

COMPLETION OF THE "P.W." COMBINATION SET.

Popular Wireless

PRICE 3d.

No. 62. Vol. III.

SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

August 4th, 1923.



Wireless on the river.
— A photograph —
taken near Maidenhead.

FEATURES IN THIS ISSUE.

Wireless in Shakespeare Land.
The B.B.C's "C.O."
Simplicity in Tuning.
Summertime Wireless.

The Rochelle Salt Crystal.
Microphone Amplifiers.
Soldering for Amateurs.
Notes on the London Ether.

AMPLION

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- In 1893.**.. GRAHAM Loud Speakers placed upon the market.
- In 1894.**.. First used in the British Navy. Transmitters applied to Phonographs for Loud Speaker reproduction. Demonstrations by Prof. McKendrick at the Royal Society.
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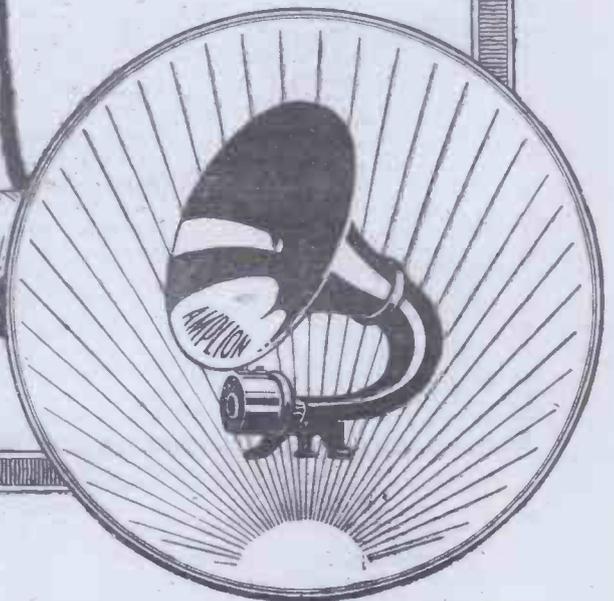
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POPULAR WIRELESS

August 4th, 1923.

SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc.

[Every Friday.]

TOPICAL NOTES AND NEWS.

A Broadcast Comedy.

THE recent transmission of "A Midsummer Night's Dream" by the London Station was quite successful. From a listener-in point of view a comedy lends itself to broadcasting considerably more than the heavier plays.

Small Motor-Car Sets.

THE Marconi Company, who, in conjunction with the British Daimler Company, were the first to adapt motor-cars to the reception of broadcast telephony, have now co-operated with the B.S.A. Motor Company, with a view to providing the same facilities for the owners of small, open touring cars. In Windsor Great Park on a recent Saturday night a demonstration was given of the new apparatus to be fitted on the cars.

Wireless Insurance.

SOME time ago I mentioned that insurance companies were considering wireless insurance. I have received a letter from a city correspondent stating that one of the first wireless policies ever placed on the market has been prepared. It follows the customary lines of insurance, and provides against loss or damage to the apparatus "by fire, lightning, storm, tempest, burglary, house-breaking, and larceny."

Useful Policy.

IT is a comprehensive policy, and an annual premium of 7s. 6d. protects against damage to wireless apparatus, including aerial, and third party damage to the extent of £500, including damage to property belonging to or under the control of the insured person. Probably this will enable the landlords to grant permission to the prospective listener-in, if he adopts the insurance.

Wireless on the Brighton Road.

RETURNING from Brighton one Sunday after hearing Willoughby Walmisley, the young English pianist, perform, I noticed a party listening-in with a portable set and an aerial fixed from the radiator cap to a bough of a tree. On the wayside a small loud speaker recorded the music

from 2 L O quite clearly. I stopped to listen and quite enjoyed the novelty of this concert amidst picturesque surroundings. The loud speaker, too, sounded quite different in the open air, and was free from many of its usual accompanying noises.

Forthcoming Items from 2 L O.

AUGUST 3RD.—Sir A. K. Yapp, K.B.E., Nat. Secretary of the Y.M.C.A., will give a talk on the Y.M.C.A.

Mr. Cecil Hallet, official guide lecturer at the British Museum, on "The Babylonian and Assyrian Collection."



Mr. Rex. Palmer and the lady responsible for broadcasting the cookery items during 2 L O's Woman's Hour.

AUGUST 4TH.—Mr. Alan S. Walker will speak about Southwark Cathedral.

AUGUST 7TH.—Irish Guards Band, and a speech by Sir John Russell, D.S.C., F.R.S.

SEPTEMBER 4TH.—Lieut.-Col. W. W. Clemenshaw, C.I.E., M.D., Lecturer on Tropical Hygiene, London Schools of Tropical Medicine, on the "Decline of Malaria in England."

SEPTEMBER 16TH.—Alderman Muriel Lester will give a talk on Child Life in East London.

Illegal Transmission.

I SUPPOSE that there will always be some person ready to take advantage of another's good fortune, or to cover his sins behind another's name, but to transmit (with various degrees of success or other-

wise) using some one else's call sign, appears to me to denote the last stages of degeneration. But so it is, for recently I have had several complaints from amateurs whose call signs have been illegally "borrowed."

Another Case.

AMONG these the latest to report such misuse is the Radio Society of Highgate, call sign 2 U S, whose secretary has had several reports on their "transmissions." These transmissions have not taken place, and the occurrences denote deliberate and repeated infringement of the call sign. The secretary, J. T. Stanley,

B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, would welcome reports of such "transmissions," as strong steps are to be taken to prevent this kind of piracy.

Underground Wireless.

SOME very interesting wireless experiments have recently been carried out by Messrs. A. Franks, Ltd., of Manchester and Bolton, in co-operation with the Wigan Coal and Iron Co., in their mines at West Leigh.

A few turns of wire were secured to the roof of the cage and the receiving sets earthed direct to the handrails. Under these very unfavourable conditions, the programme from the Manchester Broadcastingstation was received with sufficient strength to work a loud speaker whilst at the surface of the

mine. The cage was slowly lowered to about 120 ft., at which depth music which was being transmitted almost disappeared.

Reception Improves.

PROCEEDING lower to a depth of 240 ft., reception began to improve and continued to do so until the full depth of 792 ft. was reached. In this position the music was quite audible 15 ft. away from the set, although the headphones were being used, and this distance would have been considerably increased had a loud speaker been employed. It is proposed to carry out a further test at the company's Parsonage Pit, which is 3,000 ft. deep, and it is confidently expected that some very useful

(Continued on page 854.)

NOTES AND NEWS.

(Continued from page 853.)

information will be gained from these experiments. A remarkable feature of the above test was that no interference was experienced from the alternating current power cables which run the whole length of the shaft at a pressure of 2,200 volts.

Wireless in Ulster.

THOUGH restricted in the matter of licences, Ulster contains some very enthusiastic wireless societies. The Northern Radio Association, which forms the centre of wireless interest in Northern Ireland, has just held a very successful wireless exhibition in Belfast. No demonstrations or active selling propaganda were allowed, so that visitors were enabled to inspect the various types of sets at their leisure without the dread of encountering the specialised salesman.

Overheard on the Underground.

FIRST (Obviously Fresh) WIRELESS ENTHUSIAST: "I've tried hertzite, radiocite, permanite, rectarite, talite, dayzite, electronite, and various other crystals on my 'dual,' but don't seem to have struck just the crystal for the set yet. Do you know of any others worth trying?"

SECOND (Bored Old-timer): "I've heard good reports from dynamite!"

A Popular Entertainer.

OUR old friend, Norman Long, was more than welcome the other evening. You could tell by the announcer's voice that "N. L." was in the offing, and his characteristic introduction of himself would have brought a smile to the face of a burnt-out valve.

Put 'em Together.

A GREAT thought! Why don't the B.B.C. get Norman Long and Captain Peter Pendleton Eekersley to give a duet? I heard P. P. do a solo the other day—I mentioned it in last week's notes—and I can imagine there'd be a really riotous time in 2 L O's studio if these two humorists got together. Now then, Mr. Burrows, what do you think of this idea?

Encore!

WHEN we hear a voice as fine as Miss May Blythe's "on the wireless," we settle down to concentrated enjoyment. It's a rare thing to hear such a sweet voice as hers, even in the concert hall, and it was a treat for the gods to hear Miss Blythe broadcast. Encore by all means!

Transmissions from 2 Z Y.

FRIDAY, AUGUST 3RD, is the opening night at the new station. The band of the Irish Guards will give a musical programme after the opening speeches by Lord Gainford, the chairman of the British Broadcasting Co., Ltd., and Mr. J. C. W. Reith, the general manager. Individual artistes this night are Florence Holding, Lee Thistlethwaite, and Victor Smythe.

SATURDAY, AUGUST 4TH.—The afternoon transmission will be given by the Revilo Syncopated Orchestra. The evening programme will be by the Radio Orchestra and the popular Melody Four.

SUNDAY, AUGUST 5TH.—An artistes' concert by Gladys Hulme, contralto; Fred Brough and Daisy Shorrocks, violinists;



"Ariel" and the Uncles of 2 L O pay a visit to the "Daily Mirror" printing works.

Arnold Perry, pianist; and Harold Brown, baritone.

MONDAY, AUGUST 6TH.—Tennyson's birthday. Mr. J. Phythian, M.A., will give a chat on the famous poet. Mr. Albert Etchells, the blind pianist, and George Harris, the Newcastle tenor, are the artistes, with the Radio Orchestra.

TUESDAY, AUGUST 7TH.—A special modern programme, during which Max Reger's beautiful composition for violin, flute,

and viola will be played by Messrs. Hirsch, Lingard, and Widdop. Mr. Stansfield and Miss Emily Seddon are the artistes, and the entire programme will consist of modern works.

WEDNESDAY, AUGUST 8TH.—A popular orchestral programme by the Radio Orchestra.

Result of the Sheffield Experiments.

THE Sheffield station has been removed from the University to Mr. Harry Lloyd's home, and Mr. Lloyd has taken over the transmission on behalf of the B.B.C. until a suitable site for the station has been found.

Lifeboat Wireless.

IF more lifeboats were fitted with wireless, many more tragedies would be averted. I hear of a lifeboat set which has a range of 50 miles, specially designed for ships' lifeboats. The set is capable of sending and receiving messages up to 50 miles.

SOME BROADCAST "HOWLERS."

Novel Competition.

A GREAT deal of fun was obtained from the recent 2 Z Y competition, in which listeners-in were requested to advise the station director of the funniest thing they had heard from the station.

Where's the Wig?

MOST people mentioned the transmission of news in which the announcer boldly read that a certain gentleman, high in the esteem of the English race, "stood baldheaded" throughout a certain ceremony connected with the Cenotaph in London.

A Querc Fashion.

THE occasion on which the station director announced in his reading of a paper on oncoming fashions that "next season shirts will be longer" was also referred to by a large number of enthusiastic competitors.

A Stage Whisper.

AN echo from the early days of 2 Z Y's transmissions was remembered by many who heard the following remarks at 10 p.m. one night: "2 Z Y closing down for the night. Good-night, everybody; good-night." (Pause.) "Pull that — switch out!"

ARIEL

BROADCASTING TRANSMISSIONS.

Regular transmissions of news and concerts take place daily from the following stations. Full details appear in the daily press.

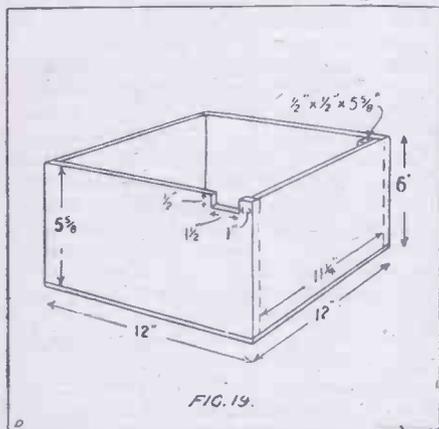
London	2 L O	360 metres
Birmingham	5 I T	420 "
Manchester	2 Z Y	385 "
Newcastle	5 N O	400 "
Glasgow	5 S C	415 "
Cardiff	5 W A	353 "
Other stations of interest to listeners-in in Great Britain are:—		
Eiffel Tower	FL	2,600 metres Throughout the day.
Radio-Électrique, Paris	SFR	1,780 " 5.5 to 6 p.m.
		8.45 to 10 p.m.
School of Posts and Telegraphs	—	450 " 7.45 to 10 p.m.
		(Tuesdays and Thursdays.)
		4.30 to 7.30 p.m. Saturdays.
The Hague	PCGG	1,050 " 3 to 5.40 p.m.
		(Sundays.)
		8.40 to 9.40 p.m.
		(Mondays and Thursdays.)

THE "P.W." COMBINATION SET.

Built and Described by the Technical Staff.

Unit Two is dealt with this week; in the next article the finishing modifications of Unit One will be detailed.

THE only things left to consider are the cabinet and the additional L.F. amplifier. Taking the former, the case should be built of $\frac{3}{8}$ in. hardwood, suitably pinned or dove-tailed together as the skill of the experimenter may permit. A piece is cut out as shown in Fig. 19, to allow for the jack carrying strip affixed to the panel. Corner fillets, $\frac{1}{2}$ in. by $\frac{1}{2}$ in., should be provided to give a firm hold for the screws holding the panel. The case should be



finished by staining and varnishing or French polishing as may be desired. Full dimensions are given in Fig. 19.

The low-frequency amplifier unit will require another low-frequency transformer,

which should be made in the same way as the previous one, a filament resistance, a valve holder, four terminals, two jacks, and a plug.

The panel on which the components are mounted consists of a piece of $\frac{1}{4}$ in. ebonite, 12 in. by 6 in. The components are arranged as shown in Fig. 20, underneath and surface views being given as before. The flexible lead connected to the plug forming the link between the two sets should be connected to the panel wiring by means of two connectors cut out of $\frac{1}{16}$ th in. brass, as shown in Fig. 20.

The battery terminals, both H.T. and L.T., which are the only terminals on the set, should be fitted on the left-hand side of the panel (viewed from above) to facilitate the common connections of the batteries to both panels. The jacks and transformer should be mounted in the same way as in the previous panel. The connections are made by means of No. 20 enamelled wire, in accordance with the skeleton diagram in Fig. 6. The case should be constructed of the same materials as those already mentioned, to the dimensions given in Fig. 21.

Marking the Panels.

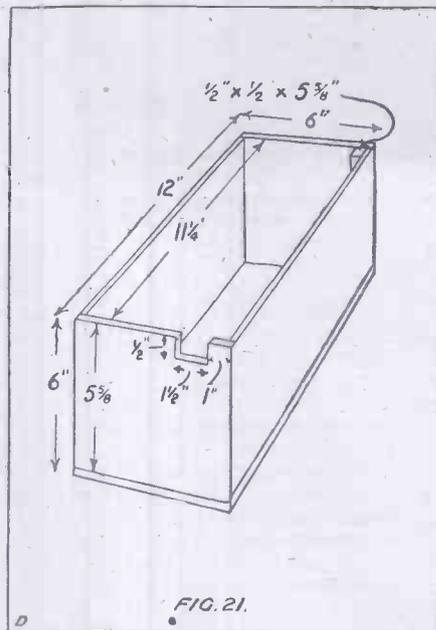
When the sets are completed the various terminals, switches, and jacks should be lettered. This can be done in white paint, either by lettering with a brush, or by using rubber stamps, if the paint is properly thinned with turps. If the latter method is utilised, experimental trials should be made on a small piece of scrap ebonite before trying on the panels themselves.

With regard to the lettering to be adopted for the switches and jacks, the following is suggested.

For the left-hand position of switch No. 1, Fig. 5, "Crystal." For the right-hand position, "H.F. and Dual." For the upper position of switch No. 2, Fig. 5, "Crystal," and the lower "H.F. and Dual." For jack No. 1, Fig. 5, "Crystal and H.F.," and for jack No. 2, "Dual." For jack No. 1 on the low-frequency amplifier, Fig. 6, "Set one," and for jack No. 2, "Amplifier."

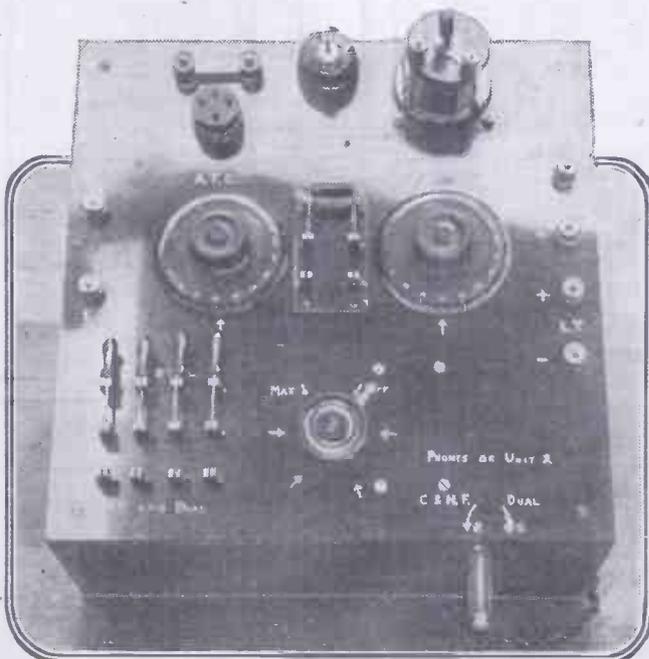
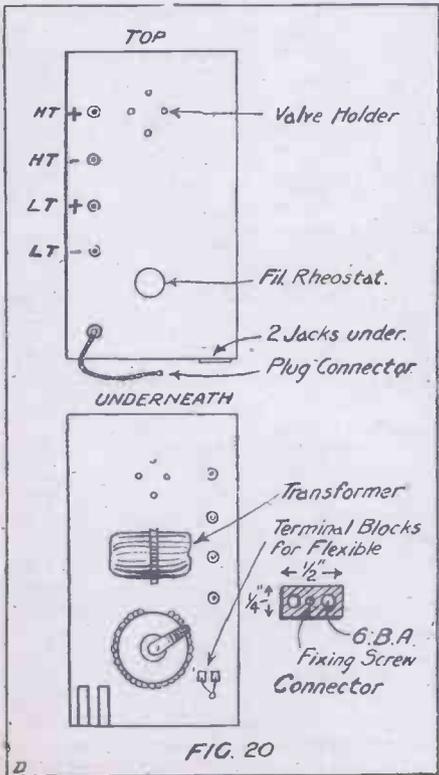
The telephones used with these sets will of course have to terminate in a plug suitable for use with these jacks.

The wave-length range of these sets is of course limited by the anode coil and the aerial tuning inductance, but those desiring to have a greater wave-length range may



obtain this by fitting a pair of terminals or sockets in series with the aerial inductance and anode inductance, to which loading coils, which may take any form, can be connected. These sockets would have to be short circuited when in normal use.

The full wiring diagrams and photographs of the interior lay out of the set will be published in the next issue of "Popular Wireless." With regard to the wiring up of the set it is advisable to space all the wires as far apart as possible, avoiding any parallel connections. Where these latter have to be made the wires should be separated as much as is practicable. Should the set appear "dead" when first tested, the primary leads of the L.F. transformer should be reversed, though little trouble will be experienced in this respect as all transformer connections are clearly marked on the internal wiring diagram.



Unit One in its completed form. Details of the series-parallel switching, etc., will appear in the next article.

TRACKING TWO "TWO L.O." CRIMINALS.

By MAJOR C. FLEMING-WILLIAMS.

An interesting description of some successful amateur detective work carried out by one of the prize winners in the recent wireless "man hunt" competition arranged by the uncles of 2 L O.

IT was really quite a family affair. One of my boys, aged 13, constructed the four-valve set that spoke out the terrible story of the 2 L O defaulters, my wife took down the message in writing, and then flew to the kitchen to pack up a meal to take the place of the one we would not have time to eat at home; I pressed the electric starter and drove "Blue Ruin," the mile-eater, while my younger son used his eyes to very good purpose when at last we were face to face with the criminals. So we all had a finger in the pie.

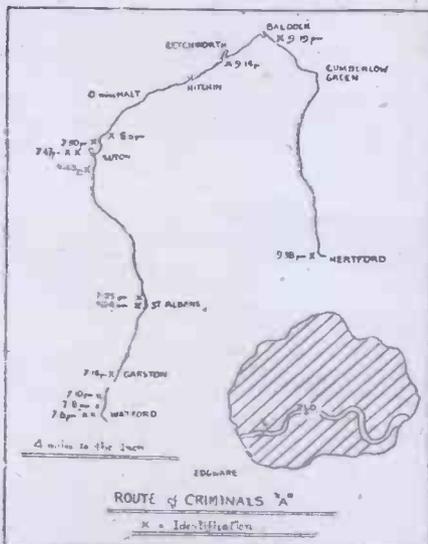
It was 6.45 when the message came through, and at seven we were well under way. We held a council of war as we sped along. I spoke first, in my best criminal investigation manner.

"Last seen at Edgware, making for the Wash." That means they have got to strike the Great North Road somewhere. Where is the first turning to the right after Edgware?"

Waiting and Watching.

The children had the map out on the after deck. We have one of those lids that half cover the rear seats of the car. It makes a good chart-room table, so to speak. "The first turning is in Elstree. The next one, I know, is at St. Albans; and they would strike across to Hatfield, take the North road there to Welwyn, after which they might take either fork, the one through Hitchin or the one through Stevenage. If we are going to get a snapshot of them before the light fails, we have got to catch them before they reach Welwyn. How many miles is it from Edgware to Welwyn?"

"About twenty-four."



The route taken by Uncle Caractacus and Aunt Sophie.

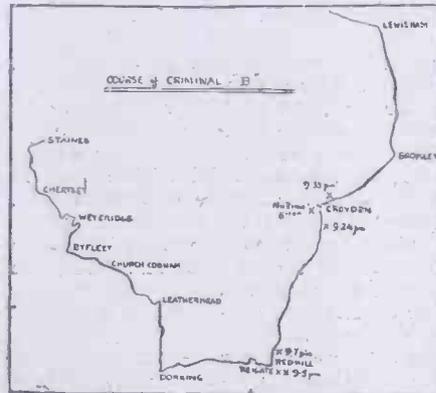
"That will take them about seventy minutes, probably a bit more, as they will be bound to travel very slowly through the towns and villages to give people the chance to recognise them."

"They ought to be at Welwyn about eight," said our Lady, who is very clever at mathematical calculations on her fingers.

We reached Welwyn just before eight, and driving a few miles farther on we drew up, and turned round so as to be ready to take up the chase if the Daimler hove in sight.

We chose a very pretty spot under some great overhanging trees, where we also got a good sweep of road to enable us to see the expected car at the earliest possible moment.

During the half hour we waited, Daimlers were more common than Fords, and we had a very exciting time seeing who could pick out the numbers first, and then noting very carefully what the occupants of them looked like. There was always the possi-



The line of Uncle Jeff's attempt to "escape."

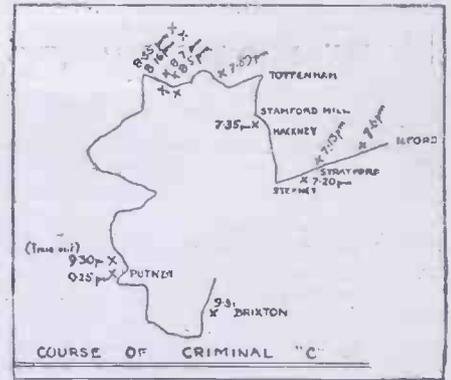
bility that the criminals might change cars, so we kept a very careful watch on everybody.

I think some of the people who passed must have thought us very rude, specially one blue Daimler limousine, to look into which, we all nearly fell out of the car.

At eight-thirty we decided that the criminals must have made a wider detour, gone on to Luton, and turned east through Hitchin, intending to strike the North road at Baldock. We thought that highly likely, as it would give them several more towns to traverse. It was obviously to their interest to be caught as many times as possible, they being only very amateur cracksmen.

Intercepted.

Working out the mileage, we decided they ought to reach Baldock about nine-fifteen, so we timed ourselves to reach there by nine. We got there a few minutes after that time, and took up station at the first cross roads



The route taken by Uncle Arthur.

in the town. It was a good place to wait, because it offered five different routes to the suspects.

At the end of ten minutes, we were discussing the chance of their having ventured as far north as the Bedford, Biggleswade traverse, and working out how long we would have to wait before they came to Baldock on the return journey.

Then we saw a Daimler car coming along the road from Hitchin, and three hundred yards away we spotted the letters H.P. on the number plate.

My hand flew to the electric starter, and we waited on the tiptoe of excitement. In a rapid succession of ejaculations, we each called out points of identification, by which time the car had stopped right close to us to ask the way of a man who was standing on the sidewalk.

To gain a bit more time for taking in details, I sidled my car up to the other, and asked Uncle Caractacus, who was driving, whether he had come through Luton. He replied in the affirmative, let in his clutch, and glided away.

We quickly ran through details of costume, and facial description of the four occupants of the car to see if we had all observed correctly, and finding that we were not quite unanimous in one or two points, I decided to give chase to the Daimler.

A Desperate Attempt.

We had to exceed the speed limit for a spell rather badly, as Caractacus was evidently "treading on the gas," and was trying to make an effort to get away.

When we came to a hill, we were pleased to find that we were gaining fast, and we soon had the fugitives nicely in hand, and were able to correct our first impressions. We followed the car for a few miles, when we decided we had all the details we required and could wend our way joyfully home, having had a good evening's fun, and attained our objective.

Subsequently I wrote a full description of the car and its occupants, and as we were unable to get a snapshot, I made a rough water-colour sketch, which helped out the description considerably.

I need not dwell on the intense excitement of the family when we heard our name come through the loud speaker later on, nor need I enlarge upon the delightful luncheon the B.B.C. gave us. As far as I can see, when I have purchased all the things the family demand as their fair share in the plunder, that five I won from 2 L O is going to be quite a costly luxury.

SOME SIMPLE WIRELESS CALCULATIONS.

By C. E. FIELD, B.Sc.

Being a short, interesting introduction to the mathematics of radio-work. The author does not weary the reader with long explanations of an unnecessary nature, but deals with the subject in its direct application to practical constructional work.

II. CALCULATIONS OF CONDENSER CAPACITIES.

IT is very important for the experimenting amateur to be able to calculate the capacity of any condenser he may be using, or to be able to construct a condenser of any required capacity.

The capacity of a condenser is a measure of the amount of electricity that can be stored upon the surface of the layers of insulating material which separate the metal condenser plates. Consequently, the capacity is dependent upon the number and dimensions of these layers, and upon the material of which they are composed.

The greater the area of a layer of insulating material (or *dielectric* as it is more usually called), the greater is the quantity of electricity that it can hold upon its surface. The thicker the dielectric between two plates, however, the less is the quantity of electricity stored, for, as the metal plates become more widely separated the force between them which tends to squeeze electricity on to the dielectric becomes weaker.

Making a Condenser.

All dielectrics cannot store electricity to the same extent, and so some means are necessary of measuring their relative capabilities in this respect. The quantity of electricity that can be stored by a given layer of air is taken as a standard, and the number of times more electricity that a similar layer of any other dielectric can store under similar conditions is known as the *Dielectric Constant*, or *Specific Inductive Capacity* of that particular material. Hence, the dielectric constant of air is 1, whilst that of paraffin wax, for instance, is 2. This means that, as a storer of electricity, wax is twice as efficient as is air, and so a condenser using insulating layers of wax (or waxed paper) would have double the capacity of a similar condenser in which the metal plates were separated by air spaces.

Thus we see that an increase in the capacity of a condenser is brought about by an increase in the area of the sheets of dielectric, in the dielectric constant of the material, and, of course, in the number of sheets that are employed, while an increase in the thickness of the dielectric produces a decrease in the capacity.

The fundamental formula for the capacity of a condenser is therefore given by $C = \frac{A \times N \times K}{T}$, where A, N, and T denote respectively the area, number, and thickness of the sheets of dielectric, and K denotes the dielectric constant of the material. This formula, however, would not give us the capacity in units with which we are familiar. In order to obtain the capacity

of a condenser in microfarads, the result given above must be divided by 11,300,000, so that the practical formula is this:

$$C = \frac{A \times N \times K}{T} \div 11,300,000, \text{ all measurements being made in centimetres.}$$

If we required to find the number of sheets necessary to give us a certain capacity, we could rewrite the formula thus:

$$N = \frac{C \times T}{A \times K} \times 11,300,000.$$

Let us suppose that we require to construct a reservoir condenser, having a capacity of 0.01 mfd. This is a fixed condenser of large capacity, and so will be made up of sheets of tin-foil and waxed paper. We propose using paper from a writing tablet, the dimensions of which are

tightly together. This we find to be, say, 0.3 in. Each leaf is therefore 0.003 in., or .0076 cm. thick.

When the paper has been soaked in wax (for which purpose three or four candles will suffice) the dielectric constant is 2, and we have then the following values for our formula.

$$C = 0.01; A = 9.6, T = .0076, \text{ and } K = 2.$$

We can say, therefore, that the number of sheets required is given by the expression

$$N = \frac{0.01 \times 0.0076}{9.6 \times 2} \times 11,300,000 = 44.7.$$

Forty-five sheets will thus be sufficient for our requirements.

Variable Condensers.

When constructing a condenser of this description, especially if an exact capacity is required, before the metal sheets are secured to terminals, the built-up condenser should be stood on a plate in a hot oven for about half an hour, a flat-iron or other weight being placed on the top of the condenser. This squeezes out all superfluous wax, which would otherwise reduce the capacity by increasing the space between adjacent metal sheets.

Let us now calculate the capacity of an aerial tuning condenser, constructed in the usual way, with fixed and moving plates of semi-circular shape, separated by air spaces.

We must first count the number of air spaces (i.e. layers of dielectric) between fixed and moving plates. This number is one less than the total number of plates, so that if we assume that there are 11 fixed and 10 moving plates, there are 20 air spaces.

In order to obtain the thickness of the air space between a fixed and moving plate, the simplest procedure is to measure the distance between the inner sides of two adjacent fixed plates (i.e. the thickness of the spacing washer) and subtract from this the thickness of the metal plate. This gives the combined thickness of the two air spaces on either side of one plate, and so the thickness of one space is given by half this figure. Suppose that the thickness of our spacing washers is $\frac{1}{8}$ in., and that of the metal plates is $\frac{1}{16}$ in., subtracting $\frac{1}{16}$ from $\frac{1}{8}$ gives $\frac{1}{16}$ in., and half of this, i.e. $\frac{1}{32}$ in. is the figure we require. Hence, the thickness of each layer of dielectric is $\frac{1}{32}$ in. or 0.12 cm. We now require the active area of each sheet of dielectric, which, in this case, is the same as the area of a moving metal plate. The area of a circle is given by the square of the diameter multiplied by 0.785; the area of each semi-

(Continued on page 858.)



4,000 people attended the above Marconiphone Wireless Concert on the Town Moor Recreation Ground, Newcastle-on-Tyne.

$10 \times 7\frac{1}{2}$ in. Each leaf of this will cut up, without waste, into 25 sheets, each measuring $2 \times 1\frac{1}{2}$ in., which is a convenient size for our requirements. The sheets of paper must be made larger than the metal plates in order that the latter shall not touch one another, and so the *active area* of the sheets of dielectric (that is, the area which is directly in between two metal plates), will be given by, say, $1\frac{1}{2} \times 1$ in., this leaving a margin of $\frac{1}{4}$ in. on three sides of each metal sheet. The active area of each sheet is therefore 1.5 sq. in., or 9.6 sq. cm. (1 in. = 2.54 cm., and 1 sq. in. = 6.4 sq. cm.)

Number of Plates Required.

The next step is to obtain the thickness of each sheet of paper. As we have no micrometer available, we count a hundred leaves, or double fifty leaves over, and measure the thickness of them all pressed

NOTES ON THE LONDON ETHER.

By 2 G M.

"FIVE VIC R" has solved the problem of wireless transmission of power without doubt. Limited to 10 watts for initial ether shaking, he regularly manages to push quite 15 watts of diaphragm tearing imitation broadcasting into our quivering receiving set, should we be so foolish as to get within 25° of his tuning.

5 V R, we should think, is a collector of antiques, his strong point in this respect being aged gramophone records. Now we don't mind him collecting such curios, but we wish he would refrain from disturbing London's ether with such relics—it isn't fair to the gramophone companies. He put a youngster of nine years of age on the other evening and 2 O M reported sagely: "Very scratchy, extremely bad resonance, transmission not good." Where's the fun?

Might be Anything.

2 O M, by the way, is putting out some good stuff. We trust he enjoyed his recent adventures up the river near Molesey with a receiver attached to "a frame aerial that was not ordinary." We heard 2 O M calling up Belfast the other Sunday, and he certainly deserved to get there. Other amateurs heard on this occasion could have been better occupied.

"Five Pip You" has got either a cold in his head or rheumatism in the microphone—anyway his transmission has lately developed a decided tendency to emulate 2 L O's first efforts, only more so. This is unfortunate, because 5 P U was always inclined to rush things; "Fie—ee—oo—o'er" might be anything to those who did not know.

2 X O, ever a "still small voice," has strayed of late into wave-lengths which should be avoided by the weak. What chance has one so diminutive beneath the lusty roar of some stalwart trawler! Come up or go down, 2 X O, lest ye fade completely away into the great unknown of shrieking, grunting shipping.

We cannot write of the London ether without referring to the father of all London ether shakers—i.e. our old friend 2 L O.



Fixing in the anode coil. The "P.W." Combination Set in the course of construction.

How the amateur transmitters hate him, how they detest his melody-bearing "carrier," how they frown when he joyfully roars-in on their loud speakers, how they curse him when his lusty wave beats against their delicately adjusted reactances, and yet we trow they dare not shut him off when the "family" are around. Amateur transmitters are few, while listeners-in are many, and the minority must give way to the majority and experiment when the lucky latter have laid down their 'phones, or tucked their loud speakers away in the pantry, for the night.

Very Depressing.

2 L O, we think, has caused greater enmity among its small imitators more by its excellence of transmission than anything else. "What's the use" must be the feeling of the possessors of scratched gramophone records and Skinderviken button transmitters. Personally we have come to the conclusion that greater things can be done in the way of improvements in reception.

As a standard receiver we have constructed and put in a place of honour on our bench the "POPULAR WIRELESS Combination Set," which as a well-behaved receiver is unbeatable, although its efficiency is rather trying. After struggling for months in an endeavour to evolve an anti-howl circuit with the sensitivity of a "just on the point" receiver, it is very depressing to come into sudden contact with a veritable mouse of a set with the power of changing its internal "hookups" with the facility of a mechanical chameleon. We shall have to climb a few more steps and jump off again, that is all there is to it.

Very sad about 2 K Z, isn't it? Our deepest condolences to this worthy electron worrier, who has developed a serious attack of intermittent generator hum. "A voice once clear in tone now drowned beneath a dynamo's moan." Good-bye! Good-bye! 2 G M closing down.

SOME SIMPLE WIRELESS CALCULATIONS.

(Continued from page 857.)

circular plate is therefore obtained by multiplying the square of the diameter of the plate by 0.39.

If our plates measure, say, 3 in. across, the area of each is equal to $3 \times 3 \times 0.39 = 3.5$ sq. in., or 22.4 sq. cm. We are now in possession of the following facts about our condenser:

$N=20$, $T=0.12$, $A=22.4$, and, since air is the dielectric, $K=1$.

Applying the formula for capacity, we have $C = \frac{22.4 \times 20 \times 1}{0.12} = 11,300,000$

$= 0.00033$ microfarads.

There are two ways in which two condensers may be coupled together if required, in order to produce a change in capacity.

Firstly, when one condenser is connected in the circuit in the usual way, each of its terminals may be joined to one terminal of the second condenser, when the two are said to be connected in parallel. This is equivalent to attaching to each terminal a number of plates equal to the sum of those

in the two condensers, and so the resultant capacity is given by simply adding the individual capacities. For example, if we were to connect in this way a condenser of 0.002 mfd. capacity to the one we have just been considering, the capacity of the two together would be 0.00053 mfd.

The second method consists of joining one terminal (or set of plates) of one condenser to one terminal of the other, leads being taken to the remaining two terminals.

The condensers are then joined in series, and the total capacity is less than the capacity of either of the components, the effect being practically that of adding together the two thicknesses of dielectric. In this case the total capacity is given by the expression

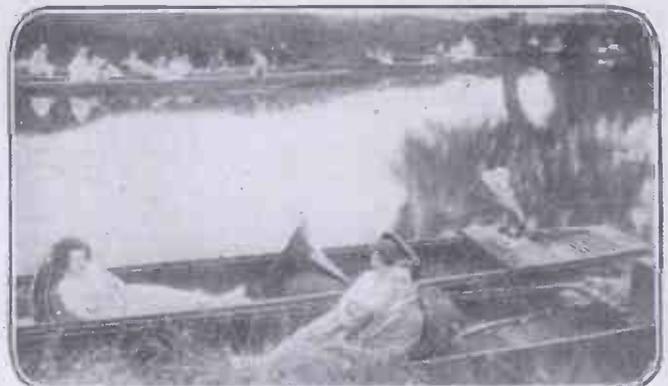
$$C = \frac{C_1 \times C_2}{C_1 + C_2} \text{ where } C_1$$

and C_2 are the capacities of the two component condensers.

For instance, by joining in series two condensers having capacities of 0.01 and 0.02 mfd., the resultant capacity would be given by

$$C = \frac{0.01 \times 0.02}{0.01 + 0.02} = \frac{0.0002}{0.03} = 0.0066 \text{ mfd.}$$

This shows how a tuning condenser connected in series with an aerial produces a reduction in the capacity, and so in the wave-length, of the aerial circuit.



A river wireless entertainment. Quite a number of boats whose occupants appear to be thoroughly enjoying the concert can be seen in the background.

How your Wire Rheostat spoils Tuning—How the LISSENSTAT Helps Tuning—MAKE THIS TEST

When your Detector Valve is functioning at the critical point of its characteristic curve, how can you expect to get fine detection with the ordinary wire rheostat?

MAKE THIS TEST.—Put LISSENSTAT in series with your old rheostat. Control your valve by each in turn. Hear the noise your old rheostat makes—now note the silent, stepless operation of the LISSENSTAT.

SAVING ITS OWN COST.

Apart from its efficiency, LISSENSTAT control actually lengthens the life of valves often from one-third to one-half, because with the LISSENSTAT it is impossible suddenly to throw a violent fluctuating current on to the delicate valve filament. Replace your existing rheostats with LISSENSTAT control—certainly LISSENSTATS should go into every new receiver. Length below panel under 2" diameter. LISSEN ONE-HOLE FIXING, OF COURSE! **7/6**



HOW WE BURNT OUT A FIXED CONDENSER.—A LISSEN dealer told us that one of his customers could not get a LISSEN reactance to work. We could not have that, of course, and asked for a circuit diagram and a few questions. The connections appeared to be in order. We made suggestions—still no result. Were the fixed condensers "leaky"? We were assured no. Nothing appeared to remain but for one of the LISSEN technical men to run over the set. The condensers were suspected because poor fixed condensers are a fruitful source of trouble. Sure enough, after the very first test, there remained nothing but smoke of one of the fixed condensers fitted! A LISSEN FIXED CONDENSER was put in, and the set then worked beautifully.

FIT LISSEN, AND MAKE SURE.



·0001 to ·0009	2/-
·001 to ·003	2/6
·004 to ·005	3/-

BEWARE OF CHEAP CONDENSERS

Condenser making is not merely the putting together of a few strips of mica and tinfoil. That is the haphazard way in which cheap fixed condensers are made. There are such things as the eliminating of variation of capacity under temperature changes, pressure, and so on. LISSEN FIXED CONDENSERS ARE WELL MADE—they never leak—they never vary—they are absolutely quiet—they do not hum. Good Fixed Condensers serve an important purpose. Fit LISSEN and make sure.

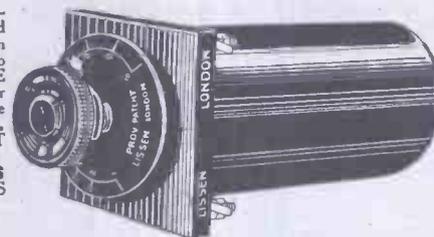
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The turns not in use on the LISSEN TUNER are shorted, and "dead-end" effects so successfully eliminated that the LISSEN TUNER will tune to any given wave-length as sharply as a plug-in coil wound for the identical test wave-length. Range 150 to 4,000 metres, with a ·0005 condenser (preferably use the LISSEN MICA VARIABLE CONDENSER, 17/6), yet the LISSEN TUNER

is so compact because of the unique LISSEN multi-winding that its length is only 4" and diameter 4". There is an 11-point switch already mounted and connected—no taps to solder—no switch to connect—panel or table mounting—engraved dial—LISSEN ONE-HOLE FIXING, OF COURSE!—it is a tuner you would like to use **22/6**
CAN ALSO BE USED AS A VERY HIGHLY EFFICIENT ANODE COIL.

SO SENSITIVE does the LISSEN REGENERATIVE-REACTANCE make a receiver that under many conditions both aerial and earth connections may be dispensed with. SO SELECTIVE can a receiver become that even 2 L O can be cut out from right close in. Range 150 to 4,000 metres—REGENERATION OVER THE WHOLE RANGE WITHOUT A BREAK. Tune with a Vernier (preferably the LISSEN VERNIER, designed for fine tuning in H.F. circuits, barely 1" diameter, price 12/6). Reaction is accurately proportioned—IT IS NOT OBTAINED WITH A SWINGING COIL. Price **£2 12 6**
LISSEN REGENERATIVE-REACTANCE PROVIDES AN UNEQUALLED FIRST STAGE H.F.

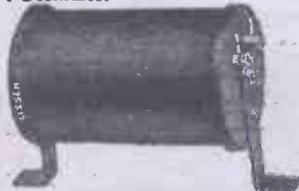


USE THIS LISSEN REACTANCE FOR 1st AND/OR 2nd STAGE H.F.

Where one stage of H.F. is desired, use either this LISSEN REACTANCE or the LISSEN REGENERATIVE-REACTANCE. Where two stages H.F. are desired, use the LISSEN REGENERATIVE-REACTANCE for the first stage and this LISSEN REACTANCE for the second stage, or for both stages as an efficient alternative. Either component can be first purchased and the other type purchased later and added in its appropriate position as recommended—

Range 150 to 600 metres ..	27/6
Range 150 to 10,000 metres ..	32/6

AUDIO-FREQUENCY. The low tones of a violin and the LISSEN T1 TRANSFORMER.



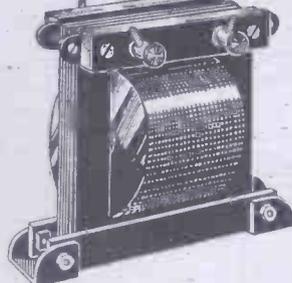
Elimination of distortion depends particularly upon the first low frequency transformer. The ratio, windings, and impedance of no other transformer is suitable for the first L.F. stage. Tests prove that it is better than any other to have the LISSEN Type T1 behind the detector valve. No blur or wooliness—reproduction is clear as crystal. That low vibrating music of a rare violin is worthy of a LISSEN Type T1 transformer immediately behind the detector valve. Price **30/-**

LOOK OUT for a new series of LISSENAGON (P. PATENT) AIR-SPACED plug-in coils—SEE THE AIR SPACE RIGHT THROUGH.

All good dealers stock LISSEN Parts—no need to take a substitute. If any difficulty, send direct to factory and goods will be immediately despatched, post free.

Dealers should please order a few days ahead—through Factor, or direct.

Another LISSEN TRANSFORMER with a purpose.

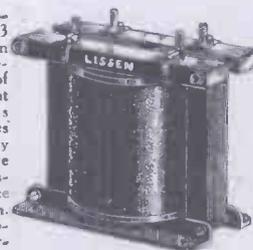


T2—perfect amplification—still in a background of silence. Price **25/-**

This transformer will further step up the pure volume of sound that has come through the LISSEN Type T1. The transformer for the 2nd and 3rd stages L.F. may have a higher ratio and less impedance than is required of the first stage transformer. This is the reason for LISSEN Type T2—really an excellent transformer .. Price 16/6.

The Popular LISSEN TYPE T3

This is the LISSEN Type T3 described in "Amateur Wireless" as one of the best light transformers made. Amplifies equal to many other much more expensive transformers. No trace of distortion. Carries the LISSEN name guarantee, and is really an excellent transformer .. Price 16/6.



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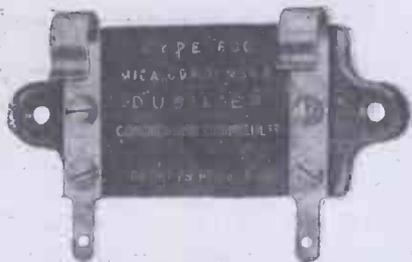
give wonderful results because our '006 mf. condensers are supplied in sets of 3, of exactly equal value.

Experimenters should make up this powerful, inexpensive and easily worked circuit with this Dubilier set of 3 fixed condensers as they ensure the very best possible results being obtained.

PRICE **9/-** PER SET OF 3

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Try the NEW "DAYZITE" Regd. The Super Marvel Crystal with Silver Detector Point, 2/6 each, or mounted in Brass Cup, 2/10, postage 3d. extra.

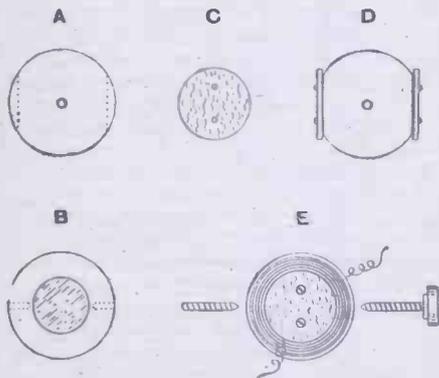
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A CHEAP BALL ROTOR.

By O. J. RANKIN.

AN ordinary wooden ball, about 2½ in. in diameter, is provided with two flat faces, as shown at A and B, and at right angles to these, in a direct line with the true diameter of the ball, a 2 B.A. tapping hole is drilled at each side to a depth of about ¾ in. Two wooden discs C, each large enough in diameter to overlap



the edges of the flat faces, are drilled as shown, and secured one to each side as indicated at D. The completed rotor former is now wound with No. 24 D.C.C. wire, winding each side in the "uphill" direction, and joining the two ends at the top.

Direction of Windings.

Commencing from each flange, one side will be wound in a clockwise direction, and the other in an anti-clockwise direction, so that the whole winding when joined is in one direction. This is often very confusing, but it should be remembered that the winding is commenced at each end to meet in the centre.

The spindles, which are cut from a length of 2 B.A. screwed brass rod are now screwed firmly into the holes, and the rotor is assembled inside the primary coil in the usual way. The general arrangement of the rotor will be clearly understood by referring to the diagrams D and E.

"FOOL-PROOF" CONNECTIONS.

HAVING had a deal of trouble with loose wires, brass slips, etc., hanging around when I am using two or more units, I decided to think out some better method

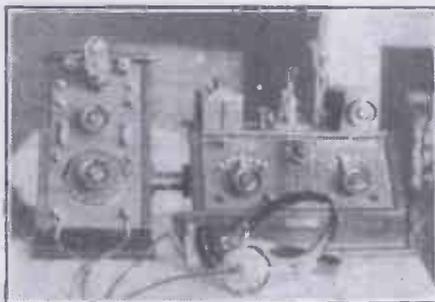
of fixing my unit system together. The illustration is in itself almost explanatory; the actual set shown is a crystal with a dual amplification circuit connected as a separate unit. This unit was dealt with by T. McL. Galloway, in Vol. III, No. 48, of POPULAR WIRELESS.

As in about 75 per cent of unit systems four connections are necessary between the two panels, these four connections are made by screwing two flanged valve holders to the sides of the cabinets. This is best done by boring a one-inch hole in about the centre of the sides, and then screwing the flanged valve holder over it, making sure that the inside prongs miss the wood, otherwise you are liable to have a slight leakage. Next solder the connections to the inside prongs. In the case of the crystal set shown a lead was taken from the aerial terminal to the top prong, one from the earth to the bottom, and the two telephone terminals were connected to the filament prongs of the valve holder.

Numerous Combinations Possible.

I next obtained five inches of ½ in. brass rod. This I saved into four and split the ends to within ¼ in. of the centre. These I use to connect up the two valve holders. As will be seen, it takes but a few seconds to connect up the two units; and, perhaps even more important than that, is the fact that wrong connections are impossible.

In cases of a smaller or greater number of connections, numerous combinations may be made. For instance, in a low-frequency crystal set which has two connections, two coil holders could be used.

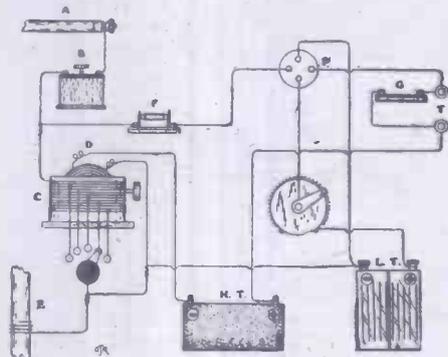


Note the plug connecting the two units.

Should any of my readers not be the proud owners of a unit system, I would draw their attention to another use to which this system of connecting lends itself—that is, high- and low-tension battery supply. Build a box large enough to take the two batteries, and allow it to be connected up to the main set as already described, and I can assure you that you will never again come home from business to find that your friends have burned out your valve—for they couldn't, even though they tried.

SIMPLE SINGLE CIRCUIT REGENERATIVE RECEIVER.

ALTHOUGH this circuit must not be used for the reception of the broadcast programmes it will, no doubt, interest those "long-distance merchants" with experimental licences who have not yet tried it out. The desired regenerative or feed back effect is accomplished by the



reaction coil, which in this case is the secondary coil or rotor, D, of the vario-coupler. A .001 mfd. variable condenser (57 plates) B, is connected in series with the primary or stator coil C, and it is sometimes advisable to connect another of .0002 mfd. capacity across the rotor. F is the grid leak and condenser, the condenser having a capacity of .00025 mfd., and the leak being preferably variable from ½ to 2 megohms.

The Tuning Adjustments.

The telephone condenser G should have a capacity of .001 mfd., and the voltage of the L.T. and H.T. batteries will, of course, depend on the particular type of valve used. There is ample scope here for experiments with different types of valves. The coupling of the vario-coupler is tight when the rotor is parallel with the stator, and the receiver should oscillate when the coils are in this position. A continual rushing noise in the headphones will indicate this, and if this is not evident the connections of the rotor should be reversed.

The rotor should be adjusted to a point just short of oscillation, and the stator coil tuned in by means of the multiple switch, final adjustments being made by manipulating the variable condenser and rotor. There are, of course, definite combinations of inductance and capacity, so that an adjustment of the coil will necessitate a corresponding adjustment of the condenser.

The dimensions of the band of wave-lengths it is desired to cover.

THE B.B.C.'s "C.O."

The following interesting details concerning Mr. J. C. W. Reith, the general manager of the Broadcasting Company, will interest many readers, and will help to make the pessimists realise that a real "live wire" has the handling of the much-criticised B.B.C.

ON his father's side Mr. Reith is Scotch, on his mother's English, and as he has lived and laboured on both sides of the Tweed he is conversant with the needs and aspirations of Scotch and English alike, and has a sympathetic understanding of the characteristics of both nations, not to speak of his American ideas.

The business capacities of the Scotch are often enough quoted in England, and in Mr. Reith we have an excellent example of inherited Scotch ability for organisation.



Mr. J. C. W. Reith.

His grandfather, Mr. George Reith, was in charge of the construction of the first railway which went into Aberdeen. He was at one time general manager of the Canadian Grand Trunk Railway, but was perhaps better known as the general manager of the Clyde Navigation Trust in Glasgow, where he played a most important part in laying deep and strong the foundations of the magnificent enterprise conducted by the Clyde trustees to-day.

Mr. J. C. W. Reith, the subject of our sketch, is the youngest son of the Rev. Dr. George Reith. He was educated at the Glasgow Academy and at Gresham's School in Norfolk, and at the Royal Technical College, Glasgow. Before the war, he gained experience of practical engineering in Glasgow and London, but on the outbreak of war he joined up immediately and threw in his lot with the Royal Engineers. For a year he was at the Front, but was severely wounded at the battle of Loos, and thereafter served under the Government in various important undertakings until the end of the war.

He was sent to America early in 1916 to take charge of several American munition contracts. This was a very difficult and delicate undertaking, as may readily be supposed, but Mr. Reith fulfilled his responsibilities with every satisfaction. Some conception of the extent of the operations may be obtained from the fact that Mr. Reith required 600 assistants for the efficient discharge of the duties entrusted to him.

The "Mystery Towers."

Whilst in America, Mr. Reith (who, by the way, is a very good speaker) did some excellent work by making speeches on behalf of the Allies. In this particular enterprise he was associated with Major John Hay Beith, better known as "Ian Hay." Ian Hay was a Captain at that time, and later, in October, 1917, an American correspondent in the London "Times" remarked that Captain Reith and Captain

Beith had caught the "public ear," and had helped considerably to mould American pro-Ally sentiments.

On returning from America, Mr. Reith was engaged on very urgent constructional work in aerodromes and coast defences, until the Royal Engineers "loaned" him to the Admiralty, under the auspices of which he was associated with the famous Argentine railway engineer, Mr. W. L. Lowe Brown, in connection with the construction of the famous "mystery towers" at Shoreham. Mr. Reith had charge of all the outside work, with some 2,500 men under him.

This was a work of some magnitude and complexity. Every conceivable branch of engineering was involved in the construction of the towers, which were built of an entirely new type of reinforced concrete. It will be remembered that these towers excited a good deal of public interest and curiosity, but that the utmost secrecy was preserved at the time as to their ultimate object and destination.

After the Armistice Mr. Reith (who was by this time a Major, though he dropped the title on the cessation of hostilities) was put in charge of the liquidation of fifteen hundred armament and engineering contracts, involving about £15,000,000.

Important Qualities.

This task was exceptionally difficult as a rapid transition had to be made from war to peace time requirements. As much money as possible had to be saved, and yet the military equipment had to be brought up to date. It will be realised that considerable loss threatened the Government; but Mr. Reith managed the business successfully, and particularly so with regard to modern 18-pounder equipment as he secured from the contractors, for the same money, many more of those formidable weapons than had been promised.

After this, Mr. Reith was associated with Messrs. William Beardmore & Co., Ltd., where he undertook the task of converting a war-time factory into an ordinary business enterprise, no mean accomplishment. He was general manager of their Coatbridge factory, and was especially responsible for the institution of systems of planning, progress, costings, and stores accounting.

It will be seen from the foregoing rough outline of Mr. Reith's activities that the general manager of the B.B.C. has outstanding capacities for organisation, and the qualities so necessary in "big" business, personality, powers of concentration, and ability to see his work from all angles.

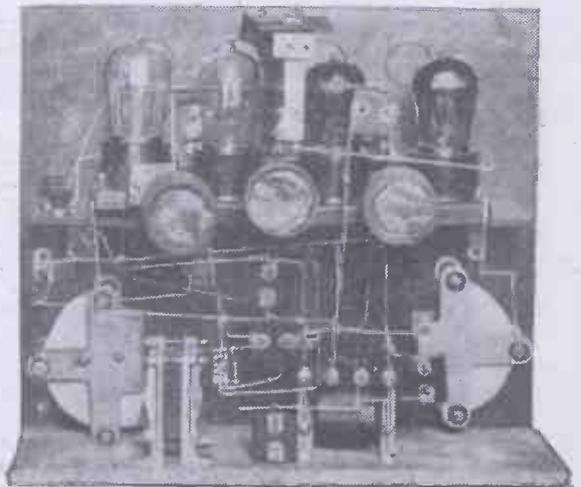
He is possessed of a restless energy. Those who put Mr. Reith in authority over thou-

sands of men, and in command over big sums of money, knew that in him they had a leader whose personality called for obedience and devotion from those under him, and whose determination would not let him rest until he had satisfactorily performed whatever was in hand.

Future of Broadcasting.

Realising this, we can well understand that so long as Mr. Reith is general manager of the B.B.C. he will not allow the broadcasting service to degenerate into a mere series of entertainments. He looks upon broadcasting as one of the greatest inventions since the discovery of steam, and he will use all his influence and devote all his energies to see that it develops along lines which are calculated to advance the welfare of the nation. Mr. Reith's cool judgment, assisted by Mr. Percy Pitt as musical controller, Captain P. P. Eckersley as chief engineer, and Mr. Arthur Burrows as the director of programmes, will place the broadcasting service of England on a very high level. We may expect it to become one of the greatest educational factors in the land. Mr. Reith is particularly anxious that it should be introduced in the schools, and he is following with keen interest the experiments which are being made in transmitting Shakespeare. He has been able elsewhere to get the right kind of men on the right kind of work, and there will be associated with him in the B.B.C. those accustomed to study public taste in all matters which broadcasting will touch, and able to supply it. He is specially anxious that, by broadcasting, the rural community will be brought into touch with the best that the city has to offer.

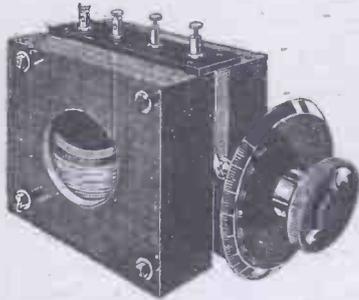
In a word, he is anxious to show that broadcasting is not merely an ingenious toy ministering lightly to the idle moments of life, but an important innovation with vast potential possibilities, and one of the greatest of all social services.



This four-valve set employs two reflex circuits, and enormous amplifying properties are claimed by this means.

10% Bonus During August

During the month of August we are arranging to give a Bonus of extra goods to the value of 10% on all orders (mail and counter) for Radio Components. For instance, if your order comes to £5.0.0 you can select components to the value of 10/- quite free of charge. Buy now while prices are low and build your Set later. Prices are sure to go up in the Autumn when everyone takes up Wireless again. Postage extra, but paid on all orders of £2 and over.



"Variobloc" Variometer

An internally wound variometer of high efficiency conforming to latest American practice. Permanent contacts. Can be instantly converted into Variocoupler.

- No. 1. Wave-length range 250-720 metres ...
- No. 2. Wave-length range 250-840 metres ... **17/6**

- Aerial Wire, 7/22, per 100 ft., 2/6; 7/25, per 100 ft., 2/9.
- Insulators, Large Shell, 10d.; small ditto, 3d.; Reel, 1½d.; Egg, 3d.; Barrel, 7d.
- Aluminium Pulleys, Large, 1/9; Small, 1/4.
- Condenser Dials, excellent quality, bevelled; Engraved 0°—100°, 1/6; 0°—180°, 2/.
- Crystal Detector, Ball-jointed, well-made, 2/-. Glass-covered, on ebonite base, 4/6. As above, for Panel-mounting, 2/.
- Contact Studs, ½ in. x ½ in., with nuts, per doz., 4½d.
- Contact Stops, ½ in. x ½ in., with nuts, per doz., 7d.
- Coil mounting Plugs, with strap, real ebonite, 1/.
- Coil Holders. For Single Coils, on ebonite stand, with terminals, 1/10. For Panel use, 1/2. For two Coils, a superior holder, in polished ebonite, with extension handles, 7/6. For three Coils, as above, 12/6.
- Filament Resistances, our own manufacture, 2/3 and 3/.
- Simplex Lead-in. No holes in window frames. 1/6.
- Panel Windows. Real opal windows for viewing filament behind panel. Each 9d.
- Insulated Sleeving, superior quality, per yard, 5d.
- Tinned Copper Wire, for wiring your set; 12 yards, 6d.
- Resistance Units, spiral wound for rheostats; 3 ohms. 5d.; 5 ohms, 6d.
- Ebonite Knobs, drilled and tapped, 5d., 3½d., and 2½d.
- Brass Rod, screwed, 12-in. lengths; 4 B.A., 4d.; 3 B.A., 3½d.; 4 B.A., 3d.
- Switch Arms, best quality, laminated, with nuts, spring and bush, ebonite knob, 1/9; also at 1/3 and 10½d.
- Telephone Terminals, per doz., 2/6; complete with nuts.
- Valve Sockets, per doz., 9d.; complete with nuts.
- Fixed Condensers, guaranteed to 5 p.c. accuracy. Our own make throughout. In ebonite cases. .0002, .0003, or .0005, 1/3; .001, .002, .003, or .004, 1/6.
- Concert Coils The well-known Peto-Scott plug-in Coils:
 - No. 1. 290—390 metres, 2/.
 - No. 2. 340—470 metres, 2/6.
 - No. 3. 420—650 metres, 3/.
 - No. 4. 570—900 metres, 3/6.
 - No. 5. 780—1,140 metres, 4/.
- L.F. Transformers. The well-proved MAX-AMP now reduced to 18/6. A better Transformer has never been made.

Peto-Scott Co., Ltd.

Head Office: 64, HIGH HOLBORN, W.C.1.
 Demonstration Lounge: 99, HIGH HOLBORN, W.C.1.
 Branch: 3, WELLINGTON ST., STRAND, LONDON, W.C.2.

Astounding Offer

TWO-VALVE SET with reaction for £3. Complete set of parts for above, consisting of ebonite panel, drilled, tapped and engraved, two coils with seven tappings each, two variable condensers, 18 contact studs, two switch arms, filament rheostat, with necessary terminals and dials. Full instructions for assembling and working. Similar set ready for reception, £6. Crystal set from 8/- Also three- and four-valve sets at prices similar to above. Other bargains: Filament resistance, 2/-; Aerial wire, black enamelled, 100 feet, copper, 3/-; Crystal detector, with ball joint, splendid quality, 2/-

Tapped coils on ebonite formers for broadcast band, 1/- To 3000 metres, 3/- L.F. Transformers, best quality only, 15/- Tapped H.F. Transformer, 200 to 4000 metres, limited number, list price 25/-, our price 15/- Assorted parcel Brass screws and nuts, tapped B.A. threads, 2/-

State your requirements. We can supply. Cash with order. Please include postage.

EMPRESS RADIO Co.,
 56, Furzhill Rd., Mutley, PLYMOUTH.



Your Own Pleasure at Your Own Price

The Neatest little set imaginable, and yet it does all the work of a large expensive crystal set.

Easily mounted and connected up, it will pick up all signals including broadcasting to perfection within a range of 15 miles.

In your home, scoutroom, schoolroom or garden, you have a real set, not a toy, at the very low price of

12/6

complete with headphone, coils, crystal and wiring diagram.

FELLOWS MAGNETO Co., Ltd., LONDON, N.W.10.

Telephone: WILLESDEN 1560-1. Telegrams: "QUIXMAG." PHONE, LONDON.



For they are jolly good Fellows

WIRELESS! WIRELESS! WIRELESS! and EVERYTHING for it.

DON'T PAY MORE! Great Britain's largest exclusive Wireless Stores.

NOTE. We are exclusively **WIRELESS** — NOT DABLERS!
Pioneers of Cheap Prices.

Quality, Quantity and Consistency our Motto.

See our six window display of popular bargains.

SPECIAL OFFER
BRUNET (Genuine). 4,000 ohms, Our Price **13/3** **ERICSSON** (Genuine French Phones, maker's name embossed), 4,000 ohms. Each pair tested and Our Price **16/9** guaranteed. Don't pay 32/-.

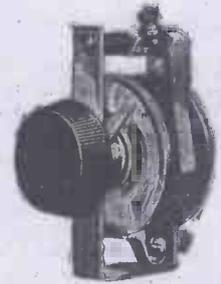
N. & K. PHONES, the Genuine Article	12/9	NUTS, 2 B.A.	per doz.	2½d.	SLIDER ROD, brass, 13 ins. long, ½ in. square, drilled	each	3½d.
SIDPE HEADPHONES, 4,000 ohms, genuine, our price	12/9	NUTS, 4, 5, 6 & 8 B.A.	per doz.	2d.	SLIDER KNOB	each	2d.
THOMSON-HOUSTON HEADPHONES (FRENCH), 4,000 ohms, our price	15/3	WASHERS, 4 B.A.	per doz.	1d.	SWITCHES ON EBONITE, S.P.S.T. (quality the best)	each	1/6
BROWN'S FEATHER-WEIGHT HEADPHONES, 4,000 ohms, our price	26/6	WASHERS, 2 B.A.	per doz.	1½d.	SWITCHES ON EBONITE, S.P.D.T. (quality the best)	each	1/11
MARCONI R VALVES	11/10	FILAMENT RESISTANCES, smooth action, marvellous value	per doz.	1/10	SWITCHES ON EBONITE, D.P.D.T. (quality the best)	each	2/9
MULLARD "ORA" VALVES	12/9	With engraved dials	per doz.	2/9	CONDENSER SPINDLES, all sizes in stock, from	each	1½d.
DUTCH VALVES	8/3	CONTACT STUDS, with nuts and washers	per doz.	4d.	SCREWED ROD, 2 B.A., 12 ins. long	each	3d.
EDISWAN VALVES	12/3	STOPS, with nuts	per doz.	6d.	SCREWED ROD, 4 B.A., 12 ins. long	each	2½d.
(All Guaranteed New.)		TERMINALS, with nut and washers, each	1d., 1½d., and 2d.		RUBBER-INSULATED LEADING-IN WIRE	per yard	1½d.
L.F. TRANSFORMERS, Ratio 5 to 1. All guaranteed (postage 1/-)	11/3	EBONITE KNOBS, 2 B.A., each	1½d., 3d., & 4d.		INSULATORS, white reel, 2 in., each	1d.	11d.
CRYSTAL DETECTORS	1/9, 1/3, and 10½d.	SPACING WASHERS, large	per doz.	2½d.	INSULATORS, white egg, each	2d.	1/8
" enclosed in glass case	2/6, 2/3, 1/6	SPACING WASHERS, small	per doz.	1½d.	WOUND INDUCTION COILS (postage 9d.)	12 x 4 2/5 9 x 4 2/3 8 x 2½ 1/11 6 x 3 1/8 6 x 2 1/5	2/6
SWITCH ARMS, 4 laminations, ebonite knob, complete with panel, bush, nuts, and spring washer	8½d.	CRYSTAL CUPS, 2 screw	each	1d.	TAPPED INDUCTANCE COILS, 20 taps, wound to 1,600 metres	each	2/6
AERIAL WIRE, 7/22, guaranteed hard-drawn copper, 100 ft. (postage 1/-)	1/10 ½	CRYSTAL CUPS, 4 screw	each	2d.	VARIOMETERS (Tube type), complete with knob	3/11 and 2/11	11½d.
CONDENSER VANES, fixed or moving, per doz.	3½d.	FIXED CONDENSERS, all capacities	each	10½d.	DOUBLE PHONE CORDS, full length	11½d.	9½d.
REAL GOLD CAT'S WHISKERS	each 2d.	EBONITE, cut to any size by machinery while you wait	per lb.	3/6	HERTZITE, Genuine Large Piece	9½d.	9½d.
SILVER CAT'S WHISKERS	each 1d.	TELEPHONE TERMINALS, nuts and washer, each	1½d.	1/3	TALITE, " " "	9½d.	9d.
CONDENSER SCALES, 0 to 180	each 3½d.	W.O. TERMINALS, nuts and washer, each	2d.	1/7	PERMANITE, " " "	9½d.	9d.
IVORINE LABEL SET, 12 different titles the set	6½d.	PANEL BUSHES, drilled	per doz.	1½d.	ZINCITE, " " "	9d.	6d.
BATTERIES, 4½ volts, each 3d.; per doz.	2/9	TOP CONDENSER, bushes	each 1d.	1/3	BORNITE, " " "	6d.	5½d.
BASKET COILS, set of 6, up to 3,000 metres	2/3	BOTTOM CONDENSER, bushes	each 1d.	1d.	MIXED CRYSTALS (6 kinds)	9d.	5½d.
SLEEVEING, 3 yds. assorted colours, for	11½d.	BELL WIRE, tinned copper, 12 yds.	each 7d.	6d.	CARBORUNDUM	5½d.	1/-
		VALVE LEGS, nut and washer	each 1d.	10d.	ZINCITE and BORNITE, both in box	1/-	
		VALVE PINS, nut and washer	each 1d.	9d.			
		PLUNGER SPRINGS, complete	each 1d.	1d.			

IMPORTANT NOTICE. We have repeatedly said **DON'T PAY MORE**, and having served the masses well, the large return of business has made it necessary for us to acquire extensive additional premises adjoining our present address. Follow the Crowd to Elkay Corner

"ELKAY" WIRELESS CO., 225 & 227, Bishopsgate, London, E.C.2.

Open Saturday all day. To the Trade—New Trade Counter now open. Send for **NEW LIST**.
We open **Sundays 11 to 2.30.** Note new Telephone No.: **Central 8544.**
Please remit ample Postage.

BATTERY POTENTIOMETERS



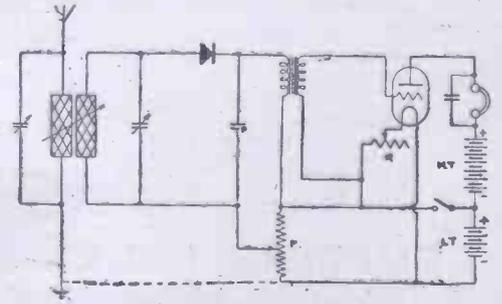
IGRANIC POTENTIOMETER
(Pat. Applied for)

Resistance 300 ohms. Adjustable Contacts.
An Ideal Instrument for the discriminating Radio Enthusiast.

Diagram shows Potentiometer (P) connected across the L.T. Battery in order to supply that definite positive potential necessary for the best operation of the crystal, while an Igranic Rheostat (R) keeps the filament of the amplifying valve at the best temperature for efficient operation.

Write for Leaflet No. Z 83.

IGRANIC 149, Queen Victoria St., LONDON.
ELECTRIC Co. Ltd Works: BEDFORD.



"STAND BY."

Fading—Fares, Please—On the Cricket Field—O Henry!—Single Silk Covered—A "Sound" Notion—The Three Listenetteers.

Fading.

AMATEURS are invited by the Radio Research Board to assist in an investigation into the cause of "fading." Old soldiers are especially requested to give the Research Board the benefit of their experience in this matter. If you can't see the point of this, query a past light of the army.

Fares, Please.

New York tram-drivers now possess receiving sets to enable them to keep in touch with headquarters.

There is nothing wonderful in this. For many years English tram-conductors have possessed receiving sets to enable them to keep in touch with their passengers. A single note from the Bell apparatus of an English tram-conductor induces a current coin of the realm from the pocket of every passenger in the cars.

On the Cricket Field.

The captain of our local cricket side is a wireless enthusiast, and his remarks occasionally require translation to the non-wireless members of the eleven.

Last week our fast bowler had had four long hops hit to the boundary in his last two overs. Our worthy captain approached him, with the remark, "Don't you think you had better try him on a different wave-length, George?"

O Henry!

What will happen when Mr. Henry "Tin Lizzie" Ford gets well into this wireless business only the future will show. It is a startling idea to set up the most wonderful transmitting station in the world in order to win the presidency of the U.S.A.

"Say, Henry," we can imagine someone on the other side of the herring pond saying, "that li'l ether tickler of yours don't want no bunch of letters for a shout-up. You jest gotta hitch on one of your automobile hooters for a call sign. Jest you give 'em perp-perp, and they'll sure know it's Henry Ford on the ether!"

Single Silk Covered.

Thunder and Lightning.—Enter Caesar in his nightgown.

Caesar.—"Nor heaven nor earth have been at peace to-night."

JULIUS CAESAR.

Another incident during the recent severe thunderstorm. My friend Toppin got the wind up pretty badly over possible danger from his aerial. When the storm was at its worst, he sallied forth in his night attire, walked the length of his garden, and let down the end of his aerial attached to the

mast. Carefully he spread out the length of wire along the grass, and even buried the free end with its insulators in the soil of a flower-bed. All this he accomplished by the light of the continuous flashes of lightning.

After he had related the story of his heroic deed to me, I had not the heart to tell him that an aerial connected to earth was as good a lightning protector as one could wish for. I did, however, ask him if he did not think it was more dangerous outside than in on the occasion of such a storm.

"I thought of that," he replied. "But you see, I was in my pyjamas, and silk is a jolly good insulator, you know!"

A "Sound" Notion.

The other day I paid one of my frequent

apparatus presumably being borrowed from the stock above. After taking a little off the 'air, he takes a little off the aerial, so to speak. It is a sound notion.

Instead of reading shop-soiled and ancient numbers of the funny papers, or a copy of the morning paper with the sporting page well thumbed and reeking of divers hair lotions, those who are unfortunate enough to have to wait their turn, now don a pair of 'phones and listen to what comes off the barber's pole and aerial.

The Three Listenetteers.

On this last visit of mine to d'Artagnan, Dishel's barber, I had a hair cut, and while the operation was in progress, three of Dishel's young assistants were using the 'phones, one having a complete pair, and the other sharing a pair between them. Just before we reached the what-will-you-have-on-it-this-time-sir stage, I demanded a shampoo of the dry variety. D'Artagnan reached down his revolving brush, switched on the juice and began to go up and down my head with the revolving brush in the manner of a jobbing gardener with a lawn-mower, and all the day before him.

In the mirror to my left I could see the three listenetteers. On each face there gradually came that look of surprise which is associated with the victim's failure to see the joke played off on him. Following this look of pained surprise, there were a series of parallel face contortions. Then Porthos of the double earpieces put down his 'phones and remarked that it was a bit hot. Athos and Aramis then put down their pair of 'phones.

D'Artagnan looked up from his work of running up and down my head, and raised an eyebrow inquiringly.

"Accumulator konked out?" he asked.

"Don't think so," replied Porthos. "It sounded to me as if the motor-fire-engine has just gone by doing a bit extra back-firing."

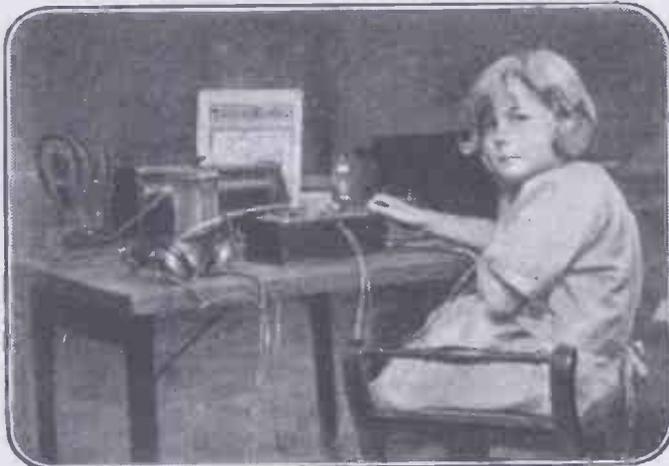
The three listenetteers departed thoughtfully up the stairs.

My good d'Artagnan switched off his brush, and proceeded to pour oil on the troubled hair. I asked him if he knew what had made the three listenetteers put down the 'phones and depart so mysteriously; but he had no idea at all.

After handing over the customary tip, I gave him a tip of a wireless nature.

"When your best customer or old man Dishel happens to be listening-in down here, don't switch on the electric brush, or there might be trouble. Think it over, and you'll get my meaning."

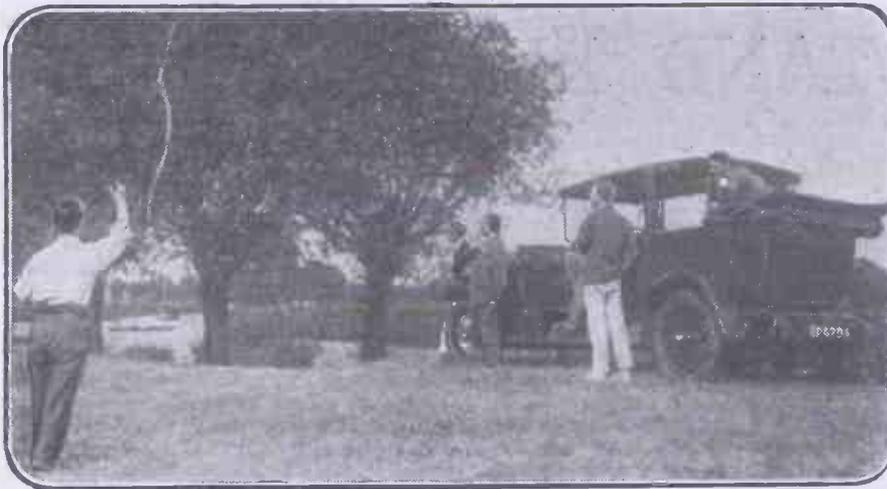
"KNOB TURNER."



Miss Peggy Bartlett, of 70, Kirkstall Road, Streatham Hill, S.W.2, listening in on a receiver built in accordance with instructions given in "Popular Wireless."

visits to Dishel's, the wonder shop in the small town a mile away. Truly Dishel's is a phenomenal establishment. Should you desire a Kodak, an expensive bottle of scent, a scarf-pin, or a valve-pin, you call on Dishel. Should you wish to hear the latest gramophone record, the new Marconiphone or a humming top, Dishel will oblige. Should the lady of the house commission you to purchase a manicure set, or your neighbour ask you to bring a bag of dog biscuits back in the car with you, there is only Dishel's for it. Should you require a dry battery or a wet shampoo, nerve tonic, or rat poison, Wood's metal or Stone's ginger ale, you drop in at the shop fixed so invitingly at the most important corner in the town.

On top of, or more correctly below, all the business done on the ground floor, and the mysterious regions at the back thereof, Dishel runs an underground barber's shop. The young man who wields the razor, the scissors, and the "have a little on the hair this time, sir!" has recently installed a valve set in his underground parlour, the



Hoisting the aerial by throwing the line with a bottle attached into a tree.

HAD Shakespeare been alive to-day there is little doubt but that he would have been as keenly interested as any modern in the fascination of wireless, and the quotability of his lines would have been possible of extension to radio and broadcasting.

And just as much as wireless has had need of Shakespeare's work in touching the imagination of the world, so would Shakespeare have had need of wireless had the times coincided. But, to get down to facts, it is interesting to attempt to describe what can be justly called a link-up of wireless and Shakespeare, and if not a demonstration to the Great Bard himself of the wonders and charms of wireless, a demonstration to Shakespeare land of all that wireless means.

Summer wireless is still too much the novelty idea in this country to be found in all places. It may be popular upon the Thames, and in one or two other districts. Wireless may still be found as a means of jolly music parties on the lawn, but there are wonderful oases in this beautiful England of ours where, though by tradition

and appropriateness it can be rightly expected, in fact it cannot be found.

Stratford-on-Avon is the real centre of literary England. Every visitor to this country who is at all concerned with the written word lays his tribute at some time or another to the great dramatist amid the scenes of his native town, and because Stratford-on-Avon is one of nature's most perfect gems, in these months of summer it is a lure of the Midlands, and week in and week out it is the rendezvous of the makers of leisure and lovers of the open-air. But the same striking fact exists in these circumstances.

On Shakespeare's Doorstep.

THE first wireless listening party on the Avon has just taken place, and since it was more or less of an historic occasion, the programme of events included listening-in to 5 I T on the very doorstep of Shakespeare's house. In short, the occasion was nothing more or less than a wireless adventure taken for the purpose of proving to Shakespeare land that wireless was not a restricted joy for the indoor town lover.

WIRELESS IN SHAK

Motoring and punting are indeed delightful summer pastimes. A special receiving-set and receiver is available to supply music. In the following experiments conducted in the

IT is something that can be enjoyed anywhere and everywhere—in the motor-car travelling from the city to the country, on the road or at the roadside halt, or as easy of arrangement on the river.

Of late great progress has been made in the matter of applying wireless to the motor-car, and in this case a 30 h.p. Daimler (1923) landaulette de luxe had been fitted with a special Marconi receiving-set. But because the aerial was a plate concealed in the upholstery of the roof of the car the company of wireless adventurers—which included Midland Marconi men and a POPULAR WIRELESS correspondent—played in the eyes of the public who saw them in the part of wireless wizards, for as long as there was a broadcasting station within 60 miles, and provided that it was broadcasting, we listened-in.

Thus it was that we listened-in on the road from Birmingham to Stratford-on-Avon, listened-in as we were entering the town, as we were passing through its streets, even as we halted for a few moments outside Shakespeare's birth-place, and thus, doubtless, secured the honour of being the first Englishmen to listen-in to a wireless broadcast concert on Shakespeare's own doorstep.

The set was an 8-valve one, consisting of one detector and seven H.F. This, together with the accumulators and batteries, was carried—or rather hidden—in the partition between the driver's seat and the rear portion of the car.

It was connected up with a small control panel on the left side of the compartment and concealed in the upholstery. This panel included a filament lighting switch, adjustable tuner arm to four studs, tuning condenser, and below there were plug-in sockets for four telephones of 2,000 ohm's resistance. The headphones used were of the head-band type and the double lorgnette type.

The Improvised Aerial.

WIRELESS as a motoring joy was thus proven to Shakespeare land in no unmistakable way, and it created such a sense of the miraculous that when a halt was made the car was surrounded by an incredulous crowd who sought the solution of the mystery of the missing aerial, and had proof positive given them of the listening capabilities of a receiving-set fixed to a motor-car. This was one aspect of summer wireless.

The other was equally striking, and took place a little way up the Avon. Members of the party punted up while the car was driven across a field into the river bank.



2 L O comes in strongly from 100 miles.



The punt pole proves useful as an improvised aerial mast.

SHAKESPEARE LAND.

er pursuits, the more so when a wireless g article are recounted a series of interesting vicinity of the Avon.

A PIECE of string tied to a bottle and impelled by a potential champion javelin thrower was easily thrown over a high bough and an aerial wire quickly hauled into position, the lead-in end being carried over a punt-pole to the set. In this instance it was a Marconi two-valve receiver with a two stage amplifier, and two Amplion loud speakers were connected up. Within a few minutes of the arrival of the party on the spot Birmingham, some 23 miles distant, was picked up, and what was probably the first wireless broadcast concert on the Avon was in progress.

A River Attraction.

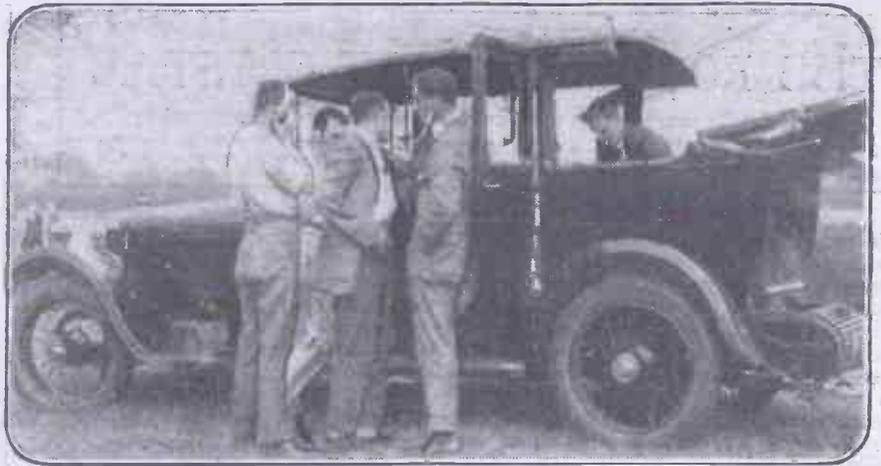
THE Avon, maybe, is like any other river retreat on a Saturday afternoon. On that particular day it possessed its long strings of punts and rowing boats and canoes, as well as its crowded river tugs. And the punting parties had realised the charms of music in the sylvan places, for many of them were provided with the ubiquitous gramophone, and as we lolled at our ease in the punts or on the river bank so the strains of the gramophones drew nearer.

But this newer miracle seemed in the ascendant. Its perfection of reception was strikingly ungramophone-like,

and as the elder brethren of wireless receivers closed down, so did the river receiving-set demonstrate its charms. And even as early as the first five minutes of the demonstration so did the traffic of the Avon at this spot slow down and punting parties draw into the banks and lend ear to 5 I T's melodies. Then the Birmingham Station closed down, and after tea we listened in again both to Birmingham and London and the other stations.

Two loud speakers were giving the river listeners-in the secrets of Birmingham's Children's Corner, and these river listeners-in numbered young and old of both sexes. It was at this stage that the 5 I T Uncle ventured the opinion that the youngsters did not find much interest in listening-in during the summer days—the open-air was by far more attractive. The parry to such ingenuousness is in a picture of the river kiddies listening-in. Keep the wireless set always indoors and it may be forgotten. But take the wireless set with you and it always has charms.

So the peaceful hours of summer eventide amid the unparalleled charms of the Avon sped by. We tuned in first Birmingham and then London, we heard song and dance music—even the Postmaster-General, who, however, had nothing to say about radio. The 2-valve set and the two Amplions were operating in the punt, and the opposite side of the river was lined by a series of crowded



The 30 h.p. Daimler fitted with a special Marconi receiving set.

punts who found in this innovation on the Avon a new delight in summertime. The notes of a particularly fine soprano song by a 5 I T soloist were to be heard. On the bank stood the car, and in it there were two or three listening-in, presumably also to Birmingham.

That was the obvious expectation, seeing that the range of the car set with its restricted aerial was only sixty miles. But there came to me a whispered rumour. "The unexpected has happened," it said. "The imp of wireless is in the car set. We've got London." I placed a pair of 'phones to my ears and caught the strains of 2 L O's dance band, and removing them with the rhythm of a waltz still in my ears I was able to catch the rich notes of the singer at 5 I T.

The Fascination of Wireless.

TO hear London or Birmingham, or Cardiff or Manchester at any time, despite the powers of wireless, still stirs wonder in us. To hear them when deep in the countryside, with as rich a glamour of romance and past renown at hand as Shakespeare land

possesses, is to be compelled to surrender oneself to the notion that this newest gift of science has made this age the very Age of Wonder.

There is something intensely fascinating in the receiving of wireless concerts out of doors in even less historical places. Could we see the connecting link between the broadcasting station and ourselves, there would be something tangible upon which to base our ideas. The very mystery of the fact that we can introduce music from afar into any verdant glade or sylvan retreat that we may desire, lends romance to what might otherwise tend to develop into a mere scientific curiosity. Our pleasures must essentially embrace mystery or excitement, it is the necessity of our age. Fifty years ago the wheels of daily life turned more slowly; to-day we always contemplate further advances in an astonishingly advanced science, but the phase of the greatest advance in wireless is with us now, in its inclusion in our daily life, as an element of social pleasure.



a distance of over



Tuning-in the receiver in a delightfully shaded retreat on the Avon.

THE ROCHELLE SALT CRYSTAL

Some details concerning a peculiar substance that lends itself to many interesting experiments.

IT is generally correct to say that the average beginner in wireless has heard most of the thermionic properties of crystals and their application to the rectification of oscillatory current. There is another important property of certain crystals that can be turned to good use by the experimenter for if some crystals are subjected to pressure a difference of potential is developed between certain parts of the crystals.

Large crystals of Rochelle salt are made by suspending small perfect crystals in a

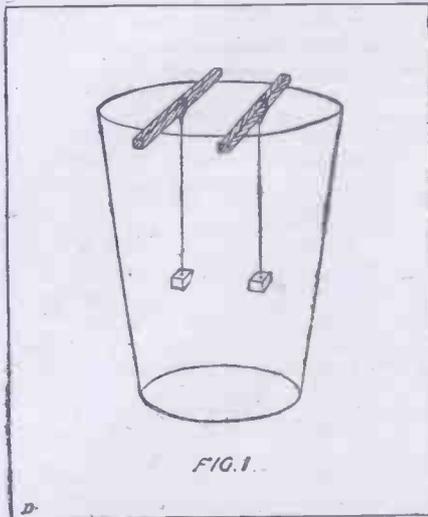


FIG. 1.

solution of the salt. Rochelle salt is potassium-sodium tartrate, and the crystals are cubic. A solution is made by dissolving the Rochelle salt in warm water.

This is best done by dissolving the

crushed salt in warm water until the water will take no more, then cooling it, and pouring more cold water to dissolve those small crystals that are precipitated during the cooling, at the same time adding about a tablespoonful more cold water than is necessary.

Novel Microphone.

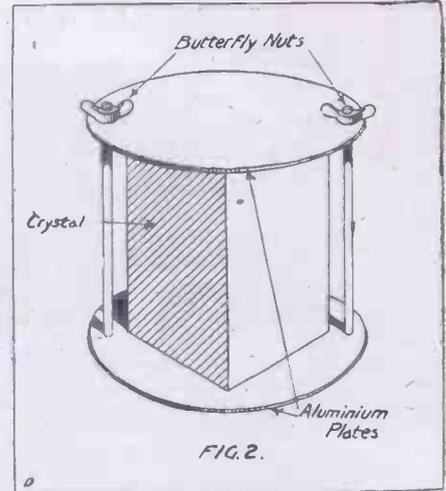
Several, small, cubic crystals of Rochelle salt are attached to threads with a slight touch of sealing wax, and suspended in the solution as in Fig. 1.

Put aside for a week or two. Now as the solution evaporates at ordinary temperatures, the crystals grow. When they are about $1\frac{1}{2}$ ins. cube they are ready for use.

The crystals are wiped and clamped between aluminium plates as in Fig. 2. The aluminium should be circular, and about $\frac{3}{8}$ in. thick. Then electrical connections are made as in Fig. 3, one wire being connected to the plates and the other bound tightly round the crystal.

Now if two of these are connected together in series, and the plate of one is used as the diaphragm of a microphone, that is, if we speak on to one of them, a difference of potential is set up between the crystal wire and plate wire, owing to the slight pressure variations produced by the sound vibrations. This causes a current to flow, which acts conversely on the other crystal, causing pressure variations of the plate and thus reproducing the sound. The critical pressure of the clamps is found easily by a little, patient experiment.

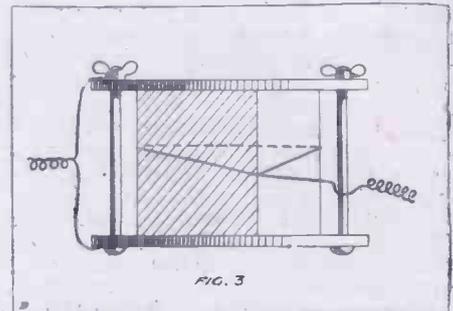
If an amplifying valve is placed in the circuit and the crystals placed close together, the slightest touch starts them "talking" and presently we hear them chattering loudly.



Further Experiments.

Now for some of its uses—one of these crystals can be used as a microphone. Another can be used as a telephone, if properly mounted so as to concentrate its vibrations on a small volume of air. One of them is as good as the agate cylinder for loud speakers, mentioned in POPULAR WIRELESS, No. 47, dispensing with the need for the electro-motor.

Moreover if a gramophone needle is placed in the face of one of the plates, the crystal can be used as a gramophone "sound-box" for reproducing the music electrically.



BROADCASTING AND THE IMAGINATION.

By **UNCLE JOHN**
(John Hope Fellows, A.M., Jun. I.E.,
G.I. Loco.E., Editor of "Locomotive News.")



Mr. J. H. Fellows.

Perhaps one's imagination is greatly enlarged as time goes on. Personally, I find it so to a very great extent.

At the beautiful studio at Savoy Hill, I

think it must be an impossible thing to those who regularly talk, say, to the children, not to conjure up the most vivid mind pictures of all the great number of kiddies listening with rapt attention at the "other end."

If one such broadcaster could only put his thoughts on paper, they would be, not merely interesting, but pen pictures of the most vivid kind.

Let me try to explain as far as possible what I mean by all this. In answering a little girl's letter thus!

"Hallo! Peggy of Maidenhead! I do hope you are having a nice party, and that you will soon be well again and able to run about in the sunshine once more."

This is a typical reply to a pathetically sweet letter from a little girl who has broken her leg.

Pictures in the Microphone.

If we let our imagination have full sway, we see instead of the scientific concoction—the microphone—we see the River Thames in all its glory at this time of the year—we see that delightful place on the river—Maidenhead—the boats, the punts, we hear the almost silent "swish, swish" of the

oars as they are gracefully handled by happy youth. Even can we imagine more. Yes, we can see the happy faces of the little party that Peggy's mother has arranged as a treat for her. All gathered round the poor little girl temporarily a cripple, all anxious to do all they can in their childish simple way.

Can you see then how the Uncles have come to love the ugly, cold and lifeless microphone that stands in the middle of the beautiful blue and gold studio.

I know that all the Uncles love to let their imagination run riot.

I do not want to be misunderstood. An artiste or lecturer coming to the studio just once, and for the first time, must find it a wee bit "uncanny." It is also doubtful whether they could imagine anything on that first occasion.

It is only when you are used to broadcasting that you can let your mind picture the faces at the other end, whether they be 5, 20, 50 or 200 miles away. And then you begin to have a very deep affection for that stolid old microphone, for indeed it is but the medium that enables you to "see" in your imagination the largest audience of all ages.

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Other special features include an article by Mr. H. G. Hersey on "How to Construct and Calibrate a Wavemeter"; Dr. N. W. McLachlan, M.I.E.E., contributes the second of two articles on the "Heterodyne"; Mr. W. G. W. Mitchell, B.Sc., F.R.A.S., writes on "Wireless Time Signalling," and Dr. E. E. Fournier d'Albe, describes the "Construction of Selenium Cells." Other articles by Mr. Rex Palmer (of 2 L O) on "Secrets of good Broadcasting"; Commander John Slee, C.B.E., M.I.E.E., on "Unidirectional Reception," and Mr. P. J. Risdon, F.R.S.A., on "From Nebula to Nebula," go to make up a number of more than especial interest.

In an early issue Sir Oliver Lodge, F.R.S., Scientific-Adviser-in-Chief to our Companion Journal, will contribute another popular article, and The Rt. Hon. Sir Alfred Mond, Bt., P.C., M.P. (formerly Minister of Health) will also contribute a special article of popular scientific interest.

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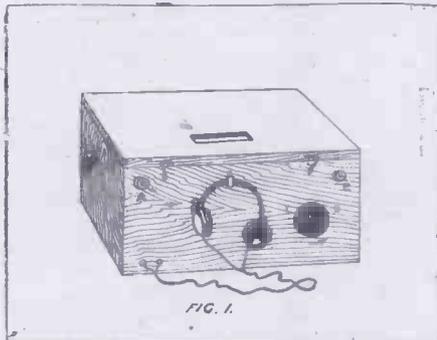
SIMPLICITY IN TUNING.

By B. J. KYNASTON.

This method can be applied to any straightforward circuit, only a few simple modifications being necessary in the case of additional H. or L.F. stages. Necessarily, one valve would not bring in all the B.B.C. stations, but the scheme is applicable to the tuner of any set.

THE wireless receivers of many experimenters appear extremely complicated to anyone who does not understand wireless; in fact, with most instruments, unless the experimenter is present his friends would have great difficulty in using his set for broadcast reception. The receiver described in this article was designed so that it could be used by anyone, whether they had any knowledge of wireless or not.

Fig. 1 shows the complete instrument, and it will be seen that there are only two controls, an aerial and earth terminal, an indicator and telephones. When the control knobs are turned in order to tune in a

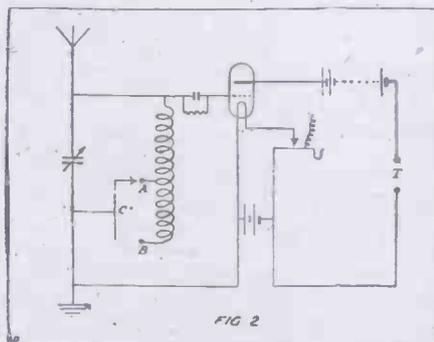


station, a wooden cylinder covered with white paper, referred to previously as the indicator, revolves behind a glass window in the top of the cabinet.

The A.T.I.

It is so arranged that when the correct tuning for the required station is obtained, the name of this station, which has previously been printed on the cylinder, is then opposite the window. Tuning is therefore extremely simple, as the person listening-in has only to watch the window and turn the knobs until the station's name appears.

It will be noticed from Fig. 1 and 2 that a hook is fitted to hang the 'phones on when not in use. This hook is fitted with a spring, so that when the telephones are removed the spring draws the hook up until it touches a metal contact which closes the filament circuit, therefore lighting the valve.



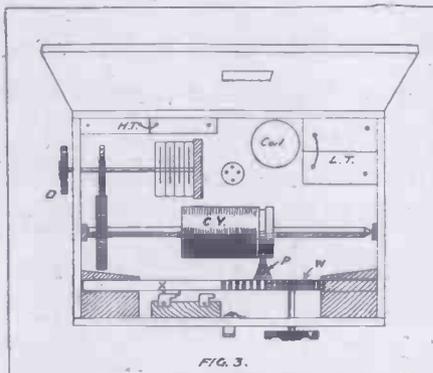
The aerial tuning inductance consists of a coil of No. 26 D.C.C. wire on a former 3 by 3. One end of this coil is connected to the aerial terminal; the other end, and the tapping taken from the centre, are connected to the two spring contacts A and B, and either of these connect with the earth terminal by means of the moving contact C. The .001 mfd. variable condenser for tuning the aerial circuit is connected between the aerial and earth terminals, and is controlled by the knob D.

The valve circuit in Fig. 2, apart from the tuner and telephone hook, requires no explanation, as it is a simple one-valve circuit using a grid condenser and leak for rectification. The box or cabinet which contains the receiver must be made fairly large, as it has to contain both high and low-tension batteries; the top of the cabinet must be made to open, as shown in Fig. 3, so that the batteries, valve, etc., are accessible. However, the actual arrangement of the interior of the cabinet will depend upon the space available.

Range Controls.

The cylinder shown as C Y. is made to slide upon a square wooden shaft. On one end of this shaft is fitted a wooden cog-wheel, which is turned by a similar cog-wheel connected to the condenser spindle, so that when the capacity of this condenser is varied the cylinder alters its position, rotating in an opposite direction to the condenser.

The wooden cylinder and cog-wheels can be easily made from three-ply wood with the aid of a fretsaw. The window in the top

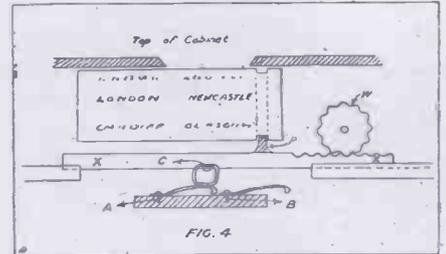


of the box must be made slightly smaller than half the length of the cylinder, so that when operating on range 1 the left-hand side of the cylinder is under the window, and on range 2 the other side.

It will be understood from this that it is necessary for the range switch to move the cylinder along its shaft from left to right, and vice-versa. The knob of the range switch is fitted to a wooden cog-wheel shown as W. This wheel, upon being turned, moves the wooden shaft X, and by means of the pin P moves the cylinder also.

It will be seen that the pin P fits into a circular slot round the end of the cylinder, and it is therefore able to move this cylinder in either direction. The fixed and moving contacts, A, B, and C, which have been previously mentioned, are controlled by the moving shaft X. (See diagram 4.)

In this drawing the range switch is on range 1, and the contact C is therefore



connected to the spring contact A, so that only half the aerial inductance is in circuit. These pieces, A, B, and C, should be cut from thin brass or other suitable metal, and arranged as shown in the diagram.

Simple to Manipulate.

In the circuits given, no filament resistance has been included, but this can be added if desired, although it is not essential. However, if a regulator is included, the control for it should be left inside the cabinet so that it may not confuse anyone who does not understand what it is for. As it is only necessary to alter the resistance upon the voltage of the filament battery dropping, it will not be used much, and therefore the control being inside will cause no inconvenience.

When the set is finished and working properly, the various broadcasting stations within range should be tuned in, and their names marked upon the cylinder opposite the window when the best adjustment is obtained. Once the stations have been marked on the cylinder no difficulty will be found in tuning in, as the place which shows the station's name is the correct tuning for that station.

Of course, in the majority of cases, anyway until the proposed new relay stations are erected, one valve will only bring in at most one station, but a similar device can be constructed so that H.F. stages can be applied.



The wireless aerial of the S.Y. Frontiersman being erected previous to that vessel leaving on a world tour.

MICROPHONE AMPLIFIERS.

By M.I.R.E.

An article of absorbing interest, more particularly to those amateurs desirous of increasing the signal strength reception of crystal sets without introducing valves.

IN the days before the introduction of the thermionic valve many experiments were made with microphonic amplifiers, both for wireless and land-line telephony. A considerable measure of success was obtained in constructing such amplifiers, and they were occasionally utilised.

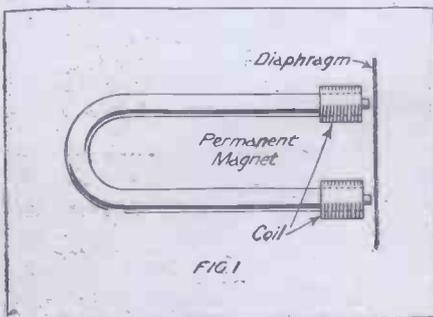
Many experimenters with crystal sets desire stronger signals, and, not being able to make use of valve amplifiers, either for financial reasons or from difficulties in obtaining the necessary charging facilities for accumulators, turn their attention to the microphonic type of amplifier.

It is not proposed in this article to give constructional details for such an amplifier, but to point out the essentials which must be observed, and to suggest methods which will overcome the difficulties that will be met with. Knowing these facts, the experimenter will be greatly helped in constructing an amplifier, the type of which depends to a great extent on the strength of the signals he wishes to amplify and the tools and constructional skill at his disposal.

Operation of Telephones.

Many experimenters have tried placing a microphone in contact with the diaphragm of the receiver, and, in consequence, have been disappointed that no results were obtained. If they had realised that a good modern receiver will produce an audible signal with a current of approximately one five-millionth part of an ampere, they would not have attempted to operate such an arrangement. It will therefore be understood that it is necessary to know more about the receiver than is common knowledge before proceeding.

Modern telephone receivers are modifications of, but still identical in principle with,

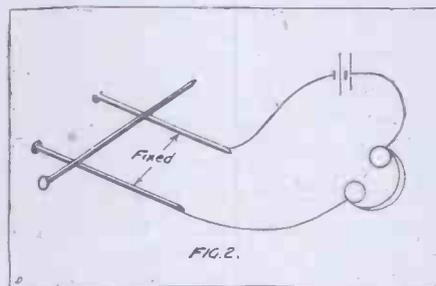


the original bell receiver, which consisted of a permanent horseshoe magnet with soft iron pole pieces, on which were wound the coils, fitted with a circular soft iron diaphragm adjacent to the pole pieces, as shown in Fig. 1.

Currents flowing through the coil alter the distribution of the lines of force from the permanent magnet, and consequently cause movements of the diaphragm, as a very delicate balance exists between the two

forces—the pull of the permanent magnets on the diaphragm, and the “fly back” tendency of the diaphragm which is tightly clamped round its edges.

In addition to the sounds caused by the movements of the diaphragm, sounds are also caused by the molecular movements of the diaphragm; that is, the expansion and contraction which results from changes in magnetisation, and also by molecular movements in the pole pieces themselves. These effects have been ex-



perimentally proved by the fact that speech has been transmitted with a receiver with a diaphragm 10 centimetres thick.

It will thus be seen that a telephone receiver is an extremely sensitive piece of apparatus, and that the movement of the diaphragm is extremely small with weak signals. The mechanical energy available is consequently very small, and if a transmitter or microphone is simply placed in contact with the diaphragm of a receiver operated by weak currents, all that happens is that the movement of the receiver diaphragm is stopped.

For fairly strong signals, such as would be received on a good crystal set with a good aerial within four or five miles of a broadcasting station, such an arrangement can be made to work. The receiver should be firmly clamped to a base board, the transmitter diaphragm fitted with a light pin soldered to it, the transmitter being held in a stiff frame with a fine screw controlled adjustment, so that the contact between the receiver diaphragm and the pin on the microphone can be adjusted.

Before the question of the amplification of weak signals by this method can be considered, the action of the microphone in normal working must be considered.

Variations of Resistance.

All transmitters used in telephony consist of a flexible diaphragm on which the sound waves impinge, this diaphragm having carbon granules in contact with it. A current is fed through the carbon granules to the diaphragm, and the current flowing is varied by the movement of the diaphragm owing to the fact that the resistance of the transmitter varies with this movement.

In ordinary transmitters there are two main causes of variation of resistance:—

- (1) The resistance decreases, due to an increase in area of contact, due to the compression of the granules by the inward movement of the diaphragm, and vice versa.
- (2) That carbon decreases in resistance with increase of pressure. This effect is very small in ordinary transmitters.

To give these effects it is apparent that comparatively large mechanical forces are required—forces much larger than those available in the receiver of a crystal set working on weak signals.

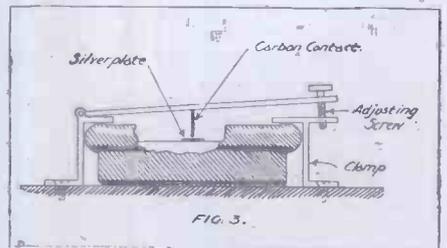
Microphone effects can also be obtained from loose contacts, such as were employed by Professor Hughes in his early experiments. Three iron nails, with one resting loosely on the other two, joined up in circuit, as shown in Fig. 2, with a battery and receiver, are quite capable of transmitting speech. The fundamental principle of their action lies in the fact that loose contacts vary in resistance when members are thrown into vibration.

Light Contacts Necessary.

If, therefore, we can combine the microphonic action due to loose contacts with that due to the variation of resistance of carbon owing to the alteration in contact area, we can considerably lighten all the moving parts in the amplifier.

For example, if a small carbon pencil, such as that contained in a lead pencil, be fixed so that it can be adjusted to make contact with greater or less pressure, as may be found necessary, with a thin silver plate soldered to the diaphragm of a receiver, as shown in Fig. 3, the requirements would be met. With contacts of this nature, sparking or arcing at the contact is liable to occur, with a consequence that the surface is spoilt—and possibly the adjustment thrown out.

There is a field for experimental work in determining the best material for such



a contact, and the best method of providing the necessary adjustment.

Another method of obtaining loose contact amplification might be effected by mounting a reed tuned to a frequency of, say, 1,500 per second adjacent to the poles of an electro-magnet fitted with a telephone winding (thus reproducing the permanent magnet and winding of an ordinary receiver), and providing a loose contact between

(Continued on page 872.)

SOLDERING FOR AMATEURS.

One of the most useful accomplishments that the wireless amateur can possess is a thorough knowledge of soldering. It is quite easy to acquire this if due attention is paid to one or two simple rules.

IN view of the emphasis laid by article writers on soldering all possible connections, a few remarks on the subject may be useful to those who have only a very hazy idea of soldering. I should like to say that these notes are the result of personal practice, and not copied from any book on the subject.

Amongst the many solders on the market are:

Plumber's.—1 part tin, 2 parts lead, melts at 440° Fahr.

Tinman's.—1 part tin, 1 part lead, melts at 370° Fahr.

Fine.—1½ parts tin, 1 part lead, melts at 335° Fahr.

Quick running.—1 part tin, 1 part lead, 2 parts bismuth, melts at 205° Fahr.

Wood's metal can also be used as quick running solder.

Fluxes also are equally varied.

Chloride of zinc (killed spirits) for iron, steel, brass, copper, tinplate, and new zinc, where the work can be afterwards cleaned.

Resin for copper and brass.

Muriatic acid (unkilled spirits) for old zinc.

Tallow and stearin for lead.

Sweet oil for tin (not tinplate) and pewter, and various proprietary mixtures (fluxite, for instance).

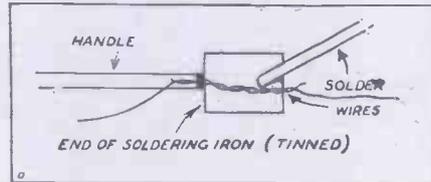
"Tinning."

Chloride of zinc can be used for copper and brass with perfect safety, if the soldered parts are afterwards washed with a solution of 1 oz. bicarbonate of soda to ½ pint of hot water. This "kills" the acid in the same manner as zinc "kills" the muriatic acid in the first place, but without any obnoxious odours, and effectually prevents the formation of verdigris.

The application of heat to metal causes the formation of a thin skin of oxide. The

and very soon crumbles to pieces, and a second-hand "iron" is like a valve, "it looks all right," but probably isn't.

When using the soldering "iron," it is necessary that all parts likely to come into contact with the work should be "tinned," and kept tinned. This is done by filing the copper until all scale is removed (the smoother the surface the longer the "iron" lasts), and then placed in the fire or gas, or whatever other medium is at hand. When hot enough (it will be found to be hot enough for general work when it gives off a faint blue smoke—don't get it red hot) dip it in the flux, rub on a little solder, and lightly brush it over the part to be tinned



with a short, stiff-haired brush until no part of the copper can be seen.

Now for the actual soldering. First clean the article to be soldered (emery cloth will be best for this), and brush on a little flux. On removing the "iron" from the fire it will be seen that the "nice bright tinning" has turned brown, and the iron is covered with dirt; this must be removed by quickly dipping it in and out of a solution of one part sal-ammoniac (one penny from any chemist) to 20 parts water. Some prefer to rub the iron on a piece of sal-ammoniac on which is placed a small piece of solder, but this method produces a thick blue smoke that is not at all pleasant.

Methods of Operation.

Now pick up a bit of solder with the end of the "iron" (or place a small piece of solder on the work), and place the flat side of the "iron" on the work and hold it still. If the "iron" is hot enough and the work thoroughly cleaned, the solder will almost immediately flush all over the joint, and a neat job will have been made.

When soldering joined wires, "iron" No. 2 is used. Clean and brush on the flux, tin the end of the "iron," and hold underneath the wires, rub on a little solder, and it will run all over the wires without leaving any blobs. Be careful to tin only the end of the "iron," otherwise some difficulty will be experienced in making the solder adhere to the wire.

It must be borne in mind that there is no golden rule for heating the "iron." Thin tinplate will buckle badly if the iron is too hot. It is advisable to use the point of the "iron" for this metal. For soldering wires to contact studs, use the side of the "iron," and for iron and steel it will be found a big advantage if the surface of the part to be soldered is first tinned in the same manner as the soldering "iron."

For joining tinfoil the iron should be just warm enough to melt the solder, and the point only barely allowed to touch the foil. When soldering zinc, first scrape the surface before applying the flux. A bit of Wood's metal might be tried for soldering terminals to tinfoil.

In conclusion, don't attempt to solder with a dirty or untinned "iron," or with dirty solder. Keep the flux clean, and above all see that all parts are thoroughly cleaned before soldering, especially when using resin as a flux. If these few hints are kept in mind soldering will be as easy as A B C.

MICROPHONE AMPLIFIERS.

(Continued from page 871.)

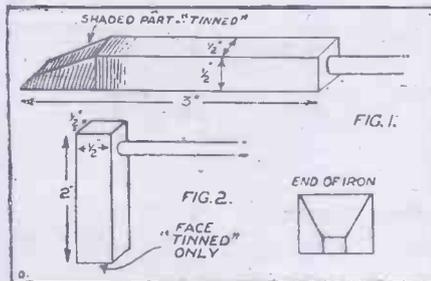
the reed and a contact screw, as shown in Fig. 3.

Many variations can be made of the strength of the electro-magnet, the periodicity of the reed (altered by varying its free length and thickness), the position of the contacts on the reed, etc., and offering an interesting field for amateur experimenters. It would probably be found that a transformer would be required between the microphone and the receiver connected to it for the following reasons.

An Important Factor.

Considering an ordinary transmitter having a normal resistance of, say, 8 ohms, if the resistance of the transmitter varies by 1 ohm under the influence of a sound wave, becoming 7 ohms, it will readily be understood that the effect this variation will have on the receiver connected to it will depend on the resistance of the circuit. If it is 2 ohms, the variation would be 1 in 10, and if 1,000 about 1 in 1,000. It can be seen that the former variation gives a much greater variation in the current flowing than the latter.

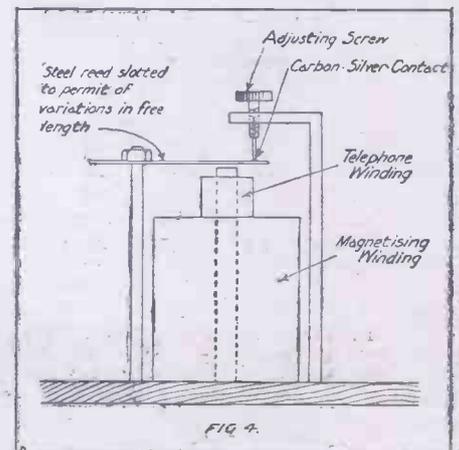
For best working the resistance of the transformer should be small, and not greater than the resistance of the microphone. The ratio of the number of turns between the primary and secondary will depend on the resistance of the telephones used, and will necessitate further experimental work to obtain the best result.



business of the flux is to prevent this formation, and so allow the molten solder to spread evenly over the parts to be soldered.

A soldering "iron," shaped as at Fig. 1, would be best for general work, and one as Fig. 2 will be found very useful for soldering twisted or straight laid wires.

These could be purchased for about 1s. each. Do not on any account purchase second-hand soldering irons. Each time a soldering iron is allowed to get red hot it loses some of its heat-retaining property,



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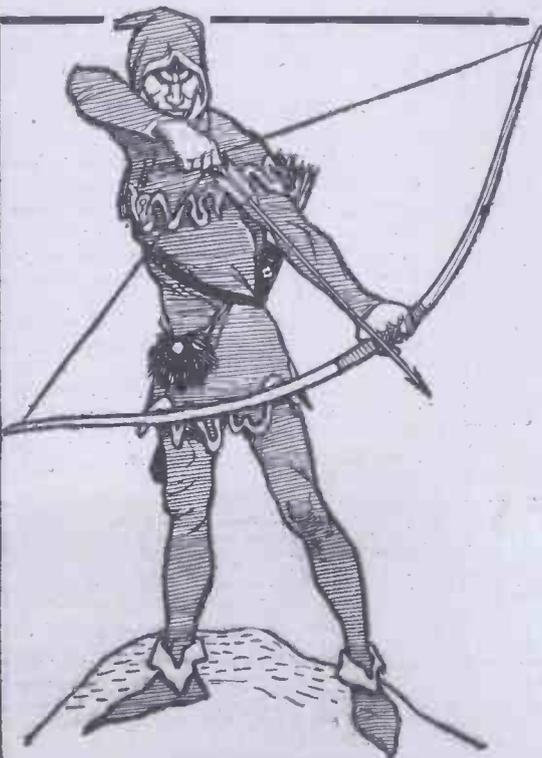
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The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the report if necessary. Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An asterisk denotes affiliation with the Radio Society of Great Britain.

North London Wireless Association.*

On June 18th, the ninth paper on "Elementary Principles" was given by Mr. F. S. Angel, choosing as his subject "L.F. Amplification."

On June 25th, Mr. R. H. Robinson gave his lecture on the "Armstrong Supersonic Heterodyne." This was of great interest, especially as the receiver is simple to operate.

Hon. sec., Mr. J. C. Lane, Physics Theatre, North Polytechnic Institute, Holloway Road, N.

The Sydenham and Forest Hill Radio Society.*

The members of the above society paid a visit to 5 D T (vice-president) transmitting station on Saturday, July 7th, 1923.

Several members spoke into the transmitter, and a very interesting afternoon was spent.

Hon. sec., M. E. Hampshire, 139, Sydenham Road, S.E. 26.

Southampton and District Radio Society.*

On Thursday, June 28th, Mr. Chester lectured on magnetic testing, and dealt with various questions which arose. Mr. G. Sutton, secretary of the Dulwich Wireless Experimental Association, expressed appreciation of the lecture.

At the meeting held on July 12th, Mr. J. Wansbrough gave a lecture showing how two- and three-valve circuits were evolved from an ordinary single valve circuit, upon which subject an interesting discussion took place. Five new members were elected.

Hon. sec., Mr. P. Sawyer, 55, Waterloo Road, Southampton.

Leyton Radio Association.*

On Tuesday, June 5th, the inaugural lecture of the June programme, "Aerial Erection," was given by Mr. C. G. Ingre, and a letter was read from the president, J. D. Cassels, Esq., K.C., M.P., congratulating the association on its progress.

Hon. sec., Capt. H. Thorley, C.A., Social Centre, Goldsmith Road, Leyton, E. 10.

Leads and District Amateur Wireless Society.*

At an instructional meeting held recently, the hon. secretary lectured upon "The Elementary Principles of Transmission." The lecturer dealt with the theory of damped wave transmission, continuous wave work being referred to a future lecture.

At the thirty-seventh general meeting, the president, A. M. Bage, Esq., occupied the chair. Mr. H. F. Yardley, M.I.R.E. (vice-president), lectured upon "Some Experiences with Non-Radiating Receivers."

Hon. sec., D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

Radio Association (South Norwood and District Branch).

The meeting of the above society held on Thursday, June 28th, at headquarters, was opened with the presentation of a four-way crystal panel to Mr. R. T. Mayes, winner of a competition for the junior members for the best home-made crystal set. A discussion was then started on modern receiving circuits.

Hon. sec., Mr. C. H. P. Nutter, F.R.A.—5 D.B. Radio Corner, 243A, Selhurst Road, Norwood Junction, S.E. 25.

Leyton and District Wireless Club.

A successful meeting was held recently, when a demonstration in polishing was given by Mr. F. Browne, and also the usual buzzer class under the direction of Mr. F. Webber.

A very interesting lecture was also given by Mr. P. J. Slade, entitled "The Elementary Principles of Wireless."

Hon. sec., W. G. Peacocke, 73, Frith Road, E. 11.

Honor Oak Park Radio Society.

At a recent meeting Mr. E. Wilkinson gave the members an account of his experiments in transmission eighteen years ago.

Hon. sec., Mr. G. J. Price, 22, Honor Oak Park, S.E. 23.

Tottenham Wireless Society.

On Wednesday, July 11th, when the society held their second demonstration evening, experiments were made with a view to cutting out 2 L O.

Hon. sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N. 17.

Liverpool Wireless Society.

A meeting of the Liverpool Wireless Society was held on Thursday, July 12th, at which their vice-president, Dr. S. S. Richardson, B.Sc., A.R.C.Sc., addressed the members on the "Control of Intrinsic Reaction."

Hon. sec., Geo. H. Miller.

North Middlesex Wireless Club.

At the meeting held at Shaftesbury Hall, Bowes Park, N., on the 11th inst., Mr. J. Maxwell Savage gave an excellent paper on "Radio-activity and its Bearings on Wireless."

Hon. sec., H. A. Green, 100, Pellatt Grove, Wood Green, N. 22.

Radio Association (Brockley and District Branch).

At the June meeting of the above branch highly interesting and instructive lectures were delivered by Mr. C. H. P. Nutter (5 D B) and Mr. J. L. Jeffrey (5 F R).

Hon. sec., R. O. Watters, Grove House, Brockley Grove, S.E. 4.

Catalogues Book Reviews Etc.



It is always advisable when purchasing batteries, both high and low tension, to get these from a reputable firm that will guarantee their goods to give maximum life and general efficiency. We have received from the "Ever-Ready" Co., Ltd., an interesting catalogue in which many types of batteries, both dry and wet, are illustrated. It is interesting to note that this firm are not behind the times as regards the batteries for the D.E.R. valves, a very neat type with special webbing carrying crate being illustrated. Some interesting data concerning the life of these batteries when used with the D.E.R. valves is also given. Besides batteries, the catalogue also includes every conceivable type of pocket lamp, hand lamp, inspection lamps, etc.

* * *

Percival Marshall and Company's practical Manuals are, perhaps, more well-known than any other series of practical books. They have lately published a very interesting booklet, giving complete instructions for making a two-valve wireless receiving set. The book deals with the construction of every part of the set exclusive of phones, batteries, etc. There are about two dozen clear photographs and diagrams. The ninth and last chapter describes any possible additions to the set, such as loading coils, H.F. transformers, H.F. amplifiers, and L.F. amplifiers, etc.



The Walthamstow Amateur Radio Society's outing. (Right) A close view of the set employed for experimental reception.

SUMMERTIME WIRELESS.

By OSWALD J. RANKIN.

II.—Dealing with the erection of light masts on punts and motor-cars.

THE two types of masts previously described are simple, compact, and very easily acquired. Those who desire a more elaborate arrangement may either construct a tubular telescopic mast as shown at H (Fig. 4) or a tubular mast threaded at the end of each section and provided with adapters or reducing sockets

worth stud as shown in the sectional diagram, L. An ordinary fretworker's clamp is drilled and threaded to take the stud and the socket is then screwed firmly to same as indicated at M. A thumbscrew is fitted into the side of the tube, near the top, for the purpose of securing the end of the mast. This fitting is easily and quickly attached to the seat of a boat or any other flat object.

an ordinary electric light fitting, the two pins (comprising two ordinary screws), and the spring, being attached to the lower end of each section as shown. The success of a mast of this description will depend chiefly on the depth of the sockets and the close-fitting ends of the wooden sections. The spring is provided merely to keep the two pins locked in position and should not be relied upon to serve any other purpose.

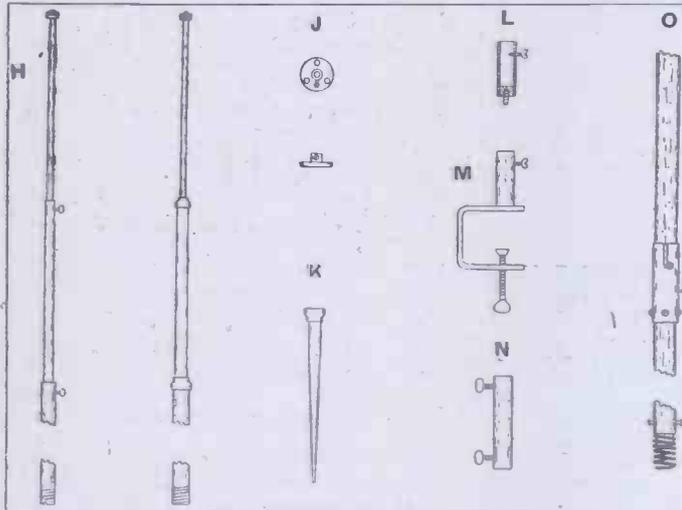


Fig. 4.

The "earth" of a river installation comprises a small weight attached to the end of the earth lead and suspended over the side of the boat into the water.

Diagram N shows a very useful fitting which should be included in the outfit. The tube, which is fitted with a thumbscrew at each end, should be of the same size as the other sockets used.

Diagram P (Fig. 5) shows another very useful fitting in the form of an adjustable clip. A long strip of thin sheet brass is perforated with holes placed about 1/4 in. apart and arranged as shown so that the thumbscrew in the larger portion may be fitted into any pair of opposite holes. This is brought into service when it is desired to attach the mast to a small tree or other round object.

In diagram R we have what is probably the most simple method of erecting a mast on a motor-car for use when the car is at a standstill. A spare radiator cap is obtained and this is provided with a short bolt as shown at Q, which is made to engage a threaded lug soldered into the end of a piece of brass tubing. A thumbscrew is fitted into the side of the tube as shown at R. On most cars there are mascot fittings to which a suitable socket can be easily adapted.

as shown at I. The sections may consist of 4 or 5 feet lengths of brass or aluminium tubing, each section being one size larger in diameter than the next. In each instance a reel type insulator is attached to the top section.

The sections of the telescopic mast H are locked together by means of small thumbscrews as shown, the lower ends of each being plugged with pieces of round hard wood to provide a firm grip for the screws. The tubular mast I is built up in a similar way, but instead of being telescopic each section is screwed to the other by means of a reducing socket having two different sizes of threads. These, with the lengths of tubing, screwed at each end, can be obtained from any ironmonger or plumber.

This may be described as an emergency or auxiliary socket and will be found particularly useful when it is desired to extend the mast or to replace a damaged socket.

A Collapsible Mast.

Diagram O shows another way of arranging a sectional wooden mast. The sockets are cut from brass tubing and should be made to fit tightly over the ends of the wooden sections. The top of each tube is slotted, to form a bayonet joint similar to

Securing the Aerial.

The matter concerning the guy wires should present no difficulties. Diagrams S and T show how a small clamp may be converted into an anchoring device and screwed to the footboard of the car. The clamp may either be drilled and bent up as shown at S or provided with a large terminal as shown at T. An alternative method is shown at U, where a fairly stout broom-handle is passed between the lower spokes of the back wheels and one of the guy wires attached to each end.

A Simple "Earth."

A solid metal or hard wood spike K, fitted with a reducing socket which will fit the bottom section of the mast, is screwed to same and pushed firmly into the ground. The guy wires or cords are attached to the top section of the mast by means of a metal flange, J, provided with three or four equidistant holes and a collar with a set screw. This is slipped over the top of the mast and secured firmly in position before attaching the second largest section. Wherever metal masts are employed it is as well to provide a few extra insulators at each end of the aerial wire and also at least one in each of the guy wires.

A very handy fitting, particularly useful when erecting a mast in a punt, is made up from a piece of brass tubing with a short length of solid brass rod soldered into one end and provided with a short 3/8-in. Whit-

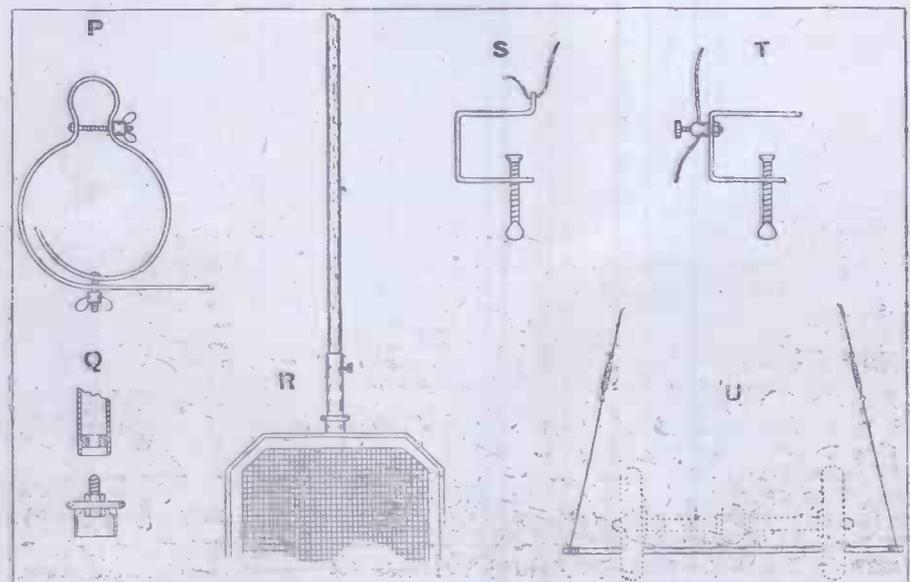


Fig. 5.

RADIOTORIAL.

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

One of my staff, testing the "Popular Wireless" Combination Set at Radlett, on the outskirts of London, was able to bring in Newcastle on a Claritone loud speaker, while 2 L.O., 15 miles distant, was comfortably audible 150 feet away. This, for a receiver employing but two valves and no reaction, is certainly a wonderful performance, but by no means a "freak." As the technical editor says in an article which will appear shortly in POPULAR WIRELESS, "with this set, one has the feeling that everything transmitting, no matter where its location, is within range."

Judging by the correspondence we are receiving, and the number of visitors that daily call to see the set working, considerable interest has been aroused, and there is every indication that there will shortly be many thousands of similar receivers in daily use. Anybody who can handle a crystal set can use the "Popular Wireless" Combination Set, and it is the only receiver that can claim "super" results and is yet suitable for the "household."

I want even more readers to come along and see the set and have the details of its operation personally explained to them. The invitation is open to all who care to fix an appointment between 11.30 and 12.30 any day of the week except Saturday. Just drop a card to the Technical Editor telling him when you will call.

A clear day's notice is advisable so that arrangements can be made to accommodate a varying number of visitors. "Seeing is believing" is an old saying, and my readers cannot say that I am not giving them an opportunity of proving that the "Popular Wireless" Combination Set is something above the theoretical diagram type of "stunt" circuit.

In next week's issue of POPULAR WIRELESS the complete wiring diagram and several interesting photographs of the interior wiring will appear; and every amateur interested should make a point of ordering his copy in advance, as it is probably the most interesting and useful series of illustrations of any that have appeared in connection with a constructional article in this or any other technical journal. This feature is by no means extended to the seclusion of all others, however, and the usual high standard of general wireless subject matter is maintained.

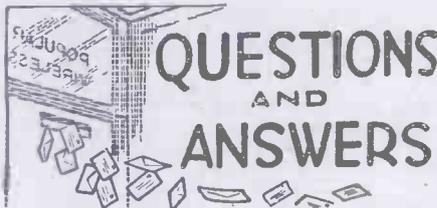
THE EDITOR.

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answer-

ing queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS Queries Department, Room 138, Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send the necessary postage for reply.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.



S. E. H. (Woolwich).—I am getting excellent results using the super-crystal set of "P.W." No. 38, but wish to increase my range. To do this I have constructed the H.F. panel by H. G. Hersey, in "P.W." No. 34, but have failed to get results when connecting the two together, the signals of my crystal set disappearing altogether. What is the correct method of connecting these two panels together? How can I add L.F. to the same set?

The first step to take is to disconnect the primary and secondary of the crystal set from the detector and the 'phones in all cases when H.F. is to be added to a crystal set. Thus, in this case the primary will remain as it is, while the two leads of the secondary

are connected to the grid of the valve and to the filament marked F on the panel. The '001 variable condenser should also be connected to these terminals, thus being in parallel with the secondary coil. The only alteration that is necessary on the H.F. panel is that the lead from the secondary of the transformer, instead of going to L.T. negative as shown, goes to a terminal of its own which should be inserted on the panel between OG and L.T. negative. The crystal connections are then one side to OG on H.F. panel, other side to blocking condenser, and other side of blocking condenser to the new terminal above mentioned, the 'phones, of course, going across the fixed condenser. L.F. may be added in the usual manner, the input terminals of the L.F. panel going to the 'phone terminals of existing set, the 'phones being removed to their new position between plate and H.T. positive of L.F. panel.

F. C. T. (Tooting).—I have a crystal set, using the tapped coil method of tuning, but this method does not give me fine enough tuning. I have been recommended to use a variometer. Can I use it in conjunction with the above-mentioned coil, or shall I have to dispense with my present coil altogether? Should the variometer be in series or parallel?

You may use the variometer in series with the tapped coil. This, besides giving finer tuning, will also increase your wave-length. For this reason, do not use too large a variometer, otherwise you will get too much dead-end effect. The wave-length of the coil and variometer in series will be the sum of both the separate wave-lengths. Another method of obtaining finer tuning is to connect a small variable condenser, say, of '0003 mfd., across the coil. Unless the tapplings of your present coil are few and far between, there is no reason why you should be getting such poor results, being, as you are, so near to the London broadcasting station.

P. W. C. (Yeovil).—I intend to construct the "P.W." combination set. What are the necessary parts, 'phones, etc., included, as I intend writing to London for them all at once?

Here is a complete list. One pair of 'phones, 4,000 ohms resistance; one H.T. battery, 60 or 75 volts; one L.T. battery, 6 volts; one valve, suitable for H.F. and L.F. work, not a soft valve; aerial, insulators, earth equipment, etc. Suitable coils for A.T.I. and anode. Should these latter be plug-in coils, suitable stands will be necessary. A two-coil holder should, of course, not be used, as coupling the coils together will give a reaction effect. Three double-throw double-pole switches; one plug and two jacks; two fixed condensers, '0002 mfd. and '001 mfd.; one crystal detector; one L.F. transformer, ratio 5-1; two variable condensers, '001 mfd. and '0002 mfd.; one filament resistance; one valve holder; and eight terminals. Tinned copper 18-gauge wire for wiring up; ebonite panel, 12 in. by 12 in., and box: odd screws. This gives the complete list for unit one. The extra unit (No. 2) requires another

(Continued on page 878.)

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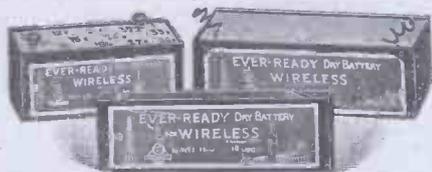


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- Turned Ebonite Valve Holders, 8 nuts, 1/-.
- Fil. Resistance, 1/8, 1/10, 2/8.
- Fil. Resistance, 7 ohms, 3/6.
- French "R" Valves, 9/6.
- Moulded Valve Holders, with nuts, 9d.
- Perikon Crystal Detectors, glass, 2 crystals, 1/4, 1/6 and 2/8.
- Glass Dustproof high-class Detector (whisker), 3/-.
- Contact Studs and Nuts, doz. 4jd.
- Valve Pins, doz. 7d.
- 2 B.A. Nuts, 3 doz. 7d., 1/10 gross.
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- Terminals, special offer with nut, 4 for 3jd.
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- Grid Leak & Condenser, .0003, 2/-.
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- 100 feet 7/22 Aerial wire, 4 Insulators, the lot, 2/6. No post orders.
- Real Ebonite Knobs, 2 B.A. Bush, 3d.
- Please note that a special discount 1d. in the 1/- is given off many articles in the windows where not marked NETT. This must save you a large sum, as in any case profits are reduced to a minimum.
- We want your business by post, but MUST have postal charges as follows: Up to 10/- 2d. in the 1/- (or any part); Up to 20/- 1jd. in the 1/- (or any part). Over 20/- carriage paid. (Condensers excluded).
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- Brunet 4,000 ohm genuine 1st quality Headphones, 17/11.
- N. & K. 5,000 ohm Headphones, extra loud, 15/11.
- H.T. Batteries, 2 Wander plugs, 66 volt, 8/6.
- H.T. Batteries, 2 Wander plugs, 60 volt, 8/-.
- Aerial Wire, 7/22 per 100 feet, 2/3d and 2/1d. No post orders.
- Rotax Accumulators, 4 v. 40 amp., 15/6.
- Phone Cords, double, extra long, 10d.
- 5-1 Intervalve L.F. Transformers, 11/6.
- Wound Coils, 6 x 3, Turns 180, W.L. 1,100, 1/6.
- Wound Coils, 12 x 4, Turns 400, W.L. 3,800, 2/6.
- Variometers, very good value, 250/750, 3/5.
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RADIOTORIAL QUESTIONS AND ANSWERS.

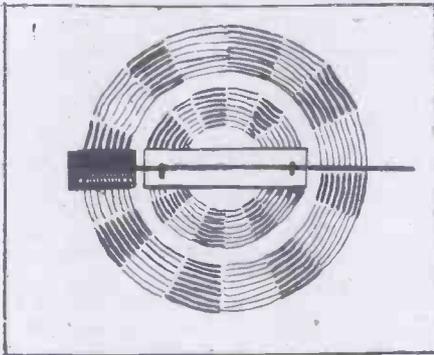
(Continued from page 876)

L.F. transformer, four terminals, one jack and one plug, and a valve socket, filament-resistance, and R valve.

C. B. (Bourne End).—Why is it that when I hold the telephone cords of my one-valve set it immediately howls, and continues to do so until I remove my hand?

This is caused by a capacity effect, and cannot be stopped if you are using a finely tuned reaction circuit. The addition of extension handles to the condensers and coil holder, if you have one, may help to get rid of this undesirable capacity effect. If you detune the station slightly, you will find that handling the telephone cords will increase the sound, but yet not cause the set to howl. A condenser across the reaction coil may obviate the trouble.

Z. Z. Z. (Printon).—I have been told that a variometer does not need a variable condenser to give fine tuning. Is this so? If so, what are the details of such a variometer? I prefer the flat coil type. Will this be applicable to my one-valve set (no reaction)? What are the connections?



Yes, you will find that a variometer will give very fine tuning, and will not need the addition of a variable condenser, unless, of course, it is desired to increase or decrease the wave-length of the said variometer. Presumably you want the variometer to tune to the broadcast wave-lengths, as you do not state otherwise. The following details will be O.K. On a hobbin 24 in. in diameter, with 13 3-in. spokes, wind 20 ft. of No. 24 D.C.C. Next wind on a layer of string for about 1/4 in. which separates the rotor from the stator; this, of course, is afterwards carefully removed. Having wound on the string, the next step is to wind on a further 20 ft. of the same wire. When completed give the coil three or four coats of shellac, which will make the coil robust, and, when dry, remove the spokes and string. The rotor, or inside coil, is next mounted on a small strip of ebonite, as shown on above diagram, and another piece fixed to the stator, or outside coil, a suitable spindle being fitted to these pieces of ebonite to control the rotor. Now connect one end of the rotor to one end of the stator, allowing plenty of lead, so that the rotor will not be obstructed in its course through the stator. The two remaining leads go to the aerial and earth. Such a variometer will tune up to nearly 600 metres.

S. A. R. (Holyhead).—I have completed the "P.W." Combination Set and have tried to add an L.F. panel that I have in order to have the two units. I have brought the jack connections out to terminals so that I do not need another jack on the L.F. unit. I find that the L.T. leads become red hot, and I have to disconnect the accumulator to prevent the wires from fusing. The panel I use is the L.F. panel from the set described in POPULAR WIRELESS No. 35. Could not this panel be utilised?

The panel you mention will do quite well, but you will have to modify the wiring. In the first place, the L.F. panel has the L.T. negative joined to the H.T. negative, while in the Combination Set the L.T. positive is connected to the H.T. negative. When you connect up the two units you automatically "short" the accumulator via the L.T.-H.T. connections, and this accounts for your wires becoming red hot. If you intend to use the panel described in our issue No. 35, you must rewire the L.T. connections, and also see that the layout of the wiring cor-

responds with that of the L.F. panel (theoretical diagram) given in Fig. 6 in the first article on the Combination Set. You may find that it is necessary to change over the input connections of your transformer before good results are obtained. The condenser across T_1 and T_2 should be removed, as this will tend to give unsatisfactory results.

B. H. (Acton).—I was testing my crystal set the other day by means of a buzzer in a different room to that in which the crystal set was, but was surprised to find that I could plainly hear the buzzer wherever I placed the slider on the coil. Should this be so?

Yes, this is quite O.K. The buzzing proves that the crystal is sensitive and that the 'phones and circuit are O.K. The reason that you were unable to cut out the buzzing is that the buzzer acts as a small transmitter and sends signals that have no special wave-length, thus it is impossible to detune them.

A. L. N. (Berwick).—What is meant by magnetic flux and magnetic flux density?

Magnetic flux is an imaginary "magnetic field" which is assumed to be present round any magnetic circuit, the value of which is given by the number of lines of force, and depends upon the value of the applied magneto-motive force. By magnetic flux density we mean the number of lines of magnetic force per square centimetre, or per square inch of sectional area of a magnetic field.

S. E. D. (Thorpe Bay).—After using my accumulator for a few weeks, I find that the level of the liquid has fallen to below the tops of the plates. The battery does not leak, so I suppose the acid has evaporated. Should I add more acid?

The loss of liquid is chiefly due to evaporation of the water in the solution, for the acid does not evaporate to any appreciable extent. If you are certain your cells have not been upset, or any of the acid spilt, you should add distilled water (obtainable from any chemist) until the acid solution is up to its previous level, about 3/4 in. above the tops of the plates. If acid has been spilt from the cells, the addition of distilled water will not be sufficient, and dilute acid of 1.25 specific gravity will have to be added. For this reason it is advisable to have a hydrometer always at hand: these instruments give a sure indication of the exact state of an accumulator, whereas a voltmeter only gives one a rough idea.

Even though the acid may not have been spilt, a certain amount escapes every time the cells are charged, because of the spraying that almost invariably takes place. To replace this acid the addition of a little acid is needed occasionally. Here again the hydrometer will be found indispensable, and as these instruments are very cheap, you should not be without one. A convenient form is the Hicks' suction hydrometer, consisting of a glass tube containing three floats of different colours. These rise or fall according to the density of the acid. Another and more accurate type can be obtained at a reasonable price where one float is used, and the density of the solution read on the scale marked on the float.

A. K. U. (Banbury).—What is meant by a directional aerial? Have they any advantage over the ordinary type of aerial?

A directional aerial is one the lead-in end of which is pointing to the station that it is required to receive. A directional aerial gives louder signals from the station to which it points than a non-directional aerial would give.

A. T. I. (Cricklewood).—Will a potentiometer of 500 ohms be suitable for use with a carborundum crystal set? If so, how much will be required, and what is a suitable size former? I intend using 36 S.W.G. Eureka wire.

Yes, a 500 ohm resistance will be quite O.K. A former 1 1/2 in. in diameter, wound to a distance of about 6 in., using the 36 wire as you suggest, will be quite O.K.

"BATTERY" (Immingham).—The terminals on my six-volt accumulator have become corroded, and a soft matter is continually deposited on them; while the wires to these terminals also get covered with some substance, making them bad conductors. How can I prevent this?

This is probably caused by creeping of the acid. There is a special oil, "Blanco," on the market that can be utilised to prevent this. A little vaseline at the base of the terminals will also prevent it, and, used in conjunction with the Blanco mentioned above, the cells should be quite free of verdigris.



To the Editor, POPULAR WIRELESS,

SIR,—I don't grudge one bit the pat on the back given to the Cardiff Broadcasting Station, in your issue of July 14th. That Major A. Corbett-Smith has done exceedingly well I am willing to admit. I do, however, fail to appreciate the assertion that this station is a model for all the others. It caters for a public whose very being is impregnated with oratory, music, and other arts, and programmes, providing delight to the Welshman, would more than likely bore the average "listener-in" in London.

Nor do I consider "vivid personality" or "intensely human touch" in any way lacking at 2 L O. Listening nightly, as I do, to the voices at 2 L O they have become real friends to me, and I for one entirely sympathise with Cardiff in their dread of losing their "Uncle Donald." What would we Londoners do without our beloved Uncles Arthur, Rex, and Jeff?

Yours sincerely,

E. G. ROBIN.

Winchester House,

Old Broad Street, E.C. 2.

To the Editor, POPULAR WIRELESS.

Dear Sir,—I was very much surprised to receive 5 N O on a crystal set.

The reception was quite accidental, as the following will show. It is my habit when I am in bed to listen-in on a crystal set which stands on a table beside my bed. The set consists of variometer, "permanite," and Brown's 'phones.

Last night, at about 10.45, I had tuned in to 600 metres to listen to the hubbub which is practically continuous here, and after a few moments I turned back the knob of the variometer to tune in 2 L O, who I can just get well enough to be worth listening to. Not having any light, I was tuning in by ear alone, and, hearing a man's voice, took it for granted that it was 2 L O.

Great was my astonishment to hear, "Hullo, everybody! 5 N O, now closing down until 3.30 to-morrow. Good-night, all!" Then followed the National Anthem, played on the piano.

I could hardly believe my ears, but, switching on my torch, I found I was some 20 degrees above the adjustment for 2 L O, so it was certainly 5 N O I had heard. Upon tuning down lower, 2 L O could still be heard transmitting music.

The above was probably a freak, but I shall try again nightly and endeavour to get him again. At any rate, this must be nearly a record for the reception of a B.B.C. station, as the distance is about 300 miles.

My aerial is across the road, between two chimneys, height about 40 ft., length 80 ft., and the earth lead about 35 ft. long, not insulated.

Yours truly,

W. E. PHILPOTT.

2 X T, Rye, Sussex.

(Continued on page 879.)

CORRESPONDENCE.

(Continued from page 878.)

THE EDITOR, POPULAR WIRELESS,

Dear Sir,—Although every vista and skyline in London and the Home Counties has for many years past been completely

THE EYESORES of LONDON.



A SOUVENIR.

ruined by forests of the irregular and diabolical tin chimney-pots of the lurch-back pattern, yet "Ariel" discovers an offence to the eye in suburban aeriads fixed on irregular poles. If irregular aerial poles are positively ugly, will "Ariel" kindly supply the necessary adjectives for describing the creations

shown on the enclosed illustration?

Truly we are an unobservant and unimaginative race, and "Ariel" must be one of us.

Yours faithfully,
G. O. PARSONS.

To the Editor, POPULAR WIRELESS.

Dear Sir,—Having read in your valuable paper of 2 G M's experiments with valves employing radio-active salts in place of electrically heated filaments, I should like to point out that I have been working on these lines for some time past, and have had a considerable amount of success in the matter.

Yours faithfully,
S. J. EINTRACHT.

100, Clarence Road,
Clapton, London, E.5.

To "ARIEL."

Dear Sir,—Re your article in POPULAR WIRELESS of the July 21, under "Topical Notes and News," where you advocate the broadcasting of Saturday evening dance programmes, between the hours of 8 and 11 p.m., may I lodge the complaint that should the B.B.C. carry out your suggestion they will do a very serious injury to the small dance orchestras all over Great Britain (and possibly farther). It is only natural that, in the event of dances being broadcast, small and large clubs will resort to the cheaper method of valves and loud speakers, and so dispense with the old dance band which had always stood them good service before the B.B.C. was born. Do not think me prejudiced against wireless (or the B.B.C., who is "doing us" splendidly) for I am an enthusiast myself, being the holder of an experimental licence. However, I do feel that in the interests of dance bands (whose members add a little more to their incomes in these hard days), you, the publishers of POPULAR WIRELESS—one of the most interesting weekly papers on the market—should give my complaint your attention and not encourage the B.B.C. in broadcasting dance programmes. Everybody I have spoken to on this subject possess the same opinion as myself, and you will no doubt hear from them in the same strain as this letter. Trusting you will not let this pass your serious attention.—Yours truly,

CHAS. E. HERBERT.

42, Amberley Road, Bush Hill Park,
Enfield.

(Continued on page 880.)



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Our Usual Guarantee goes with above, viz. **MONEY RETURNED IF NOT SATISFIED.** Send for our full Wireless Retail List and Save Money.

TRADE LIST TO SUPPLIERS.

CORRESPONDENCE.

(Continued from page 879.)

The Editor, POPULAR WIRELESS.

Sir,—No doubt many of your readers have been following with much interest the correspondence that has been appearing during the last few days in the "Times," on the question of broadcasting being spoilt by excessive jamming with Morse.

From what I can see the wireless Press seems to keep this question in the background, perhaps not wanting to discourage would-be listeners-in, but I submit that this is a matter that deserves much attention on the part of wireless periodicals.

Colonel J. T. C. Moore-Brabazon, M.P., writing in the "Times" of the 15th inst., says: "What reduces the present reception of broadcasting to a positive farce to anyone living near the coast, is that the broadcast band of waves is so near that allowed to ships, and that ships do not keep wholly to theirs. Ships with spark transmission on 300 and 600 metres, using as some of them do sets over ten years old, jam everything in the telephony line from 150 to 900 completely, and there is no way of cutting them out. The large power used quite unnecessarily by them, and their garrulity, added to various harmonics from high-power arc stations, reduces the ether to-day to something like chaos. The demand from the public to be able to hear what they have paid a licence for, will, I hope, soon compel action by the authorities to see that wave-lengths are meant to be kept strictly under penalty."

I have been in correspondence with the chief engineer of the British Broadcasting Company on the matter, and in his last letter to me he says:

"I could show you literally thousands of complaints we have forwarded to the Postmaster-General on just this score of jamming. We have received replies of an evasive sort. The only definite information we can glean is that spark telegraphy will be continued to be used in the same way because the service is responsible for life-saving at sea. That life-saving could be as efficiently, if not more efficiently, conducted were the telegraphic services conducted with modern apparatus, does not seem to have been considered by these same authorities. I do assure you that we have taken every possible measure to overcome jamming, but at every turn we have been met with official indifference. The only thing to do, in my mind, is to give the matter full and sufficient publicity in every way—which, by the way, we are doing, vide my letter in the "Times"—and listeners-in individually, I think, would be well advised to write to their Member of Parliament, pointing out that something must be done."

The majority of listeners-in have their reception of broadcasting spoilt by Morse jamming and, as Mr. Eckersley says, the only thing for them to do is to give that matter full and sufficient publicity by writing to the Press and their M.P.'s.

I have just received a letter from a Cornwall gentleman, who took part in the recent "Times" correspondence, and he says: "I believe the remedy lies in listeners-in worrying their M.P.'s, and getting some questions asked in Parliament." If all your readers would act on this suggestion results would surely follow.

Yours faithfully,

BERTRAM H. TUBBS.

"Langdown Cottage," Hythe, Southampton.

RECENT WIRELESS INVENTIONS.

The following abstracts are specially contributed by Mr. Harold J. C. Forrester, Fellow of the Chartered Institute of Patent Agents, 88-90, Chancery Lane, W.C.2.

Grant of the following patents can be opposed and printed copies of the full specifications obtained.

198,137.—**L. I. ROBINSON. W. E. WARRILOW.**—INSULATORS. A flexible covering for ropes, wires, etc., which may be used for insulating electric conductors, comprises a series of ball and socket joints of glass or other material, bored large enough to receive the wire, etc., and allow considerable flexing.

198,189.—**W. EDE & others** (Radio Mfg. Co.)—RESISTANCES. A high constant resistance for wireless receiving apparatus, consists of a filament (cotton, string, cord), impregnated with copper, sulphate, or other non-polarising conducting liquid—all enclosed in an insulating tube, having conducting ends. The filament may occupy the bore of a glass tube within a vulcanite tube, the ends being closed by impregnated pads within conical copper caps.

198,247.—**A. H. S. COLEBROOKE & W. A. WILLIAMS.**—VALVES.—Valve filaments may be renewed by weighting one end of a filament wire and dropping it through the grid, whereafter it is secured to the leading-in wires and cut off. A spherical bulb would be opened at the pip, a needle carrying the weighted filament inserted, and the filament lowered into position.

198,318.—**W. DUBILIER.**—CONNECTING WIRELESS TO SUPPLY MAINS.—For coupling receiving sets to mains, etc., taking the place of aerials, a device containing two condensers is screwed into a lamp socket, thereby connecting a condenser in series with each main. The receiving apparatus is then connected to one or both condensers, whichever gives the best result.

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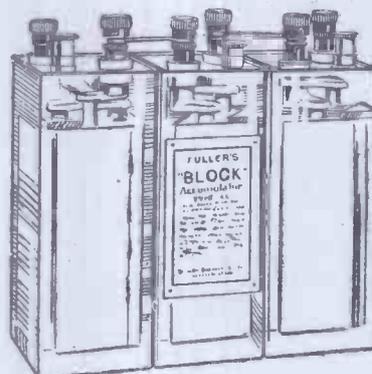
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YORKSHIRE (West Riding): Messrs. H. Wadsworth Sellers & Co., Standard Bldgs., Leeds.
FRANCE: 33, Rue d'Hautville, Paris.
AUSTRALIA: 4, Teakle Street, Summer Hill, Sydney.

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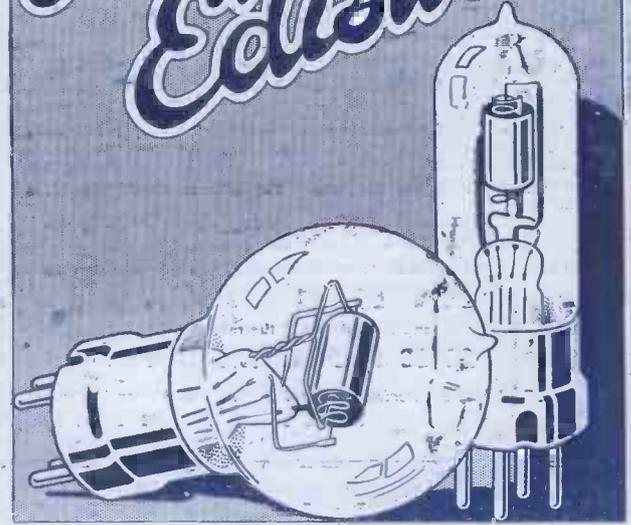
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Popular Wireless

PRICE 3d.

No. 63. Vol. III.

SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

August 11th, 1923.



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Some of the Technical Staff receiving 2 L O on the "P.W." Combination Set, using a frame aerial on the roof of "Popular Wireless" offices.

FEATURES IN THIS ISSUE.

Grading Signal Strength.

Notes on 5 W A.

Inexpensive Tool Kits.

Summertime Wireless (Part III).

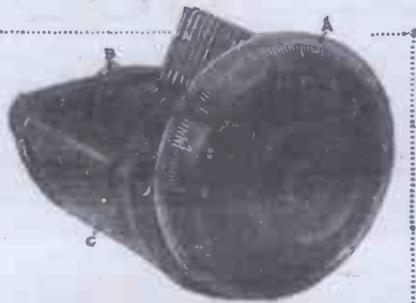
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- (1) Connection to moving plates, although frictional, gives no trouble whatever as in many Condensers.
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This letter is entirely unsolicited, and you can make any use you like of it and my name.

Sotterley, Wangford, Suffolk, May 20th, 1923.
Yours truly, A. E. D. KENNARD,
Wireless Officer in France and Instructor at R.A.F. School of Wireless during the War.

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WARNING!

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Contains every part necessary for simple erection. A Scientific Achievement. Guaranteed equal to sets costing many times the price. Full and complete instructions enclosed with each outfit. London make. Money returned if not as advertised.



Read what "POPULAR WIRELESS," June 23, says: "This little set, which retails at 7s. 6d., is worth every penny of that sum. I connected it to quite an ordinary aerial 12 miles away from 2 I.O. and the reception was excellent—quite as good as that obtainable with another and much more expensive receiver."

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(When writing mention "Popular Wireless.")

(First Floor.)

POPULAR WIRELESS

August 11th, 1923.

SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc.

[Every Friday.]

TOPICAL NOTES AND NEWS.

Short and Sweet.

THE other day an amateur made formal demand at a Post Office for a copy of a form of application for a licence for the reception of broadcast matter. This was the written reply he received on the back of his note: "There is no W.T. licence application form. Go to the P.O. nearest the address of W.T. set. Ask for W.T. licence. Pay 10s. Walk out. Finish."

American Points of View.

DR. LEE DE FOREST, who visited Britain a few weeks ago, has now arrived back in America. Interviewed by the Press, he said he gained the impression that English newspapers were boycotting the broadcasting of news items and that members of the British theatrical and musical professions were opposed to wireless broadcasting. Mr. C. Rypinski, chairman of the Associated Manufacturers of Electrical supplies, who also lectured recently in this country, has stated on his return to America that in his opinion the British public have been quick to take up broadcasting, and that he was very impressed with the unified control over broadcasting vested in the B.B.C.

D.F. Station.

A WIRELESS direction-finding station will shortly be established by the Federal Government on the West Coast of Vancouver Island for the benefit of shipping. The latest type of apparatus, on the aperiodic aerial system, will be installed.

Ex-Service Men.

THE other Saturday evening Sir Montague Barlow, Minister of Labour, made an appeal by wireless for a final effort to find jobs for the last 6,000 or 7,000 ex-officers and men still unemployed.

Wireless for Mountaineers.

THE installation of a wireless service between huts in the Alps and the valleys is expected in the near future for the benefit of climbers.

"The Cares that Infest—"

I QUITE appreciate what a certain amateur said about 2 LO's "last words" on a recent Sunday evening. The humorous side does strike the "ten-watter" rather forcibly sometimes, but it is rather a fitting ending from the point of view of the average listener-in.

Dull Emitters Cheaper.

A MATEURS residing in country districts, or those intending to make portable sets, will welcome the news that dull emitter valves are to be reduced in price. From August 1st the price of Mullard Ora dull emitters (L. F. Ora B, and L. F. Ora C) is to be £1 7s. 6d., a very useful reduction,

Long Distances.

FROM all reports 2 O M appears to be shaking the Denmark ether fairly violently, being audible at one place on a two-valve set. At Versailles he is easily understood on one valve only. Well, he deserves all his success, for 2 O M is one of the hardest working of all the amateurs, and that's saying a lot.

Highway Aerials.

IN connection with the proposal of the Sheffield Corporation to levy an initial fee of 21s. with an annual fee of 5s. for wireless aerials crossing highways, the local amateurs are protesting, and state that only a nominal amount should be charged.

WHAT OUR VISITORS THINK.

HERE are the names and addresses of some of the gentlemen who witnessed a demonstration of the "P.W." Combination Set at our offices on Monday, July 30th, together with their candid opinions of the receiver. The demonstrations held daily between 12.0 and 12.30 are quite informal, and those attending can handle the set and closely inspect the internal lay-out and wiring.

M. D. Harding, 4, Hillside Rd., S.W.2: "One of the best reflex circuits I have tried." G. Wilson, 45, Bartholomew Rd., S.W.: "Perfect set." I. W. Ireland, 11, Florence Rd., Wimbledon, S.W.19: "Good set. Intentions of making." S. E. Honnor, 61, Court Hill Rd., S.E.13: "Appears to be worth making up. Intend to do so immediately." J. R. J. Learson (Vice-Chairman Walthamstow Radio Soc.), 98, Grove Rd., Walthamstow. "Best Dual Circuit I have heard." F. D. Woodman, 3, Rowantree Rd., Enfield: "Very good indeed." G. W. Humphrey, 170, Blomfield Terrace, W.2: "Excellent." S. G. Stephenson, 2, Park View Rd., Addiscombe, Croydon: "Seems excellent." Edward Welshe, 1, Moy Mall, Merrion, Dublin: "Very good." A. K. Kirk, 54, Kingbridge Avenue, S.W.16: "Excellent."

In every case attention was drawn to the fact that no trouble can arise from "self oscillation," and the fact that even capacity effects are imperceptible called for some considerable comment. In these days of "stunt" circuits, a receiver capable of "super" results without verging all the time on the point of "howling" is worth the attention of every amateur in the country.

That the original model built by the Technical Staff of POPULAR WIRELESS is open to public inspection should go a long way towards convincing doubtful readers that here is a set that will really work, and is not merely something worked out on paper by an "expert" for enthusiastic amateurs to discover whether or not satisfactory results are possible. This offer will close on Wednesday, August 15th.

THE EDITOR.

and one that will meet with a ready response. The "P.W." Combination Set with a dull emitter valve provides a very efficient and handy portable receiver.

"2 O M"

I WONDER what will be the end of 2 O M—as a transmitter of wireless telephony, I mean. He seems to have thoroughly imbibed the doctrines of M. Coué, and even infused them into his apparatus, for he assuredly gets "better and better." Not content with carrying out tests with Glasgow, he has been busy disturbing the ether of Versailles and even of Denmark.

P.M.G. and the Scheme.

THIS scheme is subject to the company obtaining permission from the Post Office, and getting the necessary extension of the wave band allotted to them. The scheme includes stations for Plymouth, Liverpool, Sheffield, Leeds, Bristol, Hull, Bradford, Wokingham, Portsmouth, Stoke-on-Trent, Leicester, and Edinburgh.

Interesting Figures.

THE approximate figures of the population served by the main broadcasting stations in existence or contemplated

(Continued on page 882.)

Collapsible Loud Speaker.

A NOVELTY in loud speakers has been designed by Professor Low, who has invented a collapsible loud speaker horn. The trumpet, inspired of its metal composition, does not "ring," and the system, on the collapsible drinking cup principle, makes a very convenient portable loud speaker.

Relay Wirelless.

A BOUT four million potential listeners-in will be catered for by the suggested scheme of the B.B.C. which is to erect eleven wireless relay stations for retransmitting the programmes of the main stations.

NOTES AND NEWS.

(Continued from page 881.)

are: London, 10,000,000; Manchester, 7,000,000; Birmingham, 4,000,000; Cardiff, 2,700,000; Newcastle, 2,600,000; Bournemouth, 700,000; Glasgow, 2,000,000; Aberdeen, 500,000; a total of 29,500,000.

The Sheffield Station.

IF the Sheffield station proves a success the B.B.C. intend that three-quarters of that station's programmes shall be items relayed from the nearest broadcasting centre, one-eighth from London, the remainder to be transmitted straight from the station on 350 meters.

Future Items from 2 L O.

FRIDAY, AUGUST 10TH. 7.15 p.m.—Mr. G. A. Atkinson, on "Cinema Criticism." 9 p.m.—Mr. Mark Allerton on "Serial Stories."

SATURDAY, AUGUST 11TH. 9 p.m.—Lt. Col. E. Gold, on "Weather Forecasting."

MONDAY, AUGUST 13TH. 9 p.m.—Mr. B. Rackham, on the Victoria and Albert Museum.

TUESDAY, AUGUST 14TH. 9 p.m.—Prof. Lefroy, on "Insects, and the World's Cloth."

WEDNESDAY, AUGUST 15TH. 7.15 p.m.—Mr. Archibald Haddon, on "Dramatic Criticism."

A Novel Evening.

AN impromptu concert given a short time ago by the Uncles of 5 N O created great amusement, and letters poured in which the next day vouched for the complete success of the venture. With all the talent available at 2 L O such an evening should prove an interesting feature if adopted by that station.

Forthcoming Events from 5 N O.

Monday, August 13th, dance-music by the Wireless Orchestra.

Tuesday, August 14th, Miss Winifred Fisher, the well-known soprano, and Mr. Lyell Johnston, bass.

On the 15th, the first and second act of "Faust," with chorus and orchestration, with Miss Beatrice Miranda of the British National Opera Company, and Mr. Williams Mitchell taking the leading parts.

On the 17th, the band of the Irish Guards.

Glasgow.

THE British National Opera Company will pay a visit to 5 S C about the end of August. William Anderson and Beatrice Miranda will be included in the cast. The former, by the way, is making the "P.W." Set—so he told me the other day.

Mr. Carruthers, the 5 S C director, is making arrangements with a local producer for the broadcasting of Shakespearean plays.

Manchester.

THE first night of Shakespeare at 2 Z Y was quite good, but at times the voices of the actors were not quite loud enough. We must not be too critical, however, in respect of the first night, as there was every indication that, with a little more experience, 2 Z Y will soon be almost beyond criticism.

Mr. Herman Darewski.

AN interesting concert was given at Newcastle recently by Mr. Herman Darewski and members of his company. Later, Mr. Darewski gave a talk upon writing a popular song.

Wireless in the Desert.

ONE of our visitors who came to see the "P.W." Combination Set states he is going to make this receiver and use it in the Sahara Desert, where he hopes to go on a tour. I do not know what he expects to hear. I asked Harry Tate what he



"Carmo," the well-known illusionist, and his two pet leopards listening in.

thought about it, and he replied that the results depend on the "chateau d'un cylindre"—in other words, the horse-power of the camel he will be using.

New Arrangements for 2 L O.

MONDAYS will soon be devoted to popular orchestral music; Tuesday to classical, orchestral, chamber, quartet and band music; Wednesdays to popular orchestral music; Thursdays to the re-transmission of "outside" shows—i.e., plays, concerts, etc., and the wireless orchestra; Friday will be given over to special orchestral programmes—i.e., symphony concerts, special bands conducted by various composers; Saturdays will remain "dance nights"; and Sundays will be reserved for miscellaneous items of good quality, organ recitals, etc.

Australian Wireless.

A FRIEND of mine in Australia writes that the broadcasting regulations are now awaiting ratification by the Australian Cabinet; also it is probable there will be more than one broadcasting company which will have the right to manufacture receiving apparatus, which means that you can buy wireless sets from any of the broadcasting companies and pay the same company an annual fee, thus admitting you to the reception of their transmissions.

Constructor's Licence.

IN his letters he says: "Thank heavens we are going to have a home constructor's licence." Australia has learnt a lesson from English and American methods.

The Secretary to the B.B.C.

THE secretary to the B.B.C., Major P. F. Anderson, is resigning. After a well-earned rest, he will start out on his own. Major Anderson points out that every year brings more work for the company secretary, and it is only the qualified man with heaps of experience who can cope with this particular work. The smaller companies are not able to pay the necessary salary to such a man, but a qualified man can take on a number of such companies. The major will provide staff, board-room, etc., and will have centrally situated offices.

Rather Give Notice!

THE Wandsworth Housing-Committee have notified their tenants that 10/- will be charged before permission will be granted to erect an aerial. Two of the tenants have refused to pay and have given notice.

2 W Q.

A NEW experimental station will be shaking the ether somewhere around August 15th. A series of experimental telephony transmissions with power ranging from 20 to 50 watts, on 440 metres, will be given intermittently between 12.30 and 1.30 p.m., and 4.30 to 5.30, and in the evening 11 o'clock to 11.30 on weekdays, and on Sundays 11.30 to 1 o'clock. Reports on the transmissions will be gratefully received by the Midland Radiotelephone Manufacturers, Ltd., Brettell Lane Works, Stourbridge.

ARIEL.

BROADCASTING TRANSMISSIONS.

Regular transmissions of news and concerts take place daily from the following stations. Full details appear in the daily press.

London	2 L O	369 metres.
Birmingham	5 I T	420 "
Manchester	2 Z Y	385 "
Newcastle	5 N O	400 "
Glasgow	5 S C	415 "
Cardiff	5 W A	353 "

Other stations of interest to listeners-in in Great Britain are:—

Eiffel-Tower	FL	2,800 metres	Throughout the day.
Radio-Electrique, Paris	S F R	1,780 "	5.5 to 6 p.m. 8.45 to 10 p.m.
School of Posts and Telegraphs	—	450 "	7.45 to 10 p.m. (Tuesdays and Thursdays.) 4.30 to 7.30 p.m. Saturdays.
The Hague	PCGG	1,050 "	3 to 5.40 p.m. (Sundays.) 8.40 to 9.40 p.m. (Mondays and Thursdays.)

Note.—A revised and more comprehensive list of the Continental Broadcasting stations is in the course of preparation and will appear shortly.

THE "P.W." COMBINATION SET.

Built and described by the Technical Staff.

Although by now many amateurs will have satisfactorily completed the construction of this receiver, there are still one or two slight additions they may care to make, which will increase its adaptability still further without in any way impairing its external appearance, or necessitating any alterations in its existing lay out.

ALTHOUGH the construction of the two units has now been fully dealt with, there are yet two or three refinements that the ambitious amateur may wish to embody in the receiver. These additions are not essential to the efficient working of the instrument but they will be found decidedly useful and will allow the wave-length range to be extended to any desired limit.

The first item to come under consideration is a series parallel switch for the aerial circuit. A very slight modification of the wiring is necessary; reference to the diagram, Fig. 2, will make this perfectly clear. It is advisable to number the studs of the switch, at least mentally, in order to facilitate the connections. The switch itself can be mounted on the panel between the two variable condensers. In the case of the original receiver a switch on a separate base is used, although a neater job perhaps could have been made of it had the switch been constructed and mounted on similar lines to the other two change-over switches. However, this is quite a small point and one that each individual amateur will be able to solve with little trouble himself.

The Anode Coil.

Care should be taken in connecting up the series parallel switch, and the wiring should be followed point to point, and line for line in comparison with the diagram, as even the most advanced of amateurs can quite easily trip up in this quarter.

Having completed the additional switch wiring, terminals can be provided for the purpose of loading up the anode coil. Obviously this will be necessary in order to bring the anode circuit into line with any increased range introduced into the aerial tuning circuit. These two terminals can be mounted behind the valve holder and a brass strap provided to short them neatly when not required. The wiring is simplicity itself. One of the leads going to the anode coil, if it doesn't much matter which, is broken, and each end taken to one of the terminals. Thus, when the shorting strap is removed any coil connected to these terminals will be placed directly in series with the anode coil.

Will Not "Howl."

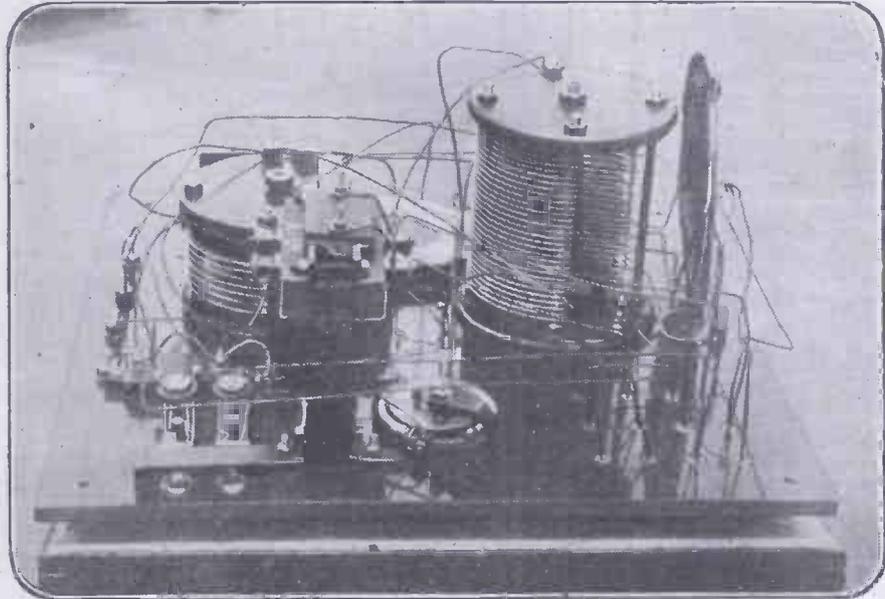
A third addition is the fixed condenser and small tumbler switch, the mounting of which is very clearly shown in the photographs. When the switch is closed the fixed condenser is brought into circuit in parallel with the .002 mfd. variable condenser. This fixed condenser is only necessary for the longest ranges of wave-lengths. In order that the value of even this fixed condenser could be varied with a minimum of delay should it be found to be necessary, the "Grelco" type, which consists of two knife clips and removable plug-in condensers, was employed.

With the above three additions it is possible to bring the wave-length range

up to any point desired. The inductance loading of the aerial circuit is carried out merely by placing suitable coils in series with the aerial terminal of the set and the aerial lead-in. The set can now be reckoned to have reached the 100 per cent. mark of adaptability, and it is difficult to conceive anything more extraordinary than the fact

that its design is such that even with these additions not the slightest tendency to "howl" is evinced. It must not be considered a matter of luck, however, that this is the case, as any serious diversion from the essential values of the circuit or the lay out will very quickly prove. A con-

(Continued on page 884.)



The interior "lay-out" and wiring can be very easily followed by comparing this photograph with the wiring diagram that appears below.

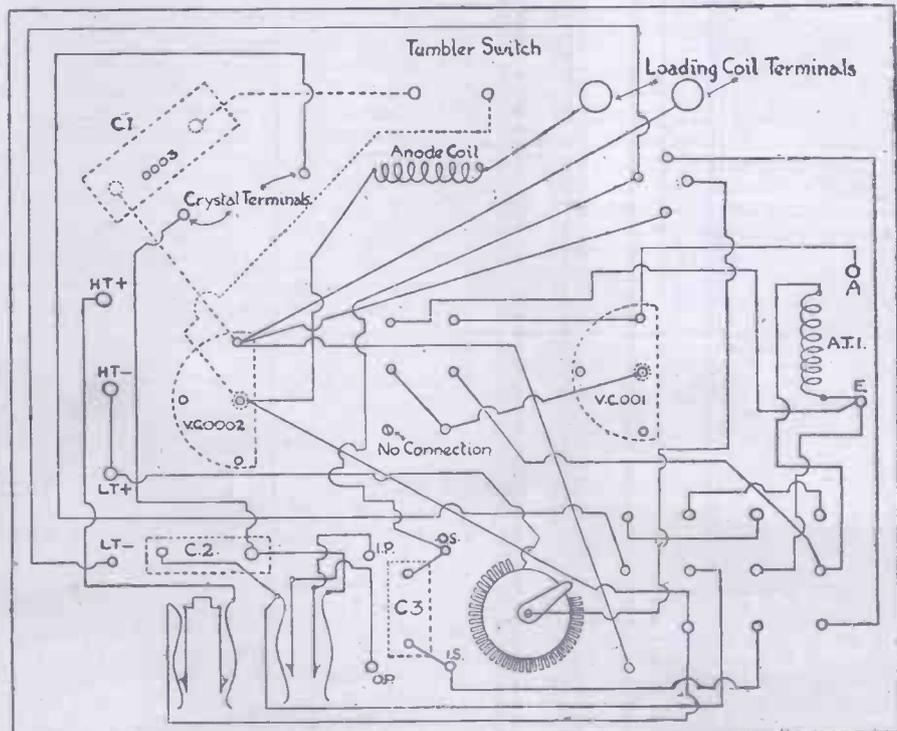


Fig. 1. The full diagram of connections, showing in dotted lines the wiring of the additional anode condenser.

NOTES ON 5 W A.

By "KYM-RADIO."

"A POLICEMAN'S lot," as W. S. Gilbert once remarked, "is not a happy one." We should like to know what that witty author would have to say concerning the lot of a broadcasting station director. The archangel Gabriel would be sorely tried in such a post. But in spite of little ups and downs the Cardiff station is extremely successful.

On Monday, July 23rd, 5 W A gave us as joyous an evening as one could wish. Everyone was in great form with merry quips; Mike, the station cat, mewed his wireless greetings (we suspect a pinching of his tail); Mr. Price submitted to an orgy of leg-pulling; Mr. Corbett-Smith gave us Chevalier songs and sketches; the orchestra played the dance music with the abandon of Viennese; and after a warm tribute by the station director to the hard work and loyalty of Mr. W. N. Settle, the deputy director, and the staff, the evening ended with "Auld Lang Syne," echoed, we are sure, in thousands of homes.

Of recent happenings an all-British orchestral night gave us much pleasure, especially as it included a performance

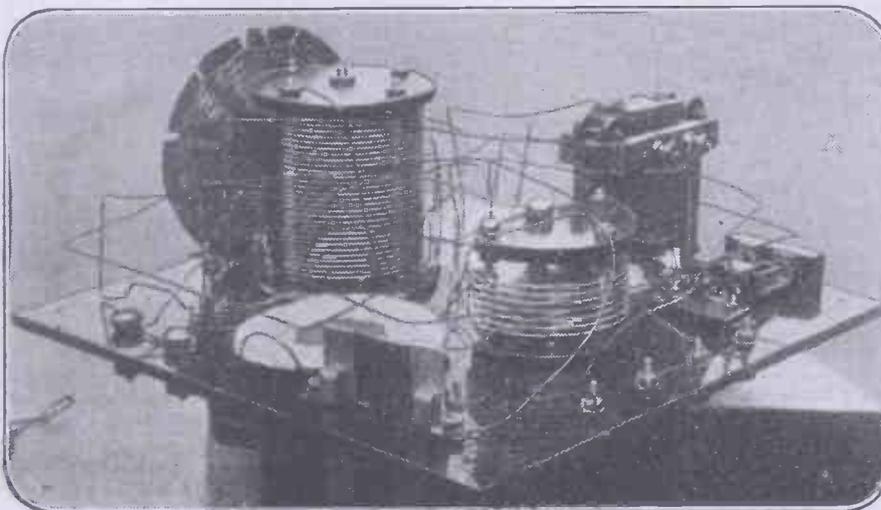
of Edward German's "Welsh Rhapsody." We are content to balance that against the somewhat dull performances of Shakespeare's "Falstaff." The intention of these was worthy of all praise; but, as Dr. Johnson remarked, "Sir, I have no patience with a man who means well." On the other hand, "Paola and Francesca" proved a veritable triumph for all concerned. It was admirably produced, and Miss Haidée Gunn, most distinguished of Shakespearean actresses after our beloved Ellen Terry, came down to play Lucrezia.

Her reading of this, the finest part in the drama, together with her exquisitely beautiful voice, came as a revelation to us all and gave us great pleasure. There are rumours that we are soon to welcome Miss Gunn once again in some Irish plays. Headphones will be at a heavy premium that evening.

High Praise.

A Sunday or so ago we had another Wagner night, with the "Siegfried Idyll," the Preludes to "Parsifal" and "The Mastersingers," and Mr. John Perry, the well-known Wagnerian tenor. On August 5th the series of Beethoven symphonies were continued with No. 2, and the "Egmont" overture.

Incidentally, the constant performance of such worthy music is having a marked effect throughout South Wales and the West Country. A distinguished Bristol musician, writing to the station director, has summed it up in the words, "Speaking soberly, I consider that, at the present time, you are the greatest musical force in Wales, and you should be very proud of your work." The remark is borne out by the ever-increasing number of letters received at the station with appreciative comments and request items of genuine merit. The "popular" requests are as steadily decreasing.



Another view of the interior of the "P.W." Combination Set. The additional anode condenser can be seen in the immediate foreground.

THE "P.W." COMBINATION SET.

(Continued from page 883.)

considerable amount of time was spent in solving the problem of obtaining a "silent" circuit, and amateurs undertaking the construction of the units will be well advised to strictly adhere to the instructions laid down in the first four sections of the article.

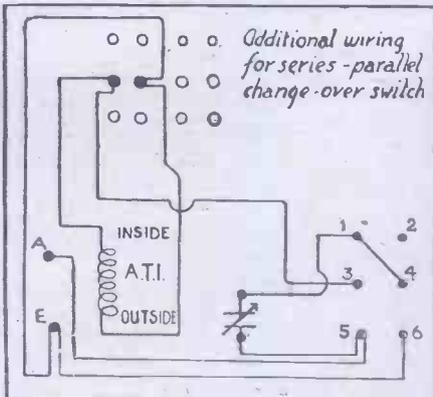


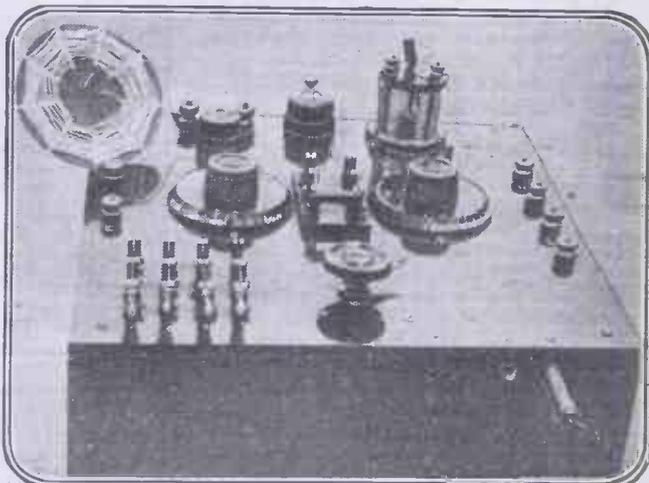
Fig. 2.

Probably it will be noticed that the photographs show the inclusion of an R.I. low-frequency transformer. Due credit must be paid to the manufacturers of this instrument inasmuch as when the transformer, the construction of which was detailed in a previous issue, was taken out and the present one put in its place, a decided increase in signal strength was noticeable, fully justifying the additional expense involved in purchasing this component.

No doubt quite a number of amateurs not in possession of lathes or suitable winding machines will prefer this course to that of tediously winding a transformer by hand, and in this case the R.I. type is to be strongly recommended.

In conclusion it is to be hoped that the constructional details have been found sufficiently clear to permit the reader to carry out the construction of the set without

difficulty, but should any reader find himself unable to grasp any little detail the technical staff will be only too pleased to help him out. All letters in respect of the POPULAR WIRELESS Combination Set should be addressed to the Queries Dept. in accordance with the instructions given on the Radiatorial page of this issue.



Unit One, showing a loading anode coil. The switches and plug are in the "dual" positions.

INEXPENSIVE TOOL KITS FOR THE WIRELESS AMATEUR.

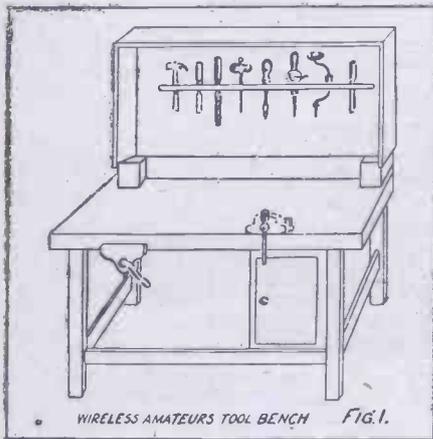
By RADIOGRAPH.

ONE of the most attractive features connected with the construction of wireless apparatus as a hobby is that wonderful results can be obtained by the aid of a few simple hand tools, provided that these are carefully selected and properly used, and whilst most of us aspire to the possession of a full-grown workshop, we do not intend to delay our experimental researches until our ambitions are realised. Wireless amateurs are drawn from all occupations and therefore many are somewhat handicapped when about to select the tools and equipment they require to enable

bench illustrated in Fig. 1, which can be purchased ready for use or constructed by the amateur himself if he happens to be skilled in the use of woodworking tools. When the lid containing the tool rack is closed down, the bench can be used as an ordinary table, and may even replace the kitchen table used in small houses, a fact that will possibly induce Mrs. Wireless Amateur to allow it the necessary space in her kitchen. The cupboard beneath the bench can be used for storing parts of work in progress, stores and accessories, whilst by fitting an aerial and earth terminal the bench can be used for the support of instruments undergoing tests. A woodworking vice, fitted in the position indicated, is a very valuable addition, and a small detachable metal vice of the kind to be described later should be regarded as indispensable. The great advantage such a bench possesses is that it enables one to clear up at the end of an evening's work leaving everything in order, and ready for the next evening's efforts, at the same time offering no real obstruction to the busiest housewife who graciously allows the kitchen or back room to be used as a temporary workshop.

a more ambitious programme will require other measuring instruments, but for the time being we will confine our selection to such as the indoor amateur will require.

Tools for Cutting Metal Sheet.—Those who have endeavoured to cut sheet metal with an ordinary hack saw find that they have discovered a very quick method of ridding the blade of its teeth, and if the process is persisted in the tool bill for cutting a small piece of metal sheet may amount to far more than the metal is worth. Shears are the

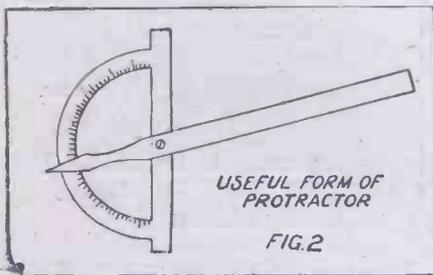


WIRELESS AMATEURS TOOL BENCH FIG. 1.

them to produce receiving sets, and so I am offering a few suggestions on this subject in the hope of assisting those of my brother amateurs to whom such may appeal. Sometimes our excursions into the realms of scientific research would be regarded less unfavourably by the goddess who presides over the kitchen or back room which has to be converted into a temporary laboratory, if our efforts were not accompanied by such a dreadful mess. The best way to avoid adverse criticism of this kind is to arrange our tool equipment in an orderly fashion, which in addition will save an enormous amount of our precious leisure hours and enable us to produce better results all round.

A Neat Arrangement.

The Wireless Amateur's Tool Bench.—For amateurs who have to conduct their operations in some part of the house, there is nothing better than the kind of tool



USEFUL FORM OF PROTRACTOR FIG. 2

Use of Callipers.

The Selection of Suitable Tools and Measuring Instruments.—First let me point out that you will need a circular wire gauge and an adjustable calliper gauge, which serves as a rule, inside callipers and outside callipers. The micrometer mentioned in connection with purchasing parts is more useful to amateurs who use a lathe, and whose needs will be discussed later. In addition to the rule on the calliper gauge, a 6 in. steel rule marked off in $\frac{1}{16}$ in. at one end and a good boxwood rule of the 2 ft. folding type will be required, and above all the amateur should accustom himself to

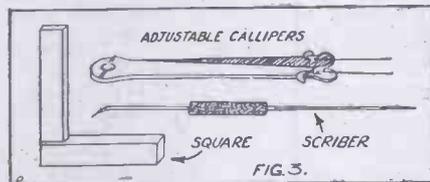


FIG. 3.

working to very accurate measurements from the start. A great deal of time and trouble can be saved in marking off condenser, variometer and other scales, and the like by the use of the form of protractor shown in Fig. 2, which can be purchased at any tool store for about 4s. In Fig. 3 a selection of other useful tools is shown, consisting of a square, a scriber, and pair of adjustable callipers. The latter can be used for inside and outside measurements, by replacing the ends a set of which is provided. Separate ends, can also be fitted so that the instrument can be employed for marking off work as dividers or odd legs. Those who undertake

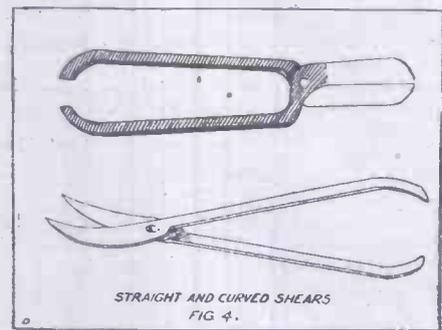
proper tools to use for the purpose, for if carefully operated they will cut the metal straight and clean, in a fraction of the time taken by the saw and without chance of injury to the implement.

Essential Tools.

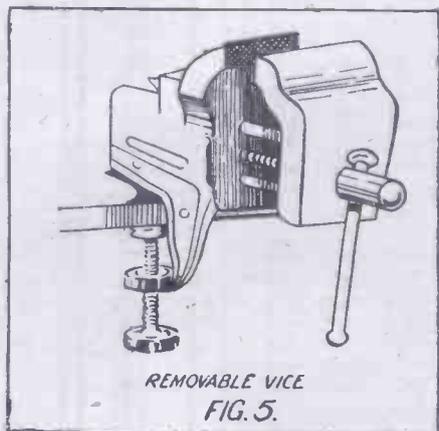
Two kinds of shears are recommended, these being shown in Fig. 4 having straight and curved blades respectively. They need not be too large, and if both pairs are about 8 in. in length they will be found suitable for any job we are likely to encounter, the prices for these tools are about 1s 5d. and 2s. 1d. Whilst considering the purchase of shears we should not forget to buy a strong pair of ordinary scissors of convenient size, as these will be continually required.

There are a good many inferior vices on the market which should be carefully

(Continued on page 886.)



STRAIGHT AND CURVED SHEARS FIG. 4.



REMOVABLE VICE FIG. 5.

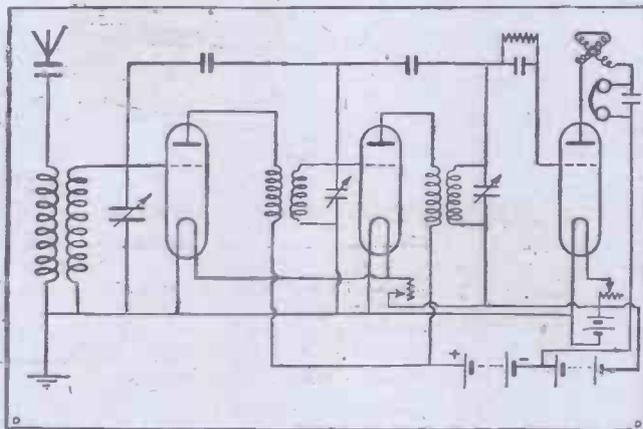
OUTLINE OF THE NEUTRODYNE RECEIVER.

Briefly describing a new circuit designed with a view to permitting stable H.F. circuits to be employed.

ONE of the greatest problems confronting the designer of high-frequency amplifying units is the elimination of oscillatory effects which are set up in the receiver circuits owing to the action of either valve self capacity or transformer coupling. The neutrodyne receiver is the outcome of experiments which have been conducted with a view to overcoming the difficulty, and the research has been attended with a great deal of success.

Stabilising Condensers.

The circuits of the neutrodyne receiver are shown in the theoretical diagram,



and it will be observed that the wiring is similar to that employed for the ordinary type of high-frequency amplifier, but possesses in addition two very small capacities between the grids of the various valves.

These capacities are shown in the diagram as two small fixed condensers, although in the actual circuit under con-

sideration they consisted of two pieces of insulated wire, each wire passing through a small brass tube.

It will thus be realised that the resultant capacities are very small—they should equal about one quarter of the capacity of the valve—and that the components referred to actually constitute two small capacities in series.

Their adjustment, which is somewhat of a delicate operation, will vary according to the type of valve used and should be found by actual test. The chief claim for this design of receiver is that the internal capacity of the valve is "neutralised," and that, therefore, any tendency of one stage of amplification to react on to another is prevented.

of the coupler, an additional coil was wound over the secondary winding and earthed, thus preventing energy from passing to the secondary from the primary through the capacity between the windings. If several stages of amplification are employed, each stage should be shielded to prevent the effect of magnetic reaction.

The introduction of a variometer or a tuned coil into the plate circuit of the detector valve will increase the amount of amplification, but such regeneration will be found to give the best results on low wavelengths round about two hundred metres.

Interference Eliminated.

It should be understood that owing to the properties of the circuit the inclusion of reaction will not energise the aerial, the oscillations being confined to the detector circuit. It will thus be seen that continuous wave reception is possible with this receiver without jamming other receiving stations in the locality, the heterodyning action being confined to the detector circuit without energy being conveyed to the high-frequency amplifying circuit and thus to the aerial.



The Chief Wireless Officer operating the radio equipment of the gigantic American liner S.S. "Leviathan."

INEXPENSIVE TOOL KITS FOR THE WIRELESS AMATEUR.

(Continued from page 885.)

avoided, for as the vice is required more frequently and more continuously than any other tool, nothing but the best is good enough. We have to remember, too, that our vice must be readily detachable from its fixture, in order that the lid of the tool bench can be closed down when we have finished work, which factors lead me to recommend the pattern illustrated in Fig. 5. The size with 2 in. jaws only weighs 3½ lbs. and costs 6s. 6d., but a smaller pattern of the same type can be bought for 3s. 3d. It will be noticed that a small anvil is formed on the fixed portion which will be found very useful

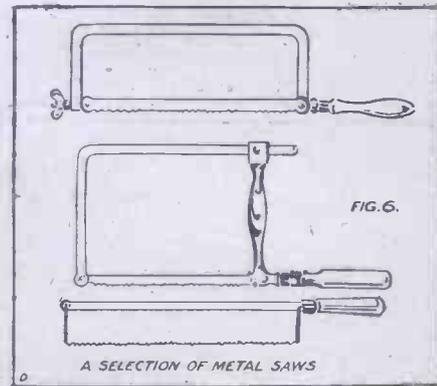
for various purposes, though the reader is cautioned against making use of this small anvil for continuous and heavy work.

Various Saws Necessary.

Saws for Wood, Metal, and Ebonite.—The ordinary wood saw, about 18 in. in length, will be needed for the various woodwork jobs encountered by the wireless amateur, and a 9-in. tenon saw is worth its place in the outfit, though neither of these tools should be used on ebonite, and, of course, no one dreams of trying to cut any kind of metal with them. Ebonite has the peculiarity of taking the edges off all tools used for cutting it, and therefore only partly worn blades should be used for the purpose. The hack saw shown in Fig. 6, is useful for round ebonite as well as metal, but sheet ebonite should be cut with the use of a frame saw, similar to that shown, for in attempting to cut the material with a shallow frame saw the latter is apt to get in the way and perhaps split the material.

The brass hack saw shown makes a further useful addition to the selection of saws, and is valuable for dealing with such parts as valve legs, plug ends of coils and similar fittings.

(To be continued.)



You are destroying your Valves— Spoiling your Tuning—DO YOU KNOW IT? Why LISSENSTAT Control has been introduced—

The filament of a valve most often breaks at the moment of cooling. Switch off with your wire rheostat—see how suddenly your valve goes out. This jerky, violent effect of your wire rheostat results in the sudden cooling and contracting of the delicate valve filament—very bad for the valve. And if the filament of your valve happens to be jarred ever so slightly at the instant you switch off with your wire rheostat the filament will break ninety-nine times out of a hundred, even though the valve be brand new. Apart from its inefficiency, the wire rheostat RUINS VALVES.

The alternative is the new LISSENSTAT control, which, apart from its efficiency, allows the delicate filament to adjust itself to finely graduated temperature change. LISSENSTAT CONTROL LENGTHENS THE LIFE OF VALVES OFTEN ONE-THIRD TO ONE-HALF. The LISSENSTAT is smooth, stepless, noiseless—such a fractional current can be passed through the valve filament that it is impossible to trace a glow in the metal. Yet control is in one knob. The LISSENSTAT should be used for long distance work always.



Control the Detector and each H.F. valve with a separate LISSENSTAT. One LISSENSTAT may be used to control three stages L.F. (although individual control is better even here). REPLACE ALL EXISTING FILAMENT CONTROL DEVICES WITH LISSENSTAT CONTROL—LISSENSTATS should certainly go into every new receiver to SAVE VALVES AND IMPROVE TUNING. Length under 2", diameter 1 1/2"—LISSEN ONE HOLE FIXING

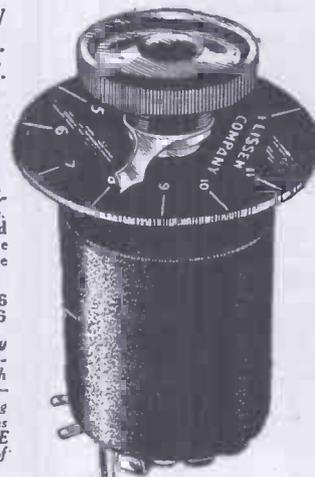
IT SAVES ITS OWN COST

Where this LISSEN REACTANCE (Prov. Patent) should be used.

This LISSEN REACTANCE (Prov. Patent) can be used by itself for one or two stages H.F. The best combination is LISSEN REGENERATIVE-REACTANCE for the first stage and this LISSEN REACTANCE for the second stage. Either unit can be purchased first, and the other added in the appropriate position when the second stage of H.F. is desired.

Range, 150 to 600 metres.. 27/6
Range, 150 to 10,000 metres 32/6

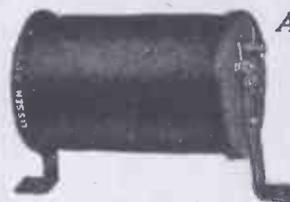
Blue prints sent out show the easy connecting-up of the LISSEN radio-frequency units—there is no switch to connect—everything is complete—no soldering even, although soldering tags are provided—no complications—and LISSEN ONE HOLE FIXING makes fitting a matter of 2 minutes.



Use also the LISSEN TUNER

150 to 4,000 metres with a '0005 condenser (preferably use the LISSEN MICA VARIABLE CONDENSER) complete with 11-point switch already mounted and connected—4" long, diameter also 4"—LISSEN ONE HOLE FIXING

WATCH FOR LISSENAGON (P. Pat.) AIR SPACED COILS



AUDIO FREQUENCY

The Transformer behind the Detector

Valve should have a high primary impedance, but not a high ratio. A ratio of 4 or 5 to 1 is not suitable. The LISSEN Type T1 DISTORTIONLESS TRANSFORMER is the only transformer whose design and windings make it ideal for the exacting conditions of the first stage of L.F. amplification. No other transformer has the correct ratio or a sufficiently high primary impedance for this purpose. The LISSEN T1 has a beautiful coil—the most expensive of any. It weighs 8 ozs. Every turn of its many thousands is wound by patent process. Use it (particularly) for the first or any stage

Tests prove that it is better than any other to have a LISSEN Type T1 behind the detector valve. 30/-

DO NOT USE A REJECTOR CIRCUIT!

Choose any station and bring it nearer—with LISSEN REGENERATIVE-REACTANCE (P. PATENT). A rejector circuit depends upon the use of an extra inductance and variable condensers. It may make tuning out possible, but the variable condensers damp down signal strength so much that tuning-in becomes extraordinarily difficult. This muffling effect makes a rejector circuit practically useless for long-distance work. It is certainly most unsuitable for English Broadcasting conditions. Obviously it is the negative way of achieving selectivity.

The LISSEN REGENERATIVE-REACTANCE (P. PATENT), on the other hand, is in itself highly selective, and at the same time it actually builds up signal strength. It is possible to cut out 2 L O from close in—Birmingham, for instance, will come through loudly on two valves without a sign of 2 L O. The other Broadcasting stations also come in, and the tuning in of the Continental Station is extremely easy—at FULL BUILT-UP STRENGTH. The LISSEN REGENERATIVE-REACTANCE (P. Patent) is the constructive method and very much the better. Always tune the LISSEN REGENERATIVE-REACTANCE (P. Patent) with a vernier (preferably the LISSEN VERNIER, barely 1" diameter, designed for fine tuning in H.F. circuits, price 12/6).



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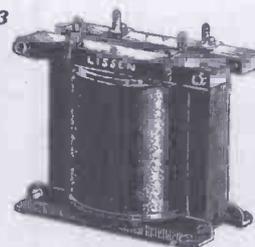
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For 2nd and 3rd stage L.F. the Transformer

need not have such a high primary impedance, and the ratio may be higher. The LISSEN Type T2 Transformer should therefore be used .. 25/-

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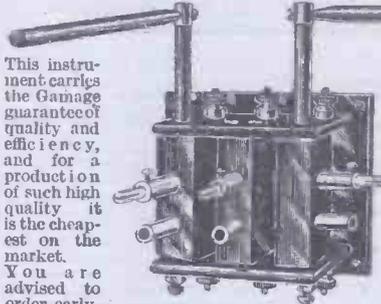
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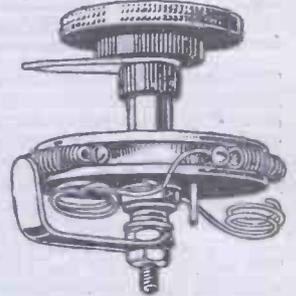
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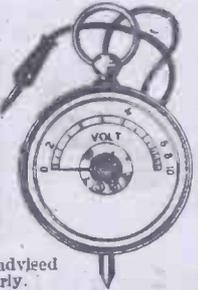
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SUMMER-TIME WIRELESS.

By OSWALD J. RANKIN.

PART III.—Frame and Kite Aerials. Describing some novel types of aerials suitable for out-of-doors wireless work.

SO far we have been concerned with ordinary single wire aerials with "free" or "open" ends; that is, with aerials connected through the receiver to the earth. It is now proposed to describe a simple frame aerial suitable for use with an outdoor portable set.

Before proceeding with constructional details, it may be well to explain briefly the difference between the "open" and the "closed" or "loop" aerial. It has already been pointed out that the efficiency of an open aerial depends mainly on the height and length, and for this reason it is erected out-of-doors, where space is less limited. This does not mean that it is not possible to arrange a similar aerial indoors, neither does it imply that closed aerials are not suitable for outdoor work.

Selectivity.

An outdoor aerial having an open end will respond more readily to the incoming electrical vibrations than a frame aerial having both ends joined to the receiver and thus closed. Where the open-end aerial will effectively operate a fairly simple receiver, the frame aerial will require a certain amount of boosting up before it will perform the same duties. Broadly speaking, the strength of the signals received on any frame aerial, however efficient, will only equal about 35 per cent of the actual signal strength obtained on an outdoor aerial, using the same receiver.

This means that a greater degree of amplification must be employed when using a frame aerial. It is obvious, therefore, that for general purposes the open aerial is preferable to the loop. The selection of either is, in many cases, a matter of convenience; and this also applies to outdoor portable installations, since the frame aerial becomes more adaptable to receiving units on moving cars, etc., than the ordinary aerial and earth system.

We must not overlook the fact that the frame aerial, although necessitating a little extra outlay on the receiver, possesses one or two admirable features. It is highly selective; that is, its directional properties tend to minimise interference or jamming from other stations working on near-by wave-lengths, and also permits very sharp tuning. By simply winding the wire round an insulated frame, in helix or spiral formation, we obtain a modified form of an inductance coil, and by winding on a sufficient number of turns to correspond with

the wave-length used by the transmitting station the aerial actually functions as a tuning inductance, and in most cases the receiver is tuned in with no other tuning device than a large capacity variable condenser.

Maximum results are only obtained when the frame is pointing edgewise to the transmitting station, because of the difference in phase produced in the opposite sides of

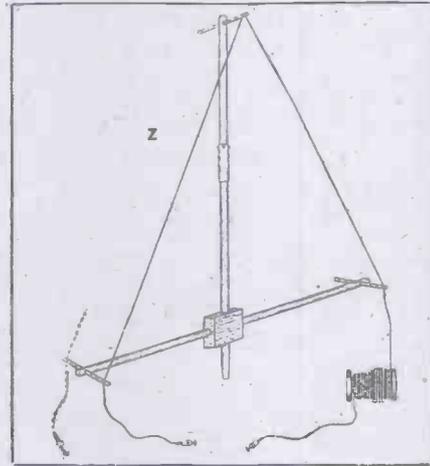


Fig. 6.

the winding. The incoming waves strike one side before they reach the other, and this alternate striking results in the production of high-frequency currents, as in the case of an outdoor aerial arranged in one single length. If the frame is rotated through an angle of 90 degrees so that it squarely faces the transmitting station, no signals will be heard because the waves will then strike both sides of the winding simultaneously and produce an equal and opposite potential which results in neutralisation.

Construction of the Frame.

From this it will be seen how simple it is to tune out any unwanted station and to determine the exact position of any particular station. These remarks apply to frame aerials generally. The instrument to be described has been specially designed by the author to give maximum results with suitable outdoor portable sets on the broadcasting wave-lengths.

The general arrangement of this will be easily understood by referring to Figs. 6 and 7. The stand used by the author was an old half-plate camera tripod, but a suitable substitute can be made up in the manner described below. Broom-handles feature rather prominently in this instrument, but if they are well smoothed down with glass-paper and given two or three coats of shellac varnish, they have a happy knack of becoming less domestic and more scientific-looking. Altogether, ten broom-handles will be required, each 1 in. in diameter by about 4 ft. long.

Two of these are cut 2 ft. 7 in. long, slightly tapered off at one end, and drilled through the other end to take a piece of 3/8 in. round ebonite or fibre rod, as shown in Fig. 5a. These rods are each 8 in. long, provided with small grooves 1 in. apart, as shown at 2, Diagram V, and made a "friction-tight" fit in the holes in the ends of the arms. Two other pieces of broom-handle are each cut 3 ft. 3 in. long, and one of these is fitted with a brass tubular socket, as shown at 3, which is made to fit tightly over the end of the other piece. These two sections form the main upright arm, and a third spreader is attached to the top. A block of hardwood, 3 in. square by 2 in. in thickness; is bored with a 3/8 in. auger, as shown in the sectional Diagram W, and the tapered ends of the arms were made to fit firmly into these holes.

The Aerial.

One of the short lengths left over from cutting the arms is tapered at both ends and driven securely into the bottom of the block, as shown at Z. Another of these short pieces is also tapered at one end to form a handle, when fitted into the manipulating pillar, X, which consists of a 12 in. length of wooden curtain rod, 2 in. in diameter, bored down the top to take the lower end of the short tapered peg attached to the bottom of the block, and provided at the lower end with a 4-in. length of 1/4 in. round brass rod with a thumb-screw and spring

(Continued on page 890.)

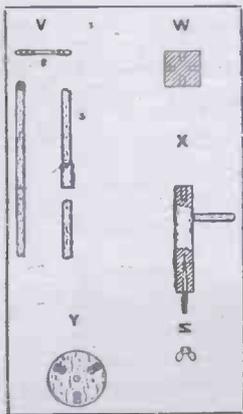


Fig. 5a.

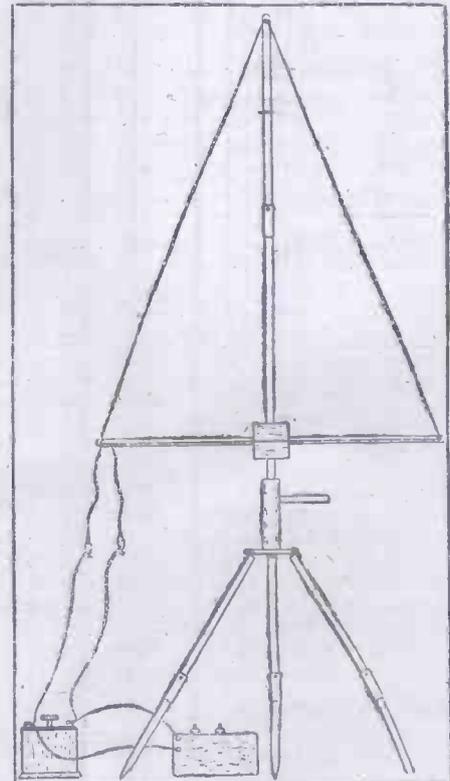


Fig. 7.

SUMMER-TIME WIRELESS

(Continued from page 889.)

washer. This rod can be tapered off to a point and firmly driven in, or clamped to a metal flange which is screwed to the bottom of the pillar.

If an old camera tripod is not available, it will be necessary to construct a simple collapsible stand. This is made up from three lengths of broom-handle hinged to a wooden disc drilled through the centre to take the $\frac{1}{4}$ in. brass spindle, as shown in Diagram Y, and joined to three other lengths by means of brass tubular sockets.

All the wooden parts are now given two or three coats of thick shellac varnish, and, when dry, they may be strapped together to form a very neat bundle, all ready for the journey. The aerial consists of a 100 ft. hank of 7/26 stranded bare copper wire, with a small terminal soldered to each end, and this is preferably wound on a large diameter wooden reel. At the selected spot erect the frame, pushing each section into its respective socket with a slight twisting movement, and see that the spreaders are at right-angles with the central hub.

No Coils Necessary.

Wind on the whole hank of wire, commencing the winding by taking a few turns round the outside groove of the lower left-hand spreader, and winding in a clockwise direction. This amount of wire will equal five complete turns. The other end is anchored in the same manner, the exact position of this being on the other end of the same spreader, as indicated by the dotted line in Diagram Z. About 18 in. of wire will be left over at each end, and two insulated leads are taken from the terminals to a .00075 or .001 mfd. variable condenser, which is then connected to the aerial and each terminal of the receiver, as shown in Fig. 7.

The receiver should be minus the usual aerial tuning arrangements, the tuning being accomplished by the large capacity variable

condenser. An ordinary receiver, complete with tuning arrangements, can easily be adapted to a frame aerial by simply disconnecting the coils and connecting the leads from the condenser to the grid and negative filament of the first valve.

Results.

This aerial, constructed and wound exactly as described, has always given excellent results on the broadcasting wavelengths, under both favourable and adverse circumstances. During the early tests, prior to its appearance in the limelight, it was situated outside the workshop, in a low-lying neighbourhood, surrounded on all sides by corrugated iron buildings.

A simple valve-crystal circuit to be described, amongst others, shortly, was selected chiefly on account of its simplicity, and the morning concert from 2 L O came through even better than when using the ordinary aerial, which is 35 ft. high. This, of course, was attributed to the direction-aleffect. With the same circuit on the Surrey Downs the results were really

astounding, and most of the other circuits to be described gave equally good results.

Those who prefer something in the nature of a novelty, and who are possessed of a fair amount of patience and good temper, can find an outlet for their ambitions by trying a few experiments with a kite or balloon aerial. Those, however, who have had little or no experience with kite flying are strongly advised to first take a few lessons before entertaining the idea. It is a mistake to walk into a toyshop and invest a shilling on a toy kite with the idea that success will attend the venture. Naturally, the more expensive the kite, the more efficient will it be, and the last ounce of efficiency is required in this case.

The aerial wire, which should preferably be of 22 S.W.G. bare aluminium, is attached direct to the kite and carefully "played out" until the kite is "riding" nicely. An egg type insulator is attached to the lower end, and this is secured to a stake, firmly driven into the ground, by means of a piece of cord and a torsional or "compensation spring." A rubber-covered lead-in wire is connected to the aerial and should be sufficiently long to allow for the swaying of the aerial, and preferably suspended over an insulator attached to a supporting arm, as shown in Fig. 8.

A Warning.

There is ample scope for experimenting in this direction, and if one is at first not altogether successful, he at least has the satisfaction of knowing that he has had a certain amount of fun out of the venture. Success will depend chiefly on knowing how to handle the kite.

Half a dozen or so of large rubber balloons, filled with hydrogen and enclosed in a light net, may be used in place of the kite, if desired. These can be filled for a trifling sum at a chemist's. The general arrangements of such a method would be similar to that shown in Fig. 8. This type of aerial will have a strong tendency to collect atmospheric electricity, and under no circumstances should experiments be attempted when there is thunder about.



Fig. 8.

GRADING SIGNAL STRENGTH.

WHEN carrying out tests or taking observations on reception, amateurs will find that the following system will prove extremely useful. There is nothing new in it, it was employed by the wireless sections of the various services and in the Marconi Company years ago, but it will doubtless prove new to the new enthusiast. The word "new" is used in respect of those people who have adopted wireless as a hobby since the advent of broadcasting in this country. Briefly, the system consists of coding the various strengths of signals in the following manner.

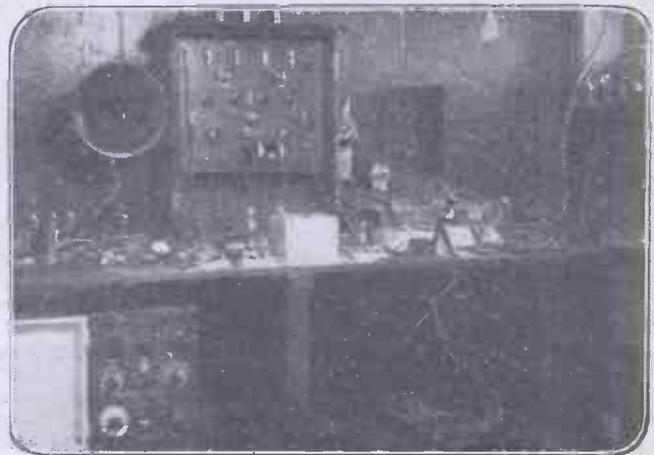
Simple Divisions.

R 1 is taken as representing so faint a signal that it is almost inaudible, and certainly not understandable or readable, while

R 9 indicates a "loud speaker" signal. Between these two limits gradation is carefully obtained by calling R 2 practically inaudible but with straining just readable, R 3 very faint but readable, R 4 just comfortably readable, R 5 comfortably readable, R 6 comfortably audible and a bit to spare, R 7 loudly audible in telephones, R 8 louder still, and R 9 extremely loud. "Readable" refers to the deciphering of Morse code, but it can be adjusted to understandable in the case of telephony.

This system cannot claim to be scientifically accurate in its interpretation of the strength of signals, but it is wonderful to

note the similarity in the reports of operators well versed in the coding of signals when listening in to the same station under exactly similar conditions.



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AERIAL WIRE, 7/22, guaranteed hard-drawn copper, 100 ft. (postage 1/-)	1/10 ½	CRYSTAL CUPS, 4 screw	each	2d.	TAPPED INDUCTANCE COILS, 20 tap-pings, wound to 1,600 metres	each	2/6
CONDENSER VANES, fixed or moving, per doz.	3½d.	FIXED CONDENSERS, all capacities	each	10½d.	VARIOMETERS (Tube type), complete with knob	3/11 and 2/11	
REAL GOLD CAT'S WHISKERS	each 2d.	EBONITE, cut to any size by machinery while you wait	per lb.	3/6	DOUBLE 'PHONE CORDS, full length	11½d.	
SILVER "CAT'S" WHISKERS	per doz. 1/5	TELEPHONE TERMINALS, nuts and washer, each	1½d.	1/3	HERTZITE, Genuine Large Piece	9½d.	
CONDENSER SCALES, 0 to 180	each 1d.	W.O. TERMINALS, nuts and washer, each	2d.	1/7	TALITE	9½d.	
IVORINE LABEL SET, 12 different titles	6½d.	PANEL BUSHES, drilled	each	1½d.	PERMANITE	9½d.	
BATTERIES, 4½ volts, each	3d.; per doz. 2/9	TOP CONDENSER, bushes	each	1d.	ZINCITE	9d.	
BASKET COILS, set of 6, up to 3,000 metres	2/4	BOTTOM CONDENSER, bushes	each	1d.	BORNITE	6d.	
SLEEVING, 3 yds. assorted colours, for	11½d.	BELL WIRE, tinned copper, 12 yds.	6d.	7d.	MIXED CRYSTALS (6 kinds)	9d.	
		VALVE LEGS, nut and washer	each	1d.	CARBORUNDUM	5½d.	
		VALVE PINS, nut and washer	per doz.	10d.	ZINCITE and BORNITE, both in box	1/-	
		PLUNGER SPRINGS, complete	each	1d.			

IMPORTANT NOTICE. We have repeatedly said **DON'T PAY MORE**, and having served the masses well, the large return of business has made it necessary for us to acquire extensive additional premises adjoining our present address. Follow the Crowd to Elkay Corner

"ELKAY" WIRELESS CO., 225 & 227, Bishopsgate, London, E.C.2.

Open Saturday all day. To the Trade—New Trade Counter now open. Send for NEW LIST.

We open Sundays 11 to 2.30. Please remit ample Postage.

Note new Telephone No.: Central 8544.

GRAND FOOTBALL COMPETITION

£500 for only **10 Results**
MUST BE WON

For Full Particulars see this week's

ANSWERS

PROGRESS AND POPULARITY.

"Wireless should be treated as a commercial proposition and not as a toy. The whole business should be taken out of the hands of bag-makers, paper merchants and opticians, and controlled by properly qualified people. Then it would indeed boom," says Mr. L. E. Wilson, A.M.I.E.E., the well-known electrical engineer, in an interview with our Manchester Correspondent.

TRENCHANT and telling sentences these, spoken to me in the course of a most interesting conversation I have had with Mr. L. E. Wilson, A.M.I.E.E., electrical engineer, famed in the North as a pioneer of electrical enterprises and practically concerned with the broadcasting of music under the old electro-phonograph system.

"The coming thing," he said, "is the broadcasting of public speeches. People who address huge gatherings will make themselves heard over a very wide area. This sort of thing, Mr. Wilson reminded me, has been developed already in America. It means that an audience of a hundred thousand can hear one man at a time, hear the voice uniformly and evenly.

"We shall," Mr. Wilson persisted, "see appliances of this kind very shortly in this country. They can be used, too, at coal exchanges and cotton exchanges for disseminating news which every member ought to hear, doing away with notice boards, usually besieged by big crowds, and a multitude of people who have at present to be employed. I may say I have already approached the Master of the Manchester Royal Exchange with the view to this practice being adopted there.

"I have also suggested to the Altringham (Cheshire) show authorities that they should transmit music so that everybody in the showground can hear the same band playing. If the entertainment-tax were only removed we should be able to do it. To realise what can be done in this direction, you have only to look at the great Brighton enterprise, where the music of a band is projected so that it can be heard the whole length of the promenade."

Then Mr. Wilson proceeded to urge that wireless should be treated as a commercial proposition and not as a plaything, but quickly added that he was hopeful because the telephone, when first invented, was regarded as a scientific toy.

Interesting History.

"A Manchester cotton man," he said, "was the first to see the business value of the telephone. He financed it, and the first telephone exchange was erected in Manchester. The French had a service called the theatrophone, and we in this country, thinking it might be applied to church services, brought out an instrument which we called the electrophone. In 1898, when the then Prince of Wales was laid up with an injury at Waddeston Hall, music was broadcast to him by means of this electrophone, so that broadcasting is really a very old institution.

"An instrument was erected at Windsor Castle by which Queen Victoria, who had never used a telephone in her life, heard music. This was the beginning of the development of broadcasting.

"Now we have reached the wireless stage. One thing I will say for the old system, we never forgot we were catering for music-

loving people, and the purity of our transmitters was perfect. As engineers we did not dare to thrust discordant noises on our subscribers."

"Looking to 'Popular Wireless.'"

Mr. Wilson says that we are suffering today because advantage has not been taken of the best electrical study.

"The whole trouble," he said with emphasis, "is that the business has got into the hands of bagmakers and paper merchants and opticians, and I look hopefully to a powerful organ like POPULAR WIRELESS being able to direct it into the hands of properly qualified people. What is lacking is the advice of the expert. One result is that commercial men are not taking the interest in wireless that they would otherwise do.

"Tradesmen have made experiments the result of which any expert could have told them beforehand. They have experimented upon the British public instead of making their experiments in the laboratory. Let us see to this at once and wireless will not only go, but will boom."

I asked Mr. Wilson if he thought Manchester was holding its own in

Glasgow started months after Manchester, but were better advised, consequently they got better results long before Manchester.

Cheap Crystal Sets.

"As for the ordinary man in the street," says Mr. Wilson, "he wants to get enjoyment from broadcasting with the minimum amount of expense, and without requiring any technical knowledge. Therefore the cheap crystal sets are the ideal thing for him, because there are no accumulators and the connections are simple, if only they could give range. A boy of seven could use the crystal set without any difficulty or danger. Developments are taking place by which the public will get valve sets taking the minimum amount of current and abolishing the use of the accumulator. That is a step in the right direction.

"We can look forward to the day," he said in conclusion, "when there will be no power required at the user's end, but that all the power will be supplied from the broadcasting station. That is the ideal system, and it is one that the telephone has to some extent evolved. One need have no fears concerning the future of wireless. It does not present any of the difficulties of telephony. Passing a current over a copper wire is a far more complex business than most people imagine. The popularity of wireless has rather hampered than helped its development in the past. Now we must settle down and apply it scientifically to practical business uses."

Mr. Wilson's last remarks aptly put the whole position of wireless, as applied to broadcasting, in a nutshell. There is no doubt but that a considerable amount of hindrance to the advance of this science has been caused by the sale of inferior apparatus and attempts to boom wireless by wrong methods, and a public once disappointed or taken-in is difficult to convince where the real social and commercial advantages of broadcasting are concerned.



The new type double transmitter, which will be employed at the new broadcasting station on the Aeolian Hall, New York.



the national movement. There was no doubt, he said, that Manchester transmission at the present moment was quite good, and almost equal to any other station in the country; but at one time it was notoriously the worst. It was the old story, Manchester had tried to carry too much on their own shoulders without getting into touch with people who knew something about it.

A NOVEL WIRELESS DEMONSTRATION AT WINDSOR.

Describing a series of interesting experiments concerning wireless receivers on light cars.

By Capt. RICHARD TWELVETREES, A.M.I.Mech.E.

THANKS to the courtesy of the directors of the Daimler and Marconi Companies, I had the opportunity of inspecting a new wireless outfit for small cars on Saturday last. A 12 h.p. B.S.A. car was placed at my disposal for making the journey, and with a party of friends I joined in an imposing convoy of cars starting from Marconi House and bound for Windsor.

apparatus was prepared in a few seconds after the cars arrived, struck one as being very remarkable.

A Compact Receiver.

There is no actual difficulty in making a receiving set work satisfactorily whilst the car is in motion, but the installation on the small B.S.A. cars is not designed with

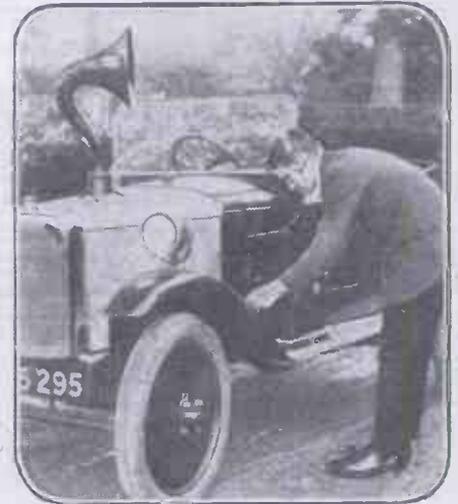
this object. The main practical objection to receiving in motion is the cost of the apparatus in the case of small cars, and it was therefore decided to provide a special form of aerial which can be slung up very easily, and which rolls on to a compact reel when not in use.

The apparatus is made in two types, one consisting of a two-valve "Marconiphone" with two headphones, and the other comprises the last-named set with the addition of a two-stage amplifier and a loud speaker. The smaller set costs £25 complete, so that in buying a new car one would hardly

notice the small additional charge. The complete set with the loud speaker is listed at £55, but it possesses advantages which are well worth the extra cost.

The entire outfit in both cases is mounted inconspicuously on the running-boards of the car, and is neatly covered with a solid leather case, protecting the instrument from dust and rain. A further feature of interest is that the apparatus is arranged so that it can be removed quite easily from the car for use in the house or elsewhere, so that wireless enthusiasts can make use of the one set for a dual purpose.

The current necessary for supplying the valve filaments is derived from the ignition accumulator, which obviates the necessity of carrying extra accumulators whilst touring, as well as the inconvenience of discharged accumulators. Both the "Marconi-



Tuning-in the London Station (2 L O).

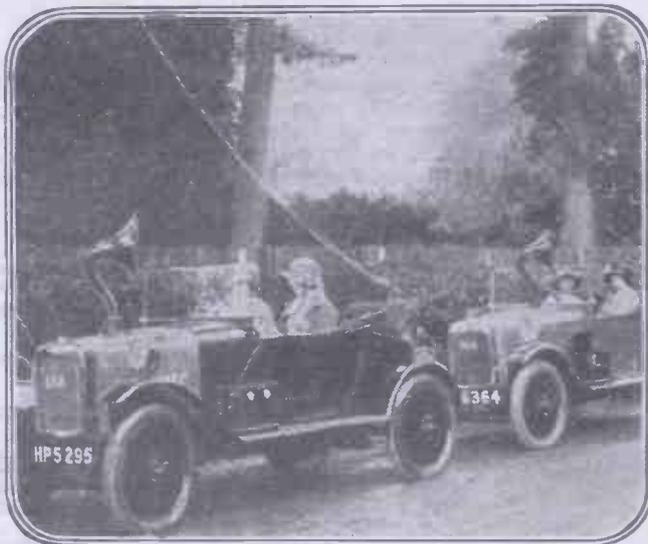
phone" and the loud speaker have rubber pads fitted to their bases, and the whole of the apparatus is constructed in a very workmanlike manner.

The thing which could not fail to attract the attention of the interested observer was that the design had been worked out with the fullest possible appreciation of the wireless-loving motorist, who naturally does not want to spend time on the road in fixing up elaborate and complicated apparatus. The absence of loose external wiring was very conspicuous, and the addition of the set in no way detracts from the appearance of these smart little cars.

A Useful Addition.

When the final bars of the National Anthem had died down, the four wireless cars packed up and, almost before one had time to look round, were spinning along the road towards London, leaving the spectators to gasp at their sudden disappearance and to reflect upon the enterprise of the two companies which hold such prominent positions in their respective spheres of British industry.

In conclusion I should like to advise all motorists to add to their pleasures by taking a wireless set with them on their tours; it is certainly worth the slight extra expense and trouble involved.

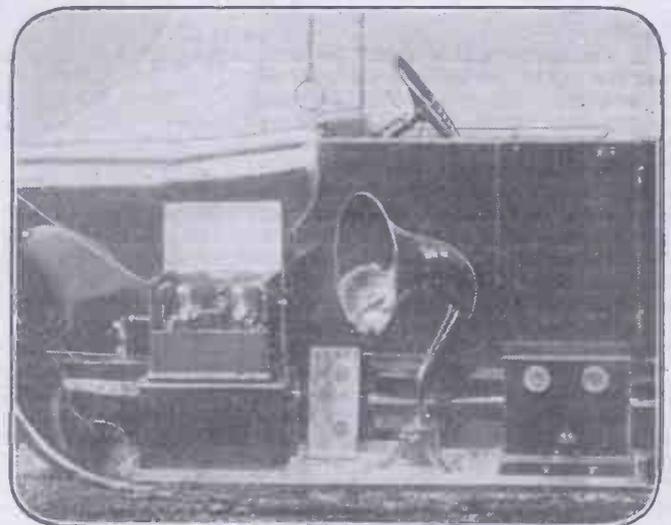


Two of the four B.S.A. light cars built by the Daimler Co., that took part in the demonstration.

Recent advances in the construction of wireless apparatus and the ever-growing popularity of listening-in have excited the interest of motorists in common with all other sections of the community, but the powerful car with its expensive wireless equipment is beyond the means of all but the more wealthy of motorists. The earlier experiments were not brought to a successful issue without a good deal of experimental research, for some difficulty was found in screening the apparatus from the electrical equipment on the cars, as well as from that of passing cars and other vehicles. Ultimately, however, the success was so marked that it was decided to fit out a small B.S.A. car, built by the Daimler Company, with a less-expensive form of receiving apparatus, and four of these little vehicles came up from Coventry for the purpose of demonstrating the apparatus in a practical form.

Rapidly Fitted Up.

The four wireless-equipped cars were lined up in the Great Park at Windsor awaiting the arrival of the convoy of visitors, who were given the opportunity of inspecting the whole outfit very thoroughly, and later of hearing the usual Saturday evening transmission from 2 L O. In spite of rather a bad attack of atmospherics, the musical items came through with great clearness, and the ease with which the



Showing the Marconiphone Receiver comfortably mounted on the running-board.

WINDOWS: FROM A LEADING-IN POINT OF VIEW.

One of the first problems that people installing wireless apparatus come up against is that of getting the aerial into the house without the necessity of leaving a window open. In this article instructions are given for dealing with this in a neat and efficient manner.

A CARPENTER, when about to bore a hole through a window frame, will, after a preliminary inspection, start boring, and the twist bit of the auger will emerge on the outside precisely where he intends it to do. Knowing the construction of the window, he can avoid obstacles. There are not many of the latter, but when one is met with it is nearly always necessary to start an entirely new hole.

A window consists of a frame built in, or fixed to the wall, and a sash which carries the glazed part or parts. The latter may be: (a) permanently fixed, (b) hinged vertically or horizontally, and (c) sliding vertically or horizontally. The majority of windows, therefore, come under the C class, sliding vertically.

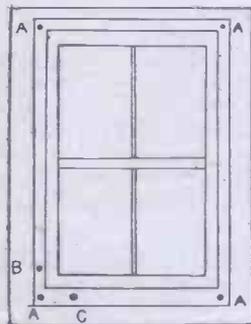


Fig. 1

dated within the frame; if, however, the sash is hinged or slides horizontal, the frame may be, and usually is, solid.

Boring Solid Frames.

The hole may be started at any part of the upright frames excepting the point marked A, Fig. 1. This is unfortunately just the very place where a novice would select; but there are usually nails there, and even a light nail when embedded in wood will utterly ruin a bit. When a jar or click is experienced at each half revolution, it is almost certain a nail is in the way of further boring. Therefore, keep about 2 in. higher or to the side of this point, B or C, Fig. 1.

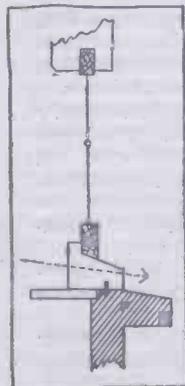


Fig. 2

Secondly, do not bore the hole level, but very slightly inclined, so that the outside or "weather" end is a little lower than the other.

This prevents moisture creeping in on the insulating tube or lead-in wire. Thirdly, make certain when boring through the frame uprights that there is sufficient clearance outside for the bit.

If you decide to try point C, see that the

hole clears the bottom of the sash. This hole will be a much deeper one than B, as it will go through the wooden sill, usually of oak or teak, and sloping down a little to throw rain

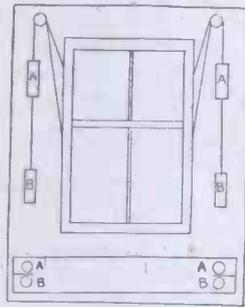


Fig. 3

water on to the stone sill. Make due allowance for this slope when starting the direction of the hole. Imagine the window cut down through the centre and then looked at sideways it would appear as Fig. 2 (or in vertical section). The arrow indicates the correct path of the auger, or bit, through the sill. Endeavour to arrange matters so that the outside hole is close to the upper edge of the wooden sill.

Boring through Hollow or Casement Frames.

The ordinary window with two sashes, one or both movable, has a hollow frame in which are the sashweights required

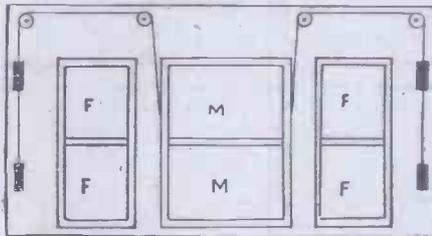


Fig. 4

to balance the sashes. The previous remarks also apply to this type of frame, and in addition the sashweights and supporting cords must be avoided. Weights A A are attached to the bottom sash and descend as it rises, and B B to the top sash ascending when the sash is pulled down (Fig. 3).

There is usually ample space between the bottom of the lowest weight and the edge of the frame to bore even an inch hole. If boring at the top, keep as high as possible; a sharp bit will easily cut the sashcord, dropping the weight to the casing bottom, no easy job to make good again.

Before leaving the subject of wooden frames, a word of warning concerning that type of window known as "Centre-hung Venetian" may be given. Fig. 4 shows the balancing system and the danger of boring over the narrow fixed sashes where one may quite unexpectedly cut through a sashcord.

Steel Casement Windows.

Modern steel casements are arranged to open in various ways, some, but not many, are permanently fixed. In every case the space between the window side and the glass is small. However, that portion of the casement embedded in the cement, etc., is usually quite small, and by carefully chipping out (from both sides) with a sharp cold chisel a way outside the frame may be cleared, suitable for a rubber-covered lead-in wire, or an ebonite or fibre tube well warmed and bent to a suitable curve to pass through the hole. The external portion of the tube should turn downwards, to exclude rain-water.

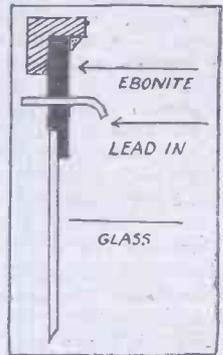


FIG. 5.

Should the window possess some small fixed panes, a small section of one may be cut out and replaced by an ebonite or hardwood sheet, thicker than the glass and recessed as in Fig. 5. This sheet should be drilled and fitted with a turned down lead-in tube before finally fixing with putty. Alternatively, the glass itself may be drilled, a process already described in POPULAR WIRELESS.



Adjusting W J Z, the new American broadcasting station, to 455 metres.

"Stand By—"

POLDHU STATION

At Loggerheads—Mathematical Cinquevallis—An Old Joke—Fifty-Fifty—Sizing Up—A Joint Effort—The Valve: A Pussyfoot Version—Animals and Wireless.

At Loggerheads.

THERE are times when that peskily clever secretary of our local wireless club gets me on the oscillation point. The discussion had been on what our president had called a mathematical formula to determine how many beans make five, or something else equally important. In the formula was the word log. Being always ready to display my ignorance in the form of a dark background for the bright and scintillating intelligence of men of genius, I blandly asked what a log was. Our clever secretary replied curtly:

"A log is an index, of course."
"Really," I could not help retorting, "and a snark is a boojum, of course."

Mathematical Cinquevallis.

Seriously, though, I do admire those mathematical Cinquevallis who can do such wonderful conjuring tricks with letters and figures. When a mathematical prodigy, however, begins to throw pies and logs about, I, for one, am bound to seek cover. From what I can make of it, this mathematical juggling looks a bit risky. One little plus sign in the wrong part of the boat and the whole cargo goes overboard.

Still, I suppose that we could not get on very well in wireless without the mathematician, and as far as wireless is concerned we must obey the Chief Scientific Adviser to POPULAR WIRELESS when he lays down the law in "Wireless Review" that after figures the unit of measurement should always be stated.

An Old Joke.

I once bought it very badly on this particular business of mentioning the unit of measurement. The occasion was my first entry into a science class at school.

"How old are you?" asked the man of science.

"Twelve, sir," I replied bravely.

"What, months?" bellowed the man who held first-class diplomas in odifery and the theory of explosives.

The joke is an old one, and has been perpetrated millions of times, yet it emphasised to my mind the importance of just mentioning the unit when giving a numerical statement.

Fifty-Fifty.

"To say that the height of a post is 50, means nothing," says Sir Oliver Lodge.

Right, but for an American to say that he will go fifty-fifty with you over a deal means a good deal to you if you keep the insulation covering off your eyes.

Sizing Up.

I can imagine that peskily clever secretary of our local wireless club selling a pair of boots to a customer after having read his "Wireless Review."

PESKILY CLEVER SECRETARY: "And what size may I get you, sir?"

CUSTOMER: "Sixes."

P.C.S.: "Sixes in what?"

C: "Boots."

P.C.S.: "Thank you, I understand that, but I am not clear as to the unit of measurement implied. Sixes in what unit?"

C. (rising to the occasion): "Feet."
(Collapse of Peskily Clever Secretary amongst his boot-laces.)

A Joint Effort.

Joints both of the electrical and of the meat variety should be avoided if possible, especially during the hot weather. A



The King of Spain (right) listens-in on a Marconi portable wireless set.

badly done joint, or one that has a high frequency, may introduce sufficient impedance into the family circuit as to cause hysteresis. Some joints are better when treated with spirits of salt, others are better when treated with salt, while the worst of them should be promptly earthed.

The Valve: A Pussyfoot Version.

Without undue exaggeration, I think I may claim to have read all the popular expositions on the way a valve works, but I have never read anything so good and so refreshingly original as Captain Eckersley's article on the valve in POPULAR WIRELESS of July 21st. The description of the little people with their parcels of

electricity, the tremendous attraction the "Positive" pubs. have for them, and the way they remain glued to the bar inside the pub. until other little people, more drunken than themselves, push them out of the bar, is the most attractive and illuminating thing I have read on valves.

In due respect to our cousins on the other side of the Atlantic, I consider it necessary to give a dry or non-alcoholic version of Captain Eckersley's simile.

Right thar along Main Street, Toobe City, Texas, the li'l electron guys hiked it, jostling and cannoning and swarring. Gee, but I guess it was some hot. Each of the li'l electron guys was chewing gum, but nobody, not even Ed. Armstrong, knew what was in that gum, only on the outside of the paper containers was written "Wrigley's Hee-lectricity." Gee, but it was some hot.

The li'l electron guys reeled along, expectorating on the bare plank sidewalk now and then to kule things down a bit. Pelham R. Oton, the foremost hiker, hitched up his pants and beat it harder, for he disarned an ice cream parlour with the li'l positive sign at the corner of the next block.

The li'l electrons were thirsty. They wanted strawberry sundaes and orangeade, but none of them had that longing for near beer which comes from being far from it.

Pelham R. Oton and the li'l electrons rushed the parlour, only to find thar a bunch of the negative boys from N'Yark.

"Beat it, you doggarned guys!" says Pelham R.

"Beat it yous-selves," say the negative boys from li'l N'Yark.

"You'd best beat it," says Pelham.

"We will not beat it!" say the N'Yarkers.

Then the li'l electron guys put it across the guys from li'l old N'Yark, and made them quit. So the li'l electron guys sat on the tall stools in front of the bar and sucked ice cream sodas through long straws from tall tumblers, and ate ice-cold sundaes with cardboard spoons. Thar they sat frozen to the icy bar for thousandths of a second, and thar they stuck until more li'l electrons thirstier than Pelham R. Oton and his bunch of the electron boys came and called on them to beat it. And so the li'l electron guys with Pelham R. Oton hitched up their pants and beat it, and progress was made along Toobe City Main Street.

Animals and Wireless.

A loud speaker has been installed in the New York Zoo in order that the effect of wireless on the animals and other living creatures there may be studied. We understand that the first experiment with the wireworms was not successful, and that the glow-worms have lodged a formal protest against the indiscriminate use of valves.

It may be noted that fishes are quite used to working on a natural wave-length while the whale does a lot of spouting, though not from a transmitting station. A couple of giraffes would make a fine portable aerial, while the mole is exceptionally good at making an earth-run.

The chameleon is a wonderful transformer and the spider can make the most perfect basket coils.

If Bruin has to listen to the wireless our only hope is that he will be able to bear it.

KNOB TURNER.



Your Own Pleasure at Your Own Price

The Neatest little set imaginable, and yet it does all the work of a large expensive crystal set. Easily mounted and connected up, it will pick up all signals including broadcasting to perfection within a range of 15 miles. In your home, scoutroom, schoolroom or garden, you have a real set, not a toy, at the very low price of

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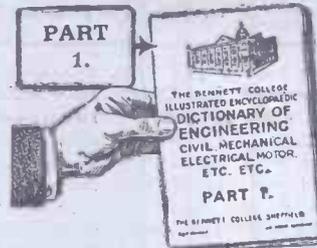
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THAT HA'PORTH O' TAR



HOW many times has that old adage, "Why spoil the ship for a ha'porth o' tar," been quoted? Never was it more applicable than in the case of the wireless receiving set. Your set may be perfect in every detail, the conditions ideal for reception, but if your connections are not soldered, your instrument is not in the perfect state it should be, and, consequently, the receptive qualities are apt to suffer; therefore, why spoil the "Set" for a ha'porth o' "Solder" — and why say soldering's a

bother, when there's **FLUXITE** to help you? Soldering is child's play when you've a tin of **FLUXITE** at hand to help you, or, better still, a complete Soldering Set that we have had specially prepared for the convenience of customers. Ask your Ironmonger or Hardware dealer to show you the neat little

FLUXITE SOLDERING SET

It is perfectly simple to use, and will last for years in constant use. It contains a special "small-space" Soldering Iron, with non-heating metal handle; a Pocket blowlamp, **FLUXITE**, Solder, etc., and full instructions. Price 7/6 Sample Set, post paid, United Kingdom.

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All Hardware and Ironmongery Stores sell **FLUXITE** in tins, price 8d., 1/4, & 2/8. Buy a Tin To-day.



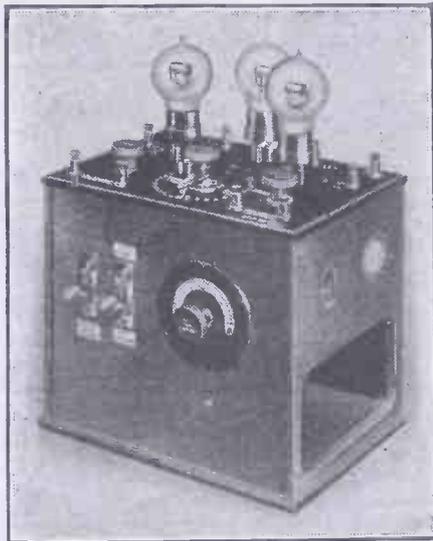
For the tool kit of your car or motor-cycle, or any soldering jobs about the home.

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WHERE WIRELESS APPARATUS IS MADE.

A Special Representative of "Popular Wireless" visits the T.M.C. Factory at Dulwich.

THE T.M.C. are renowned for their telephone receivers, more than anything else, since they have made these for commercial purposes for many years, even before they took them up from a wireless point of view. In their large factory at Dulwich they not only manufacture telephones, but also the well-known "True Music" loud speaker. Complete sets, both crystal and valve, and components, are also made in great numbers.



A typical B.B.C. stamped T.M.C. Receiving Set.

Not long ago I inspected this factory, and was surprised at its size, compared with some of the factories I have been over. The amount of glass used was surprising, but this factory is noted for its efficient lighting.

14,400 a Day.

I first passed through the store-room, where all the material is stored ready to be taken to the laboratory for test when required for use. I was again surprised at the vastness of the machine-shop.

Here there are lathes, etc., of every description, all the machinery being, of course, thoroughly up to date. While I passed through, one machine was turning out telephone terminals, and it surprised me to see a piece of brass being fed into the machine and coming out in a few seconds, after several stages, in the form of an extremely neat and highly polished terminal.

When I counted the number of these machines, I was, perhaps, hardly surprised to hear that it is not at all uncommon for them to turn out one hundred gross of terminals per day. Various other terminals, connecting strips, etc., were also being made here.

Then there was another machine turning the aluminium cups for the loud speakers,

after which they are sent to the polishing room, where they are highly polished. A special guillotine cuts out washers, lugs, and various pieces of metal at an alarming rate.

Another "guillotine," with a pressure of fifty tons, cuts out the magnets for the telephones from tungsten, which is an eighth of an inch thick. Yet another "guillotine" is busy at work, this time cutting out the diaphragms from large sheets of stalloy which have already been gauged and passed as pure.

There is a special magnet hardening furnace which automatically deals out the hardened magnets which are fed into the top of the machine.

I was next taken to the electro-plating room. Here all the apparatus to be plated is hung in the vats until the required thickness of plating is obtained.

The loud speaker horns are made by a secret process, the outline of which is as follows: A mould of the horn is placed in a vat containing a solution of copper which deposits a coat of copper on it until it is of the required thickness. After this the

mould is withdrawn, leaving a perfect copper horn. These horns are then sent up to the spraying room, where they are thoroughly enamelled.

While we were downstairs, we crossed the yard and entered another shed. This was the "tool" shed, another surprise awaiting me when I learnt that they made all their own special tools. From here I happened to look at the roof of the main building, and saw, not only one aerial, but five. This allows a considerable number of complete sets to be thoroughly tested.

Rapid Winders.

Upstairs we came to the assembly room. Here the sets, 'phones, and loud speakers are all assembled and wired. An interesting corner here was the winding benches where the bobbins for the 'phones are wound. They have 3,700 turns put on, which are counted automatically. A pair of magnets, which are wound on a patent machine, take five minutes to wind. The magnets are then tested for continuity, resistance, and covering, any that are at all inefficient being rejected.

The complete instrument—transformers, crystal detectors, telephones, loud speakers, etc., are sent to a special testing room after completion, where they have to pass very hard tests before they are classed as perfect.

Should, however, one of the loud speakers be pronounced as not perfect, it is sent to the laboratory for further tests, where any faults are corrected.

ADDITIONS TO THE "POPULAR WIRELESS" DIRECTORY OF AMATEUR STATIONS.

Call Sign.	System.	Name.	Address.
2 S F	T.T., C.W., and Telephony	C. Midworth, A.M.I.E.E.	"Sumia," Ridgeway Rd., Osterley, Middlesex.
5 C C	Spark 180 metres, C.W. & Telephony	A. Wm. Young ..	Bath Electric Plating Works, Foxcombe Road, Bath.
5 F I	C.W. & Telephony..	H. D. Webb ..	59, Bradford Street, Walsall.
5 F R	Spark, C.W., T.T. & Telephony	J. L. Jeffree, F.R.A.	191, St. James Road, Croydon.
5 F Z	—	Lincoln and District Amateur Wireless & Scientific Soc.	Lincoln Technical School, Lincoln.
5 O D	—	Ralph Bates ..	Holmside, St. Catherine's, Lincoln.
5 N P	Telephony & C.W...	Eric P. Burgess ..	2, Queen's Rd., Manningham, Bradford.
5 U M	—	H. Alchin ..	78, Chester Rd., Forest Gate, E.7.
5 S W	—	C. Bedford ..	Turton Hall, Gildersome, nr. Leeds.
5 V K	C.W. & Telephony..	Bernard Caldwell ..	Caverswall, Lower Walton, nr. Warrington.
5 W M	Spark, C.W., T.T. & Telephony	J. B. Renshaw ..	Wireless House, Old Chape St., Blackburn.
6 A A	C.W., T.T. & Telephony	Durham and Northumberland Collieries Fire & Rescue Brigade (F.P.Mills)	854, Scotswood Rd., Newcastle-on-Tyne.
6 A B	C.W., T.T. & Telephony	(Portable set)	854, Scotswood Rd., Newcastle-on-Tyne.
6 A G	C.W., T.T. & Telephony	W. H. Fortington ..	237, Dudley Rd., Rotton Park, Birmingham.
6 C C	W. & Telephony ..	David Burne-Jones	"Gwalier," Rustic Ave., Streatham, S.W.16.
6 C W	—	Burne-Jones & Co., Ltd.,	Montford Place, Kennington Rd., S.E.11.
6 D W	Telephony & C.W.	Douglas H. Johnson	131, Clapton Common, E.5.
6 G Z	—	R. C. Neale ..	Farnborough Rd., Farnborough, Hants.
6 H D	C.W. & Telephony: :	National Wireless & Electric Company	Church Rd., Acton, W.3.
6 H V	—	W. J. Butler ..	15, Algernon Rd., Edgbaston, Birmingham.

CHANGING AND REPAIRING 'PHONE RECEIVER CORDS.

Describing methods of locating faults in 'phone cords and how to deal with them without the necessity of purchasing new leads.

'PHONE cords which have been in use for some time become frayed and perhaps develop faults, which are usually of an intermittent and therefore irritating nature. It is within the scope of all readers to fit new cords, which, if necessary, may be much longer than the length usually supplied with the 'phones.

The various faults likely to occur may be classified as: (1) Contacts, due to isolated broken strands penetrating the covering and touching the other conductor. In such cases, if the contact lies between the fork of the cord and the terminals of the set, both 'phones are put out of action. A contact between the fork and one receiver will only put the latter out of action.

(2) Disconnections, due to a broken conductor. Both 'phones will fail to respond.

(3) High resistance faults, due to bad connections causing wheezing and grating noises.

(4) Leakage due to dampness. The remedy is obvious.

Lay the long portion and the single 2 ft. 6 in. strand together, as shown diagrammatically in Fig. 1, and having first marked the ends of the single piece, twist up with the free ends of the long piece, thus making the fork. (See Fig. 2.) This point should now be well bound up with strong waxed thread, as should also the points where the flexible branches to the set terminals and the receivers.

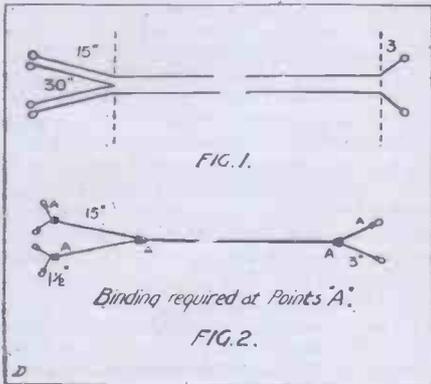
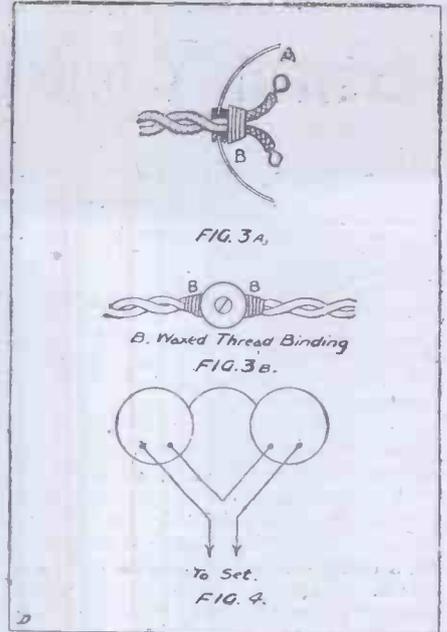
The insulation should now be carefully removed from the six ends, and suitable loops being made and bound as before, for the receiver terminals and the set connections. If straight ends are required the flexible conductors should be well cleaned and then tinned, which will provide what is practically a solid wire.

Minor Adjustments.

The secret of successful cord connections consists in so arranging things that no actual strain is taken by the terminals. This is usually provided for at the receiver ends. Fig. 3A shows one method when wiring receivers with internal connections. The cord when passed through the receiver case is pulled well through and then bound in such a manner that when pulled back again the binding butts against the inside of the case.

That part of the cord between the binding and the terminal should have a little to spare when connected up; and this also applies to Fig. 3B, which shows a small grooved ebonite or hardwood washer slipped in between the twisted strands of the flexible and secured by binding. This washer is then screwed to a suitable part of the set.

The permanent magnets of the 'phones have, of course, a fixed polarity, and they



Intermittent faults of class 1 and 2 may be located by joining the 'phones up to a single cell, not a battery or accumulator. At the instant of connecting up a single sharp click will probably be heard in the receivers. Now work gradually along the cord, moving it about between the fingers until a point is reached which, when moved, causes a loud grating noise. This is the position of the trouble. Should no click be heard when joining up proceed in the same manner.

Replacing the Leads.

To replace faulty cords, procure a length of ordinary electric light flexible cord 35/40 or 14/36. As the description implies, it may consist of 35 strands of 40-gauge copper wire or 14 strands of 36-gauge copper wire, rubber insulated and finally covered with silk or cotton. Numerous colours are obtainable, and the cost is but a few pence per yard. Purchase a piece 2 ft. 6 in. longer than the final length of cord is intended to be. Cut off the 2 ft. 6 in. piece and remove the twist until the strands are separated, as only one is required to make the series connection between the receivers.

usually operate best when incoming currents augment this polarity. When connecting up the receivers it is advisable to see that both are joined up in the same direction. For this reason the ends of the 2 ft. 6 in. single strand flex were marked, and Fig. 4 shows the connections. When these are correctly made the set ends may be arranged to give the best results.

Essential Details.

Although the difference is slight, more especially with crystal working, a keen ear can easily detect an improvement when the 'phones are working in a certain direction and every help to efficiency, however small, should be considered.

Another tip which may be useful, though it does not concern the repair of 'phone leads exactly, is that the diaphragms of the earpieces should be changed over occasionally. After a time the diaphragms become bent towards the magnets and this should be rectified every now and then by reversing each diaphragm.



A corner in the testing department attached to the factory of Radio Instruments, Ltd.

GEARY RUNS A REVOLUTION.

By HIGHAM BURLAC.

How the affairs of state concerning a South American Republic centred for a brief moment around the doings of our old friend Geary.

IN a certain drinking cellar in the little Central American town of San Blanca, where the Civil Guard at the corner of the Plaza is safely sleeping and the snuff-coloured lads gather round the little green tables for their evening vermouth-and-soda, the name of Geary is execrated as that of one of the blackest-hearted gringos that ever sold the liberty of the proletariat for counterfeit Mexican dollars with holes punched in them. It's a sad story, and Geary does not care much for it to be told; but as he has given up honest aeriels and uses a frightful affair disguised as a framed picture of "The Soul's Awakening," which comes away from the wall on hinges, he is to all intents and purposes dead to polite society, so I have no scruples in giving him away. After all, it's a matter of history.

What? Did I say he *ran* a revolution? The printer again! That was a misprint. I meant "ruins a revolution." Yes, he jammed one of the brightest and merriest little blood-letting propositions in the fair pages of San Blanca's records. Don't ask me how he came to be in San Blanca, for that is a yarn which belongs elsewhere—Scotland Yard, I expect. (I always told you I suspected Geary, didn't I?)

Well, once upon a time Geary was walking down the street of Ten Thousand Holy Snakes de la Something or Other, which was the only street in San Blanca; the other street had been sold to the neighbouring State by the President. He was dead sick of beating off the mosquitoes—big chaps as hefty as parrots—and kicking the vendors of lottery tickets. The bull fight had been postponed sine die, because they could not borrow a bull and the matador had the wind up about his pigs, which he said were developing croup and needed constant attention. Nobody seemed interested in wireless, and the only other vice was a queer sort of card game at which you either won a dud dollar or got your throat slit. Murder by shooting had been declared a Presidential monopoly. So Geary went on down the street of, etc., feeling as bored as a lion tamer at the cat show. All of a sudden things happened about as fast as the incidents in one of Tom Mix's films.

Effects of a "Tonic."

A long dago wormed out of a fonda and approached Geary, bowing and scraping like those fellows who try to sell a complete set of Shakespeare's works on the instalment plan, "complete with fumed oak bookcase."

He said, "'Scuse, please. You wanting whisky-drink? Yes? No? How do you do?"

Geary replied, bluntly and without emotion, "Yes."

I do not know why. When a strange, long greaser anywhere in Central America offers you a buckshee whisky, what do you do? You hop it, by Jove, and you don't stop till you get to the frontier and over. But Geary said "Yes." Now, I ask you!

So down they went, past the fake counter where you buy the contraband tobacco, down to where they draw pictures of gallows on the walls in chalk. Five assorted dagos were sitting round a table, and these, upon Geary's entrance, arose with expressions of politeness. A real, guaranteed non-corrosive whisky conjured itself into Geary's hand and in a few seconds down his dry gullet. Little lights came and went in Geary's head, so that he was aware that he hated the nose on the largest dago. Accordingly he smote that nose with his clenched fist, and Senor Don Jaime Lopez y Tortillano, giving vent to muffled sounds indicative of agony and vermouth, rolled upon the ground; but not a blade was drawn, not a Carramba spoken. Can you believe it? Instead of melodrama, the strange long greaser let off about twelve reels of Spanish to the other sons of sorrow, and then began his beautiful English again.



Mr. S. W. Heath, of 77, Clifton Place, Plymouth, operating his efficient amateur station.

Geary "Falls" For It.

"You seee down, mister. Oll raight-Liss-ten. You 'ave the fighting sangre. Perfectamente. Bueno. Me an' my amigos make the revolution. Savvy? Beeg, beeg shoots. 'Orrible row. We keel Presidente—w'at you call 'bump 'im off.' Bueno. Keel the Presidente, me and my amigos; all same you say 'Jollyolpals,' we geeve you concessions. Oh, lots of dough! Soft job. You 'elp us? Yes? No? God save King and all zat. Ip ooray!"

Geary got most of this, and, without asking for repeat signals, answered: "Righto, Don Quicksoat! On general principles I'd do in any honey-tinted dago President—where'd you put the bottle?—but if there's boodle in it, too, my name is Two-Gun Geary. Vamos. What do I do?"

"You are telegrafista, eh? Make the spark—pzz-pzz. Wat they say—how call dam sing—mm mm—telegrafia sin hilos. Oh, yes, walless! Leetle Marconi boy, yes? We wantin' you telegrafiar up dere. Give Carlos time when bump Presidente."

The long, strange greaser pointed to the Presidential residence which crowned the hill.

Now, Geary agreed to do what was wanted, and, having inspected the radio installation, which was housed in a mule-shed and consisted of a sulphated accumulator and a cheap medical coil, he bimbled

off to his hotel. But the morn brought counsel. Geary went out to look at the pock-marked wall against which they shot revolutionaries, and decided he was a loyalist. On the other hand, he positively had to remain in San Blanca for another month, and the idea of the long dago looking for him with a pork-knife at all hours of the night made him shudder at a frequency approaching H.F. So he walked up the hill to see the Presidente.

Geary Changes Sides.

He found the Presidente smoking cigarettes and waving long, thin fingers in the face of an angry concession-hunter. The ruler professed to be quite helpless in the matter, but added that whatever the matter was—and he did not know—he thought tomorrow would do as well as any other day. The concession-hunter confided the immortal part of the Presidente to Halifax—or it might have been Wigan—and departed. Then Geary opened out and woke up the six-foot sleeper with his news. What excited old Garcia—or was it Manuel?—was not the imminent bumping-off which Carlos had ready for him, but the information that there was a wireless set in the State of —. He wanted it for the state army, which was playing chuck-farthing in the state stable just then. To cut a long story short, Geary had to sneak the transmitter, while the President determined to arrest Carlos severely and bag his receiver. Vaya, a complete wireless station. Would Geary be state operator? Yes? No? 'Scuse, pliss.

At the appointed hour Geary crept up to the mule-shed and made the spark gibber a bit; whereupon the long dago and his bunch of stiffs, with assorted cries of "Down with tyranny!" "A bas l'income-tax!" "Vive independence and death to the destroyer of the dole!" tossed off a bumper of hot blood, and, seizing the state blunderbuss, rushed forth to—to meet eight state policemen, who knocked the stuffing out of them.

Fruits of Loyalty.

In return for the transmitter the Presidente sold Geary a concession on all the mahogany in the Republic across the road for ten dollars. Geary sold it back to him for five dollars (paper), and in the morning they formed a syndicate and sold the mahogany to the concession-hunter for a case of whisky.

The whisky was bad methylated spirits. There is no mahogany in the Republic across the road. Geary found that the paper dollars were printed by the previous administration and had been repudiated by the state army, who owned the state printing-shop. So he came away with the medical coil in his left-trouser leg and Carlos' telephones in his hat.

After this revelation perhaps Geary will kindly return the transmitting valve he borrowed from me. This is Clapham, this is; not San Blanca.

The Marconi-Osram 'D.E.R.' Valve has now been reduced from £2 to 27s. 6d.

Apart from its cheapness, the outstanding advantages of the 'D. E. R.' (the Valve which is fitted to the famous Marconiphone V2) are :—

- (1) It consumes little more than half the current used by the ordinary Valve.
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—Yours faithfully, A. W.—A.M.I.E.E.

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“WIRELESS REVIEW AND SCIENCE WEEKLY”

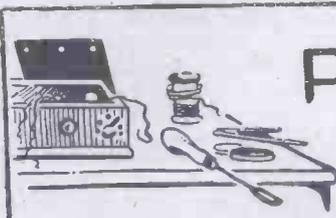
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EVERY amateur interested in wireless generally, and not solely and particularly in “listening-in,” has realised by now that *Wireless Review and Science Weekly* is the leading high-class weekly journal. Its contributors are for the most part men of universally accepted eminence in the world of Wireless and Science: it has correspondents, specially retained, in Berlin, Paris, Russia and America, to supply news of developments in Science and Wireless worthy of the British amateur's interest, and in conjunction with *Popular Wireless* it supplies its readers with an unrivalled information bureau. Every query from a reader receives the most careful attention. If necessary it is sent to the Scientific Adviser-in-Chief, Sir Oliver Lodge, for expert elucidation.

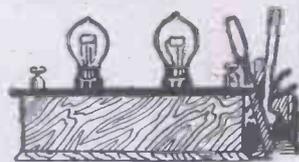
If you are really keen on your hobby, you will not fail to purchase

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Price 3d. Every Tuesday



PRACTICAL IDEAS FOR THE AMATEUR



AN ADJUSTMENT WRINKLE FOR VALVE SETS.

IT is perhaps not generally realised what an important part the grid leak plays in the ordinary type of valve receiver. The fact that the actual component itself is simple to construct—nothing, surely, is easier than making a few lines with a piece of soft lead pencil—may have a lot to do with the summary manner in which it is disposed of by the ordinary amateur; and yet it is not too much to say that a detector valve without a grid leak and condenser is inoperative.

Value Critical.

Certain readers may remember that in "pre-grid leak" days the potentiometer and battery combination answered the same purpose. One has, however, only to look at a dozen modern valve receiving sets to see that up-to-date valve apparatus has nothing in common with the last-mentioned means of obtaining prolonged rectification, and it would to-day be difficult to find a receiver on the market employing a potentiometer and dry cells.

The correct ohmage value of a grid leak is undoubtedly best appreciated by those amateurs whose apparatus depends upon a single variable condenser or adjustable inductances for tuning.

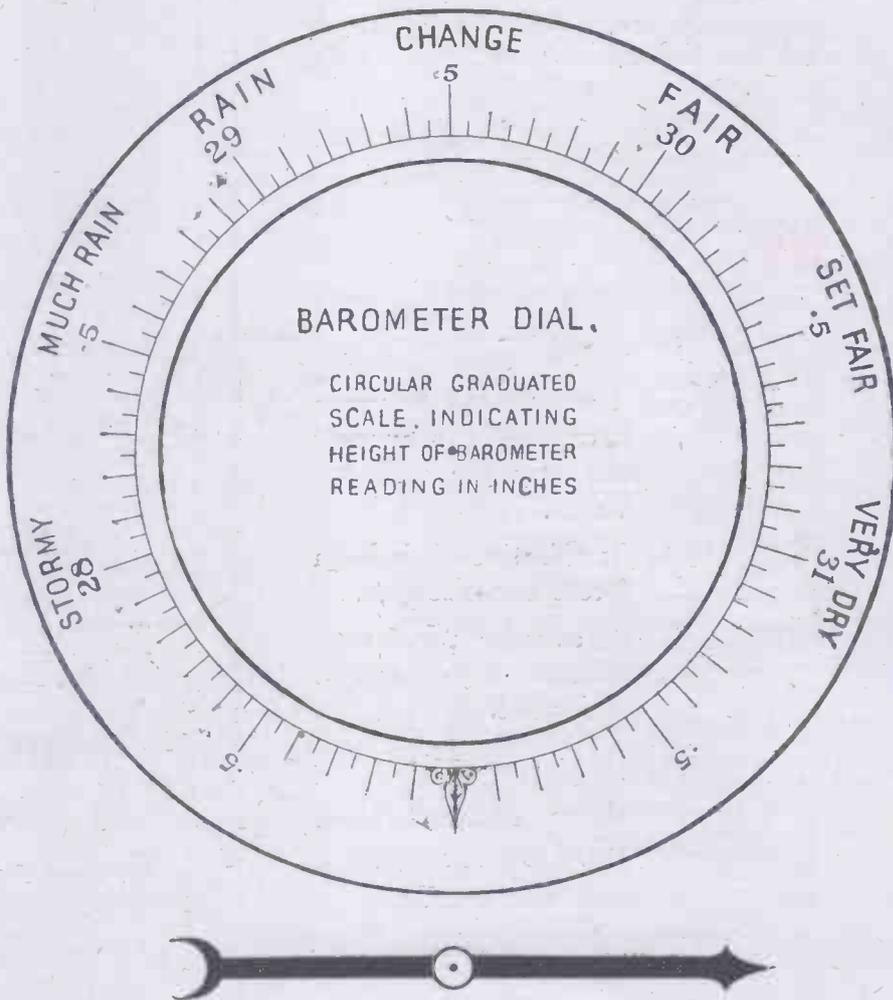
Simplicity of control is the aim of all designers of valve receivers, and the advantages to be derived from apparatus which can be adjusted by the movement of one control, such as the simplified form of "flivver" circuit, are obvious.

Such circuits, however, will, according to the condition of the atmosphere, be found to vary a good deal in sensitivity of reception, and the elimination of jamming often becomes a formidable problem.

The Variable Leak.

Those readers who have experienced the annoyance of achieving exceptionally good results—and talking about them—and then failing dismally, perhaps the very next day, to justify such remarks to others, will do well to use a variable grid leak.

It is not, of course, an infallible cure for all the troubles experienced by the "listeners-in," and it is not claimed that its inclusion in the circuit is a sovereign remedy for atmospherics; but when next your favourite circuit fails to function to your satisfaction, and you have tried without success a hundred-and-one tests to find out why, give a thought to the too often forgotten grid leak, and try varying its value—you may be surprised at the result.



A WIRELESS BAROMETER.

AMONG the items regularly broadcast are the daily weather reports and barometrical readings. But how many listeners-in have studied the barometer with care for themselves, or classified weather as other than "good" or "bad"? To these the announcements must convey a very vague impression. A definite means of following the weather report is provided by the accompanying simple barometrical dial. Below this has been separately drawn a pointer, and the suggestion is that those interested should cut out the dial and pointer, and paste them on to cardboard.

Useful Research.

Then fix the pointer to the centre of the dial, so that it can be turned to correspond with the report of the day. In this way some real knowledge of weather conditions should be gained from the account given by the broadcasting stations. For example, should the daily reading at some point or other be 31 inches, then the forecast in that quarter will be "Very Dry," whereas 28.5 inches indicates "Much Rain." Intermediate points are graduated accordingly.

A useful field for research is also opened up in that the readings of the barometer can be compared with the atmospheric conditions. The types of atmospherics experienced at various readings of the barometer should be noted and tabulated. It will be found that to a large degree the weather can be foretold by the nature of these discharges, and much useful information on this little known subject may be compiled.



Wireless Club Reports

The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the report if necessary. Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An asterisk denotes affiliation with the Radio Society of Great Britain.

The Beckenham and District Radio Society.

On Thursday, July 12th, the above society introduced a remarkably able lecturer and exponent of dual amplification circuits in Mr. Voigt, who was very ably assisted by Mr. Knight, A.M.I.E.E.

Sec., Mr. J. F. Butterfield, 10, The Close, Elmers End, Beckenham.

Croydon Wireless and Physical Society.

At the ordinary meeting on July 7th, Mr. C. W. Hale (2 H 8) described and demonstrated a three-valve set (1 h.f., 1 det., and 1 l.f.) of his own design.

Owing to the holidays, the next meeting is held over until the middle of September.

Hon. sec., B. Clapp, Meadmoor, Brighton Road, Purley.

The Radio Society of Great Britain.

On Thursday, July 5th, at 7.15 p.m., a special message was broadcast congratulating this society on the attainment of its tenth anniversary.

At the next general meeting of the Radio Society on July 25th, a paper was read by Mr. Philip R. Coursey which has been contributed by Mr. Lionel J. Hughes, entitled "Resistance Capacity Coupled Amplifiers."

Hon. sec., Leslie McMichael, M. Inst. R.E., 32, Quex Road, West Hampstead, London, N.W. 6.

North London Wireless Association.*

On July 9th, 1923, Mr. W. L. Johnson gave his lecture on "Radio Metal Craft."

A resolution was carried declaring the association closed during the month of August.

Hon. sec., Mr. J. C. Lane.

The Yiewsley and West Drayton Radio Society.

A meeting was held at the Chapel Rooms, Ernest Road, Yiewsley, on July 11th.

Mr. Alan Smith, of "The Studio Electric," Yiewsley, had brought a camera along, and a few exposures were made.

Mr. L. N. Tyrrell gave a lecture on the following Wednesday.

Hon. sec., J. H. Sutton, Esq., 47, Acacia Avenue, Yiewsley.

The South Norwood and District Branch of the Radio Association.

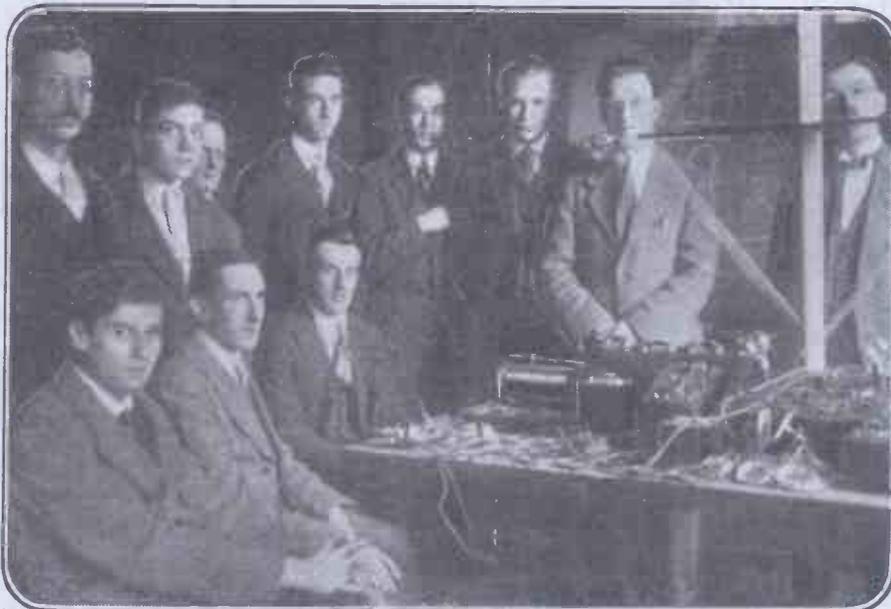
The meeting on Thursday, July 12th, was a discussion on "Broadcasting," opened by Mr. S. W. Butters (5 V U).

Mr. Butters spoke of the "good old days" of 2 M T and led up to the present day, comparing the British with the American methods of broadcasting.

Mr. E. A. Saunders then gave his views on the subject, suggesting an "aerial hunt" by radio society members organised by the P.M.G. in an attempt to run to earth the pirates.

After this discussion Mr. Butters and Mr. Saunders each gave a short lecture on "Television and Photos by Wire and Wireless." Mr. Butters remarked at the conclusion that both himself and his colleague were experimenting in this direction and hoped to bring the results of same before the branch within a few months.

NOTE.—Mr. A. Trill, a member of the above society, was successful in winning a £5 prize in the "Man Hunt" recently organised by 2 L O. Mr. Trill followed the "Uncles" on a cycle for



Some members of the Tottenham Wireless Society, together with the Club Set.

half an hour, and only gave up the chase when the chain of his cycle broke.

Hon. sec., C. H. P. Nutter, Radio Corner, Selhurst Road, South Norwood, S.E. 25.

Catalogues Book Reviews Etc.



Two interesting leaflets have been forwarded to us by "Siemens," one dealing with their loud speaker and the other with a special type of dry battery to be used for the dull emitter valve. In these batteries provision has been made to counteract the natural drop of voltage through usage by the addition of a few spare volts above the three required for this type of valve. The

loud speakers are extremely neat, and it is claimed that they are acoustically perfect. They are supplied in three different resistances.

A very neat and well-printed catalogue has lately been issued by C. F. Elwell Ltd., the makers of the well-known Aristophone receivers. Besides depicting these complete receivers, the catalogue contains many illustrations of every type of component from a telephone tag to complete aerial equipment.

Radio "Stocks" have forwarded price list No. 157. This leaflet contains a very good selection of accessories, wonderfully cheap yet of good class. We note that this firm guarantees to fully refund for any material not giving satisfaction without question.

It is not necessary for those living in the Midlands to get their wireless apparatus from London when such a good selection can be viewed in Halifax, for instance, at the showrooms of the Electrical Supply Stores. This firm's catalogue fully bears this out, it being filled with details of highly efficient complete sets and well-made accessories, etc.

An interesting little leaflet has been forwarded to us by W. V. Webber. It is descriptive of many neat accessories, also pricing complete valve sets. Particular attention is drawn to the valve panels which are fitted with a fuse, thus saving any fear of burning out a valuable valve.

We have received a sample of "Receptite" crystal from Messrs. Cook & Co., and have found it gives very good results. As a detector for use with an H.F. amplifier or a dual amplification set the crystal is wonderfully stable without losing its sensitivity.

Generally speaking, head telephones used with a horn as a loud speaker do not give good results, but the "Premier Telephone Co." state that with the large pattern "Sidpe" 'phones, for which they are the sole agents in Great Britain, excellent results can be obtained with a horn, owing to the clear and loud signals these 'phones give.

A variable grid leak is a very useful addition to any valve set, and should be used when valves are being constantly changed. A. H. Hunt, Ltd., have forwarded us a leaflet descriptive of a very neat variable leak which they have placed on the market. The advantage of this leak is that it is made to work conveniently either for panel mounting or otherwise.

RADIOTORIAL.

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

It is indeed good news to hear that dull emitter valves are now obtainable for 27 G. At this price they are within the reach of any amateur contemplating the employment of a valve set, because of the economy they effect in respect of the accumulator. Two volts will suffice to supply the necessary current, and as the current consumption even at this reduced pressure, is but half that of the ordinary type of valve, it will be seen that a 4-volt 20 amp. accumulator could be replaced by a 4-volt 5 amp. accumulator using a single dull emitter.

It is interesting to note that dull emitters can be used on the "P. W." Combination Set with quite satisfactory results. This increases the usefulness of this receiver for portable work to a considerable extent, and permits a maximum of efficiency for a minimum of bulk and weight—important points in the case of out-of-doors wireless work.

Visitors continue to attend the morning demonstrations at the offices of "POPULAR WIRELESS" in steady numbers, and the universal opinion of all those that examine the receiver and hear it working is that it is THE set of the day. Mr. B. Simmons, F.Sc., of 192, Brooke Road, E. 5, who attended the demonstration on July 31st, expressed but the general opinion when he remarked that the "P. W." Combination Set is "All that the designers say."

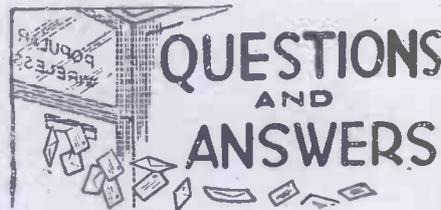
THE EDITOR.

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS Queries Department, Room 133, Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send the necessary postage for reply.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the

columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.



"DANIEL" (Bristol).—I am told that I can charge my accumulators by means of a Daniell cell. Is this possible?

Yes, the accumulators may be charged by means of Daniell cells (you will, of course, require more than one). Thus for a 4-volt accumulator you will need approximately six cells, while you will need about nine for a 6-volt accumulator. Large cells should always be used and will not need constant attention. The zincs should be carefully looked after and renewed when eaten away. The copper solution must be kept at its right strength. The cells should, of course, be connected in series, the copper being taken to the positive terminal of the accumulator. These cells are only useful for keeping up an accumulator as they give out too small a current for initial or full charging.

S. C. (Walworth).—I have built the Flewelling circuit, in fact, I have taken it down and

put it up three times, but fail to get any sign of whistle, while 2 L O is only just comfortable on the 'phones. Can you give me any possible faults that I may look for?

In the first place it should be stated that, owing to the fact that this circuit relies on its strong reaction properties, it is not permitted by the P.M.G. for broadcast reception. As you seem to have wired the circuit up correctly, the trouble cannot be looked for in this direction. Possibly your coils are wrong—the reaction should be half as large again (or even more) than the A.T.I. The H.T. battery also should be variable and should give a maximum of about 100 volts for best results. Make sure that the windings of the two coils run in the correct directions, otherwise no reaction effect will be obtained. A little experimenting with the values of condensers will probably result in the whistle being obtained. Once obtained the difficulty is to tune it out, this being accomplished by varying the coupling between the coils and the values of the leaks.

A. Q. T. (Wimbledon).—In the article on valve-crystal circuit in "P.W." No. 48, there appeared (Diagram 3) a dual amplification circuit. I have built up this set and am getting very good results. To increase my range I wish to add reaction. How is this accomplished?

Reaction may be obtained in this circuit by coupling the anode coil, that is the one in the crystal receiver, to the A.T.I. Note that this type of reaction is not permitted by the P.M.G. for broadcast reception.

A. S. K. (Brighton).—What is the reason for applying a negative potential to the grid of an L.F. valve? How can this be applied to a dual amplification set?

The effect of a negative bias on the grid of an amplifying valve is to make the valve work on a different part of its grid volts—anode current curve. During usual working the valve operates on the straight, steep portion of the graph, and the anode current is proportional to the grid potential. If we operate the valve at a bend in its characteristic curve, by giving the grid a negative bias, we then find that an increase of 1 volt, say, in the grid potential will produce quite a large increase in the anode current, while a decrease of 1 volt only results in a small decrease in the anode current. If carried to excess this bias will result in distortion or loss of signal strength, so that a variable bias should be employed. The simplest method of applying the negative potential to the grid is to connect a dry battery, preferably tapped at frequent intervals, in the grid circuit between the filament and the grid. The filament battery is connected so that the minus goes to earth (or grid), and the grid battery is placed in series with the L.T. negative and the earth connection—that is, to negative filament socket of the valve and to the earth terminal of the set.

(Continued on page 906.)

(1) TRIALS OF A "STUNT" SET.



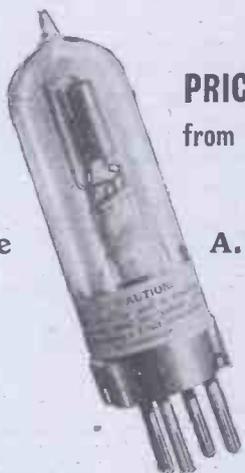
(2) JOYS OF THE "P. W." SET.



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Every care must
be taken that not
more than two
volts are put
across filament.

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Anode Volts ..	20—30.
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Cap	Standard 4-pin.

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6 yards Bell Wire, 2 1/2d.
6 yards Bell Wire, D.C.C., I.R., 3 1/2d.
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bargain, 30/-.

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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 904.)

A. J. B. (Doncaster).—What is the formula for calculating wave-lengths to which an aerial circuit can be tuned, having the A.T.C. (1) in series; (2) in parallel?

For standard aerials, the capacity of which can be taken to be about .0003 mfd., the following formula is used, $\lambda = 1885 \sqrt{L \times K}$, where L and K are the total inductance and total capacity of the aerial circuit. If the A.T.C. is in series you will have to calculate the total capacity from the formula $\frac{1}{K} =$

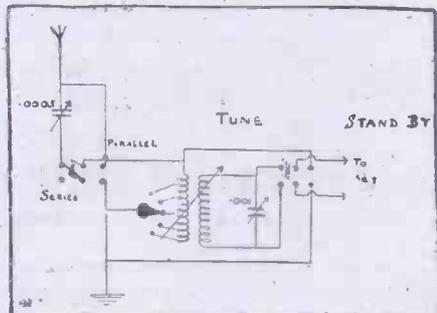
$\frac{1}{K_1 + K_2}$. Thus, if the condenser you intend to use has a capacity of .001 (max.), and is in series with the aerial, you will reduce the capacity of your aerial system, the resultant capacity being found as follows:

$$\frac{1}{K} = \frac{1}{.001} + \frac{1}{.0003}$$

The resultant capacity is then used in the formula $\lambda = 1885 \sqrt{L \times K}$, where it takes the place of .0003 for K. If the condenser is used in parallel, then the maximum wave-length will be given by $\lambda = 1885 \sqrt{L \times K}$ where K is (.001 + .0003) = .0013 mfd. In each case the answer is only approximate, as the capacity of the aerial system (.0003) is only roughly correct. The inductance of the coil in microhenries must be calculated from the ordinary formula for inductance. The inductance of the aerial will be fairly low.

A. P. D. (Wandsworth).—I have built a four-valve set, using a loose coupled tuner, but find it very difficult to tune in distant stations. Would a "stand-by tune" switch help at all?

A switch would be very useful in that capacity, as it enables you to tune in on the aerial circuit before bringing in the selective tuning of the loose coupler. The connections of a "stand-by tune" switch are shown in the diagram. A series parallel switch is also shown,



and is always a useful addition to any receiving set. To tune, place the series parallel switch in series or parallel, the former to decrease the wave-length, the latter to increase same, and place the "stand-by tune" switch in the "stand-by" position, and tune until best results are obtained on the primary coil alone. Having obtained loudest signals on this, switch over to the "tune" side, and then readjust, but this time with the aid of the secondary. Tuning on a multi-valve set, using both primary and secondary coils, is usually very tedious, and the "stand-by tune" switch does much to simplify this always tricky operation.

P. W. C. (Hull).—In the "P.W." Combination Set would the dull emitter type of valve give just as good results as an ordinary R type? May variometers be used in place of the coils shown? Can a vario-coupler be used? How is reaction obtained on this circuit?

Yes, the D.E.R. valves can be used on this circuit, and one that we are trying at present is giving excellent results. Variometers may be used. In this case the variable condensers could be dispensed with as far as fine tuning is concerned, the only advantage in leaving them in being that they would decrease or increase the wave-length if put in series or parallel. Note that the anode variometer should for best results be larger than the A.T.I. Reaction is obtained by coupling the anode and A.T.I. together. This, of course, would be a difficult operation using variometers. Note that this reaction would not be per-

mitted by the P.M.G during broadcasting hours. As regards the vario-coupler, it could be used, but in what capacity you do not state. You could, instead of only using a primary coil, add a secondary in the usual manner, making the stator act as primary and rotor as secondary. Again, the stator could be used as A.T.I. and the rotor as anode, but the remarks above as regards reaction during broadcasting still apply. As a matter of fact, it is advisable to keep to the details as given in POPULAR WIRELESS as far as possible, otherwise the full result from the set may not be obtained.



THE "P.W." COMBINATION SET.

The Editor, POPULAR WIRELESS.
Dear Sir,—We thank you for the copy of the article on your POPULAR WIRELESS Combination Dual Amplification Circuit. Since receiving the above we have had pleasure in testing this circuit, and as regards results can safely state that it is very excellent. One of the chief characteristics of this circuit is its stability and the ease of operation.

We are glad to note that the filament rheostat is placed in the positive lead of the filament battery instead of the negative lead. This greatly assists in obtaining both efficient and stable operation.

There is just one point which we think should be attended to with a view to obtaining under all conditions good results, and that is a condenser should be placed across the high tension battery; this condenser having a capacity of at least .05 mfd. The advantages of this condenser will not be noticeable with a new anode battery, but if an old battery is in use, or one possessing a fairly high internal resistance, this condenser will tend to eliminate any bad effects due to such a resistance.

It is of course important that an R.I. transformer is used.

The omission of a grid resistance box is a good point, and of course if aerial reaction were resorted to still better results could be obtained.

We can confidently state that your circuit is a sound one.

Yours faithfully,
RADIO INSTRUMENTS, LTD.
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New Oxford Street, London, W.C.1.

The Editor, POPULAR WIRELESS.

Dear Sir,—In reply to your letter of the 26th ultimo, regarding the POPULAR WIRELESS Combination Dual Amplification Circuit, our Technical Director, Mr. A. Chapman (who you will remember, is the inventor of the famous 3-Electrode Variable Condenser), is of the opinion that this circuit would afford a very high degree of sensitivity, and enable long range reception to be effected with a minimum number of valves. Furthermore the H.F. amplification coupling described on the diagram would effect an appreciable degree of selectivity to the A.T.I. input, despite the fact of its being direct-coupled.

We trust that the above opinion, coming as it does from one who has been identified with wireless work since the earliest days, will prove of interest to your readers.

Thanking you for giving us the opportunity of commenting on this very interesting circuit.

We are, dear sir,
Yours very truly,
A. E. T.
4, Victoria Street,
Westminster, S.W.1.

P.O.Z. ON A CRYSTAL.

The Editor, POPULAR WIRELESS.
Sir,—With reference to the reception of P O Z on a crystal set, I receive this station regularly on usual single-slide coil type on an indoor aerial of 17 ft. span. This is arranged in a loft under the ridge of the roof and is about 38 ft. above the pavement.

On the same aerial, but with loose coupled crystal set, 2 L O (4 miles) can be heard (and read) 15 ft. from the phones, and Birmingham has been heard occasionally.

Yours faithfully,
E. F. FULLFORD.
8, London Road, Clapton, E.5.

IN THE MEDITERRANEAN.

The Editor, POPULAR WIRELESS.
Dear Sir,—With reference to the letter from "Birdcage" re P O Z time signals in your issue of July 7th, I would mention that these signals are easily received in the Mediterranean on a small cargo boat—where the aerial attains no large dimensions—using crystal only, and are frequently received, atmospheric permitting, in the Red Sea and Indian Ocean at midnight, G.M.T.

With valves, on a ship's aerial, these signals can be read in Japan.

Yours faithfully,
"SPARKS."
Aberdeen.

FEW CORRECTIONS NECESSARY.

The Editor, POPULAR WIRELESS.
SIR,—I was surprised to see the fuss your correspondents are making in your issue of July 21st about the reception of the Nauen Time Signals on a crystal. This place is farther from Nauen than any part of the British Isles, yet when I was control officer at Ismid (60 miles east of Constantinople) soon after the Armistice, I took the time signals regularly from Nauen and F L on a plain piece of galena.

I was also much amused at the glib manner in which your correspondent "Anode" presumes to instruct his fellow-readers as regards both the Nauen and F L signals without apparently knowing what he is talking about. He tells us poor ignorant people that the letters M G Z which follow the Nauen call-letters P O Z are "the German equivalent for 'time signals'!" They are nothing of the kind; they are simply the initial letters of the German words, "Mittag Greenwich Zeit" that is, Greenwich Mean Time, on which both the Nauen and F L signals are based.

Then your well-informed correspondent "Anode" says the F L signals begin at 10.45, whereas they really begin at 10.44 G.M.T. That corresponds with about 12.44 local time here.

I am, etc.,
W. GORDON CAMPBELL.
Constantinople.

CORRESPONDENCE.

(Continued from page 906.)

To the Editor, POPULAR WIRELESS.

Dear Sir,—With reference to “Bird-cage’s” letter in P.W., July 7th, I find that most amateurs gaze at you open-mouthed when you tell them that: “Oh, yes, Nauen time sigs. come in so-and-so!” They say, “On a crystal?”

Now, there is no reason why any amateur who has bought a good crystal set, no matter how simple, or who has taken the trouble to make one, and who is under average conditions, should not get P O Z.

One’s aerial should be high and long and well-insulated. Nothing else matters. My aerial is 50 ft. from the ground, but, on the average, 5 ft. above the lead roof (the whole length). It is 75 ft. long. In one place I have actually had to bind the wire with rubber tape, because it rests on a gable. Its capacity is huge, because a coil made according to P.W. instructions, to tune to 700 metres max., brought in Croydon (900 m.) at the half-way point, using no tuning condenser. This aerial, which is in the “wireless shadow” (with relation to Berlin) of the high part of Hampstead, brings in POZ at midday with perfect clearness, and at midnight, with several times the loudness, FL (Paris) can be read with ‘phones on the table.

The following notes may interest:

The earth is another lead roof at lower level. A loose coupler has not much advantage over a single-slide inductance.

The crystal is galena and a 24- or 26 gauge $\frac{1}{2}$ in. copper cat’s whisker, and the following is important. One can listen to weak amateur telephony and set one’s crystal to a nicety for that wave-length—say, 450. One then tries for, say, P O Z, which is also weak, but on a vastly different wave-length (3,100). The result is probably nil if the signals, if there, are very weak. The crystal wants re-setting for the new (very different) wave. This phenomenon is very noticeable on weak signals, and the only way out is to set the crystal by listening to a station on or near the desired wave-length.

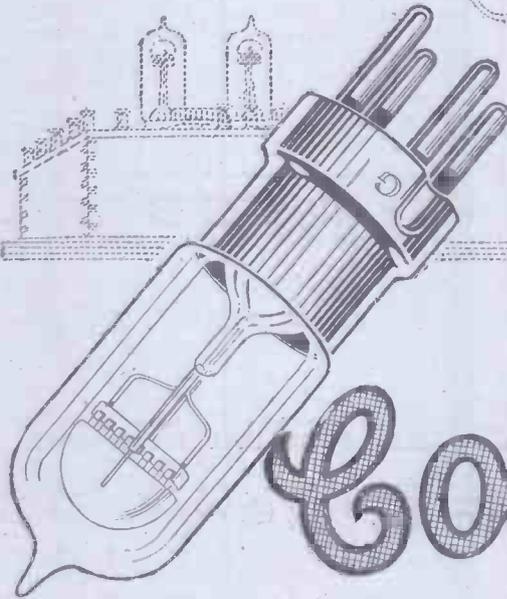
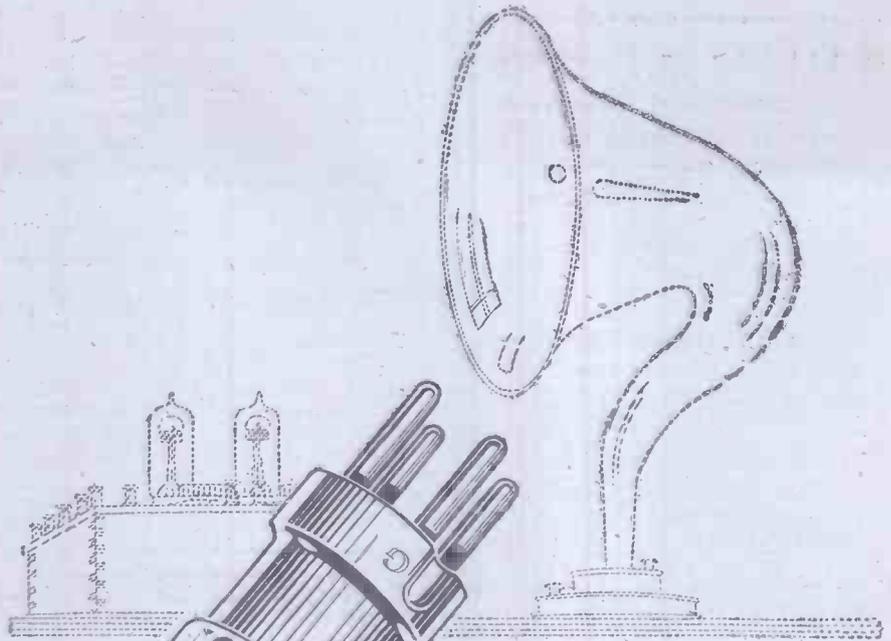
The ‘phone condenser is a necessity for spark signals, strong or weak. Never use less than .01 mfd. (this refers to crystal sets only). I often use 3 mfd. My ‘phones are of 300 ohms (total) resistance (ex-Govt.), and are not improved by a transformer. I have tried out N. & K. (German, 3,000 ohm) ‘phones, Sterling (4,000 ohm), and Federal (American, 4,400 ohm) against my own, and find all about equal (used separately). The condenser notes apply to these latter ‘phones, also.

If the amateur uses more than one pair of ‘phones at a time, they should all be of the same resistance; and if he uses first one pair and then another of different characteristics—i.e. resistance—he should reset the crystal and the tuning if this is sharp.

All the foregoing remarks *re* crystals may not apply to all kinds of crystal, but they may be of help to some who have failed in long distances if you will publish, at least, that part of my, I am afraid, very long letter.

By the way, one more thing. In dealing with fickle high-frequency currents one’s

(Continued on page 908.)



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-especially for Loud speaker use

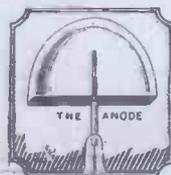
If your Loud Speaker results have been disappointing, make sure that the distortion is not due to your Set. See that the L.F. Transformers are spaced well apart, with the cores at right angles and preferably earthed.

Above all, note whether your Valves are of the right type. The unique construction of the **Cossor** renders it ideal for Loud Speaker use. The curved filament glowing inside the hood-shaped Grid and Anode uses practically the whole of the electron emission, and is responsible for a wonderful volume of sound quite free from all distortion.

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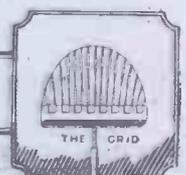
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This is thoroughly up-to-date in its design and refinements.
Features in Brief:—H.F. Valve, Tuned
Anode or Transformer Coupled at will,
Radiax Variable Reactance, Aerial,
Fine and Vernier Tuning, Selective
Secondary Tuning, separate Filament
Resistances, Switch for valves.
We include illustrated instructions for
assembly, list of all parts and their
uses, and instructions for working.
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Tottenham Court Road, London, W.1.**BEST DUTCH VALVES, 7/- EACH**Guaranteed. Round Bulb. Horizontal Grid.
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Oxford St., W.1.**THE "MYSTIC" AERIAL**Will increase the Signal Strength of your Crystal
Set or Increase the Range of your Valve Set
INCREDIBLE RESULTS ARE OBTAINEDHARD COPPER, 100 ft. 7/6
SILICON BRONZE, 100 ft. 10/6**HENRY HOLLINGDRAKE & SON, LD.**
(ESTAB. 1814).**STOCKPORT.**SOLE AGENTS (LANCASHIRE & CHESHIRE)
for THE CITY ACCUMULATOR CO., LONDON.**ELECTRONIC CRYSTAL AND
TORDINODIUM WIRE** ::**CORRESPONDENCE.**

(Continued from page 907.)

insulation cannot be too good. Always
use ebonite or porcelain everywhere, even
if only in small pieces to mount each
terminal on separately.Yours sincerely,
"EXPERIMENTER."
Hampstead.**EUROPEAN TIME SIGNALS.**

To the Editor, POPULAR WIRELESS.

Dear Sir.—With reference to "Bird-
cage's" letter in your columns on the 7th
inst. on the reception of the time signals
from Nauen P O Z on a crystal set. This is
unlikely to be a freak, as he thinks possible.
I receive this station regularly every night,
using a crystal. For the daytime signal I
find the addition of one H.F. valve neces-
sary to make the signal audible.I append the following list of some of
the European time signals sent out every
day, including Sundays, together with the
minimum number of valves which I find
necessary for their reception:

PARIS, F L, 2,600 metres, spark—
Time signal (international), 09.25 to
09.30. (Crystal alone.)
Time signal (rhythmic beats), 10.00 to
10.03. (Crystal alone.)
International collective met. forecast,
10.05 to 10.25. (Crystal alone.)
U R S I, signal, 10.34. (Crystal alone.)
Corrections for scientific time signals,
10.36. (Crystal alone.)
Time signal (French system), 10.45 to
10.49. (Crystal alone.)
Time signal (rhythmic beats), 22.00 to
22.03. (Crystal alone.)
Corrections for ditto, 22.35. (Crystal
alone.)
Time signal (ordinary), 22.45 to 22.49.
(Crystal alone.)
NAUEN, P O Z, 3,100 metres, spark—
Time signal (international), 11.55 to 12.00.
(1 H.F. and crystal.)
Ditto, 23.55 to 24.00. (Crystal alone.)
MOSCOW, R A I, 5,100 metres, spark—
Time signal (Russian system), 21.55 to
22.10. (1 H.F. rectif. with react. to
H.F.).
Above times are G.M.T.

Yours faithfully,
J. W. PALLISTER.
Stockton-on-Tees.**MUSIC FROM F L.**

To the Editor, POPULAR WIRELESS.

Dear Sir.—The following may be of
interest to your readers. Using *only* a
crystal (galena and cat's whisker), I can
receive both music and speech from the
Eiffel Tower. The speech is clear enough
to read, and the circuit I am using is a
simple crystal circuit. The inductance is
a No. 250 De Forest coil, '0005 condenser,
and a pair of Brown's 8,000 ohm 'phones,
and no blocking condenser.I have a very good twin aerial of 140 ft.
in length.I can also hear Croydon and London
telephony, and a very faint sound of
Radiola.Yours very truly,
G. S. HARRISON.
Goring-by-Sea, Sussex.**RECENT WIRELESS
INVENTIONS.**The following abstracts are specially con-
tributed by Mr. Harold J. C. Forrester,
Fellow of the Chartered Institute of Patent
Agents, 88-90, Chancery Lane, W.C.2.Grant of the following patents can be
opposed and printed copies of the full
specifications obtained.198,362.—W. DUBILIER.—CON-
DENSERS.—The plates are secured
together by two or more tubes passing
through the stack and riveted over at
their ends. Terminal members may be
placed over the tube end before riveting,
and the end plates may be of fibre, etc., in
which case the condenser may constitute a
grid leak if a pencil line be drawn across the
plates from one terminal to the other. A
number of condensers may be clamped
together by bolts passed through the tubes.198,368.—MARCONI'S WIRELESS
TELEGRAPH CO., LTD.—BROAD-
CASTING.—In order to render broadcast
signals unintelligible to unauthorised re-
ceivers, the carrier wave, in addition to
having the desired signals, is modulated by
confusing tones and signals such as tones
outside the speech range, music, or com-
binations of tones, which may be changed
from time to time. The interferences are
eliminated for authorised receivers by
supplying filter circuits, etc., the coils of
which may be set in cement to prevent
duplication.198,469.—A. J. R. STREADWICK.—
GRAMOPHONES.—For controlling the
sound of a gramophone, etc., an aper-
tured diaphragm is provided in the sound
passage, and carries guides in which slides
an apertured shutter whereby the volume of
sound emitted may be adjusted.198,499.—J. TIMMS.—BATTERIES.
—Wood pulp boards used as separators in
storage batteries are protected from the
action of acid by impregnating with paraffin
wax.**PAYING THE PENALTY.**What is the Crook's view of Crime and
Punishment?—and what is his attitude
towards society? In the current issue of the
"Detective Magazine" a master crook, an
intelligent and educated man, gives his
reminiscences ("The Inside of the Under-
world"), which have been verified by the
lawyer who often defended him.This is a new angle from which to regard
crime, and is in keeping with the originality
of the other articles and stories in the
"Detective Magazine." "The Smoke Devil"
is another instance of this atmosphere of
the unusual which pervades this unique pub-
lication. We have all heard of smoke barrages
in the war, but the idea of a criminal using
this method to commit his crime and cover
his escape is certainly new. The "Detective
Magazine," price 7d. everywhere, strikes an
altogether new note, and is guaranteed to
interest the most jaded reader.**A LOUD SPEAKER FOR 7/6**Comprises superfine horn, bush and nut com-
plete for attaching to ordinary headphones.
RIVALS ANY SMALL LOUD SPEAKER.
Call or write—MALONE RADIO DEPOT,
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And at 7, Hart Street, Mark Lane, E.C. 3.
7/6, or by post 8/6.



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THE PIONEER HOUSE FOR WIRELESS PUBLICATIONS.

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LONDON, W.C.2.

recommends to your notice five books which you,
as experimenters, will appreciate.

THE RADIO EXPERIMENTER'S HANDBOOK. Parts I & II. By Philip R. Coursey, B.Sc., F.Inst.P. (Research Editor, The Wireless World).

These books are the joy of the genuine experimenter, whose aim should not be to build an installation from complete working drawings, but rather to design the set to meet his own special requirements. These books indicate the chief features of such design work, and the principles upon which it depends.

Part I, deals with the General Principles underlying the design of radio receiving equipment. The Aerial and the Aerial Circuit; Receiving Tuners; Amplifiers and Detectors; Heterodynes. Part II is devoted to Data and Actual Quantitative Design. The Measurement of H.F. Current and Voltages; Fundamental Formulæ and Data; Aerials and the Tuning Circuit; Tuning Coils and Inductances; Condensers; Valves and their Constants; Simple measurement with Valve Circuits.

Price 3s. 6d. per part. Post free 3s. 10d.

PRACTICAL WIRELESS SETS FOR ALL—HOME CONSTRUCTION MADE EASY. By Percy W. Harris.

This is a book for the amateur who wishes to make thoroughly reliable and highly efficient sets. Full working instructions are given, and the excellent photographs and diagrams showing all wiring connections leaves no possibility of doubt in the mind of the constructor.

It explains how to make a Crystal Set; One Valve Note Magnifier; Two Valve Set; Two Valve Note Magnifier; Three Valve set for All Wave-lengths; and How to Fit Indoor Aerials.

Price 1s. 6d. net. Post free 1s. 8d.

THE AMATEUR'S BOOK OF WIRELESS CIRCUITS. By F. H. Haynes (Assistant Editor, The Wireless World).

The 111 practical circuits contained in this book have been specially prepared to meet the requirements of all users of wireless apparatus.

You will find in this book all the circuits you need, each one accompanied by practical advice, and condenser values are shown in every case.

The pages measure 10x6½ inches. This size has allowed the author ample space for setting out clearly the most complicated circuits, even to the smallest detail.

Price 2s. 6d. net. Post free 2s. 10d.

CONSTRUCTION OF AMATEUR VALVE STATIONS. By Alan L. M. Douglas.

The amateur who wishes to make his own apparatus, but does not quite know how to design it correctly, should get this book. It takes you carefully through the theory of the valve, gives suitable circuits for one, two, three, four, or seven valve sets, explains the construction of valve control panels, various types of tuners, condensers—fixed and variable, deals with transformer and resistance-capacity coupling, H. and L.T. battery circuits, telephone receivers and loud speakers, Morse inkers, aerial and earth circuits, and what to do and what to avoid when connecting up apparatus.

Price 1s. 6d. net. Post free 1s. 7d.

MAST AND AERIAL CONSTRUCTION FOR AMATEURS. By F. J. Ainsley, A.M.I.C.E.

When results are poor, don't blame your set, the real trouble lies more often than not in your earth or your aerial.

This book puts before you the essential points of outdoor, indoor, or frame aerials. With a copy of "Ainsley" at hand you can face the erection of any type of mast, without doubt or fear as to the ultimate result. Frail masts are dangerous; make sure that yours is safe.

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WE HAVE THE LARGEST WIRELESS CIRCULATION.

Popular Wireless

PRICE 3d.

No. 64: Vol. III.

SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

August 18th, 1923.



Miss Corinne Griffith
— listening-in —
"between scenes."

FEATURES IN THIS ISSUE.

The Radio Typewriter.
 Minor Valve-Set Repairs.
 Cardiff Station Notes.
 Wave-Length Calculations.

New Form of Crystal Detector.
 An Efficient One-Valve Receiver.
 The New Manchester Station.
 Single Panel Unit Valve Set.

The B.B.C.'s £200 Holiday Competition.



SPEAKS FOR ITSELF

A MPLION RECEIVERS are designed and produced by the world's original and largest manufacturers of Loud-speaking Telephones. First demonstrated in 1887, commercially introduced in 1893, adopted by the British Admiralty in 1894, and by Foreign Governments and the leading Steamship Lines in the following years, no less than 12,000 vessels were fitted with Graham's instruments by the end of the year 1919, besides installations in numerous power stations and for other purposes. To-day the number of Graham Loud-speakers in use exceeds that of all other makes combined. More Loud-speakers than ever are now produced in the Graham Factories or under licence, and in the Wireless field the Graham Amplion represents the utmost technical efficiency and unequalled commercial value.

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IRELAND—Mr. Alex. R. Munday, 41, Chichester Street, Belfast.

CANADA—Messrs. Burndep of Canada Ltd., 172, King Street West,
Toronto.

POPULAR WIRELESS

August 18th, 1923.

SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc.

[Every Friday.]

TOPICAL NOTES AND NEWS.

A Few Notes from 5 I T.

MR. JOSEPH LEWIS, a well-known Midland conductor, has been appointed musical director, and a station choir and a repertory of soloists have been formed. These will be responsible for all the vocal music of 5 I T, and besides songs, duets, etc., selections from opera and oratorios will be leading features.

ON Friday, August 17th, an augmented orchestra will give an Elgar programme, and Saturday will see the first appearance of Appleby Matthews' military band.

ON Wednesday, August 15th, there was a land-line transmission of the orchestra of the Lozells picture-house, this is an innovation which is increasing in popularity each week.

Thunder and Cold Salmon.

[T is to be hoped that a more select repertoire will be given in the children's hour from 2 L O in the future. On Thursday, August 2nd, in particular, it was rather distressing to hear pessimistic references to the approach of thunderstorms, and not particularly amusing to hear that one of the announcers had eaten too much cold salmon.

A little knowledge of child psychology would show that thunderstorms are not the most suitable subjects for children just going to bed. As for the salmon, some people never know when they have had enough!

A Farewell Ceremony.

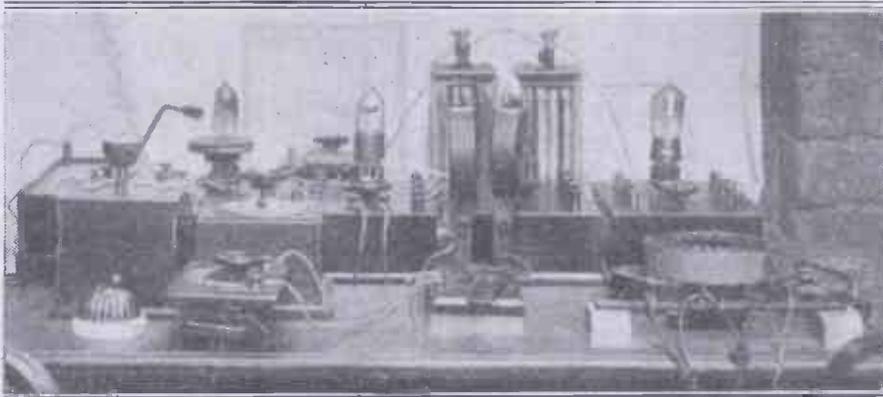
ON Friday, July 27th, a particularly happy little affair took place in Manchester, when the members of the staff and orchestra of 2 Z Y gave a luncheon to their departing director, and presented him with a handsome gold watch. This, I believe, is the first social function in the history of the British Broadcasting Company, and therefore deserves special mention. Mr. Burrows, the director of programmes to the company, and Mr. Godfrey, who will succeed Mr. Wright at the Manchester station, were both present at this function. Accepting their tribute of goodly fellowship and esteem with obvious emotion, Mr. Wright replied, nevertheless, with characteristic whimsicality: "I hope that it keeps better time than the studio clock."

Mr. Wright takes with him to London the sincere good wishes of all listeners-in the station area. The ideal feeling existing between Mr. Wright and all who come in contact with him is admirably set out in the inscription engraved on the back of his watch:

"To Kenneth Anthony Wright
(Uncle Humpty-Dumpty),
From the Staff and Orchestra of 2 Z Y.
An appreciation of a man."

The New Broom.

MR. WRIGHT is succeeded by the eldest son of a man whose name is associated with British music all over the world—Sir Dan Godfrey—whose name he bears. Mr. Dan Godfrey is already a very distinguished musician. He will



A receiving station almost entirely home constructed by Mr. A.-T. Billingsley, 103, Manor Rd., Leyton, E-10

be assisted by Sidney G. Honey, who is well-known for his charitable work among young men, and who has recently been acting as announcer at 2 L O.

Lady Baden-Powell.

MANY people enjoyed listening-in to Lady Baden-Powell talking to her Guides last week. Lady Baden Powell told me she felt quite happy before the microphone, and was quite pleased to speak to her Guides in this way.

Future Events from 2 L O.

AUGUST 17TH.—G. A. Atkinson—Cinema Criticism; F. G. Bristow, F.C.I.S., Gen. Sec. of the Commercial Motors Association, on "The Relation of Broadcasting to the Motor Industry"; Irish Guards' band; Mr. Allen S. Walker, Mansion House.

AUGUST 20TH.—Dr. V. E. Pallin on "The Wonders of X-rays."

AUGUST 21ST.—An appeal on behalf of the Royal Infant Orphanage; Major G. C. Home on "Roman Britain."

AUGUST 22ND.—Topical Empire chat; Edward Salmon; Mr. Archibald Haddon on "Dramatic Criticism"; Mr. W. H. Shipway on "Industrial Dentistry."

AUGUST 23RD.—Percy Scholes on "Music Criticism."

AUGUST 24TH.—Ernest Esdaile on "Elocution"; G. H. Atkinson on "Cinema Criticism"; F. H. Bather on the Natural History Museum.

AUGUST 25TH.—Major Harry Barnes' second talk on "London Buildings."

A Cardiff Station Item.

A SPECIAL Mozart programme will be given on Sunday, the 19th inst. when Miss Doris Lemon (soprano) and Mr. William Michael (bass) will perform.

The New Southern Station.

THE B.B.C. have acquired the whole second floor above Messrs. Vernal's' pram depot, 68, Holdenhurst Road, for the Bourne-mouth station. The studio being about 33 ft. by 20 ft., it will be the largest provincial studio, and will not be so heavily draped as is the studio at 2 L O.

The transmitting site is situated in Bushey Road, backing on the North

Cemetery. This station will be the only one on the B.B.C.'s own land, and consequently they will have considerable opportunities of experimenting and improving transmissions. The Marconi wireless installation of 1,500 watts will be used, and broadcasting will begin about the middle of September.

French Wireless Club.

THOUGH France took up broadcasting some time after this country, wireless societies are being formed all over the country. It is interesting to note that the English phrase Radio Club has been borrowed in its entirety, and is now incorporated in the wireless — of France. A new club has recently been formed at Anvers, called the Radio Club d'Anvers, and has met with a great welcome in that district.

After Three Months.

AT the time of writing the Broadcasting Committee are still "considering," and there appears to be no sign of their cogitations ever coming to an end. Mean-

(Continued on page 910.)

NOTES AND NEWS.

(Continued from page 909.)

while, the wireless slump is becoming more acute, and the general public are fast losing interest in broadcasting.

And So It Goes On.

THE report that was to have been issued last week has been postponed indefinitely, and we are still in the dark. Why the committee cannot tackle one thing at a time it is difficult to understand. The most important consideration is the licence problem, and until that is settled broadcasting can never be firmly established. If this is too much for the committee they should say so, and leave it to a more competent body.

A Wireless Obstruction.

A CHEMIST and agent for wireless sets was summoned for causing an obstruction. It was said that a crowd of more than three hundred people assembled outside his shop whilst wireless demonstrations were given inside.

It was argued that his licence entitled him to give concerts, which were advertised for him.

The Bench dismissed the case on payment of costs, as it was the first summons of its kind.

Tracking Criminals by Wireless.

SCOTLAND YARD is to have two new transmitters of 500 watts power each. Major T. H. Vitty, engineer, and Mr. G. A. H. Wootton, wireless expert of Scotland Yard, were chiefly concerned in the recent experiments which led to the purchase of the new sets.

Journeys Saved.

THE adoption of wireless by the police force will assist in cases of intricate and baffling natures, which necessitate inquiries in several directions. Many local constabularies are watching with interest this innovation at Scotland Yard.

5 W A's New Control Room.

THE Cardiff Station has been fitted with a new control room, and there is no doubt that this innovation will greatly add to the efficiency of 5 W A. The control will naturally be easier, and it will enable the station to broadcast weather reports received from Fishguard during the afternoon.

Damage by Lightning.

A READER writes that his set was damaged in the recent thunderstorm, although his aerial and earth wires were connected together. The lightning flash struck the ventilator in the glass roof, and smashing a gas bracket, set light to the gas which in turn lighted the wooden rafters in the glass roof, and

jumped a gap of one foot, six inches. The lead-in tube was bent to a curve, and the curtains and wooden curtain rings set on fire. It also blew a three-inch hole in the glass of the window, just under the lead-in tube.

A Special Wireless Telephone.

A DEMONSTRATION of the use of wireless telephony on aircraft was given to Sir Samuel Hoare, Secretary of State for Air, and Lady Hoare, when they recently flew to Gothenburg, Sweden. The aeroplane in which they travelled was fitted with a Marconi A.D.2 Wireless Telephone Set, and extra 'phones were provided to enable Sir Samuel and Lady Hoare to listen to the conversation with the wireless stations during the voyage.



Some blind boys of a New York Institution constructing a valve receiving-set.

Further Extortions.

I HAVE received a letter from one of our readers stating that the L.C.C. charge £1 deposit to erect an aerial on their land, and a further sum of £1 ls. if their own workmen erect it, in the Rotherhithe district. I suppose the L.C.C. require payment to think these things out.

A £1 ls Prize.

READERS in Bournemouth should look out for a 4-seater car, possibly an "Albert," with a representative of POPULAR WIRELESS and others who are visiting this town on Saturday, August 18th, to test a 6-valve Marconi portable set. A prize of £1 ls. is offered to the first reader who presents a copy of this number to one of the occupants. They will be in the

town for the morning transmission, and again for the 5.30 women's talk.

How You Can Tell.

IF you see the car drawn up on the front with someone listening in, just walk up and hand in your copy of POPULAR WIRELESS with your name and address. The first reader to do so will win the £1 ls.

Saved by Wireless.

A LADY travelling on the Carmania was taken seriously ill, rendering an immediate operation necessary. The ship's doctor made arrangements for wireless for an ambulance to be waiting at Queenstown to convey her to Cork.

The Wireless Craze.

WIRELESS is responsible for a new trouble that has arisen in an electrical engineering works as a consequence of broadcasting developments. The apprentices have developed a habit of making wireless parts in their spare time with their employer's material.

The Glasgow Station.

"ROB ROY," by Sir Walter Scott, is to be broadcast from the Glasgow station. This is the first time in the history of broadcasting that this famous author's work has been transmitted by wireless.

Glasgow's Future Items.

- MONDAY, AUGUST 20TH. Dance night. Mr. Chas. Wreford, Entertainer.
- TUESDAY, AUGUST 21ST. Mr. Eric Niven, Elocutionist, Miss Amy Murdoch.
- WEDNESDAY, AUGUST 22ND. Classical Night of the Wireless Orchestra, Miss Annie Hobson, Contralto, and Mr. Chas. Brown, Tenor.
- THURSDAY, AUGUST 23RD. Miss Doris Lemon, Soprano and Mr. Wm. Michael, Bass.
- FRIDAY, AUGUST 24TH.—By kind permission of Brevet Col. O. H. Delano-Osborne, C.M.G., Royal Scots Fusiliers, now stationed in Glasgow, will render the musical items during this evening's performance.
- SATURDAY, AUGUST 25TH.—Mr. George Hutchison, Humorous reader, with his delightful stories of "Mrs. Duff's Experiences in Glasgow," is guaranteed to make you laugh and weep. Miss Jessie Crombie, Soprano. ARIEL.

BROADCASTING TRANSMISSIONS.

Regular transmissions of news and concerts take place daily from the following stations. Full details appear in the daily press.

London	2 LO	369 metres.
Birmingham	5 IT	420 "
Manchester	2 ZY	385 "
Newcastle	5 NO	400 "
Glasgow	5 SC	415 "
Cardiff	5 W A	353 "

Other stations of interest to listeners in Great Britain are:—

Eiffel Tower	FL	2,600 metres	Throughout the day.
Radio-Electrique, Paris	SFR	1,780 "	5.5 to 6 p.m.
School of Posts and Telegraphs	—	450 "	8.45 to 10 p.m.
			7.45 to 10 p.m.
			(Tuesdays and Thursdays.)
			4.30 to 7.30 p.m. Saturdays.
The Hague	PCGG	1,050 "	3 to 5.40 p.m.
			(Sundays.)
			8.40 to 9.40 p.m.
			(Mondays and Thursdays.)

Note.—A revised and more comprehensive list of the Continental Broadcasting stations is in the course of preparation and will appear shortly.

HOW TO BUILD A CRYSTAL SET FROM MECCANO PARTS.

By ELLISON HAWKS.

THE constructional toy Meccano is now so well known as to be in almost every home. Those who possess Meccano outfits, or whose younger brothers are Meccano enthusiasts, can make an efficient crystal receiving-set from the standard Meccano parts without difficulty. One or two extra parts such as inductance discs, telephone ear-piece, and crystal, may be obtained separately from the Meccano-Company.

Meccano strips and plates are now made from specially prepared fibre, which gives perfect insulation. Some of the parts may also be obtained in brass, and are useful in this form because of their non-magnetic properties. As both varieties of these plates and strips are perforated with the well-known equidistant holes, at distances of half an inch, they are very useful for constructing home-made apparatus. These fibre strips, together with other standard Meccano parts, are especially adaptable to trying-out any new ideas, for standardisation of the parts enables alterations in design or circuit to be made very rapidly.

An Inexpensive Condenser.

Those of our readers who do not wish to make up the complete crystal receiver-set

will no doubt be interested in having brought to their notice particulars for making a very efficient variable condenser at the cost of a few shillings. This condenser will be found to function equally as well as a condenser costing five or six times as much.

It is made by connecting together eight 2½-in. Meccano triangular plates at the lower end by a 2-in. threaded rod (14, Fig. 2),

an insulating fibre brush between each angle strip and the plate.

The movable portion (Fig. 3) is composed of seven triangular plates threaded in a similar manner to those in the fixed portion, with two nickel spacing washers at the top and bottom, but without triangular fibre plates. This movable portion is passed between the apertures of the fixed portion and connected to the 1-in. and ½-in. brackets (7 and 7a) with a lock-nut on the outside of the same brackets. The special fibre plate (30), itself held in place by two trunnions (31) one on each side of the plate. The inductance discs (38 and 39) are attached at the upper corresponding corner of the same plate by hinges.

Tuning is effected by moving the discs towards or from each other, and the hinges are so arranged as to enable them to be brought together as closely as possible. Two terminals (33 and 34) are connected in the two top holes of the outer corner of the plate (30), and a further

lower down.

An underneath view of the set is shown in Fig. 4, and the wiring diagram (Fig. 5) will make the connections clear. The circuit may, of course, be varied by placing the condenser in the primary circuit.

(Continued on page 912.)

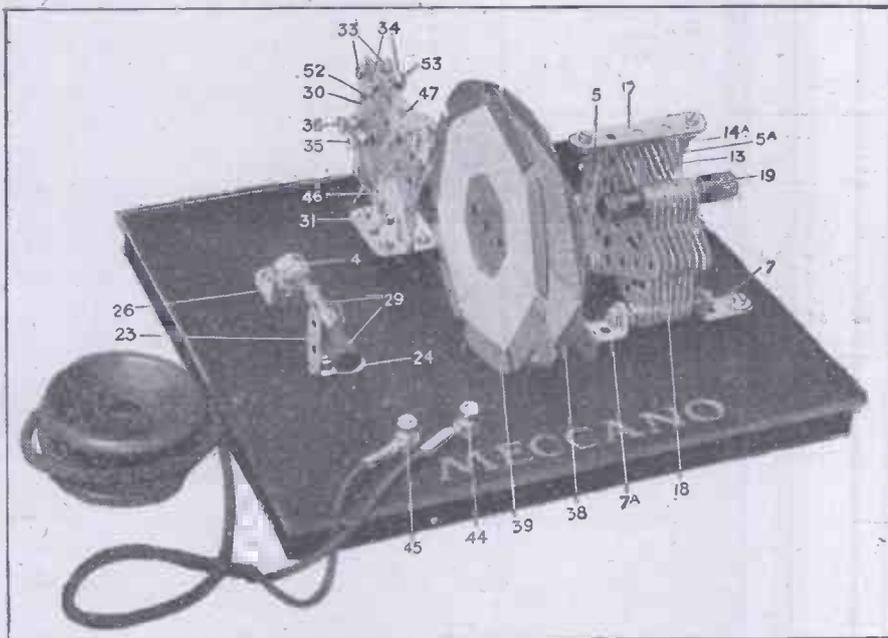


Fig. 1.

and at the same time spacing them by two nickel washers between each plate, afterwards clamping them at each end by a washer and nut. At the upper end a 2-in. threaded rod (14a) is used.

Before threading the rod through the plates, two triangular fibre plates (one of the Meccano Company's special radio parts) should be placed between each pair. In order to make the upper spacing uniform with the lower, these are spaced apart by nickel and brass washers, and are clamped together in the same manner as the lower end.

It will be noticed that in these triangular fibre plates one of the corner holes is cut out; this is intended to clear the washers on the rod (14) in order to make a better electrical contact.

Assembling the Fixed Portion.

The fixed portion of the condenser (Fig. 2) may now be fastened in position between 2½-in. and 1½-in. angle strips (5 and 5a). A 2½-in. strip (17) is bolted at the top with a spacing-washer at each end, and extra nuts (15) are threaded to both ends of the rods (14 and 14a) to centralise them. The strips 5 and 5a are then secured to the plate at 6 and 6a by two No. 6 B.A. bolts, with

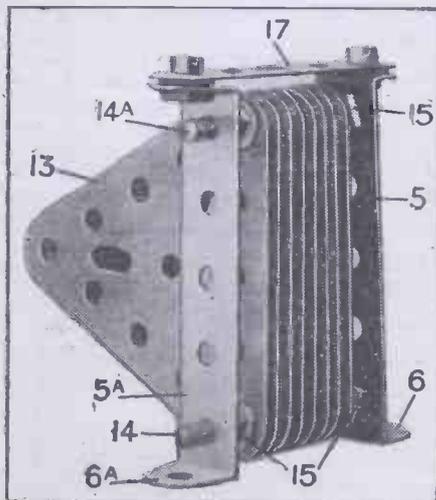


Fig. 2.

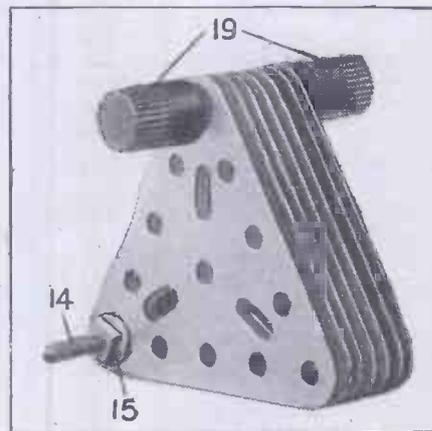


Fig. 3.

HOW TO BUILD A CRYSTAL SET FROM MECCANO PARTS.

(Continued from page 911.)

The primary inductance disc, as supplied by the Meccano Company, is wound with approximately 47 ft. of No. 23 S.W.G. D.C.C. wire, and the secondary disc with 50 ft. No. 26 S.W.G. D.C.C. wire. This gives an approximate range of wave-lengths of about 300-500 metres. Broadcast from Manchester has been clearly and loudly received on this set at distances of up to 26 miles.

The wave-length may, of course, be increased by adding holes in the fibre plate. With four such discs, time signals from the Eiffel Tower have been satisfactorily received.

This constructional set cannot be used under a broadcast licence, an experimental licence being necessary.

The following is a list of parts necessary

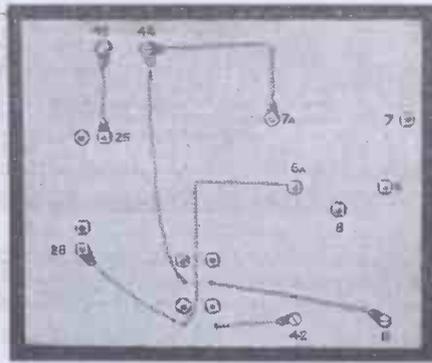


Fig. 4.

to make the set :

- 15 2½-in. triangular plates.
- 2 double angle strips, 2½-in. by ½-in.
- 2 1-in. by ½-in. angle brackets.
- 1 1-in. angle bracket.
- 2 trunnions.
- 1 flat bracket.
- 1 single bentstrip.

- 1 perforated strip, 2½-in.
 - 4 screwed rods, 2-in.
 - 7 ⅝-in. bolts.
 - 23 ½-in. bolts.
 - 4 ⅜-in. bolts.
 - 53 nuts.
 - 87 washers.
 - 15 brass washers:
 - 8 terminals.
 - 1 connecting pin.
 - 1 2½-in. by 2½-in. fibre plate.
 - 14 2½-in. insulated triangular plates.
 - 2 insulated handles.
 - 2 bushes for handles.
 - 1 detector arm.
 - 1 each inductance discs, primary and secondary.
 - 2 hinges.
 - 4 rivets.
- Crystal, telephone receiver, and mounting board.

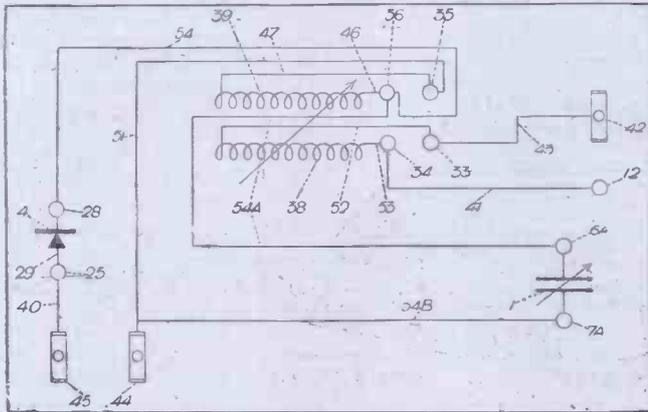


Fig. 5.

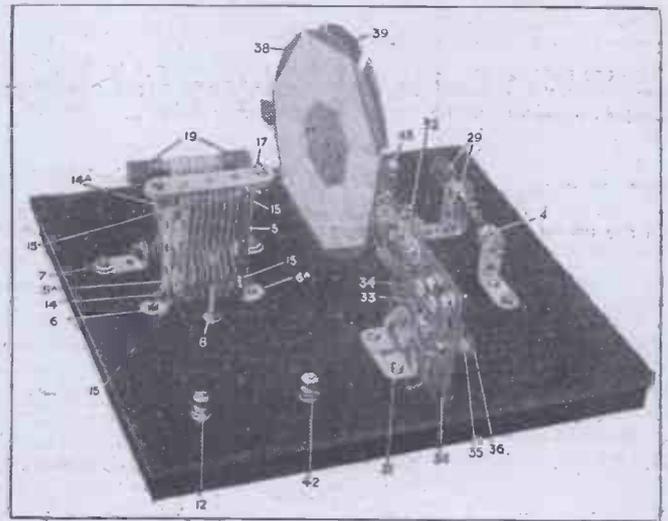


Fig. 6.

B.B.C. HOLIDAY COMPETITION.

THE British Broadcasting Company is offering prizes of wireless equipment to the value of £200 for interesting photographs, sketches, or descriptions of listening-in during the summer holidays. These will be awarded according to merit amongst the various groups.

The competition will be divided into five sections :

1. For the most artistic photograph showing the enjoyment of listeners-in.
2. For the most amusing photograph of listening-in.
3. For the most original photograph of listening-in.
4. For the most interesting, original, or amusing sketch of listening-in.
5. For the most interesting, original, or amusing description of listening-in.

Whether you may be at the sea, up the river, in the garden at home, send pictures of yourselves listening-in during some part of the day.

Fuller details of prizes will be announced shortly. The judges will be well-known men who will come and announce their decisions and give criticisms of the results personally from the London station, but their reports, as delivered at London, will be read out from other stations also.

The B.B.C. is prepared to receive entries from the 1st August, and the closing date will be the 30th of September, and the company hope to announce and publish the results early in October.

There will be no entrance fee.

The following are the preliminary rules for the competition.

Rules for the Holiday Competition.

1. The above prizes will be awarded for photographs, sketches, or descriptions which, in the opinion of the judges, are the best from the technical and from the interest point of view.
2. All entries must be submitted on the understanding that the decision of the judges is final, and no correspondence can be entered into on the subject.
3. Competitors may submit as many attempts as they choose. Each must have the name and address of the sender attached.
4. The copyright of all entries shall be the absolute property of the B.B.C.; and

cannot be returned under any circumstances.

5. The competition will be judged by the General Manager of the B.B.C., assisted by any technical experts he may decide to consult.

6. The competition will be open from the 1st of August until the 30th of September, 1923. Entries received after this date will be disqualified.

7. Entries to this competition must be addressed to the GENERAL MANAGER, B.B.C., 2, Savoy Hill, London, W.C., and the envelopes or packages containing contributions marked "Brighter Britain Competition."

8. Competitors agree to, and by submitting their entries, accept all the conditions.

The Editor of "Popular Wireless" welcomes photographs of amateur sets from readers, or anything else of particular wireless interest. 10s. 6d. will be paid for each photograph used.

SOME SIMPLE WIRELESS CALCULATIONS.

By C. E. FIELD, B.Sc.

Simple instructions for computing coil values, or discovering the dimensions required to cover certain ranges.

III. CALCULATIONS OF WAVE-LENGTH.

THE wave-length to which the aerial circuit of a receiving set will tune depends upon the inductance and capacity of the aerial, the inductance of the tuning coil, and the capacity of the tuning condenser. The second is the most important of these factors, and so we will consider first how to ascertain the inductance of a single-layer tuning coil.

It is beyond the scope of this article to give a full explanation of the meaning of inductance and its effect upon wave-length, but it may be stated briefly that the inductance of a coil is a measure of the product of the number of turns of wire, and the magnetic flux produced by a given current flowing in the coil. The flux produced by a coil depends, in turn, upon the diameter and length of the coil, and upon the number of turns with which it is wound, as well as upon the distribution of the flux outside the coil.

Formula for Inductance.

The simplest formula for calculating the inductance of a single-layer cylindrical coil is as follows:

$$L = \frac{0.00986 \times d^2 \times n^2}{l} \times k$$

where L stands for the inductance of the coil in mlys. (these being the most convenient units for this purpose), in the number of turns of wire, and d and l the diameter and length of the coil in cms.

k is a number which depends upon the value of the expression $\frac{d}{l}$, the following being a range of values sufficient for most purposes.

d/l	k	d/l	k
0.2	0.92	1.25	0.64
0.4	0.85	1.5	0.6
0.6	0.79	2.0	0.53
0.8	0.74	3.0	0.43
1.0	0.69	5.0	0.32

As an example, we will calculate the inductance of a coil consisting of 150 turns of No. 22 S.W.G. enamelled wire, wound upon a former 4 ins. in diameter.

By reference to a wire table, we find that about 13.3 turns of wire occupy 1 cm. length of winding; 150 turns will therefore occupy $\frac{150}{13.3} = 11.5$ cms. Hence the length of our coil is 11.5 cms, and the diameter is 4 ins. = 10.16 cms. This gives for $\frac{d}{l}$ the value $\frac{10.16}{11.5} = 0.9$, for which we find the value of k to be 0.71. We can now apply the formula given above, and

say that

$$L = \frac{0.00986 \times 10.16 \times 10.16 \times 150 \times 150}{11.5} \times 0.71 = 1410 \text{ mlys.}$$

Before we can calculate the wave-length to which a particular coil will tune, we must know the inductance and capacity of our aerial. There are no very simple formulæ for this purpose, but for single or parallel-wire aerials which comply with the P.M.G.'s regulations, the values of the capacity and inductance do not vary much, and in general these may be taken as .0002 mfd and 15 mlys. respectively.

The capacity of the aerial tuning condenser also affects the wave-length of a receiving set, but we shall not consider this in our calculations, for the A.T.C. should

find difficulty in obtaining the square root of a decimal quantity, such as 0.285, should move the decimal point *two* places to the right, and then proceed by a process of trial and error. Having obtained the correct value, the decimal point must be moved back *one* place to the left.

Construction of Coils.

For instance, to find the square root of 0.285, moving the decimal point to the right gives us 28.5. We can see at a glance that the square root of this lies between 5 and 6, and a few trials will give us the value 5.3. Moving the decimal point back one place gives us 0.53. Had the original number been 0.028, moving the point to the right would give 2.8, of which the square root is evidently somewhere between 1½ and 2, finally giving 0.17.

We will now imagine that we possess a quantity of No. 20 S.W.G. enamelled wire, and a cardboard tube 2½ ins. in diameter, and we desire to construct a coil which, in conjunction with a P.M.G. aerial, will tune up to a wave-length of 600 m.

First of all we must calculate the required inductance of the coil, and for this purpose we can rewrite our wave-length formula thus:

$$L = \left(\frac{\text{wave-length}}{1885} \right)^2 \div C$$

Assuming an aerial capacity of .0002 mfd., we then have

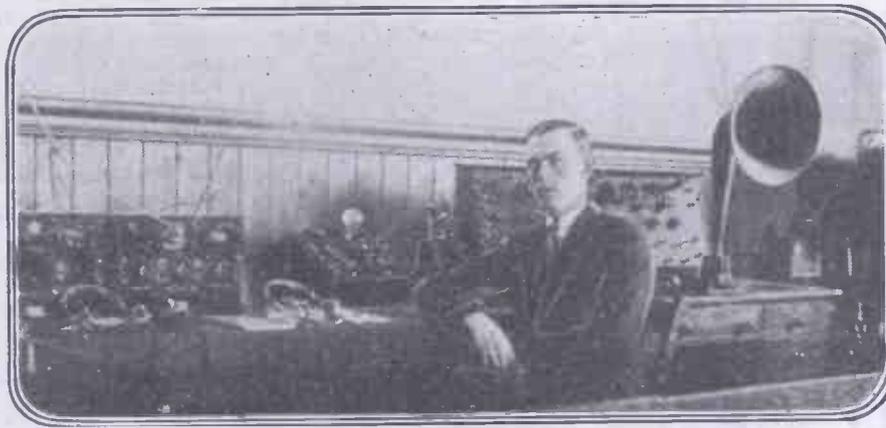
$$L = \left(\frac{600}{1885} \right)^2 \div .0002 = (0.318)^2 \div .0002 = 505 \text{ mlys.}$$

The aerial inductance is about 15 mlys., so that the inductance of the coil must be 490 mlys. Rearranging the formula for the inductance of a coil, the number of turns is given by the following expression:

$$n = \sqrt{\frac{L + 1}{0.00986 \times k \times d^2}}$$

Here a difficulty arises, for we do not know the value of l or k until we have decided upon the length of our winding, which, in its turn, is dependent upon the value of k. Consequently a certain amount of guess work is necessary. As the coil is of small diameter and wound with thick wire, the ratio $\frac{d}{l}$ will be fairly small, and we might assume, for a start, that $\frac{d}{l} = 0.7$ —i.e., that the diameter of the coil is not quite three-quarters of the length. The corresponding value of k in this case is 0.76. The

(Continued on page 914.)



G O X, the amateur station controlled by Mr. B. Quentin of L'islet Lodge, St. Sampson, Guernsey.

be used only for fine adjustments, and its value kept at a minimum for efficient working.

Determining the Wave-length.

The greater the capacity and inductance of a receiving circuit, the greater is the wave-length to which it will tune. The wave-length, however, does not depend directly upon either one of these two factors, but upon the square root of their product, the formula being as follows:

$$\text{Wave-length} = 1885 \sqrt{L \times C} \text{ metres.}$$

L and C being the inductance and capacity of the circuit, measured in mlys. and mfd. Excluding the added capacity of a tuning condenser, C stands for the capacity of the aerial, and L for the sum of the inductances of the aerial and the tuning coil.

If the coil we have just been considering were connected in series with a normal P.M.G. aerial, the total inductance would be 1410 + 15 = 1425 mlys., and the capacity would be that of the aerial = .0002 mfd.

The wave-length of the circuit would then be given by $1885 \sqrt{1425 \times .0002} = 1885 \sqrt{0.285} = 1885 \times 0.53 = 1000$ m. Those who

DIFFICULTIES OF EXPERIMENTAL VALVE MAKING.

By H. P. WARAN, M.A. Ph.D. (Cantab), F.Inst.P.

A further article by Mr. Waran, in which he describes minutely the construction of an amateur valve, will appear in a future issue of "P.W."

THE valve is probably the only component of one's wireless set which still defies all the attempts of even the most enthusiastic of experimenters anxious to improvise it in some cheap and simple form. This difficulty arises from the fact that the valve is a very specialised product requiring not only a good scientific knowledge of the processes involved in its manufacture, but a high degree of skill in such unusual arts as glass blowing as well if one is to have any measure of success in making thermionic valves.

The whole difficulty arises from the principal fact that a thermionic valve is a high vacuum device, and even for the so-called soft valve the vacuum in the valve chamber has to be quite a good one. The gas pressure has to be less than about .001 m.m. of mercury, which corresponds to what is commonly described as an X-ray vacuum. Such a good vacuum is essential for the following two reasons. Firstly, any appreciable quantity of air left in the valve will immediately burn out the very thin tungsten filament as soon as the valve is lighted up for the first time. Secondly, such excess of residual air will seriously interfere with the function of the valve by setting up space charge effects and other undesirable complications.

Preliminary Difficulties.

This necessity to keep a high vacuum in the valve precludes the efficient use of such materials as corks, rubber, wax, and other stuff of a similar nature in the construction of experimental valves. These materials are not stable compounds like glass, and thus they undergo rapid decomposition when exposed to a high vacuum or high

temperature, and the large quantities of gases and vapours liberated by them would foul the vacuum of the valve and render it useless for our purposes.

This necessity for the permanency of the high vacuum in the valve necessitates the use of only such stable materials as glass and metal in the construction of the valve. The valve must have an air-tight outer envelope of one of these materials, and there lies the difficulty for the experimenter. Since the metal (being a conductor) would short circuit the leads if used for the outer envelope the only solution is to use glass (fortunately a very good insulator) for the outer envelope and metal for the inner components. From this glass envelope the four current leads have to be taken out through air-tight seals, and to do that without using waxes and cements is rather difficult for the average experimenter. But there is still another difficulty.

Occluded Gases.

Even such apparently stable materials as glass and metal have the very undesirable property of holding large volumes of gases occluded or dissolved in them, and if these are not to foul the vacuum gradually they must be got rid of during the operation of exhausting the valve. To liberate these gases the glass envelope and the metal electrodes in it have to be heated as high as possible during the exhaust. The absolute necessity for this treatment makes it impossible to use any materials like waxes and cements in any part of the valve having access to the high vacuum inside.

Thus the only practical design for an experimental valve is that embodying an all-glass envelope without wax or rubber joints

that can be safely heated up during the exhaust to about 300 degrees C. This would mean that the experimenter ambitious to make valves must understand glass blowing, and those anxious to make their own valves would do well to start studying this very useful and fascinating art.

Obtaining the Vacuum.

The problem of exhaust even for soft valves is by no means easy. Ordinary single stage oil pumps are useless for the purpose. Some form of mercury pump is absolutely essential, and with patience and using a Sprengel or Töpler pump one can reach their limit of exhaustion which is about that required for a soft valve. For a hard valve the vacuum has to be much higher, and it can be reached only with the aid of a mercury vapour pump. Every trace of the gas occluded in the glass and metal must be got rid of by heating the valve exposed to the high vacuum. During use the plate of the valve would be subjected to a bombardment of electrons from the filament attracted to it by its positive potential. This would result in the heating of the plate which may liberate any gases left in it. Hence, hard valves are given this bombardment before they are sealed off.

Between the lighted filament and plate a high potential of the order of 1,000 volts or more is applied and the plate becomes red hot and liberates any gases contained in it, and these are immediately removed by the pump. When no more gas is coming from such sources the valve may be sealed off from the pump, and on cooling the valve would have improved in vacuum by the hot metal and glass absorbing any traces of gas still left in the valve.

Notwithstanding these difficulties in the making of a good valve that will work, experimenters will probably spend much time in trying simple arrangements with tubes, corks, and wax. In such attempts they would do well to use a thick platinum wire for a filament in preference to tungsten. Then they would be able to bring their valves up to, at least, the lighting stage even in an imperfect vacuum since the platinum wire would not get burnt out so readily as tungsten in the presence of residual air in the valve.

SOME SIMPLE WIRELESS CALCULATIONS.

(Continued from page 913.)

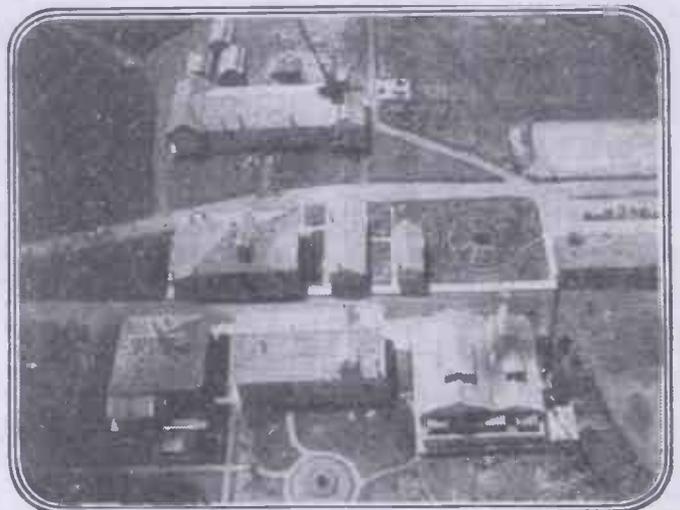
length of winding is 3.6 ins, or 9.1 cms., the diameter being 6.35 cms.

$$\text{Hence } n = \sqrt{\frac{490 \times 9.1}{.00986 \times 0.76 \times 6.35 \times 6.35}} \\ = \sqrt{14800} = 122 \text{ turns.}$$

We can now tell what sort of a guess we made as to the length of the coil; 26 turns of No. 20 enamelled wire occupy one inch of winding length, so that 122 turns would occupy $\frac{122}{26} = 4.7$ ins. Our guess of 3.6 ins. was therefore too small. If we now calculate exactly the inductance of this coil, we find that it is 405 mhs., and so our coil is too small. The required value of 490 mhs. is about 21 per cent greater than this, and so we will increase the number of

turns on the winding by 21 per cent, giving 148 turns. Although the inductance of a coil does not vary exactly with the number of turns of wire, we shall find that we are now well on the safe side, the inductance of the coil being now 500 mhs., giving a wave-length of just over 600 m.

If we propose connecting the A.T.C. in series with the A.T.I., an extra twenty turns should be added to the coil, while if the tuning condenser is in parallel with the coil, wave-lengths of considerably over 600 m. can be received.



An interesting photograph of the Osmania Station taken from a point half-way up the central mast.

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Always tune with a Vernier condenser (preferably the LISSEN VERNIER, 1 in. diameter, designed for fine tuning in H.F. circuits, price 12/6).

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LISSEN VARIABLE GRID LEAK.

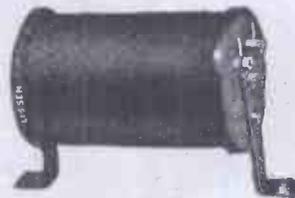
Use it to obtain clear signals—eliminate hissing—to get correct grid potential—to provide maximum signal strength—particularly in those circuits which are more susceptible to variable grid control—goes easily in between anything, no thicker than a pencil—LISSEN ONE HOLE FIXING, OF COURSE! NOTE THE PRICE! Neat and nicely finished. 2/6
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'00075	.. 8/-	Postage
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'0003	.. 5/9	One only, 9d.
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A CHAT ABOUT THE "P.W." COMBINATION SET.

By THE TECHNICAL EDITOR.

Describing the results of a series of tests carried out on the original model, and detailing a few points that should receive attention in order that the 100% mark of adaptability, usefulness and efficiency of this unique receiver may be obtained.

TO the wireless man a good circuit gives as much pleasure as does a good horse to the huntsman, a good car to the motorist, or a well-tuned, speedy aeroplane to the aviator, and I can honestly say that the series of tests that I have conducted with the "P.W." Combination Set has been work of pure delight. At no point has there been trouble, and in every respect success has attended us all the way, from the first rough diagram on paper to the finishing off of the complete set. The reason for this is obvious to the more advanced amateur, to whom will be apparent the fact that the keynote of our labours has been "efficiency, adaptability, and simplicity." The very nature of the circuits involved has rendered it unnecessary to deviate from the path of the straightforward into the complicated and tortuous path of biasing batteries, high-resistance stabilisers, etc., and, apart from the fact that the component values called for rather close attention, no trouble of an obscure nature was encountered.

It must be thoroughly understood, however, that results will suffer and "howling" can arise if the instructions regarding the construction of the set are not faithfully carried out. No guarantee of the efficient operation of the set can be given if amateurs modify the "lay out" or the values of the condensers employed, either fixed or variable. Also the indiscriminate use of twisted flexible wires may cause capacity effects to arise. It is advisable to employ the shortest lengths possible of straight twin wires of the nature of telephone cords for the plugs. **Tuning-in.**

In respect of the interior wiring of the units, the usual rules regarding good separation and avoidance of parallel wiring are, of course, essential. Should Unit Two not cause efficient note magnification, change over the transformer primary leads. As the L.T. + is directly connected to the H.T. - in both units, obviously only three battery connections between the two are necessary, but great care should be taken in seeing that the L.T. + and NOT L.T. - is taken to the H.T. - in either case, before connecting up.

With those few general remarks concerning the construction of the units, I will now proceed to deal with the handling of the set, and briefly detail some of the results obtained on the original model.

In the first place it will be found that the tuning on the H.F. condenser is not critical, but that the adjustment of the A.T.C. requires to be very close indeed. This is an interesting and useful point.

In the case of near-at-hand stations, however, tuning can at first be done on the crystal, which cuts down the variable factors or components requiring adjustment to two—the crystal detector and the A.T.C. This is one of the great advantages of the "P.W." Combination Set, and permits far

finer tuning and the finding of a more sensitive point on the detector than is possible with any other type of reflex circuit. The change-over switches are over at "Crystal," and the telephone plug in the "C. and H.F." jack for this preliminary tuning. Having tuned in the A.T.C. and adjusted the crystal, the change-over switches are carried over and the valve turned on. The H.F. condenser can now be tuned, and the telephone plug thrust into "Dual" if loud-speaker signals are desired. Where good signals are received on the crystal alone, loud-speaker work should be possible when working "Dual." Referring to loud speakers, it will be found very convenient if the telephone plug is taken to a small terminal board; this will enable any number of 'phones or a loud speaker to be very quickly brought into circuit.

When working to distant signals it will be necessary to commence tuning with the valve in



The Technical Editor adjusting the "P.W." Combination Set.

use as an H.F. amplifier, or it may be even necessary to start right away on "Dual." In these cases it should be remembered that the A.T.C. requires finer tuning than the H.F. condenser, and so, leaving the latter in approximately the correct position, close attention should be paid to the adjustment of the A.T.C. until audible signals are obtained. The crystal detector can always be adjusted to the signal of some near-at-hand station.

Some Surprising Results.

There are, with the two units, as everybody will by now know, six circuits available, and I will not anticipate the experiments of those who have constructed the set, because one of the most fascinating of all the possibilities of the receiver is that it permits a close comparison between various circuits. The difference between H.F. and L.F. amplification under varying conditions can be closely studied, and careful note can

be taken of the behaviour of different valves operating in varying capacities with varying pressures of H.T. voltages. In fact, the possibilities of the set, as any amateur who handles it will quickly discover, are almost illimitable.

At the offices of POPULAR WIRELESS, Unit One was tested on a frame aerial, and comfortable loud speaker signals from 2 L O resulted. With Unit Two "plugged in," these became deafening. Such signals were also the order when Unit One alone was coupled to an outdoor aerial without using an earth. Birmingham came in comfortably on 'phones. At Sidcup, which is 15 miles from 2 L O, this station actuated a small loud speaker with sufficient intensity to fill a small room, using only Unit One on an outdoor aerial. This was also the case when the set was tried at Radlett, which is 15 miles from 2 L O in the other direction. Bringing in Unit Two in either case resulted in deafening signals. Tried at Thorpe Bay, which is near Southend, some forty or so miles from London, Manchester, Cardiff, Newcastle, and Glasgow were comfortably received, although trouble was experienced in some cases from "jamming" by ships.

At Radlett, Newcastle was brought in on a loud speaker using both Units, while Glasgow gave comfortable telephone signals. School of Posts and Telegraphs, Paris, actuated a loud speaker comfortably.

Demonstrations of the Set.

London at Thorpe Bay came in strongly on H.F. and crystal, while "Dual" nearly gave loud-speaker signals. These latter were comfortably obtainable with Unit Two plugged in. At Leyton, five miles from 2 L O in an easterly direction, the London station comfortably worked a loud speaker on the one unit. All the well-known amateurs were easily audible on 'phones, 2 O M at Brentwood, some 20 miles away, coming in with some considerable strength. Fairly hard valves, with some 60 volts on the plate, were used during these tests.

It is one's feeling, when listening-in on this remarkable receiver, that anything transmitting is within range wherever its location. I have been present during the majority of demonstrations given to readers who have visited the offices of POPULAR WIRELESS in order to examine the original model (in response to a general invitation, which is, by the way, still open), and in no single instance have those who have actually seen the set working, and have closely investigated its action, had anything but admiration and praise to offer.

Considering the fact that our callers have included not only amateurs, but professional wireless men of advanced standing, it is a fact of which the technical staff and myself are justly proud.

THE RADIO TYPEWRITER.

By G. H. DALY.

Describing a remarkable invention whereby wireless transmission and reception is effected automatically and with secrecy.

IN many telegraph offices there will be found an instrument called the Morkrum teletype. This instrument—which at first glance may easily be mistaken for an ordinary typewriter—is for automatically transmitting and receiving messages over the telegraph line, and has been in use for a number of years.

The Morkrum teletype has a keyboard containing the letters of the alphabet, numerals, and punctuation marks exactly similar to the standard typewriter keyboard, and in order to send a message to a distant station by means of this machine it is merely necessary for the operator to strike the various letters on the keyboard, just as if he were typing a letter. In this case, however, the fact of the operator striking the keys causes the message to be automatically printed on a moving slip of paper at the distant receiving station within an extremely short space of time.

It was only natural that sooner or later the idea would appeal to someone of using this ingenious teletype for wireless work, and this someone appears to have been a Mr. J. H. Brady. The perfected radio typewriter, however, which embodies the Morkrum teletype, is the work of the U.S. Navy Department and the Morkrum Company of Chicago, and with this radio typewriter it is possible for any typist to send a wireless message in the same way as he or she would type a letter—i.e., by depressing the necessary letter keys. At the receiving station the message is automatically printed on to a moving slip of paper by means of another radio typewriter. For it should be understood that each individual radio typewriter consists of a complete transmitting and receiving apparatus in itself. A very important point about this machine is that it entails no knowledge of the Morse, or any other code, on the part of the radio typist.

Action of the Typewriter.

When a particular key of the keyboard is depressed, such as, for instance, the letter "A," the controlling circuit of the wireless transmitter—to which the radio typewriter is connected—is closed, and a series of electrical impulses are radiated into the ether. This is accomplished by the mechanical action of certain cams and levers working in conjunction with an electric motor and selecting device which are brought into action by the depression of the key, the whole being contained in a compact cabinet behind the keyboard.

Now each letter key on the keyboard is allotted a different combination of electrical impulses, and thus each key on being depressed causes the wireless transmitter to radiate one particular combination of impulses into space.

These impulses on being picked up by the aerial at the receiving station are amplified by a two-stage amplifier, and in this condition actuate an automatic relay recorder, which in turn operates the printing portion of the radio typewriter of the receiving station.

The principal unit of the receiving portion of this radio typewriter is a type wheel containing letters, numerals, and punctuation marks, exactly similar to the keyboard of the transmitting radio typewriter.

On the receipt of a certain combination of impulses by the receiving antenna this type wheel is made to rotate—by means of a delicate and selective mechanism—and print the letter which that particular combination of impulses represents upon a moving slip of paper. Therefore the letter which was depressed on the keyboard at the transmitting station is automatically printed upon this moving slip of paper at the receiving station.

As it was impossible to operate the teletype with the international Morse code the inventors found it necessary to evolve a code of their own. In this code each letter of the alphabet is allotted five units or impulses, the difference between each letter, etc., being that the five units are differently arranged in each case.

For instance, the five units allotted to the letter "A" may be said to consist of two dots and three spaces, as it were. The letter "B" consists of one dot, two spaces, and two dots. "C" is made up of one space and three dots, followed by a space—and so on with each letter of the alphabet.

One obvious advantage of this code is from the point of view of secrecy, for the actual arrangement of the code can be altered at will.

A SINGLE PANEL UNIT RECEIVING SET.

By D. STEWART, B.Sc.

THE receiving set shown in the accompanying illustration was built by the writer, as the result of experiments carried out with a view to the construction of an experimental set, which, while permitting of various arrangements of tuning coils, valves, and crystals, would yet present a neat and compact appearance, and have few loose connecting wires such as characterise the majority of experimental sets built up of separately mounted parts.

All controls and terminals are mounted on a vertical ebonite panel 36 in. by 9 in., which forms the front of the case. 36 in. by 10 in. by 10 in.

This panel, while being in one piece, is divided into five sub-panels, forming a tuner, a H.F., a detector, and two separate L.F. units.

The input and output of each unit is brought to terminals, so that short connecting wires can be used to connect up whatever valves are required. A crystal detector may be separately mounted, and the output of the tuner or H.F. valve unit connected to it instead of to the valve detector.

A three-coil holder is mounted above the tuner panel, on which itself are mounted primary, secondary, Vernier, and reactance variable condensers. The circuit of each of the three coils is broken and brought to six terminals at the extreme left of the panel, so that after short-circuiting the coil plugs any type of tuner may be connected up to the set by means of the six terminals.

The H.F. panel is designed to give either transformer or tuned anode coupling to the grid of the detector valve, the connections for one or the other being made by moving the four-pole two-way switch either to right or left. The anode coil is large enough to tune to 2,000 metres, but loading coil terminals are provided.

Grid Control.

Anode tuning is controlled by means of a nine-stud switch and a .0002 mfd. variable condenser, which also tunes the primary of the plug-in H.F. transformer when it is in use.

Grid potential is varied by a potentiometer, operated by a ten-stud rotary switch. Two sets of reactance terminals are provided, so that regenerative effects can be obtained either on the aerial secondary coil or on the anode coil.

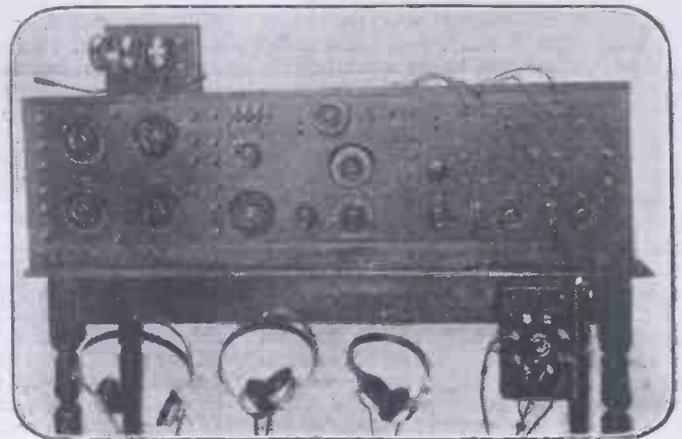
The detector panel is of the usual type, but carries a variable graphite grid leak.

The L.F. panels are also standard, and, of course, one or both may be used as desired.

One pair each of L.T. and H.T. battery terminals are provided, wires from which run to all the valves; but only those valves actually in use need have their filaments glowing, as a separate resistance is fitted to each valve.

As will be observed from the illustration, all the valves are mounted inside the cabinet, but the condition of the filaments may be readily seen through peep-holes.

Though this particular set employs four valves, a smaller or larger one on the same system is, of course, practicable, and would be as likely to prove successful as the one here described has certainly been.



The single panel-unit receiving set described in the above article.

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" enclosed in glass case	2/6, 2/3, 1/8	SPACING WASHERS, large	per doz.	2½d.	INSULATORS, white egg, each	2d.; 11d.	
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IVORINE LABEL SET, 12 different titles	the set, 6½d.	W.O. TERMINALS, nuts and washer, each	2d.	1/7	TALITE	9½d.	9½d.
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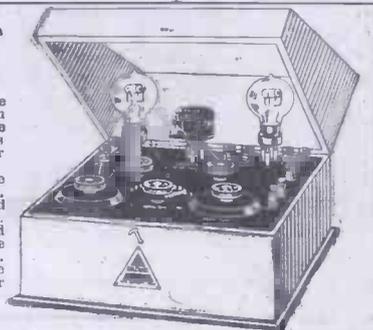
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SUMMERTIME WIRELESS.

By OSWALD J. RANKIN.

Describing some useful circuits, suitable for portable work, illustrated with some of the author's well-known pictorial diagrams.

AS in the case of ordinary stationary installations, it is not possible to specify the exact range of any particular receiver. So much depends on the existing conditions, locality, the amount of care taken in constructing the apparatus, experiments, and—the individual ability to carry out experiments. With portable sets it is possible to take a train journey and erect the installation within a short distance from the broadcasting station, so that even with a fairly simple type of receiver one is enabled to “make ends meet,” so to speak. The selection of any particular type of receiver will, of course, depend on the dis-

H is an ordinary .002 mfd. mica grid condenser connected in shunt with the variable resistance F, which, of course, is in series with the aerial lead-in and the grid of the valve. The three fixed condensers, I, J, and K, each have a capacity of .006 mfd., the exact value being a rather critical factor. The tuning will be rather difficult until the operator has become acquainted with the various adjustments.

Efficient Reflex Circuit.

Place the variable resistance F to its maximum value, and vary the coupling of the coils until a whistling noise is heard in the headphones. The coupling and variable condenser should be continuously adjusted until the desired signals are heard, when it will then be necessary to readjust the variable resistances, which are then left at the best positions while the signals are finally tuned in by making further adjustments of the coils and condenser. A good hard valve should be used, and great care should be taken to see that all the connecting wires are well insulated and well separated from each other.

Fig. 10 represents a pictorial circuit diagram of a double amplification or “reflex” valve-crystal receiver particularly suitable for portable work. The single valve functions as a high and low-frequency amplifier simultaneously, rectification being accomplished by a crystal detector. The simple slide inductances B and C are identical in size and capacity, and to enable both coils to be tuned to the same frequency a .0005 mfd. variable condenser D is connected in shunt with the active turns of the coil C. Both coils should be 6 in. long by 3 in. in diameter, and wound with No. 22 enamelled wire.

The secondary side of the low-frequency inter-valve transformer F, which is in series with the earth and the common negative line, is shunted with a .001 mfd. fixed condenser G. A fixed condenser H having a capacity of about

.01 mfd., shunts the telephones and the high-tension battery; and I is the usual telephone condenser, which is not essential, but desirable. The most admirable feature of this circuit is the entire absence of distortion, and it is also extremely simple in construction and manipulation.

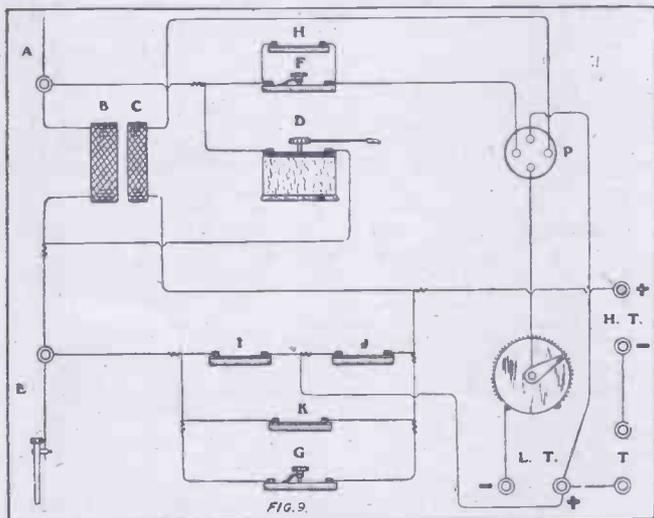
The signals are first amplified in the aerial circuit, then rectified by a well-adjusted crystal, then fed back into the valve again to be amplified at low frequency, and finally delivered to the headphones at a greatly increased strength. This is one of the very best single-valve circuits particularly suitable for portable work, since the few necessary components may be conveniently arranged in an attaché case or small box.

There are, of course, many existing two-valve receivers which, under normal conditions, would be quite suitable for portable work. The usual outfit, comprising one valve rectifying and one valve L.F., will sometimes give excellent results; but a stage of H.F. is always desirable, since we are concerned with a more or less inefficient aerial system. The two circuits to be described indicate examples of the most suitable types of two-valve receivers to use with a make-shift aerial. These are ordinary receiving circuits, the first, Fig. 11, employing one stage of H.F., tuned anode reactance coupling, and valve rectification; the second, Fig. 12, employing one stage of H.F., crystal rectification, and one stage of L.F. The latter has been adapted to the frame aerial for sake of variety.

A Two-Valve Set.

The circuit shown in Fig. 11 is selected because it is highly efficient and easily handled. Two standard coil-holders will be required, one for the primary and secondary aerial tuning coils B and C, and the other for the anode and reactance coils F and G. The secondary aerial coil C is shunted with

(Continued on page 922.)

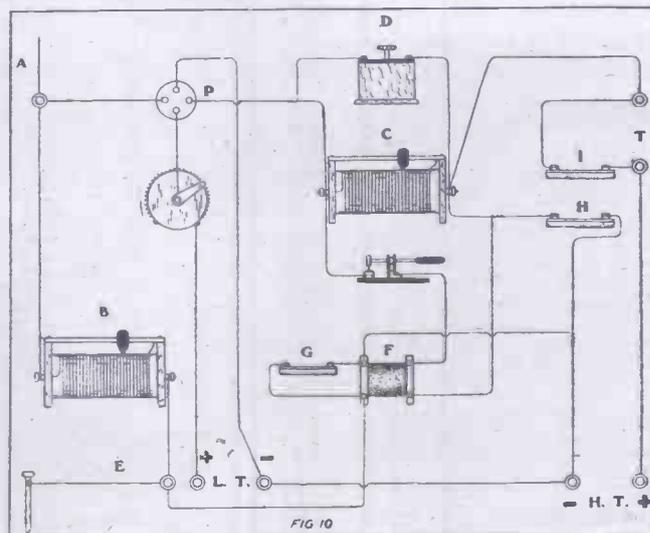


The Flewelling super-regenerative circuit.

tance between the proposed temporary receiving station and the transmitting station. For general purposes, a suitable circuit which will compare very favourably with the single-valve receiver in the ordinary way, is the Flewelling super-regenerative circuit shown in the pictorial diagram Fig. 9. This is probably the most efficient single-valve receiver yet devised, and it is extremely simple in construction and operation. It is adaptable either to the ordinary single aerial or to the frame aerial previously described. The tuning coils B and C may be of any suitable type, the secondary coil, C, giving about two-thirds of the inductance of the primary coil B. Nos. 50 and 35 Igranic coils are quite suitable, and an ordinary loose coupler or vario-coupler will also give good results.

Important Details.

The variable condenser D, which shunts the primary coil, should have a maximum capacity of .0005 mfd., and sharper tuning may sometimes be obtained by connecting a 5-plate Vernier across the terminals. These condensers and the filament rheostat should be well shielded in order to prevent body capacity effects. F is a variable grid resistance with a value from 1 to 1½ megohms, and G is a similar component, being continuously variable from ¼ to 1 megohm.



A dual amplification circuit.

SUMMERTIME WIRELESS.

(Continued from page 921.)

a .0003 mfd. variable condenser, D, and a .0002 mfd. variable condenser is similarly connected to the anode coil, F.

An ordinary mica grid condenser, I, is placed in series with the plate of the first valve and the grid of the second valve and the grid leak, J, is in series with the grid of the second valve and the positive low-tension line. K is a 2 mfd. Mansbridge type fixed condenser connected in shunt with the telephones and high-tension battery. If desired, either or both pairs of honeycomb coils may be replaced by small loose couplers. Basket coils may also be used, the amount of winding in each instance being determined by experiments and the particular wave-length it is desired to work on.

Using a Frame.

Fig. 12 represents another very efficient two-valve receiver which is a hot favourite with the author. It is here shown connected up to the outdoor frame aerial previously described, and it was this combina-

tion which gave the remarkable results mentioned in an earlier chapter. A is a diagrammatical impression of the frame aerial, and B represents the .00075 variable condenser. A five-plate Vernier condenser connected across these terminals will sometimes facilitate sharper tuning. C is a No. 50 Igranic honeycomb coil, which is in series with the plate of the first valve and the I.P. terminal of the low-frequency transformer, and D is a .0003 mfd. variable condenser connected in shunt with this coil.

E is a .001 mfd. fixed condenser which shunts the primary winding of the transformer, and another of .002 mfd. capacity is connected across the telephone terminals. Y and Z represent the two points where the leads from a tuning coil would be connected if it was desired to use the ordinary aerial and earth system. In this case the frame aerial and the large capacity variable condenser would be dispensed with.

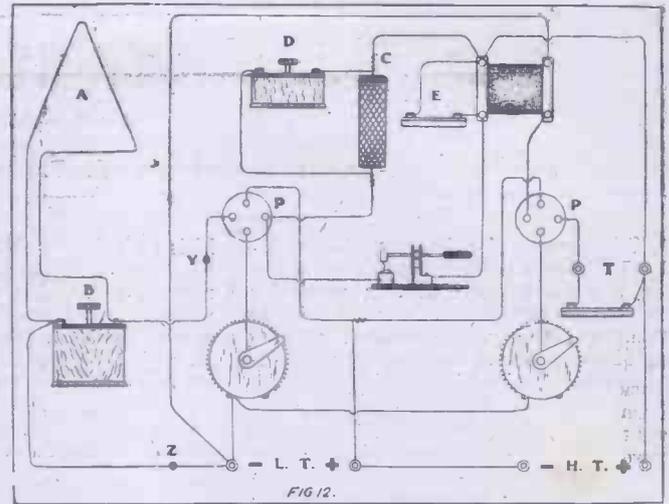
The one drawback with portable outfits is the accumulator. During the hot summer months one seldom feels energetic enough to carry masses of lead plates across rough country fields, and for this reason I have not described anything more ambitious than a two-valve receiver. These outfits will give several hours' enjoyment using a "respectable" size accumulator, say, 4 volts 20 ampere hours; and even this size may

be modified when using certain types of valves.

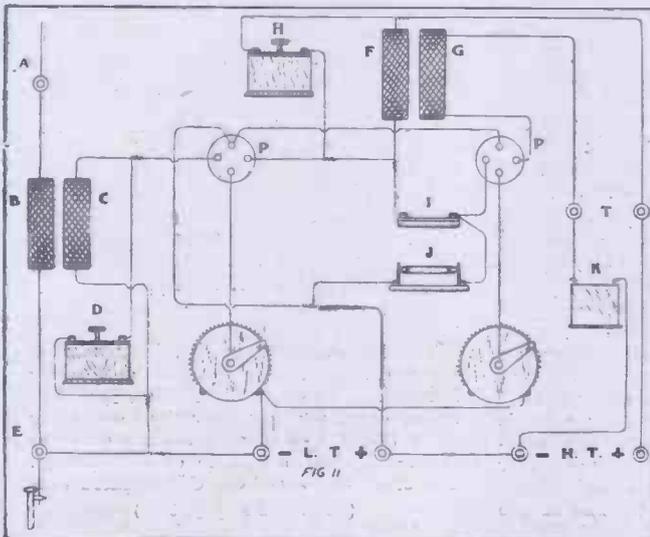
My theme has been to show the average enthusiast how it is possible to extend his efforts to the open air, and receive the usual broadcast programmes throughout the summer without experiencing that "boxed-up" sort of feeling which creeps upon us with the coming of the brighter days. Those who regard the hobby as a serious pursuit rather than a novel form of amusement, and who intend experimenting on long-distance reception, will, of course, know that the receivers described in the foregoing chapters are essentially "broadcast" receivers, and that it will be necessary to modify these circuits to suit individual requirements. For long-distance reception with portable outfits I would recommend the use of not less than two stages of H.F. amplification with reaction.

Crystal Advantages.

Concerning loud speakers, I do not hesitate to advise the use of a single-valve power amplifier having a separate high and low-tension current supply. The best results will be obtained by using a good crystal detector, since a crystal will rectify all frequencies equally well without undue distortion. This is where the crystal scores over the valve, and there is no doubt that the ultimate success of the loud speaker will be attributed to the crystal.



A circuit similar to Fig. 11, with a crystal and L.F. amplification.



One Stage of H.F. valve amplification with a valve detector.



THE CONSTRUCTION OF VALVES.

These two photographs, taken in the factory of the Cossor Valve Co., Ltd., illustrate two of the operations involved in the manufacture of thermionic valves. On the left is shown the machine that mounts the filament wires, while on the right the operator who cuts the wires to the correct length can be seen at work. The tungsten wire employed is very brittle, and extremely careful handling is required, otherwise considerable wastage would result. The factory hands are mostly girls, and it is said that they are more suitable than men for such delicate work. A high degree of efficiency is attained by these workers, who are mostly quite young, and it is a most interesting experience to walk around the factory and watch them at work.



THE NEW MANCHESTER STATION.

By Our Manchester Correspondent.

On Thursday the 2nd of August, 2 Z Y closed down at Trafford Park and re-opened again the following day at its new position in Dickenson St., Manchester. Full details of the new station and important changes in the staff are given in this article.

A FORTNIGHT ago the Manchester broadcasting station was removed with fitting ceremony from the out-of-the-way building in Trafford Park to the top floor of 57, Dickenson Street, just outside the great corporation power station.

One half of the upper floor is occupied, and the aerial suspended from the top of the power-station chimney to one of the windows of the transmission room. The studio is considerably larger than that of the old station, being about 30 feet long and 14 feet wide, compared with the former room of 24 feet by 14 feet. It is, of course, smaller than the new London studio at 2, Savoy Hill, which is 40 feet by 20 feet. On one side of the studio is a tastefully furnished green room for artistes, who enter it directly from the lift. On the other side of the studio is the transmission room, containing the new equipment specially designed and built by the Radio Communication Co., Ltd., of Barnes.

Up-to-Date Apparatus.

This set embraces all the advantages of the latest improvements, and is controllable by one operator, who can check all the necessary power and other readings by consulting all the meters in front of him, and at the same time controls the musical quality and strength of the transmission. He also has visual control of the studio through a sound-proof window by his side, so that any necessary alteration in the position of the artiste, and so on, may be carried out immediately by his instructions. The power from the corporation 400-volt D.C. mains is converted by a motor generator set supplying current at 5,000 to 6,000 volts to the transmitter. This generating set is in duplicate in a room removed from the transmitting room together with two duplicate battery-charging sets driven by five horse-power motors. The low-tension and high-tension batteries are housed in separate gas-tight compartments with controlling switchboard energy machines.

There are also directors' offices, where the many callers may be interviewed, and quite an imposing orchestral room, where the members of the orchestra or band may retire between turns and, if necessary, rehearse without disorganising the studio arrangements. The spacious general office, in which the heavy daily audition common to all provincial stations is carried out by the station staff, contains a sound-tight telephone box, in which the nightly news bulletin will be received from London by a special night operator. All rooms are easily accessible from the entrance of the lift or from the alternative staircases by a central passage.

Old Station "Closes Down"

The closure was applied at the old station on Thursday, August 2nd, when, in addition to the programme, arrangements were made

for special items reminiscent of 2 Z Y. These contributions related not so much to the difficulties of the station as to the personnel aspect of it. The old familiar voice of Humpty-Dumpty, Mr. Z. Rastus, and Massa Johnson were heard again. Unfortunately, the Cloud Lady and Mr. X were at the time on a well-earned holiday.

The old impromptu talks which were given by the staff, and were quite effective, were rearranged, and made an interesting feature of the programme, while the chat on the technical equipment of the whole station, and a little demonstration of the efficiency of microphones, also provided an attractive interlude. After this the end came with the shaded ghost, who, finding everywhere deserted, buried the carrier wave with a low, dying heterodyne note.

Memorable Evening.

There was no break in the service to listeners-in, for the next day the new station was opened with due ceremony. Arrangements, in fact, were made for the usual afternoon concert, which was provided by the Oxford Picture House orchestra. The opening night had all the appearances of being a memorable one in the history of Manchester broadcasting. In the first place, Lord Gainford, the chairman of directors of the B.B.C., was due to speak, and Sir Wm. Noble, another director, and Mr. J. W. Reith, general manager, along with many civic notabilities, were expected to be among the distinguished gathering. Following the speeches, there was to be a musical programme by the band of H.M. Irish Guards, with Miss Florence Holding as the soprano, Mr. Lee Thistlethwaite baritone, and Mr. Victor Smythe the entertainer. It is interest-

ing to note that ever since Mr. Smythe gave "Algy on the Golf Links" he has been frequently requested to repeat it, and he proposed giving the piece again on the auspicious opening night at Dickenson Street.

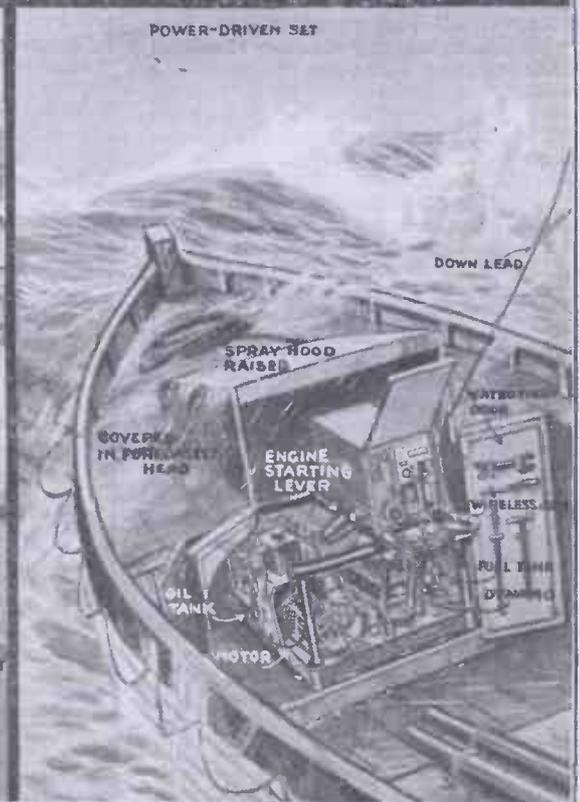
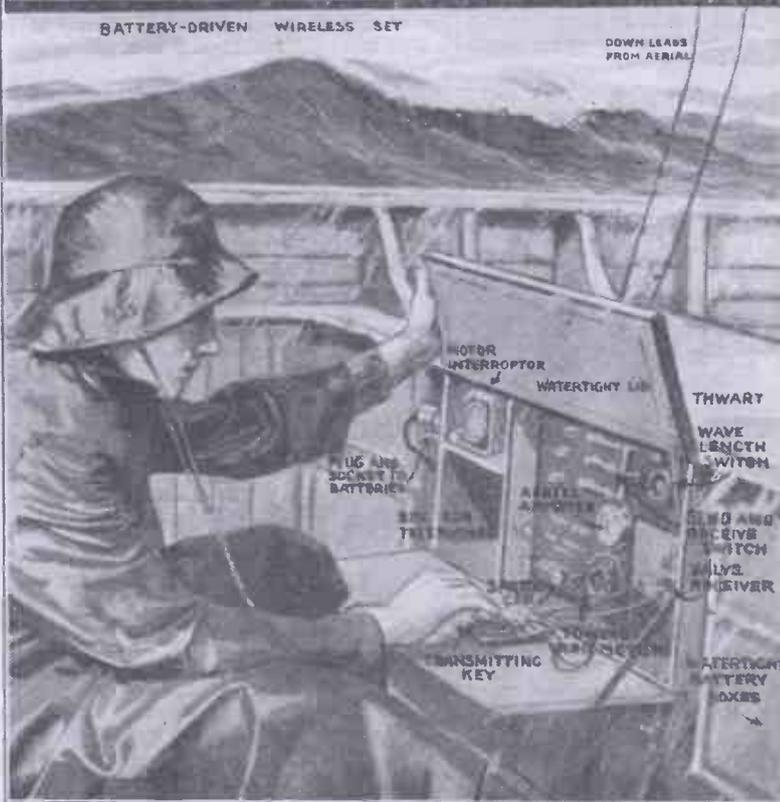
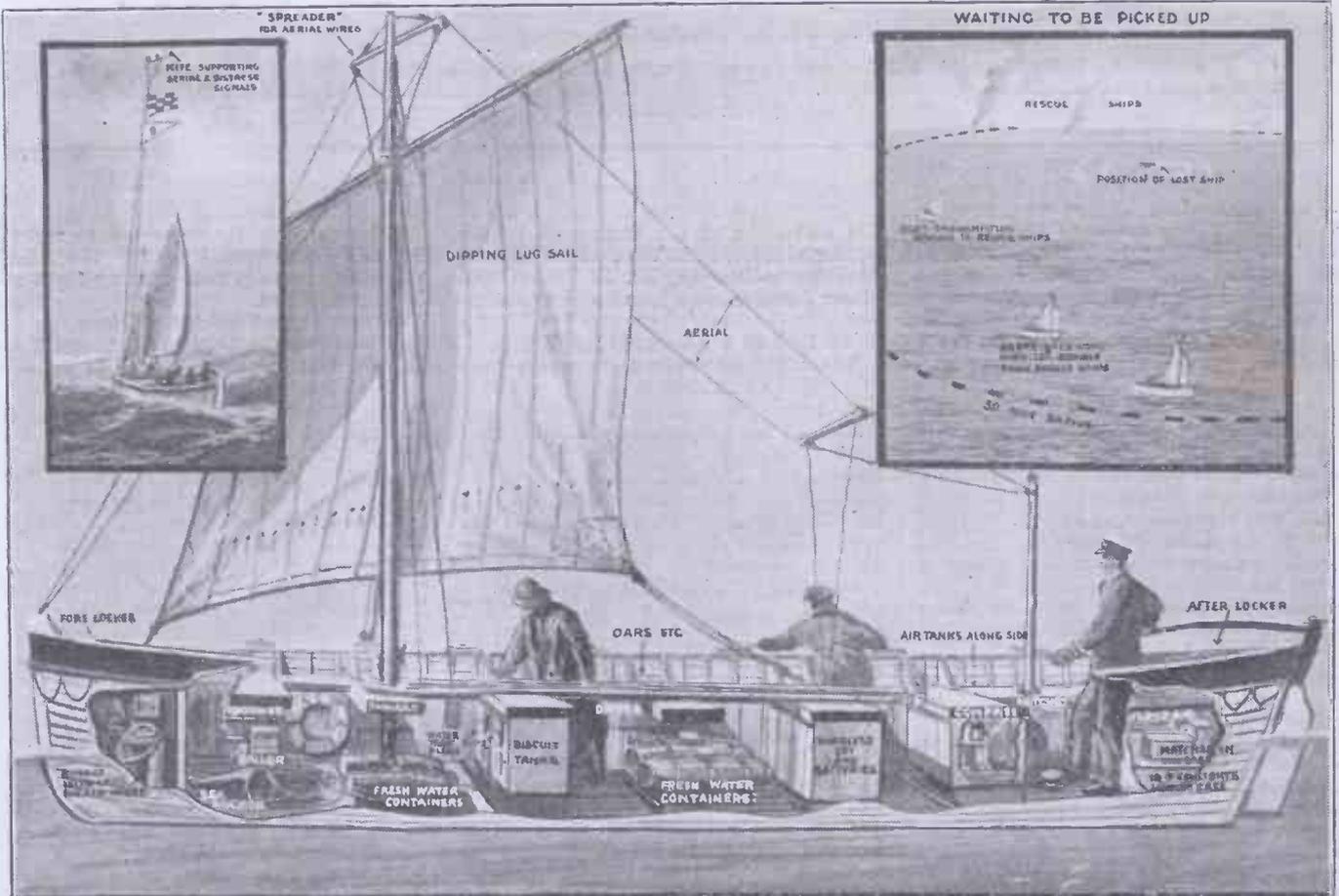
Manchester enthusiasts will be sorry to hear that with the transfer Mr. Kenneth A. Wright, who has been director of the old station since February 1st, before which he was in control of the programme for the Metropolitan-Vickers, will relinquish his duties to take up a post at the London headquarters. Mr. Wright has been a real live wire. His charming manner has endeared him to everybody, and he has made troops of friends. Speaking to me, Mr. Wright said one of the chief advantages of the removal of the transmitting station from Trafford Park to the centre of the city was that the programmes could be extended. Trafford Park was rather remote, and artistes and speakers had often to curtail their contributions in order to get back to town in time for their trains. Again, a more adequate transmitting set was installed at the new station. The set at Trafford Park was originally designed to take seven-tenths of one kilowatt, but for some months latterly it had to take something like 1½ kilowatts.

Mr. Dan Godfrey, jun., son of Sir Dan Godfrey, will succeed Mr. Wright at the new station, while Mr. F. G. Honey is to look after the educational side.



A demonstration was held at the Bronx Zoological Park, New York, recently, in order to study the effect broadcast music had on the animals. The bears enjoyed it immensely and danced to the music, but the lions roared with rage.

WIRELESS FOR SHIPS' BOATS



The above illustrations depict a proposed system of adapting wireless to ship's boats in order to enable survivors of vessels in distress to continue transmitting S O S signals. Each apparatus thus installed would have a range of 50 to 100 miles.



At Sea—Wigan Pier—Local Colouring—Buzz-z-z—The Honeyed Phrase—Parasitic Noises—Animals as Inventors.

At Sea.

AN American scientist suggests that experienced meteorologists should be distributed on ocean-going vessels, so that one or two would be always at sea. The meteorologist at sea, he suggests, would receive weather reports by wireless and issue weather forecasts to the land stations, also by wireless.

The only difference between the newly-proposed system and the present system is that in the latter all the weather prophets are usually at sea.

Wigan Pier.

The broadcasting programmes radiated from Manchester have been heard in the Wigan coal-mines. This item of news has been received with great calmness by Wiganites temporarily domiciled away from their native city. Every man jack of them stood their ground while the inevitable question was fired at them. "Ah, but have you heard of the dancing to wireless music at the end of Wigan Pier?"

Local Colouring.

The conversation turned on noteworthy achievements in the reception of wireless signals from far-distant stations. Over in the corner sat a little man with a white, pointed beard. Breaking into the talk for the first time, he remarked:

"I have enjoyed the story of your achievements, gentlemen, but I think I can go one better than most of you. On my valve set I can get Manchester so well that you can hear the cotton spinning."

That started it. "Nothing funny about that," said Nettleton. "Speaking seriously, when I get Cologne about midnight the reception is so good that you can fairly smell the scent."

"Don't be such a confounded ass!" said Jimmy Gallipot. "Talking of Continental stations, I know a schoolboy who gets Ostend so clearly that he can hear the rabbits running about the quay."

"Silly idiot!" broke in Heaviside. "I don't believe a word any of you have said. You can believe me if you like, but when I pick up Teneriffe on my super-seven, I can hear the Canary Islands whistle."

Buzz-z-z.

The chairman of the Newcastle and District Beekeepers' Association recently gave an address on beekeeping from the Newcastle station. After the address a bee was placed on the microphone and the buzz of the insect was broadcast to listeners-in.

Which reminds me very forcibly of a schoolboy friend of years ago who had the

wonderful faculty of being able to imitate a buzzing bee in true ventriloquial style. It was a pleasure to sit next to him in church.

There was a good old gentleman who used to sit in front of us. I have seen him descend suddenly from the lofty heights of an eloquent sermon to the sordid reality of a bee buzzing about his ears. That same boy used to try it on at school occasionally, but the effect was not quite so good there, and the chances of capture (of the buzzer, not the bee) were much greater. There was the possible penalty at school of so many "lines" or so many hours of "extra drill" or worse than those forms of mild punishment—the whizzing stick, which stings over a greater area than a buzzing bee.

The Honeyed Phrase.

One little incident has remained fresh in my memory of this ventriloquial schoolboy chum of years ago. It was a history lesson, and we were putting up with it as best we could. Our history master was a curious mixture. Sometimes he was funny, sometimes he was boring. His stock phrases included William the Corncurer (date of phrase 1100 circ.), Edward the Confectioner (date of phrase 1840), and Inky Stephen, a potty joke. We had read a chapter together more or less, and we were learning its contents with a view to questions. Everything was deadly quiet and dull, when gradually there arose the sound of a buzzing bee. Louder it came, and still louder, just as if the bee had come in at the window and was hovering over the heads in the front row. You can imagine how thoroughly we enjoyed it and how much we admired the courage and effrontery of my ventriloquial friend Woodhead. The bee appeared to settle and the buzzing ceased. Then there arose the high-pitched, sarcastic voice of David, our date merchant:

"Woodhead, I should advise you very strongly not to make a business of that sort of thing. There is a cure for it—the bees whacks cure."

Parasitic Noises.

If the buzzing bee performance as performed at Newcastle catches on well, no doubt we shall hear many strange noises in our telephones. The trouble will be

to determine whether those noises come from the transmitting station or from the receiving set itself.

A famous Indian scientist has photographed, by means of a wonderfully sensitive piece of apparatus, the sounds emitted by a dying carrot. Perhaps there will be developments of this kind of thing so that our broadcasting programmes will include items such as these in the future:

- (1) The howls of a skinned banana.
- (2) The high-pitched whistle of a boiling cabbage.
- (3) The peals of laughter of an orange being prepared for the fruit salad.
- (4) The chromatic scales of a prima donna mackerel. And
- (5) Mixed melodies of an uncooked sausage.

Animals as Inventors.

According to the "Wireless Review and Science Weekly," special observations of the intelligence of chimpanzees have been made recently, and the results of the observations have proved that the chimpanzee has a certain amount of inventive genius. The chimpanzee is not alone amongst the animals in this respect.

Many years ago the domestic cat perfected a system of face washing which for ease of manipulation has never been equalled by man with his soap and water methods. The fox terrier long ago thought out a wonderful game of hide-and-seek (played with ripe bones) which is streets ahead of any hide-and-seek game that children play.

In the distant past the honey bee invented a system of geometrical configuration which has been the surprise and envy of the geometrician ever since. The trapdoor spider invented the hidden pit method of capturing flies centuries before the method was used to win some of the world's most famous battles.

Last, but not least by a long chalk, the beaver must be given the credit for being the inventor of the dam water system.

Readers are invited to submit the results of their experiments in the form of short constructional articles. If accepted for publication they will be paid for at our usual rates.



The wireless set installed at Brooklands by Mr. Pullen, the well-known racer, to assist in the tuning-up of motor-cycles for racing purposes.

CARDIFF STATION NOTES.

By "KYM-RADIO."

A few interesting items concerning 5 W A and its staff.

"COMRADIOS" had a warm welcome for "Mr. Everyman" upon his return to us last Monday. The evening edition of the "Western Mail" voiced the popular feeling in a happy cartoon, "Mr. Everyman Speaking." This depicted a burly "Comradio" standing before a loud speaker, shaking hands with



Miss Haidee Gunn, the distinguished Shakespearean actress.

fantastic wireless waves that poured out, and exclaiming: "Glad to hear you again, sir." Very appropriately, "Mr. Everyman" devoted his return chat to "New Friends and Old," and charmed everyone. His other topics this week have been "The World Unrest and the British Commonwealth" (a speech of rare statesmanship), "Australia and Her Boy Scouts," and "The Burney Air-Ship."

What an extraordinary power for good or ill "Mr. Everyman" must wield! We speak of the pen being mightier than the sword, and the value of the written word diffused by a great journal amongst a million readers. But here is a man who, nearly every night, is affectionately welcomed in thousands of homes as an intimate personal friend of the family, and actually speaks to young and old sitting by their firesides. How can he fail to exercise a strong influence upon thought and action? And especially so since he possesses in marked degree that most valuable attribute of a public speaker—sincerity. Even in so trifling a topic as "The Passing of Door Knockers" he exerts influence. For I heard of two cases at least where a daughter and a nephew went out next day and purchased sets of tiny brass knockers for presents.

Listening-in, Popular.

One is often tempted to speculate upon the effect of "broadcasting" generally down here in the West Country. Here are folk listening to the great masterpieces of music and literature for the first time in their lives. What are their feelings? The station director showed me a letter the other day from a farmer's wife in Somerset. She wrote that friends walked twelve or fourteen miles to her house three or four evenings a week to "listen in." This music and poetry and drama must mean something to them. "We haven't been able to get to a theatre or hear any music for twelve years," wrote another "Comradio," "so to us your entertainments are too wonderful." It is well that folk like these are in such safe guiding hands. By the way, what curiously warped ideas some persons possess. A man wrote to the director complaining

about the inclusion in a programme of that very popular song, "We'm coom up from Somerset." He said that it was an incitement to militarism!

For obvious reasons a station director gets any praise or blame that may be going; his second-in-command is little heard of. But Cardiff is very fortunate in having such a deputy chief as Mr. W. N. Settle ("Uncle Norman" to the little folk), and the "appreciation" of Mr. Settle published last week in the leading West Country journal was well deserved. A sound and courteous business man, a hard worker, and a loyal chief-of-staff, Mr. Settle is certainly a distinct asset to the station and to the Broadcasting Company. We like him down here.

Classical Items.

A very fine Wagner night last Sunday included the Preludes to "Parsifal" and "The Mastersingers," and the "Siegfried Idyll." We have one Wagner and one Beethoven night every month. The complete series of Beethoven Symphonies (except No. 9) is being presented. The Sunday programme is certainly the most popular of the week.

LATIN—AMERICAN RADIOGRAPHIC NEWS.

Progress in Argentina and Venezuela—Success Attends Colombian Installation—Central American Enterprise.
By P. F. MARTIN, F.R.G.S.

RADIO-TELEGRAPHY is making sensible progress in Argentina. The latest arrangements include the establishment of apparatus and a club at Mendoza, the capital of the province of the same name. By means of the apparatus, concert programmes are broadcast from the Radio Club of Buenos Aires.

The Argentine Government has decided upon the purchase of two radio-plants for the use of the army, consisting of a portable set to cost \$42,000 (gold), and equipment for a 6-kw. radio station to cost \$40,000 (gold). It is understood that both plants will be furnished by the Marconi Wireless Telegraphy Company, Ltd. The existing laws in Argentina provide that privately owned radio stations are permitted only for inter-continental communication, these being under the jurisdiction of the Ministry of Marine or the Ministry of War.

Many New Stations.

The former Department controls all stations located within 100 miles of the sea or the River Plate, and within fifty miles of either bank of navigable rivers; while the Ministry of War controls all other stations in the republic. Of the forty-one existing

stations of the army and navy, thirty-five are now being used for commercial traffic. Authorisations for new stations are granted for commercial reasons, as well as on military or naval grounds.

The Compañía Transradio Internacional is about to erect a wireless station at Monte Grande, located on the Buenos Aires Great Southern Railway. This construction will prove one of the most powerful stations in the world.

In Brazil, a concession to instal and operate for forty-five years radio-telegraph and radio-telephone stations for international communication has been granted to the Sociedad Anónima Agencia Americana. The agency, which has been established with Brazilian capital, is now successfully operating radio-telephone stations for communication within the national territory, but its concession strictly excludes radio-telegraphy in that field.

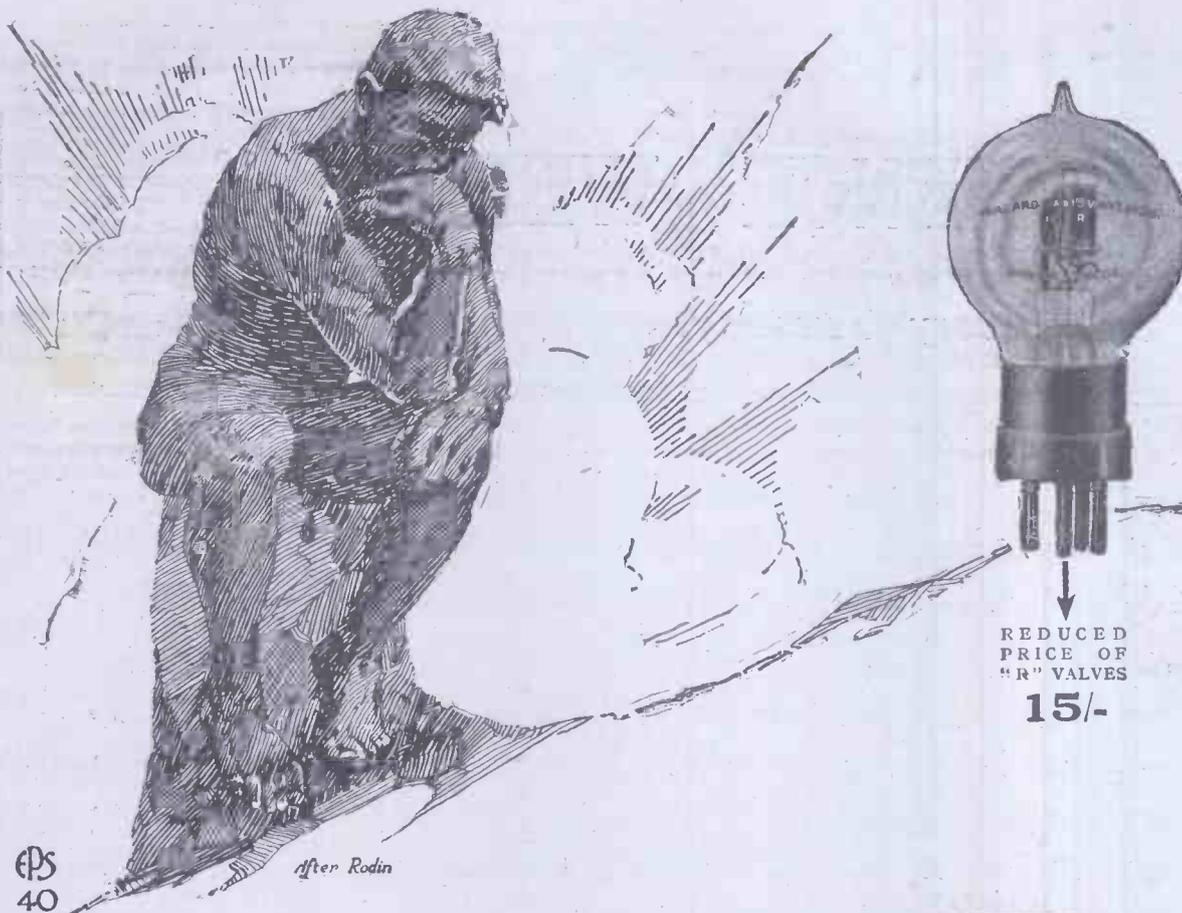
Notable Progress.

The receiving station of the Sociedad Anónima Agencia Havas, one of the first radio-telegraph enterprises to be established in Brazil, has recently secured an extension of its concession granted as far back as August 2nd, 1920. The receiving station at Praia Vermelha has lately been opened for international service.

The past year has proved notable for the progress of radio communication in Venezuela, which was one of the first of the South American republics to institute a chain of radio stations throughout the state. The service is under the control of the Minister of Promotion (Ministero de Fomento), and the present occupant of that office, Dr. Gumersindo Torrès, a man of far vision with great faith in the value of radiography for Venezuela, seeks to encourage foreign contractors and manufacturers of electrical installations to assist in developing radio communication in the country. Another official, who is likewise broadminded enough to admit of free competition, is General Tobias Uribe, Chief of Communications, under whose guidance very considerable and knotty problems, dealing with the establishment and conduct of the service, have been solved. A third official, Señor H. Eichwald, who, although bearing a Teutonic name, is a Venezuelan by birth, has in his hands the technical control of the stations, their installation and maintenance, also charge of the national school for training operators for the wireless service of the country.

Loud-Speakers Introduced.

An influential radio association is being formed in San Salvador by a group of citizens, whose object is to equip the parks and other public places of that city with loud-speaker radio-receiving stations. These will be used to disseminate market quotations for coffee, grain exchange rates, official time, concerts and late Press reports. Permission has been granted to the group to sell receiving apparatus and to instruct purchasers in the use of the instruments. Authorisation has also been given for the purchase of amplifiers and improvements for the Government wireless station. Radio-telegraphy has become extremely popular throughout the Central American states, but more particularly in El Salvador, which offers an excellent market for radio apparatus.



EPS
40

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15/-

PROBLEMS arise in every phase of life, and the power of concentration does not always solve them, but when the problem is one of valves you can see The Thinker straightening his heavy back and smiling because there is only one solution—



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“WIRELESS REVIEW AND SCIENCE WEEKLY.”

On Sale Every Tuesday.

Price 3d.

The issue of this now famous journal, on sale August 21st, will contain many special and attractive features of great interest to all wireless amateurs and those interested in popular science.

Professor A. O. Rankine writes on the “Speaking Film” device which he has invented; Dr. E. V. Appleton on “Electricity in the Atmosphere”; and Dr. N. W. McLachlan on “How to become a Radio Engineer”—the last article being of especial interest to readers anxious to take up wireless professionally.

Other useful articles include instructions for constructing Experimental Transmitting Apparatus, the Principle of Dual Amplification, How to make a Three-valve Panel, a Charging Board for Accumulators, a Series Parallel Condenser, and many other practical features. “Wireless Review and Science Weekly” is in reality a **Monthly Magazine issued Every Week** at the low price of 3d.

Its contributors are the best obtainable, its appearance, make-up and design most attractive, and its practical value to the amateur and student universally recognised.

Order your copy now and see for yourself what an excellent all round journal it is.

“WIRELESS REVIEW AND SCIENCE WEEKLY” 3d. Weekly

INEXPENSIVE TOOL KITS FOR WIRELESS AMATEURS.

By RADIOGRAPH.

II. STOCKS—AND DYES.

Some hints on the purchasing of suitable tools for amateur wireless work and how to preserve and handle them.

WHEN component parts used in wireless construction are purchased from dealers there is always a possibility that large stocks may include certain parts which are not accurately machined in some respect, and this is especially the case with regard to components having threaded portions. With constant use the taps and dies used by the makers become worn; and if for any accidental reason such tools are kept in service after the point of wear limit has been reached, inaccurate production ensues.

Constructing a Die-Plate.

Such considerations, apart from any desire to produce threaded components in the home workshop, make it necessary for us to investigate the best forms of screwing tackle to use in wireless construction. The form of thread used for scientific instruments, which category includes wireless apparatus, is known as the British Association Standard Thread, recognised by the initials B.A. It is preferred to standard Whitworth on account of its suitability for small screwed parts, and is identified by numerals from 0 to 25. For our particular purpose, however, the complete range of sizes is unnecessary, and the amateur who makes use of bought components which may require easing on the threaded portions, will find a simple screw plate and set of taps such as those illustrated in Fig. 1 adequate for his needs.

suitable size from which to form the plate. The file should be annealed by raising it to a cherry red heat and allowing it to cool slowly in a coke fire. Whilst the file is red hot it should be examined for cracks, which, invisible when cold, would render the steel useless for the intended purpose. When cold the teeth can be filed off and the file

The plate is now dead hard, and if so used would soon become broken or chipped, therefore to retain the cutting edge without risking fractures the plate must be tempered or "let down." After polishing the surfaces with emery cloth the plate is held over a gas flame until the polished surface begins to assume a straw colour, a few seconds later the straw colour will darken and before it merges into the darkest shade, the plate must be dipped quickly into cold water.

Unless readers are accustomed to tempering tools it will be well to practice on a piece of cast steel or silver steel before attempting the process on a finished tool, for the changes of colour follow each other so rapidly that before one is aware of it the steel turns blue, which gives too soft a finish for any class of cutting tool. The following table shows how temperatures may be judged by colours, and the colours at which various tools should be tempered:



TABLE OF TEMPERATURES AND TEMPERING OF TOOLS.

Degrees Fahr.	Colour for Tempering.	Class of Tool.
430	Very pale yellow	Scribers and small scrapers.
440	Light yellow	Larger scrapers, centre punch points.
480	Dark yellow	Points of dividers, edges of shears.
500	Brown yellow	Small chisels, die plates and taps.
520	Brown purple	Large chisels and small flat punches.
550	Dark purple	Ends of screwdrivers.
560-570	Dark blue	Springs.

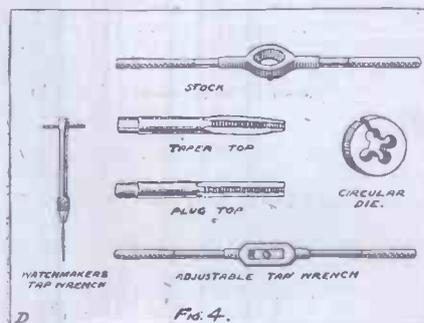
can be marked out as shown in Fig. 2. After the central holes have been drilled and tapped they should be plugged up with pieces of screwed steel and filed off flush on either side. The next step is to mark off and drill the clearing holes, A, which must be spaced so as to just break into the central holes, after which the plugs can be removed, leaving the plate in the condition shown at Fig. 2A.

In order to allow the metal removed from a tight thread to clear whilst the plate is in use, the edges of the holes, A, should be eased away at one side in the manner indicated in Fig. 2B, this being done with the aid of a small half round file. If a taper tap is used for making the thread in the central hole it should not be put right through the plate, for by leaving the threaded hole slightly on the small side, allowance is made for any distortion during the tempering process, and also for wear on the threads themselves.

How to "Temper."

After having completed the plate it must be tempered so as to preserve the cutting edges. This is done by raising the plate again to cherry red heat and plunging it into clean cold water. To avoid chances of buckling the plate by sudden contraction it should be dipped into the water edge on, which minimises distortion.

A set of die plates and taps such as those shown in Fig. 1 will cost about 4s. 9d., but amateurs who desire a rather more elaborate equipment can purchase a very useful screw-



ing set for about 15s. which will last for years with ordinary use.

A very neat set known as the "Little Giant" can be obtained from tool dealers (Fig. 3) and consists of a wooden case, five dies, five taps, a die holder and a tap wrench, the set being capable of cutting threads of 0, 1, 2, 3, and 4 B.A.

The parts are shown individually in Fig. 4, the types selected being suggested as the most convenient for amateur use. When purchasing separate taps, they should be

(Continued on page 930.)

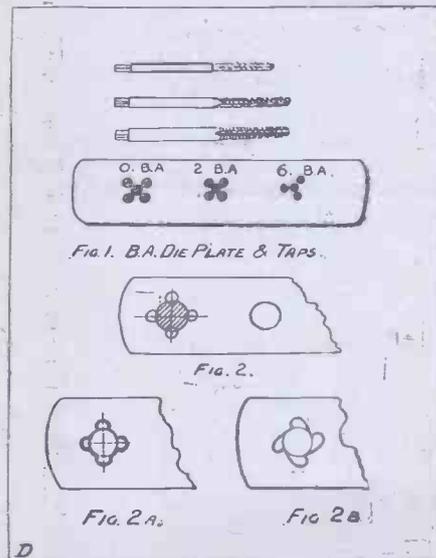


Fig. 1. B.A. Die Plate & Taps.



Fig. 2.



Fig. 2A.

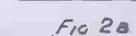


Fig. 2B.

In the interests of economy it becomes desirable to standardise the sizes of screwed parts as much as possible, and in purchasing components care should be exercised in choosing those which have threads corresponding with the sizes of threads on the screw plates and taps.

Readers who desire to make their own screw plates can do so by using a worn file of

MINOR VALVE-SET REPAIRS.

A few remarks concerning the interior of valve sets intended for the guidance of those readers not thoroughly conversant with the "innards" of their receivers.

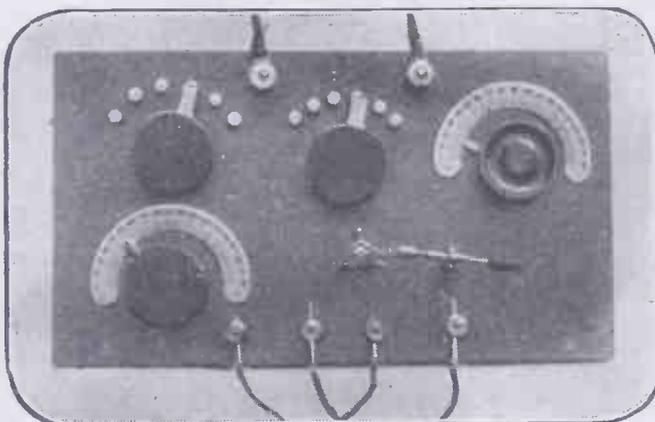
COMMONSENSE is the most important asset an "amateur mechanic" can possess, and most people have quite a lot if they will only use it. For instance, supposing it is decided that it is necessary to remove the top of a valve panel; don't seize hold of a screwdriver and commence to remove all the screws that can be seen, or the whole set will disseminate into small pieces. Only those screws situated evenly around the edge of the panel will be employed in holding down the ebonite top.

Removing the Panel.

Having removed these screws carefully, don't jerk up the "lid" hastily, because it is ten chances to one if you do that you will find you are tearing apart soldered joints and leads. Although most sets come away in their entirety when the panel is raised, it is just possible that in the particular set that you are dealing with some of the gear is mounted in the interior of the case itself. However, having carefully removed the panel, the next thing is to carefully stand it so that no weight is brought to bear upon such delicate parts as the vanes of a variable condenser, grid leak, etc.; in fact, it is generally the best plan to lay back the panel in its correct position whilst not referring to its underside. It need hardly be added that during these operations all valves

and external connecting leads should be removed.

Quite a common occurrence, and one that can be very easily dealt with, is for the locking nuts of a terminal to work loose and cause a loose or broken connection in the circuit. The more continually used terminals, such as the L.T., and A, and E, are, naturally, the chief offenders. Having worked loose, a turn of the terminal inadvertently performed while connecting the set up will generally break the soldered connection internally made to it, and apart from the fact that this will prevent reception, it is always liable to cause an internal short-circuit, with all sorts of



The super crystal receiver described in "P.W." No. 38, as built by Mr. H. Hitchen, 5, Block 20, Garden Village, Highbly, near Kidderminster. 5 I T, 20 miles away, is comfortably audible.

resulting damage, buckled accumulator plates, burnt-out valves, etc.

The Filament Rheostat.

When replacing the panel of a valve set always carefully run over the interior "lay-out," removing dust and arranging the wiring so that each lead is as far from all the other leads as possible. See also that no lead is in such a position that it will be bent back on to another or dangerously near to anything else when the panel is pressed down. Have a look at the filament resistance, and if the wire along the point of contact appears to be rather dirty, carefully clean it. Should the resistance wire along this same point of contact appear to be burnt or blackened, then the chances are that the current is "arcing" along that point, or sparking as the filament knob is twisted. This will cause horrible grating noises in the 'phones. As filament resistances vary so vastly in point of construction it is hardly possible to venture even a general remark on the adjustment of the moving contact, but it can clearly be seen whether a firmer contact is necessary, and doubtless "commonsense" will guide the amateur mechanic along the path of safe and correct procedure.

Try the effect of varying the value of the grid leak by running a pencil line along the grid leak. The thicker the line the less will be the resistance of the leak. Start with a very, very thin line, and if it does not improve results don't carry on, but if it does, then thicken it slightly, no more. After that, leave it, otherwise you will do more harm than good.

INEXPENSIVE TOOL KITS FOR WIRELESS AMATEURS.

(Continued from page 929.)

bought in pairs—i.e., taper and plug. Taper taps are very useful for threading holes in ebonite, for by leaving the threads shallow, the screws fitting into panels, etc., finish cutting the thread whilst being forced home, thus securing a better fit than when the same thread is finished with the plug tap.

The circular adjustable dies are made from well tempered steel and consist of one piece, a small set screw being provided to regulate the die to cut full or shallow threads as required (Fig. 4). They are all made of a uniform external diameter and depth, thus enabling them to be used in the kind of the die holder illustrated. For the larger sized taps a double ended adjustable tap wrench is useful, but as even the smallest of these will be heavy for small taps, it is advisable to procure a watchmaker's tap wrench on fragile taps so as to lessen risks of breakages.

Even with the best screwing tackle obtainable the results will be very disappointing unless due precautions are observed in using the appliances. A good many amateurs, and professionals, too, go wrong because insufficient care is taken in squaring things up before a start is made.

The great thing is to start with a truly vertical hole.—I shall give a few hints on drilling in another article—but for the moment it may be assumed that this condition is already fulfilled. The natural tendency of a tap is to start its downward path in an oblique direction, and unless this tendency is corrected from the start the tapped hole becomes more and more crooked.

Use of Square.

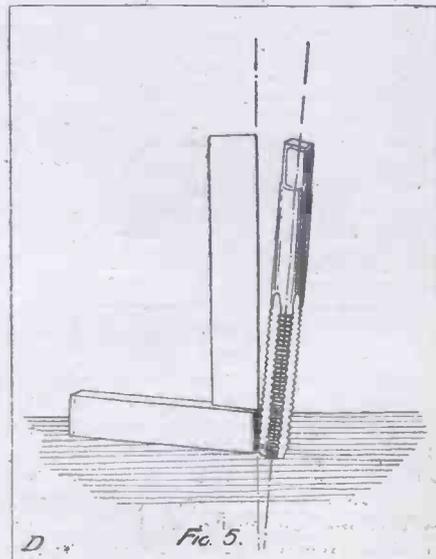
One may be blessed with a fairly "straight" eye, and yet manage to start a tap or die crooked, therefore it is best not to trust the eye too much, but make quite sure the natural perversity of the tap is overcome by introducing it to a square. The application of the square in the manner shown in Fig. 5 by itself is not enough, for if the tap is made to be against the square in this one direction, it will "have its own back" so to speak, by dodging the square the other way. So it is necessary to try the vertical accuracy in two directions—i.e., from the side and the front—and once it is started in these conditions it will give up the unequal combat and be obedient to orders.

Dies can be started so as to cut true threads if the round stock to be threaded is provided with a slight chamfer, but care must be taken to ensure that the chamfer is concentric with the diameter of the stock, otherwise the die will run down out of truth.

When tapping holes no downward pressure on the tap is needed as the tap feeds itself

into the material being cut. Jambing or clogging of the taps, which is often a preliminary to breakage, can be avoided if the direction of the motion of the wrench is reversed occasionally. This movement relieves the cutting edges and allows particles of metal to collect in the flutes of the tap, thus preventing tendencies to clog or jamb.

(To be continued.)



PRACTICAL IDEAS FOR THE AMATEUR

SOCKET TERMINALS.

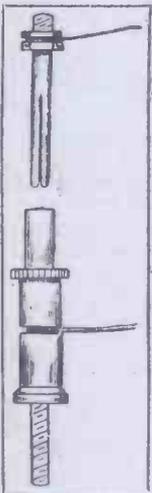
TO the experimenter, any device which tends to facilitate the making of alterations to a circuit when "trying out" various arrangements is always welcome, and to that end several contributors have recently advocated the use of valve sockets and pins. The following method has been very successfully used by the writer for some time, is capable of considerable adaptability, and combines the flexibility of the "plug in" socket with the relative permanency of the terminal.

The sketch attached shows the whole idea, which consists in soldering a small socket on to the top nut of a terminal.

Valve sockets, with the threaded part removed, are suitable, but rather unsightly, and the writer therefore used the sockets from an old tapped H.T. battery, which proved neat in appearance and much more easily soldered.

Before soldering, the lacquer on the top of the terminal nut should be removed with emery cloth and the bottom of the socket filed flat. The nut should also be plugged with wood level with the top, to prevent the solder blocking up the inside thread. A little solder is run on to the terminal, and the socket placed on top and held in position with a pair of

pliers. The hot iron is then applied to both socket, and terminal for a few seconds, and a permanent joint ensues.

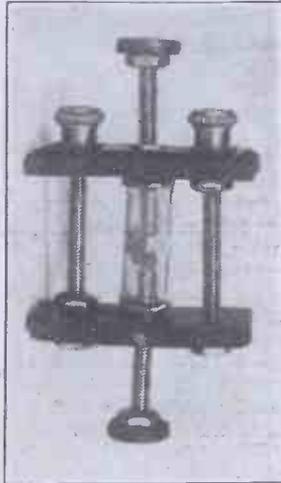


A SIMPLE PERIKON DETECTOR.

FIRST obtain two pieces of ebonite 2 in. by 1/2 in. by 1/4 in., and drill in each three holes large enough to pass a 4 B.A. screwed rod, one at the centre, and one each side 1/8 in. from it. The centre hole is now enlarged until it is just a shade smaller than the thinner end of a 4 B.A. terminal head, which should be preferably slightly rounded.

Having passed a piece of copper wire round the head, it is gently tapped with a hammer until the smaller end fits tightly in the hole prepared for it. After fitting a

head in like manner to the other piece of ebonite, a piece of glass tube 1 in. long with a 1/4 in. bore and holding two crystals is placed between them, and the whole is kept in position by passing two short lengths of 4 B.A. screwed rod through the other four holes and tightening up by means of nuts.



Two further lengths of the same rod, the ends of which should be fitted with small ebonite knobs, are then screwed through the fixed heads until they make good

contact on the crystals. The wires from the fixed heads should be joined to alternate screwed rods, which may be fitted with terminal heads and washers.

A FEW TIPS.

Before going to the expense of buying a 60-volt H.T. battery, it is advisable to borrow a battery and see what voltage the plate requires, as very often they do not need nearly as much as stated by the manufacturers. Dutch valves, for instance, will work satisfactorily on as little as 12 volts, and sometimes will not give good results on anything over about 20 volts.

Ordinary sealing wax makes a good insulator. Insulated knobs can quickly be made by dipping a screw head into molten wax, which cools instantly after being immersed, and a very neat appearance results.

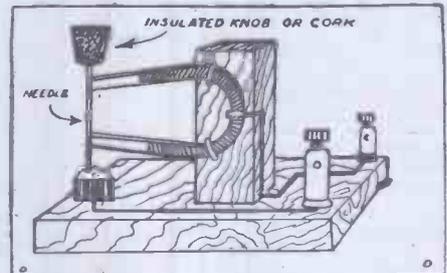
Sometimes it is very difficult to separate two stations that are both on practically the same wave-length as the Vernier condenser is not precise enough. Try the following tip with your existing Vernier, which will give very exact tuning. Take out the moving vane and on one of the radii (neglecting the round projection where the spindle goes) describe a semi-circle on the vane. Now cut out this semi-circle and the vane will then come to a point, giving extremely accurate tuning.

A NEW FORM OF CRYSTAL DETECTOR.

AN ingenious form of crystal detector is illustrated in the accompanying drawing. It possesses great advantages over the ordinary cat's-whisker type of crystal connection in that the pressure of the needle on the face of the crystal can be accurately gauged and the needle point can be moved without effort over the entire surface of the crystal. The question of pressure is an important one where certain crystals, such as galena, are employed, and the device has the additional advantage of simplicity of construction.

A wooden baseboard which can be fashioned to any design favoured by the constructor is first obtained, together with a block of wood which should not be less than half an inch in thickness and approximately two inches high. This block, after the permanent magnet has been mounted on it, is glued firmly to the baseboard as shown.

In order not to disturb the wooden block once it is in position, the two terminals indicated should be inserted into the paste-



board before gluing on the block. It is, perhaps, unnecessary to state that the magnet is tightly clamped to the block by means of the small staples, as illustrated.

Most permanent magnets of the horse-shoe type are insulated at that portion of the magnet which touches the block by a coating of red paint. The block itself, however, may be treated with a little rubber solution or other insulating material at the point where contact is made if so desired.

An ordinary sewing needle is then obtained to act as a "whisker." This, of course, will be held against the two poles of the magnet by magnetic attraction. In order that a proper adjustment may be found the fingers should be insulated from the conductive metal of the needle, and this is accomplished by placing an insulated knob over the "eye" of the needle, which also enables a better grip to be obtained.

The simplest solution of this difficulty is to obtain a small cork and insert the head of the needle into the centre, as shown.

AN EFFICIENT ONE-VALVE SET.

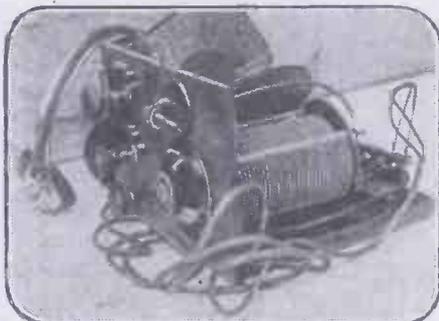
An interesting circuit claimed to give remarkable results over long ranges of reception.

A SINGLE valve set, for use with a low voltage, or dull emitter valve, that has created a great deal of interest in America, is described by P. F. Albright in a recent number of the "Radio World."

A diagram of the set will show the reader that the wiring of the instrument is carried out on almost orthodox lines, and while nothing new is claimed for the apparatus in this respect, it is stated that the circuit given is remarkably efficient for long-distance working, and that the strength of signals received will compare favourably with most other sets employing only one valve.

The Variometer.

It will be noticed that a departure from the ordinary type of single valve circuit is a lead which connects the aerial with the plate circuit of the valve. The variometer, also, is somewhat novel in design. This was made by constructing the inductance out of a cardboard tube three inches in length and three inches in diameter, the winding



The super crystal receiver described in "P.W." No. 38 as built by Mr. H. J. Redgewell, of 35, Monson Road, Redhill, Surrey.

consisting of fifty turns of No. 22 D.C.C. wire wound on to the former in the usual honeycomb manner.

Mounting the Coils.

Two further coils are then wound round the other end of the tube, as shown in the diagram, each coil consisting of four turns of No. 22 D.C.C. wire. These coils, for the sake of simplicity, might be referred to as a winding of eight single turns in two separate groups of four turns each, with a distance of about three-eighths of an inch between them. This distance is allowed to permit of the mounting of the rotary coil, which is constructed from another cardboard tube of one inch in length, and of as large a diameter as will permit of its being rotated inside the stationary tube without touching the inside of the latter.

The rotating former is also wound with eight turns of No. 22 D.C.C. wire, the windings being spaced in a similar manner to the eight turns previously dealt with—i.e., in two groups of four. This coil is mounted on the supporting shaft in such a manner that the windings come directly under the stator windings, as shown in the illustration.

Variable Leak Advisable.

The three coils described are joined up in series and connected in the circuit as shown. It will be observed that the received signals from the aerial first pass through the rotor coil, then through the two groups of windings on the stationary coil, and finally through the honeycomb coil.

It is claimed that a variometer constructed on these lines acts as a Vernier on the inductance, and increases to an appreciable extent the selectivity of the apparatus.

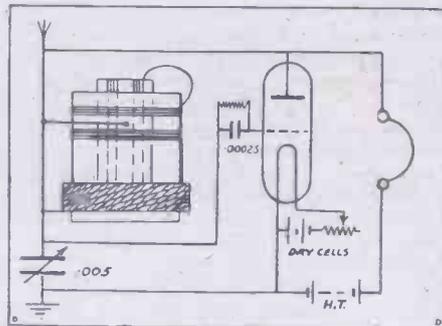
The grid condenser has a value of .00025 mfd., and as attention is called to the

extremely critical ohmage value of the grid leak, it would perhaps be advisable to use a variable leak in order to obtain the best results from this instrument.

For long-distance working, a Vernier type of rheostat should be employed.

Good Earth Essential.

In addition to the variometer tuning, a variable condenser of .005 mfd. capacity is connected between the aerial and earth and is inserted in the aerial and earth circuit between the point at which the grid connection is made to the aerial, and the lead which is taken from the earth terminal to the negative side of the high-tension battery.



The set described works admirably on the regulation 100 ft. aerial, although a good earth is essential if the best results are to be obtained.

The set referred to at the beginning of this article was wired up with No. 14 tinned copper wire, and wherever it was possible to do so, every joint was firmly soldered. The various components were mounted on a panel 6 in. by 3 in., and in addition were carefully shielded with tinfoil and earthed.

A final word of warning is given concerning the variable condenser and the inductance, which should be mounted as far as possible from each other to obviate undesirable capacity effects while tuning.

The fact that no accumulator is necessary to light the filament of the valve employed is an added attraction to this type of detector, the voltage and current being supplied by a dry battery.

THE THREE-SLIDE TUNING COIL.

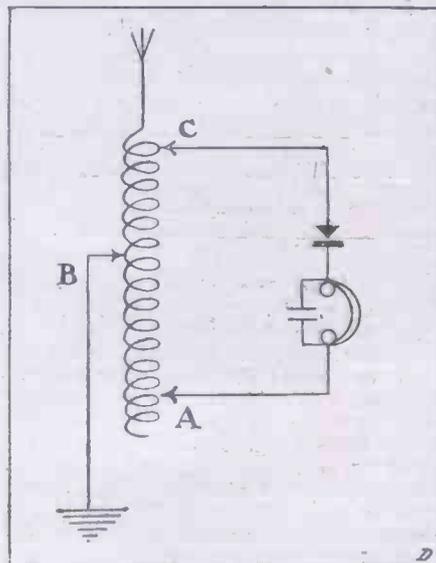
ALTHOUGH practically unheard of by the greater number of amateurs over here, the three-slider coil is quite common in America. There are very few advantages over the more common type, the double-slider, but it should be interesting from an experimental point of view.

It is constructed in the same manner as any other slider coil, with the exception of the extra sliding contact and brass rod. The aerial and earth circuit is varied by means of the one-slider, as in the case of the two-slide coil. It differs from the double-slide coil in that the detector circuit may be varied by the other two sliders. The method of tuning is as follows: The aerial and earth circuit is first tuned to the incoming signals by means of the slider B.

The secondary circuit is tuned to the primary circuit by allowing the slider C to remain near the end of the coil to which the lead-in is attached and moving slider A towards or away from slider C until the signals are at maximum volume.

Having thus tuned the secondary circuit to the primary circuit, by drawing both the sliders A and C towards the lower end of the coil a slight coupling effect can be obtained. This slight coupling effect is the only real advantage obtained with this type of coil over the other types. In obtaining this effect the turns of wire used in the aerial and secondary circuits would be at the ends of the coil, thus separating, to some extent, the primary from the secondary.

A variable condenser of .0005 mfd. can, of course, be placed in series with the aerial to decrease the wave-length, while one in parallel, say, of .001 mfd. will increase the wave-length. The diagram shows a three-slide tuning coil used in conjunction with a crystal detector.





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Finally, the appearance of "Efescaphone" Sets is all that could be desired. The lay-out is neat and compact; the cabinet work distinctive. In the set illustrated the instrument panel is enclosed, when not in use, by a neat roll shutter and the headphones accommodated in a cupboard in the base. All connecting wires are out of the way at the back of the cabinet.

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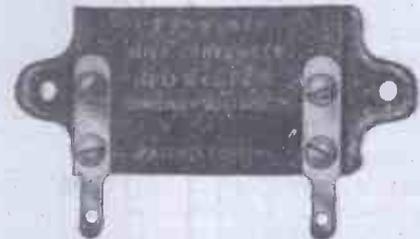
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Wireless Club Reports

The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the report if necessary. Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An asterisk denotes affiliation with the Radio Society of Great Britain.

Treharris and District Radio and Scientific Society.

The above society has, since its inception, worked hard and is building itself in the practical and theoretical phase of wireless. It has on hand the construction of a crystal and dual valve receiver, and various experiments are carried out at the meetings, which are held bi-weekly—i.e., Tuesdays and Fridays at 6.30 p.m.

The society has on its programme some interesting lectures and demonstrations. The members are keen experimenters and are not pure "broadcasters." One of the members has been successful in receiving American broadcasting. Anyone desirous of joining can obtain any information from the hon. sec. at his residence.

Hon. sec., David D. Richards, "Mametz House," Bontnewydd Terrace, Trelewis, Glam.

The Carmarthen and District Radio Society.

A local wireless society has been formed, called the Carmarthen and District Radio Society, which is being affiliated with the Radio Society of Great Britain. At a recent meeting Col. E. C. Jennings (5 O C) was appointed president, and Mr. W. D. Williams, vice-president.

Particulars of membership can be obtained on application to the hon. sec., Mr. W. I. Thomas, 9, Hall Street, Carmarthen.

Battersea and District Radio Society.*

On Tuesday, July 10th, Mr. H. Bevan Swift, A.M.I.E.E., lectured to the above society on the "Fundamentals of Radio Work," which proved of very great interest to the members.

His methods of cutting out unwanted stations was very interesting and solved the trouble of many members.

We have great pleasure in announcing that Captain Davis (2 X L) of the Pavilion, Lavender Hill, has kindly consented to become president of the society, and has offered the vestibule and aerial of the Pavilion Cinema for any special transmission.

Hon. sec., A. E. P. Walters, 31, Holden Street, Grayshott Road, Lavender Hill, S.W. 11.

Tottenham Wireless Society.

On Wednesday, July 18th, Mr. R. G. Ellis gave a lecture on "Dual Amplification."

After introducing the theory and method of this branch of research, Mr. Ellis gave details of several dual amplification circuits he had used.

Hon. sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N. 17.

The Leeds and District Amateur Wireless Society.*

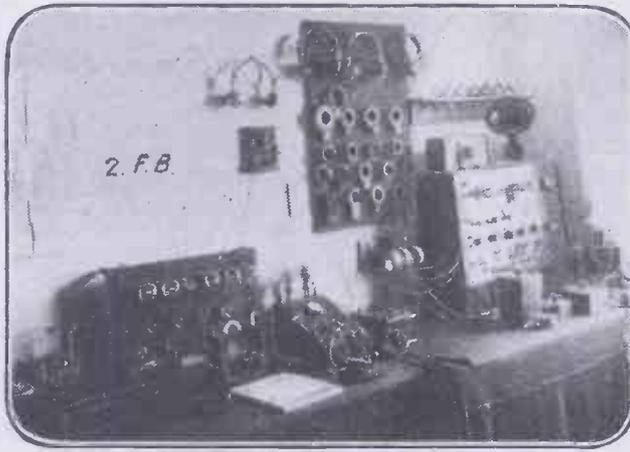
At an instructional meeting held recently the president, A. M. Bage, Esq., described "The Construction of a Two-Valve Portable Receiver." This self-contained set was on view, the first valve functioning as cumulative rectifier, magnetic retro-action being utilised for amplification, the second valve being a low-frequency magnifier, coupled to the rectifier by a transformer, normal valves and batteries being utilised. Practically every essential to maximum efficiency is included in the outfit, the more important items being the use of a micro-

variometer for fine aerial tuning, separate filament control, good potential adjustments, etc. The set was very successful last winter on the reception of U.S. broadcast and amateur traffic.

Hon. sec., D. E. Pettigrew, 37, Mexborough Avenue, Chapelton Road, Leeds.

Barnet and District Radio Society.

Mr. F. W. Watson Baker presided at the fortnightly meeting of the society which was held on Wednesday evening, July 25th. There was a good muster of members, and amongst the new members enrolled was Mr. W. R. Kent, a member of the Barnet Urban District Council and formerly Postmaster of Barnet. He is the



The experimental transmitting and receiving station belonging to Mr. W. Ison, of 80, Barnham Road, Salisbury.

second local councillor to become a member of the society.

Hon. sec., J. Nokes, "Sunnyside," Stapylton Road, Barnet.

Catalogues Book Reviews Etc.



For those to whom money is an object P. J. Risdon, F.R.S.A., Research Editor of our companion paper, "Wireless Review and Science Weekly," has written a very interesting little book entitled "Wireless Really Explained." Besides explaining the theory of wireless, there are interesting chapters on "Magnetism and Electricity," "How to Erect an Aerial," "How to Make a Crystal Receiver," etc. The twelve chapters are very interesting from end to

end, while the book ends up with an explanation of the Morse code and a few interesting photographs.

It is generally stated that a repaired valve is not so efficient as a new one. To prove that this is not absolutely correct, Crowther and Osborne, Manchester, have forwarded us a repaired R type valve for test. While taking only very slightly more current than an unrepaired valve, it gave really excellent results, and nearly quite equal to a new one. This shows that it is worth while having your burnt-out valves repaired instead of paying a high price for a new one.

An interesting price list has been forwarded to us by the "Griffin Wireless Supplies Co." Besides giving a list of components and accessories, the catalogue contains details of complete one to four valve sets, and also an interesting unit set. All the apparatus of this well-known firm is well made and thoroughly efficient, despite the low prices of the goods.

There are many excellent variometers on the market at present, but perhaps none quite so neat as the new "Sterling" instrument. It is unique in design, while the novel construction of the rotor and station afford very close coupling and selective tuning. It has an inductance ratio of 9 to 1. The wave-length range is 250—2,725 metres in conjunction with a .0005 variable condenser and when used with a standard P.M.G. aerial.

The Radio and Electrical Supply Co., of 29, Paternoster Row, E.C.1., are making a very unique offer and one that should appeal to all possessors of burnt-out valves. They are prepared for a time to accept burnt-out valves in part payment for brand-new valves of any of the Ediswan types. Somewhere around 4s. or 5s. is allowed for each burnt-out valve, so that amateurs can obtain the brand-new article for but half a guinea or so, against the usual 15s.

The Mullard Radio Valve Co. have sent us one of their "dull emitter" valves for test. We have tried it and can safely say that it is one of the best valves we have tested irrespective of its merits as a small current consuming component. At 27s. 6d. it should command a very ready sale. On the "P.W." Combination Set, using a dry battery instead of the usually required accumulator, results were excellent. A single cell of an accumulator can be used, but we should think the length of time that it would supply the valve with the small required current would tend to cause amateurs to allow their accumulators to stand too long without charging.

Two leaflets have been issued by M. Hirst & Co. They give details of a very neat set on the unit system, while a crystal receiver is also described. It should be mentioned that "Radiocite" has been obtainable from this firm for some time, whilst it has often been difficult to get it elsewhere.

The Marconi-Osram 'D.E.R.' Valve has now been reduced from £2 to 27s. 6d.

Apart from its cheapness, the outstanding advantages of the 'D.E.R.' (the Valve which is fitted to the famous Marconiphone V2) are:—

- (1) It consumes little more than half the current used by the ordinary Valve.
- (2) Its effective life is from 6 to 8 times longer.
- (3) It can be used with filament dry-batteries if desired.

The 'R'-type Valve has also been reduced from 17s. 6d. to 15s. 0d.

The Marconiphone V2 is also cheaper.

In consequence of the reduction in the price of the 'D.E.R.' Valves and of Telephones, the Marconiphone V2 is now sold at **£22 8 0**

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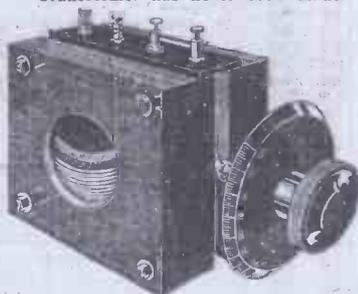
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- Insulators, Large Shell, 10d.; small ditto, 3d.; Reel, 1½d.; Egg, 3d.; Barrel, 7d.
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- Crystal Detector, Ball-jointed, well-made, 2/- Glass-covered, on ebonite base, 4/6.
- As above, for Panel-mounting, 2/-
- Contact Studs, with nuts, per doz., 4½d. Contact Stops, with nuts, per doz., 7d.
- Coil mounting Plugs, with strap, real ebonite, 1/-
- Coil Holders. For Single Coils, on ebonite stand, with terminals, 1/10. For Panel use, 1/2. For two Coils, a superior holder, in polished ebonite, with extension handles, 7/6. For three Coils, as above, 12/6.
- Filament Resistances, our own manufacture, 2/3 and 3/-
- Simplex Lead-in. No holes in window frames. 1/6
- Panel Windows. Real opal windows for viewing filament behind panel. Each 9d.
- Insulated Sleaving, superior quality, per yard, 5d.
- Tinned Copper Wire, for wiring your set; 12 yards, 6d.
- Resistance Units, spiral wound for rheostats; 3 ohms, 5d.; 5 ohms, 6d.
- Ebonite Knobs, drilled and tapped, 5d., 3½d., and 2½d.
- Brass Rod, screwed, 12-in. lengths; 4 B.A., 4d.; 3 B.A., 3½d.; 4 B.A., 3d.
- Switch Arms, best quality, laminated, with nuts, spring and bush, ebonite knob, 1/9; also at 1/3 and 10½d.
- Telephone Terminals, per doz., 2/6; complete with nuts.
- Valve Sockets, per doz., 9d.; complete with nuts.
- Fixed Condensers, guaranteed to 5 p.c. accuracy. Our own make throughout. In ebonite cases. .0002, .0003, or .0005, 1/3; .001, .002, .003, or .004, 1/6.
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RADIOTORIAL.

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

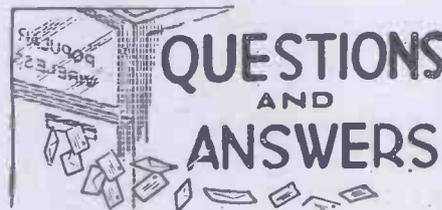
Have you seen one of those ornate ormolu clocks—a great show outside, but very few actual “works” ? If you have, then I think you can safely say that you have investigated the “materialisation” of a Government committee. Surely all the problems of the ages, let alone those connected merely with the wireless of the present, could have been discussed and satisfactorily settled during the long period that the broadcasting committee has been sitting. I am inclined to believe, however, that behind the “gilt” of promises their “works” are acting in a similar manner to the “works” of the cheapest of German alarm clocks—“in fits and starts.” But then we do not know, we have no actual proof that the worthy members of this committee are discussing matters wireless at all; maybe golf, fishing, and other holiday diversions are given pride of place behind the barriers of official secrecy and silence. It seems incredible that months should be required to decide the comparatively few problems connected with broadcasting when only a matter of days can settle such gigantic questions as those in days of war, which can settle the fate of nations. The old saying, “Don’t put off till to-morrow—” has no doubt been adopted as a motto by our energetic broadcasting committee, but the sense of the advice inverted. Several times they appear to have been on the verge of breaking their silence and emerging into daylight, but have at the last moment decided to leave it just a little longer. I wonder how many of the original members will be alive when finally their cogitations are finished, and will they be regarded with the venerable awe accorded to surviving participators of long-past historical events? Will they come within the category of “interesting facts,” and figure as the “Government committee that sat for over fifty years” ? Seriously, though, will this committee be ready with their report before the anticipated winter boom? If not, their dilatory actions will have a serious effect on trade. If when these words appear no definite news is to hand some form of serious agitation should be commenced, and readers should communicate with their M.P.’s and endeavour to force a more speedy settlement.

THE EDITOR.

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR

WIRELESS Queries Department, Room 138, Fleetway House, Farringdon Street, London, E.C.4. Readers are requested to send the necessary postage for reply.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.



A. W. C. (Bridlington).—I intend making a basket coil to tune up to 2,600 metres to get Paris time signals. I am using 22 D.C.C., and find that a very large coil is necessary for this wave-length; in fact, too large for easy handling. Is there any method whereby I can make these coils smaller, sticking to the basket method of winding? I am using cardboard formers with nine slots.

You will find that if, instead of passing the wire through every slot you pass it through alternate slots you will save a lot of room and have two layers of windings on each side of the former. These coils are just as efficient as the single layer basket coils, and have no larger self-capacity. An article on this subject will appear shortly in POPULAR WIRELESS.

A. H. S. (Moorgate).—What are the brief details of the Wireless Telegraphy Act of 1902? Has this Act been renewed or does the original act still hold good? Is it true that this act only holds good for the coherer, etc. (that is, if it has not been renewed since it was first passed)? What are the penalties for infringing these laws?

The first Wireless Telegraphy Act was passed in August, 1904 (not in 1902, as you state), and has been extended from time to time. The first section lays down that no person shall establish any wireless telegraph station or instal or work any apparatus for wireless telegraphy in any place except under and in accordance with the licence granted by the P.M.G. for that purpose. The fees, etc., are to be determined by the P.M.G. with the consent of the Treasury. Section 2 sets out that any person who can furnish satisfactory proof to the effect that his sole object in obtaining a licence is to conduct genuine experiments, shall be granted a licence subject to the special terms and restrictions, etc., but shall not be subject to rent or royalty. The fee of 10s. merely covers the various administrative charges. As regards the penalties, anyone installing a set without a licence is liable to be fined £10 if brought before a magistrate. He may also be brought before the quarter sessions or assizes on indictment, and be fined anything up to £100 or be sentenced to anything up to twelve months. In either case, the set may be confiscated. No prosecution, however, may be hunched against an offender unless consent is obtained from the P.M.G., the Admiralty, the Army Council, or the Board of Trade.

“GRID” (Liverpool).—What is the action of the grid condenser?

The grid condenser is placed in series with the aerial and the grid in order to make the valve rectify. In the normal way the grid is slightly negative or at zero potential. The incoming signals produce varying charges on the grid, so that it becomes positive and negative alternately. When the grid is made positive electrons are attracted from the filament and remain on the grid on one side of the condenser. These cause the grid to have a steady negative potential. The negative impulse from the aerial simply makes the grid more negative, so that, instead of fluctuating from positive to negative and back again, the grid becomes either more or less negatively charged. At each successive positive impulse the grid negative charge is partly overcome and more electrons collect on the grid. Finally, the grid becomes so charged with a negative potential that the incoming oscillations would have no effect on the anode current, which would have been gradually decreasing. At the end of a wave train the grid would be still at negative potential, and subsequent wave trains would produce no effect. To obviate this a grid leak is provided which enables the electrons on the grid to leak away during the intervals between the wave trains. These intervals are comparatively long, and the accumulation of electrons has ample time to leak away before the next wave arrives. This leaking away brings the valve back to about zero potential, and the process can be repeated. By this means the valve is made to pass the anode current in one way only—in a series

(Continued on page 937.)

THE DAILY DEMONSTRATION OF THE “P.W.” SET GIVEN BY THE TECHNICAL STAFF



RADIOTORIAL.

(Continued from page 936.)

of jerks, according to the wave trains, and this series causes a succession of clicks in the 'phones, which, coming very rapidly, produce a buzz or musical note, according to their frequency.

P.W.S. (Clacton).—In the details regarding the L.F. transformer for the "P.W." combination Set, are not the dimensions incorrect in one or two places?

Yes, there are two misprints in connection with the ebonite bobbin. The 1 in. should refer to radius, not diameter, while the hole should be $\frac{1}{2}$ in. instead of $\frac{1}{4}$ in.

A.E.W. (Balham)—What is the cause of "Blue Glow" in a valve?

In the first place, when constructed, a valve is evacuated, and according to its degree of evacuation so it is called either "hard" or "soft." A hard valve is one in which there is little residual gas or air, while in a soft valve there is an appreciable amount of air.

When the filament of the valve is heated and a positive charge applied to the anode, or plate, electrons stream off from the filament and rush across to the plate. Now, if the valve has been fairly completely exhausted, the electrons will fly across without encountering many molecules of gas, but if there is residual gas present the electrons will keep on colliding with the molecules.

The molecules, on the other hand, have lost electrons, so that they are left with a positive charge. They are therefore called positive ions. Being positive they will not be attracted by the anode, but repelled; they will be attracted by the filament and will rush towards it.

On arriving at the filament the ions meet more electrons flying off and will eventually unite with some of these electrons, becoming neutral molecules once more. But they are now in amongst the crowd of electrons moving round the filament, and which naturally have a somewhat screening effect, because they will tend to repel some of the electrons leaving the filament.

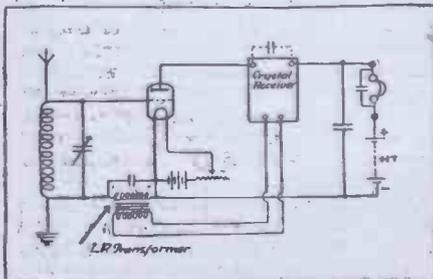
The effect of utilising some of these electrons by the molecules, or rather ions, will "ease" this crowd, as it were, and thus remove its screening effect to some extent. The direct result of this is that more electrons rush off the filament to the plate.

All this action and interaction between the electrons and the molecules of gas means an expenditure of energy, which in turn is largely converted into heat. It is this heat that causes the "blue glow," for the molecules are heated up and the gas becomes incandescent.

A great drawback of soft valves is the fact that they are liable to have a much shorter life than those that are harder. This is because the filament is constantly bombarded by the positive ions, and thus is weakened and burns out more quickly.

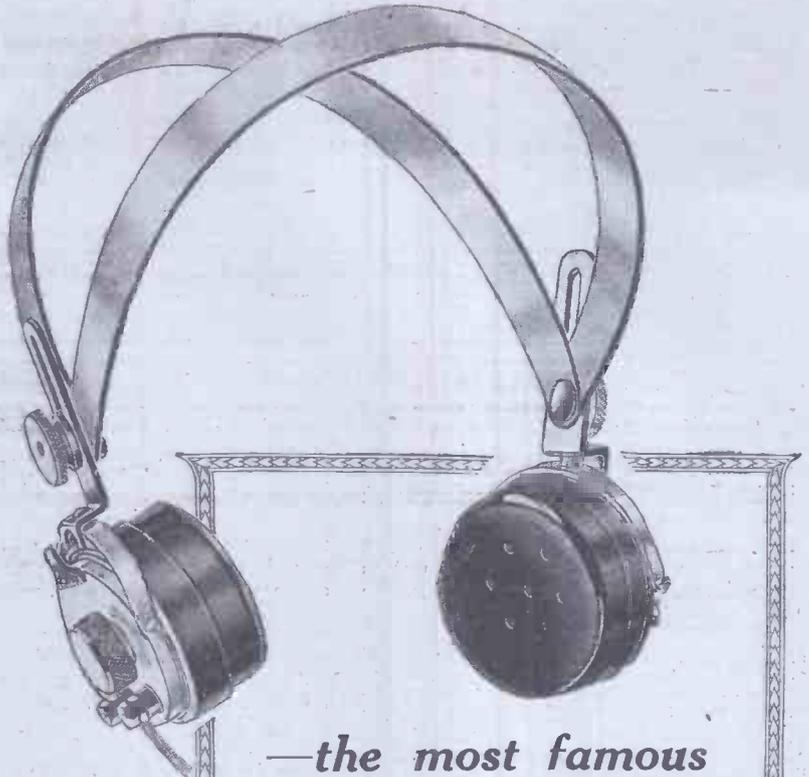
If, therefore, you find that your valve begins to "blue glow" you must cut down your H.T. voltage so that the electron bombardment is lessened.

DUAMP (Kendal).—I have made up the Super-Crystal Set from "P.W." No. 38, and get some quite good Morse, but no telephony, being about 70 miles from Manchester. I did once get him faintly during the winter, so the set is quite O.K. I now wish to add a valve. Is it possible to make it into a dual amplification circuit without any switches, as in the "Combination" set? If so, what are the connections?



This is quite possible. As the A.T.I. of the crystal set will act as the anode coil in the dual amplification set, it will not be necessary for both the primary and the secondary coil to remain in the crystal set, so the first thing to do is to remove the secondary, taking the aerial terminal of the crystal set to the plate of the valve, and the earth terminal to the 'phones and H.T.+, while the crystal is connected across the coil as in a simple crystal set. The valve is connected as follows, the coils mentioned, of course, being for the broadcasting band of wave-lengths. The removed secondary of the super-crystal set can now act as the primary of the dual set, a new A.T.I. being constructed to form a loading coil if necessary. Take a lead from aerial to grid of valve, and connect plate to the aerial terminal of the crystal set. I.S. of

(Continued on page 938.)



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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 937.)

L.F. transformer should go to earth, while O.S. goes to H.T.—, filament and L.T.—. A fixed condenser of '0003 mfd. is connected across the secondary of the transformer. The primary leads of the transformer go to the original telephone terminals of the crystal set. The filament resistance, of course, is connected in the usual manner between L.T. and filament. The earth terminal of crystal set goes to 'phones, the other side of these latter going to H.T.—. A fixed condenser of large capacity is connected across the H.T.— and one of '001 mfd. approx. across the 'phones. One of '0003 variable mfd. may be necessary between A. and E. terminals of crystal set. The new A.T.I., that is, the old secondary, will be suitable for broadcasting while both it and the anode coil (the old A.T.I.) can be loaded to reach higher wave-lengths.

L.W.C. (Manchester).—Is it possible to employ reaction on the "P.W." Combination Set? In this event, could plug-in coils be utilised?

It is certainly possible to employ reaction in the POPULAR WIRELESS Combination Set, but this will not result in very greatly increased signal strength. Up to 30 miles or so the effect of reaction is hardly noticeable if the set is used on an efficient aerial. It is useful for bringing in distant stations, but as it necessitates a form of reaction forbidden on 300-500 metres by the P.M.G., it should not be used on broadcast wave-lengths. Reaction is, of course, carried out by coupling the anode coil to the A.T.I., but this is likely to cause the set to oscillate and disturb other listeners-in if it is not carefully handled. If you decide to alter the lay-out of the set to use reaction the coil connections should be brought up to sockets on the surface of the panel so that either one or the other is movable and can be variably coupled to the remaining coil. If these alterations are carried out the purpose for which the set was designed will no longer be achieved, for the set was built in such a manner that it is perfectly stable under all conditions and will not cause interference, however carelessly it is handled. Apart from this, its ease of operation makes it an ideal "household" receiver. Reaction will bring up the signal strength of weak stations to a certain extent, but it may cause difficulty in that the set may become less stable and howling be introduced. If reaction is used, we would advise you to keep the coils away from the L.F. transformer, and also to fit that type of crystal detector which employs a Vernier adjusting screw for varying the pressure of the cat's-whisker upon the crystal. This latter—the pressure—is an important factor if reaction is used, for a very light contact will cause violent oscillations and consequent howling to take place. Heavy pressure on the crystal will have an opposite effect, and will cut down the signal strength, so that it is important that the correct pressure be obtained.



THE "P.W." COMBINATION SET.

To the Editor, POPULAR WIRELESS.

Dear Sir,—In reference to your letter of the 26th ult., wherein you enclose pull of POPULAR WIRELESS Dual Amplification circuit. We have to inform you that we have tested this out and find it eminently satisfactory.

We attach herewith some notes we have made on the operation of the set, which you are free to publish if you think fit.

Yours faithfully,

Ernest A. GORDON
(for Managing Director).

L. McMichael, Ltd.,
Hastings House,
Norfolk Street, Strand, W.C.2

This would appear to be the ideal amateur combination in the form of the irreducible minimum, and perpetrating the arrangement 1 H.F., 1 R., 1 L.F., which most of us use for general purposes, for that is, in effect, what is happening here. In addition, by an arrangement of switches and telephone jacks the crystal can be used or set alone.

On the full application the valve acts

first as a high-frequency amplifier with a tuned anode transference to the crystal detector, after which the low-frequency impulses pass through the primary of an intervalve transformer. The secondary transfers the stepped-up voltage to the first grid again, and the magnified result is taken through 'phones or loud speaker inserted immediately in the following anode circuit.

On test we found the combination working amazingly well, but we would warn you that results come suddenly. A crystal "rectifies," and until that is adjusted properly the excellence of the circuit cannot be judged. That is the only fault we have to find—the crystal—every day, however, brings new crystals to light, and perhaps we shall soon find a permanently sensitive specimen, or means of quick and certain adjustment.

One or two refinements suggest themselves, of course. The anode coil can be magnetically coupled with the aerial coil, giving reaction, and its consequent signal strength increase, but entering oscillation tends somewhat to upset the adjustment of any but robust crystals. Nevertheless, oscillation can be avoided.

A slight negative bias, 3-6 volts, can be given with advantage to the first grid. A small battery can be inserted on the right of the '0002 μ F condenser in series with the transformer secondary. Furthermore, a blocking condenser across No. 2 jack (a nominal '001 μ F, say) improves the tone somewhat.

We think investigation in this direction will lead to something really good, although at present the hum of nearby electric light and power mains is strangely strong in dual circuits. Experimenters should certainly try this circuit out for themselves and communicate the results for general information.

The Editor, POPULAR WIRELESS.

Dear Sir,—In reply to your letter of the 26th ultimo, regarding the POPULAR WIRELESS Combination Dual Amplification Circuit, our Technical Director, Mr. A. Chapman (who you will remember, is the inventor of the famous 3-Electrode Variable Condenser), is of the opinion that this circuit would afford a very high degree of sensitivity, and enable long range reception to be effected with a minimum number of valves. Furthermore, the H.F. amplification coupling described on the diagram would effect an appreciable degree of selectivity to the A.T.I. input, despite the fact of its being direct-coupled.

We trust that the above opinion, coming as it does from one who has been identified with wireless work since the earliest days, will prove of interest to your readers.

Thanking you for giving us the opportunity of commenting on this very interesting circuit.

We are, dear sir,

Yours very truly,
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CRYSTAL RECTIFICATION.

The Editor, POPULAR WIRELESS.

Sir,—Will you kindly allow me to make a few comments on your "Notes on Crystal Rectification" appearing in the July 28th number of your journal, as this is a subject I have made a special study for the past fifteen years.

It is impossible to accept the theory of thermal action to explain the rectifying properties of the usual crystal detectors, for the three following reasons:

- (1) When heat is applied to them they give no practical indication of thermo-electric action.
- (2) If the most sensitive thermo-junction known—the platinum-bismuth couples used by Professor Thompson for measuring the heat of the stars, or the heat of a candle a mile away—are used in place of the usual detector, nothing can be heard in the telephones.
- (3) Assuming a thermo-junction to act as a detector of feeble high-frequency oscillations, the resulting current from speech transmission would be quite inaudible in telephone receivers owing to the time lag of the heating and cooling of the junction.

The statement that the resistance of a typical wire contact detector is 10,000 ohms is only half the truth, as all these detectors have a negative and positive resistance. The positive resistance in the case of the cat's-whisker type averages 500 ohms, the current travelling from crystal to wire. On reversing the battery with negative to crystal the average resistance is 10,000 ohms.

In the case of zincite combinations the values are 750 ohms against 15,000 ohms or more.

The difference in resistance in the two directions fully explains the purely rectifying action that goes on. The greater the difference in the two resistances the more sensitive is the detector. It will be seen from the figures quoted that 95 per cent of the half wave is rectified, a figure that is not likely to be improved upon.

It is a simple matter to verify all this by measuring an adjusted detector on a Wheatstone bridge or placing it in series with a 1-volt cell and a milliammeter. The latter should register 2 milliamps. in one direction and 1 milliamp. when the detector is reversed.

What is required for the functioning of all crystal detectors is high resistance at the point of contact.

When this high resistance is broken down by mechanical pressure, or the moving of the contacting elements to a position of, or too low, resistance, then rectification becomes inefficient or ceases altogether.

During the past few weeks I have tested upwards of 1,000 detectors on a microammeter passing an average current of 200 microamps. from the rectified carrier wave of 2 L.O., and only in one instance was there a reversal of current—a matter of only 20 microamps. in the apparently wrong direction—and on investigation this was found to be due to the imperfect contact of the crystal in its holder causing partial rectification in two directions. Crystals must always be thoroughly embedded in "wood's" metal.

Those interested in thermo-electric effects will be glad to know that a very efficient junction can be made for next to nothing by twisting together one end from each of a piece of fine euraka wire and a piece of copper or silver wire. The heat of the fingers applied to this junction will generate a current of 20 microamps., and the approach of a match will send it up to 200 microamps.

Although this is one of the most efficient thermo junctions known, it is quite useless as a detector in a wireless receiving circuit. It could be arranged to give a deflection on a visual indicator when placed in a tuned circuit near a transmitter.—Yours faithfully,

B. S. T. WALLACE.

(Continued on page 940.)

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CORRESPONDENCE.

(Continued from page 938.)

A HUMAN AERIAL.

The Editor, POPULAR WIRELESS.

DEAR SIR,—During the past week I have been experimenting with various types of aeriels, and had been getting quite good results on a one-valve set, using quite primitive aeriels. On July 19th I was listening to 2 L O on a crystal set, using a normal outside aerial, and tried to get results by using my body as an aerial. Wetting my fingers I pinched the aerial terminal, and by increasing the inductance about 75 per cent faint signals were received from 2 L O. The music was clear, and by straining my ears I could just manage to read or understand the announcing, etc.

I am seven miles from 2 L O, and my set is installed on the ground floor, thereby obtaining no height. I would be pleased if you would publish this letter in your valuable paper.

I am,

Yours sincerely,

A. N. S.

Wimbledon Park.

DAMAGED BY LIGHTNING.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to your article re lightning a few weeks ago in POPULAR WIRELESS.

A friend of mine living near here was accustomed to earth his aerial inside his house with a piece of 24 S.W.G. enamelled wire. On the morning after the storm this wire was fused and the woodwork round the earth lead slightly scorched. Considerable current must have passed to have fused wire of this size.

His aerial is mounted on two poles 12 ft. in length and mounted on the roof. The wire is about 3 ft. above the ridge, a total height from the ground of about 52 ft.

My own aerial is 30 ft. in height and 55 ft. long and is earthed by a switch, inside the window, having a separate direct lead to a buried earth plate. The ground is always damp. On the night of the storm I noticed for a short time a bluish glow around the mast head.

My aerial, etc., suffered no damage whatever.

Trusting these few particulars are what you require.—I am, yours faithfully,
W. H. CLARKE.

TRADE MARKS AND WIRELESS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re Trade Marks for Gramophones, etc., and Wireless. In view of the fact that many owners of trade marks for sound-reproducing instruments, e.g., gramophones, are now dealing in wireless apparatus, it may be useful to them to learn that it is not safe for them to assume that they are justified in excusing themselves from applying for registration in respect of wireless apparatus (if they wish to be protected for such apparatus) merely because they are registered in respect of sound-reproducing instruments.

It may, however, be stated that official objection is taken to an application for registration of a trade mark for wireless apparatus if a similar mark is already on the official records for sound-reproducing instruments.—Yours faithfully,

H. T. P. GEE.

(Patent and Trade Mark Agent.)

RECENT WIRELESS INVENTIONS.

The following abstracts are specially contributed by Mr. Harold J. C. Forrester, Fellow of the Chartered Institute of Patent Agents, 88-90, Chancery Lane, W.C.2.

Grant of the following patents can be opposed and printed copies of the full specifications obtained.

198,552.—J. ROBINSON, H. L. CROWTHER, & W. H. DERRIMAN.—AERIALS.—For directional transmission only vertical portions of the antennae are used, the idea being that radiations from horizontal portions produce errors due to reflection in the upper atmosphere. Two aeriels having horizontal and vertical portions may be employed, the horizontal portions lying parallel and close together, and thus mutually neutralising, and the vertical portions being placed as far as possible apart, the aerial then being practically H-shaped.

198,589.—A. W. KNIGHT.—INDUCTANCES.—Three flat circular coils are mounted upon ebonite stands, the centre one of which is fixed, the other ones being attached to a rod passing through the fixed stand and to a concentric sleeve respectively. The stands are adjusted by means of knobs upon the ends of the rod and the sleeve, and are pressed together by a spring which presses the sleeve and rod in opposite directions.

198,636.—CAPITOL PHONOLIER CORP.—RECEIVERS.—A receiving set is incorporated in an ornamental table-lamp. The hollow base forms an inverted loud-speaker horn and capacity earth, and is fitted with a deflector. Umbrella and loop aeriels are formed in the top and sides of the shade which is hinged for adjustment, and a fringe conceals the valves, etc., placed at the centre, and also the lamps which are supported in reflectors around the sides.

198,662.—DR. G. SEIBT.—CONDENSERS.—A variable condenser is formed from metal coatings separated by very thin sheet mica. The metal coatings are relatively movable, and at least one must be very thin. In one form, a thin bronze band presses a mica sheet against a vulcanite drum half sheathed in brass, the capacity being varied by rotating the drum which may be paraffin lubricated.

198,700.—BRITISH THOMSON-HOUSTON LTD.—VALVES.—The electrodes for low-capacity amplifying valves are arranged in a special manner, and are then sealed into the bulb so that the anode leading-in wire enters at the opposite end to the grid lead-in. The valve is ultimately clipped into supports which engage the leading-in wires.

198,757.—MARCONI'S WIRELESS TELEGRAPH CO., LTD.—VALVE GENERATORS.—Short wave-oscillations are generated by a two or three electrode valve having parallel wires leading to the grid and filament, the grid lead being connected to the H.T. positive and being separated from the filament lead by a condenser. A negatively charged metal cylinder may surround the valve if only two electrodes are used, and the wave-length generated is adjusted by altering the length of the parallel leads.

Where Performance
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To produce a loud speaker which is worthy of the artistes who nightly broadcast has been our ambition. A loud speaker which reproduces the fulness of the flute, the delicacy of the violin, the blare of the trombone and the characteristic quality of the voice, that has been our ambition and that is the guaranteed performance of

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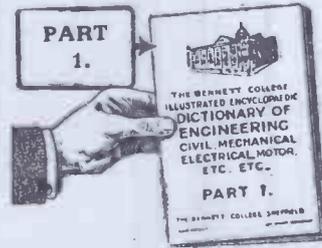
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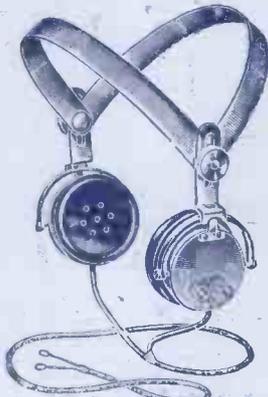
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New Low Temperature (Dull Emitter) VALVE

PRICE REDUCED
from £2 to 27/6

PRICE REDUCED
from £2 to 27/6



Type

A.R.D.E.

Every care must be taken that not more than two volts are put across filament.

Filament Volts	1.8—2.0
" Current	30
Anode Volts	20—30.
Bulb Diameter	29 m.m.
Overall Length including pins	110 m.m. max.
Cap	Standard 4-pin.

July 1st saw the reduction in price of our R. Valve from 17/6 to 15/-.

NOW we announce another enormous price reduction—our Dull Emitter Valve type A.R.D.E. previously costing £2 is reduced to only 27/6.

Improved methods of production, coupled with years of experience in Valve manufacture, make this wonderful offer of ours possible to-day.

Use this Valve under proper conditions and reliable perfection is the result. Simply see that only 2 volts are passed across the filament.

We also manufacture complete Receiving Sets, Accessories, H.T. and L.T. Batteries. Ask for Descriptive Leaflets.

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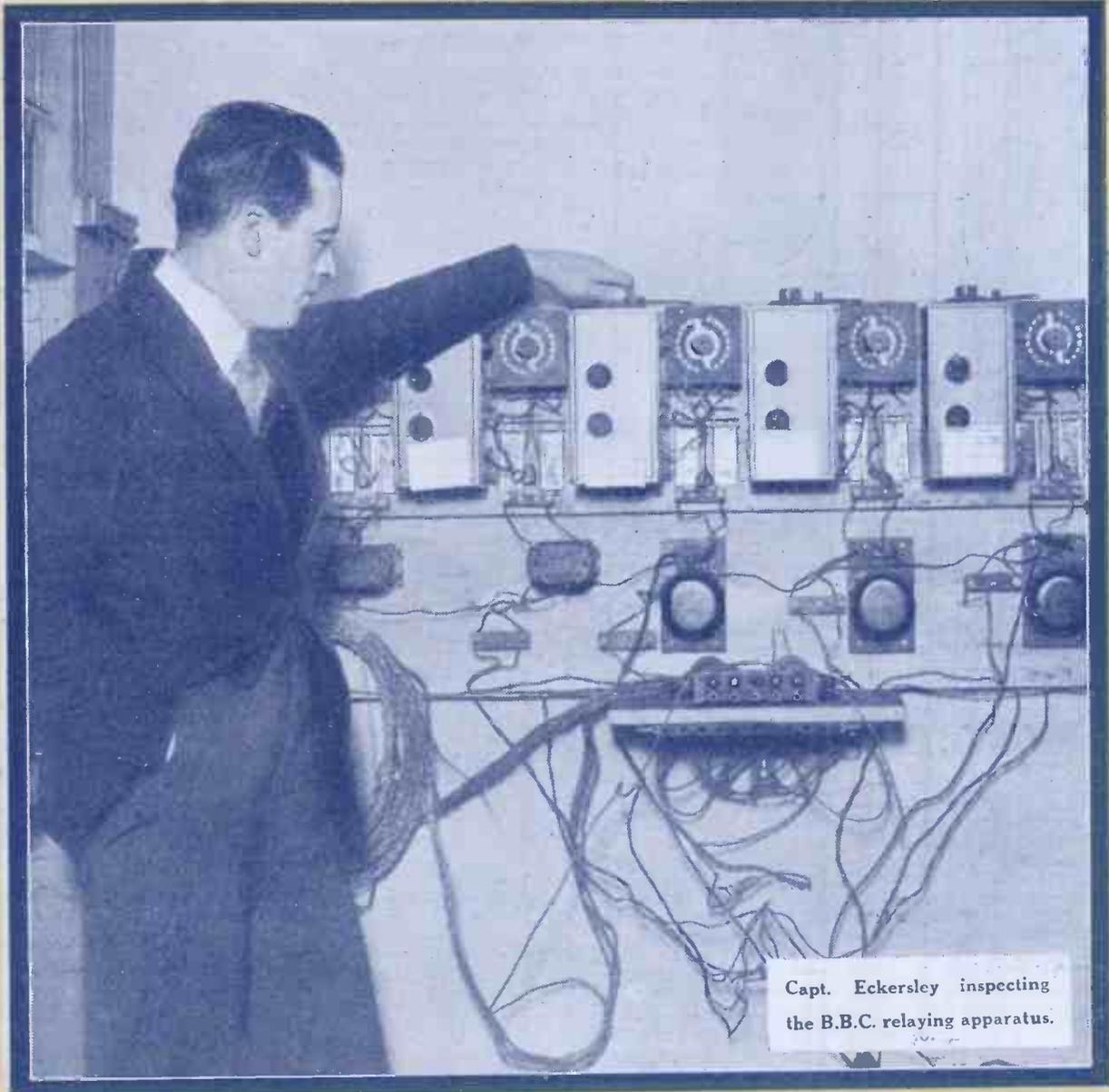
Popular Wireless

PRICE 3d.

No. 65. Vol. III.

SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

August 25th, 1923.



Capt. Eckersley inspecting the B.B.C. relaying apparatus.

FEATURES IN THIS ISSUE.

The Use of Graphs.

An Amateur H.T. Battery.

The Series-Parallel Switch.

And an extended and revised list of the Continental Broadcasting Stations.

A Novel Note Magnifier.

Interesting Experiments with Crystals.

Some of 2 L O's Artistes.

POPULAR WIRELESS

August 25th, 1923.]

SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc.

[Every Friday.]

TOPICAL NOTES AND NEWS.

Amateur Transmission.

MR. A. RICH, of 13, New Road, Ponders End, N., tells me that he will be very pleased to have reports from amateurs who pick up transmissions from his station, 6 Q V. Details as to strength of reception, clearness of speech, and distance over which reception is accomplished will be very welcome.

The Radio Association.

READERS should note that the headquarters of the Radio Association have been removed from Great Russell Street to Sentinel House, Southampton Row, W.C. All inquiries should be addressed to the Hon. Secretary, Mr. S. Landman, M.A., at the above address.

"Blind" Spots.

IT has often been stated that the south coast of England contains a large number of "blind spots," where reception of the British Broadcasting stations, especially 2 L O, is very difficult, if not impossible, but no definite data on that subject has been compiled.

Results of Tests.

ASERIES of tests have been carried out by POPULAR WIRELESS round about Hastings, and it was found that no great difficulty was encountered in tuning-in 2 L O. A six-valve portable receiver with small frame aerial was used, and also the "P.W." Combination set with outdoor aerial. With this latter, jamming from ships and shore station was not serious enough to interfere with the broadcast reception, while with the frame aerial no jamming at all was experienced.

Not "Blind."

THESE tests proved that Hastings, at any rate, is not a "blind spot," and though with flatly tuned sets a great deal of jamming may occur, and may prevent the reception of the broadcasting stations and render the locality "blind" from that point of view, yet in the true sense of the term it cannot be called a "blind spot." It would be interesting to hear the experiences of readers in other places where (not taking

jamming into account) reception is difficult or impossible.

Test "En Route."

FURTHER interesting tests were carried out with the Marconi six-valve portable set "en route" to Hastings. Reception was very satisfactory even when travelling at considerable speeds over not-too-good roads, although due credit must be paid to the smooth running of the seven-seater "Steyr," which was driven by Mr. Bray, the well-known motorist.

A New Station.

THE Pekin Government at Bashgar, the Western capital of Chinese Turkestan, are about to build a powerful wireless

Bouquets by Wireless.

FLOWERS can now be "dispatched" by wireless to almost any part of the world through the Florists' Telegraph Delivery Association (America). Originated by a few florists, the association now contains more than 2,500 members in the Western Hemisphere alone.

Floral Greetings.

ARRANGEMENTS are so minutely made that it is possible to "send" a bouquet from England to anyone in Canada or the States, to be delivered within a few hours of the order. Flowers have recently been "dispatched" by wireless for delivery in places so far wide apart as Toronto, Copenhagen, Rome, Tasmania, and Buenos Aires. With the flowers is sent a card of greeting or any message preferred.

Water as Aerial.

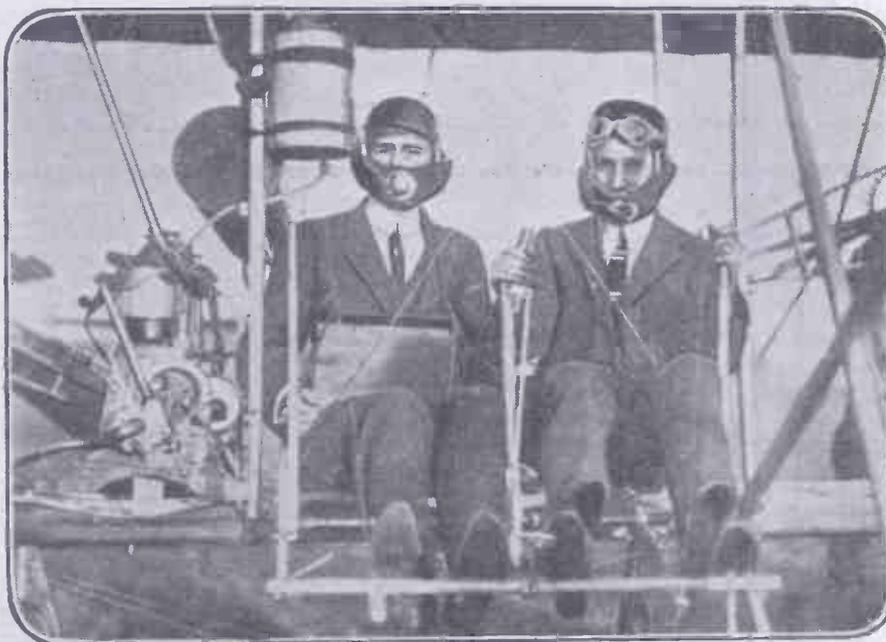
STREAMS of salt water, thrown high into the air, can be used as a transmitting aerial by broadcasting stations. Experiments with this medium have been successfully carried out. With special apparatus wire connections were made from a powerful broadcasting apparatus to a large stream of water pumped into the air, and communications were established over a distance of eighty miles.

This method may prove very useful in cases of emergency on board battleships.

The Nighthawks.

MR. GREEN, the owner of the station 5 O W, informs me that the information received by POPULAR WIRELESS regarding the above "society" is incorrect. He states that no such society has been formed, but that the alleged "concerts" that were transmitted from 5 O W were purely tests carried out with other amateur stations. This, of course, appears to be more likely to be the case, as the formation of an amateur broadcasting society would be an infringement of the P.M.G.'s regulations.

(Continued on page 942.)



An hitherto unpublished photograph of Messrs. Berneys Johnson and Howard Gill conducting early experiments in aeroplane wireless telephony.

station. The machinery was carried across some 2,000 miles of desert on the backs of 1,200 camels. The camels used to convey the machinery are not from the same stables as those of "Harry Tate's one cylinders."

No H.T. Battery.

AREADER tells me that he has a multi-valve set that works perfectly without an H.T. battery. The set, an R.I. five-valve receiver, has been in use for some months, but for the last week or so has been operating without the H.T. being connected. Reception of nearly all the B.B.C. stations and of Paris has been successfully accomplished under these conditions.

NOTES AND NEWS.

(Continued from page 941.)

5 N O.

MANY thousands of London listeners-in heard transmissions from Newcastle for the first time last week, when one of a series of simultaneous-radiation tests was carried out; but instead of the items emanating from 2 L O, as hitherto, 5 N O originated them, each of the other stations' microphones being connected by telephone cables to the Newcastle studio.

Wireless Letters.

THE German Government is instituting a service of wireless letters from Germany to New York. They are following the example of the Marconi Company, who have been running a wireless letter service between this country and the U.S.A. for some months.

400 Metres.

LISTENING-IN from 2 L O during the morning has greatly improved, in consequence of the increase of the wave-length by 31 metres.

I have received several letters from our readers stating that audibility has greatly improved.

Back to 369.

ALTHOUGH there are several reports and rumours that the B.B.C. are going to keep to this wave-length of 400 metres, I have it on good authority that this will not be the case; not, at any rate, until the committee's report is issued, which may be in the near future.

Not Cutting Programmes.

I HAVE received several letters and telephone inquiries from readers inquiring if the B.B.C. are going to supply the whole country with one programme. I can assure them that it is not the intention of the B.B.C. to do anything of the kind; in fact, what they will do if they can get the permission of the G.P.O. is to build another dozen or so stations in large towns with relay apparatus.

Holiday Listening-in.

WIRELESS listeners-in may take their receiving sets with them on a short holiday, a General Post Office official stated recently.

"Only if the set were transferred for an extended period—a few months—would the question of permission for transference be raised.

"It is advisable, however," he added, "to notify the Post Office at which the set was licensed before making any change."

2 L O at Bombay.

I HAVE received a letter from a wireless operator at a land station in India, saying that while he was on duty recently he heard a concert from 2 L O. It was as clear as if sitting in the studio, though he was only using a set which cost £11.

BROADCASTING TRANSMISSIONS

Regular transmissions of news and concerts take place daily from the following stations. Full details appear in the daily Press.

LONDON	.. 2 L O	369 metres.
BIRMINGHAM	.. 5 I T	420 "
MANCHESTER	.. 2 Z Y	385 "
NEWCASTLE	.. 5 N O	400 "
GLASGOW	.. 5 S C	415 "
CARDIFF	.. 5 W A	353 "

A comprehensive list of the Continental broadcasting appears on another page in this issue.

2 Z Y's Programmes.

FRIDAY, AUGUST 24TH.—W. Leigh Howarth's Dance Orchestra. Mr. Owen Brangwyn, baritone.

SATURDAY, AUGUST 25TH.—Mr. John Wright, baritone, and Miss Florence Holding, soprano. Mr. Victor Smythe will give further diversions of "Algy."

SUNDAY, AUGUST 26TH.—The speaker will be the Rev. Dr. Roberts. Miss Olive English, soprano.



Some of the Marlborough College Cadets at field wireless practice.

MONDAY, AUGUST 27TH.—Miss Sophie Rowlands, soprano, Mr. Tom Kinniburgh, bass, Mr. Arthur Holland, baritone, will sing.

TUESDAY, AUGUST 28TH.—Second Symphony Concert, with augmented orchestra. Symphony No. 1 in "G" Minor, by Kallinikow. It is believed that this is the first performance of this work in the district. The vocalists are May Blyth, soprano, and Robert Parker, bass, both of the B.N.O. Co.

WEDNESDAY, AUGUST 29TH.—There will be the usual programme of light music, and the vocalists will include Miss Jennie Lord, soprano.

A Great Success.

THE success of the first Symphony Concert was immense, and has shown how much the very highest class of music is appreciated by the listeners-in of 2 Z Y. These concerts will continue fortnightly during the season.

Another Radio Circle.

A RADIO Circle for listeners-in is being started, and badges will shortly be ready. Those wishing to join this circle should apply to the Station Director at 2 Z Y.

"Talks" from 2 L O.

THE following are the talks arranged for the week August 27th to September 1st:

MONDAY, AUGUST 27TH.—7.15 p.m., C. A. House, Chief of Staff of "Cage Birds," on "Canaries." 9 p.m., A. Bertram, official lecturer of the National Portrait Gallery, on "Portrait Painting."

TUESDAY, AUGUST 28TH.—7.15 p.m., H. A. Bromley, Examiner Supplies to H.M. Stationery Office, on "The Evolution of Paper Making." 9 p.m., H. E. Powell-Jones on "Mexico."

WEDNESDAY, AUGUST 29TH.—7.15 p.m., Dramatic Criticism. 9 p.m., Professor A. J. Ireland on "History."

Successful Relaying.

THE engineers of the B.B.C. are very satisfied with the result of the tests they have made in connection with the relaying system, and it is now definite that Sheffield will be a permanent "sub-station," and it is also decided that other similar stations will shortly be erected.

A Good "Crystal Range."

THE B.B.C. are more than satisfied, inasmuch as listeners-in with crystal sets were able to hear the relay station very clearly twelve miles away. This is in excess of the guarantee made by the engineers, who stated four miles as being the likely range with a crystal.

News from 5 I T.

THE features for Sunday, August 26th, are two London soloists—Sophie Rowlands (Soprano), and Tom Kinniburgh (bass), and on Monday the famous operatic baritone Robert Parker will sing. On Tuesday, August 28th, the band of the Irish Guards appear. On Wednesday, Miss May Blyth, of the British National Opera Company, will be the soloist. Thursday is again "Request Night," with solos by the Repertory Company. And on Saturday night, September 1st, the Appleby Matthews Military Band will present a programme of popular and classical music.

ARIEL.

A CHEAP BUT EFFICIENT CRYSTAL SET.

This receiver can be constructed quite easily in one evening, and is quite suitable for adaptation to valve work when the constructor "graduates"

THIS apparatus is the simplest and most easily made of any I have yet seen, and is eminently suitable for the beginner or amateur who wishes to make an inexpensive crystal set of his own. I have already had one in use with perfectly good results, and I consider it will give results just as good as any other crystal set on the market which is used without any amplification.

The necessary parts consist of two cardboard formers or cylinders, one 4½ in. in diameter and 2½ in. long, and the other 2½ in. in diameter and 2½ in. long; 2 oz. of No. 26 D.C.C. wire; tapped brass spindle, 2 B.A., or thereabouts, about 10 in. long; seven nuts to fit spindle; one knob to fit spindle; four terminals; crystal detector; and a .002 fixed condenser.

The Variometer.

First take the larger drum and make two holes near the left-hand edge with a darning-needle or hatpin. Push about 10 in. of wire through the second hole and bring wire back through the first hole to the outside (see A, fig. 1), and, after pulling tight, leave thus. Wind 25 turns round the drum, keeping the wire close and evenly together. Make two slots in the drum (see B, fig. 1). Take the loose wire and bring to the edge of the drum. Enter in the longest slot and pull tight when close to the winding. Bring wire back to the edge and enter in the smaller slot, and pull tight. Wind another 25 turns, and when this is finished make other two holes, finishing the wire as it was begun and leaving about 10 in. of wire; then cut it.

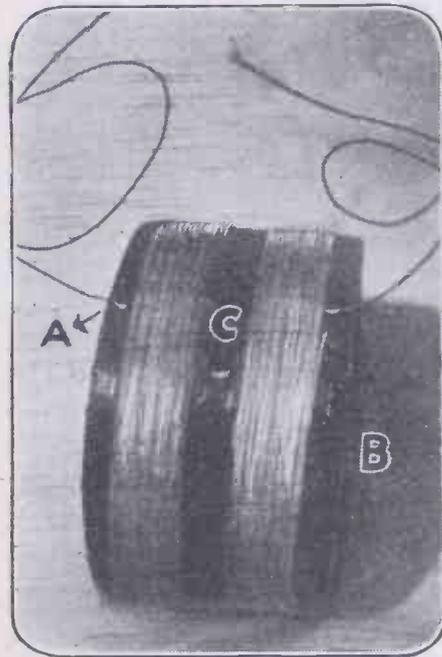


Fig. 1.

Wind the smaller drum similarly. When finished, bore a hole through the centre of both cylinders just wide enough to allow the brass spindle to be pushed through (see C, fig. 1). Push spindle through one side of drums after the smaller drum has been placed inside the larger, and screw on two nuts. Push spindle right through holes on either side just sufficient to take a nut, which should be screwed on outside. The two nuts which are now on the inside of the small drum should be screwed

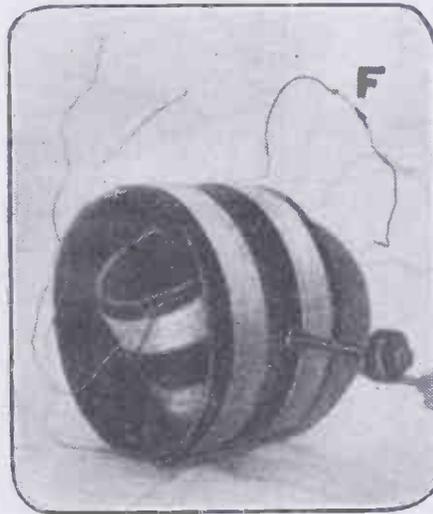


Fig. 2.

against the insides of the drum. Leaving about 1½ in. on the side of the spindle which is longest, it should now be cut through and the knob screwed on. This gives a result as shown in fig. 2.

All that remains is to solder one of the loose wires from the smaller drum to a loose wire on the opposite side of the larger drum, thus connecting in series, and a little insulation tape can be put over the joint (see F, fig. 2). This leaves two loose ends, which are connected with aerial and earth. The remainder of the set is connected as shown in fig. 3.

Connecting Up.

Fig. 4 shows the set connected up firmly in the following manner. Obtain two pieces of wood, 7 in. by 4½ in., and in one bore two holes at the top near right and left corners for aerial and earth terminals. Fix crystal detector across the middle and two terminals below for telephones. (See fig. 4.) Take the other piece of wood and bore a hole in the middle, 3 in. from the front, just enough to allow the remaining portion of spindle to go through. When this has been done the various terminals and crystal detector can be affixed to the front portion.

Take the brass spindle and screw on two nuts about 1 in. from each end. Put one end through the hole in the piece of wood, and bore a hole in the bottom of the largest

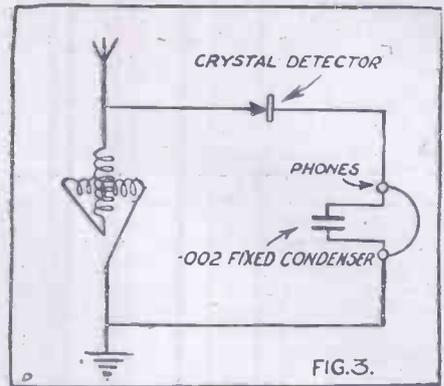


FIG. 3.

cylinder to allow the other end of the spindle access. Put end of spindle through cylinder and screw on nut. Do same below piece of wood, and screw inside nuts tight, which will hold both drums upright. Bore a hole slightly larger than is required to allow spindle free play in the front piece of wood, and on taking off knob this can be brought through above the crystal detector. Put on knob again, and a few nails across the bottom will hold rigid.

Results Very Satisfactory.

When the set has been connected up as shown in fig. 3, connect aerial and earth with top terminals, and 'phones with bottom terminals, and adjust crystal detector until signals are heard; then turn knob above crystal detector until signals are loudest.

I might add that in the average crystal detector the wire, or "cat's whisker," is much too hard or strong, and it should be removed and a piece of copper wire, No. 40 or finer, made into a spiral spring and put into its place. The difference will be observed at once.

A few nights ago this little instrument was tested along with one of a well-known make costing about £5, and the results were exactly similar, much to the surprise of the owner of the bought set.

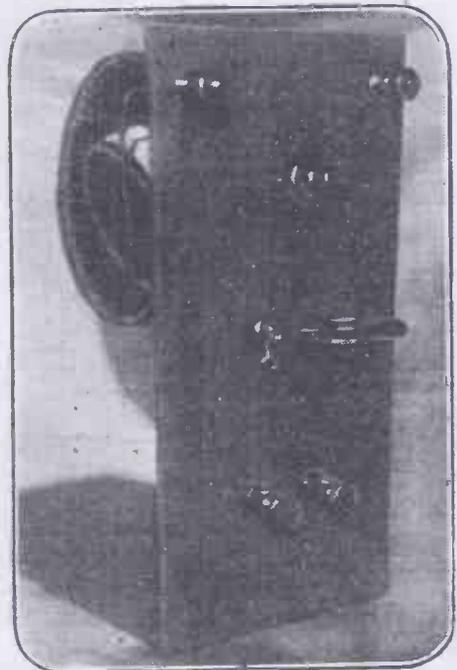


Fig. 4.

2 L O's ZOOLOGICAL EXPERIMENT.

By "ARIEL."

An amusing description of an attempt to control the actions of an elephant by means of wireless telephony.

A FEW evenings ago an experiment was carried out to discover whether an elephant would obey the voice of a Mahout it could not see. It was a decided success in the sense that it proved broad-

the Zoo Superintendent, threw down a penny. "Pick it up," came Ali's voice. Down went Indarini's trunk, a quick search round, then it was up again—grasping a potato. The crowd roared.

Then 2 L O tried the effect of music on the obstinate animal, and Indarini looked unutterably bored with the whole proceedings. The supply of potatoes was rapidly giving out, and that was the only thing of interest to her. Even the "Indian Love Lyrics" failed to awaken a responsive chord. Once more the voice of the Mahout was heard in a final desperate effort to enforce obedience. Indarini triumphantly rescued a potato that had become lodged under the side of the bath, and very gravely and thoughtfully proceeded to chew it—the potato, of course, not the bath. It was the last potato within sight, and Indarini's appetite still seemed unappeased. She glanced inquiringly at

the receiving set, doubtless viewing its possibilities as a meal; but there was no hope of entertainment in that direction for

the set was erected in the enclosure next to hers and out of her reach.

An immediate meeting of Fellows of the Zoological Society decided "The success of the orders given by a Mahout depends upon his gestures and personal contact. This evening's experiment is considered a failure." This is, of course, looking at the experiment from a disciplinary point of view. As an example of the usefulness of wireless as an aid to an elephant's digestion, I consider that the experiment was perfectly successful. Then again there is the interesting fact to bear in mind that Indarini did not seem to regard the loud speaker with any other feelings than that of a slight curiosity. 2 L O and the Zoo should not abandon their natural history and wireless telephony studies, and it is suggested in all deference that they should undertake similar experiments with other animals as small as the elephants are large. Could the common mouse or rat be made to obey the command by wireless, "Walk into that trap," then will broadcasting tend to usefully replace the professional rodent catcher.



Syed Ali delivering his orders into 2 L O's microphone.

casting an excellent aid to digestion. With that extremely useful discovery, surely the experiment cannot for one moment be considered a failure.

The idea was that Syed Ali, the native Mahout, should give orders by wireless from 2 L O. These orders were to be received by Indarini through the loud speaker placed just outside the elephant paddock. Ali appeared in the broadcasting studio of 2 L O impressively in crimson turban and khaki drill, and promptly at 6.15 proceeded to communicate his orders to Indarini.

Beans and Potatoes.

The first was "Lie down," pronounced in the "language of elephants," and Indarini proceeded to locate a succulent cluster of locust beans from the floor and munch them without as much as the quiver of an eyelid. The second command was to "stand up," and I have it on good authority from close observers, that Indarini's left ear twitched. I was standing on her offside, and the only thing I noticed was that she gathered up a fresh collection of potatoes and went on with her munching.

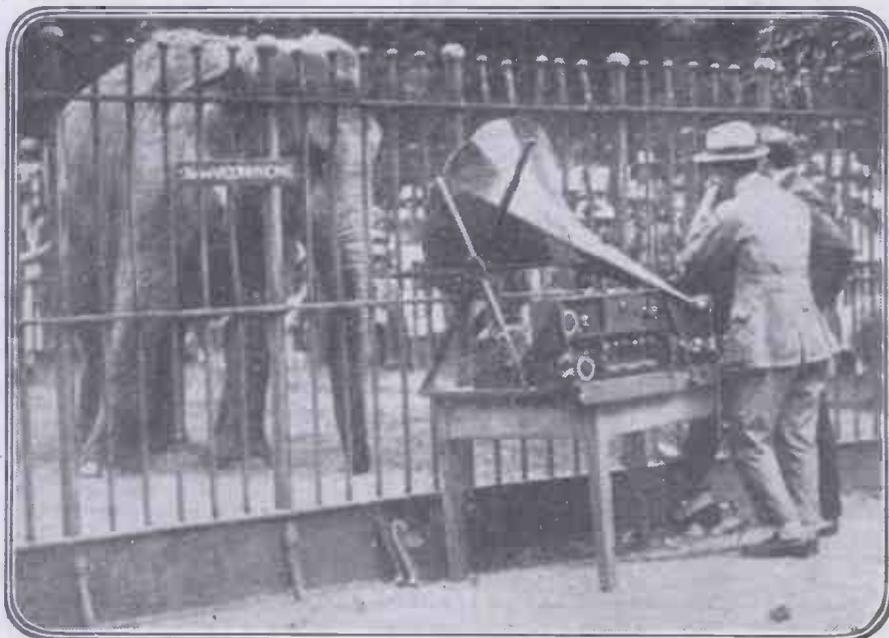
When the order to salute came she was deep in her meal—nearly ankle-deep in fact. The locust beans were finished, but the supply of potatoes was ample.

Then came what was intended no doubt to be the "pièce de résistance." Dr. Vivers,

A FEW WRINKLES.

Although a soft carpet may have saved your 'phones on many occasions, remember that dropping them is liable to weaken the magnets, and not only smash the ebonite caps. Remember, too, that the diaphragm is a most delicate part of the 'phones, and should be handled as little as possible, as a slight dent in same may be the cause of failure to receive signals.

If you are using one of those excellent little Dutch valves as a rectifier (they do not, as a rule, work well as either H.F. or L.F.), remember that too much H.T. is liable to shorten their life considerably. Even though stronger signals are obtained when a slight blue glow appears, this should always be avoided.



Indarini shows but slight signs of interest regarding the loud speaker.

SOME SIMPLE WIRELESS CALCULATIONS.

By C. E. FIELD, B.Sc.

Being a short, interesting introduction to the mathematics of radio-work. Mr. Field does not weary the reader with long explanations of an unnecessary nature, but deals with the subject in its direct application to practical constructional work.

IV. THE USE OF GRAPHS.

JUST as we can illustrate a story by means of pictures, which save a considerable amount of description, so we can illustrate a calculation by means of what we call *graphs*, or *curves*, and so save a large amount of mathematical working, a great many arithmetic sums, in fact, being replaced by one graph. Hence graphs save work, and ought therefore to appeal to everybody.

A graph is a line which shows the corresponding values of any two quantities which are dependent one upon the other, and the method of drawing it is as follows.

A number of straight lines are ruled on a piece of paper in such a way as to divide it into a great many equal squares. These lines will be referred to as *vertical* and *horizontal* lines in order to avoid confusion,

1.5 ohms is obtained by measuring from 0, 3 squares horizontally and 1.5 squares vertically, giving the point B.

The point C indicates in the same way that the resistance of 5 yards of wire is 2.5 ohms. A line drawn through the points A, B, and C is then the graph showing the relation between the length of the wire and its resistance.

If we now take any point at random, such as D, we find it to be distant from 0 by 2 squares in a horizontal line and 1 square in a vertical line, which means that 2 yards of wire have a resistance of 1 ohm. This graph could be used in this way to find the resistance of any length of the wire without any sums or reference to tables being necessary.

Characteristic Curves.

In this particular case the graph is a straight line, but this does not always hold; and, in fact, the most useful graphs are usually curved or wavy lines.

Graphs are of great assistance in the study of the thermionic valve, and so we will see what we can learn from a valve graph, or *characteristic curve*, as text-books generally call it.

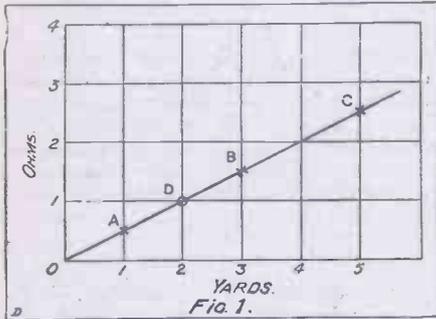
Fig. 2 is a graph which shows the relation between the high-tension voltage applied to a valve plate and the output current when there are no signals being received, and the filament is maintained at a constant brightness. One square measured horizontally from the point 0 represents 20 volts on the high-tension battery, and one square vertically represents 1 milli-ampere of plate current.

Let us consider the three points, A, B, and C. The point A is distant from 0 by 2 squares vertically and 1½ squares horizontally, and so it represents values of 2 milli-amperes and 30 volts. That is, when we use a 30-volt H.T. battery, we get a plate current of 2 milli-amperes. The point B shows us that a high-tension battery of 60 volts gives us a current of 4 milli-amperes. We have therefore doubled the current by doubling the voltage, as we might have expected. The point C indicates

that 100 volts high tension gives a plate current of 4.6 milli-amperes; i.e. an increase of 40 volts has increased the current by 0.6 milli-ampere, whereas the previous increase of 30 volts increased the current by 2 milli-amperes. Hence the addition of the last 40 volts is not justified by the results produced, and we would be foolish if we used more than about 70 volts with this particular valve.

We learn, therefore, from this graph the results derived from which apply to all valves of every make, the actual figures, of course, varying, that beyond a certain point it is no use increasing the H.T. voltage, because practically no increase in signal strength results.

Fig. 3 shows another valve graph giving the relation between the voltage applied

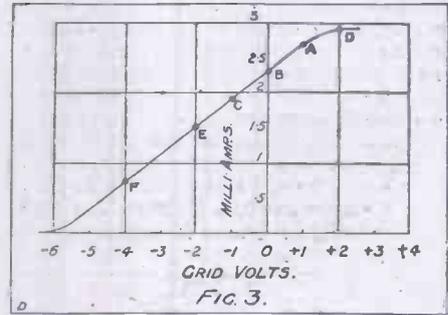
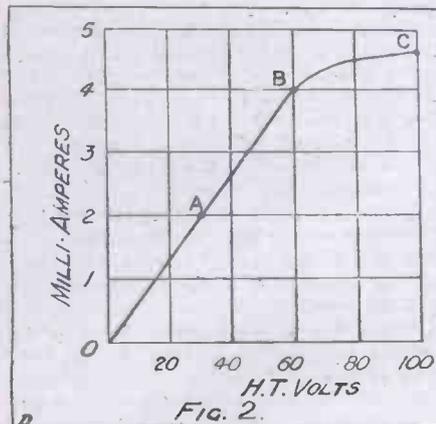


the vertical lines being those running from top to bottom and the horizontal lines those running from left to right of the paper. One vertical and one horizontal line are drawn thicker than the remainder. These are known as the *axes* of the graph, and their point of intersection is the starting point for all measurements.

To Discover Resistances.

Suppose we wanted to draw a graph to show the relation between the resistance and the length of a piece of copper wire, when we know that the resistance of 1 yard of wire is 0.5 ohm, the resistance of 3 yards is 1.5 ohms, and that of 5 yards is 2.5 ohms. We first divide the horizontal axis to the right of the starting point into a number of equal parts, each of which represents to some scale a length of 1 yard. In Fig. 1 the side of one square has been made to represent 1 yard. In the same way, the vertical axis is divided up to represent resistance in ohms, measuring upwards from the starting point, the side of one square in this case representing 1 ohm.

We are told that the resistance of 1 yard of wire is 0.5 ohm. This statement can be indicated in Fig. 1 by a point whose horizontal distance from the starting point, 0 (i.e. *length*), is the side of one square (i.e. 1 yard), and whose vertical distance from 0 (i.e. *resistance*) is half a square (i.e. 0.5 ohm). This point is lettered A. Similarly, a point to represent the fact that the resistance of 3 yards of wire is



to the grid and the plate current of an amplifying valve, the H.T. and filament voltages being kept constant. In this case the horizontal axis has been extended on both sides of the point 0, all points to the left of 0 representing negative quantities.

Let us see what happens when a signal produces an alternating potential of 1 volt on the valve grid. When this voltage is positive the conditions are given by point A on the graph, which is one square to the right of 0. This point is 5.4 squares vertically above 0, and so indicates a plate current of 2.7 m.a., one square vertically representing 0.5 m.a.

To Avoid Distortion.

At the point B there is no voltage on the grid, and the plate current is 2.3 m.a. When the alternating voltage is at its maximum negative value of 1 volt, we get the point C, showing a plate current of 1.9 m.a.

Thus, as the voltage increases and decreases by one volt, the current increases and decreases by 0.4 m.a. That is, the voltage alterations are faithfully reproduced in the output current, giving amplification without distortion.

Now, suppose that the signals are stronger, and increase and decrease the grid potential by 2 volts. The points representing 2 volts positive and negative

(Continued on page 946.)

AN AMATEUR HIGH-TENSION BATTERY.

By CAPT. H. SHAW, M.Sc., A.R.C.S., F.Inst.P. (Principal of the Radio Correspondence College).

A practical unit, which, when constructed by the author, was in constant use for two years and is still in good condition.

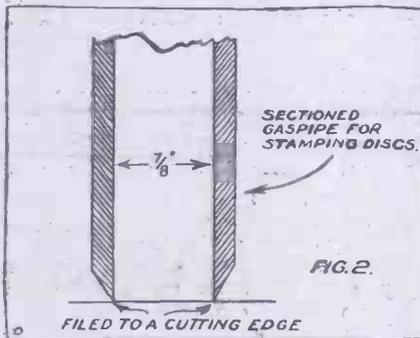
MANY of us have experienced inconvenience during an interesting concert or experiment due to the high-tension having either run down or reached the stage when nasty crackling noises appear. Such interruptions are exceedingly annoying and usually occur unfortunately when the stores are closed and the battery therefore cannot be replaced. In order to obviate any future occurrence of this trouble, I set out to produce a high-tension battery which should be reliable, and at the same time convenient and simple to make and replace. It is really an efficient and economical battery of the Léclanché type which can be produced at very small cost.

The Materials Used.

The materials required to make a high-tension battery of this form are: A small reel of old cinema film (which can be obtained from most cinema operators for a few coppers), a small quantity of celluloid cement, some pieces of old broken celluloid accumulator cases, some odd pieces of sheet zinc, a number of thin carbon rods, and a little cotton wool, paraffin-wax, and sal-ammoniac. For a 60-volt battery 50 containers are required, and these are best made with the aid of a former of $\frac{7}{8}$ inch

diameter and about seven inches long (a piece of gas pipe of these dimensions makes an excellent former).

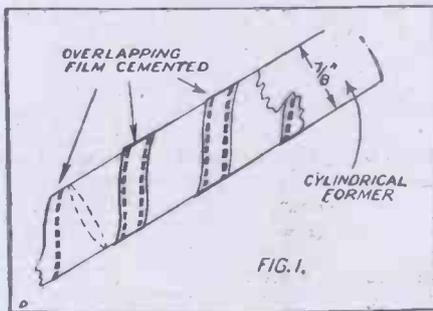
The film is first soaked in warm water for a few minutes, by which means the gelatine is softened so that it may be removed without difficulty. The film is then wound round the former as shown in Fig. 1, during which process a small quantity of the celluloid cement is applied with a brush to one edge



of the film. A tube is thus formed having the perforated edges of the film overlapping, and when the cement is dry the tube can be slipped from the former quite easily.

These tubes should next be cut to a length of 3 inches, and their ends squared off and trimmed with a pair of scissors.

The circular bases for these containers now remain to be made, and this is done by cutting circular discs of thicker celluloid from the old accumulator cases. The requisite number can be made readily and quickly by taking a piece of gas tubing of $\frac{7}{8}$ inch inside diameter, and filing it to an edge, as shown in Fig. 2. With this the discs can be stamped out by simply placing the sharpened edge of the gas pipe on the celluloid.



loid, and giving it a sharp blow with a fairly heavy hammer.

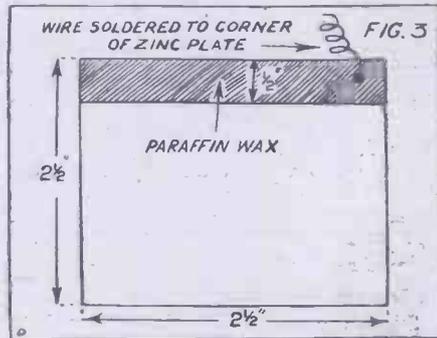
Now place one of these discs in each tube, and run a little cement round the edge in this way the bottom is firmly fixed in the tube, forming a container that will not break. A rectangular piece of zinc of the dimensions shown in Fig. 3 is now required for each container, and to one corner should be soldered a piece of copper wire. The zinc is next bent into a cylindrical form so as to fit easily into a container, and the upper edge is dipped into molten paraffin wax. When cool, a layer of the wax adheres to the zinc, thus protecting the soldered joint and also preventing any creeping of the electrolyte.

Replenishing the Cells.

Now cut the carbons into $3\frac{1}{4}$ -inch lengths, and around one end of each wind three or four turns of thin copper wire, which should afterwards be bound tightly with rubber insulating tape, leaving about 3 inches of wire for connecting purposes.

A carbon rod is placed in the centre of each container and cotton wool packed tightly between the carbon rod and the zinc. All that remains is to prepare a saturated solution of sal-ammoniac and to completely soak the cotton wool with it. Connect all the cells in series by joining the carbon of one cell with the zinc of the next, and so on.

A battery made in this manner has been in use for over two years and still remains in good condition. To replenish the cells when running down, it is only necessary to moisten the cotton wool of each cell with the concentrated sal-ammoniac solution, a treatment analogous to that of replenishing the ordinary Léclanché cell.



SOME SIMPLE WIRELESS CALCULATIONS.

(Continued from page 945.)

are D and E, which show currents of 2.9 m.a. and 1.5 m.a. respectively. Hence the normal current of 2.3 m.a. has been increased by 0.6 m.a. and decreased by 0.8 m.a., showing that in this case the current variations do not exactly follow those of the grid voltage, which means that the amplified signals will be distorted. This is because of the bend in the curve between points A and D.

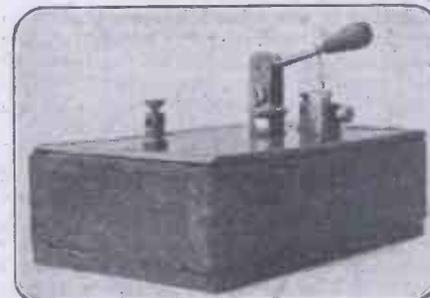
In order to avoid distortion, therefore, we must arrange that the maximum positive grid voltages do not come beyond the point A, where the bend commences. This can be brought about by applying a

steady negative potential of, say, 2 volts to the grid to begin with. The no-voltage point is then at E, the corresponding current being 1.5 m.a. An addition of 2 volts positive gives the point B, representing 2.3 m.a., and an additional 2 volts negative gives the point F, representing 0.7 m.a. The increase and decrease in the current are thus both the same, i.e. 0.8 m.a., and so the current is faithfully reproducing the voltage variations and giving distortionless amplification.

From this curve, therefore, we see how to improve our results by altering the potential of the grid of a valve, this being accomplished, of course, by means of a potentiometer.

There are a great many more useful graphs in connection with valves, and also with crystals and almost every other piece of wireless apparatus; but space

will not permit of their being dealt with here. Amateurs, however, should not fight shy of graphs, but remember that they are labour-saving devices from which a great deal of information may be derived.



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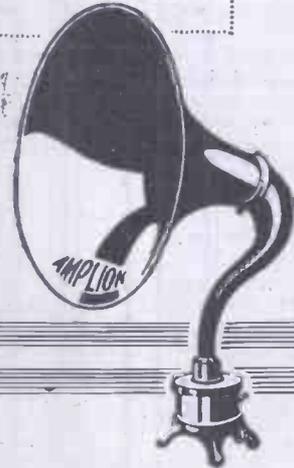
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By E. C. CRAVEN.

Those readers who remember the article "Notes on Crystal Rectification" that appeared recently in this journal, will find in this article a complete and practical conclusion to the author's theory.

THE experiment about to be described is one which can be performed qualitatively by anyone who happens to have three perikon detectors at hand, using 'phones instead of a microampere meter. Although a somewhat troublesome experiment to carry out, it throws a great deal of light on the rectifying action of a crystal, a problem which is of the greatest interest to the experimenter.

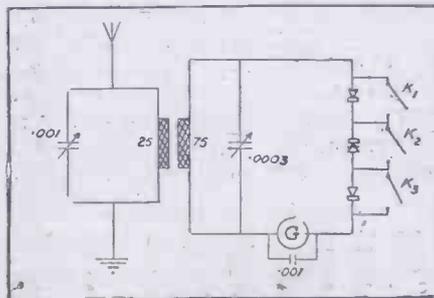
Fairly Conclusive Evidence.

Some time ago I outlined in these pages a theory that the rectified current flowing in the 'phones is a secondary thermo current produced by the heating of the crystal junction by the passage of the high-frequency alternating current across it, and suggesting that the common idea that the crystal in some way filtered out approximately one set of half waves from the H.F. current was in error.

The present experiment is also fairly conclusive evidence on this point. Suppose we put two similar rectifying couples in series opposing each other, and adjust each separately to equal effectiveness. According to the "filter" theory of rectification the first crystal will stop one half of the H.F. vibrations, and the second the other half. Hence the whole of the H.F. vibrations will be wiped out, and no current should be found in the detector circuit. On the present theory, however, the H.F. vibrations will pass unchanged in form, but decreased in amplitude in proportion to the increased resistance of the circuit.

Stable Combination Required.

This was tried out, using the circuit indicated in sketch. A galvanometer of low resistance reading to $\frac{1}{2}$ microampere and a third crystal as a detector were used, while the galvo. was shunted by a .001 mfd. condenser to give free passage to H.F. vibrations. By closing the various keys, it is possible to determine the effects of the various crystals.



As nearly as possible, the order of the experiment was as follows: The keys 2 and 3 were closed and the circuits tuned to the

2 LO transmission, and the first crystal adjusted to give maximum deflection of the galvanometer. Keys 1 and 3 were now closed and 2 opened, and the second crystal adjusted to give the same magnitude of deflection, but in the opposite direction. Key 1 was then opened, and the combined effect of the two crystals noted. It did not prove to be possible to get this accurately zero, but it was always very small. The three crystal detectors used, it should be mentioned, were perikon combinations, chosen because it was necessary to have stability for quantitative work.

Three Tests.

Keys 1 and 2 were now closed and 3 opened, and the third crystal adjusted to give as nearly as possible the same deflection as the first. All keys were now opened, and the effect of the combinations noted. The following results were obtained in two experiments, the P.D. across the crystals being calculated on the assumption that the resistance of each contact was 10,000 ohms:

EXPERIMENT 1.

Crystals.	Current Microamps.	P.D. volts.
1	21.0	.21
1, 2	1.0	.02
3	22.0	.22
1, 2, 3	7.0	.21

Calculated P.D., 1, 2, 3 = $.22 - .02 = .20$

EXPERIMENT 2.

Crystals.	Current Microamps.	P.D. volts.
1	21.5	.215
1, 2	0.5	.010
3	23.0	.230
1, 2, 3	7.0	.210

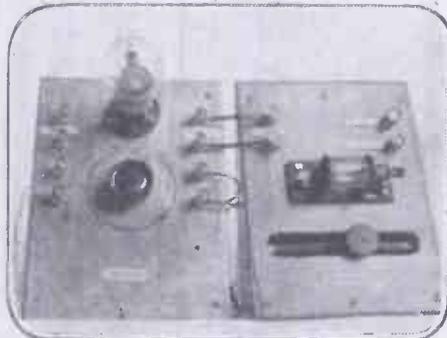
Calculated P.D., 1, 2, 3 = $.23 - .01 = .220$

The circuit was now detuned somewhat, and the measures repeated:

EXPERIMENT 3.

Crystals.	Current Microamps.	P.D. volts.
1	18.5	.185
1, 2	0.0	0
3	20.0	.20
1, 2, 3	6.0	.18

Calculated P.D., 1, 2, 3 = $.20 - 0 = .20$



A neat valve-crystal receiver mounted on wooden panels, constructed by Mr. D. Campbell, 31, McLelland Drive, Kilmarnock, Scotland.

It is clear from the above experiments that the H.F. current flows across the crystal contacts indifferently to their direction, and the resulting rectified current is, within the limits of experimental error, exactly what can be calculated by the resistance of the circuit.

These results fit in exactly with the idea that the rectified current is a secondary thermo current, but are absolutely opposed to the filter theory.

THE SERIES-PARALLEL SWITCH.

By OSWALD J. RANKIN.

Describing the many uses to which this kind of switch can be put in wireless circuits.

IT is doubtful whether any other type of switch is as simple, reliable, and as readily adaptable to so many different purposes as the ordinary "series-parallel" switch described in this article.

An ebonite knob, an ebonite disc, two strips of spring brass, six screws, a short spindle with nuts, bush, and spring washer, and eight contact studs are the only parts required to construct the simple switch to be described, which can be used by the radio enthusiast for at least ten different purposes.

Construction of the Switch.

The two switch arms are cut from ordinary spring brass sheet, each being about 3 in. long by $\frac{1}{4}$ in. wide, and the ends are bent over to right angles at the dotted lines shown at A, so that the radius from the centre to each end will be $\frac{1}{4}$ in.

The two holes in each are provided for

small screws which clamp them firmly to a $\frac{1}{8}$ in. sheet ebonite disc, B, in the manner indicated in the illustration. The other two holes in the disc are provided for the purpose of attaching same to the hub of an ordinary ebonite knob, the general arrangement of which is shown at C.

Diagram D shows how to connect up the switch so that the aerial tuning condenser may be placed either in series or in parallel with the primary tuning coil. Hence the term "series-parallel switch." When the arms are in the position shown, the condenser is in series with the coil; and when switched over to the other four studs, the condenser is then in parallel or shunt.

Diagram E shows a similar arrangement, but the coil in this instance is the secondary or closed circuit tuning

(Continued on page 500.)

THE SERIES-PARALLEL SWITCH.

(Continued from page 949.)

coil. It is an advantage to be able to series or shunt both condensers, and this is easily accomplished by employing two switches connected up as shown in the Diagrams D and E.

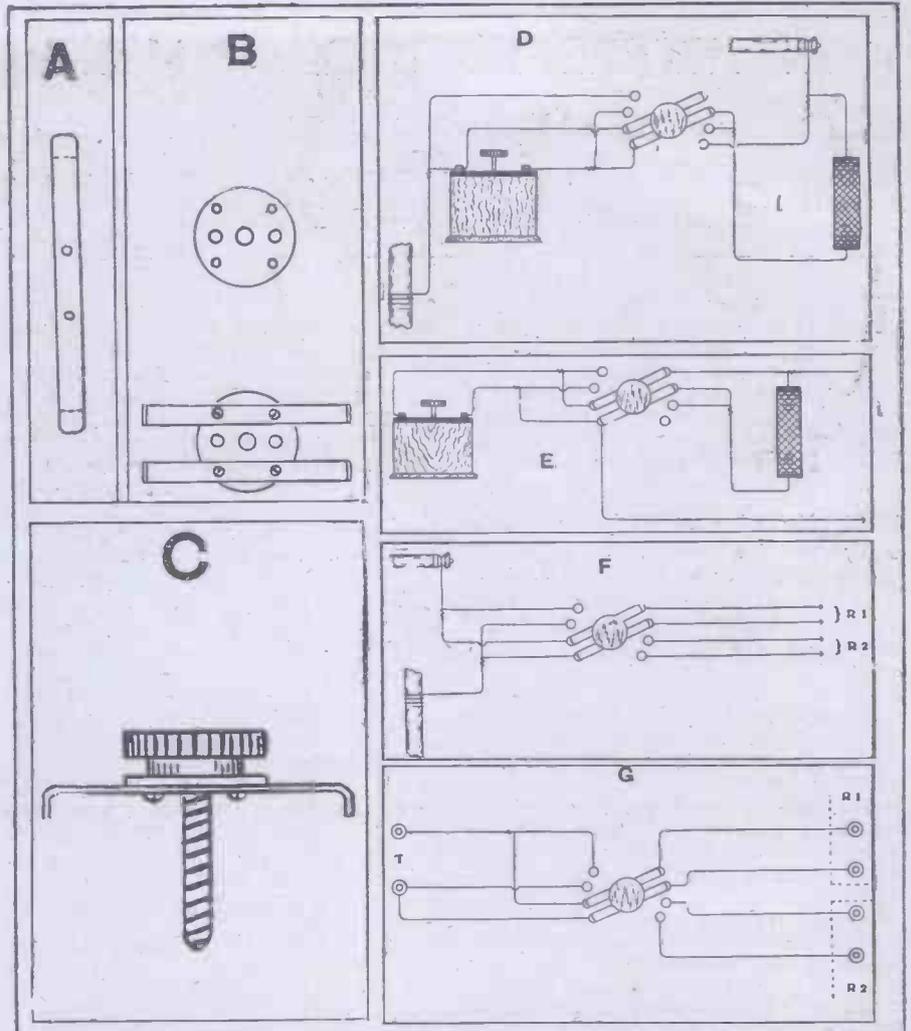
In Diagram F the switch is arranged as a convenient change-over device from one receiver to another, R1 and R2 representing the leads to the two receivers. The telephones may be switched over from one set to another by the simple arrangement shown at G, where T represents the telephones or telephone terminals, and R1 and R2 the two receivers. H gives a very effective method of changing over the connections from the telephones to the loud speaker. X represents the output or telephone terminals of the receiver, Y the leads to the telephones, and Z the leads to loud speaker.

Further Uses

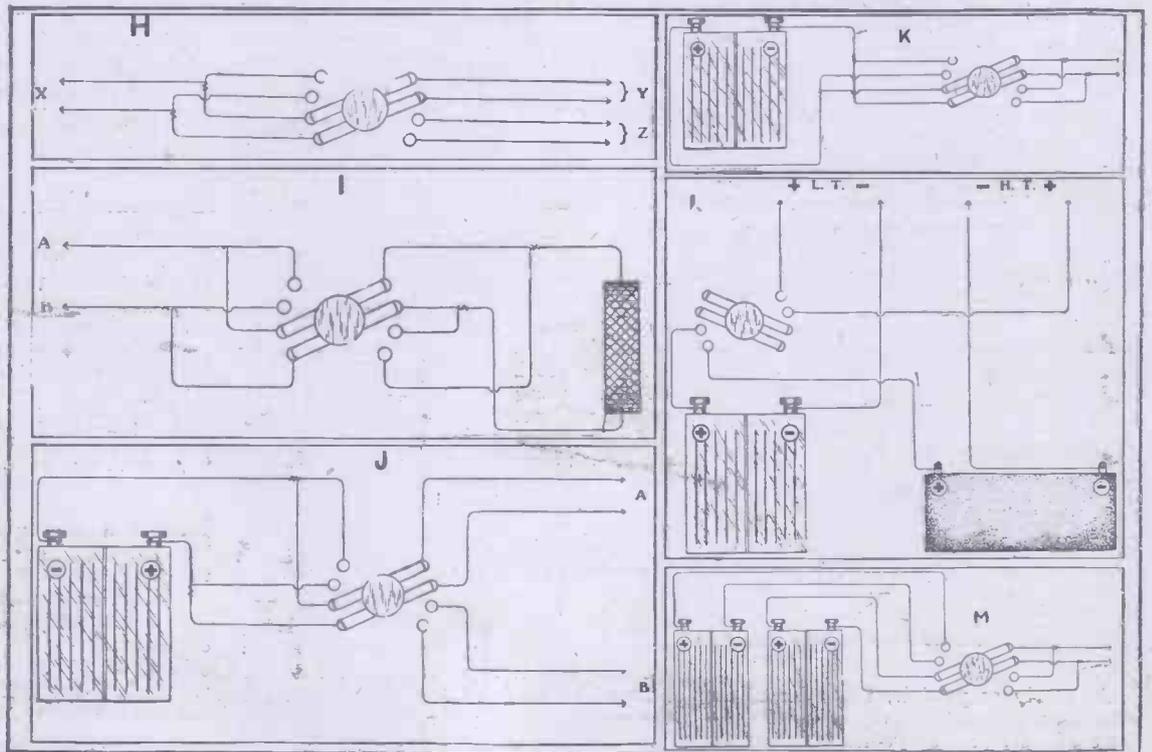
Diagram I shows how it is possible to reverse the direction of a reaction coil winding without disconnecting and rejoining wires. In this case the switch arms may also be placed in a midway position, so as to engage the two centre studs on each side, when the coil would then be short-circuited and thus cut out of circuit. This is often an advantage when rapidly searching for stations. When the arms are in the position shown the current flows in a clockwise direction, and when thrown over to the other two pairs of studs current flows in an anti-clockwise direction. A and B represent the leads to the plate and positive of the high-tension battery respectively.

Diagram J shows how a battery may be quickly changed over from the charging plant to the receiver, and vice versa. A representing the leads from the source of supply and B the leads to the receiver; while K shows how to reverse the polarity of a battery without disconnecting and rejoining wires.

In Diagram L the switch is used as a simple cut-out for simultaneous switching of the low-tension and high-tension battery current, and M shows how to connect it up in order to effect a quick change over from one battery to another, this arrangement being particularly convenient when using small capacity accumulators on a multivalve set working on a lengthy programme.



Above are shown four of the more general uses of a double pole switch, while below further useful circuits are depicted.





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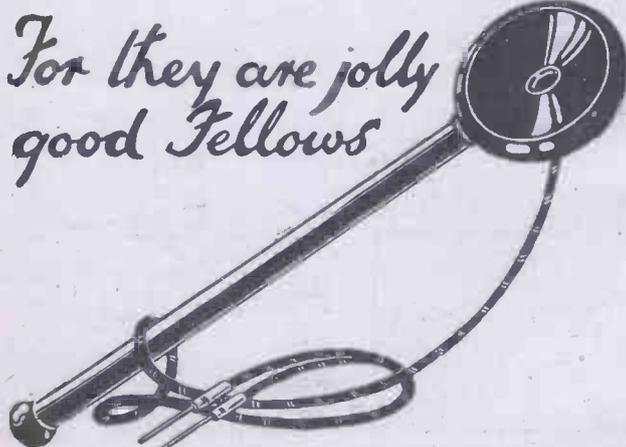
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Components. The Competition will be judged by
an independent expert approved by the Editor,
and the prizes will be awarded to those Sets which
give the best performances under actual test.
Neatness of wiring will be taken into consideration.
All Sets remain the property of the competitors,
and will be returned to them after the close of
the tests.

Note these special points.

As this competition is intended to
exercise the skill and ingenuity of wire-
less enthusiasts, the Cabinet and Panel
supplied do not follow the exact dimen-
sions given in the official description of
the Set. Competitors will be required
to place components in the positions

most suitable for wiring. Although in
the original design fixed Basket Coils
were used, it is agreed that plug-in
Honeycomb Coils would enable the Set
to be used over unlimited wave-lengths.
Coil Holders will therefore be supplied
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Complete Set of Parts include:

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Cabinet, Crystal Detector (glass covered), set of Valve Sockets,
two double-pole, double-throw Switches, one Series-Parallel
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Dials, one **Max-amp** Transformer, one Velostat, one large
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two single Coil Holders, one Telephone Plug, two Telephone
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“WIRELESS REVIEW AND SCIENCE WEEKLY”
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SOME OF 2 L O's ARTISTES.

Some intimate details concerning a few of the more popular performers that have broadcast from and via the London Broadcasting Station.

THOUGH barely six months have passed since broadcasting has been taken really seriously, the programme issued each day by the British Broadcasting Company, Ltd., has become one of the most important features of the morning paper. After a swift glance at the latest strike, or a word of exclamation at a new murder or accident, the general query is "What's on to-night?"



Mr. Sidney Russell, operatic singer.

An artiste like Miss Carmen Hill, a singer whose rich contralto voice has delighted thousands at the big classical and ballad concerts, has found a still wider audience in broadcasting. Miss Hill has sung in so many different halls, large and small, that she has acquired an almost surprising control according to the size of the building in which she is singing, and it is possibly this facility that has enabled her to throw her voice into the microphone with such excellent effect. Miss Hill has created a great name for her singing of classical music, but she is equally at home in ballad singing, and we feel sure that all the "listeners-in" who heard her sing "I'm wearin' awa', Jean," or "The Rose-Leaf Boat," would have liked her to continue for the rest of the programme. When she returns from her summer tour perhaps we shall hear her again.

A Welcome Performer.

Miss Winifred Fisher is another artiste who ranks amongst the distinguished stars of the aerial. Her perfect diction and voice production make her a finished radio artiste. It is very difficult, too, to make her talk of her art. She is one of those rarely met artistes who take their work seriously and invariably



Miss D. Lemon, operatic singer.

give the best that is in music. Miss Fisher has made a special study of folk songs, and with these alone has won the hearts of her huge audience. An ex-student of the Royal Academy of Music, she originally intended to take up dancing as a profession, but, luckily for the British public, music claimed her, and so to-day as she proceeds to the various broadcasting stations at Cardiff, Birmingham, Manchester, Newcastle, and Glasgow, she will always find enthusiastic if invisible

audiences. One of the daintiest and most perfectly rendered of her songs at a recent concert was "A Fairy went a Marketing," and equally effective her rendering of the lyrics in the Shakespeare play "A Midsummer Night's Dream," broadcast a short time ago.

A talented pianist, whose playing must have been a revelation to "listeners-in," is Mr. John Pauer. Recently he broadcast Grieg's great pianoforte concerto in A Minor, with which he had splendid support from the London Wireless Orchestra. Their joint performance constituted one of the most artistic additions to the 2 L O programme.

Two Audiences.

Mr. Pauer comes of a musical family, his father and grandfather before him being musicians. Absent during the war at Ruhleben, 1914-1918, he took an active



2 L O's popular announcer, "Uncle" Arthur Burrows.

part in the musical side of the camp, co-operating with Benjamin Dale, the composer who died subsequently, Bainton, and F. Reel, another pianist and conductor. It has taken him over two years, however, to make up for the lost time. It is to be hoped that he will play again shortly for the Broadcasting Company.

During the British National Opera season, recently concluded, the broadcasting of the opera while it was being actually performed at Covent Garden proved exceedingly successful. It is one thing for an artiste to attend at the Broadcasting Company and sing direct to the microphone, where there is every scope for getting the exact pitch and knowing exactly whether the voice is registering

properly, but when it comes to acting a difficult rôle, singing most difficult arias to two entirely different publics, one visible and applauding, the other invisible and possibly still more critical, this is the test of great singing, and it speaks volumes for the artistic capabilities of the artistes of the British National Opera Company that so many people testified by letters their enjoyment of the experiment.

It gave, too, the opportunity to many people of hearing the actual opera from which perhaps they had only heard snatches, or simplified arrangements, as well as the artistes engaged. Amongst those who figured prominently in the opera scheme must be mentioned Miss Doris Lemon. Her



Miss Carmen Hill, one of 2 L O's favourite singers.

parts demanded a wide range of tone and dramatic characterisation, and she succeeded whether as Nedda in "Cavalleria Rusticana," a perfect Hänsel in Humperdinck's fairy opera "Hänsel and Gretel," or as Musetta in "La Bohème."

Another great success was achieved by Sidney Russell, actor and singer too, and of all his parts perhaps the best was as Mime in "The Rhinegold" in the Wagnerian "Ring" Cycle.

2 L O's Popular Entertainer.

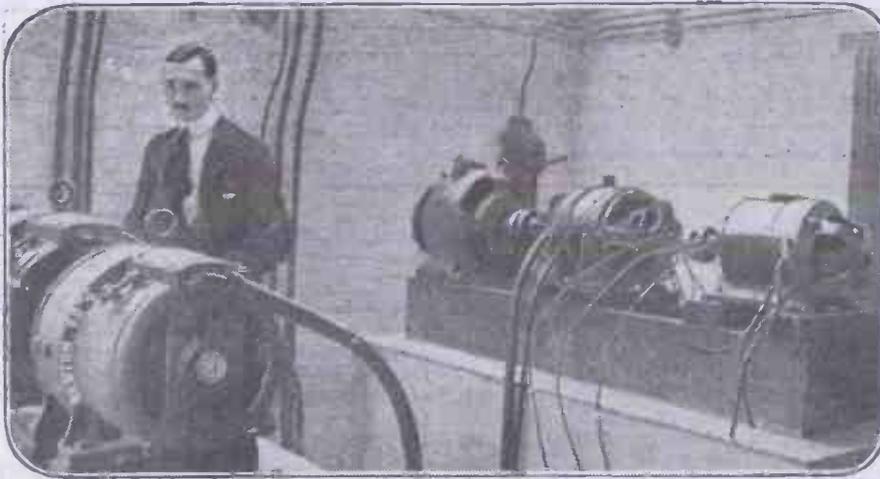
One of 2 L O's well-known entertainers, and perhaps the most popular, is Mr. Norman Long. A cheery soul this, and one whose humour is natural and not forced. In personal appearance he is as genial as his voice over the ether would lead one to believe. When he enters the broadcasting studio the whole atmosphere changes, the orchestra grins in anticipation of some of Mr. Long's sly digs, while the announcer can positively be heard to chuckle as he announces "Mr. Norman Long will now entertain you."

The motoring talks given by Capt. Richard Twelvetrees are a regular and welcome feature and it is interesting to note that under the "nom-de-plume" of "Radiograph" he is a regular contributor to POPULAR WIRELESS.

Mr. William Anderson of the British National Opera Company has sung at 2 L O several times and is, of course, one of the finest bass singers in this country. Mr. Anderson has a large contract with the B.B.C., and will probably sing from most of the provincial stations.



Miss Winifred Fisher, a popular radio artiste.



The duplicate generators of the control station.

“FORWARD 5 I T.” In these words, on the night of August 11th, Mr. Arthur Burrows, director of programmes of the B.B.C., announced to the listeners-in to 5 I T, that that well-known broadcasting station had commenced its new lease of life.

For over seven months 5 I T's home had been a temporary one, on premises at Witton, belonging to the G.E.C., a distance of some three and a half miles from the city. A prolonged search led to a home being secured for the studio over the New Street Picture House, at the very heart of things, while for the transmitting plant arrangements were successfully carried through for its housing at the Summer Lane Power Works, near the centre of the city.

The new studio is some 25 ft. square, and with the rest of 5 I T's accommodation is situated on the third floor of an imposing building in New Street, which, by the way, is the main city street, and containing one of the chief theatres, while other theatres, music-halls, and public halls are within easy reach. Adjoining the studio is the modulator room, while behind is the reception room and a band room for the storing of instruments, while also adjoining are the

offices of the station director and the assistant director and the musical director.

The floor, walls, and ceiling of the new studio have been covered with thick felt, while the arrangement of thick felt on swinging frames over the windows have permitted these to be used. Over the wall and ceiling felt there has been placed more or less artistic hangings, and the addition of chairs, settees, and other adornments gives the studio an attractive appearance.

An Interesting Feature.

THE microphone is of the stand type, and the studio also contains an Aeolian grand piano, a cabinet gramophone, tubular chimes, as well as an orchestral organ. The lighting is by means of four centre lights and four double brackets.

A particularly interesting feature of the studio is a signal panel used for communication by the engineer in charge of the transmission, to indicate whether or not the artist is in the right position for broadcasting. A red light is used to warn that the microphone circuit is switched in, and then a number of varied lights indicate the

THE NEW BIRMINGHAM

An interesting account of the opening ceremony of the new studio, the control room, and

following: All correct, come closer, move back, rearrange, wait, speak. The engineer, or rather operator, is enabled to see what is happening in the studio by means of a small window in the partition between the two rooms. The studio can be entered from the band room, the reception room, and the two offices, while it in turn gives admittance to the modulator room.

This room contains a three-stage amplifier unit, a control switch enabling the right amount of current to be passed to the transmitting panel at Summer Lane, a check being provided by a volume indicator. A loud speaker enables the operator to judge of the strength of transmission, while for listening-in purposes there is a three-valve receiving set working off a small outside aerial on the roof of the Picture House.

The aerial is a matter of 210 ft. high, and has a span of over 100 ft., and is of the T-sausage type, consisting of six wires of $\frac{7}{16}$ gauge phosphor bronze wire, secured on four hoops of duranium, while the down-lead possesses nine hoops, the whole being insulated against a voltage of 5,000.

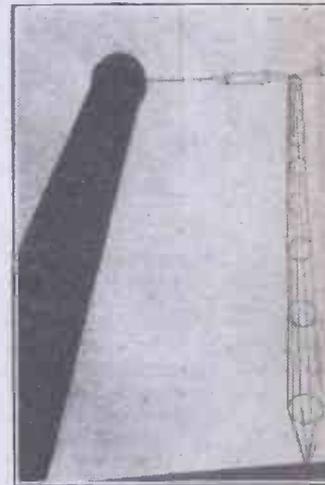
The building specially erected for the transmitting plant consists of two rooms. In the former there are two motor generator sets, one being a 5 h.p. motor, with 2 kw. high-tension generator, generating 1,600 volts, and a low-tension generator, giving 16 volts. This plant is in all respects the same as was installed at Witton, and of which a full description appeared in POPULAR WIRELESS for March 10th.

Underground Cables.

THE transmission-room contains two panels—the control panel and the radio power panel, this latter consisting of five valves—two oscillators, two modulators, and an amplifier. The earth of the station is by means of copper plates, while these are also connected to the water main in company general with all the earths at the power station.

There is, of course, an underground cable from the studio to Summer Lane; while the studio is also linked up, as before, with the Lozells Picture House, whose orchestra is regularly transmitted.

This in the main constitutes the general description of the new 5 I T studio and transmitting plant, the whole of which were successfully inaugurated by a gala performance.



A view of the



A corner of the new studio, showing the staff.

THE BIRMINGHAM STATION.

ony, and some details concerning the new and the transmitting plant.

AN R.A.F. band, which has become a particular favourite with Birmingham listeners-in, was engaged; and at 9 p.m. precisely Mr. Arthur Burrows announced Major J. C. W. Reith, general manager of the B.B.C., who, in turn, announced Sir Herbert Austin without further ado.

Some of the Visitors.

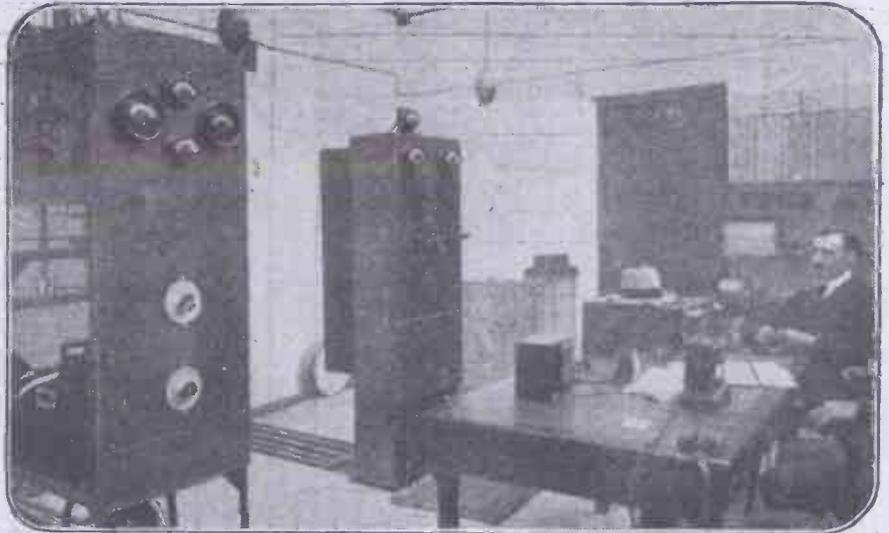
THE important nature of the event was emphasised by the gathering in the studio. Among those present

were Sir Herbert Austin, Sir William and Lady Noble, Major J. C. W. Reith, Capt. P. P. Eckersley, Messrs. J. W. Bishop (area engineer), G. Richardson (Post Office telephones), W. H. Fletcher, Dr. Ratcliffe (president of the Birmingham Experimental Wireless Society), Major Hall-Edwards, Messrs. Cooke and Whitfield, Mr. Percy Edgar (station director), Mr. Joseph Lewis (musical director), Mr. H. G. Casey (assistant station director), Mr. Appleby Matthews, Mr. A. E. Thompson (formerly engineer at the

Birmingham station), together with the Birmingham Aunties (Misses Sherwood, Usherwood, and Colbourne), and Uncle Jim (Mr. J. Socket).

Sir Herbert Austin remarked that he had run down expressly from Llandudno to carry out the opening, and as a listener-in was naturally very pleased that they had been able to get a really effective station in Birmingham. He believed that they would have every reason to be satisfied with the change, for the new position was very much more convenient and gave far better facilities. He had listened in, he added, to a good many of the Birmingham programmes; and while some of them had pleased him, others had not appeared as satisfactory. They all hoped, he continued, that the station would serve to carry through some of the great schemes the B.B.C. were putting forward.

After a short speech by Sir William Noble there came an unexpected pleasure for 5 I T's audience in a few words from that pioneer of broadcast, Captain Eckersley, who commenced "C. Q. Everybody." He reminded them that when broadcasting commenced, Birmingham was unique in its technical qualities. The microphones were superior to any other used, and it was to that that it owed its excellent transmissions. It was even superior to their old friend W-r-r-ittle.



The control room and transmitting panels.

Captain Eckersley went on to describe how the change over from Witton to the new site was accomplished. At 10.30, he said, on Thursday night, the 9th, on the sound of the word "everybody"—this being the last words of 5 I T's "Good-night, everybody"—they commenced work, and they were actually broadcasting at 6.30 the next evening, less than twenty hours later. He proceeded to thank the engineering staffs of the Post Office, the G.E.C., the Western Electric, the power station, and his own staff, specially mentioning the names of Mr. A. E. Thompson and Mr. F. H. Amis.

An Apt Conclusion.

HE concluded with a few words of warning to the howlers, and then proceeded to give his well-known performance of what howling sounds like during an operatic Italian air. Then the gala programme proceeded and 5 I T commenced on its new broadcast career, watched over by an en-

thusiastic staff, which includes on the technical side M. J. A. Cooper, B.Sc., A.M.I.R.E., senior maintenance engineer, and Messrs. S. G. Parsons and Jinman.

The following extract from Sir William Noble's address will provide an apt conclusion to this account of one of the B.C.C.'s latest developments:

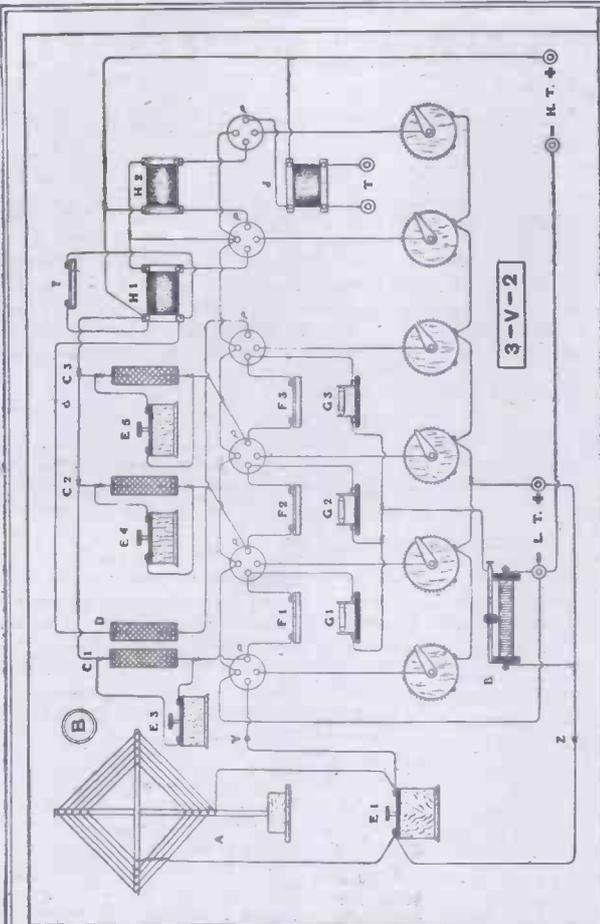
"We have our troubles, our anxieties, and our difficulties; but these are the spice of life, and we don't quail before them. You can rely on the Broadcasting Company discharging its duty to the British public. All we ask is that the Government should fulfil its part of the bargain entered into with the company through the P.M.G. He, the P.M.G., undertook in a signed agreement to give the firms who form the Broadcasting Company a measure of protection for a period of two years against foreign competition. In this new and unique industry, which gives work to many thousands of unemployed, this protection is absolutely essential."



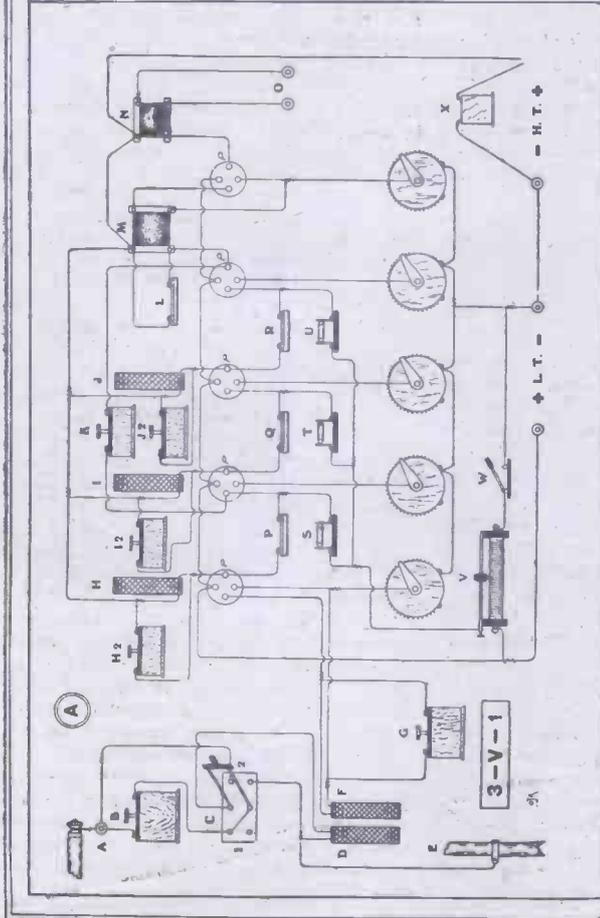
new aerial.



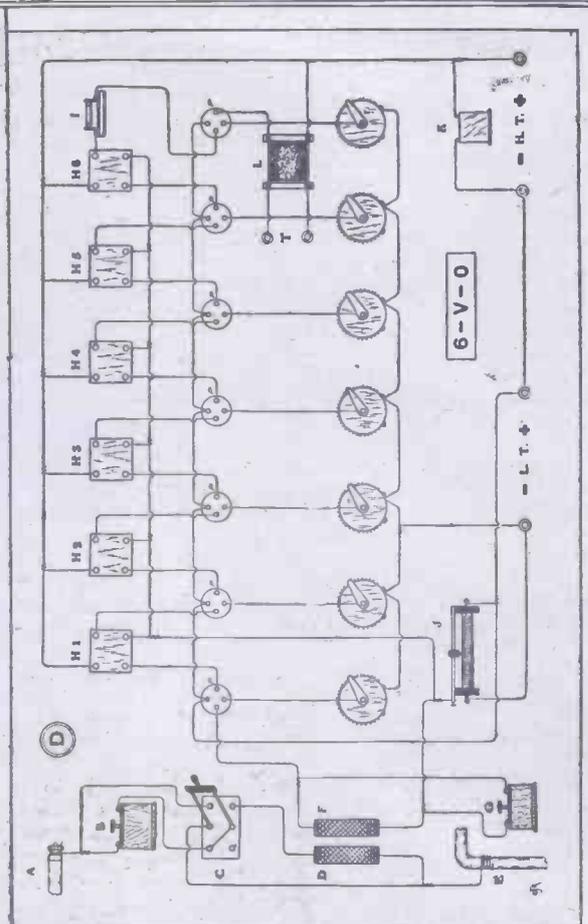
Sir Herbert Austin, M.P., broadcasting an address.



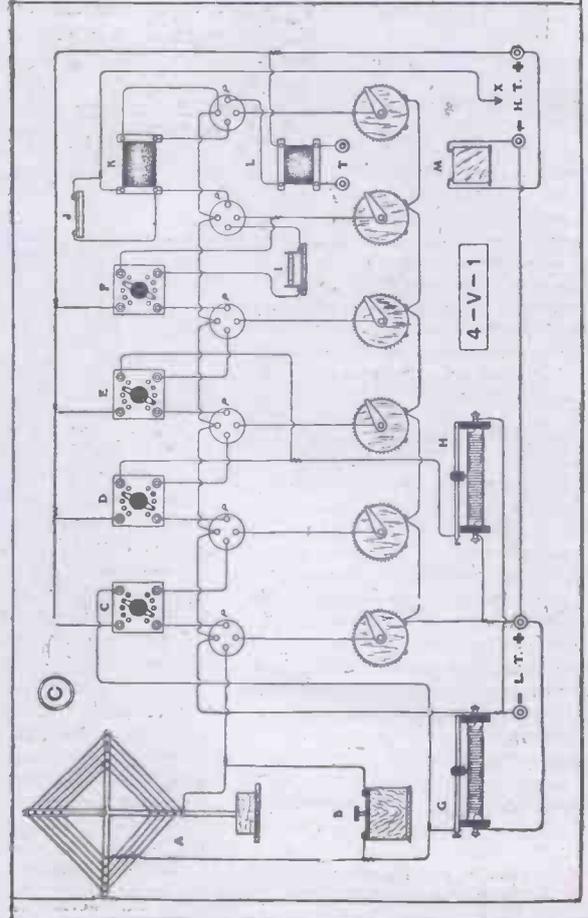
Three H.F. and two L.F. stages of amplification are involved in this six-valve receiver which makes a very suitable set for use with a frame aerial.



A five-valve receiver employing three stages of H.F. amplification and one of L.F. A useful circuit, giving long range reception and good signal strength.



A circuit suitable for long range frame aerial reception. 6 H.F. stages are employed, giving an easily controlled and highly sensitive receiver, capable of covering long ranges.



A six-valve receiver employing four stages of H.F. amplification and one L.F. Note the method of grid control employed to prevent self-oscillation of the H.F. valves.

SOME PICTORIAL MULTI-VALVE CIRCUITS.

By OSWALD J. RANKIN.

A description together with accompanying pictorial diagrams of some 5, 6, and 7 valve circuits suitable for long distance, loud speaker and frame aerial reception.

THE chief trouble with multi-valve receivers is the tendency to self-oscillation in the high-frequency circuits, and this can only be eliminated by exercising the greatest care in wiring up the apparatus, and by knowing how to handle it. Such experience comes to those who are disposed to devote a good deal of time to experiments, and it is hoped that this article will be of assistance to the reader who is interested in long-distance reception. The accompanying diagrams, being self-explanatory, need only a brief description.

Grid Control.

Diagram A shows a simple five-valve combination employing three stages of H.F., valve rectification, and one stage of L.F. (3, v., 1) with tuned anode H.F. amplifiers and capacity reaction. The value of the reaction condenser, K, which is connected between the second and fourth valves, should not be greater than .0001 mfd. The potentiometer, V, is desirable, but not absolutely essential, and if it were decided to omit this, the left-hand leads from the grid leaks, S, T, and U, should be connected to the positive L.T. line. These have values of 2 megohms.

Whenever employing a potentiometer, it is advisable to insert a simple switch, W, in series with one of the leads, in order to disconnect same from the battery when it is not in use. It should be remembered that the resistance coil is connected directly across the L.T. battery terminals, and that when the current is not flowing through the valve filaments there is a risk of short-circuiting the L.T. battery. Where an ordinary cut-out switch is fitted between the battery and the L.T. terminals on the receiver, this, of course, is not then required, providing the potentiometer is connected between those terminals.

B is the aerial tuning condenser, having a capacity of .001 mfd., connected via the series-parallel switch, C, to the primary tuning coil, D; and F is the secondary coil, which is shunted with a .0005 mfd. variable condenser, G. These, and the three anode coils, H, I, and J, are of the plug-in unit type, the latter being shunted with .0003 mfd. variable condensers, H2, I2, and J2. The fixed condenser, L, which is connected across the primary side of the L.F. intervalve transformer, M, has a capacity of .001 mfd. N is the telephone transformer, O the output terminals to telephones or loud speaker, and X the 2 mfd. fixed condenser connected across the H.T. battery terminals. The grid condensers, P, Q, and R, have the usual values of .0003 mfd.

Diagram B shows an excellent frame aerial circuit, employing three stages of H.F., valve rectification and two stages

of L.F. (3, v., 2) with tuned anode high-frequency couplings, and reaction, which, being arranged in the anode circuit, is permissible on the broadcasting wave-lengths. With such a highly sensitive circuit it is only natural to expect a little trouble through self-oscillation; but, as pointed out above, it is possible to reduce this to a minimum by the application of a little patience.

A suitable frame aerial would be constructed on the lines indicated in the diagram, the vertical support being 5 ft. 6 in. long and the horizontal cross-piece 4 ft. long. Seven complete turns of wire, each spaced about $\frac{3}{8}$ in. apart, will be sufficient to cover the broadcasting wave-lengths when the .001 mfd. variable condenser, E1, is connected as shown in shunt with



Mr. L. A. Collins of 111, Lower Addiscombe Rd., Croydon, listening-in on the Shirley Hills.

the winding. A five-plate vernier condenser, connected across the terminals of E1, will sometimes facilitate sharper tuning.

Different Plate Voltage.

The three anode coils, C1, C2, and C3, are shunted with .0003 mfd. variable condensers, E3, E4, and E5, and reaction is arranged by connecting another coil, D, in the plate circuit of the rectifying valve, and coupling this to the first anode coil, C1.

The grid-condensers, F1, F2, and F3, each have a capacity of .0003 mfd., and the grid leaks, G1, G2, and G3, have values of 2 megohms. These are connected to a common lead, which is taken to the slider of the 400-ohm potentiometer, B. H1 and H2 are the L.F. inter-valve transformers, the .001 mfd. fixed condenser, I, being shunted across the primary winding of H1.

J is the telephone transformer, and T represents the output terminals to telephones or loud speaker. For the broadcasting wave-lengths the three anode coils may each comprise a No. 50 Igranite coil, the reaction coil, D, being slightly smaller. For higher wave-lengths it is, of course, necessary to increase the values of the coils and frame aerial winding. If desired, the ordinary aerial and earth system may be

used with this circuit by simply connecting the secondary tuning coil to the points marked Y and Z. This circuit, as would be expected, is highly selective over a very great range, but the manipulation of same is a somewhat complex undertaking, the problem of self-oscillation presenting many difficulties.

Diagram C shows another six-valve receiving circuit having four stages of H.F. valve rectification and one stage of L.F. (4, v., 1). When employing more than three stages of high-frequency amplification, the control of the oscillating point is usually a very difficult matter, often bordering on the impossible. In this circuit an effort has been made to surmount this difficulty by employing two potentiometers, G and H, to control the grid potentials of the H.F. valves, and by providing a simple means of feeding the plate of the rectifying valve with a lower voltage than that applied to the amplifying valves.

A Seven-Valve Set.

This is accomplished by connecting the out primary lead of the L.F. transformer, K, to a third wander plug, X, so that the voltage of the rectifying plate circuit may be separately adjusted. B is a variable condenser of .001 mfd. capacity, and C, D, E, and F are variable H.F. transformers which, if not properly designed, will require .0002 mfd. variable condensers connected across their primary windings. I is the usual grid leak and condenser, and J is a .001 mfd. fixed condenser connected in shunt with the primary side of the L.F. transformer, K. L is the telephone transformer, and M the 2 mfd. fixed condenser which shunts the high-tension battery.

Diagram D shows a very simple seven-valve combination employing six stages of H.F. and valve rectification (6, v., 0). By employing aperiodic transformers, and efficient potentiometer control to the H.F. grids, it is possible to arrange up to six stages of H.F. without experiencing an unusual amount of trouble with self-oscillation, as would be the case if tuned anodes or ordinary transformers were used.

The out secondary leads from the aperiodic transformers, H1, H2, H3, H4, H5, and H6, are joined to a common lead connected to the slider of the 400-ohm potentiometer, J, and the out primary leads are all taken to the H.T. positive line. B is the usual .001 mfd. variable condenser, which may be placed either in shunt or series with the primary tuning coil, D, by means of the series parallel switch, C; and G is a .0005 mfd. variable condenser connected in shunt with the secondary coil, F. I is the grid leak and condenser, K is a 2 mfd. fixed condenser which shunts the H.T. battery, and L is the usual telephone transformer.



Down Among the Dead Men—A Broadcast Howler—A Promising Two-Year-Old—Something Wet in the Aerial Line—Wireless on the Farm—A Boring Joke—Spheres that Impinge.

Down Among the Dead Men.

IT strikes one as a very curious thing that wireless experiments carried out in coal mines show that, after about two or three hundred feet, reception gradually improves as you go deeper and deeper. Some wireless amateurs are deriving consolation from the possible chance of getting a really good reception when the time comes for them to go below.

A Broadcast Howler.

That energetic station 2ZY has been amusing itself and its listeners in by a competition in which the competitors had to give the funniest thing they had heard from the station.

I had made a mental note of the following slip from 2LO in case the London station ran a similar competition. In giving the cricket scores from 2LO, one of the uncles not long ago announced: "Zunmerzet, a hundred and ten for two minutes, please."

A Promising Two-Year-Old.

During one of those recent warm evenings I had a valve set working in my garden. A near neighbour, passing by with his little son, saw me at work and came in the garden to compare notes. After a little talk, I suggested letting the little fellow listen-in. Thinking he had better have too much rather than too little noise, I added my two-note magnifier to the detector valve. The orchestral music from 2LO was pretty strong, and I thought it would just about suit the little fellow. On holding the 'phones to his ears, however, he quickly objected, saying: "Too much noise; take it away."

Something Wet in the Aerial Line.

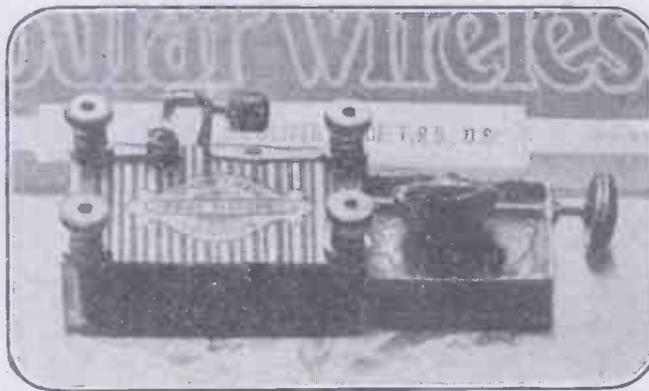
When the "Sea Gull," a boat belonging to the United States Navy, recently went to the Hawaii Islands for the purpose of carrying out tests in wireless reception, the aerial erected on the Island of Oahu was of the Beverage type.

I have not yet obtained full particulars of this type of aerial, but it is pretty certain that two stout poles are required, and that the aerial wire must be tight. Moreover, it is doubtful, judging from the dilute accounts to hand, whether the Beverage aerial can bear porter-ble one. However, I am gratified to note that the Beverage aerial, with its long down-lead, proved most efficient in damp reception.

Wireless on the Farm.

In some rural and remote districts the farmer is beginning to take a lively interest in wireless. On a certain farm twenty miles or so from 2LO a wireless receiving set has provided amusement for the evenings, and has also proved of use in giving the farmer the latest weather reports and forecasts.

The wireless fever has caught on very badly with some of the labourers on this particular farm. One worthy son of the soil, usually addressed as John Tom, has assimilated a number of scientific terms connected with wireless. John Tom looks



A match-box receiver constructed by Mr. J. Kelly of 4, Hurdis Bldgs., Christchurch Street, Frome, Somerset, on which Cardiff comes-in well over a distance of 48 miles.

after the poultry, and he is above all things a practical man, and one who practises what he preaches. With a fine appreciation of the elegant expressions to be found in wireless literature, he has just christened the egg-laying champion White Leghorn the "Heavside Layer."

A Boring Joke.

At the club Brigadier-General Wellington Pepper, D.S.O., is known to be one of the high-frequency spitfire variety. The general has no love for wireless. He is very emphatic that there never was such rotten shooting in the war until our gunners got messed up with aeroplanes and wireless for range-finding. General Pepper believes in seeing the thing he is going to hit. He has no use for wireless, since you cannot see even a bit of field telephone wire connecting the communicating stations.

During the war the general happened on a wireless school, and went round the buildings on a tour of inspection. Seeing an N.C.O. at work on an operation familiar to all wireless amateurs, the general asked:

"What are you doing, corporal?"

"Drilling ebonite, sir," was the reply.

"Umph!" said the general. "You would find drilling a platoon a little less boring, I think, corporal."

Spheres that Impinge.

"Everyone admits that the dog's world must be very different from ours," says Professor J. Arthur Thomson in the "Wireless Review." I am inclined to agree with the learned professor, and to admit, as everyone else seems to do, that the dog has a world very different from that of man. Man has his sphere, the dog has his sphere. Nobody would have the slightest objection to this right and proper arrangement, were it not for the fact that these spheres show a decided tendency to impinge, as the mathematical high-brows put it.

In this little suburban retreat there is a golf club; there is also a dog club apparently. The former club rents and uses a large part of a public common. The latter club uses, but does not rent, a small portion of that same common.

Possibly the dog club merely insists on its common rights, but it is unfortunate that the piece of land selected by the dog club for the frolics of its members happens to coincide with the fairway immediately in front of the bunkers-guarding the last green. No matter what hour of the day you play your round of golf, you are bound to finish up by having to shoo two or more members of the dog club from off the fairway.

I am inclined to the point of view that the dog club has perfected a system of reliefs so that their impinging programme covers the hours of golf very nicely. Nick the mongrel, and Ginger, the Irish terrier, take their turn, turn and turn about, in the early morning.

They are relieved before lunch by Rough, a big Airedale, and Clummy, a black and white nondescript. In the afternoon you find Bonzo, an imitation fox-terrier, having a round or two with Peter, the nasty-tempered fellow who has twice bitten the butcher's boy for being late with the meat. And so it goes on throughout the hours of golf. There are always at least two members of the dog club on the golf course, and sometimes it is possible to see as many as six.

The only sensible suggestion as to how an end could be made of this impingement business has been put forward by Gellerton, who proposes to import into the district one Dempsey, a devastating and devouring bull-dog, a hater of all other dogs. Gellerton is of the opinion that it would take Dempsey a matter of a couple of days or so to wipe up all the members of our local dog club. I am not so sure of it, for I think that our dog club would undoubtedly elect Dempsey president, and then things would be decidedly worse.

Neat panel labels can be made in the following manner. On a clean piece of white paper or thin cardboard make out the required words and mount on the panel with a thin piece of clear mica stuck over them. These labels, while cheap to make, always give a neat finish to any panel if carefully made.

A NOVEL NOTE MAGNIFIER.

This circuit, it is claimed, will give considerable magnification of already loud signals without distortion, a considerable asset in loud-speaker work.

A DESCRIPTION of a new type of note magnifier or low-frequency amplifier which should prove of interest to experimenters is given below. The circuits detailed have been employed commercially, and, although specially constructed inter-valve transformers were used, this fact need not deter any reader who wishes to test out the circuit, as standard transformers can be adapted to suit the purpose.

The advantage claimed for this type of amplifier is that, if it be included in a circuit which already possesses one or more stages of amplification, it is capable of dealing with, and further amplifying, already strong signals without introducing any unpleasant distortion—a great advantage when one reflects on the difficulties usually met with when endeavouring to combine clarity with loud signal strength.

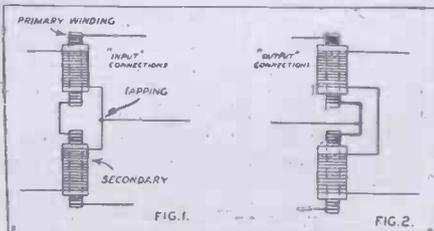
New Type of Transformer.

The most important point in constructing this magnifier is, of course, the method of coupling amplifying valves so arranged to the ordinary type of circuit, and the procedure in this respect is therefore given in detail.

In order to make up the complete instrument as shown diagrammatically in Fig. 3, it will be necessary to employ four—or, if a prior stage of note magnification is used, five—amplifying transformers, assuming that these components are of the standard type, and not specially manufactured to meet the needs of the distinctive circuit under consideration.

In placing the amplifier in circuit, the first coupling to be considered is obviously that which will connect the instrument either to a previous stage of magnification or direct to the detector circuit.

It is therefore apparent that a transformer is required possessing one primary winding and two secondary windings, and standard transformers to meet this need are adapted as follows, the operation being carried out as shown diagrammatically in Fig. 1.

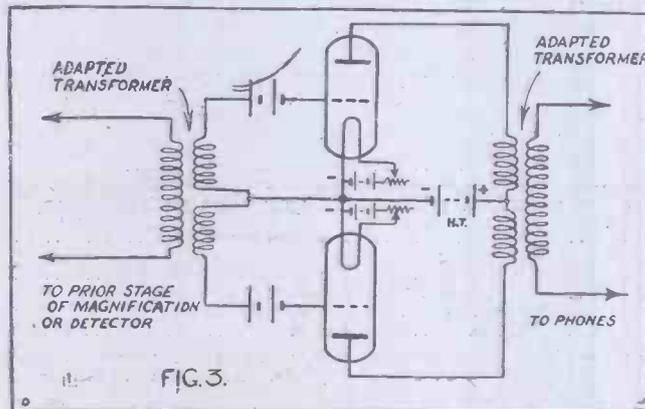


Two standard transformers are taken, and the primary windings are connected in series, thus forming, to all intents and purposes, one winding, which is connected in the input circuit from the detector in the usual manner—that is, the lead from one end of the winding going to the plate

circuit of the valve, and the other being taken to the positive side of the H.T. battery.

The secondary windings of the two transformers which form part of the circuit of the amplifier being considered are then also connected in series, a tapping being taken from the connecting wire as shown in Fig. 1 to the negative terminal of the filament batteries employed to light the two valves.

The output transformer is constructed in a similar manner, except that in this case the tapping is taken from the lead which joins the two primary windings together, and it is the two secondary windings, joined in series, which constitute



the output coupling. These connections are given in Fig. 2.

To obtain the best advantages from an amplifier of this description, it is undoubtedly better to employ other stages of magnification between the instrument and the detector circuits in order that the utmost advantages may be derived from the instrument.

It is not advisable to utilise a common high-tension battery for the amplifier and any other valves employed, but to keep the plate battery supplying the two amplifier valves distinct from other high-tension circuits. The value of this battery might, under certain circumstances, be as high as 120 volts, but the actual voltage employed will be best found by experiment.

The foregoing remarks do not apply to the filament battery, which can be made to light both valves

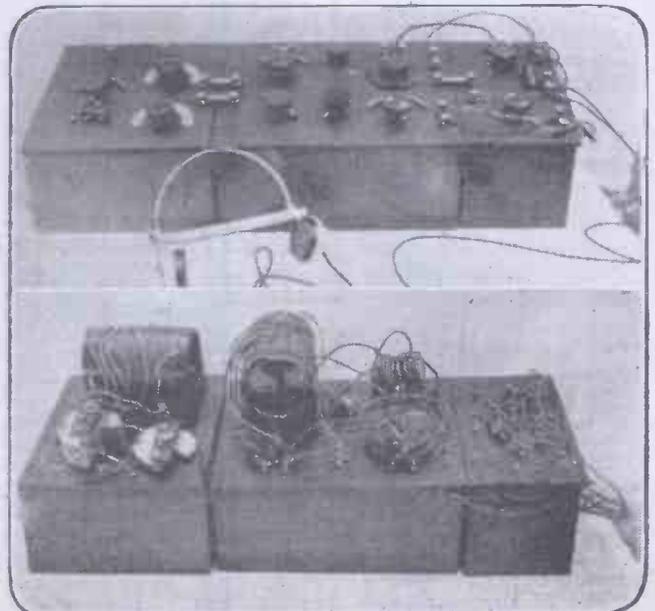
if required. It is essential that the valves used should be of the same make, in order that a correct balance of the circuit may be assured, and the utmost care should be given, when wiring up the circuit, to the polarity of the high-tension battery and the filament accumulator connections.

Grid Bias.

It will be observed that in Fig. 3, where the wiring is indicated and the valves are shown, each with a separate filament battery, the three negative terminals of the battery are connected to a common joint, the fourth lead being that previously described as connected to a point midway between the two secondary coils of the in-put transformer.

It will be seen that, by connecting up the set as described, the amplifier is so arranged that the input strength or voltage is equally divided between the two secondary windings, while the output of the two valves to the telephones or loud speaker is combined by means of the transformer coupling at that end of the circuit.

Grid bearing batteries are provided so that each grid has a negative bias. This results in greater amplification unless too great a bias is employed. These batteries should have tapings so that voltages of from 0 to 9 volts can be employed. It will be found that as the grid bias is increased the H.T. voltage will also need increasing.



The unit valve receiver described by Mr. Hersey in "P.W." as constructed by Mr. R. M. Browne, Lisle Court, Bellevue Road, Cowes, I. of W.

THE CONTINENTAL BROADCASTING STATIONS.

Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
BELGIUM.					
Brussels (1)	Brussels	12 noon.	Weather report	1100	Working days.
		4.50 p.m.	" "	1100	When necessary.
		6 p.m.	Concert	1100	Sunday, Tuesday, Thursday.
HOLLAND.					
The Hague	P C G G	3-5 p.m.	Concert	1050	Sunday.
		8.40-9.40 p.m.	Concert	1050	Monday & Thursday
The Hague (Laboratorium Heussen)	P C U U	7.45-10 p.m.	Concert	1050	Tuesday.
		9.40-10.40 a.m.		1050	Sunday.
The Hague (Velthuyzen)	P C K K	8.40-11.40 p.m.	Various	1050	Friday.
Ymuiden (Middelraad)	P C M M	8.40-11.40 p.m.	Concert	1050	Saturday.
Amsterdam	P A 5	8.10-11.10 p.m.	Concert and News	1050	Wednesday.
FRANCE.					
Lavallois-Perret (Radiola)	S F R	12.30	News, Liverpool Cotton Prices	1780	Every day.
		12.45	Concert (Tzigane Orchestra)	1780	Every day.
		2-3 p.m.	Music	1780	Sunday.
		4.45 p.m.	Stock Exchange News	1780	Every day
		5-6.15 p.m.	Instrumental music	1780	"
		8.30 p.m.	General News	1780	"
Paris (2) (Eiffel Tower)	F L	9-10.30 p.m.	Vocal and instrumental concert	1780	"
		6.20 a.m.	Weather Forecast	2600	"
		11.15 a.m.	Weather Forecast	2600	"
		3.15 p.m.	Stock Exchange News	2600	"
		6.20 p.m.	Weather Forecast, Concert	2600	"
		10.10 p.m.	Weather Forecast	2600	"
Ecole Supérieure des P.T.T. Radio-Riviera (Nice)		7.45-10 p.m.	Radio Concerts	450	Tuesday, Thursday
		2.30-7.30 p.m.	Radio Conferences	450	Saturday.
		11 a.m.	News, Concert, Tzigane	460	Every day.
		5-6 p.m.	News, instrumental Concert	460	"
		9-10 p.m.	Latest News, Concert	460	"
GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND.					
Berlin (Königswusterhausen)	L P	6-7	Financial News, etc.	2800	Every day.
		11-12.30 a.m.			
Prague	P R G	4-5.30 p.m.	Financial News, etc.	2800	"
		7-11 a.m. and 3 p.m.	Weather News, General News	1800	"
Geneva	H B	9 a.m. 2 p.m. & 9 p.m.	Concert	4500	
		5-6 p.m.	Concert	1210	"

(1) If, at the indicated times, a station has to receive or transmit service communications, the weather transmission will take place after these communications. Tuesday: Operatic selection on the gramophone. Thursday: Various on gramophone. Sundays: Various by artistes.

(2) Special concerts given during the evening are announced in the course of the preceding transmissions.

NOTE.—All times are G.M.T., not B.S.T.

PARAFFIN WAX AND SHELLAC VARNISH FOR INSULATING.

PARAFFIN wax and shellac varnish are two extensively used insulators, but in order to obtain the best results care must be taken in the methods used when applying them.

This substance is used largely in the manufacture of condensers. Sheets of paper are impregnated with wax and placed between sheets of tin, or lead, foil. It is in impregnating the paper that care must be exercised. The wax should not be heated above the boiling point of water (100° C. or 212° F.).

For this purpose a double saucepan is excellent as water can be boiled in the outer vessel and the wax melted in the inner one. The paper to be impregnated should be put in after the wax has reached its final temperature and kept completely covered until all bubbles have ceased to rise. The bubbles consist of air and water, both of which it is

desirable to drive out. If the wax is not hot enough these tend to be trapped in. This also happens if a portion of the paper rises above the surface of the wax. On the other hand, if the wax is too hot its insulating property is impaired and the paper becomes brittle. There is a wide range of safety, however, but heating in water ensures that the temperature is within the range.

When properly impregnated the paper should be allowed to drain so as to remove the superfluous wax. Keeping the wax hot while the paper is immersed ensures clear draining and a uniform surface to the paper.

When the wax becomes discoloured with impurities it should not be used for condenser work. It is still good enough for cardboard and wooden bobbins on which coils are to be wound, as these are also improved by impregnation. The whole coil can also be impregnated afterwards.

Making the Varnish.

If a sliding contact is to be made on the winding of the coil it is better to use shellac varnish. This is another very good insulator for amateur use. It can be obtained ready mixed or can be prepared by dissolving shellac in methylated spirit. A wide-mouthed jar with a cork stopper is best. It

should be mixed to the consistence of thin mustard and diluted to suit the work. It can then be painted on the completed coil. A coil so treated must be dried in an oven, the temperature of which must not rise above about 168° F.

Shellac Linen and Silk.

These are two very useful and easily prepared insulators. Linen, or silk, is well soaked with dilute shellac varnish and then hung up to dry. The linen is excellent for lining a metal bobbin or covering the iron cores of transformers before winding. If smoothed with a warm brass "iron" it will adhere to the metal. The "iron" can be made of a piece of 1/8 in. sheet brass, 1 in. wide and 6 in. long, held in a wooden file handle.

The silk is used for insertion between the layers and sections of induction coils. Also for re-insulating a joint in a winding. To do this a small strip of shellac silk is cut sufficient to overlap on to the insulation of the wires jointed. This is folded in halves with the joint inside and pressed with the heating iron. A coil that has shellac silk between the layers need not be painted with varnish as well unless each layer is allowed to dry off before covering with silk. This will make coil winding very tedious.

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24/-
per pair.**

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**NEW
EDISWAN
Headphones.**

SPECIALLY designed to embody both high efficiency and the maximum of comfort in use. The cases are of Polished Pressed Aluminium and are fitted with Moulded Ear-Pieces. Double Adjustable Headbands are fitted and Six Feet of Flexible Cord is provided. The total resistance is 4,000 ohms.

Also Manufacturers of Complete Receiving Sets, Accessories, H.T. and L.T. Batteries. Ask for Descriptive Leaflets, post free. Should your Dealer not be able to supply, send us a post card with his name and address, please.

Free:—Illustrated Booklet entitled "The Thermionic Valve." Write for yours.

EDISON SWAN ELECTRIC CO., LTD.,

Contractors to H.M. Admiralty, War Office, Royal Air Force.

123/125, Queen Victoria Street, E.C.4,
and 71, Victoria Street, S.W.1.

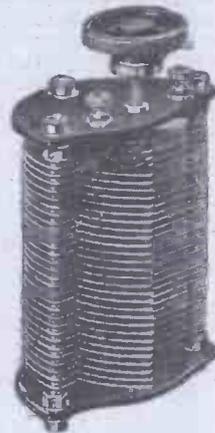
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VARIABLE CONDENSERS



COMPLETELY ASSEMBLED WITH EBONITE ENDS AS SHOWN IN SKETCH.

ASSEMBLED BUT WITH- OUT EBONITE ENDS.	
*001 - 8/-	*001 - 6/6
*00075 - 6/9	*00075 - 5/6
*0005 - 5/11	*0005 - 4/6
*0003 - 4/11	*0003 - 3/6
*0002 - 3/11	*0002 - 2/6
*0001 - 3/8	*0001 - 2/3
Vernier - 3/3	Vernier - 1/9

Pair of ebonite drilled ends to fit yourself on above 1/- extra:

NOT A BAG OF PARTS.

NOTE.—Postal Charges 9d. per set, otherwise not executed. To callers 1d. in the 1/- discount off condensers.

Variometer on ebonite, W. 250 750 metres, internally wound. Very fine. Sell at sight, 15/.

Fixed Condensers (iron 0002 to 0003), 9d., 10d., 1/- 1/6 & 2/-.

Ebonite Dials (with knob 0-180), 1/4, 1/6 & 2/-.

Turned Ebonite Valve Holders, 8 nuts, 1/- & 1/3.

Fil. Resistance, 1/8, 1/10, 2/3.

Fil. Resistance, 7 ohms, 3/6.

French "R" Valves, 10/6.

Moulded Valve Holders, with nuts, 9d.

Perikon Crystal Detectors, glass, 2 crystals, 1/6, 2/8 & 3/-.

Glass Dustproof high-class Detector (whisker), 3/-.

Contact Studs and Nuts, doz. 4jd.

Valve Pins, doz. 7d.

2 B.A. Nuts, 3 doz. 7d., 1/30 gross.

4, 5, 6 B.A. Nuts, 3 doz. 6d., 1/6 gross.

Terminals, special offer with nut, 4 for 3jd.

Valve Legs and Nuts, 1d. each, 9d. doz.

Valve Legs with shoulder, 2 for 2jd., 1/- doz.

Switch Arms, very good, 6d., 10d., 1/3.

Twin Flex, 4 yds. 7d., 12 yds. 1/7d.

Genuine (Shaw's) Mertzite, 9d., 1/- 1/3, 1/6, according to size.

100,000 ohm Resistance, 2/3 & 2/6.

Grid Leak & Condenser, 2000, 2/-.

Coil Holders, 3-way, on ebonite, 6/- and 6/6.

2-way Coil Holders, good value, 5/-, 5/6.

15 v. H.T. Batteries, 2 plugs, 2/6.

30 v. H.T. Batteries, 2 plugs, 4/9.

H.T. Batteries, 2 Wander plugs, 60 volt, 8/-.

Real Ebonite Knobs, 2 B.A. Bush, 3d.

Marconi R Valves, latest type, 45-60 v., 14/11.

Brunet 4,000 ohm genuine 1st quality Headphones, 17/11.

N. & K. 6,000 ohm Headphones, extra loud, 15/11.

H.T. Batteries, 2 Wander plugs, 66 volt, 8/6.

Aerial Wire, 7/22 per 100 feet, 2/3d and 2/1d. No post orders.

Rotax Accumulators, 4 v. 40 amp., 17/6.

'Phone Cords, double, extra long, 10d.

5-1 Intervalve L.F. Transformers, 11/6, 13/- & 15/11.

Variometers, very good value, 250 750, 3/5.

Crystal Detectors (whisker), extra value, 1/3 & 1/6.

Large Telephone Terminals, 2 B.A., with nut and washer, 2 for 3jd.

Terminals, all kinds, with nuts and washers, 4 for 6d.

Basket Coils (6 in set), up to 3,000 metres, well made and efficient, 2/6.

1 Switch Arm, 12 Contact studs and nuts, the lot 1/-.

Sleeving, takes 18-gauge wire, 3 yards for 1/-.

Insulating Hooks, 3 for 3jd., 1/- doz.

D.P.D.T. Switch, compact, high-class article, 2/3d & 2/6.

4 yards Copper 18-gauge connecting wire, 2d.

6 yards Bell Wire, 2jd.

6 yards Bell Wire, D.C.C., I.R., 3jd.

Radio Instruments, Ltd., L.F. Intervalve, 25/-.

6 v. 50 a. Accumulators, extra bargain, 30/-.

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The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the report if necessary. Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An asterisk denotes affiliation with the Radio Society of Great Britain.

The Yiewsley and West Drayton Radio Society.
The weekly meeting was held on Wednesday, July 26th, at the headquarters, W. D. Smith, Esq., in the chair.

The insulating values of bakelite and ebonite were discussed, also their comparative strength and working properties.

Liverpool Wireless Society.*

The second meeting, in July, of the above society, was held on the 26th of that month at the society's headquarters, Royal Institution, Colquitt Street.

The society was honoured by a visit from Messrs. S. G. Brown, Ltd., whose representative, Mr. Lucy, entertained and instructed the members present with a historical survey of wireless receivers and relays, and gave a demonstration of their latest device in loud speakers.

Hon. sec., G. H. Miller, 138, Belmont Road, Liverpool.

The Kensington Radio Society.*

At the July meeting of the above society, Mr. F. H. Haynes delivered a lecture on Low Power C.W. Transmission and Telephony.

He dealt with many points of special interest to amateurs, and the lecture was well illustrated with lantern slides.

The next meeting of the society will be held in September, due notice of which will be sent to members.

The hon. sec., Mr. J. Murchie, 33, Elm Bank Gardens, Barnés, will be pleased to hear from anyone desirous of joining the society.

Radio Association, Brookley and District Branch.

On Friday, July 27th, a meeting of the above branch took place at the headquarters, Gladstone Hall, New Cross Road, when a most interesting lecture was delivered by Mr. G. A. Saunders, entitled: "A few considerations of Ethor, Electrics, and Material Phenomena." The lecture was highly instructive, and greatly appreciated by all present. It was announced during the evening that Mr. Morgan, well known to members of the branch, would officiate at an outdoor meeting to be held on Friday, August 10th. The meeting place is at Crofton Park Station (S.E. & C.Ry.), and the time 8 p.m. sharp.

Hon. sec. R. O. Watters, Grove House, Brockley Grove, S.E.4. (Letters only.)

Tottenham Wireless Society.

On Wednesday, July 25th, the meeting of the society was of an informal nature.

The chairman read a paper of the Radio Society of Great Britain on High Frequency Amplification.

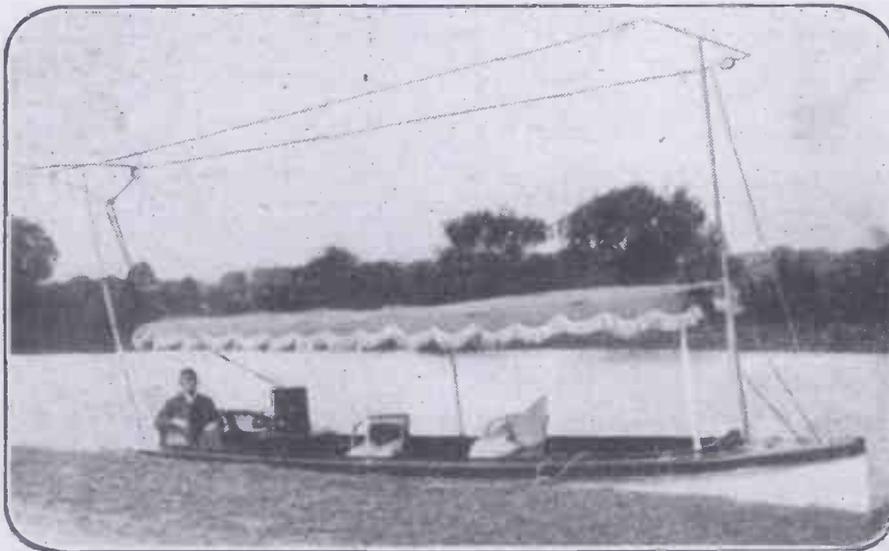
Many difficult points were cleared up, but others have been noted by members as the

basis for further experiments. Following this several dual amplification circuits were set up with varying success.

Hon. sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

North Middlesex Wireless Club.

At a well-attended meeting of the above club held at their headquarters, Shaftesbury Hall, Bowes Park, N; on July 25th, Mr. L. C. Holton, late wireless officer in H.M. Army, gave a very interesting lecture on "Earth Current Telegraphy." The use of a power buzzer for communication over a few miles was described and illustrated by experiments. In this form of wireless no aerial is necessary, the earth itself



Mr. H. M. Myer, of Sleepy Hollow, Chislehurst, Kent, has fitted his launch with receiving apparatus, and spends enjoyable hours listening-in on the Thames.

being utilised to convey the electric current from transmitter to receiver.

Hon. sec., H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

Catalogues Book Reviews Etc.



Some very neat sets have been placed on the market by the Eagle Engineering Company. These sets, which bear the well-known trade-mark "Chakophone," are extremely efficient and of good workmanship. It should be stated that the two-valve instrument which embodies variable re-

action was passed by the P.M.G. as far back as November of last year. This catalogue also contains a full list of all components and accessories, all, of course, well made and thoroughly efficient.

One of the greatest difficulties encountered by amateurs in marking out their panels is getting the holes for the valve legs in the exact position. To obviate any trouble in this respect, the Bay-Brooke Co., Ltd., have lately placed on the market some specially made valve templates. Those templates readily adhere to ebonite, glass, and even metals, while they easily peel off again, and no distortion of the diagram is possible with moderate care.

A catalogue of useful components has been forwarded to us by the Formo Company. Every component is carefully made from the highest quality material, which is tested at frequent stages during manufacture and guaranteed.

Three very neat little instruments have been forwarded for test by "Radio Specialities." The first, the "Filtron Variable Grid Leak," is perhaps too well known to need detailed description. The second is the above leak, but combined with a variable grid condenser. The third is an extremely neat instrument for dealing with any static or atmospheric discharges that may come on to the aerial. It is called the "Static-Rstor." All these instruments are well made and have proved very satisfactory under test.

It is often a great advantage to include a variable type of grid leak in the set, especially if valves are often changed. A very neat one has lately been placed on the market by the "Matwil" Wireless Company. This instrument is specially designed for panel mounting while the resistance is steadily variable over a wide range. The particular points in the construction of this grid leak are: The pressure on the pellets is very steady, due to the interposing spring plungers operated by a fine thread screw. This allows a large leakage path from the resistance, owing to burning out. The pellets are unbreakable and cannot be damaged by clamping down too tightly. The resistance is from 5 to 5 megohms.

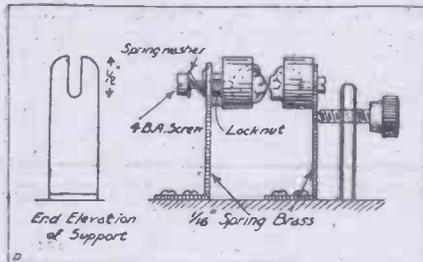
It is interesting to note that on the R.F.H. B.B.C. 2-valve reaction type of set all broadcasting and Continental telephony can be heard, while with the 3-valve type, W J Z has often been received. This firm has just issued a leaflet descriptive of these sets and their ranges, etc., which all interested in wireless should see.

PRACTICAL IDEAS for the AMATEUR.



AN IMPROVED PERIKON DETECTOR.

AFTER experimenting with several types of perikon detectors the writer evolved the form shown in the diagram. This proved to be most selective, as the copper pyrites cup works with a rotary or longitudinal motion in the slotted support. A spring washer ensures good contact and easy movement, while a locknut prevents the screw from slackening back. The pressure

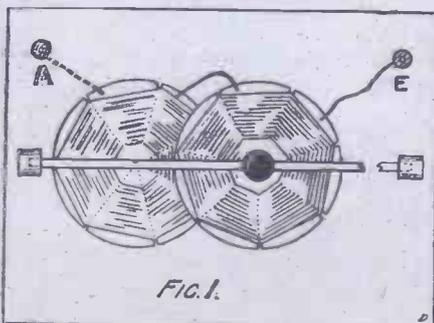


of contact is adjustable by means of a thumbscrew. If several cups with crystals are thus prepared, an instant change of crystal can be effected.

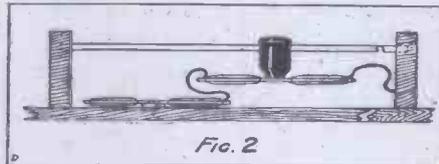
A CARD INDUCTANCE TUNER WITH IMPROVED DETECTOR.

THE following is a short description, of a receiver, making use of card inductances and a detector providing a choice of three crystals.

A baseboard 8 in. by 6 1/2 in. is procured, and on one half of this are mounted the coils. Between two blocks of wood 1/2 in. square by

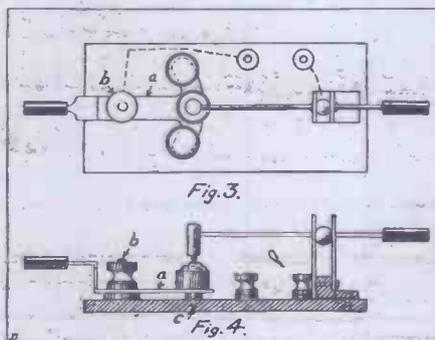


1 1/2 in., a 7 in. length of brass rod 1/4 in. square is mounted, provided with an ebonite slider, less contact stud,



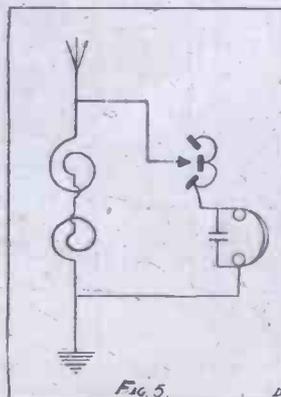
Two coils are then made by winding nearly full with 28 S.W.G. D.C.C. wire, two cardboard discs 3 in. in diameter, cut with an odd number of slots. One coil is then fixed at its centre to the slider. The other being screwed to the baseboard. The brass rod and slider coil is assembled, and connections made. (See Figs. 1 and 2.)

The detector consists of an ordinary cat's-whisker and mounting, fixed to a piece of ebonite about 3 in. by 2 in. The crystal cups are soldered to a piece of brass foil (a), fairly springy, cut out T-shaped, and about 2 1/2 in. in length and 1 1/4 across the T-end. Along half the length of the stem of the T a hole is drilled, and the stem is fixed to the pillar of a fairly large terminal (b), and so is capable of moving from left to right. Beneath the copper foil, at C, a small brass screw, with a cheese head, is



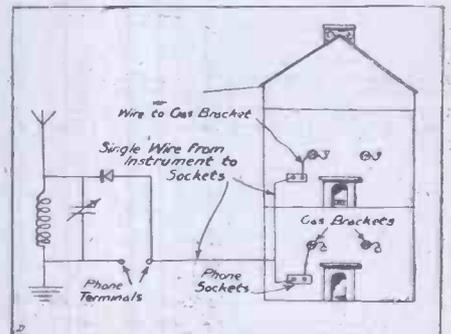
screwed into the ebonite, to afford a support for the cup carrier. Two terminals are provided and connections are made, as in Fig. 3. To the end of the cup-holder stem is fixed a small ebonite knob and the arm is bent as in Fig. 4. This detector is then screwed to the baseboard.

Four terminals are provided for aerial, earth, and 'phones, and the whole is wired up as in diagram (Fig. 5), with a blocking condenser across the 'phones.



TELEPHONE WIRING.

TO users of crystal sets the advantage of being able to connect up the 'phones in any room need hardly be pointed out, for all know how annoying it is to attempt to listen to weak signals while a conversation is being carried on in the same room. If every room in the house be provided with telephone terminals one is able to use the quietest room and receive maximum enjoyment without disturbing the other members of the household, but the usual method of using two wires becomes very expensive if the rooms are far apart.



The following method will enable those who possess single circuit crystal sets to save at least forty per cent of the cost of wiring. The usual arrangement for making connections with the 'phone leads is fastened on the wall in each room, preferably at the side of the fireplace. Two telephone terminals mounted on a small rectangle of ebonite or wood will be found simplest and best. One of these terminals is connected by copper wire (which need not be covered) to the nearest gas bracket. This will in many cases only need a very short length.

A single wire, well insulated and coming from the wireless set, is connected to the other terminal. This wire passes from room to room, making connections with one terminal of each pair, and then passing on to the next pair. At the tuner this wire is connected to one of the telephone terminals, the other being ignored. The correct terminal may be ascertained by connecting the 'phones to the nearest pair of terminals, and trying first one and then the other of the telephone terminals on the set. One will give signals and the other will not. The diagram will make the connections clear.

Since the earth serves as the return wire, the system can only be used for sets where the 'phones are inserted between the crystal and the earth lead.

RADIOTORIAL

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

It seems fairly certain that a number of relay stations will be erected throughout the country in order to retransmit the programmes of the main stations. This will bring broadcasting within "crystal distance" of many thousands more listeners-in. Before this can be done, however, it is necessary that the B.C.C. should know the recommendations of the Broadcasting Committee, otherwise the company will have no indication as to their exact future status. I wonder whether the Broadcasting Committee really does realise the discomfort they are causing to every interest concerned in broadcasting by their delay in coming to decisions? If they are holding their whole report up merely because they are undecided in respect of just one or two points—important or otherwise—I consider that the Committee should hand in that part of their report that is completed, then resign and leave the remainder to another committee. A large firm contracting to deliver a million articles does not wait until it has manufactured the whole number before it makes delivery. Let us have a few advance delivery from the Broadcasting Committee.

THE EDITOR.

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS Queries Department, Room 138, Fleetway House, Farringdon Street, London, E.C.4. Readers are requested to send the necessary postage for reply.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

X. Y. Z. (Dundee).—I am troubled by crackling noises in my 'phones, which I know is not caused by atmospherics, and is very persistent, sometimes drowning Glasgow altogether on my three-valve set. I have my own electric light plant. Would this be the cause of my trouble?

In all probability your motor is the cause of the trouble. Try surrounding the set with some sheet metal, which should be earthed. Failing this (presuming you are using L.F.—one stage at least) try shielding the L.F. transformers by surrounding them with tinfoil or thin iron, and earthing the iron cores as well as the metal screen.

"STAR" (Denbigh).—Using a Dutch valve as detector, and an R. type as H.F., I get very poor results, not nearly equal to the results obtained with one valve only—the R. I am using a 50-volt dry battery for the H.T., with tapplings, and a six-volt accumulator. Are these O.K.?

Probably your trouble is too much H.T. on the Dutch valve. These valves often take as little as 15 volts on the plate, and will "blue glow" if given too much. Do not allow the valve to "blue glow," as it shortens its life considerably. Your trouble will therefore be that the H.T. on the R. valve should be about 60 volts, while the Dutch only needs 20 or 30 volts. You should either use two valves requiring the same plate voltage, or else provide separate plate batteries—one for each valve.

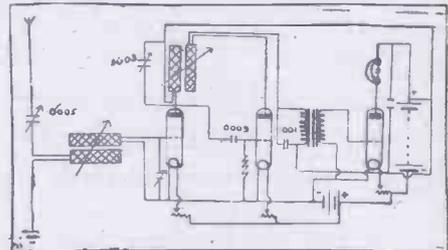
"DUPLEX" (Forest Row).—I am using a one-valve set with reaction, but wish to use double reaction for the continental telephony. How is this accomplished?

Double reaction cannot be used with a one-valve set; two valves, one of which must be an H.F., at least are required. The H.F. valve should preferably use the tuned anode method of coupling. See the answer to J. M. (Radlett) on another page. This will give full details regarding the type of reaction you wish to employ.

H. A. L. (Warrington).—A friend told me that he conversed with another amateur every evening after broadcasting by inserting a tapping key in the H.T. positive lead. Is this possible for ranges up to quarter of a mile or so, as I have applied for a transmitting licence, and should like to try this? Is a microphone necessary?

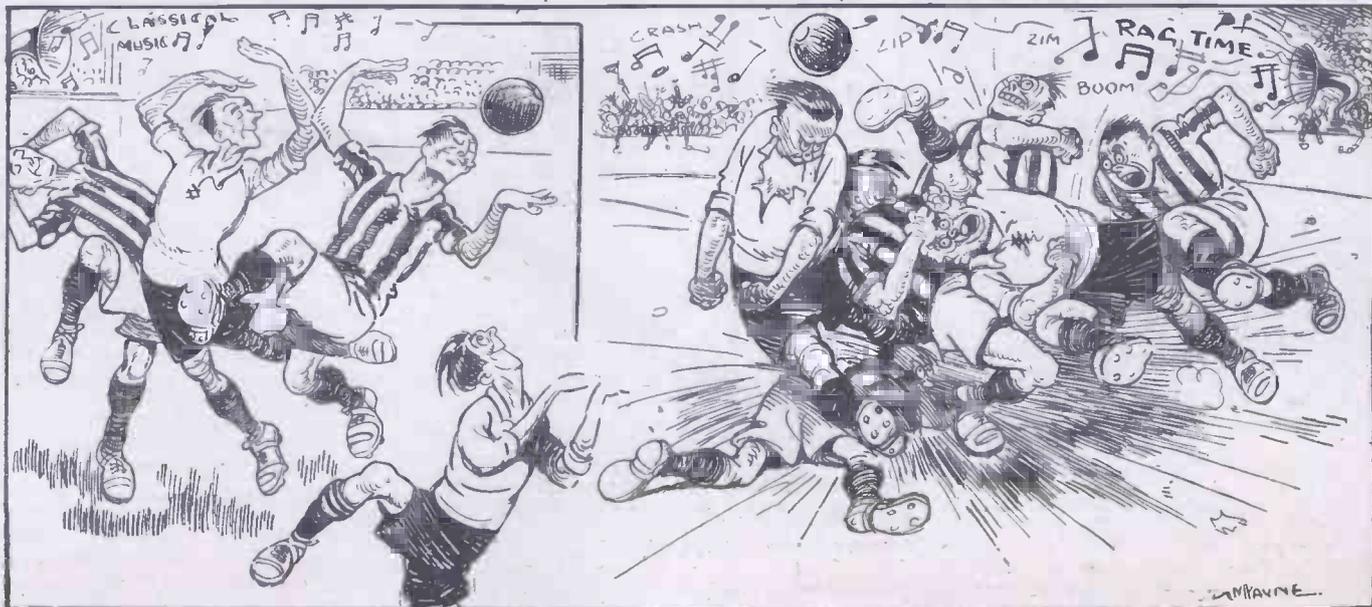
This is not very satisfactory for Morse transmission, and of course useless for telephony. A better way is to insert the key in the earth wire, so that it breaks the aerial circuit. Reaction must be used, and usually a fairly high voltage of H.T. is necessary, the higher the voltage, the greater the range, within the limits of the valve used. The coupling should be fairly tight, so that the set oscillates readily. The key should now be inserted in series with the earth. By pressing the key contact is made, thus completing the aerial circuit, and causing the set to send out a high-pitched note as long as the key is pressed. For receiving purposes, the key of course is kept closed or shorted. The disadvantage of such a method is that the coupling will usually be slightly different for receiving and transmitting, and some time is wasted in tuning in after transmitting. The method of tuning is carried out as usual, of course, so that it is easy to transmit on any wave-length desired.

"PETUNIA" (Birmingham).—I wish to build up a three-valve set that will be selective and give good results from all the broadcasting stations near Birmingham (12 miles out approximately). I have a good aerial directional to Glasgow, 40 ft. high and 90 ft. in length. I also wish to get the Continental telephony. Reaction permitted by P.M.G.



must be included. The tuned anode method of coupling should be used for the H.F. (if H.F. is advised). May D.E.R. valves be used? (Continued on page 966.)

THE PROBABLE EFFECT OF BROADCAST RECEPTION ON THE FOOTBALL FIELD.



The Marconi-Osram 'D.E.R.' Valve has now been reduced from £2 to 27s. 6d.

Apart from its cheapness, the outstanding advantages of the 'D.E.R.' (the Valve which is fitted to the famous Marconiphone V2) are:—

- (1) It consumes little more than half the current used by the ordinary Valve.
- (2) Its effective life is from 6 to 8 times longer.
- (3) It can be used with filament dry-batteries if desired.

The 'R'-type Valve has also been reduced from 17s. 6d. to 15s. 0d.

The Marconiphone V2 is also cheaper.

In consequence of the reduction in the price of the 'D.E.R.' Valves and of Telephones, the Marconiphone V2 is now sold at

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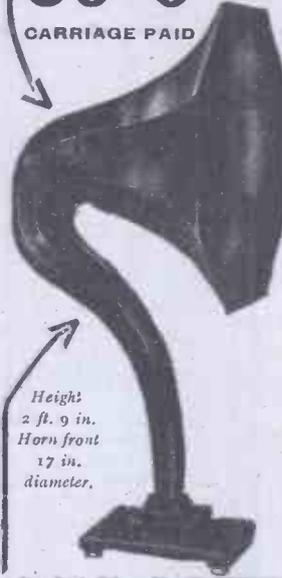
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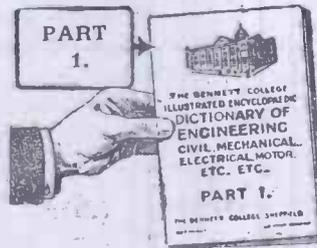
This Loud Speaker will operate perfectly on 3 valves up to 30 miles radius. No amplifier is required. Supplied to fit any type of existing earphone (state size when ordering), and in any wood stain with a polished finish.

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(Do not fail to give the particulars required and use this full address.)

Department D 106,
The Bennett College,
Sheffield.

RADIOTORIAL

(Continued from page 964.)

The circuit shown should get all broadcasting, Birmingham, of course, easily on a loud speaker. One H.F., one detector and one L.F. are used. Two double-coil holders are necessary, the one for the primary and secondary coils and the other for the anode and reaction coil. For wave-lengths other than broadcasting, double reaction can be obtained by coupling the anode and reaction coils to the primary or secondary. Either basket or honeycomb coils may be used, the latter being preferred for all-round reception, as the basket coils become too big to handle easily. D.E.R. valves may be used quite successfully, and have a much longer life than the ordinary type of valve. The addition of a potentiometer may help to stop any tendency to oscillate internally, though this should not be present if the set is carefully made. The secondary coil may, of course, be omitted, but the set would not then be so selective.

"**RADIO.**"—How many valves do you advise for the reception of Cardiff and Manchester? Should I use H.F. or L.F.?

As you are situated somewhat near the coast, you will probably get quite satisfactory results using two valves: the second being an H.F. Three valves using reaction on the anode, with the third valve as L.F., however, should give loud results. Why not try the "P.W." Combination set and add an extra L.F. valve if found necessary? This will give you all the broadcasting stations with a minimum of expense and power output.

"**MIKER**" (Highgate) submits a sample of mica, and asks if this will be O.K. for fixed condensers of the following capacity, .006, .0003, .001, .01 mfd., using ordinary copper foil.

Yes, this mica will be quite O.K. It is .001 thick. For the .006 you will require 11 foils $2 \times \frac{1}{4}$ cm. For .0003 mfd. 1 foil 3×1 cm., .001 3 foils 2×1 cm., and for the .01 6 foils 5×2 cm.

P. W. S. (S. Mimms).—Can dull emitters be used on the "P.W." set for both units? I understand they are too microphonic to be of use as L.T. amplifiers.

We have found no difficulty in this respect. As a matter of fact, one of the "P.W." Combination Sets, using unit 2, is in daily use with two dull emitters (D.E.H. type made by the G.E.C.), and though they are microphonic if the set is knocked while listening, this drawback, peculiar to low temperature valves, is by no means serious. Results are quite as good as with ordinary valves, while reception is free from any of the extraneous noises so often accompanying the ordinary valve, and the saving of power is of course very considerable. We can certainly recommend this type of valve for use with the "P.W." set.

K. B. L. (Norfolk).—What is the easiest formula for calculating the capacity of a fixed condenser?

The following formula will be found to give quite useful, though the results are of course only approximate:

$$K = \frac{Ka}{4\pi t \times 9 \times 10^5}$$

where K represents the capacity of the condenser in mfd. a the effective area of one set of plates in square centimetres, t the distance between plates, and k the specific inductive capacity of the dielectric between them. In the case of air $k = 1$; for paraffin paper $k = 2$; for mica $k =$ approximately 5, depending on quality. This formula is reasonably accurate for all ordinary forms of condensers used in wireless receiving circuits—i.e., condensers in which the thickness of the dielectric t is small compared with the area of the plates. In such cases the effective area A used in the above formula is the total area of one set of plates which is opposed by plates connected to the other terminal of condenser.

A. E. W. (Sheffield).—I have just fitted a charging plant for my accumulators, but am doubtful as to which is the positive lead on the output side. Can you give me details of a simple polarity indicator?

A simple indicator can be made up as follows: Put a quantity (about as much as will cover a half-crown) of sodium sulphate into a cup half full of warm water, and add as much phenolphthalein as will cover a farthing. Both these salts can be obtained from a chemist, and three-pennyworth of each will be ample. Stir the liquid until all the substances have dissolved. Then place your output leads into the solution, the leads being about $\frac{1}{4}$ in. apart, when the negative lead will turn the surrounding solution red. On shaking the liquid the colour will disappear. A useful container can be made up from a glass tube about 3 in. long with two rubber stoppers. Two terminals should be fitted (one at each end) in the corks so that

they protrude about $\frac{1}{4}$ in. on the inside. Now fill the tube with the solution, leaving a slight air space. This polarity indicator should last a considerable time and will form a very useful accessory to anyone who charges his own batteries.

J. M. (Radlett).—I have a two-valve set, one H.F. and one detector, and wish to use double reaction. The set is of the tuned anode type, and I understand that that type of reaction can be used. Is this so?

Yes, you can use double reaction, but it will necessitate reacting on the aerial, and this is, of course, forbidden during broadcasting if you are on wave-lengths between 300 and 500 metres. Instead of mounting the tuned anode coil away from the aerial and reacting upon it, it is mounted as one of the outside coils in a three coil holder. The middle coil is then made the reaction coil while the third, also outside, is the aerial tuning coil. If you are using a loose coupled aerial, you will have to arrange either another coil holder so that the secondary can be used or else dispense with the secondary altogether. As a matter of fact this latter course is the more preferable as double reaction means very sharp tuning and a very sharp oscillation point. The tuning will be a little tricky, but if the following details are followed it will present no very great difficulty. In the first place, tune in your station with the reaction coupled to the anode coil, the aerial being well away from the reaction coil. Then, when signals are as good as you can get them, bring up the aerial coil and readjust the tuning. By varying the distances between the three coils and adjusting the tuning condensers very loud results can be obtained. Care will have to be taken when tuning-in, for the set will oscillate very easily.



THE "MAY" CIRCUIT.

The Editor POPULAR WIRELESS.

Dear Sir,—Will you kindly insert this in your most popular paper when convenient.

Having tried out most of the novel circuits given in the various wireless journals during the last few months, I have to-day tried the American May Circuit, using a detector panel unit and a double-pole change-over switch mounted on a bit of ebonite with six terminals for convenience. I used a McClelland's variometer and Sullivan's .001 variable condenser, .0002 grid condenser, and 2 megohm leak. I picked up Manchester with 18 volts H.T., and the signal strength improved with each step up of H.T. up to 66 volts.

This is far and away the best results I have ever obtained, especially without reaction and only one valve. I received 5 I T and 5 N O quite loud and clear, so loud that I popped on the loud speaker; and 5 N O was very good indeed, and is 130 miles away from me.

With a bit of juggling I go 2 Z Y splendid without a trace of carrier wave, and the lady's voice as clear and perfect as if she was standing by my side.

I intend fitting a variable grid leak and carrying out further tests, and wiring the panel specially for this circuit, and then adding one L.F. valve.

I will let you know the results of my future tests.

This is the quietest circuit I have ever handled.
ALFRED FRANCE,
33, Church Road, Rotherham.

SAVED BY THE AERIAL.

The Editor POPULAR WIRELESS.

Dear Sir,—In response to your invitation in POPULAR WIRELESS of July 28th, I send you an account of my aerial being "ticked" with lightning.

It happened in the evening about 7 p.m.,

during a short but rather severe storm, when circumstance placed me in one of my shop windows. I saw the reflection of lightning which appeared to be striking something above. I felt something had happened, seeing across the street a man standing in his doorway look up at my aerial. I expected to see him make some signal that damage was done. As he made none I was relieved.

After the storm he said, "Your wireless saved your premises." He then told me the lightning went along the aerial and down lead. When the storm had well passed I listened in, examined aerial, switch, etc., but could find nothing different.

The aerial, owing to circumstances, is of peculiar arrangement, as will be noticed.

The down lead fastened to a piece of electric-light wire, 3-22, by a terminal, passes through tube about 4 ft. to a two-way electric-light tumbler switch, then through the floor and shop to basement, where it is fastened to a lead waterpipe with a clip.

As on previous occasions, I had also taken A wire of set off and put on E terminal. I was not able to find anything unusual with aerial wire or cord tying insulators to strainers.

I might mention several buildings were struck in the town, and varying damage done.

I hope this rather rambling account will be of use.

Yours truly, KEITH P. FIRTH.
97, Norfolk Street, Wisbech.

THE ROCHELLE SALT CRYSTALS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having read your article on "The Rochelle Salt Crystal" in this week's POPULAR WIRELESS, and realising how much the success of such experiments depend on the growing of the crystal, I am enclosing greater details which will no doubt be of interest to your readers. These details are taken from an article entitled "Speaking Crystals," by the inventor, Mr. A. McL. Nicolson, which was published in the December, 1919, issue of "The Electrical Experimenter" (New York City).

The crystals should first be dissolved in boiling distilled water till a super-saturated solution is obtained. This solution should be made up of 8 parts Rochelle salts to 5-33 parts of water, and at 50°C. should have a specific gravity of 1.33—as measured by a hydrometer. In 12 hours small crystals will have formed.

These should be removed and dried between filter papers, or on a blotter. A fresh solution of the salt should now be made up as before, and when its temperature has dropped to about 42°C. it should be placed in a tumbler or a beaker containing sufficient mercury to cover the bottom.

When the solution has dropped to 38°C. one of the small crystals should be placed in it and resting on the mercury so that its parallel faces are in a horizontal plane. The solution must not be disturbed. The crystal should now be allowed to grow, and when of requisite size it should be placed in 90% alcohol for 3 or 4 hours, and then in absolute alcohol for 20 minutes, if it is desired to remove all traces of water (mercury being used as before at the bottom of the containing vessel). These Rochelle Salt crystals will only operate properly if carefully prepared as above.

Yours faithfully,
"VARIOTRON."

CORRESPONDENCE.

(Continued from page 966.)

EFFECT BETWEEN AERIALS.

The Editor, POPULAR WIRELESS.

Sir,—I would like to know if anyone else has noticed the same phenomenon as I am describing. The other day I was receiving Manchester quite loudly on a one valve set with reaction. My next-door neighbour, who was listening to Birmingham (15 miles away from my house) on a crystal set, heard my howl and then noticed a considerable increase in sound in his 'phones. The strangest part was that he got Manchester when Birmingham closed down, apparently off my aerial. I might mention that the two aerials are almost parallel. If any other enthusiast has had a similar experience he might interest many readers of POPULAR WIRELESS if he related it in this column next week.

INTERESTED.

THE "DEVIL IN MUSIC."

To the Editor, POPULAR WIRELESS.

DEAR SIR,—Our broadcasting programmes each evening are becoming popular in many respects, and one is the invitation to fair criticism.

I would like to make reference to over-indulgence in jazz and particularly syncopated bands. Now, to my mind (and I know I am voicing the opinion of a large number of listeners-in), this production is neither interesting nor educational, and its introduction is not music in any sense of the word.

On the Continent, syncopation has the reputation of being known as the "Devil in Music." Well, to have a night of this is simply torture, and I hope it will be discontinued and something more sensible substituted, as its continuance is merely a waste of time and money.

V. DONALDSON.

Rock Ferry.

PLEA FOR COLOURED VALVES.

To the Editor, POPULAR WIRELESS.

DEAR SIR,—May I offer a suggestion? As is well known, every valve has its own characteristics, and I think it would be a good idea if manufacturers of thermionic valves were to test each individual valve and discover in which position it functions best, and colour each according to its merits—say H.F., red; Det., green; and L.F., orange. The advantages, I think, are obvious, one being the absence of unpleasant glow, as in the case of uncoloured valves.

Yours truly,

E. E. HEWINS.

Glam.

IS THIS A RECORD?

To the Editor, POPULAR WIRELESS.

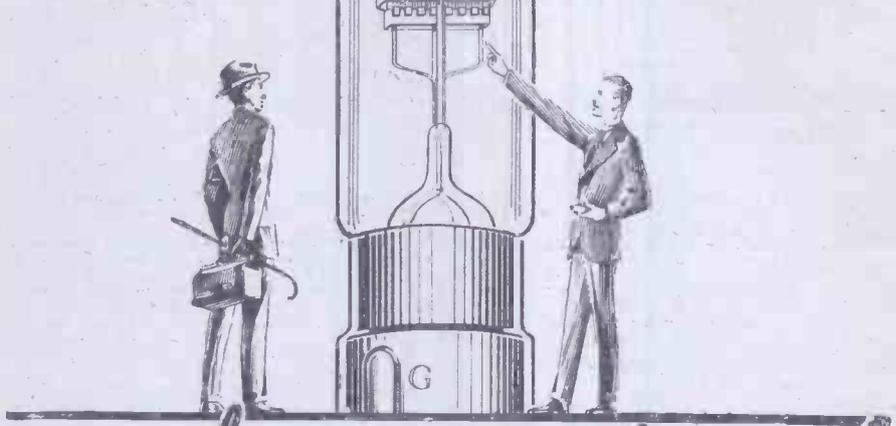
Sir,—Re "2 X T's" reception of 5 NO on a crystal set, I should like to state that while in Dundee last February I heard all the B.B.C. stations then working. The crystal used was iron-pyrites. Signals were comfortable using two pairs of 3,000 ohm telephones. 2 LO and 5 NO were best, though at that time 2 LO faded rather badly. These signals were heard every night for a month while I was resident in Dundee, so there was no freak in it.

I am, yours truly,

THOS. LITSTER.

Peebles.

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— here's the reason

Listen to the Cossor Research Director:

"YOU know, of course, that when the Filament of any Valve is glowing that it is giving off a constant stream of electrons.

These electrons travel in every direction away from the whole length of the filament not from just merely a portion of it. It is the object of the Anode (or Plate) to catch these electrons—or as many of them as get past the Grid. The fewer electrons wasted—and by "wasted" I refer to those escaping to the sides of the glass—the higher the efficiency of the Valve.

Obviously it is mechanically impossible to seal up the Filament within the Grid and Anode themselves, but if it could be done we should be reasonably certain of using 100% of the electron stream.

The next best idea, though, is to be found in the design of the COSSOR. Here we have a curved filament in the shape of an arch extending up into a hood-shaped Grid and Anode, which completely enshroud it.

Observe for yourself how the Filament is completely hidden. Its emission cannot possibly escape—a very different state of affairs to the ordinary tubular Anode.

Here, then, is the reason for the remarkable results obtained by users of the COSSOR. If you have not yet used these Valves, you have certainly not obtained the maximum enjoyment from your Receiving Set."

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RECENT WIRELESS INVENTIONS.

The following abstracts are specially contributed by Mr. Harold J. C. Forrester, Fellow of the Chartered Institute of Patent Agents, 88-90, Chancery Lane, W.C.2.

Grant of the following patents can be opposed, and printed copies of the full specification obtained.

198,799.—BARON CLIFFORD OF CHUDLEIGH.—SOUND REPRODUCERS.—In sound reproducers for gramophones, etc., having extra diaphragms to amplify the sound, which form between them an air chamber and a chamber containing non-inflammable gas at low pressure, an electric current is caused to pass across the gas chamber. Variations in this current due to sound vibrations may co-operate with a selenium cell to produce a photographic record on a film.

199,016.—WESTERN ELECTRIC CO., LTD.—BROADCASTING.—An installation for broadcast transmission which will give a minimum distortion when received by loud-speakers consists of a push-pull, air-damped microphone which feeds very low voltage L.F. currents to an audio-frequency amplifier, so increasing them to ordinary strength, whereafter they are applied to modulate the output of a system comprising amplifying valves, variable impedances, and an H.F. generator.

199,233.—H. P. REES.—INDICATING WAVE LENGTHS.—In a tuning condenser of a receiving set having a pointer moving over a scale graduated in wave-lengths, the scale is held in spring clips and secured by a clamping screw, so as to be adjustable for slight variations of aerial constants, etc. For use with a variable inductance, the scale may have separate graduations for each position of the inductance switch, but preferably a calibration card is provided, the scale having only one set of graduations. The scale may be set by tuning-in to a known wave-length and adjusting to indicate the corresponding graduation.

199,238.—A. C. HUSKINSON.—CONDENSERS.—In variable condensers of the kind having fixed and movable sets of plates separated by a solid dielectric, which may be merely a coating on the plates, the plates of one or both sets are loosely mounted for self-adjusting purposes, should the distance between the plates vary.

199,258.—J. H. L. BRIDGE.—COIL MOUNTINGS.—Inductance coils are provided with a device whereby they may be freely rotated. The device consists of a coil holder fitted with concentric cylindrical terminals which engage a corresponding double socket formed by two cylindrical shells one within the other, but insulated from each other. The terminals and socket are thus relatively rotatable and good contact is always maintained. The device may be modified for use with coils already having pin and socket terminals.

199,283.—IGRANIC ELECTRIC CO. LTD.—CONDENSERS.—A variable con-

denser consists of two units for main and fine adjustments respectively. Each unit comprises a drum on which is mounted an armature covered by a dielectric, and a second armature of flexible material is wrapped partially round the drum and attached at one end thereto, the other end being attached to a smaller drum containing a spring which tends to wind the armature upon this drum. Adjustment is made by rotating the larger drum to wind more or less of the flexible armature thereon, the drum being retained by friction members in its set position.

199,384.—METROPOLITAN-VICERS ELECTRICAL CO., LTD.—MOULDING COILS.—Reactance coils are wound and concrete supports are then moulded around them. The mould, of special construction, has a collapsible core and removable radial mould members.

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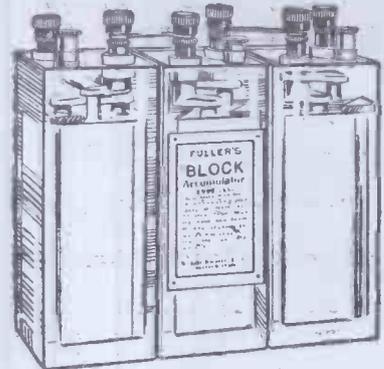
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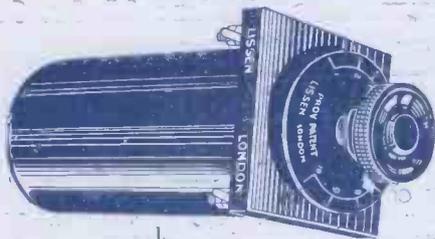
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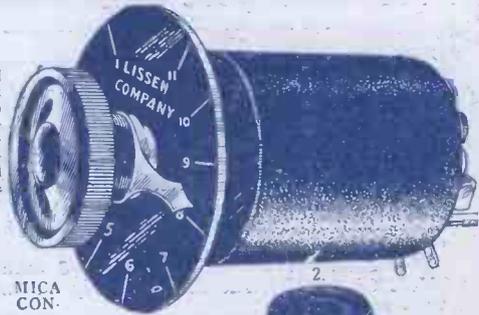
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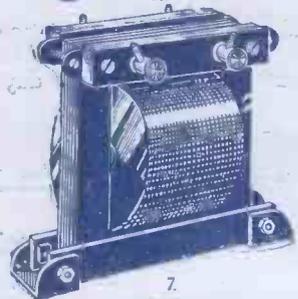


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