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No. 328. Vol. XIV.

INCORPORATING "WIRELESS"

September 15th, 1923.



Special Features This Week

MORE ETHER SPACE. VANISHING SHORT-WAVERS. "MEMORIES"

THE NEWCOMER TO RADIO

(You can start this series this week).

AN IDLE BATTERY. ARE MOVING-COIL LOUD SPEAKERS WORTH WHILE ?

THE "TOM-TIT" TWO

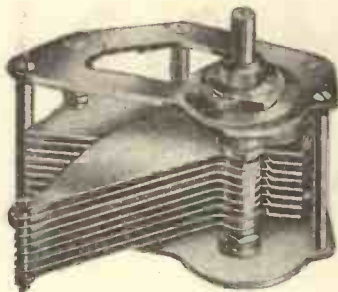
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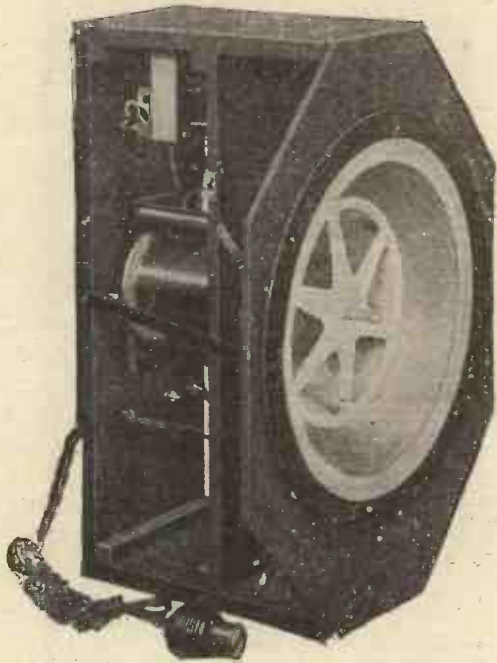


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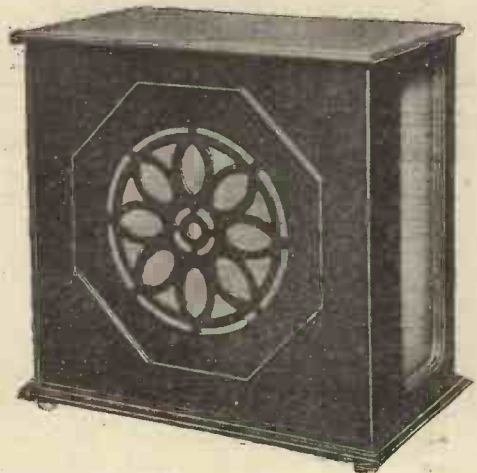
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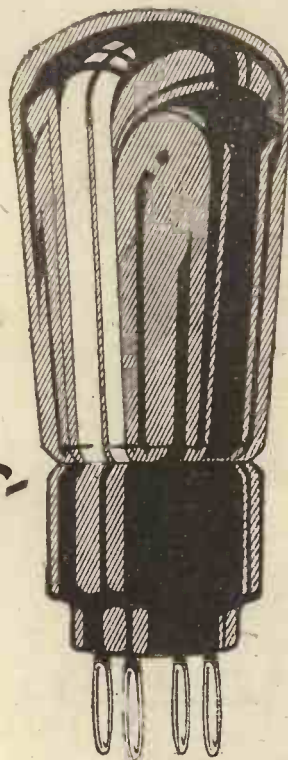


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OCTOBER ISSUE

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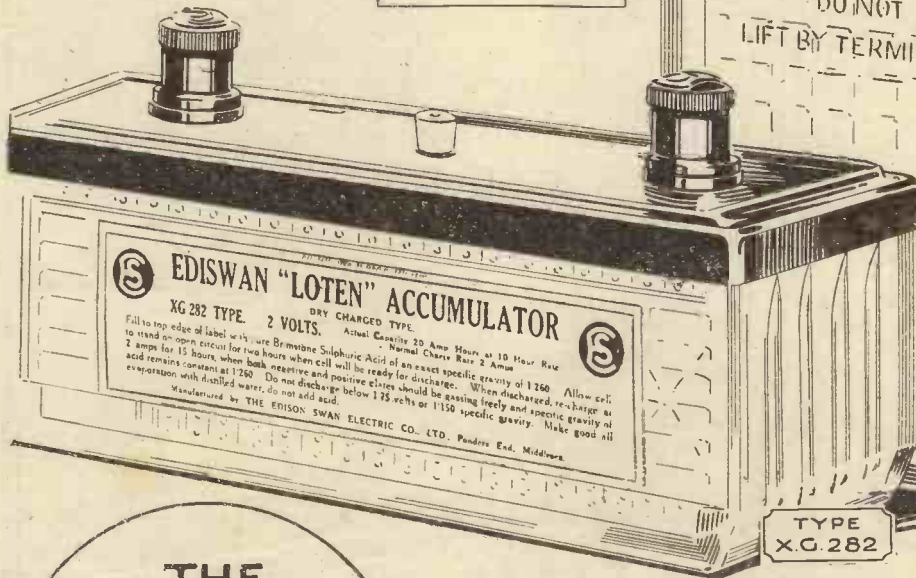
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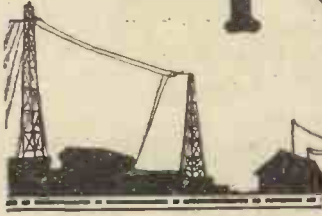
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Popular Wireless



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RADIO NOTES AND NEWS.

Germany's Wireless Marvel—"Ariel's" Nature Notes—Are There Radio Cads?—News From New Zealand—The Bag and the Tools—Radio the Rascal—Lead-Swinging Abolished!

"Speakies" to be "Movies"?

RUMOURS of an exodus from Savoy Hill. Studios becoming larger and more numerous; announcers springing up like mushrooms and squeezing the cranks and experts unbearably; nightingale trackers demanding smoke-rooms. All this and more also makes the B.B.C. think of flitting, but to where? I can suggest only the new western bit of Bush House or the Crystal Palace.

Radio and Print.

One is bound to agree with Mr. R. D. Blumenfeld, President of the Institute of Journalists, when he utters the platitude that broadcasting is unlikely to supersede the printed word. I have seen the same remark dozens of times. He thinks that the broadcasting of news serves to increase the demand for newspapers. Right again! All the great interests which fancy that radio is an enemy should recollect that radio is to them that most potent of publicity measures—the giving of samples.

Germany's Wireless Marvel.

THE German Navy has fitted up an old cruiser as a sort of wireless hare. It has no crew but is controlled by wireless. The engines are fed with oil fuel automatically. The idea is that this vessel shall venture forth and be blazed at by the fleet, while another ship, which controls her movements by radio, tries to keep her dodging the shells. The poor beggar can't sink if she catches "a packet." Filled with cork!

Portable Radio de Luxe.

THE other Sunday I took my very grown-up daughter on the day after her fourteenth birthday to some beautiful commons hereabout which boast several fine ponds in which the youth of Kent angle for carp and stickleback. I had not taken four draws at my pipe before her ladyship announced the "biggest fishing-rod you ever saw, daddy." As I wanted to see the biggest rod I had ever seen, I grunted and rose from my tree-stump. The fellow had two ten-foot rods and an aerial slung between them; he had also a six-valve, home-made receiver and a

glorious moving-coil speaker. Rough on the genuine fishermen, though.

Nature Notes.

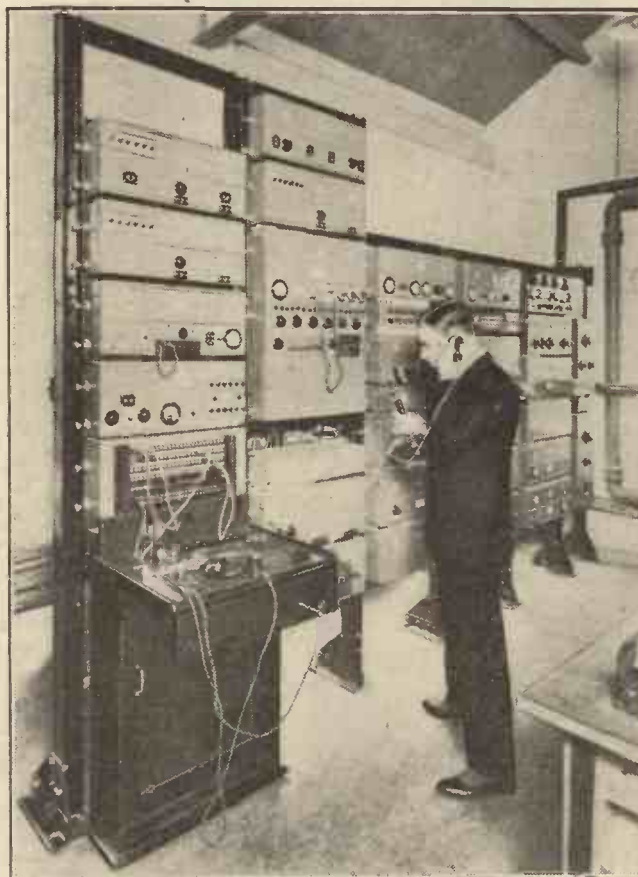
I SAW a motor-cyclist to-day with a pillion-rider who did not wear silk stockings. It was a radio set. Some disillusioned wretch, I suppose! Chucked! And whilst we are on nature study, I may as well mention, for the benefit of biologists, that my son has a couple of miserable

tadpoles in a pic-dish. These poor creatures have just grown hind-legs and entered upon a semi-vertebrate existence. When left alone they kick like blazes, but when my loud speaker gives them the Brum Studio orchestra they "freeze" like spotted hares. Charmed—or stunned?

Book Note.

IF you want a book which will keep you awake till the missus comes home from the whist drive, I recommend "Spies," by B. Gollomb. Therein you may read of the heroine named Louise de Bettignies, alias Alice Dubois, who did yeoman service for the Allies in Belgium. From secret inks she passed to homing pigeons and then to portable wireless. And all in the face of the genius and science of the German invaders. A marvellous yarn!

THIS WEEK'S WIRELESS WONDER.



At the new Bridgewater Beam Station shown above, it is possible to mix Morse telegraphic messages with telephone calls, send them mingled to Montreal, and sort them out properly again upon receipt in Canada!

Are There Radio Cads?

NEWs from Connecticut, U.S. states that the American Radio Relay League offered a reward of £100 for the apprehension of the person who broadcast messages purporting to have been sent by Mr. B. Hassell and Mr. P. Cramer from the aeroplane "Greater Rockford," which was missing. The 'plane left Ontario for Greenland on Aug. 18th. The messages are supposed to be fakes—and I hope the £100 is won. Incredible that a radio man should play the

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

foot in a matter of life or death. Yet the world is full of all kinds of people.

A Contemporary Caught Out.

I AM indebted to Ariel of the "Musical Times" for this joke, though he himself is most solemn about it. In referring to a talk by Prof. George Gordon about the "Oxford Dictionary," in which appeared an example of the work of the Dictionary in correcting popular errors, some "expert" of the B.B.C. headed the paragraph, "Scotching the vulgar error," thus committing a very vulgar error, for "to scotch" means "to cut or wound slightly." It is a relief to find that, after all, the B.B.C., which pretends to "lay down the law" about the English language, has a vulnerable heel.

Conductivity!

MY namesake who does the wireless notes for the "Musical Times" pertinently asks why when Sir H. Wood directs a concert the B.B.C. announces the programme as being "conducted by Sir Henry Wood," but when Mr. Jack Payne takes charge of the B.B.C. Dance Orchestra we are told that the performance is "personally conducted by Jack Payne." Well, it's done to let you know that Jack Payne is really there. Think it over!

B.B.C. Jokes.

MY inclination has always been to defend the B.B.C. against the idle, inveterate "grouser," but since the Corporation has assumed such royal airs and has made such pretensions of instructing its grandparents to suck eggs, I cannot refrain from an occasional lob at its wicket. "Punch" says that a wireless weekly, (I suspect the "Radio Times") translated "L'Après midi d'un Faune" as "The Afternoon of a Fawn," and adds: "Faun (petulantly): I wonder why the B.B.C. spells me with a 'w'! It has quite spoilt my afternoon."

New Source of Interference.

AS a postscript to the two preceding notes I may relate that on my inquiring of a gloomy "fan" how things were jogging along with him, he complained bitterly of interference. "What now," I asked. "Is it Morse, static or trans?" "No! B.B.C.," he replied.

Indian Visitor.

JUST about now, Mr. Fazalbhoy, managing-director of the Bombay Radio Co., should be in this country on a business trip. His firm is one of the pioneers of radio in India and specialises in British goods. We hope that he will just catch a glimpse of our sun, which is shortly going to set until April, 1929, and that he will be warmed by a trade welcome. Anyone who really and truly specialises in British goods ought to be met by the Mayor and Corporation of the port at which he disembarks.

News from New Zealand.

WITH special interest I reflect to my readers the gist of a letter from a potential Valve Bart. of New Zealand, which is the first turning on the right after you get to Australia. Brevity being the soul of space-saving, I'll condense: M. H. C. (Auckland). Crystal in 1923.

Heard 2 X A F September, 1927, on two-valver. Prefers English components and only American part used is Weston 'phone plug; says he has not seen good English plug. Up to present has logged 117 stations, all telephony, on the valves, and attributes the clarity and volume to Ferranti transformer.

The Bag and the Tools.

BAG includes ANE, ANH, RFM (Siberia), PCJJ, 5SW, GBS (Rugby), AFK, 2XAF, 2XG, KDKA, CJ (Canada), 2FC, 3LO, JOAK (Japan), JOBK and JOCK. Set is capacity-controlled reaction type; Philips valves, Ormond condensers, Benjamin valve-sockets, Lissen grid condenser, leak, and H.F. choke, Brandes' phones,

SHORT WAVES.

My neighbour tells me that a little boy threw a stone through his front room window and missed his loud speaker by a few inches. Still, no one can deny that it was a good shot. —"Popular Radio Weekly."

A PUZZLING CIRCUIT.

Newlywed: "Now, dear, I'm sure you can learn to cook by radio."
Mrs. Newlywed: "All right, Freddie, you hurry and hook up the radio to the range while I run down to the grocer's." —"Radio News."

He was a son of Scotland,
As thrifty as could be,
And he inquired at the local post-office
The cost of a listening tee.

He thought hard for several minutes—
Twenty-four shillings was rather dear.
Then he asked for half a licence,
Because he was deaf in his right ear. —"Australian Journal."

Answer to Correspondent: No, the fireworks had nothing to do with the bad atmospheric conditions which prevailed on the night of your local regatta.

"Enthusiasts should make a habit of thoroughly cleaning and polishing aerials and earths, and connections; this will help the brighter broadcasting movement."

HE WANTED PLAIN TREATMENT.

Doctor Sawbones: "Yes, I know a broken leg is mighty painful, but I'll give you some sort of an anodyne."
Patient (a radio fan): "Oh, I can't afford anything so expensive. Better give it just an ordinary set." —"Radio News."

Oh, what use is the B.B.C.,
What use the S.O.S.,
If it can't render help to me
In moments of distress?

If, when at the last tick I learn
My partner won't occur,
They cannot send me by return
A perfect Charlestoner?

And if, by a last-moment wire,
I'm vexed as by a midge,
I will the B.B.C. require
To send a fourth for bridge.

What if my best man springs a sprain?
What if my bride is late?
By S.O.S. I will obtain
A new best man—or mate. —"Daily Herald."

Philips' and also Browns' loud speakers, Gecophone "B" battery eliminator and Fuller accumulator. Single-strand, inverted L aerial, 50 feet high, 85 feet long; water-pipe "earth."

Radio the Rascal.

RADIO, it seems, is going to revolutionise almost every department of knowledge before we are much older and wiser. It is said that longitude measurements made by means of radio signals sent between London and Paris showed a variation of 50 feet; in other words, that

Paris is 50 feet nearer to London sometimes than at other times. Like the key and the keyhole after a hectic evening! They are also trying to prove by radio means that Greenland is moving west at 34 yards per annum. I invite Canadian readers to emigrate before the bump comes.

Lead-Swinging Abolished.

WHEN Shakespeare wrote, "Full fathom five thy father lies," he did not know that a bright young person of 1923 would be able to check up that estimate of profundity without even standing on deck. I learn that it is now possible to take marine soundings by radio. The voice of an electric gong is broadcast by the ship through the water, and by means of a receiver, a chronometer and a few calculations, connected with, I suppose, the effect of water on E.M. waves, the depth is found. The Grimsby trawler, "Endylyon," is trying this out.

We Beg to Differ.

"ELECTRICAL INDUSTRIES" seems to think rather odd the claim of a householder in a certain district that, as an alteration of the electric system and pressure will necessitate an alteration in the method of charging his radio batteries, the Corporation ought to provide the new apparatus at their expense. I understand that the local Electricity Committee dispute the claim. Well, I think such a claim is just. It is so palpably just that when our local supply was changed to A.C. I did not even have to kick; a man came in, sneaked my D.C. charging board and left behind a fine rectifier, which is my property.

Our Competition.

YOU—in the deck chair on the sands! Wake up and fill in the last line. The best line wins a "P.W." O—B (looming)E (Radio section).

There was a young Valve Bart. of Filey,
Who tried to be deucedly wily;
He logged every station
Of every darned nation,

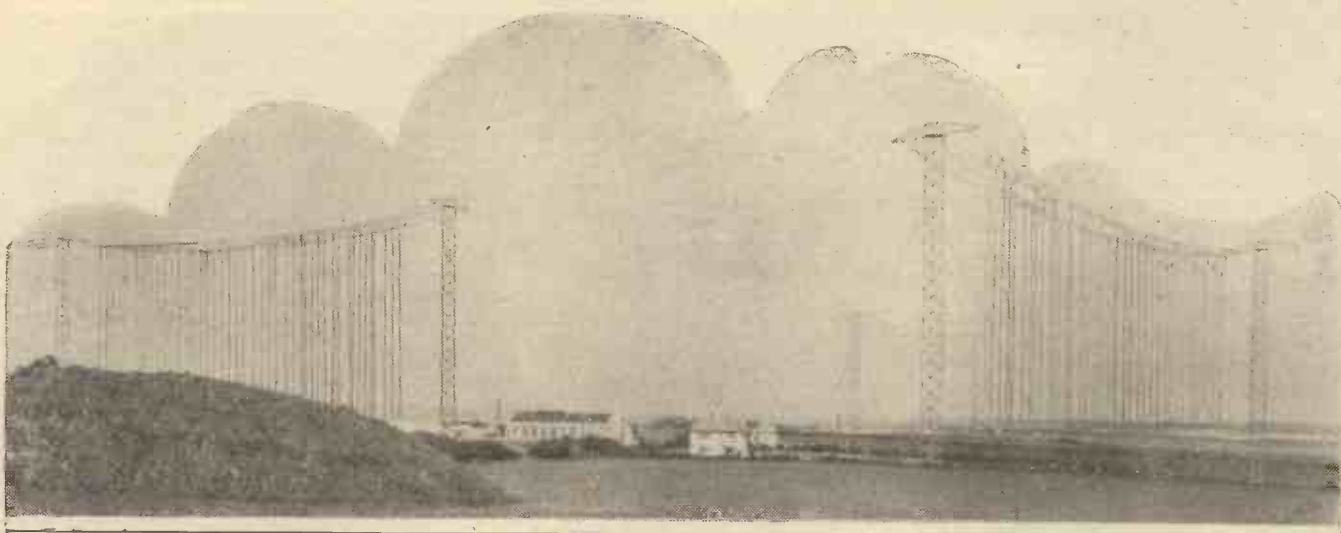
Send the kids to listen to the pierrots, and then settle down to poetry. Not the "Foundations of Poetry," but the fag-ends.

Radio Astrology.

MR. G. W. PICKARD, a well-known wireless pioneer of America, takes a photograph of the sun every day and observes the sun-spots, collating his findings with the quality of radio reception for the day; all this to study the effect of the spots on the signals. I am wondering whether any relation exists between radio programmes and sun-spots; it's not unlikely. But fancy having to compare our sun-spots with psycho-analyses of the Programmes staff of the B.B.C.

Next Week's Issue.

THE issue of "P.W." that will be on sale next Thursday is to be the first of our Special Exhibition Numbers. And it will be a snorter! Specially enlarged for the occasion, it will be on the bookstalls for the usual modest threepence—but it may not be on sale there for long, so make sure of your copy now!



MORE ETHER SPACE

THE most pressing problem in broadcasting at the present moment is the need for more elbow space in the ether. New transmitting stations are constantly coming into operation on the Continent, and still more are in course of construction.

Meanwhile the powers that be have laid down one comparatively narrow band between 200 and 600 metres, supplemented by another between 1,000 and 2,000 metres, as the two channels within which all broadcast transmission must be confined throughout the European area.

These limits have been accepted by international agreement, and are designed to prevent any interference due to broadcast transmission with long-range commercial stations, or with the ether channels used by various countries for naval, military, and air force operations. The existing limits are not likely to be extended merely to afford additional accommodation for broadcasting, which is at present regarded purely as an amusement or entertainment service, and therefore of minor importance.

The International Committee in Geneva have prepared several distribution schemes with the object of making a fair division of the available ether space amongst the various countries concerned. In doing so the Committee have agreed that a minimum "spacing" of ten kilocycles is necessary, to prevent one station from interfering or heterodyning with the stations next above and below it on the wave-length scale. Such a distribution affords elbow room for only 115 stations in all, including both the available channels mentioned above.

Preventing Overlapping.

It may be asked why such a wide spacing as ten kilocycles (10,000 cycles) is necessary to prevent one station from overlapping its nearest wave-length neighbour.

The answer lies in the fact that although the carrier-wave of any given station is said to have a constant or single frequency (or a definite wave-length), this is only true in theory. More precisely it is only true so long as the station is transmitting a pure carrier-wave unmodulated by any signals.

Directly the wave is modulated by low-frequency currents, corresponding to the

At the present rate of growth the radio stations springing up all over the world threaten to cause a complete crowding. But a far-reaching development is described in this article which would allow hundreds more stations to operate without (material) interference.

FROM A SPECIAL CORRESPONDENT.

applied speech or music, the original carrier-wave is split up into an immense number of side-bands, so that the wave reaching the receiving set is no longer a "single" frequency, but is flattened or spread out so as to extend over a very considerable band of frequencies.

Fringe of "Side-bands."

Exactly how wide is the zone covered by the side-bands depends upon the frequency range of the various low-frequency currents applied to the modulator at the

For example, suppose that the low-frequency notes cover a range of 5,000 cycles, then the carrier-wave develops a corresponding fringe of side-bands covering 10,000 cycles.

This is the basis taken by the Geneva Committee. Assuming a modulating range of 5,000 cycles, they calculate the spread of the resulting side-bands to cover 10,000 cycles, or 10 kilocycles, and stipulate that every station shall be separated by at least this gap from its nearest neighbour on the wave-length (or frequency) scale.

The Effect Illustrated.

The precise reason why the application of a low-frequency modulating current to a constant-frequency carrier-wave should result in the production of side-bands, is a matter for the mathematician capable of using Fourier's theorem. This states that a periodic curve of any shape can be built up by suitably combining a number of sine curves whose frequencies are simple multiples of one fundamental sine curve, provided the amplitudes are suitably chosen.

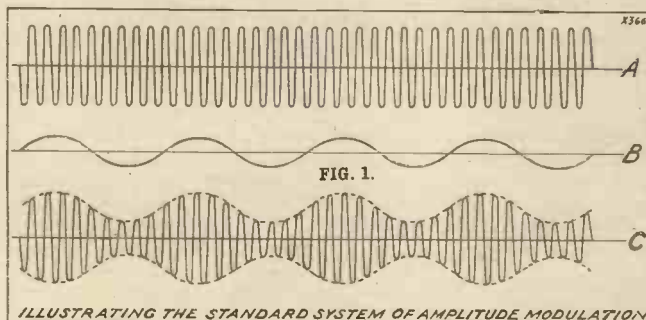
The accepted method of illustrating the effect of ordinary modulation is shown in Fig. 1, where the curve A represents the unmodulated carrier-wave of single frequency, B the applied low-frequency (speech or music) current, and C the resulting modulated carrier-wave.

The latter corresponds to the "periodic curve of any shape" re-

ferred to in Fourier's theorem, and the side-bands are the numerous sine curves into which it can be resolved, and of which it is, in reality, composed.

It will be seen that the amplitude of the wave C varies from point to point, some of the carrier components being shorter than the others. Actually the outline or "envelope" of curve C follows the outline of the modulating current B, as shown in dotted lines.

(Continued on next page.)



transmitting end. Opinions differ as to the range of the low-frequency notes necessary, say, to transmit an orchestral performance. It has been put as high as 20,000 cycles and as low as 3,000.

But whatever is the figure taken on the low-frequency side, the modulated carrier-wave is flattened out by the presence of side-bands covering twice the difference between the highest and lowest pitch used in modulation.

**MORE
ETHER SPACE.**
(Continued from previous page.)

This system of modulation can be defined as "amplitude" modulation by way of contrast with the new system about to be described.

Quite recently it has been found possible to transmit speech and music through the ether merely by varying the frequency, but not the amplitude, of the carrier-wave. This, at first sight, may not appear to be a very startling development, but it promises to have very far-reaching results.

Compare the Figures!

In particular, it practically "washes out" side-band frequencies as we now know them. Low-frequency components must, of course, be present in the carrier-wave, otherwise they could not be detected in reception. But they do not "spread" the carrier-wave to anything approaching the same extent as is the case in present practice.

For instance, it is possible to transmit perfectly intelligible speech on a carrier-

components are all of the same amplitude, though they are spaced apart by different amounts, corresponding to the rise and fall of the low-frequency curve.

Where the latter reaches its highest point, the carrier components are crowded together most, whilst they are most widely spaced apart at the trough or hollow of the low-frequency curve. The carrier spacing is normal only where the curve *b* crosses the datum line.

Various methods are available for modulating by frequency variation. For instance, the currents from the microphone can be applied to vibrate an electromagnet, which in turn controls one plate of a tuning condenser.

Special Receivers Unnecessary.

The latter may form the main condenser controlling the tuning of the transmitting aerial, but preferably it is a smaller condenser inserted in parallel with the first.

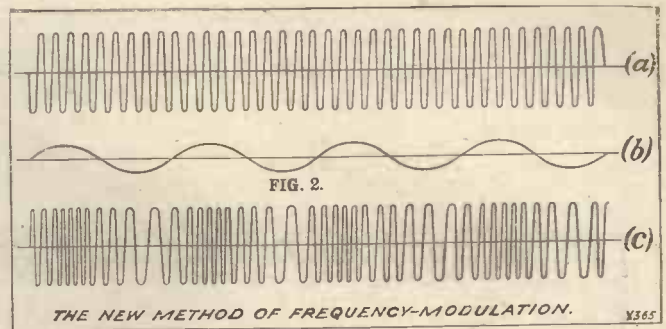
In either case the movement of the condenser plate varies the total capacity of the transmitting-aerial circuit, and therefore varies the frequency (though not the amplitude) of the oscillations generated, so giving rise to a radiated wave of the form shown at (c), Fig. 2. The manner of reception is also simple.

Every sharply tuned radio receiver has a resonance or response curve of the form shown in Fig. 3. That is to say, the value of the current flowing in the receiver will rise or fall according as the tuning of the circuit coincides with, or differs slightly from, the frequency of the incoming wave.

This is proved in practice by the way in which signal volume can be cut down by slightly detuning one of the circuits of a multi-valve set. Sometimes the same effect tends to spoil reception, as shown by the way in which loud-speaker reproduction on a highly selective set will sometimes turn thin or "tinny," owing to some of the side-bands being cut out because the circuits are too sharply tuned.

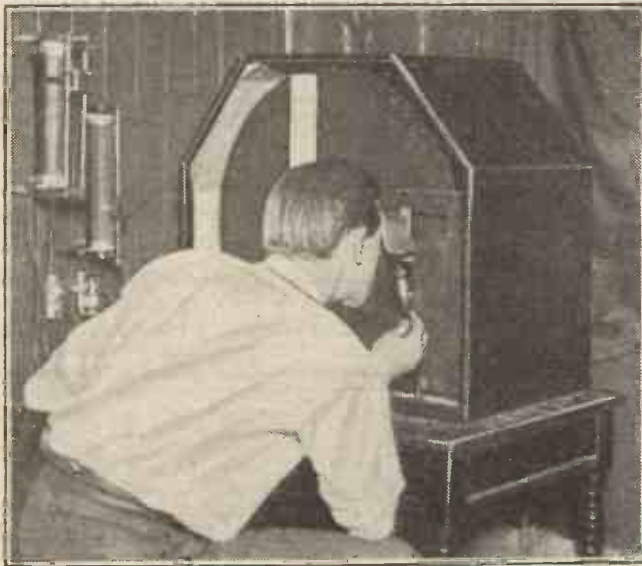
Let us suppose that a highly selective receiving set is slightly detuned from the carrier-frequency of the wave shown in Fig. 2 (c), so that it is working, say, on the point *x* of the resonance curve of Fig. 3. As the frequency of the modulated wave increases, corresponding to the crowded portion of (c), the current flowing in the receiver increases from *xy* to *EN*.

Similarly, when the frequency decreases, corresponding to the open part of the wave (c), the current in the receiver circuit falls from *xy* to *DM*.



It follows that the applied frequency variations of the carrier-wave have now been converted into corresponding amplitude variations (ranging from DM to EN). In this form they are capable of amplification and rectification in the ordinary way.

It has been stated in criticism of television that, whatever may be its merits, there is no room for it at present in the ether without causing very serious disturbance to the existing broadcast service. It may be that along the lines indicated above room may be found in the ether for both a broadcast and a television service running conjointly and without mutual interference.



It is interesting to note that most of the known television schemes occupy very wide wave-bands. There would be room for few of these on the 2 L O - 5 G B frequency range. The photo shows an American television experiment being carried out.

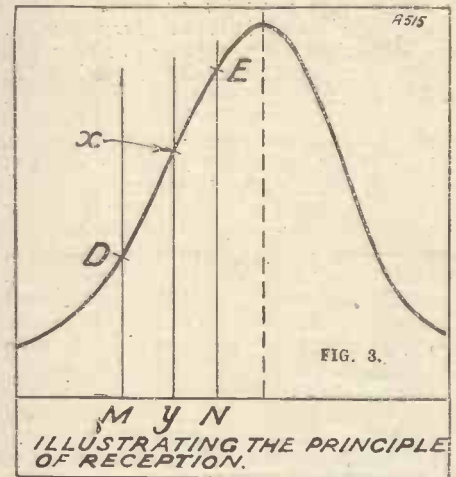
wave which only extends to a mere 100 cycles on either side of its fundamental frequency. Compare this with the 10,000 cycles separation insisted upon by the Geneva Committee!

Should the new system ever come into universal use, it will allow at least twenty to thirty stations to operate, with greater freedom from mutual interference, in the space now allotted to one single-station.

Method of Transmission.

Fig. 2 illustrates the operation of the new system of modulation. The difference between the new and old methods will be clearly grasped by a comparison of this figure with Fig. 1.

As before, (a) represents the unmodulated carrier-wave, (b) the applied speech or musical frequency, and (c) the result of combining the two by frequency modulation. It will be seen that the carrier-wave



NOTE THESE POINTS.

IF you want to use very old or indifferent fixed condensers do not try using them as coupling condensers, for the slightest fault in a component in this position will result in distortion.

If one of your grid-bias negative plugs is plugged into the battery at eighteen or somewhere in that neighbourhood it must on no account be moved from that position unless the filaments are switched off whilst adjustments are made.

Ordinary rubber solution as used for mending bicycle tyres can be employed to fix on ivory labels which have become detached from panels.

The golden rule of radio is to take out the H.F. negative plug before making any adjustment to the wiring or inside the set.

ARE "MOVING-COIL" LOUDSPEAKERS WORTH WHILE?

Is it worth its money? Is it really all that it is claimed to be? These and other important questions are definitely answered in the following article.

From A SPECIAL
CORRESPONDENT.

THIS question has been answered before, but it might be as well at the beginning of a new radio season once more to review this problem. Many newcomers to radio will be arriving with more or less completely open minds, and will be faced by a wave of moving-coil speaker popularity.

They may get the idea into their heads that this type of instrument is a complete "last word," and that all other varieties are obsolescent, if not obsolete. Further, they might already have come to the conclusion that moving-coil loud speakers are expensive because they are comparatively new, and that in due course they will be as cheap as the cheapest of "cones."

Let me destroy this impression right away. The so-called moving-coil loud speaker is not so very new, although it is true that it is only fairly recently that it has been made available to the ordinary listener. There are even now only two makes of moving-coil loud speakers which, to my knowledge, are supplied complete.

Units That Are "Wash-outs."

The instrument is not complete unless it is fitted into a proper cabinet or supplied with what is known as a baffle-board, a vital part indeed of the device. These complete outfits cost anything up to £50 or so. The alternative sets of parts which are sold for home assembly are manufactured by a large number of firms. And they vary in quality to an extraordinary degree.

Complete units consisting of the large magnet and coil and diaphragm can be obtained at £9 10s., and this is a reasonable price, in that they are articles in which individual and careful assembly figure. They are very different to ordinary speaker mechanisms.

Now some of the sets of parts to which I have referred are very tricky to put together, while others are moderately easy. And they vary to an enormous degree. I have in mind one make costing something less than £5 which comes in this latter category, and is also extraordinarily sensitive for its type, and most successful in point of quality of reproduction.

Another and cheaper set of parts that has been advertised is, in my opinion, quite a "wash-out." The assembly is not very difficult, but the completed unit is most insensitive, and gives no more real bass than a cheap cone.

I cannot help saying it, although I know it sounds most disquieting, but I know of only two moving-coil assemblies that can be regarded from all angles as satisfactory assemblies. Both have been mentioned moderately recently in "P.W." And if prospective acquirers of this type of instrument cannot purchase one or other of these, then I would advise them to buy complete units.

Effect of Imagination.

So much for the actual obtaining of a moving-coil loud speaker; but the question asked by the title of this article still remains to be answered. And it is easy enough for



One of the R.K. moving-coil loud speakers which are now available. (B.T.H. Ltd.)

me to give a definite answer. I do not intend to leave the reader with the feeling that I have dodged the main issue.

In my opinion, the moving-coil loud speaker can only be of interest to the listener who needs great volume (a loudness almost sufficient for a small hall at least) and a listener who can also run to an expensive multi-valve set.

The listener who must economise in regard to his set in order to obtain a moving-coil speaker will be wasting his money in making this sacrifice.

Imagination does, I know, play a great part in radio reception, and it is quite possible that many amateurs operating a moving-coil speaker with a very ordinary two-valve set would believe the resultant noise to be very perfect radio. But other listeners probably would not.

Very few moving-coil speakers indeed will give results even equal to good-class ordinary cone models, or even horn speakers, unless they are fairly powerfully driven. In fact, many definitely distort weak inputs.

Even with the local station some four or so valves, including a stage of H.F., are generally needed.

And this type of speaker has an uncanny habit of exaggerating imperfections in the set. Certainly there must be no "pushing," reaction must be eschewed, and low-magnification stages resorted to. Further, the need for heavy chokes, and so on, that do not reveal saturation troubles, super-power valves and high anode voltages become dire necessities.

Until the amateur uses a moving-coil speaker he does not notice how much minor distortion the average speaker mercifully hides. It takes time and money to cope with this temperamental and "perfect" instrument if it is going to be made to give the realistic results of which it is undoubtedly capable.

And if the listener is not going to be able to detect the above mentioned discrepancies as they become apparent, and if he cannot afford the time and money to see that they are smoothed out, then he will be well advised to stick to ordinary cones and horns.

That Bass!

Certainly, if he cannot see his way to go above three very ordinarily arranged valves then this will undoubtedly be his wisest course.

A further point is that some amateurs actually prefer a little "coloration" with their music, the coloration that is adequately provided with some cones, quite apart from the fact that this sugaring also smothers minor harshnesses due to faulty inputs. I have had quite a few people say to me that they prefer certain ordinary speakers to the moving-coil instrument I frequently operate.

To say that they were foolish is beside the point—they knew what they liked, and said so, and I respect them for it. They did not back the moving-coil speaker because it was the more expensive device.

With an ordinary speaker one definitely loses a great amount of bass, but many people do not seem to miss or to want bass, and, after all, one cannot seem to get bass with quietness. It is the bass that is the backbone of real volume, and I know of more than one ordinary cone speaker which will give a quiet rendering very little short in realism to the loud perfection of a moving-coil speaker.

THE MENACE OF THE TALKS.

"The B.B.C. still clings to a belief in that fundamental fallacy—the listeners' letter. If they could break away there is a simple remedy to hand to the problem of Talks That Tire."

By THE EDITOR.

IN a recent issue we reported that when the B.B.C. Governors meet again in the autumn one of the subjects for discussion will be "Talks"—and lively argument is likely to ensue when the pros and cons for reducing their number are dealt with.

It would thus seem that the very fierce criticism to which talks have been subjected during the last few months, has even reached the ears of those gentlemen whom the Prime Minister, in his wisdom, chose to fulfil the task of "governing" the B.B.C., and consequently it becomes apparent even to the casual student of broadcasting that the recent row about talks—their dullness and excess of numbers—has had reverberations which have even penetrated into such an aloof and rarefied atmosphere as that enjoyed by the Olympians of the B.B.C.

Misled by Letters.

Whatever the outcome of the autumn discussion among the Governors, they can now hardly declare their ignorance of a controversy which, although it has given the B.B.C. publicity, must have alienated the sympathies of many of their supporters who believe, and rightly so, that the matter should have had closer and more immediate attention.

But the B.B.C. still clings to a belief in that fundamental fallacy—the listeners' letter. A few thousand letters from listeners who like the B.B.C. talks—who, in fact, will declare their enjoyment of a long-winded discourse on the Predatory Habits of Carnivorous Mammals as readily as they will applaud the choice of a subject dealing with the intimate domestic habits of a flea or cannibalistic head-hunters from Borneo—will uplift the B.B.C. talk department to an ecstatic state of conviction that the majority of listeners like talks, and that, furthermore, the subjects chosen are eminently suitable.

But Fleet Street can, and will in due course, teach the B.B.C. at least one thing: that a few thousands of letters from a clientele running into millions do not indicate, with any reliable accuracy, the true feelings of the majority.

Very Great Mistake.

Editors know by painful experience that they cannot judge the tastes of the majority of their readers by the correspondence they receive; and the B.B.C. officials, catering for millions of people, make a very great mistake when they suppose that, because a few thousand people write and commend the talks, they are justified in continuing to devote so much programme-time to talks, which are often of a nature which reek to high heaven of pedantry and insufferable dullness.

No responsible critic of the B.B.C. has yet suggested that talks should be completely abolished; but many responsible critics have suggested that talks should be

reduced in number, length of duration, and that the subjects should be chosen with more discrimination and more psychological appreciation of public taste.

Talks could be made an extremely interesting feature of the B.B.C. programmes, but when erudite gentlemen are allowed to drone before the microphone upon subjects which the average man cares absolutely nothing about, and which, in any case, he cannot satisfactorily assimilate by word of mouth, the sarcastic and sometimes angry criticism which the B.B.C. invokes is an indication of incompetence



"We have very few talkers who can hold our attention by charm of voice, presence and manner." And Sir Oliver Lodge, a recent photo of whom appears above, is one of the outstanding few who have these gifts.

in the talks manufactory at Savoy Hill. Certain subjects which have been chosen for talks can only be properly appreciated by the medium of the printed word.

Technical profundities about the spider and its habits, for example, are not suitable for a broadcast talk, although the subject of spiders could, no doubt, be made extremely interesting and entertaining if dealt with by the popular L. G. M., or if a budding lecturer, who could discuss spiders with the charm and ease with which Maeterlinck wrote about bees, could be gathered into the talks fold at Savoy Hill.

Unsuitable Subjects.

Sir Charles Oman was, perhaps, a little severe when he condemned a recent talk on spiders as a "disgusting business." No doubt many listeners regard spiders as disgusting, and many listeners among the fair sex must have been far from edified

by this intimate chat on one of the most abhorred of "creepy-crawlies."

Insects and vermin are, to put it bluntly, hardly suitable subjects for broadcast talks. If people want such details they will find them in books, and the knowledge they seek will doubtless prove most complete and will be retained with greater facility than by the medium of B.B.C. lecturers.

It must also be remembered that as a race we are not very susceptible to lecturers.

In America it is different; there, the lecturer—if he knows his job and has a personality—can reap a rich harvest. And in Germany the lecturer has it all his own way.

"The Remedy Is Simple—"

There is, however, not much scope for the public lecturer in this country—unless he be a very famous man. And in such a case, ninety-nine people out of a hundred will go to his lectures not so much to listen to him as to see him.

The trouble may be that we have very very few talkers who can hold our attention by charm of voice, presence and manner; and the difficulty is even greater when considering the broadcast talker. Charm of voice is essential: one B.B.C. "talker" in a hundred has it—and Sir Oliver Lodge and Sir Walford Davis cannot charm us every day.

The remedy is simple: make quality and less quantity.

Emphatic!

Perhaps the B.B.C. Governors will endorse that remedy when they meet. If they do they may be sure that the majority of listeners will be grateful; if they do not they may be sure the majority of listeners will be— Well, we will not look on the black side. Anyway, it will be something quite emphatic!

FOUR HINTS.

A FEW pennyworth of distilled water (obtainable at any chemist's) is sufficient to top up an L.T. battery during the whole of the season.

Dirty solder need not be thrown away. If it is placed in a suitable flat lid over a gas ring the scum can be scraped off and the solder poured on to a cold surface, such as a large slab, when it will set immediately.

To keep small drills, tools, etc., in good condition they should be protected from the air and damp by a thin coat of grease or oil.

When fixing a panel to a baseboard do not drill the holes through the panel whilst it is out of the cabinet, but place the baseboard in the cabinet in position and the panel in its correct relative situation first.



ONE of the most popular developments in broadcasting has been the making of running commentaries on important events. People who have often watched the Boat Race have said that they had never "seen" it so clearly as when they listened to Mr. J. C. Squire broadcasting his description of it. Nowadays we all feel that we have been to the Derby; the nation was enabled to welcome home the Duke and Duchess of York; all Wales attended the unveiling of the National War Memorial; and many old ladies are becoming football fans.

But running commentaries can differ as much as pictures. Some are merely photographic or cinematographic, and should be—others are, but should not be. The commentator must realise that once he diverges from an impersonal description of events, making emphasis here or there, he begins to colour his word picture. His picture must, then, if it is to be a work of art, that is if it is to do its work properly, obey a number of rules common to all works of art.

A Good Example.

It must have unity and right proportion; it must have a definite spirit of its own—an emotion. The speaker must decide whether the colour is to be strong or of delicate pastel shades, whether the outlines shall be as bold as a woodcut or as fine as silver point. It all depends on the subject. The speaker's personality, in any case, will "come through."

As an example of a commentary well suited to its subject I may take Mr. J. C. Squire's first description of the Oxford and Cambridge Boat Race. No doubt you heard it. A "close-up" description of bow's blue eyes would have been as boring as a bare statement of the position of the boats; a poem on the River Thames would have annoyed listeners as much as a long history of previous races.

Mr. Squire is, of course, a sportsman as well as an artist, a master of words, and we knew what to expect—a fine, balanced description with the interest maintained by his partner's intimate knowledge of what was happening in the boats. The only mistake was that the wrong boat

An exclusive series of articles
describing the inner secrets of
the studio.

3. PICTURES IN SOUND.

won! Of this year's race the less said the better.

For experiments in this art of picture-making in sound I must refer to my own work, for I do not know of any other. I will take two, both ideal subjects, the opening of the Welsh National Museum by their Majesties the King and Queen, and the unveiling of the Welsh National War

Memorial by H.R.H. the Prince of Wales.

The first was given on a lovely summer afternoon. In Cathays Park in front of the Museum were gathered about 20,000 excited people; inside the Museum were the leaders of Wales, massed choirs, and the station orchestra. I was perched outside on the roof.

Some time before the arrival of their Majesties the orchestra played national airs and the choir sang a Psalm in addition to old Welsh folk-songs. All these items were broadcast through loud speakers to the crowd. The atmosphere was on a high emotional level—kingly dignity, civic pride, national sentiment and public gaiety were all aroused by the music and by the occasion.

It clearly demanded a mystical note in its description and the red dragon of Wales, rampant on the flags and in carvings beside me on the museum roof, was the obvious motif.

Collaboration.

The dragon became my collaborator; in fact, he was the principal character. He became, as I suppose he originally was, the dragon of mythology guarding the ancient treasures, the wise dragon, not to be confused with the evil one. After a short prelude, containing a description of the scene, the State Coach was sighted from the roof, but I finished my few remaining sentences before I announced the arrival. This I considered artistic licence.

Finally there came the dramatic knocking of the King on the
(Continued on next page.)



The modern commentator is greatly assisted by the special new B.B.C. van, shown in action herewith. The roof of the van serves as an observation studio, and in the interior are all the necessary amplifiers and so on.

" MEMORIES. "

(Continued from previous page.)

great door beneath, and it was to this moment that I had carefully led up. From then, until the final scene, the commentary became a straight broadcast. Their Majesties went away to the gay strains of a drum and fife band, and the gradual fading of the band in the distance gave an excellent impression of the departure. But the dragon still remained, and he and I ended with a few frivolous words on dragons in general; the dignity of the day had gone and the time had come for festivities.

Similarly I used a motif for the unveiling ceremony of the Welsh National War Memorial. The Memorial is circular; everyone was grouped around it; everyone was



Mr. Wilkie Bard, the famous comedian, amuses listeners via 2 L O's microphone.

thinking of it—so the motif I took was a circle, a wonderful thing in itself, as all mathematicians know.

"The Memorial is not only open at the top, but all round, between the pillars, so that the sun will shine there from sunrise to sunset—on the days when the sky is clear. And after sunset the stars will fill the circle.

"It was the custom of old painters to represent a nimbus, a circle of light surrounding the heads of saints and heroes. Here we have the circle of light above the heads of all three warriors."

A Serious Occasion.

It is evident that in this case again the description had to be serious, though possibly the comments made in the hut (but not broadcast) would have been more entertaining. The obvious motif, had the occasion been a gay one, would have been the back view of some oddly assorted heads just in front of me. Four heads close together, the Roman Catholic Archbishop's with its covered tonsure, Mr. Lloyd George's with its straying locks, the Arch Druid's (Elfet's) with its bald top, and an officer's bearing a Guards' busby, made a somewhat ludicrous contrast. But I had to resist all such temptations.

For an hour bands of the R.A.F. and the Guards played selections and also accom-

panied the crowd for the singing of famous hymns. Unfortunately the people in the enclosure were too self-conscious to sing lustily and we thus had poor balance in this part of the broadcast. This was an example of the difficulties in making a really good running commentary; another was the unexpected noise of the crowd which surged round the Memorial at the end and overcame the gentle splashing of the fountain within the Memorial.

The first hour, then, was introductory. It contained band music and song, and, in the gaps, my reflections on the scene, particularly on the Memorial within its circles. Everything worked up to the arrival of the Prince, announced by the growing volume of cheers and by the smart clicks of the guard of honour presenting arms—accompanied, of course, by the National Anthem.

The Finale.

The next hour contained a straight sequence of speeches, the unveiling being suggested by the minute's silence with the trumpeters' sounding of the Last Post and Reveillé. Finally, a few more notes describing the movements of the principal characters, the Royal Salute again, and the departure of the Prince to the fading cheers. But still the Memorial remained and the fountains played on.

As a finale I recited a few lines of glorious poetry specially written by Mr. Prys-Jones, the Welsh poet; and I tried to let the fountains be heard through the lines and for about half a minute afterwards in order to suggest an eternal memorial. But the fountain, as I have said, was almost "drowned" by the crowd. However, I understand that the whole transmission was particularly clear. The first hour was not broadcast through Daventry, but only through Cardiff and Swansea, so perhaps these notes may help distant listeners to appreciate the aim of my commentary.

I AM not ready to prophesy what will be the effect on radio of the latest work of Sir William Bragg, the new president of the British Association, and his son, Professor W. L. Bragg. They have something to tell, however, about X-rays—which are wireless waves, but shorter; and about electrons, which carry the current between your valve electrodes. And their work already has brought an improvement in the accumulators you buy.

When you look at the sky through a feather you see the colours of the rainbow because the white light is diffracted or split up. The "hairs" of the feather act as a "grating." Laue, a German physicist, discovered that X-rays could be split up similarly.

"Seeing" the Invisible.

Professor W. L. Bragg saw that when the closely packed rows of molecules in a crystal were used as the grating, the degree of refraction of X-rays shot through the crystal showed how the molecules and atoms in the crystal were placed.

Sir William Bragg followed a similar line. With his X-ray spectrometer, which he devised for the work, he has studied crystals of organic compounds. The latest result of his work must, of course, have had a bearing on his presidential address to the British Association.

" SEEING " ELECTRONS.

By W. J. BRITAIN.

"We have been able to find that the molecules of 'chain' compounds—which include alcohol and sugars—are formed like a zig-zag," Sir William told me. "We have been able even to measure the distance between the points in the zig-zag.

"At the ends of these zig-zags are atoms, forming a head and a tail. You may take a poison, change the head and the tail, and you have a cake essence. It is not unlike the universal tool into which you can fit new heads to make it a screwdriver or a gimlet or half a dozen things.

"We have almost reached the complete truth behind the 'chain' compounds, and now we are turning our attention to the 'benzene ring' compounds, which include poisons and explosives.

"The great importance of our results is that we are learning what things are like inside, and until we know that we cannot make them ourselves, or even use them properly. Methods of lubrication, for example, may be improved by the knowledge we have gained of the structure of oils."

What Sir William and his son actually are doing is seeing beyond sight. Since molecules are smaller than a single wave of light we can never hope to see one, however powerful a microscope we may take. X-rays, however, have a wave-length only one ten-thousandth the wave-length of light, and they reveal the secrets of the ultra-tiny world.

Valuable "Inside Knowledge."

"In addition to going right down to the electron," Professor Bragg said to me during an interesting talk at Manchester University, "we can make an analysis which stops before the stage reached by chemical analysis—and this is very useful.

"Steel manufacturers can now know what happens to the steel on hardening and stretching it. We have been able to show metal-makers that when a metal is drawn into a wire, the crystals of the metal turn in the direction of the length of the wire.

"Accumulator manufacturers already are making use of our methods to determine what exactly happens on accumulator plates during charging and discharging. Chemical analysis would show only each element present—such as lead, oxygen, and sulphur—but by the new X-ray method it is possible to learn just what compound is present on the plates at any stage of charging or discharging."

YOUR AMPLIFIER



AT this time of the year it is not uncommon for little troubles to develop in the L.F. side of a set.

Possibly the receiver has been in continual use since last winter, and during that period has been given no attention whatever.

The L.F. stages may be functioning quite satisfactorily, but even so it is well worth while to "go over" the set regularly in much the same way as one does a motor-car or cycle, with the object of maintaining its 100 per cent efficiency.

Those who use dry battery or accumulator H.T. supply should have a look at these first of all.

The life of a dry battery depends upon the "drain" on it and the size of the cells.

Howling.

There is also another factor, i.e. a "dry" battery is not really dry. It consists of a number of small cells which are packed with a sal-ammoniac paste. Now, even when the battery is not being used, the paste is gradually drying up; and, in addition, there may be small internal local currents flowing due to impurities in the zincs. Hence the battery is very slowly running down when it is not being employed to work the set.

For this reason it is advisable to test the voltage of any dry battery at regular intervals, because if any of the cells become defective all kinds of mysterious troubles can occur, and it is frequently very difficult to diagnose them.

For example, an amplifier will perhaps work perfectly satisfactorily for several months and then suddenly develop a bad howl. On the other hand, distortion may be noticed on certain notes, or there may be a blurring effect. The listener will be puzzled, and probably the last thing he will suspect will be his H.T. supply.

Using a Voltmeter.

Unfortunately, however, the apparently innocent H.T. battery can easily be the whole cause of the trouble. When the battery commences to run down, or develops a fault, its internal resistance rises, and it is this fact which produces the instability on the L.F. side.

The most satisfactory method of testing the battery is by means of a high-resistance voltmeter. The voltmeter should be joined across the H.T. + and H.T. - terminals after the H.T. battery has been

Some practical suggestions for overhaul before the dark days catch you unawares.

By A. JOHNSON-RANDALL.

in use for half an hour or so. The reason for this is that a battery recovers its voltage if left for a few hours not on load. When, however, current is taken from it, the voltage drops to a value depending upon the condition of the cells, and the reader will therefore appreciate the desirability of taking the voltage reading after the battery has been in use for a period, if a reliable indication of the state of the battery is to be obtained.

Shunting Condensers.

It has been stated at various times that when a battery commences to give trouble



Carrying out a 'phones and dry-cell test, as detailed in this article.

one can reduce the possibility of ill effects by connecting a large Mansbridge condenser across the H.T. + and H.T. - terminals. This is to some extent true, but only if the condenser is large enough. In practice, it is useless to connect a 2-mfd. condenser across the terminals in the hope that the amplifier will cease to howl.

Actually a value of from 10-20 mfd. is necessary.

The best scheme is to purchase a new battery. When the H.T. battery is renewed, it is also a good plan to obtain a fresh grid-bias battery, because, although no current is actually taken from this small battery, the electrolytic tends to dry up

after six months or so. Thus a faulty grid battery may also cause trouble.

In the case of H.T. accumulators, if L.F. instability occurs, it is advisable to look for a sulphated cell; but one does not expect to get trouble from this source if the accumulator has been looked after by a reliable battery-charging station.

H.T. accumulators should never be allowed to run down below 1.8 or 1.9 volts per cell, and they should always be charged within twelve hours of reaching this minimum figure.

Topping Up.

Moreover, it is necessary to inspect the cells frequently, particularly in hot weather, to ascertain the level of the acid. This level must be just above the tops of the plates, and the evaporation should be made up by the addition of a little distilled water, introduced with the aid of a pipette or fountain-pen filler. Neglect to attend to these points will lead to sulphation, which, as has been stated previously, is a frequent source of L.F. instability and howling.

If the efficiency of the amplifier remains below standard after an inspection of the batteries and wiring, it is a comparatively easy matter to test out the components with the aid of a pair of 'phones and a dry cell. The procedure is as follows:

Testing the Components.

One tag of the 'phone should be connected to one terminal of the dry cell, and two flex leads should be connected, one to the remaining 'phone tag and the other to the remaining terminal of the dry cell (a flash-lamp battery is quite satisfactory).

These two flex leads, if now touched lightly together, will produce a strong double click in the 'phones, one click when they make contact with each other and another when they are separated again. They may thus be used for testing for continuity in leads, etc., since the loud double click is ample evidence that everything is satisfactory.

A fault on the coil holder, for instance, such as a break between the terminal and the plug or socket to which it is connected, may now easily be detected, since if one flex lead is connected to the terminal and the other to the side of the holder to which the terminal should make connection, absence of the double click is positive evidence that the component is faulty.

LATEST BROADCASTING NEWS.

SUBSIDING STORMS

THE RELAY RE-SHUFFLE—
ALBERT DE COURVILLE CALLING
—JACK PAYNE FOR OLYMPIA—
SIR JOHN REITH'S HEALTH, Etc.

(FROM OUR OWN BROADCASTING
CORRESPONDENTS.)

The Storm Subsides: Some Inside History.

THE B.B.C. handled the "release" of their decision about single wave-length working with unusual skill and success. POPULAR WIRELESS was literally the only publication that gave its readers an accurate and comprehensive idea of what was happening some weeks before the official announcement.

Except at Nottingham and Sheffield the new policy has been accepted and indeed welcomed. It may be doubted whether it was the right moment to close down the Nottingham station, seeing that it had been run so long on an obviously uneconomic basis. But apparently the people at Savoy Hill decided to tackle the whole set of troubles at once. On the day before the relay-station announcement, Sheffield got wind of a letter from the Postmaster-General to a city official in Sheffield.

This letter appears to have informed its recipient that the Postmaster-General had authorised the B.B.C. to proceed with the Regional Scheme, under which the Sheffield relay station would be abolished. It was accordingly concluded that the step was imminent. Whereupon Sheffield was greatly concerned and hardly believed the subsequent statement from Savoy Hill that single wave-length working would improve the service from the Sheffield station by 300 per cent., and that there was no chance of the transmitter being taken away for at least three years, and possibly not then.

Sheffield, dissatisfied with these assurances, is organising civic protests first to the P.M.G. and then to Parliament, if the first fails, as it probably will. Nottingham is resigned to its fate, the fact being that most listeners in that area already depend on the Daventry stations, since heterodyning has been acute. There is a movement, however, that the B.B.C. should set up an East Midlands region with a transmitter working on high power. Nothing will come of this. For the rest, the changes have been accepted philosophically. It remains for the B.B.C. engineers to apply the changes with the minimum of disturbance.

Albert de Courville.

The early difficulties between the B.B.C. and Mr. de Courville were exclusively given in POPULAR WIRELESS, which is now able to make the first definite announcement of the completion of the negotiations. On Tuesday, October 9th, Mr. de Courville will give the first of a weekly series of six revues, specially written and produced for the microphone. It is believed that Mr. de Courville has some mighty original stunts up his sleeve. More of the pro-

fessional touch such as this is what is wanted. Incidentally, Mr. Charlot discovers on his return to the London theatre that his connection with broadcasting recently was emphatically no disadvantage.

Bach and Beethoven for 5 G B.

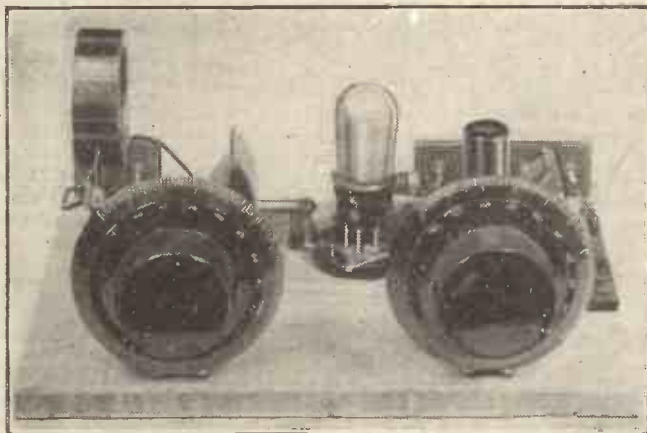
Forthcoming "Proms" to be broadcast by 5 G B include a Bach evening on Wednesday, September 19th, and a Beethoven evening on Friday, September 21st. Myra Hess will be in the former, and Edward Isaacs in the latter. The Proms, by the way, are going very well again this year. The B.B.C. is perhaps a little sparing with the portion allocated to 2 L O; but it is an error on the right side for once.

A Good Vaudeville Show.

On Saturday next (September 22nd) Wilkie Bard is the leading attraction of a variety broadcast including as well Jack Strachey, Billy Hill, Horace Percival, Ruby Miller, and Eliot Makeham. This is a formidable line-up, and shows that the B.B.C. has really begun to take the lighter side of its work seriously. It is stated that variety and vaudeville will be much stronger this winter. If this is so, there need be no fear of a slump in licences. What about a chunk out of talks while the good work is going on?

A WIRING WARNING.

If you "try-out" circuits in baseboard form, remember that they may work differently when boxed in cabinets because of the altered spacing of components.



TECHNICAL NOTES.

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

LOUDNESS & ENERGY

THE QUESTION OF UNIFORM RESPONSE—OVERLOADING H. T. UNITS, Etc.

Loudness and Energy.

NOTICE that some discussion has been going on lately as to the relative loudness of sounds of different pitch carrying the same amount of energy.

Everyone knows by general experience that a high-pitched sound tends to be more penetrating than a low-pitched one, but considerations of the actual amount of energy carried do not arise within our ordinary experience. In fact, it is a highly mathematical subject, the consideration of the actual energy represented by the sound, and the relation between that and the amount of energy needed to produce the sound at its source.

Uniform Response?

It is a fact, however, that the ear is not uniformly responsive, in this sense, to sounds of different pitch. For a given amount of energy in the sound-waves, a high-pitched sound will seem much louder than a low-pitched sound; or, to make the

Jack Payne for Olympia.

Jack Payne will be well to the fore at the Radio Exhibition, September 22nd for ten days at Olympia. He will take down his B.B.C. Dance Orchestra in full strength to play from 8.0 p.m. to 10.0 p.m. on the 31st. On most other days he will be there with his Dorians, a new dance band with some fresh stunts specially reserved for radio fans at the big show.

Sir John Reith's Health.

General sympathy is felt for Sir John Reith, whose health has been in bad shape for some weeks. His condition is not understood to be serious or alarming; but there is no doubt that he is run down, suffering from a long period of strain and overwork. The well-being of the Director-General is of such importance to the broadcasting business that it is a matter of public interest that it should be safeguarded at all cost. It is hoped, therefore, that Sir John will be induced to take a prolonged rest or voyage.

statement the other way round, if two sounds, a high-pitched one and a low-pitched one, seem more or less of the same loudness, you would find, if you had the means of proper investigation, that the energy represented in the high-pitched one was very much smaller than that in the low-pitched one.

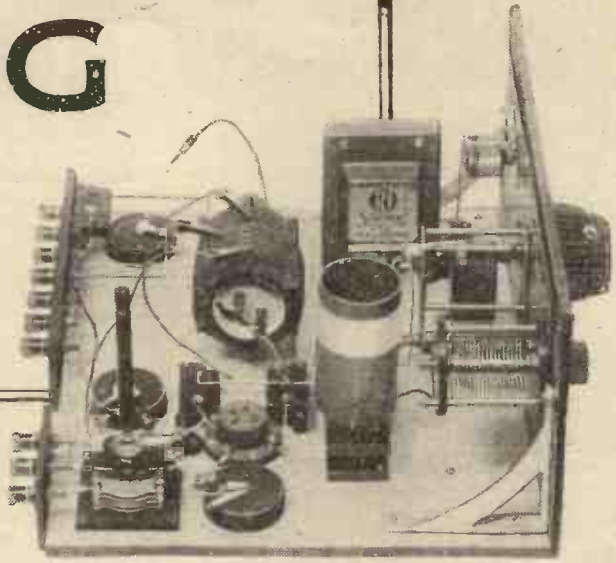
It is believed to be partly for reasons such as this that a woman's voice and a child's voice, which are usually of relatively high pitch, are less easily tired than a man's voice which, being of much lower pitch, needs a great deal more effort for a given amount of talking. (The cynic may give other explanations, but this is the scientific basis.)

Overloading H.T. Units.

When using H.T. eliminators it is very important to remember that the rated output of the unit is (or may generally be assumed to be) the maximum output of which it usefully is capable. Now, when

(Continued on page 47.)

VANISHING SHORT WEVERS



"OH, hang! I've lost him. Still, no doubt about him being a Yank, eh?"
 "Not a scrap of doubt. I heard the accent most distinctly."

How many times must this dialogue have taken place between two short-wave enthusiasts? And, stopping to consider it, why, after all, should a station vanish when it has been coming over quite well?

Were I to take a short-wave receiver and a joy ride up to the Heaviside Layer, I should feel much more competent than I do at present of offering some sort of explanation.

The fact of the matter is that no one as yet has been able to tell us anything very definite about the cause of fading.

As may have been expected, several theories have been advanced from time to time, and there is one that I am going to pass on which to my mind is a very plausible explanation of this curious phenomenon.

The Heaviside Layer.

When a signal is sent off from a transmitting aerial, waves travel outwards from the aerial in all directions. Those listeners who are located reasonably close to the station are able to receive what are known as the direct rays, but as this ray travels over the earth's surface it is absorbed and consequently does not reach listeners who are a long way off.

But those rays which are propagated upwards strike what is called the Heaviside Layer, and are reflected or "bent" down to earth again, from which they travel up and then down, and so on.

It is this upward and downward course of the waves—or, to give it the technical name, the indirect ray—that enables listeners thousands of miles away to join in the programme from the transmitting station.

Curing "Fading."

Now, to come to the fading part of the business, the explanation put forward is that certain irregularities occur in this Heaviside Layer which

Some "fading" is home-made, but other kinds are out of the amateur's control. This breezy little article tells you about both sorts.

By G. T. KELSEY.

alter the course of the reflected ray, with the result, as it usually is with me, that the station fades right out just as the call sign is being announced!

Since I cannot take my joy ride until the rocket car is perfected (there would probably be more fading then!), I must let the explanation pass without further comment except to add that it certainly does seem a very probable reason.

But there is another kind of "fading," about which I should like to say a few words.

It is that mysterious disappearance of stations when the hand is removed from the tuning controls. I will agree that under these trying circumstances, when visitors are present, the word fading comes in extremely useful, but between you and me it happens to be fading which invariably

can be cured. It is a matter either of screening, or arranging for the hands to be kept away from the controls when tuning-in a distant station.

Dealing with the first of these, a cure can usually be effected by placing a sheet of copper foil under the baseboard and along the back of the panel.

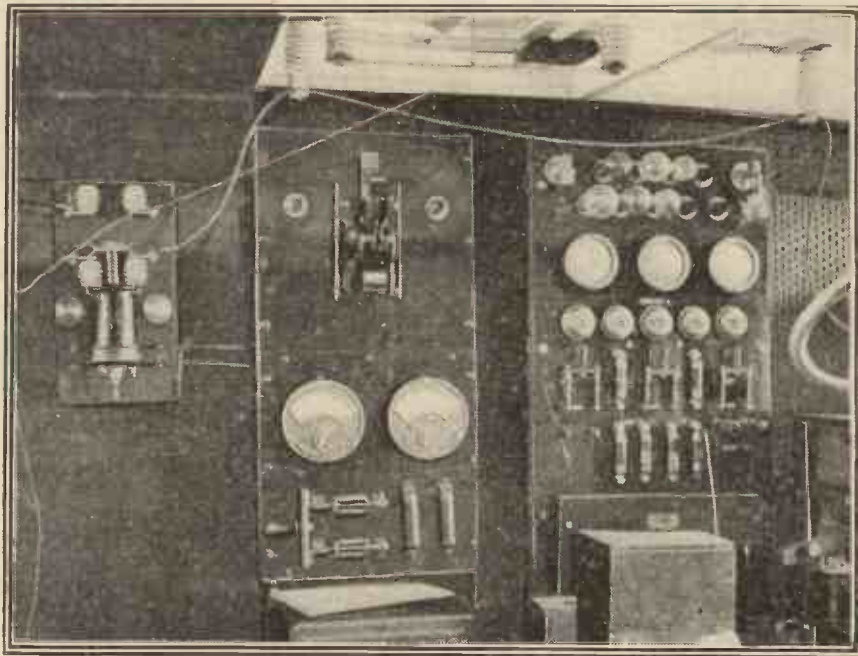
The copper screen thus formed should cover the whole of the panel and baseboard, and should be connected to earth. It is hardly necessary to add that certain components on the panel will require to be insulated from the screen.

Less Satisfactory Method.

The other and, to my mind, less satisfactory method of curing "home-made fading" is by attaching long extension handles to the variable condenser dials. The hands are then kept well out of the way during the tuning operations.

Finally, I should have something to say about short-wave sets and the author's test reports. Alas, only too often the constructor makes a short-wave set and finds to his disappointment that he cannot get as much as a whisper from stations claimed to have been heard on the loud speaker.

It is, I suppose, quite reasonable, under such provoking circumstances, to have doubts as to the genuineness of the test report—but ignore such ideas. Stations on short waves are altogether different from those on the broadcast band, and whereas on some occasions conditions allow of excellent reception from America and Australia, there are times when such stations, especially the Australians, are inaudible for days on end.



The above shows part of the Beam apparatus on Senatore Marconi's yacht "Elettra." With the Beam system, the effects of fading are considerably reduced, since the energy from the transmitting aerial is concentrated in a given direction.

The Cosmic Ray

An Imaginative Speculation about Its Wonderful Possibilities.
By G. H. DALY.

ANY new discovery in connection with the ether of space is always interesting, and the newly discovered wave known as the cosmic ray is doubly so owing to the mystery of its origin and great power; for it is the most powerful and penetrating denizen of the ether yet discovered.

This ray will penetrate 190 ft. of water or 16 ft. of lead before dying out. This is double the penetrating power of any other ether wave all the way down the spectrum from the gamma rays of radium, X-rays, light, heat, and, finally, to wireless waves. And this after it has passed through the several hundreds of miles of our atmosphere.

Sun or Milky Way?

The power of the ray before it has passed through, and been toned down by, the atmosphere can only be imagined. Incidentally, it adds yet another terror to anyone contemplating a journey to the moon, or anywhere else in space. Probably it would shrivel them up before they had left the earth's sphere of influence. It may also turn out to be the death ray beloved of novelists.

The chief mystery about the ray is its origin.

At first it was thought that the ray came from the earth, and was due to some action in the elements of the earth. This, however, was disproved when it was found that the higher the altitude the more powerful the ray became.

It is more powerful, for instance, at the top of a mountain than down in the valley. This led to the conclusion that the sun was the originator, and so tests were carried out when the sun was overhead, and also when it was down. The two results were practically identical, thus proving that the sun had nothing to do with it.

The planets and other stars were tested in the same way, with similar results, thus eliminating them. That great and distant cluster, the Milky Way, was also tested for the origin of the ray, but it made no difference whether the Milky Way was directly overhead or not, and it is now thought that the rays come from spiral nebulae far beyond the frontiers of the Milky Way.

An Appalling Force.

This, of course, is purely a tentative suggestion, and the ray might come from anywhere in space, though the origin mentioned is thought to be the most likely.

It is interesting to speculate upon the possibilities of the ray. Popular rumour has it that someone may be examining us by means of this ray in somewhat the same way as a photograph can be taken of a man in a pitch-dark room by means of the invisible infra-red ray, without the man being aware of the fact at all.

It is probable that the cosmic ray, or perhaps we should say the cause or creator of the ray, whatever or whoever it is, is the most powerful force in existence. For the ray is undoubtedly only the outward and visible sign of something quite appalling in the realm of force.

Can Man Use It?

The ray at its source must be infinitely more powerful than light or heat rays on the hottest or most luminous part of the sun, although whether they would affect humanity in the same way as heat or light is open to argument.

Anyone understanding the method of creating this ray would have an ideal method of signalling across space owing to its great penetrating and lasting powers—far better than light or wireless waves, which have hitherto been the recognised mediums for inter-planetary or inter-stellar communication. If we could find out how it is created, it would also be an ideal method of ordinary wireless communication, for so little power would be required that everyone could carry his own transmitter with

energy due to the separation of positive and negative electrons.

It is only correct to say, however, that the amount of energy which would result from this destruction of mass would appear to be even greater than that of the ray; but it is difficult to be very definite about a ray after it has been travelling for, perhaps, 50,000 years, which is what the cosmic ray has been doing, and is still doing.

If the ray should happen to be radiated waves, due to the breaking up of the atom, it is of even greater importance than was at first supposed. For, if we can once learn how it is done, then that tremendous store of atomic energy will be at the service of mankind. And as we possess the ray, as it were, finding out how it is done should not be so very difficult.

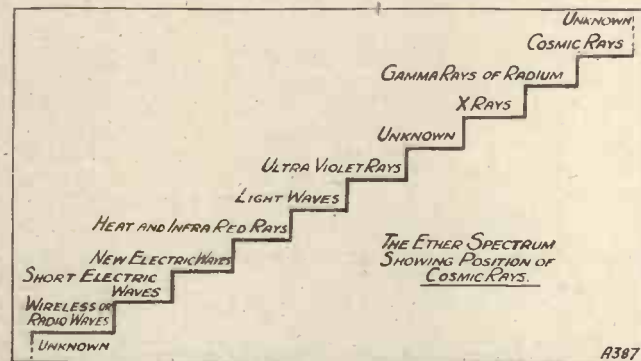
We are long familiar with the statement that there is enough atomic energy in a pinch of salt to enable a great liner like the "Leviathan" to steam at full pressure across the Atlantic, but the difference which such a discovery would make to our civilisation is almost beyond the bounds of our imagination.

No "Cost of Running."

A motor-car or train could be run so cheaply that it would be ridiculous to speak about the cost of running at all. Life might be infinitely more pleasant for all if such a discovery were made.

However, this at present is only a possibility, and we must wait for further research to take place before knowing anything more definite about this mysterious visitor from space. Nevertheless, it would certainly appear that the

discovery of this ray is one of the most important advances in modern science and likely to lead to infinitely more wonderful discoveries than have been made before in the history of mankind.



* * * * *

**RADIO
POINTERS.**

* * * * *

enough power to carry to the ends of the earth. The question of jamming or interference naturally arises, but this could probably be adjusted by some secret wireless arrangement. Possibly future wireless may develop along these lines.

Whether the cosmic ray is created by an intelligence or merely by natural causes is at present causing much discussion. Some thinkers believe in natural, others in intelligent creation; but whatever its source, it remains to be seen when and how this powerful ray can be adapted to the uses of mankind.

In some scientific circles it is thought that the cosmic ray is created by direct encounter between the nuclei of atoms and high-speed electrons. Another suggestion is that the ray is connected with the long-sought energy from the atom, the secret of which scientists have been searching for since the beginning of science. In other words, the ray might be the result of the transformation into radiation of the

IF your loud speaker is several years old and does not seem to be so good as formerly, it is possible that if overhauled by the makers or a firm specialising in such work it would receive a new lease of life.

The position in which the loud speaker stands in the room very often makes a great deal of difference to the reception.

Do not stand the loud speaker too close to the set itself or you may cause it to vibrate the filaments of the valves and this will give rise to a loud howl.

Two loud speakers working in series will very often give a more pleasing result than would either one of them alone.

Dust, fluff, and other similar foreign bodies, if allowed to enter the horn of a loud speaker, may accumulate on the diaphragm and seriously interfere with reception.

LISSEN offer you an advance in two standard components



LISSEN SUPER TRANSFORMER

Lissen promised that if a better transformer than the famous Lissen 8s. 6d. model could be obtained it would be added to the Lissen range.

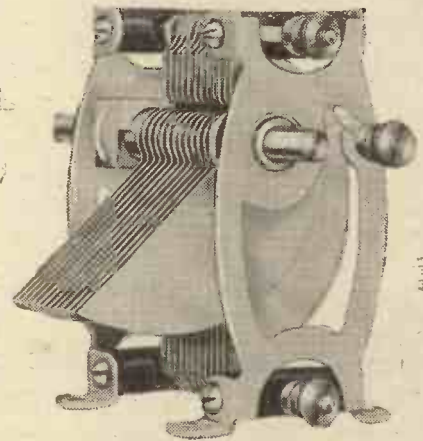
And here it is—a transformer that gives crystal-clear reproduction of high notes and retains the deep sonority of the bass in a way that is startlingly true. A year ago this latest transformer could not have been made. It is incomparably better than any other transformer selling at any price at all. No transformer, however high in price, can even claim comparison with it unless that transformer has also been produced within the past few months.

For only now has the depth of radio technique yielded the knowledge which has made the latest Lissen Transformer possible. And in certain ways this latest Lissen Transformer will prove to have anticipated the advance experience of to-morrow. It represents value in high-priced transformers to the last degree. It represents a big saving in price to the transformer-buying public in comparison with every other high-priced transformer available. Ratio $\frac{3}{4}$ to 1. PRICE **19/-**

The long-awaited LISSEN VARIABLE CONDENSER

It has taken years for Lissen to make a condenser which at last satisfies every Lissen requirement, and at a price which is in keeping with the Lissen tradition for fine value. But now Lissen has produced a condenser which for fine and facile tuning, for low loss, for universal use, is surely without a rival.

- You can use it as a standard condenser in any circuit.
- You can gang it—two or three of them together.
- You can use a drum control for it instead of a dial.
- You can mount it on a panel and it has feet for base-board mounting, too.
- One-hole fixing, of course.



LISSEN UNIVERSAL SLOW MOTION DIAL

Made in Bakelite. An attractive slow motion dial at a keen price .. **3/6**

·0001	mfd. capacity	-	5/9
·0002	" "	-	5/9
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You can get the new Lissen components from practically every radio dealer.

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STRENGTH OF PCJJ.

The Editor, POPULAR WIRELESS.

Dear Sir,—I was interested in the letter of your correspondent, H. H. O. R. (Broadstairs), and my experience might assist him.

My set is the Universal S.W. Receiver, for which "Modern Wireless" was responsible last February, det. and L.F.

I used to get PCJJ last year regularly, using coils, aerial 4 turns, reaction 6, and grid 9 turns, on an ordinary aerial, at lower end of scale.

Some four or five months ago I lost him and could not find him for some weeks, yet the readings of other S.W. stations had not varied in the slightest.

I plugged in the following coils, aerial 2 turns, reaction 4 turns, and grid 4 turns, and very soon found PCJJ at the top end of the scale, where he has since been found on every occasion I have tried for him, the last time being Thursday, the 16th inst., when he was coming in very strong, fading being negligible.

Yours faithfully,
J. F. M.

Ripon.

The Editor, POPULAR WIRELESS.

Dear Sir,—In reply to H. H. O. R.'s letter in your issue of the 25th ult.

I have also found PCJJ's strength very weak since the end of June.

Several weeks last month the signal disappeared entirely, and I thought the station had been closed down.

It has now reappeared at fair strength, but is subject to fading and is far from normal.

I am using the "Wide Range" Two, published in "Modern Wireless" in May last.

Yours, etc.,
A. B. C.

Liverpool.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re H. H. O. R.'s letter in to-day's POPULAR WIRELESS concerning reception of PCJJ, I can confirm the strength of this station as experienced by him. During the summer months, on the rare occasions I have had time to try for the Dutchman in daylight, I found him only just audible on the loud speaker. But I think if H. H. O. R. will again try for PCJJ, he will discover that he has regained his normal volume. I tuned in on Saturday, August 18th, at 16.30 B.S.T. for a few minutes, and he was coming through nearly as good as mid-winter, except for a rather bad frequency vibration. PCJJ's weakness was most noticeable during the very hot weather, and I assumed that that caused the skip distance to be considerably shortened. He is not worth receiving here after dusk.

Perhaps this will interest your correspondent.

Best wishes to "P. W."

Yours faithfully,
GILBERT D. NESBIT.

Southsea, Hants.

ERECTING AN AERIAL.

The Editor, POPULAR WIRELESS.

Dear Sir,—The following method of erecting an aerial in a tree, for use on outings or for semi-permanent requirements, may interest you and our

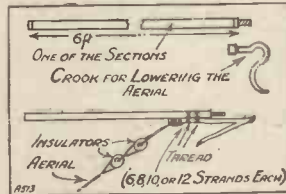
CORRESPONDENCE.

STRENGTH OF PCJJ

ERECTING AN AERIAL—
BATTERIES v. MAINS UNITS.

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

fellow readers. Procure some lengths of bamboo rod, make screwed joints (using metal ferrules, etc.), capping the last rod by screwing on a hook shaped like a shepherd's crook. Now on the free end of the aerial and at the angle of the lead-in, attach your insulators, leave enough spare halliard or holding wire to clear tree boughs, and attach a large hook with a fair amount of straight shank, so:



(I use a wooden one cut from a small bough.) Discard the screwed crook for the moment and fasten the hook, with aerial attached, to the small end of pole by binding in two places with 6, 8, 10 or 12 strands of ordinary thread. The number of strands depends on the weight of aerial to be lifted. Now raise the pole with one hook attached, place hook over the required bough and simply pull the pole downwards. Result: the thread breaks and leaves the hook on the bough. Repeat the process at the other end, and your aerial is ready. The use of the crook is to lift the hooks off the boughs. My pole is 30 ft. long—five sections of 6 ft. each. I have placed the hook, with aerial attached, in a large staple, on a bough, in a loop of wire, and on a high gutter.

I do hope my description is clear; I enclose a drawing.

Yours faithfully,
J. BUDGEN, Junr.
Nr. Dorking, Surrey.

BATTERIES v. MAINS UNITS.

The Editor, POPULAR WIRELESS.

Dear Sir,—From the correspondence in the wireless journals I have gathered that the question of battery versus eliminator is not yet definitely settled—some stubborn ones, while admitting that the eliminator

has advantages over the accumulator, maintain that for their particular requirements the advantages of the accumulator outweigh those of the eliminator. I am assuming that the issue lies between the accumulator and eliminator and have not considered the dry cell as an economical proposition at all. I am one of the stubborn ones, and I have read with great interest indeed the various arguments brought forth.

One aspect of the case, much to my surprise, for it seems to me to be so obvious, has not been stated as far as I know, and that is, that with an accumulator one does know with real accuracy what the voltage is, but with all the eliminators that I know, or know of, not only is the voltage unknown but it can only be ascertained, even approximately, with a lot of trouble, if at all. Also, should any altered condition of working occur, as, for instance, a difference in grid voltage, the eliminator voltage might become anything almost. It appears to me to be not a very intricate job to devise a combination of ammeter and voltmeter to automatically correct for the regulation of the transformer or circuit. With appreciation of the excellence of your magazine.

Yours truly,
A. F. GRANT.

Sydney, N.S.W.

[Space does not permit us to publish the whole of Mr. Grant's letter, but we assure him that the several suggestions he makes will receive our closest consideration.—EDITOR.]

SMOKING H.T.

The Editor, POPULAR WIRELESS.

Dear Sir,—I read with interest in POPULAR WIRELESS of the 18th ult. the interesting letter of "F. H." on "Smoking H.T."

I wonder how his batteries were connected? Straight along one row and back along the other? If so, the following simple precaution against "smoking H.T.'s" might be of some use.

If the H.T. is made up of flash-lamp batteries, and it is necessary to arrange them in two rows, connect them as follows:

Call one row A and the other B. Leave the negative of No. 1 battery in A row free. Connect the positive of this battery to the negative of No. 1 battery in B row. Connect the positive of No. 1 battery in B row to the negative of No. 2 battery in A row. Connect the positive of No. 2 battery in A row to the negative of No. 2 battery in B row and so on.

The negative lead from the whole H.T. battery to the set comes from the free end of No. 1 battery in A row.

The positive lead of the whole H.T. battery to the set is taken from the free end of the right-hand battery of B row. Intermediate tappings are "taken off" where required.

A glance at the "difference of potential" between any two adjacent-batteries (which is primarily responsible for the trouble) will at once indicate that by connecting the batteries in the foregoing way an H.T. battery, consisting of flash-lamp batteries, is rendered practically immune from "smoking" or "firing."

Yours faithfully,
"ADSUM."

Chester.

RECENT experiments with a short-wave set and an H.T. battery eliminator working from A.C. mains have disclosed two minor troubles which were rather more difficult than usual to discover, and I am passing them on to readers in the hope that the cures that proved effectual in my case will be equally so in others.

The first trouble arose through the fact that no earth was usually employed on the receiver, and consisted of a loud hum when the set was not oscillating. The provision of an earth—and a very doubtful earth at that—completely cured this at once.

Eliminating a "Hum."

The other was of quite the reverse nature—a severe hum was heard when the set was just on the oscillation point or oscillating fairly feebly, but all was quiet when not oscillating. Reversing the mains connection to the eliminator helped this considerably, reducing the hum to about 30 per cent of its previous value, but it still was loud enough to be annoying when listening to weak stuff. Eventually it was found that it could be completely cured by inserting a small H.F. choke in each lead from the eliminator to the set.

SHORT-WAVE
NOTES.

By W. L. S.

The chokes consisted of fifty turns of No. 30 wound on test tubes.

It is interesting to note that the same eliminator, with exactly the same connections to the mains, and working in exactly the same position, gave not the slightest suspicion of hum on a broadcast receiver, even if one looked especially for a noise of this sort.

Another little annoyance that short-wave enthusiasts have to put up with is a really loud crash on occasions when certain lights in the house are switched on or off. These crashes are nothing like the gentle little "plops" that the average broadcast receiver produces on such occasions, but really big fellows that hurt the ears.

So far as I can see they are something to do with the fact that certain sections of the house wiring have inductance and capacity values that tune them roughly

to certain short wave-lengths and give large surges when the circuit is made or broken.

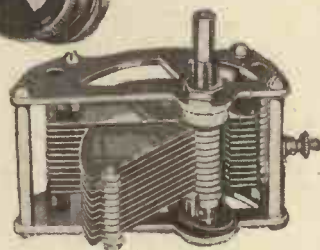
With reference to this, a friend with a transmitter using quite low power makes a bedroom lamp (a 60-watt) light up quite brilliantly when he presses his key. Considering that the lamp is in a remote corner of the house and nowhere near his aerial, while his power is only a fraction of the 60 watts necessary to light the lamp, it appears that we have some little problems to unravel yet!

2 X A D Revives.

If you have not been listening to 2 X A D recently it will be well worth your while to unearth your 20-metre coil and do so once more. He is again coming in with all his old "push" and provides quite an enjoyable programme for any owner of a set worthy of the name.

I should like to have an official note as to his actual power input—it must be fairly colossal for him to come through consistently, night after night, breaking through atmospherics and fading but slightly. Yet the long spells of bad conditions, lasting for two months or so, have their effect even upon 2 X A D.

Look for at LOTUS OLYMPIA!



REMOTE CONTROL RELAY



LOTUS VALVE HOLDER



LOTUS COIL HOLDER

News at the Lotus Stand!
Two new Components—two new sets being introduced by Lotus!

There is a new Variable Condenser and Vernier Dial—both typical Lotus quality. The condenser is mid-line and logarithmic. It is made with chemically cleaned special brass vanes and end plates, with ample spacing and ball bearings.

The Lotus Vernier Dial is a slow motion dial with machine geared movement giving a ratio of 14 to 1. A closely - marked satin aluminium dial reading 0-180 fitted to rear, fits flat against panel and a nickel plated cursor is rotated by small knob round the dial.

The famous Lotus Remote Controls, Buoyancy Valve Holders, Coil Holders, Jacks, Switches and Plugs are also on view.

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STAND No.115**

LOTUS COMPONENTS

PRICES:

New LOTUS Variable Condenser:—

'0005	5/9
'0003	5/6
'00025	5/3
'00015	5/-

New LOTUS Vernier Dial, 4/9

**The New LOTUS
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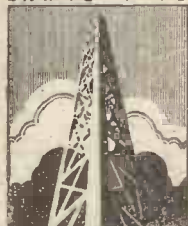
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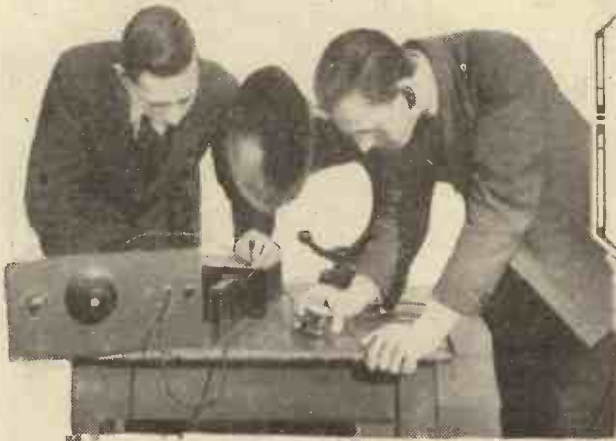
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A. J. W.

THE NEWCOMER TO RADIO



In this week's article a start on the construction of the fine three-valve set is made, although the author continues his interesting how-it-works chat. New readers can commence the building of the receiver without having to refer to the previous articles in this series, although they will find it of advantage to endeavour to obtain the two preceding numbers. And to prevent the slightest chance of missing the forthcoming articles readers are strongly advised to place orders for "P.W."

3. BUILDING A RADIO SET.
By G. V. DOWDING, Grad.I.E.E.

of the set, it means much to its appearance, and appearance is a factor that careful constructors bear in mind.

The two most popular materials for radio set panels are ebonite and bakelite. Ebonite is a vulcanised mixture of rubber and sulphur, and bakelite is a purely synthetic material, certain stages in the manufacture of which run parallel to those connected with the production of artificial silk. Bakelite can be obtained in several colours, one of the most popular being that giving a mahogany finish.

Ebonite, which is invariably black, can be bought at any wireless shop, although it is worth noting that its quality varies to an enormous extent. You must be very wary that you are not landed with a shoddy ebonite panel. Bad ebonite is difficult to work, it chips and cracks easily and it may steal life from your set. Whether you choose bakelite or ebonite, therefore, make sure that the panel is of high-class quality, bearing the brand of a reputable manufacturer. Ebonite or bakelite is used also for the terminal strip. The baseboard is of 5-ply wood.

Starting Work.

It is possible to purchase a cabinet complete with baseboard, panel and terminal strip, and as the cost will be no greater than buying these items separately, this is what I would advise you to do. You will then know for certain that the panel will fit the cabinet. It frequently happens that one has to trim a panel down slightly, in order to get it to nestle snugly into a cabinet, when the two items are obtained from different sources. And even to remove a fraction of an inch from one edge of the panel is a task which demands some little skill with a file and a moderately great measure of patience.

The panel is fixed to the baseboard by means of screws, additional rigidity being provided by two angle brackets. These latter are not essential, but tend to make the job more workmanlike. But before the

panel is secured you will have to drill in it a certain number of holes. Fortunately, ebonite is an easy material to deal with, and this operation does not call for any real mechanical skill.

YOUR SHOPPING LIST.

- 1 Panel, 14 in. × 7 in. × $\frac{1}{8}$ in. or $\frac{3}{16}$ in. (Any good branded material, Radlon, Raymond ebonite, Becol, etc.).
- 1 Cabinet to fit, with baseboard 9 in. or 10 in. deep (Raymond, Arteraft, Camco, Pickett, Caxton, Bond, Makerimport, etc.).
- 1 0005-mfd. variable condenser, with slow-motion movement, or subsequently fitted with a special dial as indicated in text (Lissen in original. Any good make, J.B., Igranlic, Cyldon, Raymond, Bowyer-Lowe, etc.).
- 2 Baseboard-mounting coil holders suitable for standard plug-in coils (Lotus, Raymond, Burne-Jones, etc.).
- 1 Terminal strip, 12 in. × 2 in. × $\frac{1}{2}$ in., with 8 terminals as described. (Indicating terminals such as Igranlic, Belling-Lee, Ealex, etc., give a neat finish.)

All you want is a hand drill, although you should note that the drill must be suitable for metal-working and not of the wood-working kind. The holes that have to be bored are of varying sizes, but you need

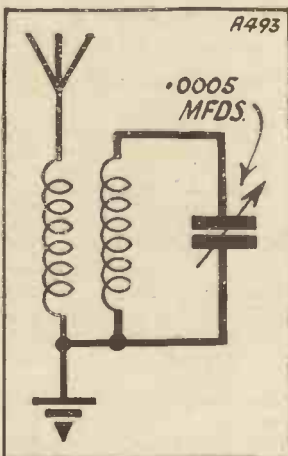
THE first thing a wireless set has to do is to pick out, from a whole hoard of other vibrations that one due to the station to which it is desired to listen.

The set does this by tuning the aerial to one particular wave-length. Therefore, the first step in the construction of our three-valve receiver must be to provide it with means for carrying out this tuning. And this is the work I have planned for this week. (We must go slowly at first, although we shall soon be able to smarten up the pace.)

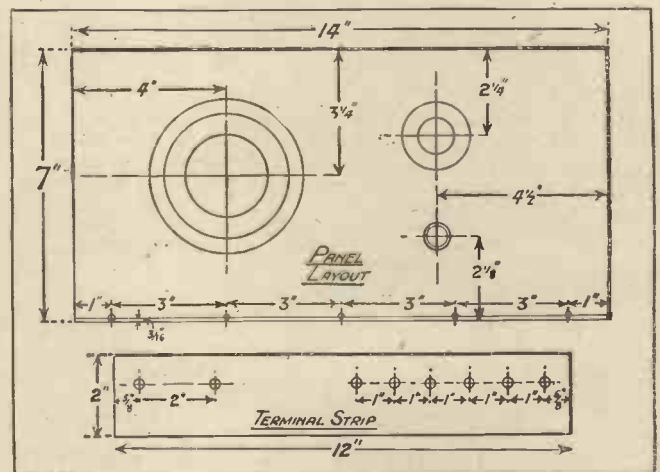
We have arrived at the point where you must commence making purchases if you intend to build the set, and for the first constructional step the articles described in the accompanying table are necessary. The cabinet accommodates the full three-valve receiver, although if you stop at two valves you will find that not too much space is wasted. The appearance will be that of quite a normal two-valver. If you are fairly good at carpentry, there is no reason why you should not make your own cabinet, and thereby effect a considerable saving. If you prefer to purchase the article, I would advise you to pay the few shillings extra for one made of good mahogany or oak.

Concerning Cabinets.

Cabinets constructed of inferior wood can be given very attractive appearances by the artful application of varnish, but here you are always up against the possibility of warping occurring. Although the cabinet has nothing at all to do with the working



This diagram also appeared last week, and you should note that it is a theoretical illustration of the circuit of the instrument shown in the photo on the next page.



The positions of the holes required to be drilled in the panel are given in the top drawing, the lower one representing the ebonite strip, which, fixed to the back of the baseboard, carries all the terminals.

not go to the expense of buying a set of drills, one of $\frac{1}{8}$ in. size will suffice. You can pierce all the holes with this drill, and then enlarge the holes, with a simple tool, known as a reamer. You can buy a reamer (Continued on next page.)

THE NEWCOMER TO RADIO.

(Continued from previous page.)

from any ironmonger's shop for about 6d.

Alternatively, many firms will supply the panel ready drilled, according to the dimensions given in the appropriate diagram for a few pence extra, or, in cases, at no additional charge. You will find that after you have drilled the panel with the holes shown in the panel diagram, and the terminal strip, in order to accommodate the eight terminals, no further boring will be demanded.

All the wireless components that will be mounted on the panel and all the terminals on the terminal strip, will be needed for the one-valve circuit, no further panel components or terminals will be necessary even for the three valves.

A "Radio Wave Tuner."

This week's article really forms a complete constructional contribution. Just as in the case of the description of the building of a large valve set, you have the list of parts required, a theoretical diagram, a wiring diagram, a panel lay-out diagram, and photographs, but the instrument we are dealing with here is not a receiving set, but is a "radio wave tuner." When completed, it will tune in 2 L O, London, 5 X X of Daventry, or any other radio station, but it will give no visual or aural evidence that a certain station is tuned in. The electricity will be there, but we shall have to find some means of using it.

Two coils and a variable condenser comprise the vital elements of our tuner. You will remember that a coil gives you a sort of jumping-off point for tuning. It brings you up to a certain point in the wave-length scale in accordance with its size. The variable condenser introduces a smooth upward increase, proportional with the addition of capacity it contributes to the system.

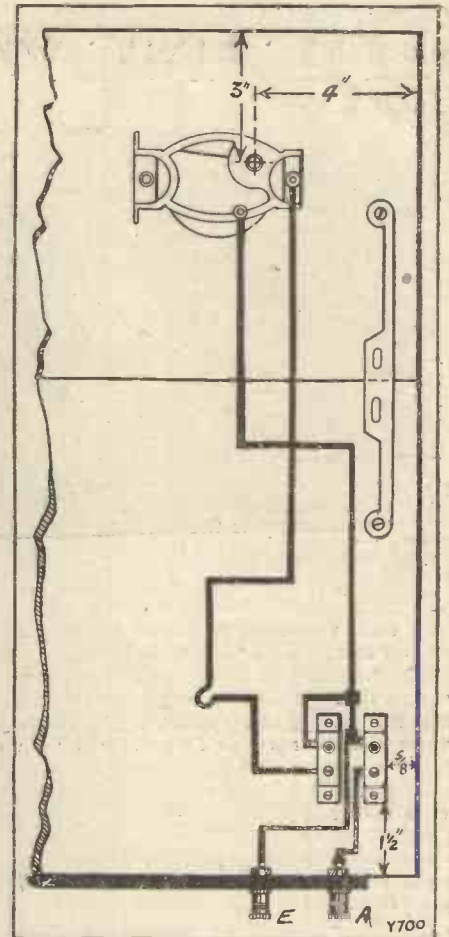
"A Necessary Evil."

Obviously, when you have added as much capacity as the variable condenser can provide you have reached the maximum wave-length to which you can tune. To go higher still, you must change your coil and use a bigger one. Provide a higher "jumping-off point" as it were. From that point you can smoothly go further upwards by again referring to the variable condenser.

Likewise, if you want to work on a lower wave-band as we call a range of wave-lengths, you change your coil for one of a smaller size.

You cannot get 5 X X, Daventry, and 2 L O or any of the ordinary main broadcasting stations on one coil. But why, perhaps you will ask, cannot you have a coil providing a jumping-off point lower than the wave-length of 2 L O and keep feeding in capacity until you arrive at 5 X X. The reason is that you mustn't have too much capacity; the capacity of the set must be reduced to a minimum.

You won't go far wrong if you regard capacity in anything to do with the tuning part of a receiver as a sort of necessary evil, and that, generally speaking, the less there is of it the better.



Here is the wiring diagram. The wire going from the coil holder to variable condenser should be bent approximately as shown, so that it can be used for a future connection.

So that it can be changed easily, each coil has on its base a plug and socket, and these fix into a plug and socket on a coil holder. The coil holders figuring in our set are secured to the baseboard. There are two coil holders and the variable condenser for you to fix up.

There are dozens of makes of variable condensers on the market, but this is really an easy component to choose, for its primary requirement is a smooth, easy mechanical action, and you should remember that much of your ultimate success in the selecting of stations will depend upon the fineness to which you can adjust the variable condenser vanes.

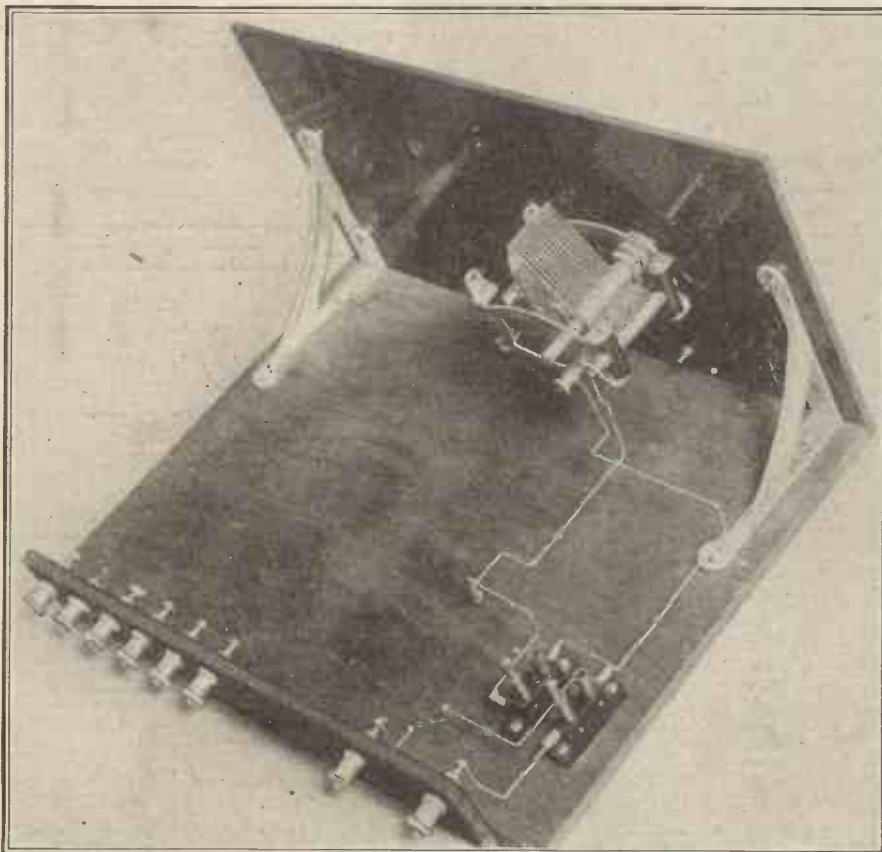
A Slow-Motion Dial.

Some variable condensers incorporate gearing; but if the one you purchase does not, then in addition you should acquire what is known as a slow-motion dial. This is a device which adds gearing and enables you to make very fine adjustments.

To describe in detail a variable condenser would take a whole article; but here, as in other cases which we shall come across, you will be given the assistance, if you want it, of other articles running currently in "P.W." (See, for instance, "Does a Condenser Condense?" in September 1st issue of "P.W.")

Sooner or later, articles going more or less deeply into the functioning of every single component used in a wireless set are sure to appear in this journal, and one of my

(Continued on page 44.)



A photo which clearly shows the parts and wiring concerned with this week's work. No connections need to be made to the group of six terminals until the next stage is reached. Compare this photo with the wiring and theoretical diagrams and see if you can trace the circuit in each case.

The "TOM-TIT" TWO



SETS with wave-change switching are rapidly increasing in popularity, but many bemoan the fact that special coils generally have to be made or purchased. Why, these constructors ask, cannot I

Although only two valves are used this neat little set, which covers long and short wave-lengths without coil changing, will give really excellent results on both wave-bands.

By A. S. CLARK.

COMPONENTS FOR "TOM-TIT" TWO.

- Ebonite panel 14 in. × 7 in. × $\frac{1}{8}$ in. or $\frac{3}{16}$ in. (Any good material, Radion, Becol, "Kay Ray," Ebonart, etc.)
- Cabinet for above with 9 in. deep baseboard. (Makerimport, Raymond, Cameo, Bond, Pickett, Artcraft, Caxton, etc.).
- 2 Terminal strips and 10 terminals marked as indicated on wiring diagram (Belling & Lee, Eefex, Igranic, etc.).
- 0005 Variable condenser (Raymond in set. Any good make, Lissen, J. B., Cyldon, Igranic, Utility, Geophone, etc.).
- 0001 Reaction condenser (Cyldon, Igranic, J. B., Bowyer-Lowe, etc.).
- Push-pull L.T. switch (Lissen, Lotus, Benjamin, etc.).
- 4 Single-coil mounts (Lotus, Burne-Jones, etc.).
- 1 Anti-capacity D.P.D.T. switch for panel mounting (Utility, Dubilier, etc.).
- H.F. Choke (Lissen, R.I.-Varley, Igranic, Lewcos, Dubilier, Burne-Jones, Cosmos, etc.).
- 2 Anti-shock valve holders (Burne-Jones, Lotus, Igranic, W.B., Burndep, Marconiphone, B.T.H., Benjamin, Bowyer-Lowe, etc.).
- 2 ·0003 Fixed condensers, one with grid-leak clips (T.C.C., Lissen, Dubilier, Mullard, Igranic, Burne-Jones, Goltone, Clarke, etc.).
- 002 Fixed condenser. (See above.)
- 3-meg. grid leak (Mullard, Dubilier, Lissen, Igranic, Clarke, etc.).
- L.F. Transformer (R.I.-Varley "G.P." type in set. Any good make, Lissen, Ferranti, Mullard, Igranic, Marconiphone, Phillips, etc.).
- 2 Grid-bias wander plugs and tinned wire, flex, screws, etc.

change set, to whom it is immaterial what components are employed.

Two complete sets of plug-in coils are employed, and in order to avoid the complicated switching which would be involved in changing over three coils, the aerial and reaction coil are one and the same. Since there are, therefore, only two coils to change over, an efficient scheme is obtained by means of one double-pole double-throw switch.

The theoretical circuit diagram shows how the coils are arranged. It is necessary to have the two sets of coils at right angles,

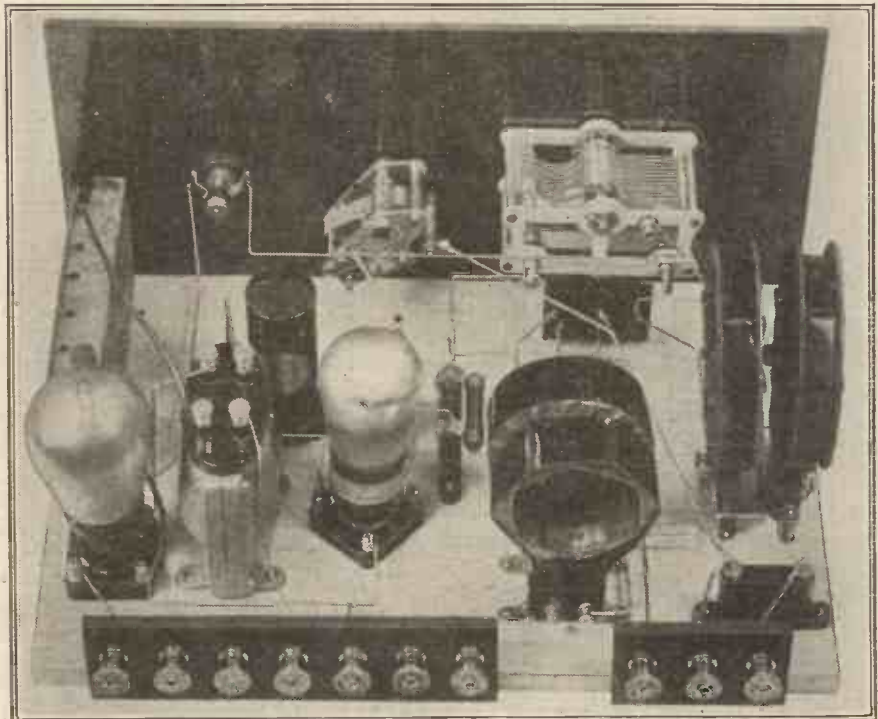
so as to avoid any serious losses due to coupling. A series aerial condenser is provided, as on some aerals better results may be obtained with it in circuit. By means of the two aerial terminals it is an easy matter to include or omit this from the circuit as desired.

The L.F. side of the circuit is quite a normal arrangement, and an L.F. transformer is employed, as this is usually the best where only one stage of audio-frequency amplification is employed.

Simplified Wiring.

On first looking at the back-of-panel photographs it may appear that the baseboard components are mounted in rather peculiar groups. A careful study of the photographs, however, will show that the components are arranged in the best method for efficient wiring.

(Continued on next page.)



Seen from behind the panel the "Tom-Tit" looks a very perky little set, and if this photograph is compared with the wiring diagram which follows the wiring-up is a very simple business.

use my present components, referring generally to ordinary plug-in coils? The set described in this article will be of particular interest to such, as well as to those looking for a simple and efficient wave-

THE "TOM-TIT" TWO.

(Continued from previous page.)

Plenty of room, for instance, is allowed behind the wave-change switch, thus enabling the wires running to same to be well spaced. Incidentally, it also makes access with the soldering-iron easy, and therefore simplifying wiring and ensuring good joints.

The grid bias stands on the baseboard at the right-hand end, and the flex leads for connection to it can clearly be seen.

A fairly deep baseboard is employed, since it is important that the two sets of coils should be well separated. On the panel will be seen mounted the two variable condensers, the wave-change switch and the L.T. switch.

Excellent Results.

When the handle of the wave-change switch is put over to the right, the set is adjusted for long-wave reception, the left being for the lower wave band. Actually, either set of coil mounts could be used for

the long waves, but those nearest the end of the panel are most conveniently situated for the longer coils.

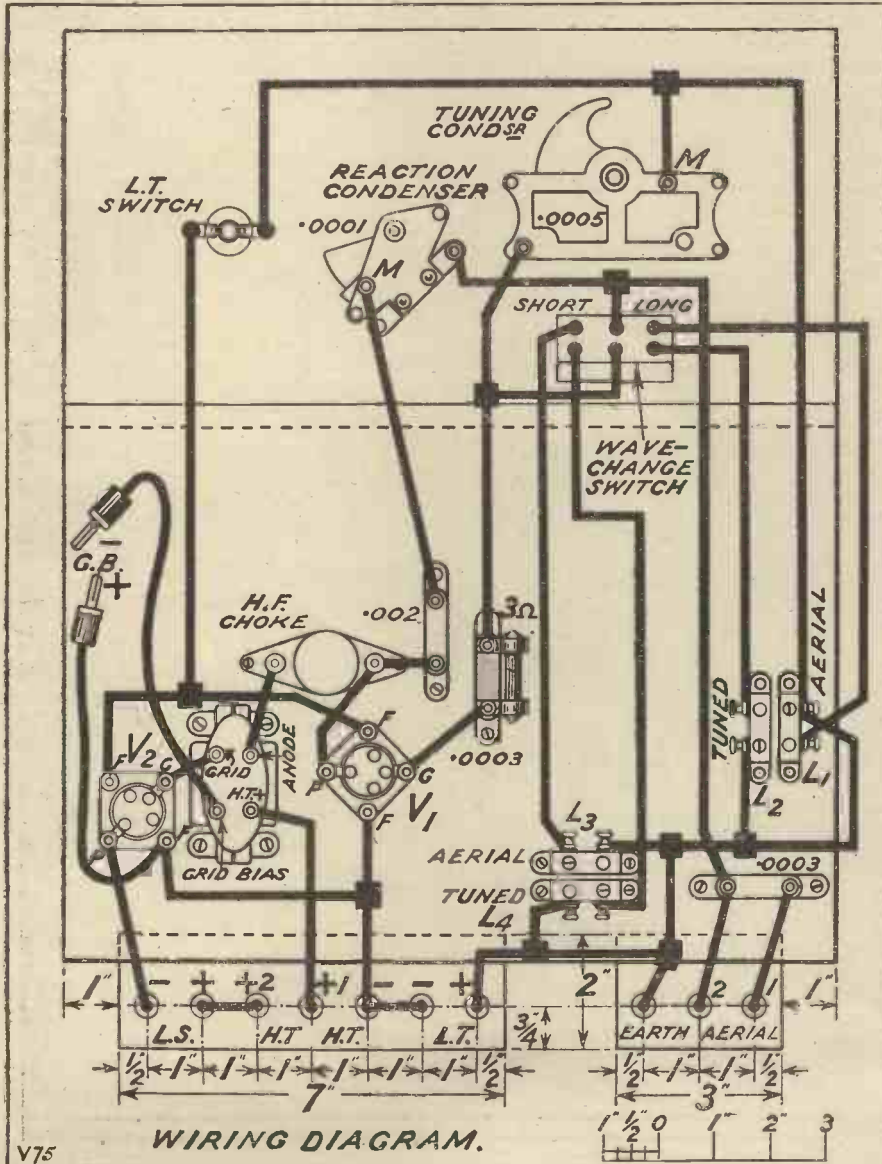
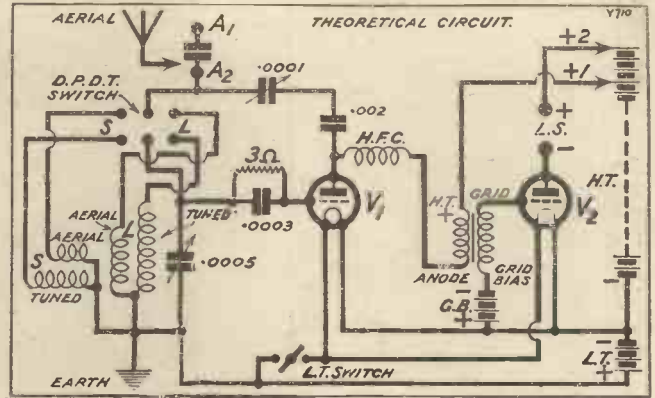
The set fully justifies building, since the results seem, for some rather obscure reason, to be better than those obtained with three separate coils. Although a little time should be spent finding the most suitable coils, it is well repaid by the number of stations which can be received.

With two coils, on the lower broadcast band, it was actually possible one night to hear twenty stations really well. On the long waves it is also possible to hear quite a surprising number of stations. The results just mentioned were, of course, heard on the telephones, but three or four stations can generally be expected at loud-speaker strength.

A list of all the necessary components for building this set will be found in another

part of this article. The names of makers are given as a guide to suitable types, and are not the only ones which can satisfactorily be utilised.

Actually, any good make of the right



type of component may be employed, and the choice can therefore be left entirely to the constructor. Having collected all the components together the construction may be commenced.

First of all the panel must be marked out in accordance with the dimensions given on the drilling diagram. Since the marking-out should be done on the back of the panel, do not forget that the disposition of the holes must be reversed. Before actually drilling centre punch all points where the holes are to be. This will prevent the drills wandering and ensure that the holes are actually in their correct places. The terminal strips should now be made.

Making a Start.

These can conveniently be cut out of old panels. Their dimensions and the positions of the terminals can be gathered from the wiring diagram. Do not forget to drill three holes in the larger strip for the fixing screws, and two in the smaller.

The next step is to mount the components. The order in which the marked terminals should be mounted can be seen in the back-of-panel diagram. When these are in place, their shanks should be heavily tinned if it is intended to solder the wires on to them.

The soldering lugs and terminal shanks of all the other components should also be treated in this manner. It is much easier to carry out this operation before the components are mounted, and considerable time can therefore be saved.

When you have prepared the parts in the above manner for wiring, the components which go on the panel may be mounted. Now place the baseboard, panel and terminal strip in place in the cabinet and screw them together.

Standard Cabinet Slots.

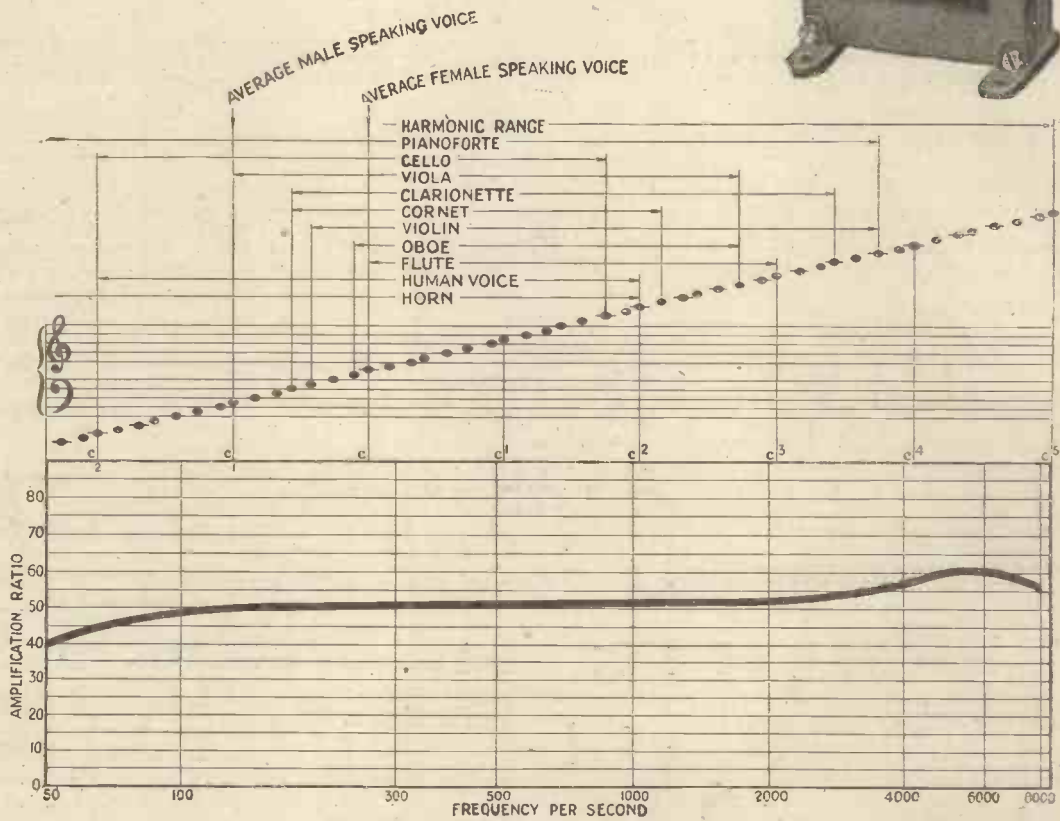
This will avoid a misfit, such as might occur if the panel and terminal strips were attached out of the cabinet. It will be noticed that the terminal strips are arranged one inch from the ends of the baseboard. This is to comply with a new standard arrangement by which all cabinets are to have a 2-in. deep slot right along the back and ending one inch from either end.

The remainder of the components can

(Continued on page 29.)

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"It's the Tobacco that Counts"

THE "TOM-TIT" TWO.

(Continued from page 26.)

now be screwed to the baseboard, the lay-out given in the wiring diagram being followed as far as possible. It is as well to insert coils and valves so that ample room is allowed for them between the other components when screwing the parts into position.

The wiring is all that now remains to complete the set. It can be carried out with

As regards coils, these may be of any good make, and of the ordinary plug-in type. Centre tapped, and X coils may of course be used as plain coils if the turn numbers are correct and they happen to be on hand. For the lower waves a No. 60 for the tuned coil will be required and a No. 30, 40, or 50 for reaction. As regards the longer waves, use a No. 200 as the tuned coil, and a No. 75 or No. 100 for reaction. A slightly larger or smaller coil may be required for the tuned position for some stations at the ends of the wave-bands, but this really depends on the characteristics of the actual coils employed.

When connecting up the set the aerial

torted due to the necessary use of a large amount of reaction.

No attempt was made to identify the above stations, since now that there are so many continental stations' no useful purpose can be served by giving a list of stations. It is sufficient to state that quite half a dozen different languages were heard.

When working with a loud speaker, 2 L O, 5 G B, and two German stations were received at proper loud-speaker strength.

On Long Waves.

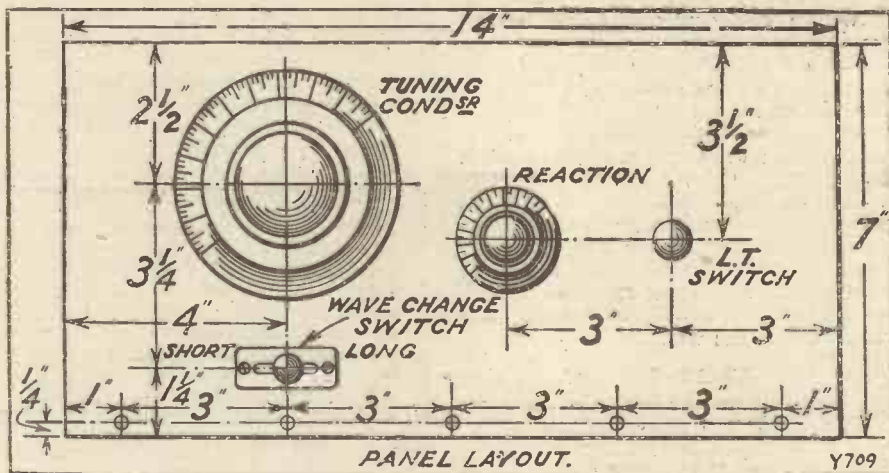
As regards the long waves, the set handled very much the same as on the lower band. 5 X X was received on the loud speaker, and about six other stations were heard at really good strength on the telephones. All the above stations, on both long and short waves, were received on a loft aerial.

Thus, at least as good results may be expected by any reader with an outdoor aerial. Those who build this receiver can therefore be assured that it will prove a fascinating set with great possibilities where distant reception is concerned.

TWO HELPFUL HINTS.

AN old hack-saw blade filed down and put on a handle of suitable size makes a good keyhole saw for cutting small holes in ebonite.

Do not use long extension leads to the loud speaker unless you have a choke coupled or transformer coupled output circuit. Otherwise there is sure to be H.T. leakage to earth.



any form of stiff wire, either covered or bare. If the latter, however, is used, do not allow any wires to pass closer than a quarter of an inch, or disaster may follow through two wires touching.

The wiring diagram must be very carefully followed. The photographs should also be studied as they will enable the wires to be correctly spaced. The only flex leads required are the two to the grid-bias battery.

When the wiring is finished it may be checked to see that no connections have been omitted, by means of the circuit diagram. Do not hurry the wiring process, as apart from the possibility of making incorrect connections, the workmanlike appearance of the set depends on good wiring.

The Accessories.

The efficiency can also be impaired by poor wiring. Before testing the set certain accessories must be purchased, and the following details of same will be found useful.

The set will not be found critical as far as the valves are concerned.

For the detector either a general-purpose or H.F. valve may be employed, the latter being especially suitable when an L.F. transformer with a high impedance primary is incorporated in the receiver.

For the second position a small power valve must be used unless telephone reception only is contemplated, when an ordinary L.F. valve should be used. Valves of either the 2-, 4- or 6-volt class may be used, and a small accumulator of similar voltage will be required.

An H.T. battery of not less than 100 volts is desirable for loud-speaker work, although 72 volts will give good results with telephones. A 9-volt grid-bias battery will also be required.

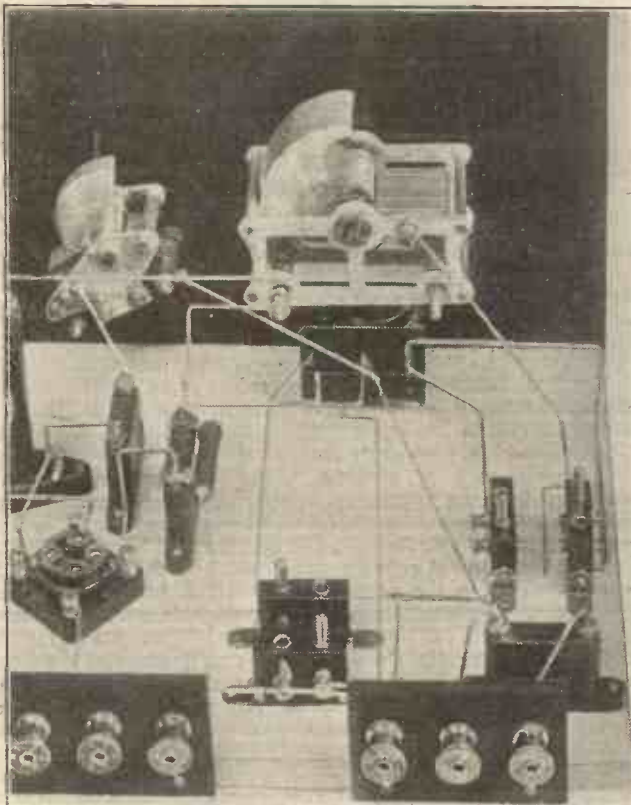
should first be used on the A2 terminal, and a voltage of 60 to 80 used for H.T. + 1. The maximum H.T. should be applied to H.T. + 2. The best coil for the aerial sockets must be found by trial, since a compromise between selectivity and volume must be aimed at, selectivity, of course, being best with the smallest coil.

Suiting the Aerial.

Whether the aerial series condenser is to be employed or not must be decided by trial for each individual aerial. It will generally be found to improve selectivity, but do not assume that because it is an improvement on one wave-band it will necessarily be an improvement on the other.

The set was tested about eight miles from 2 L O, and the selectivity on the lower band with coils No. 30 and No. 60 in use was extremely good.

As already mentioned, twenty stations were heard on these two coils and that while 2 L O was working actually about ten other stations could be heard, but reception from some of them was rather poor and dis-



Spacing is always important at the H.F. end of the set but this view shows the positions of all the chief wires, and also of the switch connections.

FROM THE TECHNICAL EDITOR'S NOTE BOOK



NEW COLVERN COIL BASE.

AT the beginning of every radio season there is a flood of new components. Some of these will be completely new productions, and others old friends of improved design. In the row of components in the latter category, which are before me as I write, the new Colvern 6-pin base catches my eye.

In regard to coils and their necessary fittings and accessories, Colvern Limited are specialists, and the finesse they impart to their designs has made their name synonymous with high-class coil equipment, and they are going to be well to the fore in the new season if only by reason of this latest 6-pin base.

It is fitted with terminals, and each terminal is fixed to the clean moulding by being passed through this and the connecting strip underneath, then being punched into position. Security and a good electrical



The Colvern 6-pin coil base.

connection are thus ensured. The Colvern holder appears to be both from an electrical and a practical viewpoint an eminently sound product. It retails at 2s.

THREE TRIX COMPONENTS.

The first thing one looks for in a modern variable condenser is a smooth mechanical action, free from harshness and backlash. This is certainly present in the new Trix Log condenser. A pleasing action is contributed by an adjustable ball-bearing and leather washer control, which is provided for the spindle.

A somewhat novel point, and one which appeals to me in the design of this Trix condenser, is that an additional fixing screw is available which can (or need not) be used if desired. Personally, I would use such an addition to "one-hole" panel mounting, although no doubt in many cases perfect security is possible with this alone. In other respects the design of the condenser is straightforward and sound. Its aluminium end-plates are cut away and a minimum solid insulation is employed. The retail price is 7s. 9d.

Another Trix component I have recently tested is the H.F. choke. This has sectional windings and the terminals are placed at the far ends. This Trix product also appears to be quite sound, and a careful test failed to reveal any peak effect throughout any of the wave-lengths normally encountered in broadcasting. It has a bright, clean finish.

The Trix R.C.C. unit is one of the smallest that has ever come to my notice, but a careful dissection shows that the Fixed Condenser is of robust copper and mica construction. The resistances are moderately robust and should stand up to ordinary loads reliably and with constancy.

A WET H.T. BATTERY.

I have had under observation for some time a wet H.T. battery sent me by Mr. Cleary, of 226, Albert Road, North Woolwich, London, E.16. Mr. Cleary makes several types of wet H.T. batteries, but this particular one is a forty-cell battery, having a total voltage of 60. Complete in its half-inch deal tray, it sells at 22s. 6d. It appears to be a soundly designed and made battery.

Precautions are taken against the creeping of the electrolyte and its corrosive action, and each jar is carefully insulated from the others by wax impregnated separators. It has been subjected to discharges up to 10 milliamps over periods of from two to four hours for about two months. After about a week the voltage dropped to 58, at which point it has remained practically constant. The battery still appears to be in good condition and capable of useful service.

N.S.F. COMPONENTS.

I recently had sent me a range of components handled by Messrs. S. W. Lewis and Co., Ltd., 39, Victoria Street, S.W.1. The range comprises an N.S.F. fixed condenser, an N.S.F. variable condenser, an N.S.F. valve holder, and a Weilo power transformer. As a matter of fact, none of these is new to me, nor will they be to many readers of "P.W.," I think, for I believe reports concerning them were published some six or seven months ago.

They are quite sound productions, are well made and function satisfactorily. I believe they are all of Continental make, but are representative of a better class of component than one usually associates with many of the German and French factories.

The Weilo power transformer, for instance, is confidently guaranteed for two years. It has a ratio of five to one, and comparative tests show that it has good electrical characteristics.

A notable feature of the N.S.F. fixed condenser is its compactness. The 2-mfd. 500-volt sample is only about as large as a

matchbox. I put over 600 volts across it and it withstood the pressure quite stoutly. Its power factor is good and it holds its charge remarkably well. Both the valve holder and variable condenser are well up to standard, and if their prices are less than equivalent British makes they will be excellent value.

NEW IGRANIC TRANSFORMER.

The new Igranic L.F. transformer, type "J," is a remarkably small component for its type, and measures only 3½ in. long by 1½ in. wide by 2 in. high, and weighs but ten ounces. It is available in two ratios, 3 to 1 and 6 to 1, the former for use with valves having impedances from 10,000 to 20,000 ohms approximately, and the latter for use in conjunction with valves having impedances between approximately 5,000 and 10,000 ohms.

A filter condenser, which is embodied in the moulded casing, is permanently con-

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

nected across the primary winding. A connecting tag for earthing the core of the transformer is provided, and it is recommended that this should be used when more than one transformer is employed.

The Igranic people claim that it has been found possible to dispense with the metal screening case, which has previously been a feature of their transformers, without fear of interaction, as a result of the particular design of the instrument.

Transformers have hitherto tended to be somewhat bulky and unwieldy components, and I must say I find the modern trend of development of this component towards extreme compactness most refreshing. At one time, as I have said elsewhere, one would have been inclined to jump



The new Igranic L.F. transformer gives a performance out of all proportion with its size.

to the conclusion that a transformer of the smallness of the new Igranic could not possibly be efficient in operation, but on test I find its size no index to its capabilities. It is a first-rate component.

Another Problem Solved

★ When you shut off for the night, just give, last thing, the necessary touch to a simple straight forward switch. That's all—but it will mean that all that night and all the next day – till you move that switch again – your batteries will be drawing from the house electricity main. They will be renewing themselves! All night – all the next morning – slowly and steadily—without haste but without rest—with perfect safety – at a rate specially adjusted to your set—costing you practically nothing after the first cost—your batteries will be absorbing electricity from the main. And when you listen-in again all the power you used last time will be renewed!

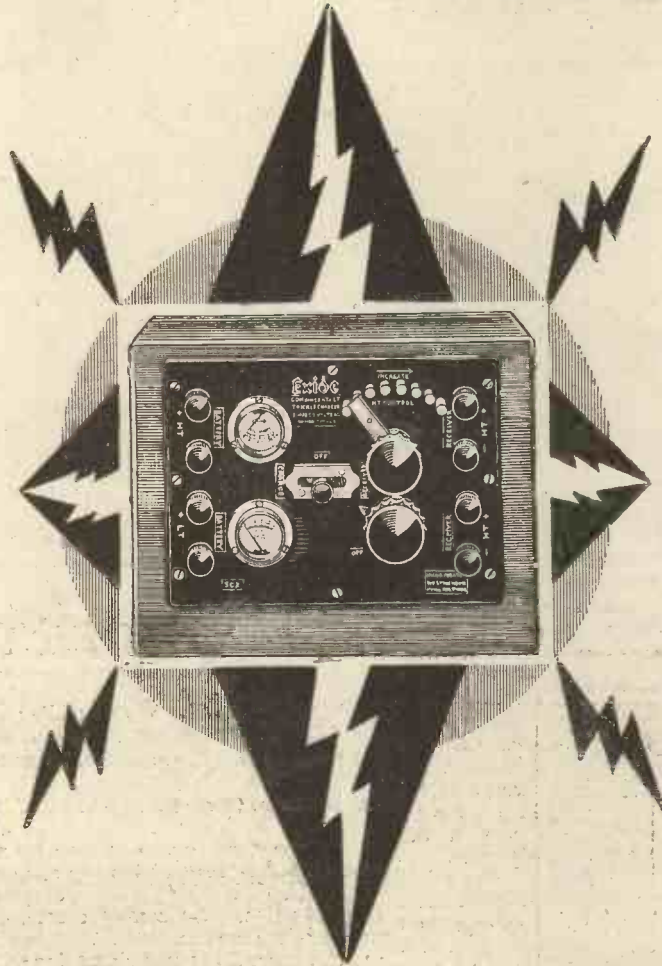
Install an Exide Trickle Charger and you will always have that pure, smooth wireless reception which only a battery can give, with none of the inconvenience of battery recharging.

And another thing! Your batteries by this method not only feed but they actually nourish themselves. The slow gradual dosage does them good and used batteries feeding themselves so, enter on a fresh lease of life.

That's the Exide Trickle Charger. Perhaps you are one who likes to know in technical terms the why and wherefore. If so, literature is at your service.

★ ★ ★

Your dealer or Exide Service Agent will fit the Exide Trickle Charger and adjust it to your set.



Exide TRICKLE CHARGER

For A.C. Mains. For High Tension Batteries, for Low Tension and for both.

AN IDLE BATTERY

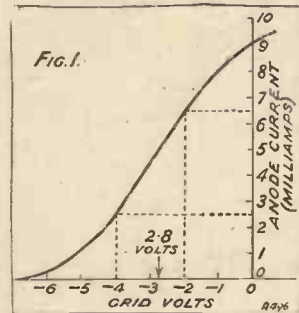


THE grid-bias battery is the only battery used in a radio outfit which does not do any real work. Work, that is, in the sense of supplying power. No current flows, or should flow, if the receiver is adjusted correctly, from this battery. All it is asked to do is to supply voltage.

That a battery can usefully do this without any current flowing from it may cause many constructors a certain amount of puzzlement, but the facts are these. The grid-bias battery is present for the purpose of adjusting the initial conditions of the grids of the valves concerned, and it will be necessary for the purpose of the clearing up of this main point briefly to run through the theory of the operation of the valve.

A Simple "Curve."

As you will know, the valve is a sort of relay. The grid is interposed between the filament and the plate, and acts as a kind of tap. When the grid is made more positive it allows a greater number of electrons to pass through it to the plate, and the practical result is that more current flows from the H.T. battery through the 'phones (or transformer primary). Making the grid negative has the effect of cutting down this H.T. current flow.



Thus varying voltage impulses on the grid cause varying currents to pass through the 'phones. The effect of certain voltages on the grid of a valve can easily be plotted in the form of a simple curve such as is shown in Fig. 1, which is illustrative of no particular type or make. You will note that the more negative the grid is made the less anode current flows.

Interesting Examples.

Now the grid-bias battery is used in order to give the grid an initial starting voltage. From this point the signals fed in operate either negatively or positively (more or less negatively is the same thing in effect).

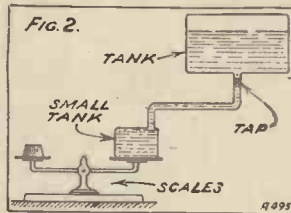
Supposing our valve, as in Fig. 1, had its grid biased (with a G.B. battery) to the extent of 2 volts negative. Before the arrival of radio signals (or gramophone pick-up signals, for that matter!) a steady anode current of 6½ milliamps would be flowing. If a signal impulse of 2 volts negative suddenly jerked in the grid would immediately become 4 volts negative,

and the anode current would just as rapidly drop to 2½ milliamperes.

This quick change of current would, of course, affect the telephones; your circuit would start to work! But note that the grid-bias battery will have done nothing except to create the initial conditions; it will have had no direct connection with that 4-milliamper anode-current charge.

However, were the grid-bias voltage increased to 2.8 volts, the initial anode current would be dropped to 5 milliamperes.

Further, a signal impulse of 2 volts negative would still give you an anode current change of the same degree. So you see, without losing anything anywhere else, you would be saving anode current or expenditure of H.T. battery energy.



H.T. Economy.

You cannot keep on adding initial grid-bias voltage until you are using practically no H.T. current, because it is only over a certain area of the "curve" of the valve (same thing is to say "a range of grid volts") that one can work without distortion occurring. You must keep away from the "bends" at the top and bottom. Over the straight portion lies purity of reproduction. We are, of course, dealing with valves used in the L.F. stages of a set.

One generally aims, by applying grid bias, to bring the grid volts to a point somewhere in the centre of this straight portion of the curve, although very often, indeed, one can be much more economical of H.T. current than that and work well down without causing trouble.

Run your grid bias up to the limit; always work for a maximum here, and not a minimum. In cases it is possible to cut down H.T. expenditure to surprising degrees.

You will now have gathered that there is no reason why the grid-bias battery should supply current (or electrical energy), for the voltage it provides does not itself have to change. This voltage is added to or subtracted from by the radio signal. It is like a deposit account in a bank, the radio signals being current accounts, and always adding to and taking away from the initial accumulation of money.

And if you think in terms of electrons, you will more clearly grasp the idea. A battery has two terminals, one marked negative and the other positive. The

negative terminal is joined to something inside the battery which has an excess of electrons. On the other hand, the positive terminal is connected to interior material which, in comparison, is simply starving for electrons.

"Extending the Terminals."

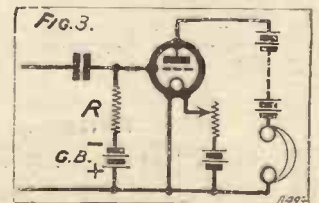
Join those two terminals with a piece of electrically-conductive material, and the negative side will, through that path, feed the positive side. But supposing you join two separate wire leads, one to each terminal of the battery. The moment you touch the free ends of these bits of wire together there will be a spark, and the excess of electrons will start flowing round the completed circuit. Cannot you imagine, therefore, that these excessive electrons from the negative part of the battery had already walked as far as they could along the electrically-conductive path thus provided before that actual linking contact had been made?

If you can, you can appreciate that if this path had terminated in the grid of a valve the electrons would spread themselves as far as this terminal point. There need be no further flow, and the number of electrons would depend upon the voltage of the battery.

It is merely extending the terminals of the battery. Here is another simple analogy. Take two water-tanks, one upstairs full of water, the other empty and downstairs. The full tank is our negative portion of a battery, and the tap in its bottom is the negative terminal. The empty tank is our positive portion of the battery. If you connect the two tanks together by a pipe, water will flow through it, and this water flow would be energy and could be made to do real work such as operate a water motor.

Now supposing you joined a pipe only to the top, full tank, and this pipe had a tap at its further end, with another small tank situated at a lower level. Water would flow to this tank, and if this tank were placed on a pair of scales it would press them down against a certain weight as the water filled it up. But once full,

(Continued on page 46.)





Marvellous New Scientific Process for making Wireless Valves

Better All-round Performance Guaranteed

"TENACIOUS COATING"

A Triumph for Osram Valves!



BADLY COATED FILAMENT

Reproduction from an untouched Micro-photograph of part of the filament of a badly coated valve before use, showing a serious gap in the coating. A gap such as this starts the valve off in its life with a poor performance, and may bring about a further portion of the coating falling away or peeling off. The valve then prematurely fails.

Good News for wireless enthusiasts! This season's Osram Valves represent a startling advance in valve manufacture.

It's the coating on the filament, not the filament itself, that gives you results. The better the coating adheres to the filament the longer the valve will last.

In the new process the coating is not merely passed on to the filament. As a matter of fact the filament is *not* coated at all until the construction of the valve is completed and all the air has been exhausted from the bulb. Then in a vacuum atoms of the pure metal are deposited on the filament to form a solid "TENACIOUS COATING."

Think what this means! It means that the well-known enormous electron emission of Osram Valves is *maintained* throughout an exceptionally long life.

Change to Osram Valves immediately and get the benefit of "TENACIOUS COATING."



OSRAM FILAMENT with "TENACIOUS COATING"

This reproduction shows the coating typical of all OSRAM VALVES. Notice the absolute evenness of the coating. There are no gaps, the coating clings, so that the full benefit of the coating is maintained. The secret is the startling new discovery of the scientific process of "TENACIOUS COATING."

CHANGE to the latest improved

Osram Valves

and
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*Scientifically made by
Experts in England.
Sold by all Wireless
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WRITE for Booklet "OSRAM WIRELESS GUIDE," giving full particulars of "TENACIOUS COATING" and full range of OSRAM VALVES for 2v., 4v. and 6v. users, and users with A.C. Electricity Supply. Also helpful wireless information of importance to every listener. Sent POST FREE on request to THE GENERAL ELECTRIC CO., LTD., Publicity Organisation, Magnet House, Kingsway, London, W.C.2.



RADIOTORIAL

All Editorial Communications to be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgic Circus, London, E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work, carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

LOUD-SPEAKER CONNECTIONS.

C. W. (Beeston, Notts).—"My loud-speaker terminals are not marked positive or negative. Can you tell me the best means of ascertaining one from the other?"

It is not easy to tell which is the positive and which the negative terminals, although it can be done. The usual method of determining this depends upon the fact that if a small current is run through the loud speaker the magnetism resulting from this current will either assist or oppose the permanent

magnetism of the loud speaker, according to whether the battery supplying the current is connected correctly or incorrectly.

In practice the experiment is generally carried out as follows. The horn and its support are removed from the loud speaker unit and the latter is suspended at a convenient height with the permanent magnet exposed to view.

Leads are connected to the loud-speaker terminals and taken to a battery, which can be cut in or out at will by means of a switch. Then the magnet is magnetically "loaded" by pins or other small objects, the idea being to attach a load to it as heavy as it can magnetically bear. When the magnet is fully loaded, the battery should be switched in and the effect upon the load should be noted.

If the switching-in appears to have no effect upon the load reverse the battery terminals and switch in again. Should the load fall off when the battery connections have been reversed, this will indicate that the battery connections are now the wrong way

round, and that its magnetism is opposing instead of assisting the permanent magnet. By careful manipulation it is possible so to load the magnet that every time the battery is reversed the load falls off.

When the correct position for holding the load has been definitely ascertained in this way, mark the loud-speaker terminal which is connected to the positive of the battery with a plus and that which is connected to the negative of the battery with a minus mark. This will ensure that the plate current of the valve which flows from the H.T. positive will be connected to enter the loud speaker at its positive terminal and leave at its negative. (In sets which incorporate an "output filter," or where a separate transformer (or choke-and-condenser coupling) for the loud speaker is used, it does not matter which way round the loud speaker is connected in circuit.)

NEUTRALISING THE "FLEXIBLE" THREE.

To neutralise the "Flexible" Three, choose a time when there is no broadcasting on, or else disconnect the aerial, so that when the set oscillates the corresponding "hiss" will clearly indicate this fact.

Now set the neutralising condenser and the reaction condenser at zero, and turn your attention to the two tuning dials.

First set the H.F. dial at about its midway position, and then, making sure that everything is in working order, carefully and slowly turn the other tuning dial, and intently listen for the hiss which denotes oscillation.

Probably the hiss will appear only when the two circuits are in tune with each other; but there may be just one or two degrees on the dial where the set oscillates, or there may be a fairly wide range of adjustment inside which the setting will give rise to the oscillation hiss.


On the other hand, there may be no sign of oscillation at all, in which case you can advance the reaction adjustment a little, and then retune until you find the requisite little patch of liveness when the two circuits

(Continued on page 36.)

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STAND 269a

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Even six months ago, amateurs thought twice before attempting to construct a Moving Coil Speaker—to-day with Goodman's parts, particularly the new Centrex Frame and Stand (illustrated above) it's a perfectly simple matter and you can be sure of the best result.

Correct tensioning and centring are assured with the minimum of trouble by a separate member, supported on special springs, adjustable by Wing Nuts, which enables the tension to be varied at will. The Goodman's Centrex Frame and Stand 32 3 will fit any Pot. Can we send you particulars?

Write for full particulars of all our Models—for 2, 4, or 6-volt accumulators, or D.C. Mains.

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OF INTEREST to all wireless users

THE attention of all visitors to the National Radio Exhibition, which opens Saturday, September 22nd, at Olympia, is drawn to the striking exhibit which has been arranged on the Ediswan Stand. For example: everyone is familiar with the silvery coating inside the radio valve, but few have had an opportunity of seeing how it is produced. We are demonstrating this interesting operation at frequent intervals. A full range of the new EDISWAN Low Temperature valves will be seen by the public for the first time, which includes the following:

A.C. Mains Valves of special construction suitable for use in any type of Receiving Set.

Valves for all types of screen grid circuits.

Pentodes.

"Rectron" Rectifiers for use in Battery Charging and Battery Eliminating Devices.

Transmitting Valves capable of handling as high a power as 4 kilowatts as well as low power valves for amateur transmitters.

Constructors' models of the several new R.C. Threesome circuits and constructors' models incorporating the new Ediswan screen grid valves.

New ideas and designs in Components.

Complete range of Ediswan Accumulators and Dry Batteries including the newest types of the popular 100% British LOTEN Dry-Charged Accumulators.

An Invitation

All the year round Ediswan is giving advice to constructors on the most suitable valves for various types of circuits. Bring your queries to the Ediswan Stand. The Company which made the FIRST Wireless Valve will give you advice really worth having, not only in regard to valves, but in all matters Wireless, and in the choice and maintenance of accumulators and batteries.

A cordial welcome awaits you at the

EDISWAN STAND

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 34.)

are brought into tune, causing the set to oscillate.

When the hiss is present, leave the tuning condensers alone, and slowly and carefully advance the neutralising condenser a little. Probably the hiss will stop. Re-tune, and it may start off again, in which case another touch on the neutralising condenser will be required.

When careful re-tuning fails to make the set oscillate, advance the reaction condenser again until oscillation restarts. Now gradually increase the setting of the neut., at the same time adjusting one of the tuning condensers a trifle to make sure you are keeping the circuits in tune with each other.

You will presently find the set will stop oscillating. Note this setting of the neut., and then increase it further, still re-tuning all the time, until the set begins to oscillate once more. Note the new setting of the neut., then go back half-way to the setting at which you found oscillation ceased. This is the correct neutralising adjustment.

INSULATION OF A "COUNTERPOISE."

"INTERFERENCE" (Grimsby).—"Is it really necessary to use insulators to separate a 'counterpoise' from its earthed supports?"

Yes, the counterpoise should be insulated as carefully as the aerial if it is to perform its work efficiently.

A DISAPPOINTING "IMPROVEMENT."

S. G. (Leicester).—"The set is a Det., 2 L.F. with a resistance in the plate circuit of the detector valve.

"In accordance with the suggestion I saw some time ago, I tried to control the volume at the output of the set by means of a potentiometer. From the enclosed sketch it will be seen that the high resistance remains connected to the plate of the first valve and to the coupling condenser, but the other side of this coupling condenser is connected to one side of the potentiometer. The other side of the potentiometer goes to grid bias, and thus the potentiometer winding takes the place of the old grid leak."

"The slider is connected to the grid of the second valve, but instead of the arrangement controlling volume as I understood it would, it completely cuts out the signals and the set is not worth listening to. What is the matter?"

Your connections are quite O.K., but from the results you are obtaining we imagine that you are using an ordinary potentiometer instead of the high resistance type. The ordinary potentiometer, as used for the control of an H.F. valve, has a resistance of only 300 or 400 ohms, and this is quite unsuitable for the purpose of controlling volume, because here the resistance required is that of the grid leak, 250,000 ohms or so.

THE "G.P.K." AMPLIFIER.

"AMPLIFY" (Stratford, London, E.).—"What are the connections for the G.P.K. 2-valve amplifier in words? It was put out by 'P.W.' in July."

The connections are as follow:-
L.T. + terminal to one filament socket of each valve holder.

L.T. - terminal to one L.T. contact on the jack (top right-hand contact).

Bottom right-hand contact on jack to the remaining filament contacts of the valve holders, to one side of the 2-mfd. Mansbridge condenser and to the G.B. + plug via a flexible lead.

Input - terminal to one side of the .01 fixed mica condenser, and to the bottom contact of the 250,000-ohm anode resistance holder.

Top contact of the same anode resistance holder to the Input + terminal.

Remaining side of the .01 mica condenser to the grid of the valve holder V2 and to one side of the 2-meg. grid leak holder.

Other side of grid-leak holder to the G.B. - plug via a flexible lead.

Plate of V2 to the "anode" (or "O.P." or "plate") terminal on the L.F. transformer.

"H.T. + " terminal (or I.P.) on L.F. transformer to the centre right-hand contact on the jack, to the remaining side of the 2-mfd. Mansbridge condenser and to the H.T. + terminal.

"Grid" terminal (or O.S.) on the L.F. transformer to one end of the 1-megohm potentiometer resistance element.

Other end of the potentiometer resistance element to the "Grid Bias" terminal (or I.S.) on the L.F. transformer and to the G.B. - 2-plug via a flexible lead.

(Continued on page 38.)

"P.W." TECHNICAL QUERY DEPARTMENT

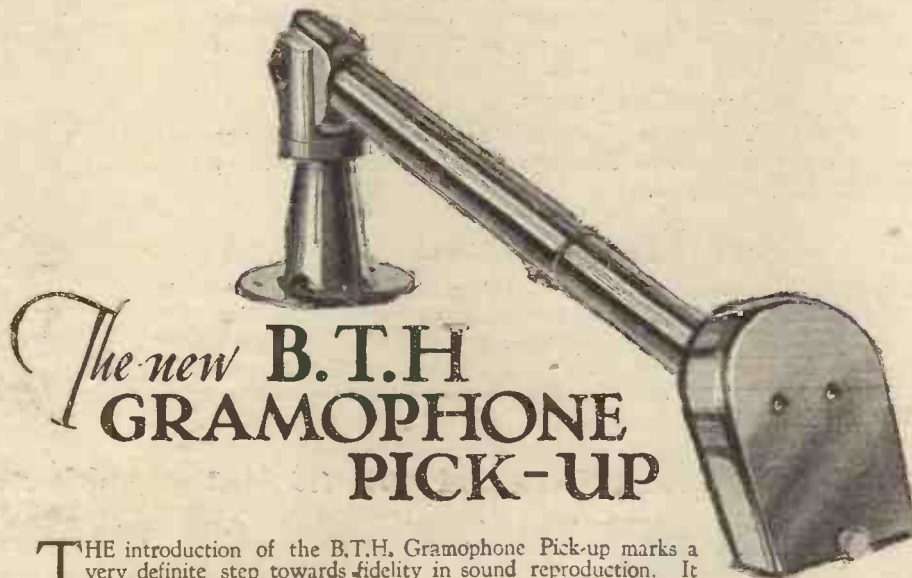
Is Your Set "Going Good"?

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

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

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

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



The new B.T.H. GRAMOPHONE PICK-UP

THE introduction of the B.T.H. Gramophone Pick-up marks a very definite step towards fidelity in sound reproduction. It is a thoroughly reliable instrument of extreme sensitivity and is capable of translating the impressions on the gramophone record into electrical impulses over an exceptionally wide range of frequencies. A wonderfully designed balanced tone arm ensures correct needle weight, thus minimising wear on the record. Used in conjunction with the new B.T.H. Pick-up amplifier, and a moving-coil loud speaker, a most remarkable degree of tonal purity is obtained.

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The B.T.H. Pick-up Amplifier

This instrument will appeal to those who have their own power amplifiers, but require a further stage. In addition to the one stage of amplification, this instrument embodies a scratch eliminator and volume control.

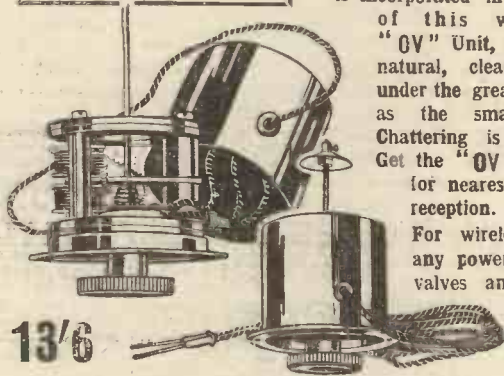
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IDEAL FOR USE WITH PORTABLE SETS.

"OV" CONE UNIT

The "OV" Unit is beautifully finished, reliable, and is everlasting. Complete with Cone Washers, Reed, and Five Foot Lead. Make a first-class Loud Speaker unequalled by the most expensive on the market and at a fifth of the price charged for these.

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GET THE "OV" CONE to use with THE "OV" UNIT



3/-

Postage 6d. extra.

for Perfect Reception

The wonderful purity and volume of reception obtained with the "OV" Ridged Cone has won for it a foremost reputation throughout the Wireless World.

It is made from a special fabric possessing exceptional tonal qualities, with the vertical ridges so arranged that the Cone permits free and easy vibrations at the same frequency over the whole surface. The scientific principle embodied in the manufacture of this Cone results in clear and natural reception of great volume, impossible to be obtained from the usual type of Cone.

The "OV" Cone can handle a very large output without distortion, and yet gives powerful reception on small sets.

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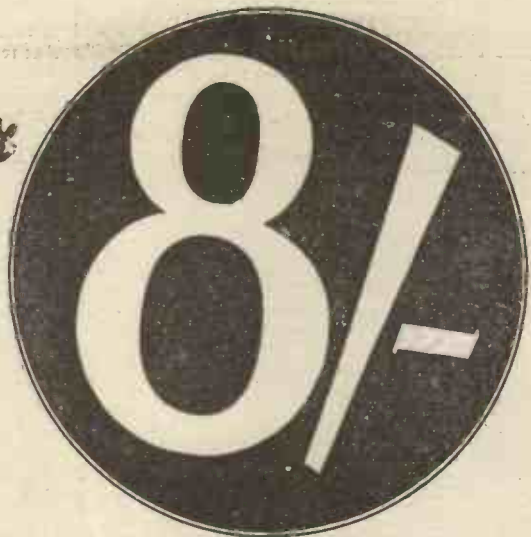
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 36.)

Arm of potentiometer to the grid of V2.
Plate of V2 to the remaining contact on the jack (single contact at left-hand side of jack).
This completes the wiring.

DRIVING THE DIAPHRAGM.

"REAL RADIO."—"What makes the diaphragm actually move in a moving-coil speaker, and who invented this class of instrument?"

The principle of the moving-coil loud speaker is simplicity itself. A small coil of wire is placed in the field of a very strong magnet, which may be either of the permanent variety, or a magnet depending upon an electric current—i.e. an electromagnet. The low-frequency currents from the radio receiver are passed through this coil which, by thus setting up its own magnetic field, is made to move forwards or backwards according to whether this opposes or assists the field magnetism. The coil thus actuates the diaphragm to which it is fixed.

To Sir Oliver Lodge, who is the scientific adviser to POPULAR WIRELESS, can be given the credit for inventing the coil-driven loud speaker. As a matter of fact this famous scientist took out a patent for such an article as far back as 1898. In this, as in many other things, Sir Oliver was many years before his time, and it was not until nearly a quarter of a century afterwards that the universal need for a device of this kind began to be felt.

"ROTTEN RESULTS."

E. T. C. (Wembley).—"At first it was just a crystal set, but because this was not strong enough we added an amplifier and made it a crystal-L.F. set. It was splendid like this and gave very good results indeed, so we thought we would like to put it in a better cabinet. Unfortunately, as soon as we had done this results fell off and the set was hardly worth listening to for months. Then the other day I was altering it around a bit and shifted one of the wires from the variable condenser a little, afterwards putting it back,

as I thought, on the same place on the crystal. But to my surprise on listening again all the rotten results had vanished and the set was as good as before again. I cannot understand it, and I am sending you a sketch of the set to see if you can tell me where it was wrong all that time.

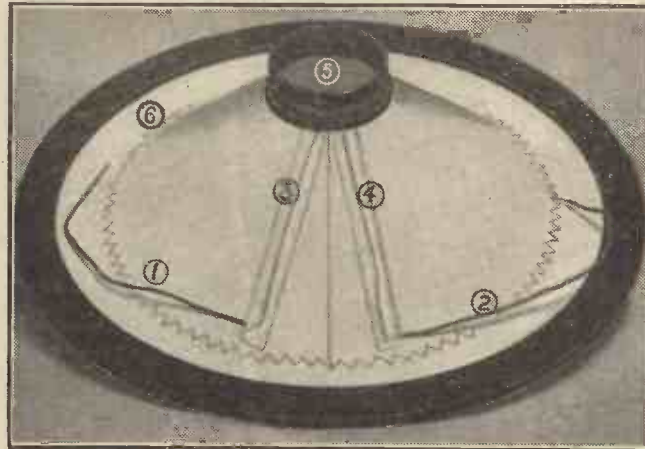
"P.S.—Would it matter which side of the crystal I joined the condenser to?"

Your results would have been very puzzling indeed except for the postscript, which gives the whole game away. If you look over the set carefully you will see that the aerial is connected to the centre tap on the aerial coil, and one end of this is connected to earth, to one side of the variable condenser, and to the primary of the L.F. transformer, etc. The other side of this coil and the other side

properly, in fact in order to get any signals worth listening to, the variable condenser must be joined at both ends to the coil.

The crystal also is joined to that coil, but what you have done is to place the variable condenser connection to that side of the crystal which is *not* joined to the coil. Consequently the current which should flow through the coil on to the condenser and from there back to the coil has actually been passed through the crystal all this time, and it is for this reason that your reception has been so bad. Upon rearranging the set recently you put matters right accidentally and now you are getting the reception which you might have had all the time if you had not wired up wrongly.

This is a good instance of the importance of following wiring instructions exactly. It is not sufficient to connect that side of the variable condenser merely "to the crystal," but it *must* be to that side of the crystal which is joined to the coil.



"MOVING-COIL" MECHANISM.

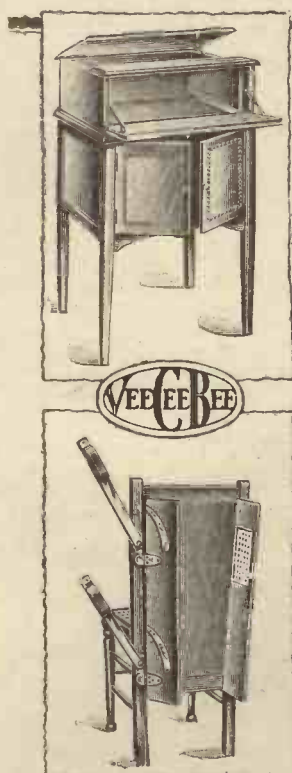
A. S. (Wokingham).—"How is the coil of a moving coil speaker fixed to the diaphragm?"

The accompanying photograph makes this clear. It shows a typical diaphragm, with the moving coil attached, removed from the "pot" or magnetising unit of the loud speaker.

(1) and (2) are the flex leads by which the coil is connected to the set's output terminals. (3) and (4) are the same leads traversing the diaphragm, and stuck down by paper strips. (5) is inside the moving coil, whilst (6) denotes the ring upon which the diaphragm is suspended.

SAFETY FIRST.

S. M. (Cricklewood, N.W.).—"Noticing that one of the screws on the variable condenser was a bit loose I put a screwdriver (Continued on page 40.)"



"The picture on the box"

may not be the sign of a good cigar, but a good wireless cabinet is a sure sign of a good set.

Your set deserves a V. C. Bond Cabinet. It will not only add distinction to your room as a piece of furniture, but will add to the efficiency of your apparatus.

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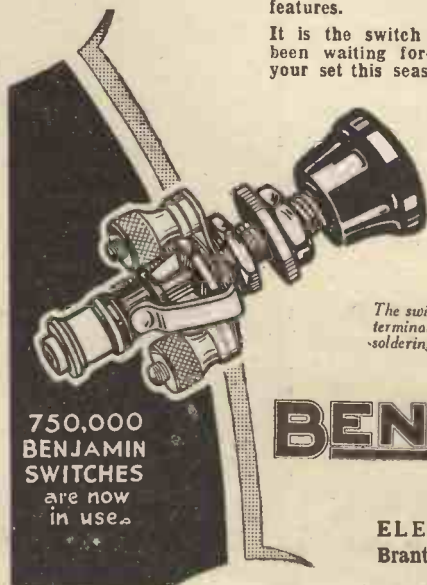
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to the 2LO wavelength being heard, free from
any distortion, using but one L.F. stage and a
cone type loudspeaker.

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SOME 37 STATIONS ON THE LOUD-
SPEAKER.**

Anybody who has a Solodyne type receiver need
do no more than instal a set of your coils, and
have a set capable of receiving any worth-while
transmissions from the Continent without any
fear of difficulty in operation."

DSP/3. One S.P.
Aerial Coil and two
Split Primary H.F.
Transformers, the
last with Reinartz
Reaction, complete
with panel control

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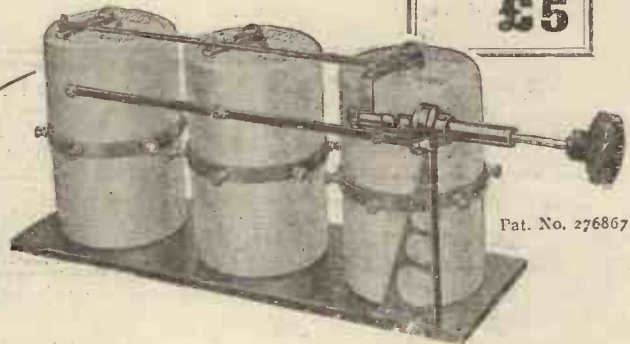
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 38.)

carefully down inside the set and tightened it up. I made quite a satisfactory job of this, but just as I was pulling out the screwdriver there was a sudden flash, the valve lit up very bright and then went out, and ever since then I have not been able to get anything in the way of broadcasting. What have I done?"

You have demonstrated once more the old, old truth that it is never wise to alter the wiring or interfere with the interior of any wireless set unless you remove the H.T. negative plug from the battery. Time and time again we have warned our readers of the danger of allowing the H.T. voltage to reach the filament. A metal screwdriver, a lead out of place, a terminal dropped inside the set, a short piece of wire straggling, the tags of the telephones touching against the internal wiring—any one of these or similar instant will provide the necessary path, and allow the H.T. positive voltage to come into contact with the filament wiring.

If this happens the valve, instead of getting 2, 4, or 6 volts (whichever it may be rated), gets the full voltage of the H.T. battery. Whether this is only 45, 60, or 160 the result is equally disastrous, and the valve will probably burn out.

The remedy is to remember Radio's Golden Rule—i.e. before altering the wiring of the set in any way, or inserting a metal screwdriver or other similar tool into the set, remove the H.T. negative plug from the H.T. battery.

A HOME-MADE CONE.

M. M. P. (Royston, Cambs).—"So what I should like now is to build up a cone loud speaker for myself, using the unit which is like the illustration I am enclosing. Can you tell me where I can get details of how to make a cone loud speaker of this kind?"

You can make an excellent speaker using a unit of this kind or, indeed, any of the similar makes now on the market, from the description which recently appeared in "P.W." The article in question was entitled "A Home-Made Cone," and the cost of the instrument including the loud-speaker unit was about 17s. 6d., while the results compare very fairly with those of many commercial manufacturers. The loud speaker referred to was primarily designed for use in "The Traveller's Three" a well-known portable "P.W." set, but it proved so useful that it has been described separately and worked into a variety of portable receivers and also has been mounted in a cabinet for permanent use. You will find the details in "P.W." No. 322 (August 4th, 1928) issue.

BACK NUMBERS OF "P.W."

L. G. (Loughton, Essex).—"Where can I get back numbers of POPULAR WIRELESS?"

You can obtain any back number of POPULAR WIRELESS which is not out of print upon application to The Amalgamated Press, Ltd., Back No. Department, Bear Alley, Farringdon Street, London, E.C.4, price 4d. per copy.

AIR CONDENSER FOR SHORT-WAVE WORK.

"SHORT WAVES" (E.C.)—"It was some months ago, and I think it was in the 'Sydney' Two, that I saw a description of how to make an air condenser for short-wave work. It was not an expensive thing, but simply made up of a little bit of scrap ebonite, a few odd screws and some copper strip. At the time I meant to keep the description, because I intended taking up short-wave work, but unfortunately I cannot find it now. As I am getting 'dead spot' trouble I should very much like to try this method of series condenser for the aerial circuit, so can you tell me what size the copper strip should be and how the condenser was made?"

The parts required are very few in number, the condenser being made upon an old piece of scrap ebonite about 3½ in. long by 1 in. wide by ¼ in. thick. Two holes are drilled in this to secure it to the base-board and it can be affixed with wooden screws. Along its centre and at a distance of about 2½ in. apart two more holes are drilled and a small bolt is countersunk in each, the ends of which stand up to act as the shank of a terminal.

Two suitable B.A. nuts are screwed on, but between these nuts and the base are placed, one on each nut, a copper strip which makes the two plates of the condenser. Each copper strip is about 2½ in. long by 1 in. wide. One is left perfectly flat and having a

hole screwed suitable to slip over the shank of the terminal. It is secured to the little ebonite baseboard by the B.A. screw and fixing nut.

The other one is secured similarly at the other end of the base, but instead of it lying flat upon its fellow a little air gap of about one-eighth of an inch across is left between the two plates. (They are mounted in line so as to overlap for almost their whole length and when you have got the set working upon the short waves you should try the effect of varying this air space between the two vanes a little by carefully bending the plates, thus securing a variation of the capacity which is in series with the aerial.)

BASKET COILS FOR CENTRE-TAPPED TRANSFORMER.

N. J. D. (Finsbury, London, N.).—"The most successful H.F. stage I ever made was that using basket coils as an H.F. transformer. I should like to try this again, but in order to neutralise I should like to use a split-primary method with these coils. It occurs to me that I ought to be able to do this with a centre-tapped coil for the primary. Would this be O.K.?"

Yes, it is quite possible to use an ordinary basket coil as an H.F. transformer in this way. Using a centre-tapped coil as primary simply means that one end of it must be connected to the plate of the H.F. valve and the other end to the neutralising condenser, whilst the centre tapping is taken to the appropriate H.T. plus tapping on the high-tension battery.

OBTAINING A TRANSMITTING LICENCE.

R. K. S. (Shepperton, Middlesex).—"Having been a follower of the absorbing study of wireless for some years now, and being by now

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the possessor of a certain amount of knowledge concerning the general principles of transmitting and receiving, I would very much like to join the ranks of our amateur transmitters in the near future, to enable me to experiment with the former as well as the latter side of wireless.

"I am, however, unfortunately totally unacquainted with the proceedings necessary to obtain the licence.

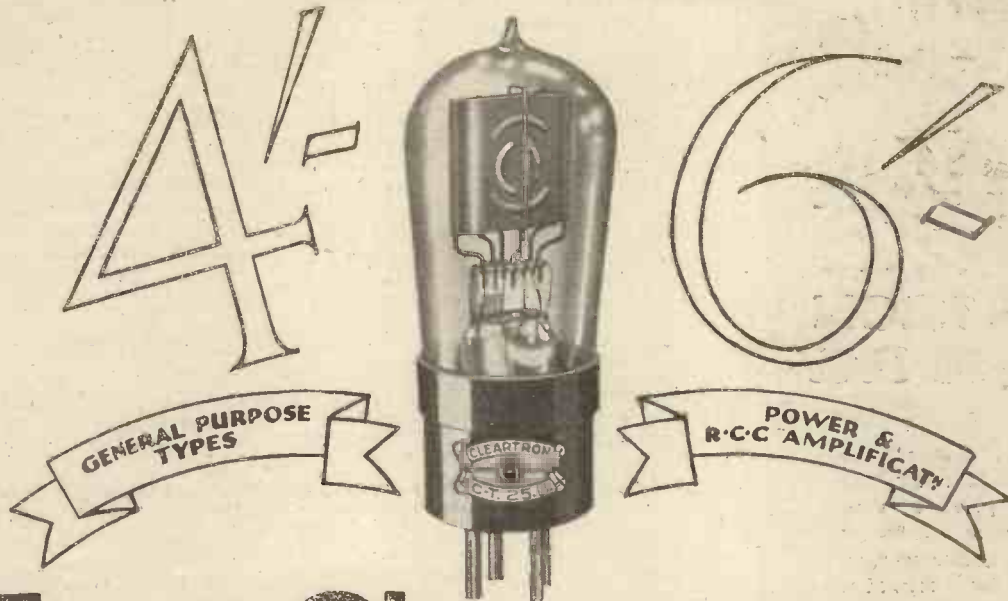
"Would it be possible to let me know what steps have to be taken, and to give me a rough idea of the amount of knowledge that is called for?"

Applications for experimental licences have to be made to the Postmaster-General, and each case is considered by him on its merits. It is well known, however, that permission to transmit on an outdoor aerial is given in only a small proportion of cases. Usually the exact nature of the radio experiments which it is desired to carry out must be stated, and the applicant must satisfy the P.M.G. that he is a responsible person, preferably with qualifications or special ability or opportunity to carry out the experiments which he proposes.

An important aspect of such cases is that permission to transmit means that the applicant will have the right to be "on the air," and thus possibly interfere with other transmissions.

To safeguard these as far as possible the applicant is required to be able to send and receive in the Morse code, at reasonable speed, so that he can be communicated with direct by other stations if necessity arises. This is an important proviso, which is obviously to the interest of everybody concerned. Apart from telegraphic skill the questions of interference with broadcast listeners, naval and military stations, etc., arise, so that a great deal depends upon the neighbourhood of the address at which the experiments will be made, the wave-length, etc.

In fact, in the present congested state of the ether a transmitting licence is rather difficult to obtain, but if the applicant can put forward a convincing case he will doubtless receive careful consideration from the authorities.



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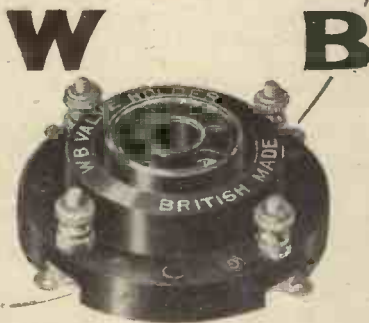
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VARNISH FINISHING.

THOSE who know how to use varnish will realise that it is possible almost to equal a french-polished finish in this way, but it is not easy, and a little practice is required. Firstly, is recommended the use of water-stains. When the stained cabinet is thoroughly dry, it is ready for varnishing. If the varnish were applied at this stage, however, it would sink into the wood, especially if soft wood is used. It is a good idea, therefore, to apply first a coat of polish. Any polish will do—floor polish, beeswax, or furniture polish.

Finish the polishing off with a dry rag and leave for a few hours, then apply lightly and thinly with a soft brush some pure spirit varnish. Apply with long, light quick sweeps, and do not go over the same place twice. If there is any dampness present from the stain or the wood, the resin in the stain will show up thick and cloudy. This is also caused by going over the same place too often. If this does happen, do not make things worse by applying more varnish. Leave it, and as it dries it will fade away. Spirit varnish is pure, is very clean and dries rapidly.

TWO TIPS.

IF you wish to make a soldered joint on nickel-plated metal it is important to remember that the nickel-plating must be filed away so as to expose the brass, or other metal underneath.

Do not think that a loud speaker which you hear in a shop will necessarily sound just as well at home, because so much depends upon the set to which it is connected. (The only satisfactory way of testing it is to try it on your own set and under the conditions in which you will listen to it yourself.)

A LACQUER- REMOVING COMPOSITION.

IT is often necessary to remove the lacquer locally from metal articles of radio use in order that a soldered connection can be effected at some particular spot.

The objection to the use of ordinary spirit for this purpose is that if the spirit is not extremely carefully applied it runs all over the surface of the metalwork, and thus tends to spoil the appearance of the article.

The following lacquer-remover, however, takes the form of a paste. It can be applied locally to any particular spot on a metal article, and, in addition to removing the lacquer, it also cleans the metal surface underneath, and so renders it immediately suitable for soldering.

The lacquer-remover is made by dissolving a small quantity of caustic soda in the least possible amount of hot water. After this, a mixture of equal quantities of finely-powdered chalk and lime is finely ground up, and added little by little to the strong caustic solution in sufficient quantity to form a thick paste.

A small blob of this paste applied locally to the surface of any lacquered article will remove the lacquer within a few seconds, after which it can be rubbed off with a damp rag, thus leaving the metal surface underneath in a fit condition for soldering.

BATTERY LEADS.

IT is well worth while buying special material for battery leads. Do not be tempted into using 22 D.C.C. or 24 S.S.C., or other wire such as is used for winding coils. The insulation of such wires is not sufficient to guard against trouble in the case of battery leads, more especially where they tend to bunch together. The cotton covering of D.C.C., let alone single-cotton-covered wire, will fray away very easily indeed, leaving nothing but the bare copper wire.

Consequential short circuits, and so on, may be dangerous. Again, single-stranded wire cannot be regarded as coming within the necessary specification of "flexible." Stranded wire, provided with both rubber and fabric covering, should be used throughout for the external connections of the receiver.

UNWINDING WIRE.

WHEN winding coils it is quite a usual practice for amateurs to drop the bobbin of wire on the floor and allow it to unwind itself. But this is frequently attended with unsatisfactory results; the bobbin darts about all over the floor and the wire becomes entangled with the legs of chairs and other articles of furniture, and should the wire be at all springy, it is liable to come away from the bobbin in coils which get into kinks and a general confusion.

But here is a tip which indicates a way to avoid all this and although it might be, to some, an obvious solution of the problem, might not have occurred to others. A small hole is drilled in the work bench or table, if it happens to be the kitchen table the household can hardly object because it needs only be a very small hole, made with a gimlet or a small size drill.

The dimensions of the hole should be such that it will take a knitting needle of stout gauge or a piece of stiff wire quite tightly and hold it rigidly in position. The knitting needle must, of course, assume a vertical position. Over the knitting needle should be slipped a large button and then the bobbin of wire. The button will act as a sort of bearing and prevent the reel from becoming jammed. The wire can then be pulled away and unwound and the process of coil winding carried out without any further trouble.



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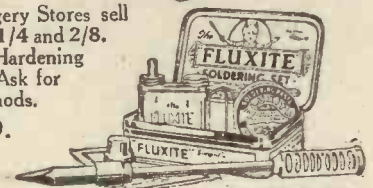
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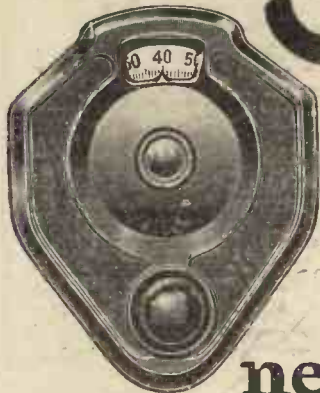
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TELEVISION

THAT the many problems of true "television" are now becoming more generally realised is an accepted fact, and the following extracts from a letter to "The Times," emphasise certain aspects of this matter very clearly. The italics are ours, but the writer says: "In the very interesting discussion on television in recent issues of 'The Times' it does not appear to have been pointed out that, apart from mechanical imperfections in the apparatus, a really satisfactory service from a single station would necessarily occupy such a broad band of wave-lengths that it is unlikely, to say the least, that space would be available.

Millions of Dots!

"Suppose that for a 'really satisfactory' service we demand a picture 1 ft. square, with the same fineness of detail as the illustrations on the picture page of 'The Times.' This demands 40 dots per linear inch, 1,600 per square inch, and 144 times as many per square foot (i.e. 230,400).

In order to secure persistence of vision—that is, lack of 'flickering'—we need to scan each dot 16 times per second; hence we must transmit $16 \times 230,400 = 3,686,400$ dots per second—say, approximately 3,500,000 dots per second.

Let us consider on what wave-length such a transmission could be made.

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We may suppose that, from a consideration of tuning difficulties, etc., we should need the wireless frequency to be at least ten times the modulation frequency; this would mean 35,000,000 periods per second, corresponding to a wave-length of about 8 or 9 metres. Reception at these very high frequencies (or very short wave-lengths) is, at present at any rate, a job for an expert. It would then seem that 'really satisfactory' television, as above defined, is out of the question, as there is no room in the ether.

Stationary Pictures.

"The transmission of stationary pictures (as contrasted with the moving picture of television) is another matter, as we may take two or three minutes instead of a sixteenth of a second to transmit our 230,400 dots which compose a square foot of picture. It is stationary-picture transmission which it has been suggested that the B.B.C. are to provide this winter, but it is questionable whether this will be worth while in the long run, for it is seldom that a picture can be of such urgent and immediate interest that one cannot await the arrival of the morning paper."

THE NEWCOMER TO RADIO.

(Continued from page 24)

aims with this Beginner's series is to cover the groundwork necessary to provide you with the knowledge required to link these up. And the following is, for the time being, as much as you need know about a variable condenser.

It consists of two sets of plates, sometimes referred to as vanes. The one set is fixed in position and the other by rotation of a dial can be made to intermesh with them. The capacity of the condenser will depend upon the area of overlap of the two sets of plates, and the distance separating them. Therefore, maximum capacity is reached when the moving vanes are fully enmeshed with the fixed set, and the capacity gets less and less as the former are withdrawn.

These two sets of plates are insulated from each other. There is no metal connection between them, and a terminal is provided for each. The term "insulated" means "electrically separated." If one component or one piece of metal is insulated from another, it means that no electrical current can flow between those two points. Likewise, insulating material such as ebonite is a substance through which electricity cannot flow.

Starting Construction.

To return to practical considerations, I want you now to fix all parts in their correct positions. Screw the panel to the baseboard and mount the variable condenser. Then fix the valve holders and terminal strip into position. After this, we come to the wiring and begin to make serious headway in the work.

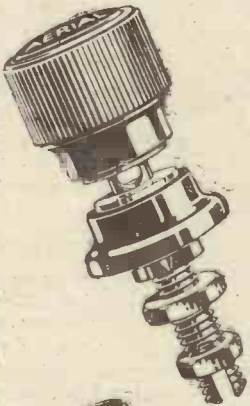
Wire known as 18 gauge, tinned copper, is a very suitable kind, although there are special wires obtainable having their particular attractions, such as Glazite, Junit, and so on. If you have not tackled soldering before, I do not think I would advise you to make a start with this set. This form of connection is certainly to be recommended, but good screw connections will be far better than bad soldering; and if you are intent on avoiding soldering, make sure that all the wireless components purchased for this set are fitted with terminals. If you are not wary in this regard you may find yourself landed with an article having soldering tags only, and to which connections can be made only by soldering.

The Wiring Connections.

Now for the actual wiring; and you will find it very helpful if you compare every lead you make, not only with the wiring diagram and photograph, but with the theoretical diagram. Thus you will see from the wiring diagram and photographs that a lead joins the aerial terminal to one of the two points on the one coil holder. In the theoretical diagram the aerial, shown as a vertical line having two branches at its upper end, is joined to that spiral representing a coil. The other end of this coil is connected to three points: (1) The earth, shown as three horizontal lines of diminishing length (earth terminal on set); (2) one end of another spiral, symbolising another coil (one connection of the other coil holder on set); (3) to one side of a symbol representing a variable condenser (one terminal of the variable condenser mounted on the panel of the receiver).

(Continued on page 46.)

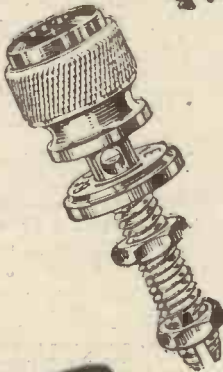
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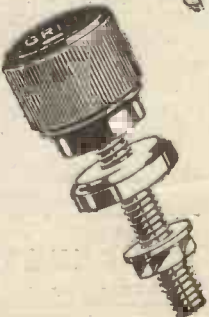
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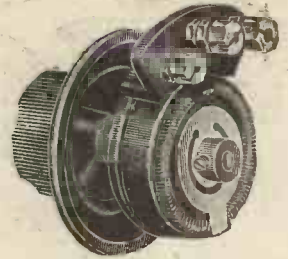
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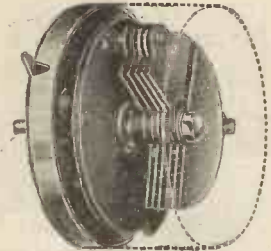
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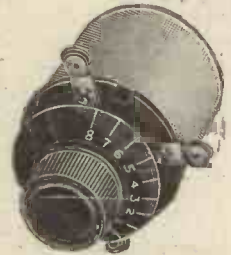
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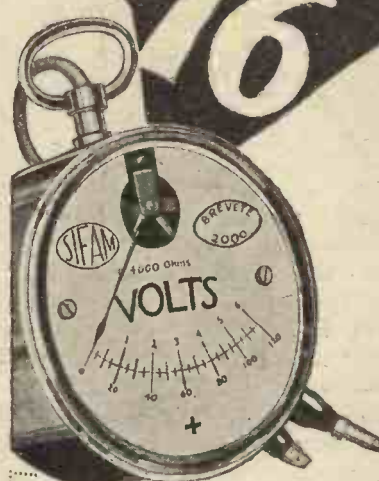
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THE NEWCOMER TO RADIO.

(Continued from page 44.)

You will now begin to see the relation of a theoretical diagram to a wiring diagram. Just as the remaining connection to be made in the set is denoted by a lead from the hitherto empty terminal of the variable condenser to a terminal of the coil holder, so the theoretical diagram is completed by that variable condenser symbol being joined to top end of the second spiral or coil. So when you insert two coils in the coil holders of the baseboard you have a circuit exactly as represented in the theoretical diagram.

The tuner portion of your receiver is complete. Have you yet guessed how it works? I say "guessed" because I have not completed my explanation. I will detail the exact sequence of events. You connect an aerial wire to the aerial terminal and join the earth terminal to a wire which runs to a water-pipe or a metal object buried in the ground.

Explaining "Selectivity."

In your aerial are generated currents by all the radio waves which cut it. Some of these currents will be small and others great, according to the disturbance that reaches your vicinity. The currents dash down the aerial through the one coil, out of the set by the earth terminal, and so to earth. They dash backwards and forwards through this path at terrific speeds. As they dash backwards and forwards through the coil so magnetic fields are thrown out from this at speeds and strengths corresponding with the current.

Like the radio waves do in the case of the aerial, these magnetic fields develop currents in the second coil placed near to it, and just the current you want is tuned in by the variable condenser. Actually, therefore, you are not really tuning the aerial; you are tuning in on a small circuit into which currents are induced from the aerial. The use of two coils coupled together in this manner gives you what is known as "selectivity," enabling you more easily to pick out just that one station you require.

AN IDLE BATTERY (Continued from page 32.)

no further water would flow; but the weight of this little tank would not alter unless something else were placed on it, or some of the water were momentarily to be taken away, only subsequently to be put back.

REGARD that little tank as the grid of the valve and the water as electrons (or grid bias), and you have a very rough-and-ready idea of why a grid-bias battery can be useful while doing no actual work.

Also, you will, with a little puzzling, dig out the reason why the interposition of a high resistance in the path of the grid-bias battery and the grid is not going materially to affect the biasing voltage, the resistance being a grid leak, as at R, Fig. 3.

Referring back to our Fig. 2 analogy, you will see that whatever the length or size of the pipe (its resistance), that little tank is going to fill up with its quota of water.

No analogy can be complete, or, as Sir Oliver Lodge has said, it becomes the real thing; but I trust mine have at least given you something of a solution to one or two otherwise mysterious effects. But remember that while, in a sense, the grid bias is an idle battery, it will deteriorate with time, and need changing or charging as with the L.T. and H.T. varieties.

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12x 10, 3/1	14x 10, 3/5
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TECHNICAL NOTES.

(Continued from page 16.)

the unit is being loaded near to its rated output, there is a tendency for the chokes, etc., to be nearing a point at which they cease to filter effectively.

The filtering efficiency of the unit as a whole falls off, and also there may be overloading of the rectifier and the smoothing condensers. The question of the overloading of the rectifier depends greatly upon the type of rectifier used; with a valve rectifier, for instance, you can get overloading of a very definite character, just as you do with a receiving valve.

Cause of A.C. Hum.

Overloading of the H.T. unit is one of the most prolific sources of annoying A.C. hum. Often a set which has been working perfectly with battery supply will misbehave itself in the above-mentioned respect when supplied from an H.T. unit. Investigation by means of a milliammeter will generally show that the unit is being called upon to supply a current in excess of its rated maximum output—a current which was probably easily supplied by the battery previously used.

Testing Voltage Output.

By the way, it is scarcely necessary to say that in testing the voltage output of an H.T. mains supply unit, owing to the high internal resistance, the voltmeter used should be of the high-resistance type—preferably the very high resistance variety. The usual cheap voltmeter—quite suitable for a battery—takes an amount of current which may well be greater than the current intended to be supplied to the H.T. circuit of the set and, consequently, the load thrown upon the unit when testing the "voltage" is such that the reading is quite misleading.

For best results, it is a good rule never to draw from an "eliminator" more than about half, or perhaps two-thirds, of the rated current output.

Glass in Radio.

An excellent insulating covering for busbar in wiring up a set, especially where crossing wires come into close proximity, is glass tubing, of the kind used in scientific work. This tubing is very cheap and can usually be obtained of wholesale chemists and occasionally from an ordinary retail chemist. It has the advantage that it may easily be bent after heating in an ordinary white gas-flame.

Bending the Tube.

The tube should have an internal diameter as near as possible to the outside diameter of the busbar, so that the latter slips easily into the tube. When a length of busbar has been fitted with its glass sleeve, should it be necessary to bend the wire, the tube, with wire inside, should be held in a gas-flame, at the part where the bend is to be made, until sufficiently soft; there will then be no difficulty in making the desired bend. When the glass is thoroughly cold, the carbon deposit on the outside (produced by the flame) should be carefully wiped away, as this is electrically conducting.

A reader tells me that he has used glass-

(Continued on next page.)



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The cheapest, most efficient wireless mast can be fixed in half an hour. No holes to dig. Rigid, gale proof, strong and lasting.

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TECHNICAL NOTES.

(Continued from previous page.)

tube insulation in this way in making up sets and that the appearance is very pleasing if proper care is taken. Needless to add, the glass is one of the best of all insulators, and only in very exceptional cases is there likely to be any need to give thought to its dielectric properties.

Indoor Aerial.

A novel indoor aerial, which has been tried by an experimenter with excellent results, it is claimed, consists of two large coils, held in a horizontal position, one being slightly larger than the other, so that they form a sort of gigantic loose-coupler. In a particular experiment, the larger coil was upon a tube 13 inches in diameter and the smaller one 12 inches diameter. Forty turns of bell wire were wound on each tube, one end of the larger coil being connected to the earth terminal of the radio set (the other end of the coil being free) whilst the smaller coil was similarly connected to the aerial terminal of the set.

The "coupler" made in this way was suspended near the ceiling of a ground-floor room and the signal strength was compared with that received on an ordinary outdoor aerial 45 ft. high and 100 ft. long. According to claims, the signal strength with the indoor aerial was about twice that with the outdoor one.

The experiment is easily tried and by varying the number of turns the best results for a particular set can be found. The "formers" or tubes may be of cardboard.

Short Waves.

Notwithstanding the remarkable developments in short-wave transmission and reception, and the undoubted future of short-wave work generally, it must be borne in mind that short-wave transmission has certain difficulties peculiar to itself, one of the most curious, as well as one of the most serious, of which is the "skip" effect. A station sending on, say, 30 metres, is found to give but poor reception within about 200 miles, whereas beyond that distance the reception may improve noticeably with increase of distance.

In a particular case, the transmission from a station working on about 30 metres, and using only 500 watts, was received at considerable volume on a three-valve receiver 10,000 miles distant.

Skip Distance.

Various theories have been put forward to account for the "skip distance" effect with short waves, but the effect is still there, and even if we succeed in arriving at a satisfactory explanation, what is wanted is some method of making the short waves operate effectively over short distances, such as the distance of the "local" broadcast station.

It is difficult to prophesy on this point, but there seems no reason to doubt that suitable modifications in the transmitting apparatus may result in due course in this particular difficulty being overcome.

Return to Favour.

It is curious how things go in cycles. What was fashionable a short time ago may be out of fashion to-day and may be in fashion again to-morrow.

In radio, and indeed in science generally, there have been numerous instances of devices being superseded and discarded, then a change in the need brings them back into favour again.

For example, thermo-electricity, which is mainly a scientific curiosity, and which is only used to any appreciable extent in certain types of electrical measuring instruments, is likely to come into important use again in connection with radio and other applications. I have myself, as you know, been perhaps the principal advocate for some two or three years past of the development of this little science, and I firmly believe that in the next year or two you will see thermo-electric devices in practical use for radio purposes.

Small Element Voltage.

Up to the present, the chief difficulty is to get sufficient voltage from a reasonable number of thermo-elements, the result being that the thermo-generator is apt to become rather large.

Smaller units can be made, and have been made by myself as well as by others, which give a comparatively large thermo E.M.F. per couple, but there is a great tendency for the E.M.F. to fall off with continued use.

This is an excellent field for experiment for the amateur. The materials needed are readily obtainable, and no out-of-the-way laboratory facilities are required. It may be necessary in some cases to have recourse to brazing or silver-soldering, but that is really not a difficult matter, especially if you have a blow-pipe. I have previously given directions for brazing and silver-soldering, and if any reader requires further particulars I shall be pleased to supply them.

Smooth Output.

In these days of low-tension eliminators, it should be borne in mind that the current output from a thermopile is *absolutely* smooth—as smooth as that from a perfect accumulator. So the device has eminent claims to the attention of the experimenter!

"Eliminators" Popular?

What I rather had in mind, however, when I began to talk about things going out of fashion and then coming back again, was the alleged supersession of the H.T. battery by the H.T. "eliminator." Not so long ago, it was freely stated that the H.T. battery would soon be a thing of the past.

It is perfectly true that the mains-supply-unit is very convenient, in cases where electric supply is available (which, by the way, leaves out a much larger section of radio users than is commonly imagined). And, of course, for the L.S.L. (local station listener) convenience is a very important consideration, even perhaps at the expense of some degree of quality.

Batteries Improving.

But a wave of enthusiasm is returning for the battery, and I understand from the heads of several of the battery manufacturing concerns that the battery business is not only maintained but actually improving. Of course, this is partly accounted for by the general increase in the number of radio users.

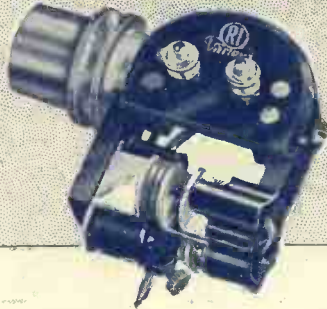


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ONE of the reasons for the growing popularity of the electrical pick-up has been the utter inadequacy of mechanical methods to reproduce the whole audible range of frequencies.

With the exception of the new R.I. and Varley Pick-Up, there is no device on the market which has so completely overcome these mechanical drawbacks. The well-known excessive damping, necessary in all other pick-ups in order to prevent "chatter" and distortion due to resonance of the various moving parts in the pick-up itself, which in turn causes such excessive wear of the gramophone record, has been overcome in a simple, conclusive, and ingenious manner. A special method of compound suspension of the moving parts—which are kept extremely light—has been adopted. The mass factor is divided into two parts, one of which deals with the higher audible frequencies and one with the lower. Each mass component is suspended in a special way, one superimposed on the other, with the resonance of the one kept well below and the resonance of the other well above the audible frequency band.

By this means, too, there is absolutely no fear of "chatter"—found in other pick-ups where the damping is light.

Lastly, it is unnecessary to resort to fibre needles for cutting down volume which, after all, are only a subterfuge to hide blasting, and to protect the track of the record from damage due to excessive damping.

Write for Leaflet FP1, which gives full details of this wonderful new invention.

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R/B