispensable article in the workroom of the busy constructor.

Naturally, for the heaviest use, an orthodox pattern of oilstone should be used, but for the purpose of keeping an edge on chisels and other cutting tools—particularly if they be small ones—the "oilstone" depicted in the illustration will be found to serve a very useful purpose.

It is made simply enough. Merely glue an old photographic negative (quarter-plate size is the best) down to a suitable wooden base. If the plate is heated before the application of the hot glue the latter liquid will not crack it, whilst after glueing, of course, weights should be placed on the plate for twenty-four hours in order to keep it firmly in contact with the wooden baseboard.

For use, sprinkle a little glass powder, or better still, emery powder (about No. 0 grade) on the surface of the glass, and then work it up with a little oil.

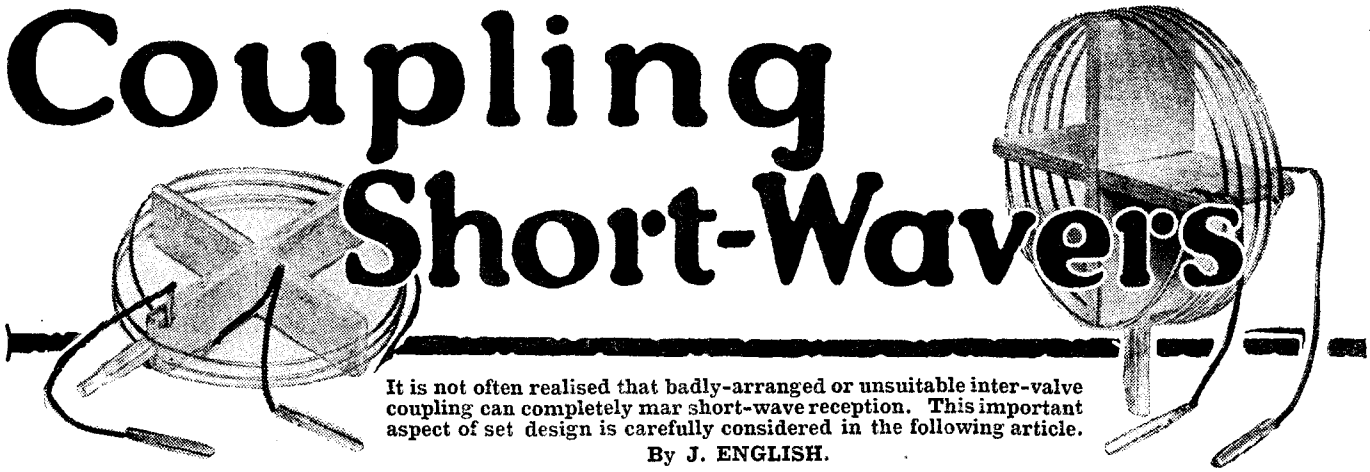
Screwdrivers too!

A very effective "oilstone" surface will then be provided at a cost of next to nothing. Its regular use will keep all varieties of cutting edges in good order, and even screwdrivers may be given a few rubs on the surface from time to time in order to keep their edges in condition.

PUTTING AN EDGE ON IT

Trimming a screwdriver's edge on the home-made oilstone.

Coupling Short-Waves



It is not often realised that badly-arranged or unsuitable inter-valve coupling can completely mar short-wave reception. This important aspect of set design is carefully considered in the following article.

By J. ENGLISH.

IF one of your friends were to ask you to give your opinion of his short-wave receiver, you would naturally look for such things as easy tuning, smooth reaction, and general sensitivity, features which are mainly to do with the tuning arrangements and the detector valve.

How many of you, I wonder, would examine closely the coupling between detector and first L.F. valves? This is so often taken for granted that it is not generally realised that a badly arranged or unsuitable coupling here can completely upset the working of the receiver and cause its owner much disappointment. Choose the right coupling, however, and you score heavily in short-wave reception.

Of the several types of L.F. coupling, the transformer is undoubtedly the most widely used in short-wave sets, while resistance-capacity-coupled detectors, although somewhat out of vogue at present, rank second.

Dodging Threshold Howl.

Most people use a transformer because it is such an easy coupling and one which produces the most volume without being too particular about the detector valve that precedes it.

In spite of all its attractions, however, the transformer must often be held responsible for that bugbear of short-wave reception—threshold howl. You know it well; just when you are getting reaction screwed up to the most sensitive point, an L.F. howl starts off.

All short-wave enthusiasts come across this irritating condition at some period in their career, and then feverishly try out a long list of recommended "cures." We blame the transformer because it is the inductive load of its primary in the detector's anode circuit that is the main cause of all the trouble.

Threshold howl may not be the particular vice of your short-waver, but you will have noticed that your transformer-coupled detector requires nursing with potentiometer-controlled grid bias and careful H.T. adjustment if you want that smoothness of reaction control without which the detector-L.F. type of short-wave set is more or less a failure.

In spite of the relatively smaller amplification given by R.C. coupling one cannot help appreciating that it has its attractions for short-wave work.

It is possible so to design a coupling system that one retains all the virtues of resistance and transformer coupling without any of their vices.

Some amateurs prefer to use two R.C.-coupled stages just for the sake of a quiet background and freedom from threshold howl. Sometimes it is a little difficult for you to get full and smooth reaction from an R.C.-coupled detector, but old hands know how to get over this difficulty and to make control quite smooth.

However, to get the best results means careful choice of coupling components and of valves which is, perhaps, one reason why R.C. coupling does not appeal to everybody.

Now I have purposely dwelt upon the respective merits and disadvantages of transformer and R.C. couplings because this naturally leads you to visualise an ideal method which combines all their virtues with none of their vices.

The Shunt-Fed System.

This "dream" coupling can be materialised in quite a satisfactory form if we use a scheme which has recently come to the fore, namely shunt-fed transformer coupling. The general scheme is shown in Fig. 2, and if you compare this diagram with those of Figs. 1A and 1B you will see how much it owes to transformer and R.C. coupling while being different in the way it works from both of them.

Here anode current is fed to the detector through R which also diverts the speech frequencies through the easier path of C and transformer primary. Since the latter no longer carries the steady detector anode current this scheme is very suitable for small-type transformers which cannot tolerate much D.C. through their primaries.

In addition, if a variable resistance is used for R, you have a further control of reaction which increases as R is decreased, and vice versa.

This provides wider control than is possible with the usual variable condenser which can here be used mainly for fine adjustments of reaction, being left set at about half maximum capacity.

Now for some practical details. If you use a modern transformer with a high-inductance primary, the condenser C can have a value from ·5 to 1 mfd. when the detector valve has an impedance between 15,000 and 20,000 ohms.

Values to Use.

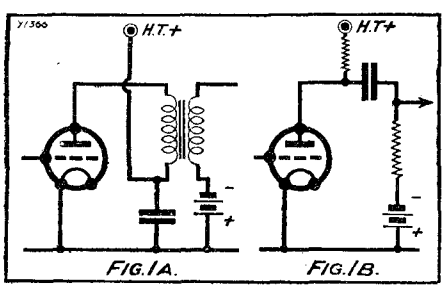
The majority of amateurs now use for a short-wave detector a valve with an impedance rated at round about 20,000 ohms; the working impedance with grid-condenser rectification is, of course, somewhat less than the manufacturers' rating. A suitable value of R is then 50,000 to 80,000 ohms, and for a variable component 0 to 100,000 ohms.

From practical experience of this coupling I find that the fuller control which the variable resistance gives, apart from the other advantages of the scheme, is an ample compensation for the additional cost of this component.

As regards reaction circuit connections, the series arrangement shown in Fig. 2 is generally the more satisfactory, and provided the maximum capacity of C_2 does not exceed ·0001 mfd. there is no risk of high-note-loss.

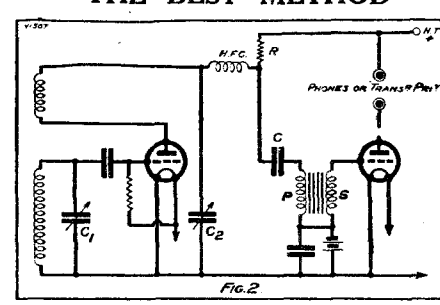
Notice that the detector can have a common H.T.+1 terminal with the L.F. valve, the best operating voltages ranging between 60 and 90 volts according to the type of valve used in the detector stage.

HOW COUPLING AFFECTS SHORT-WAVE STABILITY



Whereas plain transformer coupling is likely to provide threshold howl, resistance coupling is almost immune from that fault.

THE BEST METHOD



This method of shunt-fed transformer coupling is quite satisfactory, and is recommended by the author.

THE FUTURE OF TELEVISION.

The subject of television broadcasts is still under review by the B.B.C. Meanwhile an independent television station is in the process of construction.

DISCUSSIONS at Savoy Hill still continue around the question of Television. Shall further facilities be granted? Shall the present ones be restricted or stopped? No definite decision seems to have been arrived at—at least, as we go to press with this issue of "P.W." the matter is still more or less in the melting-pot.

Arguments have been put forward for and against the idea of the B.B.C. linking itself up with Television interests—and both the "pros" and the "cons" have waxed eloquence. Even Sir Ambrose Fleming, the distinguished physicist and radio engineer, has put his views into print.

Cutting Into Programme Time.

The other day Sir Ambrose wrote in the "Daily Mail":

"At the present time the B.B.C. is granting half an hour, from 11 a.m. to 11.30 a.m., for a television broadcast, and also often half an hour after midnight.

"But these times are impossible for busy people. The pick of the day is about 4 to 6 p.m. and 8 to 10 p.m. We can sit down now after dinner, even at 200 miles from London, and attend a Queen's Hall Concert in London, conducted by Sir Henry Wood. We want to be able to do the same thing for television and take a 'look-in' at some interesting picture transmissions of *real* objects and *real* events, not merely made-up televisions plays."

However, Sir Ambrose admits that it is hardly reasonable to expect the B.B.C., whose principal work is, and must be, the broadcasting of music and speech, to cut into its best times with television transmissions.

And Sir Ambrose adds:

"It will be a long time yet before we can hope to see as well as hear the performers in the B.B.C. studios, or public events such as the 'Varsity boat-race or Cup-Final football match. But the time is ripe and the means available for the television of film pictures of actual objects.

Facilities at Hendon.

"This, however, implies and requires separate television studios with their own transmitters and assigned wave-lengths. This must come if television is ever to have its proper place in the entertainment field. A beginning of it is now in progress from a station at Hendon, which will transmit on a 50-metre wave-length."

This Hendon station seems to solve the B.B.C.'s problem. The G.P.O., having granted the Hendon station television broadcasting facilities, relieves the B.B.C. of the responsibility of further assistance—assistance which, by the way, it has already given very generously.

According to Sir Ambrose, whatever television system is ultimately successful, the details of the requirements necessary for successful television are clearly understood, and it is only a question of time, talent, and expense to bring about the desired result and give us in the future television in the home as efficient and attractive as is now the radio transmission of music and speech.

"Time, Talent and Expense."

If that be the case, then the Hendon station should prove even more valuable than the facilities offered by the B.B.C., for at Hendon those concerned on the development of television can have, within the limits of the G.P.O. licence, a free hand.

After all, although, as Sir Ambrose ingenuously admits, it is only a question of "time, talent and expense" to bring about the desired results, it is better that television should have its own home in which to work out its destiny.

The time factor alone may mean one year or a hundred; the talent we can take for granted—and no doubt the question of expense can be satisfactorily dealt with.

So that's the position to-day. Long Acre and Hendon—one, the incubator of television—the other . . . well, there again, only time will show.

TELEVISION AT A BERLIN THEATRE

The transmitting section of a Baird television outfit that recently figured in a series of interesting demonstrations at the Scala Theatre, Berlin.

MARCONI ON TELEVISION.

"Television is still in the experimental stage, but in the next decade I think you will find that it will be installed in as many homes as now have wireless sets. Television and wireless will bring the world to the cottage parlour. Wireless has speeded up life; it will speed it up still more when we are complete masters of the ether. This is not yet the case, but in ten years we shall be approaching complete control."

(The above opinion of television was given by Marchese Marconi in an interview which was recently published in "The Sunday Express.")

THOSE B.B.C. "BIRTHDAYS"

Friday, November 14th, is the eighth anniversary of the beginning of the B.B.C. Everybody likes to celebrate his birthday in some way or other and hitherto the B.B.C. has been no exception to this excellent rule.

Usually the celebration has taken the form of a concert by members of the staff—enjoyable informal affairs which listeners always said were very pleasant because they departed from the general rut and provided opportunities of hearing people whose job does not often bring them in front of the microphone.

There were sketches, songs and gags, many of them quite clever and lively tunes, especially those written by Mr. Roger Eckersley, the Director of Programmes, which were easily good enough to give him a place with people who are entitled to be called writers of songs.

Informal!

Listeners liked those birthday programmes and will be genuinely sorry that the edict has now gone forth to stop them. The time has come when Savoy Hill thinks the Corporation to be so well established that its own birthday is not a thing to foist upon the public.

There may be some justification in adopting this attitude, but after all the B.B.C., like the rest of us, has only one birthday per year, and while the staff may be their severest critics in judging the standard of their own annual show, many people would no doubt prefer to hear the irresponsibilities of programme builders than the concert by the National Orchestra of Wales, the chamber music and the poetry reading which is down for the evening of November 14th.

The "PHONE-CONTROL" UNIT

A remarkable device which combines the advantages of a loud-speaker output filter and 'phone tags with volume control.

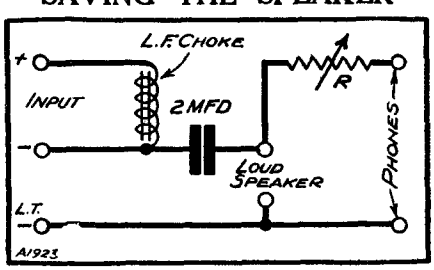
By G. P. KENDALL, B.Sc.

HAVE you ever tried to run a pair of leads into another room so that someone could listen there with headphones while the receiver was working the loud speaker as usual? If you have, you will have discovered that there is a catch in it.

The difficulty is the very obvious one of volume. Signals which are strong enough to work a loud speaker comfortably are pretty sure to be quite unbearable in headphones, and at first glance it appears difficult to find a way out.

If you yourself have never had occasion to try to do something like this you might be inclined to say, "Well, what about it? Who wants to do stunts like that, anyway?" It is just a matter of whether you have ever encountered the particular circumstances that cause you to want to do this kind of thing. If you have, you will know that it is a natural enough proceeding.

SAVING THE SPEAKER



The L.F. choke takes the brunt of the H.T. current, and thus protects the loud speaker.

How It Happens.

How it usually happens is something like this. Some member of the household is ill in bed and drops the hint to the effect that it would help to pass the time if only he or she could hear the wireless. You then proceed to buy the necessary number of yards of twin flex, and run it from your set up the stairs and into the sick room, at which point you generally realise that you are going to be up against it.

In all probability you only have just the one loud speaker, and so it naturally occurs to you to make use of the odd pair of 'phones which most people have. This is where the volume question comes in, and in all probability you will see it coming.

You have the choice either of giving the sick person the headphones and keeping the loud speaker where it is, or of bringing the loud speaker upstairs and using the headphones near the set, but whichever you do some adjustment of strength must evidently be made before the scheme will work satisfactorily.

Another Possibility.

It sometimes happens, too, that you wish to use both 'phones and loud speaker in the same room, for example, when one of the listeners is rather deaf. Deaf people often find that they can hear very much better with 'phones when a fair volume is available than from the speaker.

To enable you to carry out all these schemes with the greatest of ease we have designed the special control unit which you see illustrated on this page. It is, in the first place, an output filter unit, which, of course, you always require when working with extension lines and also when using 'phones with a fair sized set.

Combined with this is a very simple volume control scheme for the adjustment of strength in the headphones, which you will discover solves all problems at one stroke.

A glance at the little circuit diagram will show you how it works. You will see that it is in the main a perfectly ordinary output filter unit, with the addition of a 'phone circuit shunted across the loud-speaker terminals with the volume control in series with the 'phone terminals. The volume control, by the way, is just a variable resistance of suitable value, and it is so connected up that it gives you a complete control of strength in the headphones, at the same time preventing the 'phones from affecting the working of the loud speaker in any way which you can discover.

The general details of the construction of the little unit you will find quite clear in the photograph and diagrams, so let us devote the rest of our space to telling you how to connect it up and use it.

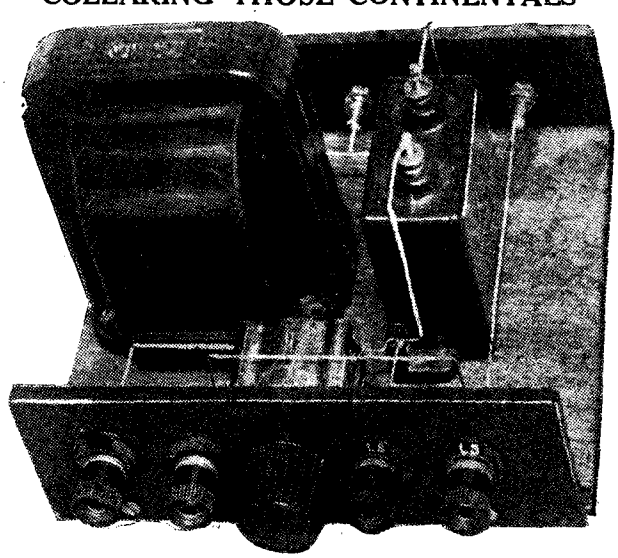
Along the terminal strip at the back you will observe that there are three terminals, a pair of marked input plus and minus, and one marked L.T.—. The input terminals, of course, are to be connected to the output terminals on your set, carefully noting which is positive and negative. (The positive input terminal on the unit should go to the output terminal on your set which is wired to H.T.+).

Extremely Simple, Isn't It?

A lead should also go from the terminal marked L.T.— on the unit to the corresponding point upon the set, or to H.T.— or earth. Along the front of the unit you will find there are two pairs of terminals. The ones marked L.S. are quite obvious in their application. The other two are for the 'phones, or the extension lead which goes to a different room where the 'phones are to be used.

(Continued on next page.)

COLLARING THOSE CONTINENTALS



You can fit on 'phones when you want to search for those very distant stations, adjusting the volume to the most comfortable degree.

QUALITY COMPARISONS.

By G. V. DOWDING, Associate I.E.E.

Have you ever listened to a broadcast item over the radio the same evening that you've heard the original performers? Our Technical Editor has on several occasions, and he gives you his impressions regarding these interesting experiences.

RADIO amateurs should attempt to hear as many broadcasters in the flesh as they possibly can. Only by doing this is it possible to keep unbiassed one's judgment of the results given by one's own set.

You see, the ear is rather too accommodating at times. You can get so used to a form of distortion, or to an interference such as mains hum, that, eventually, you do not notice it at all.

"Squeaky and Raspy."

This fact sometimes leads to amusing situations. You get one amateur declaring that some friend's set is a horrible affair, and that it is "tinny," "squeaky," "raspy," and altogether horribly "high-pitched." The friend listens to his critic's outfit and says that he considers it "boomy," "drummy," and completely minus high notes.

Then someone else comes along, hears both receivers working, and states it as his opinion that both are pretty rotten—they ought to hear his latest hyper-super-senso-dyne, etc., etc.

I expect all three would get rather a shock if they could hear, say, Jack Payne and his Boys in a concert hall, and then immediately be switched back to their homes to listen to the same band after its music had been subjected to the usual one hundred and one radio processes ending up with a good old "mangling" through a not-too-good receiving equipment.

I have heard the Wireless Orchestra in the studio and at home on my set within the same hour; I have conversed with Sir Oliver Lodge within a short period of hearing him via a portable set in a friend's house; the original voice of Captain Eckersley has still been ringing through my head when he has been announced on the radio while I have been listening on a crystal set; I have watched a dance band at work in Manchester one evening and heard it via the radio in London the next evening; I have listened to Tom Jones and his Grand Hotel Orchestra in the hotel itself and then listened to the same thing on a portable, in Eastbourne, after the music had travelled up to London by landline and back again to Eastbourne by radio.

"It Made Me Start."

I have heard an artiste's real voice and his loud-speaker rendering at one and the same time—a very interesting experience that!

All of you have the chance some time or another to make similar comparisons, even if you have to wait a little before you can complete the "couplets." Radio stars often appear at music-halls, local cinema organs and bands are sometimes broadcast, broadcast lecturers sometimes appear in the flesh at local societies, and so on.

Of course, the closer you can make your couplets—the original and the radio—the better, for the ear, as I have already indicated, is a terrible deceiver.

On this particular occasion I do not intend to say much about my own experiences—there is hardly room in this half-page or so—but I will say that I consider that we are now able to get very near reality with our radio.

I find that speakers are sometimes disconcertingly real over the radio. One day, when Sir Oliver gave one of his characteristic little coughs before commencing his broadcast talk, the uncanny naturalness of it made me start in my chair.

But you do want good gear most carefully operated to get orchestral music through with anything like fidelity.

NEXT WEEK

THE "DUAL COIL" ONE.

A Magnificent Little "DX" Set.

Baffling the B.B.C.

One of the hardest items of all to handle is the piano solo. The B.B.C. have found that at their end. It is not generally realised that the piano covers a range of frequencies extending from approximately 26 to 4,000 cycles, and that is without the harmonics.

There is no receiving outfit yet designed that can properly cope with such a range, and the average set is far from being able to do so. However, enormous progress has been made during the past few years, and if this progress continues at a similar rate the average receiver will soon be able to give wonderfully realistic results.

THE "PHONE-CONTROL" UNIT.

(Continued from previous page.)

Now about adjusting the volume. Suppose that you intend to use a loud speaker in the distant room and have the 'phones connected straight to the unit. In this case your extension lead will go to the loud-speaker terminals on the unit, and the loud speaker will be connected to their further ends.

So far so good. Now switch on the set, satisfy yourself that the signals are coming through to the loud speaker all right, and then connect your 'phones to the 'phone terminals on the unit.

Adjusting Strength.

Now just turn the knob of the volume control resistance until you are getting suitable strength for 'phones and the job is done. If you are providing for the convenience of a deaf person, it is as well to let them manipulate the volume control resistance for themselves.

We think you will see for yourself how to make the necessary volume adjustments when other schemes are in use.

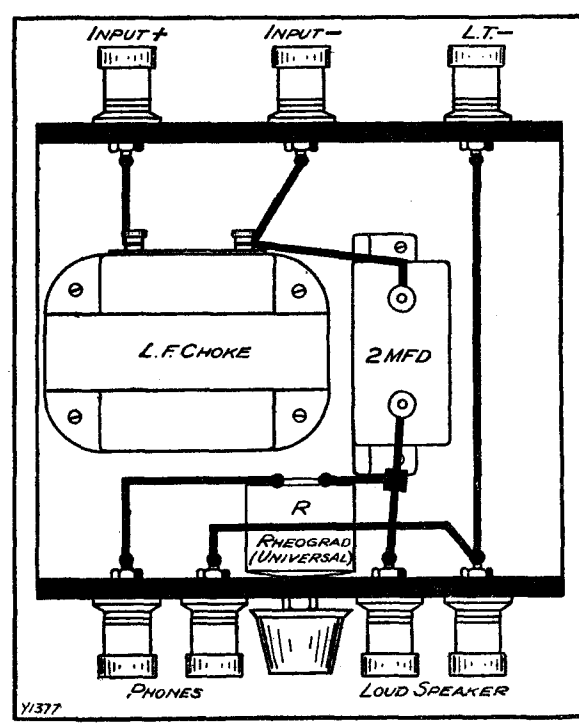
THE PARTS REQUIRED.

1 baseboard, 6 in. × 5 in.
2 terminal strips each 6 in. × 2 in.
7 terminals (Igranic, or Belling & Lee, Eelex, etc.).
1 Output filter choke (Lissen, or R.I., Ferranti, Varley, Wearite, Atlas, Magnum, Bulgin, etc.).
1 2-mfd. condenser (T.C.C., or Dubilier, Lissen, Mullard, Ferranti, Hydra, Igranic, etc.).
1 Variable resistance, any type with a low minimum value and a maximum of 100,000 ohms or higher (Atlas Rheograd, Universal model, or Rotor-ohm, etc.).
Various screws, wire, etc.

COMING SHORTLY

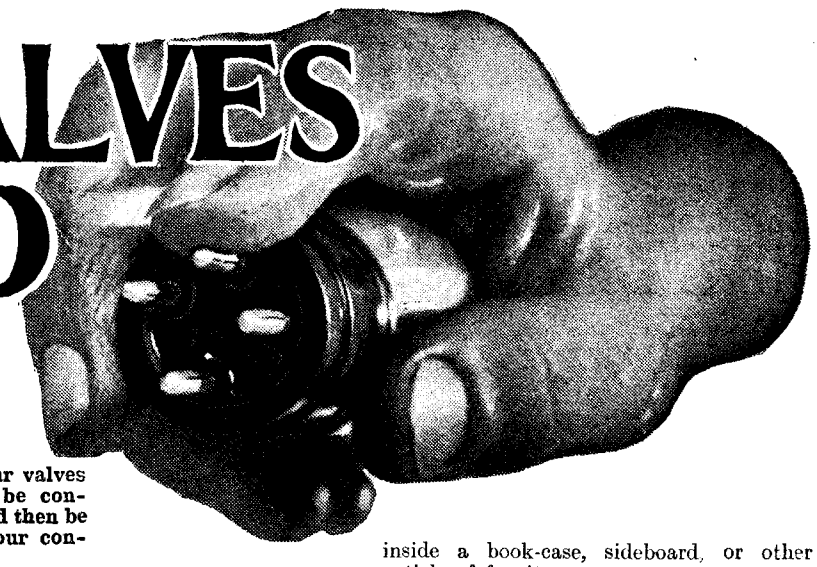
"Famous Radio Stars at Home."

YOU CAN'T GO WRONG



The circuit connections are very simple and straightforward.

NEW VALVES WANTED



BY CARDEN SHIELS

Is it not time some alteration in the design of our valves was made in order to allow radio receivers to be considerably reduced in price? Cheaper radio should then be obtained over here as in other countries, and our contributor points out how it could be done.

WHAT—the reader will say—*more* valves? No, thanks! We've got too many already. Think of all the screened-grid, pentode, indirectly-heated, power, super-power, and what not, and then have a heart and pity the chap who has to pick out exactly the right one for a given job of work!

But the suggestion is that the time has come to introduce an entirely fresh strain into the valve family. Something altogether different from the types with which we are so familiar. I don't mean anything so fantastic as the "cold-emitter" or the "photo-electric" valve, though perhaps even these are not so impossible as may appear. No, there are other novelties in valves which are actually on the market in other countries, though we never—or very seldom—see them over here.

A Peculiar Type.

For instance, the "sensation" of the recent Berlin Exhibition was the new Arcotron tube—otherwise known as the Bar valve, so called because of its unusual shape—which is being introduced and manufactured in Germany by the famous Telefunken Company.

Here is the real flavour of novelty—a distinct departure from standard practice. It is different not only in appearance and size, but also in operation. Last but not least it has been specially designed for mass production, so that it can be sold at a comparatively low price.

It is heated directly from the mains, and although the cathode carries 0·2 amp. of raw A.C. current there is no hum, partly because of the low terminal voltage (1 volt) and partly because of the unusual arrangement of the electrodes. The "grid" is not mounted inside the glass bulb as usual, but is in the form of a metal film or coating deposited in the outer surface of the glass.

Makes Cheap Sets Possible.

The "Arcotron" is used either for detection or low-frequency amplification. In the former case the valve is gas-filled, and detection takes place as a "leakage" effect between charges set upon the inner surface of the bulb and the signal voltage on the outside grid. No grid leak or condenser is necessary. When used for L.F. amplification the tube is highly exhausted, and the different stages are resistance-coupled, i.e., the plate of one valve is directly connected to the grid of the next.

All this makes for cheapness. In fact, the outstanding aim of the designers is economy, both in the construction of the valve and in the cost of the circuit components necessary to make the complete set. In addition they have achieved neatness and compactness—both very useful features in any kind of set, but more particularly in the case of portables.

Compactness is of itself a point worth special consideration. For instance, there is an American-built super-het. set containing no less than nine valves, all housed inside a casing 12 in. by 6 in. by 9 in.

A GERMAN JUGGLER

Dr. W. Reisser, at the Zehlendorff laboratory, testing a system by means of which he can interpose announcements in a relayed programme, and at the same time hear the programme before and after relaying.

Needless to say, the valves used are not of the standard British make, but are a special "peanut" type—about a quarter of the size. They are exceptionally efficient, however, for the work they have to do.

A smaller-sized tube—provided it is equally efficient—gives the set manufacturer, and the amateur constructor, wider scope for new ideas in design, particularly now there is a craze for "disguising" sets in various ingenious ways. I refer to those which are made to imitate a clock, or similar ornament, or stowed neatly away inside a book-case, sideboard, or other article of furniture.

Another type of valve which deserves consideration for the home market is the so-called multi-stage valve, of the Loewe type, where two, three, or even more sets of electrodes are mounted inside a single glass tube. For some reason or other, possibly because of the patent position, these valves have not yet been generally exploited in this country.

Mounting the Units.

The various "units" are resistance-coupled, and not only the valve electrodes, but also the coupling-resistances, grid-leak, condensers, etc., are mounted inside the glass bulb, so that in effect the "valve" contains the complete receiver—apart of course from batteries and loud speakers.

Some of the more recent developments of this type of valve in Germany are particularly interesting from the point of view of mass production. In the early models, the sets of electrodes were mounted in separate groups, which called for a high degree of skill and accuracy in assembling.

The Loewe tube is now being designed on a much simpler plan, which should have the effect of bringing the cost of production still lower. For instance, all the plates are assembled together as a single unit, consisting of two cylindrical tubes, the smaller arranged inside the larger. Radial partitions are fixed across the annular space between the two cylinders, so as to divide it into, say, five separate compartments. The filament and grid of each stage are then threaded through the length of each compartment, thus forming five complete sets of electrodes.

LATEST BROADCASTING NEWS.

"CANNED" PROGRAMMES

THE SCOTTISH EXHIBITION—ARMISTICE DAY—CHILDREN'S HOUR REVIVAL—NOTABLE BROADCASTERS.

HAS the time arrived when it will be no longer necessary for radio artistes to appear in person for their broadcast performances?

We know what the cinematograph film and "canned" music have done to bring the world's most famous actors and bands before the public in a way which people thought to be impossible a few years ago, but as yet the B.B.C. has given us no mechanical vaudeville programmes.

The possibilities of such a scheme are tremendous, but who would dare to suggest it? Apparently somebody has done so, because on Monday and Saturday next, November 3rd and 8th, complete vaudeville performances consisting entirely of gramophone records—artistes, incidental music, and even the announcements—are to be broadcast from the London studio.

The first programme will consist of American and Continental artistes such as Maurice Chevalier, Tito Schippa, Jack Smith, Segovia, Sacha Guitry and Yvonne Printemps; while the second programme will be devoted to British artistes, Sir Harry Lauder—whose fee is not less than £300 an hour for broadcasting—Gracie Fields, Henry Ainley, Gertrude Lawrence, Sidney Howard, and others. It is all so interesting that we hope nothing happens to prevent it taking place!

The Scottish Exhibition.

Scotland's first all-radio exhibition takes place in the Waverley Market, Edinburgh, from Wednesday, November 12th, to Saturday, November 22nd, and all Scottish stations are to broadcast the opening ceremony which will be performed from London by Sir John Reith, the Director-General of the B.B.C.

The Scottish Radio Retailers' Association is hoping for big results from the show, and all the principal wireless firms in the country will be represented.

One of the features of the Exhibition will be a model studio, on the lines of that erected at Olympia some years ago, through the glass panels of which visitors will be able to watch the actual performances of some of the afternoon and evening programmes for Scottish listeners.

Armistice Day.

The main items of the programme on Armistice Day, November 11th, will be in accordance with the solemnity of the occasion which, as listeners know, is an accepted principle of the transmissions for that day.

They will begin at 10.30 a.m. with a broadcast of the National Service at the Cenotaph, in Whitehall, which is to be attended by the King. Permanent lines were installed some time ago for broadcasts from the Cenotaph, while the microphones are carefully concealed and an out-of-the-way spot in Whitehall Gardens is used as a control point for the engineers to keep in touch with Savoy Hill.

At 8 p.m. there will be a relay of the British Legion Festival of Remembrance from the Albert Hall, which will be followed after the second news bulletin with a special Armistice Day "In Memoriam" programme from the studio, at the conclusion of which the "Last Post" sounded at the Menin Gate, will be heard.

Children's Hour Revival.

The last few weeks has brought some noticeable efforts on the part of wireless "aunts" and "uncles" to get more ginger into the Children's Hour programmes all over the country. It may be, and probably is, quite a seasonal matter brought about by the change from summer to winter time which, it is estimated, trebles the juvenile listening audience, for whom in these sophisticated days any old kind of slap-dash programme will not do.

Radio Circles still flourish everywhere, and the B.B.C. knows full well that the listening generation of the future must be fostered and made to realise the indispensability of broadcasting as an integral part of our everyday life.

Quite naturally the National Radio Circle has the largest membership, but the Northern Region is a good second. This winter the north has a fine scheme for the children which has an educational value beyond anything yet attempted in juveniles' programmes.

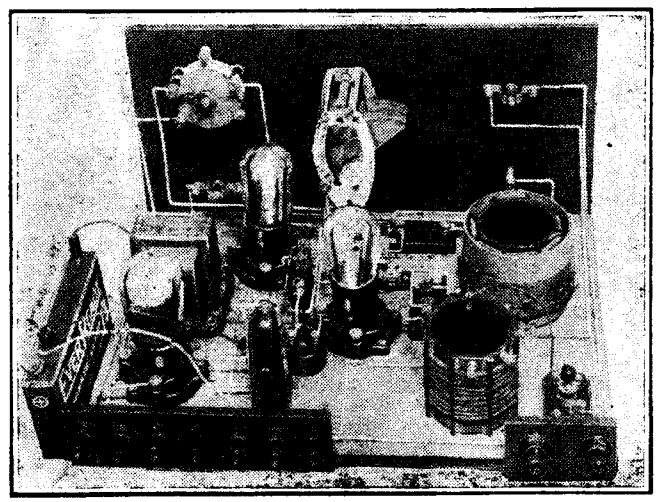
It takes the form of a competition for the best pageant, suitable for broadcasting, to be written and acted by members of a school. All schools in the north can compete and pageants may be written round anything of local and historical interest—town, village, castle, or personality.

The competition is open until the end of December and teachers may assist scholars in writing the script. It is intended to broadcast the four best plays on four Saturday afternoons in the New Year, the programmes to be given entirely by scholars.

Notable Broadcasters.

The Prince of Wales, the Prime Minister (Mr. Ramsay MacDonald), and Mr. Stanley Baldwin are all to be heard by listeners to the National and London programmes in the near future.

ANOTHER GLIMPSE AT THE "CONTRADYNE" THREE



Here is a photograph of The "Contradyne" Three ready to connect up. This fine set is fully described elsewhere in this issue.

FOR THE LISTENER.

By "PHILEMON."

A critical survey of some of the recent programmes, with frank comments on the fare provided and the way it is served up.

"Strife."

THERE will be no strife among us as to the success of the broadcasting of Mr. Galsworthy's play. It was an excellent example of what a radio play should be—a fine piece of dramatic work in itself, enhanced by the effects which the use of the studios can bring to its production.

The studios were subordinated to the play, not, as so often has happened, the play to the studios. The management of the "crowd" was excellent. The Savoy Hill "crowd" is really rather wonderful.

Mr. C. M. Hallard played the leading part very well indeed. The whole company seemed to be "on their toes," and achieved a piece of teamwork which will set the standard for a long while to come.

My only criticism—and it is a very minor one—is that one or two of the actresses rather overdid the screaming. Cries of agony and fear do not come over the wireless very well.

Congratulations to Howard Rose, the producer; and if, in course of time, we may have another Galsworthy, I prophesy a full house.

Oscar Wilde.

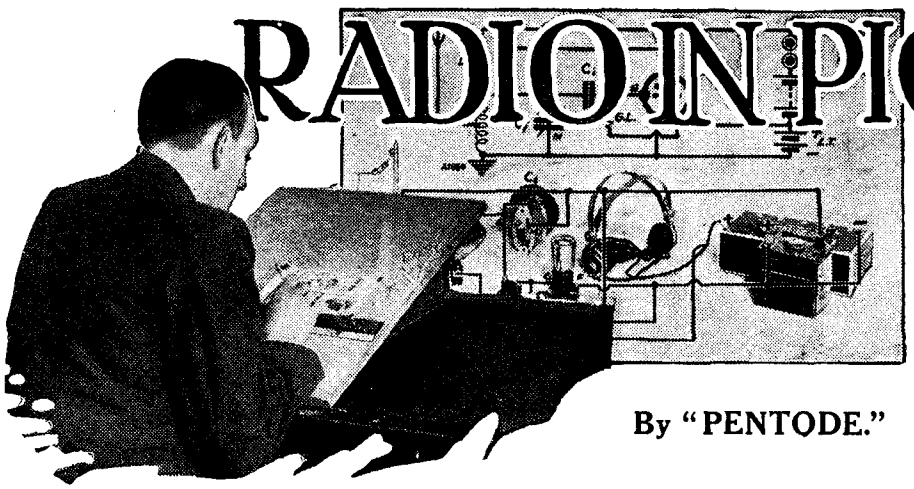
The next important dramatic transmission will be "The Importance of Being Earnest," Oscar Wilde's brilliant comedy. Heaven send you the clearest reception, for you cannot afford to miss a word of that play.

On the Road.

Lieut.-Col. Brabazon is a very good salesman. When he was describing the light cars exhibited in the Motor Show, my mouth watered—the glossy, spry little things! In my imagination I ordered several;

(*Continued on page* 398.)

RADIO IN PICTURES



By "PENTODE."

3.—REACTION.

Continuing a novel and fascinating series of articles, our popular contributor describes two complete one-valve circuits, embodying different forms of reaction, and illustrates the article with further specially prepared composite pictures. These enable everyone, even if they've had no experience, to read the appropriate theoretical diagrams.

LAST week we arrived at a complete one-valve receiver, but such an outfit has no very great advantages over any simple crystal set. It is true that the valve amplifies a little as well as detects. But the results you get are very little better than those given by a crystal receiver, and the apparatus used is more complicated and far more costly.

A crystal set generally comprises only a coil and condenser, telephone receivers and crystal detector. In our valve circuit we are replacing the crystal detector by a valve, a grid leak and condenser, an H.T. battery and an L.T. battery. What you do get in exchange that is well worth considering is consistency in operation.

Adding the Reaction Coil.

The crystal detector may need constant adjustment, whereas a valve detector does not. But you can lift the valve circuit miles above the crystal by introducing what is known as reaction.

All you have to do is to join a coil in between the plate of the valve and the telephone receivers and place that coil a certain distance from the tuning coil. Our first illustration this week shows a simple valve detector circuit similar in every detail with the one we discussed at length last week, but with a reaction coil added. You will see at a glance how simple is this modification if you refer to the theoretical diagram.

The reaction coil is marked L_2, and the aerial coil L_1. "L," by the way, is a symbol for inductance, that property which a coil contributes to a circuit. And the "C" in the diagram is not the initial of Condenser, but of Capacity.

It may be a pity that condenser and capacity each have the same initial from an academic point of view, although, practically, it does not matter a scrap because you can think of the C as standing for either capacity or condenser.

How Energy is Fed Back.

The indications are repeated in the pictorial part of our illustration so that you can identify each of the components. The two coils are accommodated in a holder of the type that enables one coil to have its position adjusted in relation to the other. That is very necessary in this particular case as you will see later on.

The purpose of the reaction coil is to feed back a certain amount of the H.F. energy in the anode circuit to the grid of the valve for further amplification. It does it in this way:

When impulses of electricity flow through a wire, magnetic forces are radiated. These forces are at their strongest close to the wire; they get weaker and weaker the farther you get away from it.

When you wind the wire up into coil form you intensify this magnetic field, as it is called. If you bring another piece of wire within the field of electromagnetic force, currents of electricity will be generated in it.

Wind this second piece of wire up into a coil and it will derive more energy from the magnetic field.

As I explained last week, the anode circuit of the valve carries an H.F. current distorted into an L.F. form. This current still rises and falls at a high frequency, but is much more effective in the one direction. Nevertheless, it is obvious that the magnetic field radiated by the reaction coil will vary in intensity at a high frequency.

And if the reaction coil is brought to within a certain distance of the aerial coil, the latter will pick up the high-frequency currents.

These will reinforce the H.F. energy, already oscillating in the tuning circuit, and so the grid of the valve receives a further stimulus. This, in its turn, will cause larger variations of the H.T. current flowing in the anode circuit and so amplification to a marked degree will be effected.

'Ware the Vicious Circle.

The amount of energy fed back from the anode to the grid circuit will depend primarily upon the distance between the two coils. If the two coils are widely separated the aerial coil will be in a much thinned-out part of the magnetic field of the reaction coil, and that means only a small feed-back.

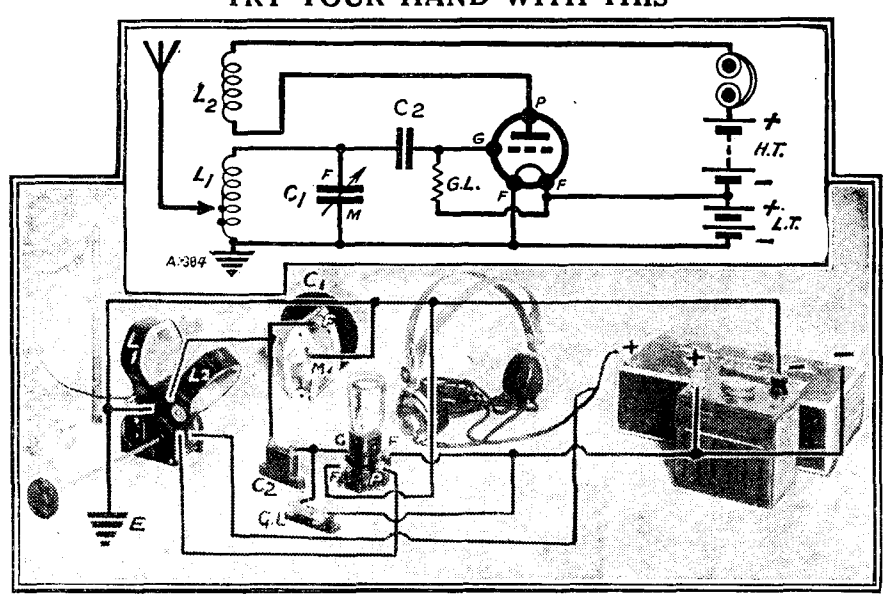
Bring the coils closer together and the reaction effect is intensified.

In passing, I must point out that "reaction," "feed-back," and "regeneration" generally all mean the same thing.

The reaction and aerial coil *coupling* must

(*Continued on next page.*)

TRY YOUR HAND WITH THIS



Here is a complete one-valve circuit with "swinging-coil" reaction. The components in the photo are connected up exactly in accordance with the theoretical circuit above, and all the lettering appears in its correct order. See if you can identify all the components and follow out their connections.

RADIO IN PICTURES.

(Continued from previous page.)

not be too *tight* (these two words are quite self-explanatory), or a condition referred to as " self-oscillation " will occur.

That means to say that the reaction develops into a kind of vicious circle; a great deal of energy is fed back from the plate to the grid, the grid varies the anode current considerably, and thus causes a further intensification of the feed-back, which is followed by a greater stimulus of the grid and so on, and so on!

Making Your Own Oscillations.

You build up to a point where the feed-back gets out of control, and even without the initial energy derived from the aerial in the way of wireless signals, this anode-grid grid-anode, anode-grid self-oscillation continues.

You are making your own H.F. oscillations, and these are communicated to the aerial and radiated in the form of wireless waves. And your neighbours pick them up with their radio programmes, and that is the kind of thing that causes them to write to the B.B.C. for an oscillation pamphlet—to send you!

The aim of the careful set operator is, therefore, to adjust this reaction so that he gets the greatest possible benefit from it in the way of extra amplification without going too near that point where he runs into self-oscillation. The reaction adjustment in the case of our first circuit is provided by the variable coil holder. You merely adjust the position of the coil until the best reaction results are obtained.

There are other methods of obtaining reaction in a set, and the one I have just been describing is usually referred to as the " swinging-coil " type. And for very obvious reasons!

It has one serious disadvantage; you find that as you vary the distance between the reaction and aerial tuning coils, so you are liable to upset the tuning adjustment. This makes it necessary for you to re-tune by altering the variable condenser adjustment every time the reaction control is moved.

Control by Condenser.

Obviously, it is very desirable that the tuning and reaction controls should be as independent of each other as possible. A much better system from this point of view is that known as " capacity reaction." Here the reaction is adjusted by means of a variable condenser.

There are quite a number of applications of capacity reaction. One of the most effective is the Schnell.

A simple one-valve detector circuit with Schnell reaction forms the subject of our second illustration. The tuning and reaction coils occupy fixed positions, a high-frequency choke is inserted between the plate of the valve and the telephone receivers.

This H.F. choke is a coil consisting of a large number of turns of wire, so that it offers considerable resistance to high-frequency currents. An alternative path for those developed in the anode circuit is provided through the reaction coil L_2 and the reaction condenser C_2.

The easiness of this path to H.F. currents can be varied by the variable condenser C_2 (reaction control). The higher the capacity of this the easier it is for the H.F. currents to pass through it. Conversely, the smaller the capacity the higher its resistance to H.F.

So you see the reaction condenser is capable of controlling the amount of H.F. current that flows through the coil L_2. Therefore, it directly controls the intensity of the magnetic field developed by that coil.

Now let me outline the complete operation of our new circuit. The variable condenser C_1, in conjunction with coil L_1, tunes the aerial system to the wave-length of a desired station.

The radio waves develop high-frequency currents in the aerial, and these are impressed across the filament and grid of the valve.

A grid leak and grid condenser, C_3, are interposed so that the H.F. current is rendered less effective in the one direction, and so that its low-frequency modulations as originally developed by the broadcasting station are brought into prominence.

The grid influences the stream of electrons thrown out by the filament of the valve, and constituting a bridge between that and the plate. Therefore, the currents flowing from the high-tension battery through the telephone receivers and the H.F. choke are made to vary in accordance with the fluctuations on the grid.

Coupling and Capacity.

The high-frequency choke offers a considerable resistance to the high-frequency variations, so high, in fact, that it flattens them out. And the current flowing through the telephone receivers, which originated in the H.T. battery of course, tends to become practically pure low frequency.

But an alternative path is offered to the H.F. through the reaction coil L_2 and the reaction condenser C_2. The H.F. resistance of this path can be varied by varying the capacity of C_2, and in this way you adjust the reaction effects at will.

The value of the reaction condenser, and of the reaction coil, are to a very considerable extent interdependent. With a very small reaction coil placed near the aerial coil, or a large reaction coil a long way away from the aerial coil, you want a reaction condenser of quite considerable capacity, say ·0003 mfd. or thereabouts.

With a large reaction coil, or one closer to the aerial coil and thus giving a tighter coupling, a smaller reaction condenser can be used; ·0001 mfd. is quite a usual value.

In every circuit so far, the H.T. — has been joined to L.T. +. At one time this was widely done. Nowadays, it is more usual, or, one might almost say, it is the standard practice to join H.T. — to L.T. —.

I deliberately introduced the H.T. —, L.T. + connection in the initial diagrams so that you will have at least some acquaintance with it, for it does crop up now and again in commercial sets.

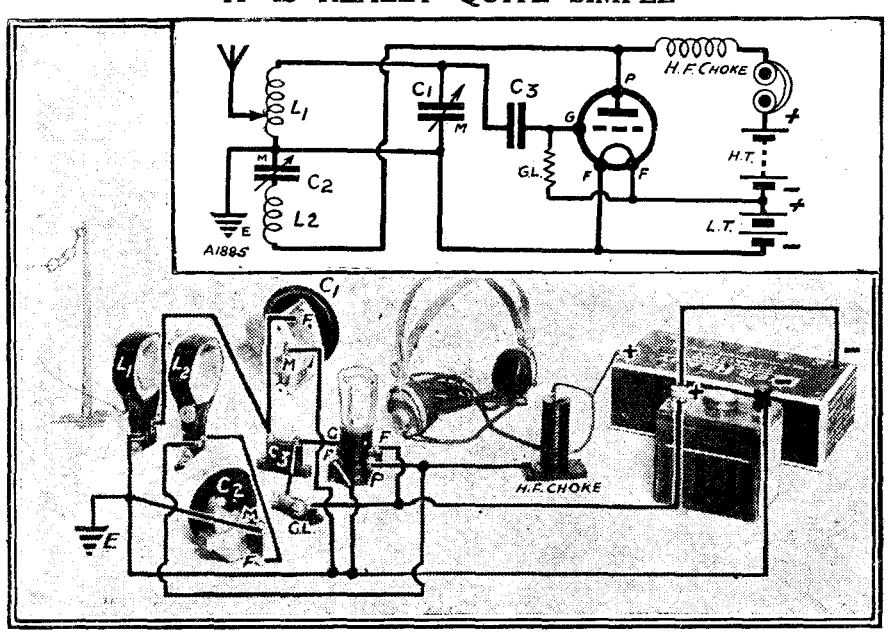
Reinartz and Differential Reaction.

Before I leave the subject of reaction I must not forget to point out that there are one or two other systems besides those I have described. For instance, there is the Reinartz type. But this differs in its essentials from the Schnell only in that the reaction condenser is joined between the plate of the valve and the reaction coil instead of as in the diagram.

The theory is exactly the same, but the Schnell, a later development, scores in that it enables the one set of vanes of the reaction condenser to be connected to earth. This makes for greater freedom from hand-capacity effects.

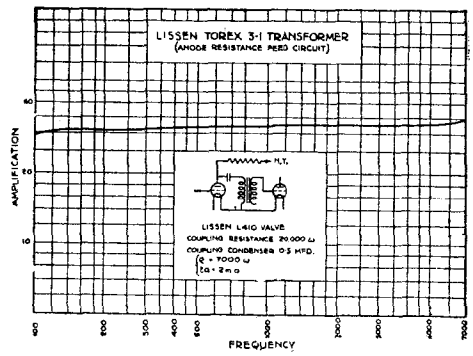
Finally, we have the differential reaction scheme popularised by " P.W." That is merely a form of capacity reaction which, in conjunction with articles describing sets embodying it, you should have little difficulty in unravelling.

IT IS REALLY QUITE SIMPLE



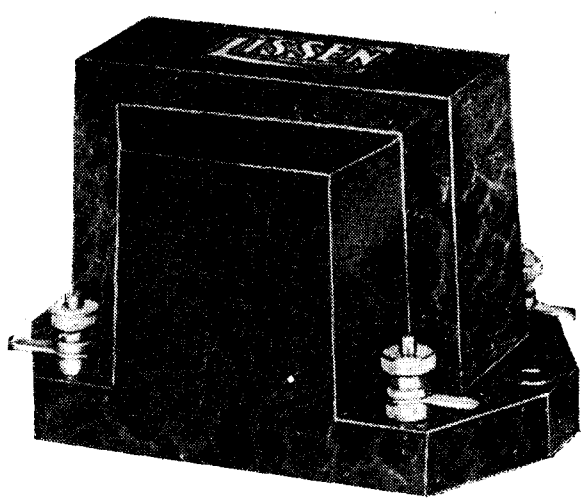
This circuit embodies a rather more complicated reaction system, but you should have little difficulty in tracing it out with the aid of " Pentode's " specially prepared picture.

A MIGHTY good TRANSFORMER WITH A CURVE!



for 5/6

This new Lissen Torex Transformer enables you to make a big cut in the cost of building amplifiers. It is a high-grade silicon-steel core transformer, with remarkably even amplification over the whole band of audible frequencies (see curve). It is a neat, compact component; moulded bakelite case which is hermetically sealed and completely insulates the windings. Proof against shorting, leakage, or moisture.



WHERE TO USE IT

Use this Lissen Torex Transformer for the first L.F. stage of any amplifier. Use it where big amplification is desired at small cost. Use it for all temporary "hook-ups"—you can change it from set to set because it is a "general purpose" transformer. Particularly fine results are obtainable when this transformer is used in an anode resistance feed circuit.

LISSEN
TOREX
TRANSFORMER

LISSEN LIMITED, Worple Road, Isleworth, Middlesex

CAPT. ECKERSLEY'S QUERY CORNER

**DE-COUPLING RESISTANCES—
ELECTRIFIED BY STEAM—
GRID BIAS TROUBLES.**

Under the above title, week by week, Captain P. P. Eckersley, M.I.E.E., our Chief Radio Consultant, comments upon radio queries submitted by "P.W." readers. But don't address your queries to Captain Eckersley—a selection of those received by the Query Department in the ordinary way will be dealt with by him.

De-coupling Resistances.

A. P. (Stamford Hill).—"What factors contribute to the choice of a fixed resistance of 500 to 600 ohms as a de-coupling device in the anode circuit of an H.F. valve? Why should this resistance have such a low value when one of 20,000 ohms or more

BY PASS PATHS

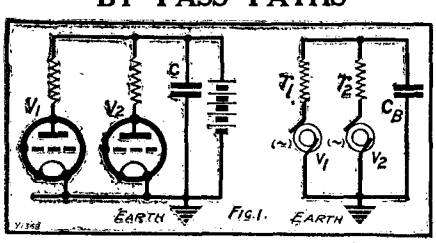


FIG. 1.

This illustrates Capt. Eckersley's reply to "A.P."

is required in a detector or L.F. anode lead to prevent motor-boating?"

A de-coupling resistance is included so that each valve shall be completely uninfluenced by any other valve except in the intended way.

Thus two valves may be fed from the same high-tension battery. This has resistance, hence the surges of current feeding one valve puts a voltage on to the other, and vice versa. Hence the blocking condenser.

But the blocking condenser has resistance—and if the blocking condenser has resistance it, too, must apply appreciable voltage from one valve to another. The de-coupling device is nothing more than a method of eliminating "common" voltages to valves fed from the same source.

If we consider two valves V_1 and V_2 (see Fig. 1) as *generators*, V_1 should pass all current via C to earth, and should not pass any current to earth via V_2. If we see V_1 and V_2 with de-coupling resistances (Fig. 2), we see that there is a by-pass to earth of a condenser Cd_1, and a resistance Rd_1, each making it more difficult for V_1 to pass a current through V_2 to earth.

It is only natural, answering your question, that it is easier to build a de-coupler for high than for low frequencies, since convenient valued condensers have a lower impedance, and so resistances can be effective with a lower value. We want no current from V_1 to pass to earth via V_2, and as we cannot make CB big enough to "short" V_1 and V_2, we use the arrangement shown in Fig. 2.

THE EXTRA RESISTANCE

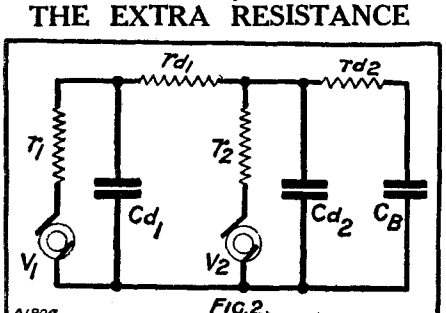
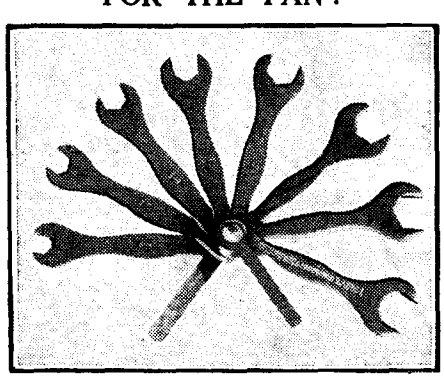


FIG. 2.

Rd 1 and Rd 2 are for de-coupling.

FOR THE FAN!



A combination spanner of this kind is invaluable to the set-builder.

Electrified by Steam?

L. P. (Seven Kings).—"My residence is situated with a fairly busy steam railway track at the end of the garden. As far as I am aware, the trains which pass my house do not carry any electrical equipment, being, to my certain knowledge, mostly lit by gas.

All the same, the passage of a train past my house is quite often accompanied by a moderate amount of interference, heard as a sort of hissing crackle in the loud speaker. Although this is not very troublesone the circumstance puzzles me considerably, and I should welcome your explanation of the possible cause of the trouble and, if possible, a cure."

How extraordinarily interesting! I could not have thought you would have got the effect, but it is well known that a steam discharge creates an electric potential.

That's why steam wagons with rubber tyres drag a chain on the ground to earth them and prevent the driver getting shocks! But the engine *is* earthed.

Can it be that it's not thoroughly earthed—that the atmosphere becomes charged? That, in any case, the length of earth path is considerable?

I don't know, but I expect my explanation is not very wide of the mark. In the cause of science could you flag a train, get it to blow off steam, then to stop "steaming," and prove the effect?

* * *

Grid Bias Troubles.

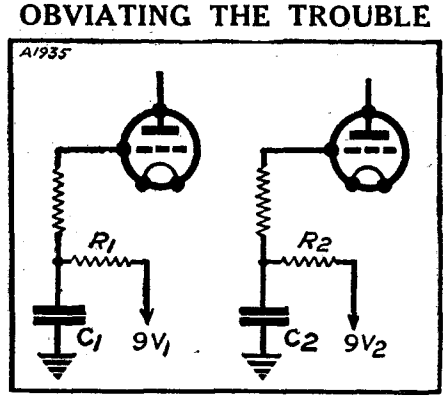
A. R. (Westcliff).—"Do you consider motor-boating can be caused by having two or more L.F. grid-bias tappings from one common G.B. battery? If this is so, will you please show me how I might overcome the difficulty (if possible) without necessitating the use of further batteries?"

Yes, a common grid-battery of rather high internal resistance might easily cause "couplings" when very high magnifications are used. If it's L.F. you must realise that a shunting condenser can have a very high resistance at low frequencies. 1,000 ohms 4 microfarads 50 cycles!

So it's worth while bringing the grids back as shown in the sketch.

Thus C_1 and C_2 are 4 mfd. (say), R_1 and R_2 are 25,000 ohms, say (more if you like), and $9V_1$ and $9V_2$ are the two grid negative wander leads.

OBVIATING THE TROUBLE



The method recommended for preventing grid interaction.

It's grid de-coupling just the same way as you use anode de-coupling.

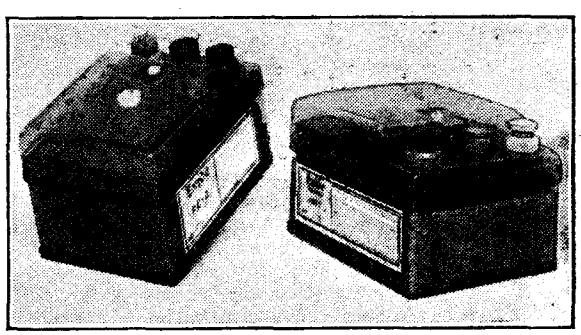
FROM THE TECHNICAL EDITOR'S NOTE BOOK.

Tested and Found—?

NEW EXIDE ACCUMULATORS.

THE Exide Gel-Cel' accumulators and the improved Exide unspillable "free acid" types are specially designed for portable sets, but their potentialities are much wider than that. Personally, I would never care to use these days any accumulator that was not "unspillable" and I expect there are many others who feel the same way.

If an accumulator can be made unspillable, then surely it is wise that all should be so designed, at least that is, all those made for using indoors with a radio set.



The new Exide unspillable accumulators.

The Exide Jelly Acid and free-acid accumulators have several very interesting features and these are admirably summarised in the following.

1. New Moulded Celluloid Boxes, which have been re-designed and re-inforced to overcome every weakness.

The following are features of the new box:

(*a*) Moulded lid; no joints to leak, and corners which are as strong as the main body of the box.

(*b*) Re-designed Unspillable device which is even more effective than before.

(*c*) New method of sealing, so that the lid tends to shrink *on to* the box.

(*d*) Bottom reinforced by moulded shoe which makes leakage at this point quite impossible.

(*e*) Increased strength at filler caps.

(*f*) Non-interchangeable, varicoloured, round and hexagonal terminals, with larger and more effective gaskets which eliminate leakage.

2. These points apply to both the free acid and jelly cells for which very similar boxes are used.

(*a*) In the free acid cells there are re-designed groups, with increased plate pitch and increased volume of free acid reducing the tendency to hydration and sulphation.

(*b*) In the jelly acid cells the plates are of special design and composition for use with jelly acid and are the result of very long experimentation.

From this you will see that the Chloride Electrical Storage Co., Ltd., has used its large research resources to very practical ends. They have completely removed several of those bugbears that we have grown to regard as inevitable in small accumulators.

The samples of the new Exide accumulators sent for test purposes were found to have 100 per cent unspillability. And they are particularly robustly constructed. Electrically they appear to be as good as anything Exide have previously done, and that is saying a good deal!

A SIX-SIXTY PUBLICATION.

Six-Sixty Radio Co., Ltd., have now published their 1931 catalogue and this carries the title of "Six-Sixty Radio Valves and Equipment."

NEW COLUMBIA SET.

You probably saw the Columbia Model 307 set at Olympia if you went to the Exhibition. It is a new three-valver of the mains type that uses an S.G. H.F. valve and a pentode, and full-wave rectification (in the A.C. models).

Quite recently I have carried out a series of tests with this set, and must say I think it a fine production. It is very sensitive, and on both wave-bands (there is a combined wave-change pick-up panel switch) reaction is smooth and free from any faults.

Also the 307 is more than usually selective, and there is a wide gap of separation between the two Brookmans. The smoothing is first-rate, and on the A.C. outfit I had on the bench there was no audible hum.

There is ample power and the quality of reproduction is impressive. The construction of the outfit is on scientific lines, and the screening is neat and effective.

Externally this Columbia receiver has a handsome appearance and its controls are nicely placed.

A double-drum thumb control is provided for tuning, and this is delightful to handle.

KONE DOPE.

Those interested in loud-speaker assembly should note that the Kone Dope Co., of Idmiston Road, London, E.15, are selling a special linen for linen loud speakers at 5s. per square yard—any size.

They are also marketing a non-inflammable "Kone Dope" dressing for similar speakers at 6d. and 1s. per bottle. The linen appears to be excellent stuff, and I can certainly recommend its use.

The "Kone Dope" people further sell quite a good chassis (16 in. by 16 in. linen diaphragm with stretchers) at 19s. 6d.

WATES "STAR" PICK-UP.

I have now been able to test a Wates "Star" Pick-up and also the Wates Pick-up Tonearm, which is available for use in conjunction with it. The Wates "Star" Pick-up is supplied complete with an adaptor for gramophone tonearms, and this has a sleeve so making its fitting universal.

It is an excellently made pick-up, and it does give good results. There is a brightness and a clean bass that would be a revelation to those who heard only the first pick-ups on the market. Also, there is no appreciable record wear, a point that will strongly appeal to those amateurs who have hitherto operated mechanical gramophones of a type that are "heavy on the wax."

The Wates Tonearm is a neat affair, and it has a swivel end enabling the pick-up to be turned over and placed free from the record. But I would suggest that the Standard Battery Co. should restrict the movement of the arm so that it cannot swing over should the record be accidentally left playing, for on some records there is a tendency for an arm to swing right over and to cause a serious scratch.

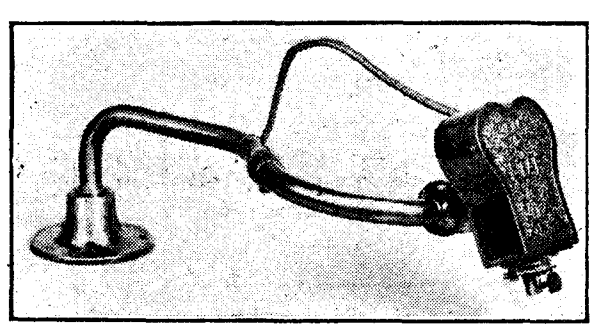
Manufacturers and traders are invited to submit radio apparatus of any kind for review purposes. All examinations and tests are carried out in the "P.W." Technical Department, with the strictest of impartiality, under the personal supervision of the Technical Editor.

We should like to point out that we prefer to receive production samples picked from stock, and that we cannot guarantee their safe return undamaged, as it is our practice thoroughly to dissect much of the gear in the course of our investigations!

And readers should note that the subsequent reports appearing on this page are intended as guides for buyers, and are therefore framed up in a readily readable manner free from technicalities unnecessary for that immediate purpose.

"THE LINK BETWEEN."

This is the title of a booklet dealing with Igranic Elkon metal rectifiers and their applications. It is a very useful brochure, and there are circuits of various mains units together with interesting and informative articles about them. I would advise all mains enthusiasts to secure copies—they are available free from R163, Igranic Electric, Ltd., 149, Queen Victoria Street, London, E.C.



Here is the Wates "Star" Pick-up and Tonearm.

The "CONTRA

CERTAIN members of the "P.W." Research Staff have been going about with an air of happy preoccupation of late. To them had been allotted the job of finding out just what could be done with that extraordinarily valuable device, the "Contradyne," and an extremely interesting time they had in consequence.

Most Valuable Discovery.

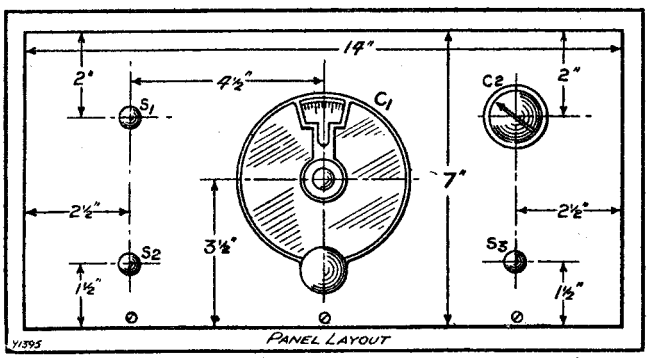
We always make it a rule to carry out a thorough investigation whenever we come across something with such obviously important potentialities as the "Contradyne." We try to think out all its possible applications, and then proceed to discover practically just how they behave in their different forms and modifications.

We are great believers in this intensive method of investigation, because we have so often found that in the course of it one is very likely to get upon the track of something new and important which was quite unsuspected at the beginning of the work. Some of the best features of our special sets have been discovered in this way.

The "Contradyne" idea has been "put through it" pretty thoroughly, and we have discovered some extraordinarily interesting and valuable things about it. What these are you will discover in due course as we exploit the new idea in its various forms in the designs constituting our programme for this season.

This week we are showing you one of its simplest and best applications, which has proved to be so good that we are releasing it at once without further delay.

IT DIALS STATIONS IN DOZENS



There is but one tuning dial, and with it you can roam round dozens of alternative programmes. The "Contradyne" Three finally kills the old fallacy that selectivity can be obtained only by sacrificing simplicity and inexpensiveness.

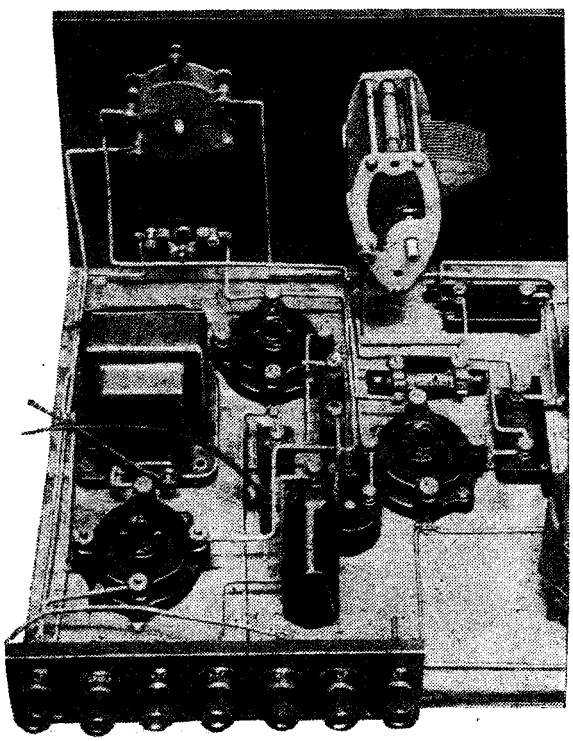
One of the first things we discovered about the "Contradyne" was that by applying it to a circuit of the Det.-L.F. type, using our new dual-range coil, it was possible to produce an extraordinarily fine three-valver of the deservedly popular general-purpose type.

Remarkable Results

That is just what the "Contradyne" Three is, and you can take it from us that it is a really hot-stuff set.

It is that most exceptional type of receiver, one which performs excellently on both the ordinary wave-bands and on long waves as well. On the lower wave-band it has the fine selectivity and sensitivity characteristic of our new coil unit, and on going over to long waves you find it has still more remarkable virtues. There is not a sign of the local station breaking through, as so often happens with receivers of the Det.-L.F. type, and the long-wave stations themselves come in with a power and purity that will surprise even the experienced constructor. The set possesses genuine selectivity up here also, and you should have none of that annoying trouble of 5 X X overlapping upon Radio-Paris that is so common with the simpler type of receiver.

AND ONLY THREE VALVES!



With only three valves you will get those foreigners clearly and free from interference. Great power and high quality result, too from the use of scientifically-balanced L.F. stages.

Absolute Control.

A run over the circuit diagram will show you how the main features of the set are arranged, for it is quite easy to follow. It is really very simple in spite of the remarkable things it will do.

Starting at the aerial terminal and working downwards, you first encounter an adjustable type of condenser with a maximum value of ·001 mfd. This is your main control of selectivity, which is chiefly required for use on the lower wave-band.

The general idea of the use of this device is to keep it as near maximum as you can and only reduce it to such a value as is sufficient to give the amount of selectivity you want. On long waves, for example, you will generally be able to keep it at its maximum value.

Passing down the aerial lead, you next come to the "Contradyne" coil itself, and here you will observe that a switch is provided to short-circuit this component when working on the lower wave-band. To do this, of course, you just pull outwards the knob of the

Here is a set absolutel effective features. They i dyne" principle, P.W.'s ling, and the new "P.W —three scientific "stars" nitude. In combination vellous selectivity and p astonishing simplificati and control. You must guaranteed winner—and most intensive researc "P.W.'s" Research Dep dependent experts have the very few progressiv world still producing nev and lasting

THESE ARE THE PA

1 Panel, 14 in. × 6 in. (Lissen, or Red Seal, Paxolin, Goltone, etc.).
1 Cabinet to fit, with baseboard 10 in. deep (Pickett, or Camco, etc.).
1 ·0005-mfd. variable condenser (Lissen, or Dubilier, Lotus, Formo, Igranic, J.B., Ormond, Ready Radio, etc.).
1 Slow-motion dial (if condenser of plain type) (Igranic, or Lissen, Ready Radio, Formo, Lotus, Brownie, etc.).
1 ·0001- to ·00015- mfd. differential reaction condenser (Dubilier, or Lotus, Igranic, Lissen, Ready Radio, Formo, Wearite, J.B., Magnum, Ormond, Parex, etc.).
1 3-point wave-change switch (Bulgin, or Wearite, Ready Radio, Magnum, Red Diamond, etc.).
2 On-off switches (Lotus, or Lissen, Igranic, Benjamin, mond, Ready Radio, etc.).
3 Sprung valve hold Telsen, W.B., Lisse Benjamin, Junit, etc
1 "P.W." dual-range Ready Radio, Magnu
1 "Contradyne" coil Magnum, Wearite, P
1 ·001- mfd. (max.) condenser (B.I., or Polar, Formo, etc.).
1 ·01- mfd. fixed cond Lissen, Mullard, Du Igranic, etc.).
1 ·002-mfd. ditto (Liss
1 ·0003-mfd. ditto (Liss
1 2-meg. grid leak and

- - THIS SET PUTS AN END TO

tely full of novel and y include the "Contra- V.'s" Brookmans coup- P.W." dual-range coil s" of the greatest mag- ion they give you mar- l power together with ations of construction st try this set—it is a nd is the result of the rch on the part of Department—which in- ve described as one of sive institutions in the new radio ideas of real ng value.

used in the "Exhibition" Four recently. This is obtained by means of the condenser of ·002-mfd. capacity, which you will see connected between one side of the tuning condenser and the earth circuit.

Perfect Reaction.

Next observe that there are two windings in the coil unit which are joined together at the upper end and to the terminal G. Of these, the one which goes down to the terminal S_3 is the long-wave secondary, while the one which terminates at the lower end in terminal S_2 is the low-wave secondary.

On low waves these two are connected in parallel by means of the wave-change switch, and on long waves only the long-wave section is effectively in circuit on account of the action of the switch.

The remaining winding in the coil unit terminates at its upper end at the point R, and this is the reaction winding which serves to give reaction on both upper and lower wave-bands. It does this, of course, by virtue of the special way it is placed in relation to the other windings, a point which you will already have understood if you read the specification published recently for the construction of the new coil.

Wonderful Wave-Change Scheme.

The wave-change switching is quite simple if you follow it out carefully. The switch used is of the very simple three-point on-off type, and you will discover for yourself that when this is in the closed position it places the two secondary windings in parallel, and short-circuits the ·002-mfd. condenser, which is only required for aerial coupling on the long waves.

From this you will gather that to go over to long waves you push the switch INWARDS, while for work on the medium wave-band you pull it OUTWARDS. Similar operating rules apply to the switch controlling the "Contradyne" coil. These switches, by the way, are at the extreme left-hand end of the panel, the lower one being the main wave-change switch and the upper one that controlling the "Contradyne" coil.

The remainder of the circuit is really very simple and straightforward, and you will recognise the usual form of differential reaction, with its well-known virtues, and a perfectly normal low-frequency amplifying side with one resistance-capacity coupled stage and one transformer stage.

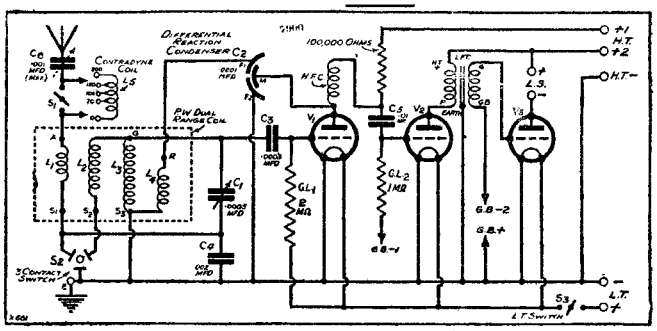
Very Easy To Build.

The construction of the receiver, you will discover, is a delightfully simple and straightforward job, but there are perhaps just one or two points we might mention to help you. First we must warn you that the layout of the tuning and reaction portion of the circuit is rather important.

Do not take any liberties with the positioning of the two coils, in particular.

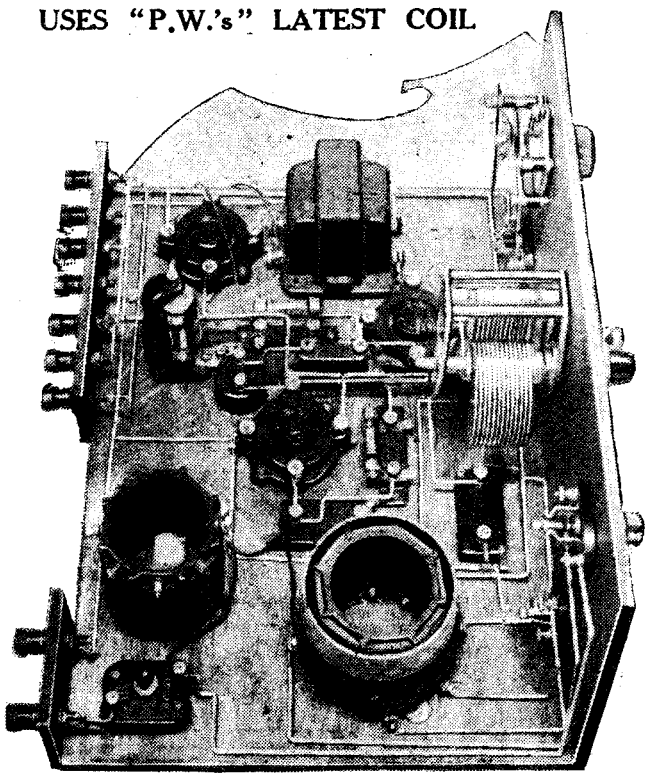
(*Continued on next page.*)

A WONDERFUL NEW CIRCUIT



When we say NEW we mean NEW, and this "Contradyne" circuit comprises features of an entirely original character giving it superlative qualities.

USES "P.W.'s" LATEST COIL



Right in the foreground of this photo, right in the forefront of radio component design, is "P.W.'s" new dual-range coil—the low-loss high-efficiency device that conserves every electron of radio energy.

PARTS YOU WANT.

n, Junit, Red Dia- dio, Pioneer, Bulgin,

olders (Igranic, or ssen, Lotus, Bulgin, etc.).

ge coil (Wearite, or gnum, etc.).

il (Ready Radio, or , Parex, etc.).

) compression type or Lissen, Lewcos, .).

ndenser (T.C.C., or Dubilier, Ediswan,

issen, etc.).

Lissen, etc.).

nd holder (Lissen, or Ediswan, Dubilier, Igranic, Ferranti, Mullard, etc.).

1 1-meg. ditto (Lissen, etc.).

1 100,000-ohm anode resistance and holder (Varley, or Igranic, R.I., Lissen, Mullard, Dubilier, etc.).

1 H.F. choke (Ready Radio, or Telsen, Lissen, R.I., Dubilier, Varley, Lewcos, Lotus, Wearite, Parex, Magnum, Igranic, etc.).

1 L.F. transformer (Telsen, or Ferranti, Lissen, Igranic, Varley, Mullard, R.I., Lotus, Lewcos, etc.).

1 Terminal strip, 7 in. × 2 in., and one about 3 in. × 2 in., or alternatively one strip 14 in. × 2 in.

9 Terminals (Igranic, or Eelex, Belling & Lee, etc.).

Wire, screws, flex, G.B. plugs, etc.

THE "CONTRADYNE" THREE.

(Continued from previous page.)

Really it is best to make a fairly careful copy of any set of this specialised type, for although it is not really critical, you never know quite what is going to happen if you make any really serious alterations.

Now there is a point about the low-frequency transformer. The model we used in the original set was provided with an earthing terminal for the core, and we made the normal use of this, but the set was quite stable without it, and it was done merely as an additional precaution

Earthing the Transformer.

If the particular low-frequency transformer you use has no means of making an earthing connection to the core, do not be alarmed thereby, and just wire up the usual four terminals.

In this case the wire which in our diagram is shown as making an earthing contact on the transformer would just run straight past and go on to one of the sets of fixed plates of the differential reaction condenser.

We did not make any provision in the original set for the mounting of a grid-bias battery on the baseboard, and it is to be understood that the usual alternative positive is to be used, in which the bias battery is secured by means of clips to the inside of the cabinet at the back. As a matter of fact, you could find room for a small battery standing on end beside the "Contradyne" coil, and between that component and the 100,000-ohm anode resistance.

The general idea of the operating controls of the set you will already have gathered from our explanation of the different features of the circuit, particularly the action of the wave-change switch and the "Contradyne" control switch.

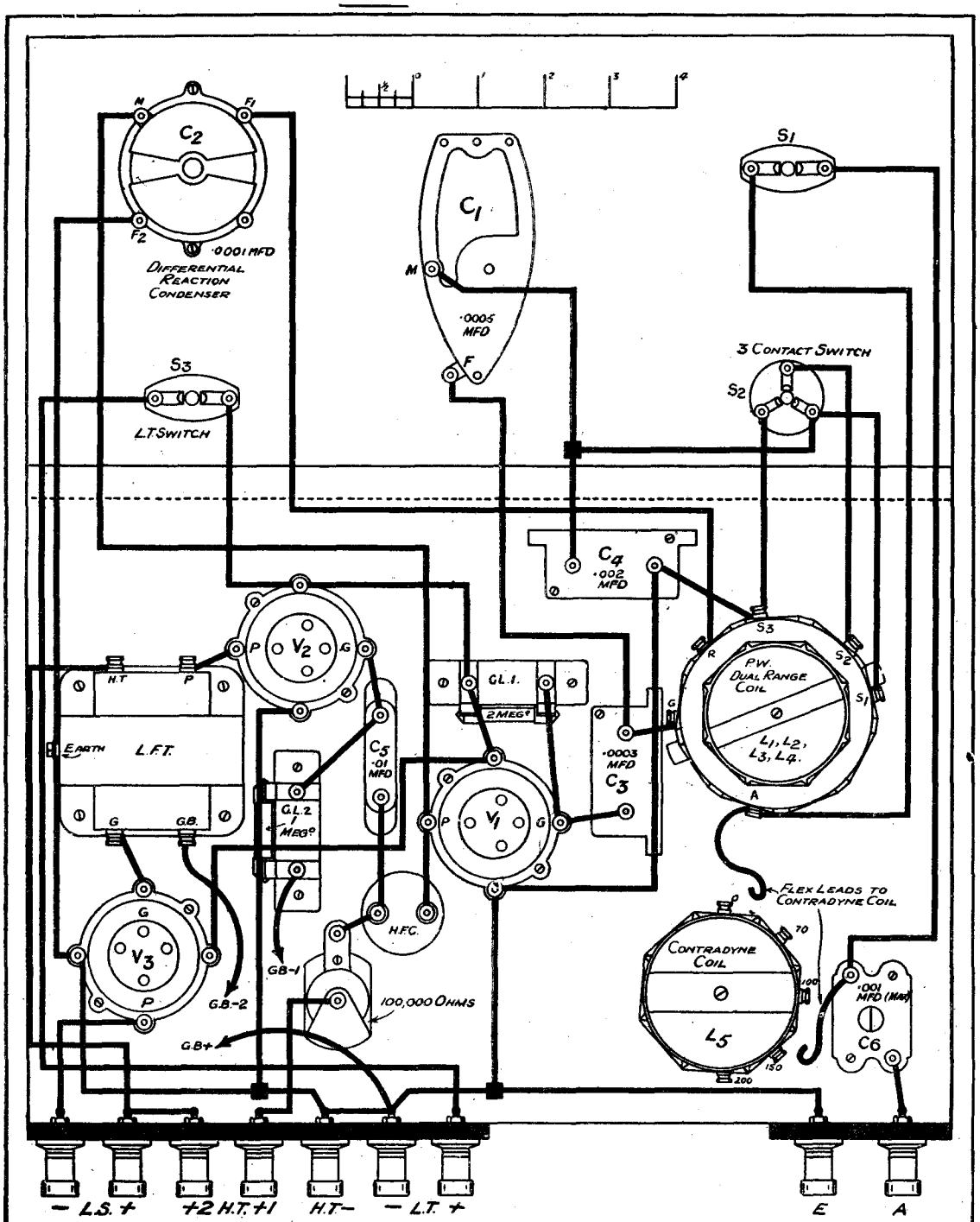
What you require in conclusion is just the necessary information in regard to operating conditions. The valves should be one of the H.F. or special detector type for the detector (this goes in the socket beside the H.F. choke), one of the L.F. type for the first L.F. valve (the one nearest the panel), and a power or super-power for the last valve.

EVERY "P.W." SET HAS TO PASS THE MOST EXACTING TESTS BEFORE ITS DESCRIPTION IS PUBLISHED.

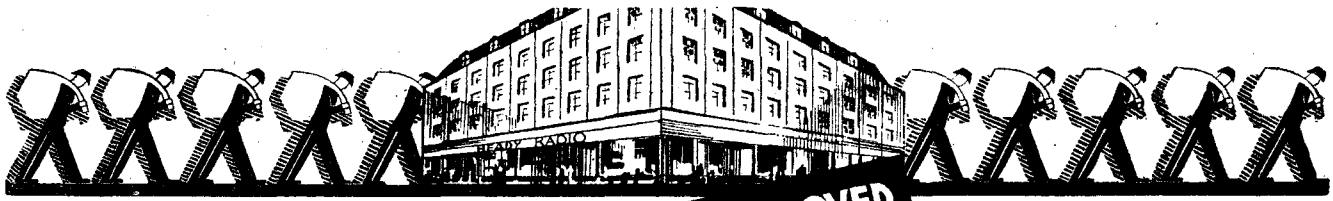
The H.T. voltages will in normal use be somewhat as follows. Terminal H.T. +1 supplies the detector valve, and here you should try voltages from about 60 up to 90, noting which seems to give the best results on weak signals.

Terminal H.T. +2 runs the two L.F. valves, and here you want the conventional 120 or a little more, according to the supply available and the types of valves.

YOU SIMPLY MUST TRY THIS REMARKABLE SET



Until you've had a "Contradyne" set in actual use you cannot possibly imagine the really wonderful results it is able to give, even in face of the most depressing local conditions. And, as you can see from the diagram above, the "three" *is* a very simple set to "hook-up."



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KIT B with valves less cabinet £8: 6:6
or 12 equal monthly payments of **15/3**

KIT C with valves and cabinet £9:16:6
or 12 equal monthly payments of **18/-**

"SHARP-TUNE" TWO

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or 12 equal monthly payments of **8/3**

KIT B with valves less cabinet £5:8:0
or 12 equal monthly payments of **10/-**

KIT C with valves and cabinet £6:7:0
or 12 equal monthly payments of **11/9**

"EASY-CHANGE" THREE

KIT A less valves and cabinet £4: 4:6
or 12 equal monthly payments of **7/9**

KIT B with valves less cabinet £5:12:0
or 12 equal monthly payments of **10/3**

KIT C with valves and cabinet £7: 2:0
or 12 equal monthly payments of **13/-**

"MAXI-POWER" FOUR

KIT A less valves and cabinet £7: 8:0
or 12 equal monthly payments of **13/6**

KIT B with valves less cabinet £9:15:6
or 12 equal monthly payments of **18/-**

KIT C with valves and cabinet £11: 5:6
or 12 equal monthly payments of **20/9**

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GERMANY'S RADIO RELAYS

Transatlantic relays and radio tours are often carried out by the German broadcasting stations. How these relays are managed and the scientific investigations necessary are described below.

By A. A. GULLILAND.

FOR the carrying of those popular wireless link relays from across the Atlantic and those "Visits to Foreign Stations," the central Germany broadcasting company, the Reichs-Rundfunk-Gesellschaft, operates a number of listening posts, observation laboratories, and a meteorological station. The chief engineer of the R.R.G., Dr. Reisser, is responsible for this, though, of course, he has many other duties besides the supervision of the listening posts.

The former listening post of the Stuttgart Broadcasting Co. is situated near Stuttgart, at Castle Solitude. In addition, there is the permanent listening post formerly at Buch, near Berlin, now at Schloss Werder, near Cöpenick, also close to Berlin.

A Third Post.

I say "permanent" listening post, for here somebody is on duty during all broadcasting hours, whereas Solitude is only in operation for a number of hours per day, and on special occasions. Then there is a third listening post situated in the basement of Dr. Reisser's own home at Zehlendorff, near Berlin, and the meteorological station is on the island of Föhr, at Wyck.

Of all these stations, Solitude has probably the best reception conditions, being isolated and high up; and it is probably for that reason that the Stuttgart listening post has carried out more or less successfully most of the relays from the United States on the different occasions of the Zeppelin's arrival there.

Zehlendorff is hardly less famous to Berlin listeners, and the equipment here is worthy of the R.R.G.'s chief engineer. Apart from reception relays, he carries out numbers of tests on all sorts of receivers, and recently has taken to testing television reception.

Television Receivers.

One of the Baird standard sets is there, and one of Mihaly's receivers. This latter, it will be remembered, permits of both the reception of the Baird standard and the German Reichspost standard transmissions.

I saw the giant Stenode Radiostat standing there just undergoing tests, and it will probably interest British readers to know which commercial British sets have found their way to Dr. Reisser's home. He told me that each time he was over in London he bought the type of set he liked best, and so has quite a collection.

Among others, he pointed out an Osram Three, a Burndept, and an Igranic. I asked him how they compared with German receivers.

Carrying Out Relays.

He was unable to give me a full answer, as he did not wish to make a sweeping statement which might be unfair to sets he has not tested. Generally speaking, he seemed to incline that they were of excellent workmanship and gave excellent results.

For important reception relays of Transatlantic stations, either the Zehlendorff station is in operation or the German commercial radio company's (Transradio) reception post is loaned for the evening, as practically ideal conditions prevail there.

For relays on longer waves there are usually four men on duty at Dr. Reisser's. He himself is at the switchboard, which permits the putting of one receiver after another into circuit, interposing announcements from a microphone and, at the same time, controlling or listening to the output of a second set and of the set actually working on the broadcaster.

All this rather complicated switching is done by a few movements of one or two switches, the whole having been developed by Dr. Reisser himself. Three sets are kept going, usually each with a different station, so that switching over can be done immediately after the appropriate announcement.

For S.W. relays a large special receiver is in use at Zehlendorff. It was designed by the laboratory staff of the R.R.G., and it is completely screened.

Many Aerials Used.

I saw three aerials in Dr. Reisser's garden. One of these is suspended from a 40-foot mast to a smaller mast on the top of the house. For the sake of comparison it is perhaps interesting to note that the Solitude listening post has over seventeen aerials!

But, then, as Dr. Reisser pointed out, he was only on duty on very special occasions when it was necessary for the captain to be on the bridge. Special land-line circuits connect Zehlendorff listening post to the Berlin control-room and transmitter.

Before leaving, Dr. Reisser kindly showed me the small stand with meteorological instruments in his garden. He is thus always able to find out if any peculiarity in reception is due to some unusual meteorological conditions.

THE STENODE IN GERMANY

A British Stenode receiver being used in Germany for the relaying of programmes picked up by radio.

CORRESPONDENCE.

MIXING LOUD SPEAKERS

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

MIXING LOUD SPEAKERS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Though a wireless trader I have always been an interested and regular reader of your paper, and from time to time have noticed you recommend the use of two loud speakers—one horn and one cone. I think you mentioned this a week or so ago when an article on a set was published.

I have experimented for some time with power amplifiers, and found that several types of L.S. give the best results.

The speakers I use at fêtes, sports, etc., are two 6-ft. exponential horns with moving-coil units, a third is a big horn-type moving-coil which I built myself—the tone of this speaker alone is rather high. Two other speakers were built from parts supplied by the Star people to my designs. The one is a very low tone, and tried my patience for months; the other one is about average, and easily beats any commercial model against which I have tried it. Both of these cones and moving-coil formers were made from one piece of buckram. The moulding was done between two pieces of wood. The three home-made speakers are all 48-watt fields at 12 volts.

The tonal balance and volume of the complete battery of speakers is splendid. My total engagements during last summer were forty-three, which speaks for itself.

The set is the outcome of over six years of experiment. It comprises a B.T.H. pick-up and "mike," and A.C./H.L. and P.1 valves with 4L.S.6A. valves in push-pull at 500 H.T. Instead of an output transformer I use a specially made centre-tapped choke. The five speakers are in "series." The set is "all-electric," and weighs 2¼ cwt.

With best wishes to "Pop." for the future.

Yours faithfully,
ARTHUR S. HOW.

Chesham, Bucks.

A NEW SHORT-WAVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—A new short-wave broadcast station for British listeners to try for is L S H at Buenos Aires, Argentine. It is on the air from 8 to 10 p.m. eastern time, which corresponds to 01.00 to 03.00 G.M.T. I have been hearing it for a time now, but as the announcing is all in Spanish I was not able to identify it at first. The wave-length is 28·9 metres, and it is very good here at times, being up to R 9 on occasions.

The address is: Transradio Internacional, San Martin 329, Buenos Aires, Argentine.

According to reports there is a new short-wave broadcast station at Sourabaya, Java, whose call is P K 3 A N. The wave-length is given as 49 metres, but I have not heard it and have no further dope concerning it.

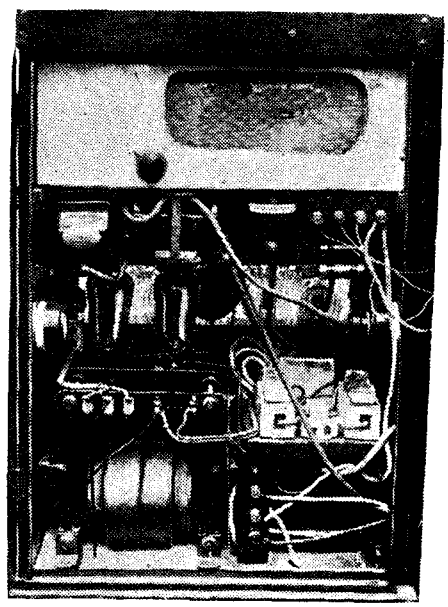
The Buenos Aires station has no interval signal that would enable it to be easily identified by anyone not familiar with Spanish. The call letters being pronounced ell-a ess-a atch-a, which I learned was L S H.

The New Zealand Government 'phone station at Wellington is now testing on 27·3 metres. I think it will be used for 'phone service between New Zealand and England later. The call letters are Z L W (the Z pronounced zed, which is like England). As this concludes my stock of short-wave news I will close now and put the 'phones back on, or I will miss something.

Yours respectfully,
FRED EASTER.

Cincinnati,
Ohio, U.S.A.

IT WEIGHS 280 LBS.!



A view of the set with which Mr. How operates his battery of loud speakers.

HELPFUL HINTS

Short Earth Leads—Increasing Reaction—Controlling Regeneration.

If the many advantages of a short earth lead were generally realised there would be a decrease in the sale of wire!

* * *

Generally speaking, an increase in the high-tension on the detector valve will mean increased strength of reaction.

* * *

If you are unable to get reaction when your condenser is all in, except towards the lower end of your tuning range, a small fixed condenser, usually ·0001 or less, connected across the reaction condenser is an improvisation worth trying.

* * *

When reaction seems much too strong and it is inconvenient to take off turns from the reaction winding, the effective capacity of the reaction condenser can be reduced by joining a fixed condenser of about equal capacity in series with it. (The smaller the capacity in series the greater the reducing effect).

SHORT-WAVE NOTES

By W. L. S.

News and views of higher frequency activities for the amateur experimenter.

I SUPPOSE the outstanding feature of this autumn, from the "short-wave" point of view is the extraordinary way in which the New Zealanders have been coming over on 40 metres in the early morning. There are not so very many "hams" in New Zealand, and yet I seem to have heard thirty or so during the last ten days alone. Some of our people, using plenty of power, seem to be getting out the other way, too, but not many of the normal-powered stations seem to be able to do it at present.

Are they "Stunt" Sets?

W. H. H. writes from N.W.10 on the subject of the short-wave receivers used by amateur transmitters. He says: "I was listening to an amateur telling someone in Italy that he was getting him on the loud speaker as he could not wear headphones on him. What sort of thing do they use? They seem to be able to separate their stations as easily as I can on the broadcast band."

Well, W. H. H., speaking as one of the amateur fraternity myself, I have not found any transmitting amateurs who use a receiver that is at all out of the ordinary. My own is a straight S.G. and detector, with an "optional note-mag." in a separate box. Most of them, I believe, dispense with the S.G. and use a straight detector and L.F.

As far as separation of stations is concerned, naturally the separation of two C.W. signals is more a matter of practice than selectivity, and involves the ability to read one Morse signal and exclude the other, even though they are the same strength.

Probably W. H. H. is confused between selectivity and critical tuning, as most novices to short-wave work are at first. Since it is a point of general interest, it is worthy of more than a casual mention. Naturally, anyone can make his receiver tune "sharply" on any particular station by using a huge tuning condenser.

Spreading the Stations.

This will make this station occupy about a twentieth of a degree instead of, perhaps, one degree on the dial; but it will in no way increase the selectivity of the receiver—i.e. its ability to cut out another station nearby. Naturally, what is wanted for short-wave work is a spreading out of the stations over a wide band of the dial.

A golden rule is to choose a size of condenser and coil that will give a frequency range of about 500 kc. over the whole dial. This is what is usually covered by the dial on a broadcast receiver—it represents the frequency band between about 250 and 520 metres.

If this is done it stands to reason that the tuning of the short-waver cannot be any more difficult than that of the broadcast set, apart from such things as hand-capacity effects and bad reaction control. But these latter must definitely be regarded as *faults* in the receiver, and not blamed on the innocent short waves!

Separation Quite Easy

If this spacing is achieved, the amateur wave-bands on 20 and 40 metres, both about 200 kc. in width, will occupy rather less than half the dial, and tuning-in and 'separation' of amateur signals will be perfectly easy.

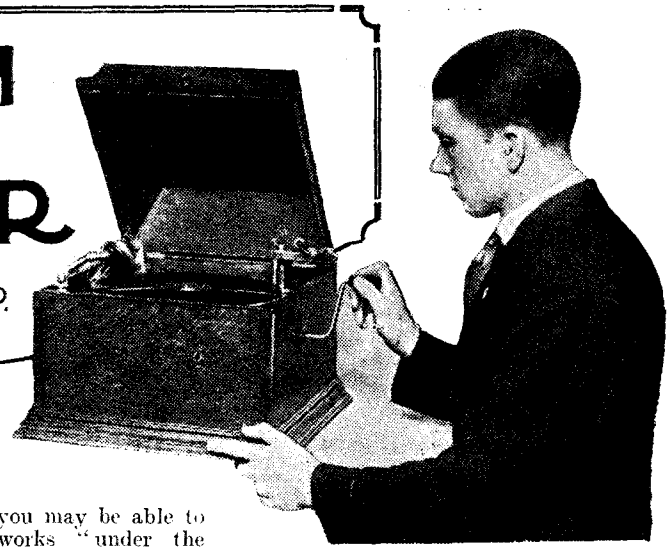
As a rough guide, I am using, for 40 metres, a 10-turn coil with a tuning condenser of ·00003. (·0001 is definitely too big for comfort.) On 20 metres I use the same condenser with a coil of 5 turns. The reaction coil in each case has three turns.

An intermediate coil of seven turns covers the short-wave broadcast band between 30 and 32 metres comfortably. So it is surely preferable to use three coils and a small condenser to the usual method of sticking to the commercial turn numbers and having to use something like ·0003 to cover the range, at the same time giving almost impossibly-difficult tuning.

YOUR RADIO-GRAM MOTOR

by

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



Some useful hints and tips for gramophone enthusiasts. Dr. Roberts is well qualified to write on this subject as he was for some years Technical Chief of the great Columbia Graphophone Co.

"OUT of sight out of mind" may aptly be applied to the gramophone motor.

We all know the importance of the soundbox, of the tonearm, sound-chamber, amplifier and record-surface.

But we are apt to overlook the fact that unless the record is strongly and uniformly revolved, the reproduction, no matter how excellent the other parts may be, is bound to suffer.

I dare say that not five per cent of gramophone users ever trouble to clean or lubricate the gramophone motor, much less to concern themselves with questions of its design or operation.

Yet there are great differences between different makes of gramophone motors, probably as great as the differences between different makes of motor-cars. You would not think of going to a motor-car dealer and just specifying that you wanted "one motor-car."

"Under the Bonnet."

You would, in fact, previously have weighed up very shrewdly the respective merits and advantages of different makes and (bearing in mind the all-important question of price) have decided beforehand precisely what make and model you intended to buy.

In the same way, it is well worth while to acquaint yourself with the principal features in the design and construction of a gramophone motor so that you may be able to judge whether the works "under the bonnet" come up to the standard of the exterior of the instrument.

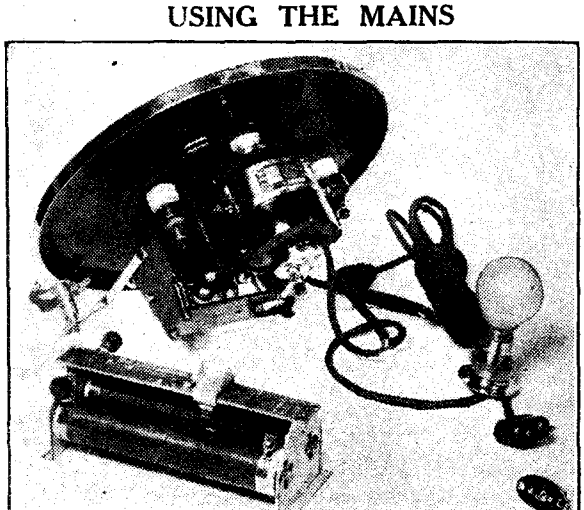
The first-class gramophone manufacturers can be relied upon to install sound and satisfactory motors in their machines; but, unfortunately, some of the lesser known makes of gramophones are got up more to catch the eye than to give long and satisfactory service.

Some of the Troubles.

I have, in fact, on many occasions inspected gramophones in which extremely poor and shoddy motors were fitted, with various unsatisfactory results; in some cases a 12-in. record would scarcely play properly towards the outer edge, where the pull is greatest; in some cases the record would quite noticeably pull up (with a horrible drop in the tone) whenever a loud passage was encountered; whilst in many cases also there would be an obvious falling-off in speed (and pitch) towards the end of a single record unless, indeed, the gramophone were given an additional winding during the playing of the record, when the pitch would noticeably rise.

I expect many of you have noticed some of the effects which I have just described; if you have, I hope it has been in other peoples' gramophones and not in your own!

USING THE MAINS



An electric gramophone-motor complete with control rheostat.

Choosing a Motor.

For your general guidance, whether in purchasing a new machine or in keeping your present motor in proper operating condition, you may perhaps like to have a few general observations on the design and working of a gramophone motor.

Although electric gramophone motors are now gaining ground, the vast majority of gramophones are fitted with spring motors and, therefore, I will commence by considering the spring type of motor.

You no doubt know that the main-spring of a motor is nearly always contained in a metal "barrel."

If the motor is what is called a "single-spring" motor, there is only one barrel, if it is a double-spring motor there are two barrels, and, if a triple-spring motor, three barrels.

It is unusual for a gramophone motor to have more than a triple-spring, but occasionally quadruple springs are fitted. If more springs than one are present, these are generally mounted on the same shaft and are connected together in a way which may be described, borrowing an electrical phrase, as "in series."

IT WINDS ITSELF

Electricity and clockwork in combination. The electric motor of this device automatically comes into operation and winds up the spring motor when this runs down.

Usually, the winding handle rotates the barrel and this winds up the spring (one end of which is attached to the inside of the barrel), the opposite end of the spring thereby tending to rotate the shaft to which it is attached.

This shaft may then turn the shaft-end of the next spring which, on being wound up, tends to rotate the second barrel. If it is a double-spring motor this second barrel, by means of a tooth-wheel secured to it, then drives the remaining working parts of the motor. Alternatively, the force from the first spring may operate upon the barrel of the second spring in which case a telescopic shaft is used and the drive is taken from the shaft of the second spring.

Those Sticky Springs.

However the individual springs may be arranged, the effect of multiple springs, if in series, is the same as though a single spring of greater length were used.

In some gramophone motors the multiple springs are arranged in parallel, in which case the effect is the same as though a

(*Continued on next page.*)

YOUR RADIO-GRAM MOTOR.

(*Continued from previous page.*)

stronger spring of the same length were used, but inasmuch as this permits a greater velocity ratio or step-up as between the spring and the rest of the motor, it comes to much the same thing in the end.

When the motor is freshly installed, the turns or convolutions of the spring are filled with a heavy grease, but in course of time this may become exhausted or sticky, and it sometimes happens that adjacent parts of the spring are not able to slide freely over each other.

At the moment of "sticking," the force which should be exerted upon the turntable is temporarily arrested and the result is that you get erratic reproduction.

A Word of Warning.

It is very important, therefore, to be sure that the springs are properly supplied with grease, and if you are in serious trouble from this cause it is better to dismount the motor altogether and give the springs a thorough cleaning out with paraffin oil, afterwards introducing a good quality of heavy grease.

I should warn you, by the way, not to attempt to remove the spring from its barrel, as the spring as a rule is an extremely powerful and unwieldy object, and if you once get it out of the barrel you will have great difficulty in getting it in again.

Also if removed from the barrel, except by anyone accustomed to the job, it is liable to spring out with great force and is therefore dangerous. In the ordinary way there is no need whatever for you to interfere with the spring otherwise than to wash it out and relubricate it.

Which Kind is Yours?

It is important that the motor should have what is known as a "forward wind," that is to say, the end of the spring which drives the motor should be the *opposite* end from that which is wound up by the winding handle.

If this is so, then the motor can be actually rewound whilst the gramophone is running. In some types of gramophone motor, more particularly the earlier types, one end of the spring is fixed in a stationary position and the opposite end is wound up in one direction and unwound during the operation in the opposite direction.

The result is that whilst the winding handle is being turned the force is taken off the working parts of the motor and therefore the motor ceases to operate during rewinding.

You may have noticed that many kinds of clocks are worked on this principle, and that whilst you are actually rewinding the clock, the clock will stop.

Governing the Speed.

The next most important item in the structure of the gramophone motor is the governor which, as you know, is introduced in order to make the motor run at a more or less constant speed.

I say "more or less constant" because many people think that the mere fitting of a governor automatically ensures an *absolutely constant* speed. This is not the case.

All that the governor does is to take up the main load of the gramophone spring. It is obvious that (even without a record being played) the actual speed of the motor will gradually fall away as the spring runs down.

I expect some of my readers will be inclined to dispute this, but if you will just think about it for a moment you will realise that it is so.

The motor, when in operation playing the record, is driving two loads simultaneously, one is the load due to the governor and the other is the load due to the friction between the record and the needle.

The load due to the governor, at a constant speed, is fairly accurately constant, but the friction on the record is continually varying, not only from point to point, but also gradually falling off from the outer part of the record towards the centre.

Imagine a Horse!

If the governor is to control the speed and keep it fairly constant, it is essential that the load due to the friction in the governor shall be large compared to the variable load due to the record.

This is a point which unfortunately is very frequently overlooked by the designers of gramophone motors and, in fact, I will go so far as to say that many so-called designers are completely ignorant of it.

A simple illustration is a horse carrying a load which varies between say, 100 pounds and 110 pounds. Provided there is a constant load of 100 pounds, the slight variations between 100 and 110 will make very little difference.

If, however, the constant load is 10 pounds and this varies between 10 and 110 pounds, the varying loads become more important than the constant load, with consequent variations in the performance of the animal.

Unfortunately, the governor is again a feature of the motor which you cannot very well interfere with.

The "Hunting" Gramophone.

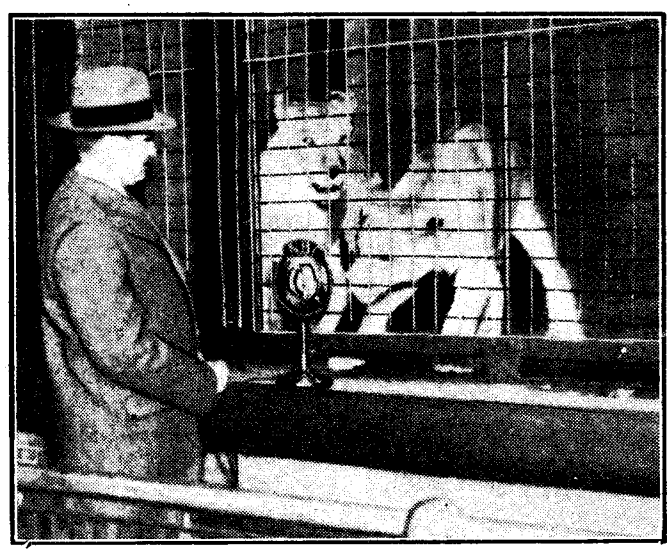
The friction pad of the governor should not be lubricated too freely. Bear in mind that it is a *friction* pad, and that most of the energy of the unwinding spring is being dissipated in the friction between the governor pad and the friction disk.

If the pad and disk are too dry, the friction will be excessive and the governor will be "fierce." A "fierce" governor may lead to what is known as "hunting," that is, to the speed of the motor continually rising and falling in an oscillatory fashion, like a huntsman on horseback.

On the other hand, if the friction between the pad and disk is too small, the governor balls may swing out unduly widely before they have exerted a sufficient pressure against the pad to produce the necessary friction. Generally, if your motor is working satisfactorily, it is better *not* to oil the pad but to leave well alone.

In a subsequent article I will tell you of some of the other parts of the spring motor and also discuss electric gramophone motors.

LISTENING TO THE LIONS



Lions in a New York Zoo broadcasting their growls to the dozens of stations constituting the National Broadcasting Company's chain.

RECEPTION REMINDERS

Screening—Adjusting G.B.—etc.

If you are making a set in which a tuning coil is placed somewhere near to a screen, be very careful to see that you keep it the correct distance from the screen, for if it is too close you are almost certain to lose selectivity.

* * *

One of the simplest ways of preserving the life of your power valve is to remember that never under any circumstances should the grid bias plugs be readjusted unless the set is switched off first.

* * *

Every listener who is really interested in the reception of foreign stations should calibrate his set, for a tuning chart is very easily made, and is simply invaluable for telling you the wave-lengths covered at various degrees.

* * *

Among the chief factors influencing the degree of reaction employed is the spacing from the tuning coil of the reaction coil and the number of turns in the latter. The greater the turn number the stronger the reaction, but the greater the distance between the coils the weaker the reaction.

* * *

When experimenting with circuits in which centre-tapped coils are used, do not forget that the centre terminals or connection points of two centre-tapped coils may easily touch one another, with disastrous results if one of them is at high potential.

We are afraid you have not quite got the idea behind the S.G. valve. Stated briefly, the position is this:

The input circuit of any H.F. valve must be kept well separated from its output circuit, because if interaction is taking place, the stage becomes unstable, and will not amplify satisfactorily. With the old-fashioned valves complete separation of the input from the output stage was impossible, because even should these be externally screened from each other, there was a feed-back *inside* the valve, from plate to grid, owing to the inter-electrode capacity.

It was found possible to overcome this by means of neutralising windings and condensers, and stable amplification could be obtained in this way provided the external grid circuit and the plate circuit were kept well screened and separated.

Then came the S.G. valve in which an earthed screen was placed between the grid and plate of the valve, so preventing the tendency to feed-back. Although it has proved very stable in practice, the fundamental necessity of keeping the anode circuit from coupling with the grid circuit still remains, and

(*Continued on page* 396.)

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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

WHERE CAN I GET DETAILS OF THE "EUROPEAN" THREE?

R.B. (Caterham).—"I have had such good reports of the 'European' Three that I should like to get the back number describing it. How do I get it?"

Back numbers of "P.W." which are still in print can be obtained from the Amalgamated Press, Ltd., Back No. Dept., Bear Alley, Farringdon Street, London, E.C.4, price 4d. per copy post free.

A QUESTION OF SCREENING.

D. S. (Paisley).—"I do not regret changing over and scrapping the old neutrodyne set. Although it was good, the S.G. is definitely more snappy and much easier to handle, with the advantage of being as steady at the top of the tuning range as at the bottom, and none of that worry about the exact neutralising setting.

"There is, however, one thing that puzzles me. Why was it necessary to screen the set as well?

"If the valve is screened to prevent feed-back from plate to grid, what is the purpose of having the huge outside screen as well? Is it really necessary?"

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 394.)

it was for this reason that the large external screen which you mention is used.

If anything, such screens are more important with an S.G. valve than they were formerly, because of the added magnification of such a stage, which means that the valve's output power is so great compared with its input that if even a slight feed-back is permitted between the anode circuit and its input circuit, instability, etc., may result.

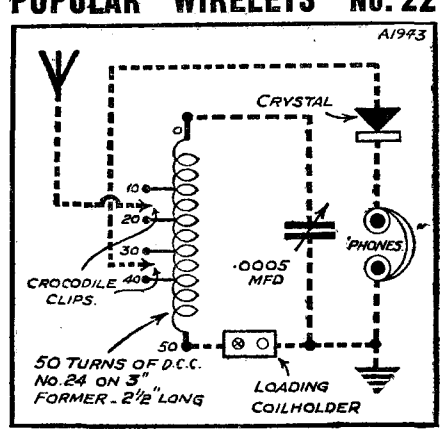
RESONANCE IN LOUD-SPEAKER CABINET.

K. T. G. (Brentwood, Essex).—"The only fault of which I can complain in my loud speaker was the fact that on certain notes it seems a trifle too deep-toned and boomy. Many people who had not heard the loud bass notes etc., brought out on wireless before were inclined to think this was an advantage, but to me it always seemed as though there was a little too much bass compared with the high notes.

"I tried several things to stop it, including a tapped choke for the output instead of an output transformer, but nothing that I could do seemed to make any real difference until the other day.

"Then I was examining the speaker and had taken the back of the cabinet off to investigate its 'innards.' For the first time

POPULAR "WIRELETS" No. 22



The connections for a good crystal circuit (based on a home-made coil and the other "components" shown last week) are indicated by the dotted lines above.

It will be seen that both the crystal and the aerial leads can be "tapped" into the coil, the best position for them being found by experiment under working conditions.

I did not pause to put everything back right, but as I wanted particularly to hear an item that was being broadcast, I connected the speaker up before replacing the back of the cabinet.

"To my surprise the additional 'boominess' seemed to have completely disappeared, and the speaker gave better results than it had ever done before. As the alterations I had been carrying out were quite minor ones which could hardly have affected this, I suspected the back of the cabinet.

"To test it, I replaced this, with the result that the boom started again. In fact, the boom seemed to be due to the cabinet being enclosed at the back. Is this a kind of resonance effect?"

Undoubtedly the closed cabinet is giving you a low-note resonance effect, and over-emphasising your bass. A great many speakers which are enclosed in cabinets will do this, and generally the simplest way out of the difficulty is to take the back off the cabinet and cover this with a light material to keep the dust out, instead of using any form of solid backing.

Have you tried a baffle board instead of a cabinet? If not, you might find that such an arrangement would give even further improvement.

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

A QUESTION OF SWITCHING.

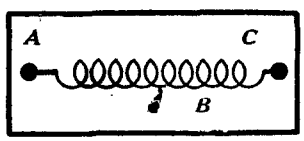
G. M. S. (Reading.)—"I have been experimenting with the circuits with the idea of building a two-screened-grid, det., and L.F. for powerful loud-speaker work, but the results I have had with one H.F., Det. L.F., are so good that I do not think the second valve necessary. So I am planning a permanent receiver on these lines.

"As there will be only one H.F. stage instead of two I am thinking of going into the long as well as the ordinary waves, provided it can be done with simple switching. For my aerial circuit I shall have decided on two plug-in coil units with a switch that will change over from the short to the long waves easily.

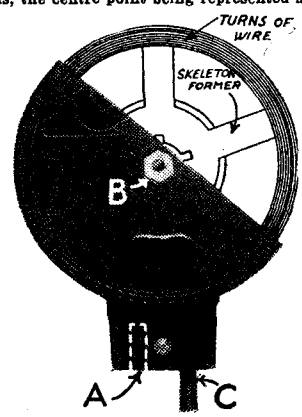
"Between the H.F. valve and the detector, however, I have at present a home-made grid-coil tuned by a ·0005-mfd. with a centre tap coming from the H.F. valve to a fixed condenser. Is there a simple way of switching in and out a long-wave coil here?"

"INSIDE" INFORMATION

No. 3.



The theoretical sign for a centre-tapped coil is similar to that for an ordinary coil (shown last week) except that an additional connecting-point is shown in the centre of the winding. For identification purposes the letters A, B, and C are used in these illustrations, the centre point being represented at B.



THE NEW "P.W." DIAGRAPHS.

You could employ one of the ordinary three-point switches for this quite easily by using a centre-tapped coil for the long waves. It would have to be mounted so that it did not couple with the present grid coil, and then the lead from the coupling condenser should be disconnected from the centre of the grid coil and taken to the plunger of a three-way wave-change switch and also to the centre tapping of the long-wave coil.

Each of the other contacts on the switch should go to the respective ends of the long-wave coil, and continue on to the respective halves of the grid coil, which, instead of being centre-tapped as formerly, must be split at the centre tap into two separate half coils.

These halves are joined together when the wave-change switch is on the "on" position, but when it is in the "off" position the long-wave coil is placed between these points.

USING A TWO-VOLT VALVE IN SIX-VOLT SET.

T. E. (Plymouth).—"Before going over to the 6-volt valves I used to use 2-volters and still have two 2-volt L.F. valves on hand practically

(Continued on next page.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from previous page.)

new. But owing to a bit of carelessness with a screwdriver I have lost a perfectly good 6-volt L.F. valve and I should like to try using one of the 2-volters in its place.

"I do not know how much extra resistance is required in the filament circuit, though I know you have given that information in 'P.W.' How can it be calculated?"

To use a 2-volt valve with a 6-volt accumulator is easily arranged by means of an extra resistance placed in the filament circuit, providing you know exactly how much filament current the 2-volt valve is supposed to take.

You must have this information because in order to find out the required resistance you must divide the 2-volt valve's filament current into the difference in voltage between its normal rating (2) and the accumulator with which it is to be used (6). The rule is that R (resistance required) equals $\frac{V}{C}$ where V means the *difference in volts* (or the excess volts, which have to be dropped), and C the filament current required by the new valve.

If, for instance, your valve is one of the .1 type, you will need a 40-ohm resistance because the filament current of .1 when divided into 4 (which is the difference between its normal supply rating and that at which it is to be worked) will give you an answer of 40.

If it were a ·25 filament current your valve required, you would need a filament resistance of only 16 ohms, as you will find if you divide its filament current into the difference between the two accumulators.

"THE KEY TO THE ETHER."

In repairing—at the very last moment before going to press—a damaged illustration of the one-valve circuit shown on page 25 of "The Key to the Ether," the lead from C_4 (moving vanes) to switch, potentiometer, and valve holder was made to join, instead of cross over, the L.T. — lead.

FOR THE LISTENER.

(Continued from page 374.)

indeed. I think I ordered one of each. I devoutly hope there is no such thing as telepathy!

I was coming up from Wales the other day—a gorgeous English autumn Sunday—and I saw many of you on the open road in your Baby or your Minor or your Midget, and, Lord! how I envied you! If I join you it will be Colonel Brabazon's fault.

Here and There.

Sometimes, in order to renew my youth, I drop into the Children's Hour. There is a young man there who reads gnome stories in a very intriguing voice. And now Commander King-Hall has joined the merry staff.

He gives the News of the Week to the youngsters. I think they are lucky, for the Commander has a modest and engaging personality, a light touch, and a sense of humour. I think they will look forward to his weekly budget with the same sort of eagerness as that with which we used to await the turn of Vernon Bartlett.

Puccini.

With "Turandot" and "Madame Butterfly," Puccini had a good place on the air the other week. I had heard them both several times in Italy. Something here was lacking.

Elizabeth Nelvi, in the name part, and Tudor Davies were in great form; so was the Wireless Chorus; but—what was it that was missing? Togetherness, perhaps, or fire, or inspiration.

It was like English coffee after Italian coffee; quite good, but something just the

(Continued on next page.)

FOR THE LISTENER

(Continued from previous page.)

least bit short of the "real thing." I suppose I shall be in this mood to make "odorous" comparisons for some little time yet; but I will restrain myself and be thankful.

Two Stars.

Not exactly twin star; Mr. Bernard Shaw and Professor Einstein are in different parts of the firmament, but they are both of the first magnitude. The occasion of a dinner in the professor's honour is to bring them together, and we are to hear them, glittering side by side.

Einstein has the reputation of possessing a pretty gift of quiet humour; Shaw is a star which is always breaking into meteoric showers: and it will be very diverting to have them in conjunction.

Words.

I hope you have taken my tip and listened faithfully to Mr. Squire's talks on Words. His last was on the Music of Words, and was too delightful.

My favourite words are those which have a "v" in them, like "haven," and also those which contain the combination "mber"—"amber" is a lovely word, so is "remember."

Have you ever noticed, on the other hand, what ugly words have been found in various languages for those most beautiful of all human things—the eyes? The word "eyes" itself is ugly; but what of the French "yeux," the Italian "occhi," the German "Augen"?

Perhaps in the days when these words were made, the "evil eye" was more prominent than the "glad eye."

Medicine.

The series of talks on Health promises well. Probably the healthier we are the less we trouble about it, and possibly if we troubled less about it we should be healthier.

Sir George Newman, of the Ministry of Health, opened the series in a forcible speech, in the course of which he declared that any attempt to impose a public medical service upon the profession would prove to be impracticable. The science and art of medicine, he said, were essentially individualistic, and could only flourish in that atmosphere.

Ronald Frankau.

This bright entertainer, the length of whose cigarette holder rivals that of Edgar Wallace's redeemed recent vaudeville programme from mediocrity. Even he was not quite at his best.

The account of his rencontre in Shaftesbury Avenue was risky without being very amusing. Mario de Pietro played mandoline and banjo solos with a good deal of verve and skill. But the fantasy, "One Night in Summer," seemed to me, except for one song, much too sentimental and precious and—dull! I'm sorry, but it was so.

TECHNICAL NOTES.

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

Tuned Circuits.

I HAVE had a number of queries with regard to the function of filter circuits and bandpass filters. Some readers are not clear as to the effect of resonance or tuning in a bandpass filter.

Perhaps I should explain very briefly, for the benefit of newcomers to radio, what is meant by resonance as applied to a bandpass filter. In the first place, you all know that when a circuit is tuned to any particular wave-length the response of the circuit (that is, the amplitude to which the circuit will be set into electrical oscillation) is very much greater for that particular wave-length than for wave-lengths somewhat higher or somewhat lower.

Sharp Tuning.

If the circuit is what we call "sharply tuned," or very selective, to express it another way, it means that a very small departure from the particular selected frequency or wave-length will result in a considerable drop in the response of the circuit.

Thus if we could apply gradually increasing wave-lengths to the circuit we would find that as we approached near to its natural frequency there would be very little response until we were almost on the verge of the actual frequency; the response would then become very pronounced, whilst as soon as we had passed that particular frequency the response would again fall to a very low value. No doubt most of you are familiar with so-called "resonance curves," which generally take the form of a sharply defined peak falling away on both sides.

Bandpass Filters.

Now, this is all very well, and at first sight it seems that all we want is a very sharply-tuned circuit to act as a filter so as to receive a particularly desired wave-length and to exclude wave-lengths adjacent to that one, so cutting out stations which would otherwise interfere. But the problem is not quite so simple, for, in order to get satisfactory and undistorted reception, we require to receive not only a particular wave-length but an actual *band* of waves, the extent of which may be generally assumed to be about 5,000 cycles on each side of the resonance frequency.

If the tuning is so sharp that it cuts into this band—that is to say, if the more outlying frequencies *in the band* are scarcely received at all, then it means that reception will be distorted. Therefore, what we require is a reception or response curve which falls away sharply at the sides, but has a broad top instead of a sharp top, the breadth of the curve covering the desired frequency-band.

Shape of Curve.

This can be obtained by using *two* circuits, these tuned very close together but not actually to the same frequency. The result is that we get a frequency curve which is the composition of the two separate frequency curves and which has in effect the characteristics just mentioned above—that is, a broad top but fairly steeply-falling sides.

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TECHNICAL NOTES.

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At first you might think that this would involve separate tuning of the two circuits, but once they have been properly balanced the two can be tuned with a common condenser.

Before leaving this point I should say that there are certain objections to a band-pass filter of this kind which become more pronounced if the double circuit is not properly adjusted. For one thing, although giving *selectivity*, it may seriously interfere with *sensitivity*; whilst if the two frequencies become widely separated we get double-tuning on the tuning dial.

I hope this brief explanation of the band-pass filter may help those of my readers who are not clear on this point.

Is It the Aerial?

In a set employing reaction you will often find that the effect of the reaction control differs at different parts of the tuning range, and this is a trouble upon which I have received many inquiries from time to time.

Sometimes the cause of trouble lies with the aerial, which may perhaps, by its capacity, prevent the receiver from oscillating (or rather from being capable of oscillating) over the entire tuning range. It may be that the aerial is too large so that its capacity, as already mentioned, is too high.

It is very easy to find out if this is the case by reducing the effective capacity of the aerial, and this can be done quite simply by introducing a series condenser, say ·0001 or ·0002 into the aerial, that is, between the aerial lead-in and the aerial terminal of the set. This will readily indicate whether the trouble is due to aerial capacity.

Reaction Coils.

If you find that the above-mentioned cause is *not* the one responsible for the trouble, it may be that the reaction coils themselves are not suitable, and the obvious remedy here is to use different reaction coils with different numbers of turns.

In cases where a dry battery is used for the H.T. supply, you will sometimes find that if this has fallen much below its rated voltage, it will be impossible to get proper oscillation and therefore proper reaction effect. You might try adding a little H.T. voltage if you have any reason to doubt the supply voltage.

Suitable Choke Values.

There is one other cause of the above-mentioned trouble, but this is not so likely as the ones I have mentioned. If you

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TECHNICAL NOTES

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employ a choke in the anode circuit of the detector, you want to be careful that the value of this H.F. choke is properly suited to the circuit, otherwise this again may prevent you from getting the benefit of reaction.

I should say that the most usual cause is a wrong value of reaction coil, but this is so obvious that I assume you will try different coils as a first attempt to overcome any trouble. The next most likely cause is a falling-off in the voltage of the H.T. battery, whilst too large a capacity in the aerial is perhaps the third most likely cause.

Amplification Factors.

Those of you who are experienced in radio are, of course, quite familiar with the amplification factors and their meaning, but to newcomers the amplification factor often seems rather a mysterious and a difficult term. Perhaps I should make it clear that the amplification factor is not necessarily constant, but may vary according to conditions.

A.C. Valves.

A particular case, which is of increasing interest, is the amplification factor of a valve designed to operate directly on A.C. current. The filament of a valve of this kind (or perhaps I should say the *cathode* rather than the *filament*, since the filament is actually the heater) is at practically the same electrical potential throughout, whereas in an ordinary battery-operated valve the electrical potential falls gradually from one end of the filament to the other.

You will appreciate that in a battery-operated valve, where the heating current actually passes through the filament, there must be a higher potential at one end than at the other in order to drive the heating current through the filament.

Therefore this potential-gradient, or voltage-drop as it is sometimes called, affects the conditions upon which the amplification factor depends, and in some cases if the negative grid bias is increased the amplification factor will increase also, whereas in an A.C. valve an increase in the negative potential applied to the grid will usually cause a decrease in the value of the amplification factor.

Potential Gradient.

In an A.C. indirectly-heated valve there is, of course, a voltage drop along the heating filament, just as there is in the filament of a battery-operated valve, but this does not matter in the A.C. valve, since the heating filament is completely shrouded by the tubular cathode, and as there is no current passing along the cathode (other than is accounted for by the distribution of the electronic emission current, which is comparatively very small) we may regard the cathode as being at virtually the same potential throughout.

The amplification constant is a very important factor in the efficient working of the valve in any position in the circuit, and if the amplification factor is very unsuitable for the conditions in question, you will get distortion and inefficient operation.

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Aerial Arrangements.

It is a well-known fact that there is a more or less "best size" of aerial for any particular wave-length of incoming signals, and that it is only as a matter of convenience that we use one particular aerial for various incoming wave-lengths and adjust for these by the controls of the receiver.

In view of this I have more than once been asked by readers of these Notes whether it would be practicable to erect a "battery" of aerials, say perhaps three to six, of different lengths adapted to receive different wave-lengths and so covering between them the whole of the required wave-length range.

It has been suggested that the various aerials should be connected, all the leading-in wires being brought to a common terminal of the receiver and, alternatively, it has been suggested that the leading-in wires should be brought to the studs of a selector switch so that any particular aerial may be selected. On the face of it this seems ingenious, but unfortunately in practice it is not satisfactory.

An Ingenious Suggestion.

Taking the first suggestion, that is the several aerials all connected together, you will see at once that these act in the circumstances not as a number of individual aerials, but as one combined aerial, and the efficiency of this combined aerial will actually be much less than that of any one of the individual aerials which are included in it.

I think you will readily understand that this particular form of combined aerials is quite out of the question.

The second suggestion, namely, that a number of individual aerials should be brought to a selector switch so that any one can be chosen at will certainly has more to recommend it than the first one.

Where the Snag Lies.

The snag is, however, that even the aerials which are out of circuit, inasmuch as they are bound to occupy positions relatively close to the aerial which is in use, are certain to absorb a large proportion of the incoming energy, and the efficiency of the reception will be very greatly cut down by their presence.

You will see then that the above are ingenious suggestions which are of no use in practice, and you will be much better

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advised from every point of view to stick to the regular type of aerial, making this of such a size and capacity that it most nearly meets your requirements.

High-Pitch Howl.

A high-pitch howl in a three-valve set may be due to quite a variety of causes, but when my correspondent tells me that it disappears when headphones are substituted for the loud speaker, it seems to indicate at once that the effect is due to acoustic reaction between the speaker and the valves of the set, more particularly the detector.

If the speaker is separate from the receiving set, it should be a comparatively simple matter to place it at such a distance away and in such a position that the sound waves are not able to affect the valves, but if the loud speaker is incorporated in the cabinet, this is a different matter.

TECHNICAL TWISTERS

No. 33.

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If the needle ..... downwards the grid bias should be .....
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If grid-bias adjustment will not prevent needle ..... in both directions the last valve is being .....
Inserted in the high tension.... lead the milliammeter shows the set's total ..... current consumption.

LOOK OUT FOR THE MISSING WORDS NEXT WEEK.

Last week's missing words (in order) were: Contact, Damp; Short, Long; Condenser.

In the latter case, the only thing to do is to cover the detector valve with cotton-wool, or, if the effect is very pronounced, the detector may even be covered with a metal or cardboard shield with cotton wool inside. You will also find that some detectors are much more sensitive than others to this effect, and if you happen to have a spare detector on hand it is just as well to try substituting it before doing anything else.

Acoustic Reaction.

Acoustic reaction is precisely similar in principle to the electrical or electro-magnetic reaction which you use in the receiver itself as between one coil and another.

AN ADVERTISER'S CORRECTION.

The Telsen Electric Co. advise us the 1s. valve holder described on p. 315 ("P.W." Oct. 25th issue) should have been illustrated by a 4-pin and not by a 5-pin valve holder as shown.

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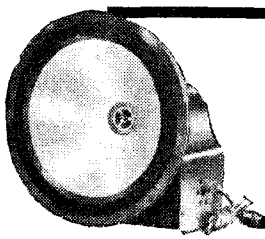

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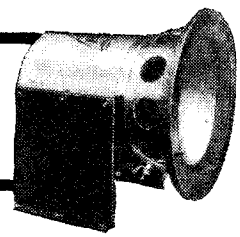

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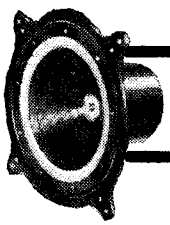

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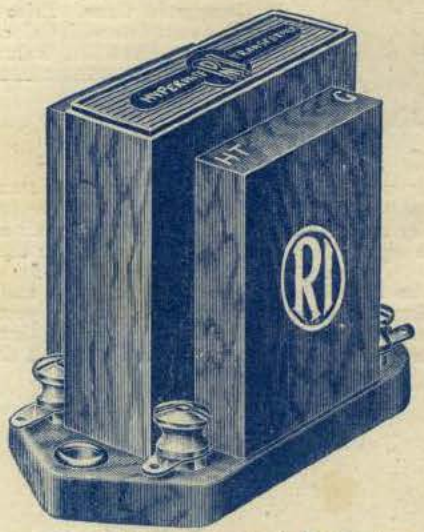

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