WIRELESS WEEKLY

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VOL. 5. No. 24 FRIDAY, APRIL 10, 1925.

3D

H.C. COILS W/LENGTH. P. 14.

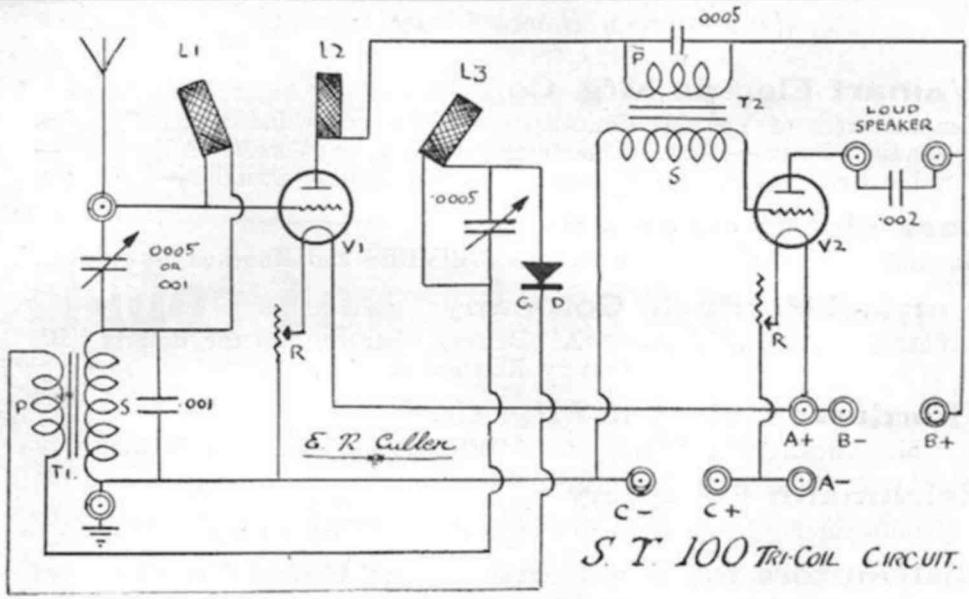
FEATURE:

An All Wave CRYSTAL RECEIVER

(2 Circ. 2 Cond-2 Cond.)

The Fifth
CULLEN
Circuit

YOU HAVE MY WORD FOR IT



S. T. 100 TRI-COIL CIRCUIT.

WONDERFUL as the ST 100 receiver is, it has one disadvantage it is not as selective as could be desired. To overcome this difficulty the circuit above was devised.

ST 100-ites who wish to convert their sets will notice how very easily this may be done. Provision has been made for a Grid Bias battery (C battery) to both valves.

Only the best quality materials are here quoted. Many people strike failure in reflex sets through employing inferior apparatus. The valves to be recommended are UV201A's which now sell at 25/- each. True Blue and A.P valves have functioned splendidly. A high plate voltage, usually 100 volts, will be found best as both valves are amplifiers. This circuit is stable, one adjustment of the coupling of the coils being sufficient to stop self oscillation. Try it.

PARTS REQUIRED

1 Panel, 18 x 9 x 3/16.
1 3-Coil De Luxe Holder.. .. 15/6
2 Jefferson Star Transformers, £2/5/-
2 .0005 Master Variable Condensers, with Dials £2/10/-
2 Master Valve Sockets 12/-
2 Nutmeg Rheostats and Dials, 13/4
1 Cullenola Crystal Detector .. 5/-
10 Terminals 3/4
1 .001 Wetless Condenser 1/6
1 .0005 Wetless Condenser.. .. 1/6
1 .002 Wetless Condenser 1/6
Busbar, Screws, etc... .. .. .. 3/-

Wireless Weekly

12-16 REGENT STREET, SYDNEY, AUSTRALIA.
'Phones: Redfern 964 and 930.

Official Organ of the New South Wales Division of the Wireless Institute of Australia, with which are incorporated the Affiliated Radio Societies and the Australian Radio Relay League.

Editor: A. W. Watt.—The Editor will be glad to consider Technical and Topical Articles of interest to Australian Experimenters. All Manuscripts and Illustrations are sent at the author's risk, and although the greatest care will be taken to return unsuitable matter (if accompanied by stamps), the Editor cannot accept responsibility for its safe return.

Subscription Rates.—Twelve months (52 issues), 13/-, post free. Six months (26 issues), 6/6, post free. Single Copies 3d. each, or post free 4d.

Questions and Answers Department.—Except in the case of subscribers, all Technical Questions, or those entailing research work or drawings, must be accompanied by a postal note or stamps to the value of 1/-.

Advertising.—Advertising Rates may be had on application to the Advertising Manager. Copy must be in the hands of the Editor by the Friday preceding each issue. If copy is not received in time, the previous week's advertisement will be repeated.

All accounts should be made payable to Publicity Press Ltd., 12/16 Regent Street, Sydney.

Agents in Great Britain.—The Colonial Technical Press Ltd., Dudley House, Southampton Street, Strand, W.C. 2...

VOL. 5 No. 24 APRIL 10, 1925

Editorial.

WIRELESS AT THE SHOW.

IF we may believe it, radio has not yet entered the homes of most of the dwellers outback, partly because many of them have not yet had an opportunity of listening for themselves to the broadcast programmes and again for the reason that quite a large number are merely disinterested.

Once a year, at the Royal Easter Show, thousands of these prospective listeners-in gather to observe the latest developments in the agricultural and commercial world and to gain impressions which they carry back to the thousands of others who seldom get as far as the city.

It is gratifying to note that some of the large Sydney wireless concerns have prepared attractive exhibits at the Show and that special demonstrations are to be arranged for the benef't of country visitors. These demonstrations, let us hope, will be conducted wisely and with due regard for the unfortunate effects produced by some of the attempts of the past, when over-eagerness and a desire to impress a large number of people at once quite spoiled otherwise well arranged affairs. It is far better to create a good impression upon one individual than to hurl a tremendous volume of poor music at a crowd. The attendants at the wireless exhibits at the Show have a golden opportunity for spreading the gospel of broadcasting in the right direction—among people who are total strangers to the subject and who are perhaps a little difficult to convince of the undoubted benefits derived from a good broadcast receiver.

There is, among many country people, a belief that static is a permanent and prohibitive feature of broadcast reception in the outback, and here again is a splendid opportunity of correcting an unfortunate impression spread indiscriminately by thoughtless persons. Every convert to wireless is an asset not only from a trade point of view, but also as a supporter of bigger and better broadcasting in the future, an ideal which we all have before us. A country resident returning home convinced of the value of broadcasting carries a message worth many pounds of publicity.

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ACROSS IN DAYLIGHT.

ACCORDING to report, a Sydney experimenter is awaiting confirmation of amateur transmissions to and from the United States in broad daylight and if the confirmation is received, definite proof will be established that an input of only 25 watts is sufficient to reach America on short waves without the friendly aid of darkness.

Too much importance cannot be attached to a test of this kind, since it opens up an entirely new field and creates an almost incredible record. It seems that the efficiency of short waves has scarcely yet been tested and there can be no doubt that the coming winter will witness an almost complete scrapping of present methods and the adoption of certain features in transmission and reception which are only just becoming unearthed.

HEADQUARTERS
Royal Society's House
5 Elizabeth St.
SYDNEY, N.S.W.

Wireless Institute of Australia

N.S.W. Div. Inc.

Incorporating the Affiliated Societies and The Australian Radio Relay League

Phil. Renshaw, Hon. Sec.
Box 3120 G.P.O. Sydney
Phone B2235
A.H. Perrett Publicity Officer.

All Clubs' Night.

The "All Clubs' Night" took place at the Royal Society's Hall, 5 Elizabeth Street, Sydney, on Monday, March 30, 1925, and was as great a success as was anticipated. The attendance was not quite so great as on the previous occasion, but all those who were present were very enthusiastic over the proceedings.

Mr. C. D. Maclurcan, President of the New South Wales Division of the Wireless Institute of Australia, took the chair at 8 p.m. and the screening of the films took place immediately. The three films of the evening were proceeded by a gazette and succeeded by a Mack Sennett comedy, entitled "Where is my wandering boy this evening." Both of which were pre-leases. The first of the main films was entitled, "The Dawn of Light," and depicted the progress of lighting from the earliest stages of producing fire from flint up through the various stages of rubbing dry wood together to gas lighting, and the modern electric light. This film was of an extremely instructive character and gave those present a very vivid idea of the progress which has been made during comparatively recent years. This was followed by a film entitled, "King of the Rails." This also depicted the progress that has been made by modern science in locomotion. It started the idea of dragging loads which could not be lifted, and progressed step by step through the various stages of sledges and bullock waggons, hence to horse-drawn vehicles, steam locomotives, to the modern high speed ultra powerful electric locomotive.

The final film was entitled, "The Wizardry of Wireless." This gave a very clear idea of the operations which are taking place inside the wireless telephonic transmitter and receiver. The method by which this was set out, was very unique, but it forcibly impressed upon one's mind the various processes which are taking place inside a vacuum tube.

These three films were kindly loaned by the Australian General Electric Co., and the thanks of the Wireless Institute and Affiliated Clubs goes out to this firm for their generous act.

Country Members' Subscriptions.

At the Council Meeting held at Headquarters on Wednesday, April 1st, a most important decision was arrived at with regard to country members. It was recognised that many country members were never able to attend any of the meetings, and it was unanimously decided that from the 1st April, 1925, the subscription for members residing in the country should be fixed at £1/1/- per annum. The term country was defined as all that district lying beyond the boundaries formed by the straight line joining Barrenjoey on the coast to the north of Sydney, to Hornsby to Parramatta to Waterfall then by straight line to the ocean.

Of course this will make no difference to the privileges of country members and we look forward to these gentlemen expending their savings by attending the annual dinner and other functions.

VALVE REDUCTIONS.
Further Announcement

Please note the following reductions:—

A.W.A. 99	25/-
A.W.A. 33	25/-

QRM.

Loud lamentations about laminations have been heard from 2GM.

Station 2JT now possesses an operatoress. Congratulations O.M.

2GC must be careful. He should not leave 1500 volts loose when strangers are about. It might result in a post-mortem. We know you are fond of kicks yourself, but be careful of others. Who was it put 45 watts on one 201a bottle?

M.C. stands for Master of Ceremonies, and also for Maclurcan Cup.

About those New Zealand Tests. We don't think we have got your entry yet. What about it?

YOU WILL SEE —— SOUTHERN CROSS.

CORRESPONDENCE

(To the Editor)

Sir,—It is not without a feeling of remorse that I pen these lines, but the time is ripe for a little comment on the conduct of some of our high power low-wave transmitters.

Let it be thoroughly understood that I do not write this in an aggressive mood, but more to point out where trouble is sure to develop in the near future.

No one begrudges the fact that one or two stations use high power fone on short wave, provided it is used for definite experiments, but when one is compelled to listen to some weak signals being drowned by the ridiculous hilarity of a seemingly hysterical female giving her regards to someone a couple of hundreds miles away with an input of, I believe, five hundred watts, it speaks worlds for the leniency of our respected radio inspectors.

Now this is not playing the game. Remember there are other stations which are endeavouring to conduct tests. They have not the privilege of using high power, and those who have should see that it is not abused, if not for consideration of others, then for consideration of themselves.

Let me suggest that those transmitters using 50 watters and over build small sets for short distance work; this should not be a great inconvenience, as most of them still have the gear, and at least two (2BK and 2DS) already have sets built.

Now, nothing is more exasperating than to hear a conversation about nothing at all between two stations, say three miles apart, damp out everything for twenty degrees on the scale, when the same thing could be done on a five watter with consequently increased selectivity, and increased life of 250 watters, etc.

Trusting that this will bring the guilty parties to see things in the right light, and will not be taken as a personal reflection.—Yours etc.,

2HS.

42 Jersey Road,
Woollahra.
2/4/'25.

(To the Editor)

Sir,—The following report on the reception of broaodcasting from Durban, South Africa, may be of interest to your readers. This station was first heard on Friday, March 27th, at 5 a.m. The first item heard was "a tenor solo" followed by a recitation, "The Rosary," at 5.17 a.m. At 5.17 the song "I passed by your window" came in with good strength and was very clear as were the announcements between the items. This station was heard again at 4.10 a.m. on Sunday, March 29th, and again on Tuesday, March 31st. On the latter occasion reception was very clear and the musical items came in with good strength on three valves. At 5.53 the song entitled, "For you Alone" was heard particularly well. At 6.1 the following announcement was heard, "Hullo everybody, Durban calling, I just want to call up Mr. Taylor. We hope . . . . you are getting our signals . . . ." This station did not use call letters, the usual announcement being, "Hullo everybody, Durban calling." The receiver used was a three valve consisting of a "low loss" detector with two steps of audio amplification. On plugging in to one step the music was still audible. Particulars of "low loss" are as follows: Aerial coil, 16 turns of No. 18 d.c.c. wire wound spiderweb fashion. Secondary 35 turns of No. 18 d.c.c. wire wound on a 4½ inch former. The tickler consisted of 40 turns of No. 22 d.c.c. wire wound on a 3 inch former. The secondary was tuned with a .0005 "Reliance" condenser, the aerial being untuned. I would like to know if this station has been heard in Australia, previous to Friday, March 27th. I have cabled to Durban for confirmation of reception.—Yours etc.,

ALLAN T. HUTCHINGS.

"Bryn Avon," Callawadda, Vic.

(Editors—Subsequent to the printing of the above letter we received a further communication from Mr. Hutchings. A copy of it appears below).

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(To the Editor)

Sir,—I wrote to you yesterday mentioning my reception of South African broadcasting on the morning of Friday, March 27th. This reception has now been confirmed. I sent a cable to the broadcasting Company at Durban naming items heard and this morning received the following reply: "Thanks cable. You heard Durban evening 26th, wavelength 400 metres, power 1½ kilowatts. Send Particulars by mail." Hoping this information will be of interest.—Yours etc.,

ALLAN T. HUTCHINGS.

"Bryn Avon," Callawadda, Vic.

Round the Clubs

The asterisk denotes clubs affiliated with the Wireless Institute of Australia (N.S.W. Division).

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THE LEICHHARDT AND DISTRICT RADIO SOCIETY. *

On Tuesday, March 31st, members of the Leichhardt and District Radio Society held their 125th general meeting at the club-room, 176 Johnston Street, Annandale.

The attendance was very satisfactory, and the business of the evening consisted of an exhibition and demonstration of members' apparatus, which proved very satisfactory and instructive.

Next Tuesday evening the Society will hold its 127th general meeting, and the business on that occasion will be the delivery of lecture No. 6 of Syllabus 3. The work will be entrusted to Mr. R. C. Caldwell, who will have something very interesting to say under the heading of "The Problem of Fading Signals."

The following meeting will take the form of a social evening, and on Tuesday, April 28th, a lecture entitled "Batteries," will be delivered by a gentleman who is generally recognised as being an authority on this particular subject, so that, on this occasion, members will have an excellent opportunity of obtaining some really first-class information about this very important subject.

The Society's membership continues to increase steadily, and persons interested in its activities are invited to communicate with the Hon. Secretary, Mr. W. J. Zech, 145 Booth Street, Annandale.

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CONCORD AMATEUR RADIO CLUB *

The usual weekly meeting of the above club was held on Thursday, 2nd April. The President, Mr. J. V. Stevenson, occupied the chair, and opened proceeding at 8.5 p.m. The attendance was good.

After the usual routine was disposed of, a discussion on the club's proposed new transmitter was entered into. Several smoothing and choke systems were reviewed, which brought to light much interesting material for debate.

Finally, the aid of "Ballantyne" was sought, to enable the club to make the transformers and condensers required. The formula given, ably worked out by Mr. Morton and Mr. Barker enabled us to compute the cost of the necessary gear which the secretary was instructed to purchase.

Once again, two members presented the club with various useful articles.

A lecturette by Mr. Barker, on Transformers, was much appreciated.

The club hopes to be on the ether again shortly, and anyone hearing 2GD's transmissions is requested to drop a line to the Secretary, "Euripdes," Wallace Street, Concord.

Our membership list is still open, and anyone genuinely interested in radio is cordially invited to pay us a visit or write the Secretary for particulars.

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STRATHFIELD RADIO CLUB *

The usual weekly meeting was held at the Club Rooms on Tuesday evening, 31/3/'25, with Mr. A. F. Jacob in the chair.

On account of All Clubs' Night at the Institute clashing with our ordinary meeting night the attendance was not so good as usual, but a very interesting evening was spent by those present. Mr. G. M. Cutts had the floor for the evening, and he gave a very interesting lecture on "Power Circuits in Experimental Transmitting Stations," in which he dealt with the various methods of D.C. and rectified A.C. power supply systems in use but more particularly with A.C. systems employing step-up transformers and electrolytic rectifiers. The various methods of filtering to eliminate A.C. hum were well treated, and generally speaking the lecture was both comprehensive and interesting. At its conclusion a large number of questions were satisfactorily answered by the lecturer who was then accorded a hearty vote of thanks. In supporting this vote the Secretary pointed out the good work being done by Mr. Cutts in his capacity as Secretary of the Institute's Roster Committee, and his frequent visits to clubs in the capacity of lecturer, and as an appreciation of his services to the experimental movement he was unanimously elected an Honorary Member of this Club. Mr. Cutts suitably replied, expressing appreciation of the honour thus conferred.

Members are looking forward to next meeting which promises to be very interesting indeed, as through the courtesy of Amalgamated Wireless Ltd., Mr. Geo. Apperley is to give a cinema and lantern entertainment. A film on "Modern Broadcasting" and an illustrated lecture on "Commercial Direction Finding" constitute the programme. Easter Monday being a holiday, the usual weekly meeting will not be held Easter Week, but Monday, 20th inst., will see us in full swing again.

An All Wave Crystal Receiver

By "INSULATOR."

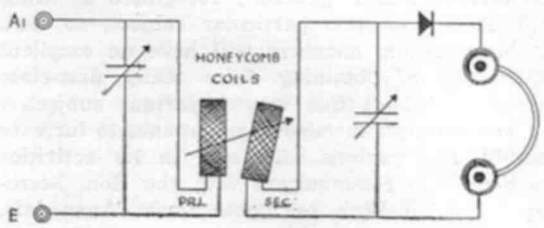
THE crystal enthusiast is very hard to cater for, because there isn't a wide variety of circuits. Crystal circuits are much of a muchness, and new designs seem to run along the same lines. Have you ever met the man who proudly boasts that he has the smallest and always the loudest crystal set ever made? His own one is the result of several hours' close study and application, and so pleased is he with it that he inquiringly requests the address of the Patents Office. You are invited down to hear this marvel, and after tea you plead urgent business with the wife and stroll along to inspect. Your host on arrival sticks his thumbs under his armpits, and with a "what a clever fellow I am" attitude displays a contraption looking all the world like a dead spider, and advises you that it is a "set made in a green pea" or some such silly thing. Maddening, indeed!

To-day I made a crystal receiver, and it is a good one, and I shall always be pleased to own it. So will you who make it. From the man next door I "borrowed" a piece of 3-ply, sized 10 x 7½, and Mrs. Insulator provided me with some "Ezywork" black floor stain. I provided the labour and stained this board all over. While it was drying I collected the following components from my "junk" box:—

1 .001 Variable condenser.
1 .0005 Variable condenser.
1 Fixed panel plug.
1 Movable panel plug.
1 Glass enclosed crystal detector.
4 Terminals.
And some panel wire.

When I say I raked two condensers from my "junk" box it sounds like "skiting," but my "junk" box now assumes enormous proportions. However, the panel being dry, I placed it flat on the table and laid out the components to determine the best system. The illustration shows you my final decision. No too bad, is it? I know Mrs. Insulator was highly enraptured when she saw it completed, and was more so when she heard it perform on an aerial of the average height of 12 feet by 30 feet long (22 d.c.c. wire).

I'll describe in easy stages just how I built this receiver. The blacking of the 3-ply wood I have already touched upon. Really I touched it several times, and I used a cake of sandsoap to clean the marks off my hands. Measuring 4¼ inches from the bottom, I made two marks each 2¼ inches from opposite edges. These were for the spindles of the variable condenser. Using the template supplied with the condensers I marked out the necessary fixing holes. That was that! Next I directed my attention to the crystal detector. This useful article I determined would be best placed between the variable condensers. I marked out the necessary for it accordingly. On looking at the illustration it will be noted that the crystal cup end is on the level with the centres of the condenser dials. Beneath this provision was made for the two coil holder. The movable plug requires two ¼ inch holes 25-30 seconds apart, the bottom hole being exactly one inch and a quarter from the bottom of the panel. The fixed



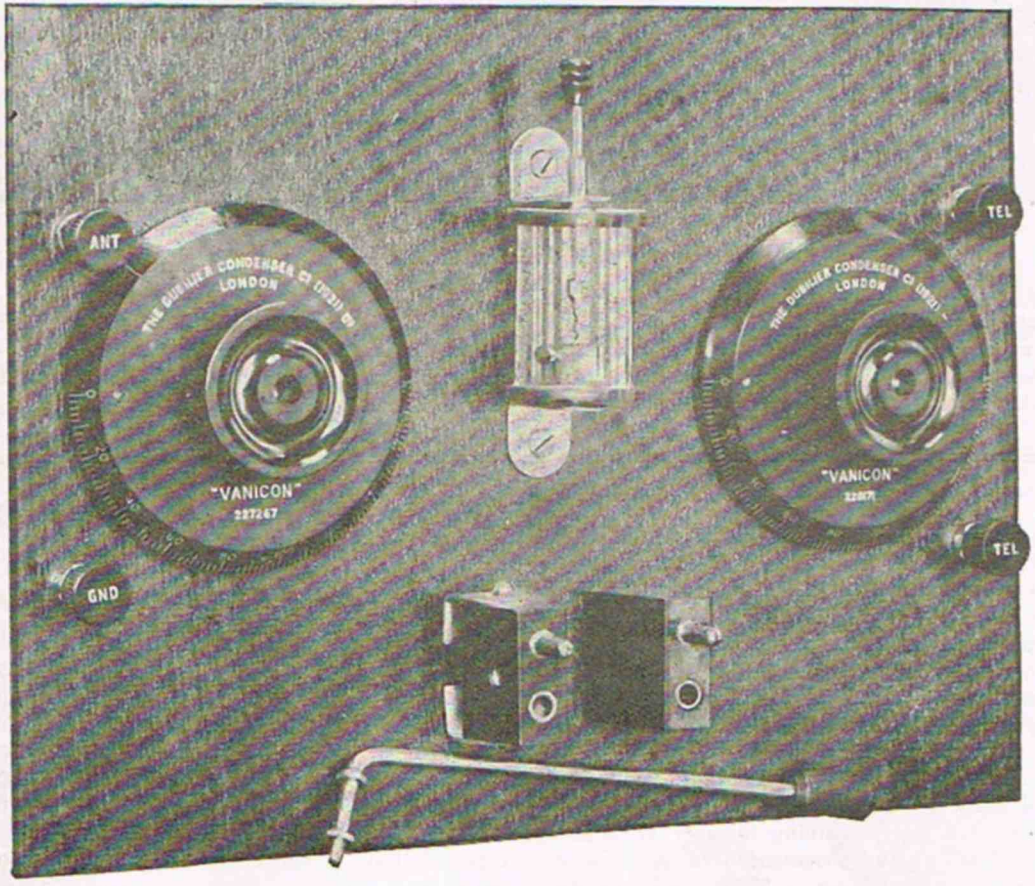
The Circuit.

plug, on the other hand, called for two ¼inch holes ⅝ inch apart, the bottom hole in this case being one and three-eighths of an inch from the bottom of the panel. The most suitable distance apart for these two plugs was found to be 1½ inches. The terminals were next provided for, but as you may employ different condensers to me, I'll leave it to your discretion as to the most suitable place for them. I had just completed this marking out when a ring at the front door announced the arrival of my brother. He is a very handy fellow, so he was pressed into service to hold the panel while I drilled it. It's a remarkable thing how a blessed little drill will hold you up. Both of us searched for twenty minutes to find that elusive little fellow sized ¼ inch. It was ultimately found—in the chuck. Language! Whew! Let's put the lid on it!

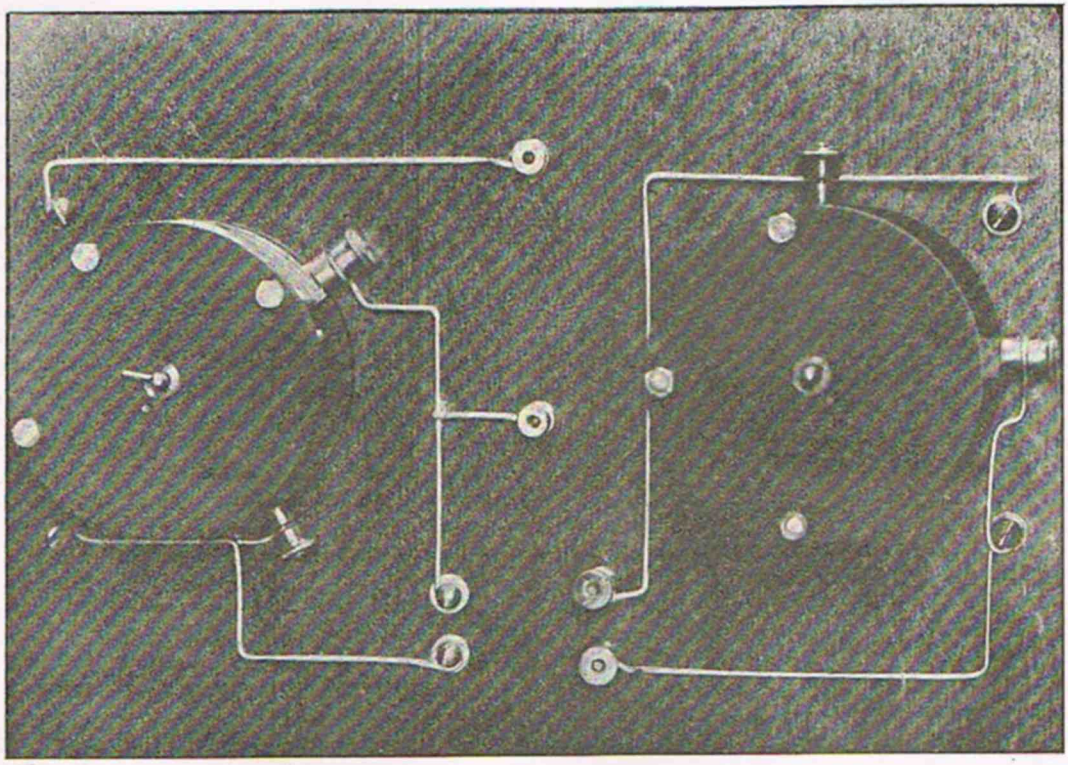
However, he holding, and I drilling, the holes were soon made, and another coat of black was given the panel, hands, face, shirts, etc. Gosh, we were doing well. First the terminals were mounted, next the coupling plugs, then the crystal detector, finally the condenser, and we were ready for wiring. The bus bar couldn't be found—this always happens—so we had to resort to No. 16 tinned copper wire. My brother straightened it in the usual manner—that is, twisted a few turns around a door knob, unwound about 12 feet, and pulled. He straightened the wire, cricked his back, broke the door knob, and lost the top of his stud. Well, if you know anything more annoying than losing the top of a perfectly good stud, keep it to yourself—it won't stand printing.

Still, we wired it. From the aerial terminal a wire was taken to one side of the .001 condenser, and from thence to the top of the nearest coil plug. The bottom of this plug was joined to the earth terminal and then to the remaining side of the .001 variable condenser. The primary circuit was thus completed. The top of the crystal detector was next joined to the top telephone terminal. The bottom phone terminal was taken to one side of the .001 condenser and then on to the bottom screw of the secondary (fixed) coil plug. The top of this secondary plug was led on to the bottom of the detector, and from thence to the remaining terminal of the smaller condenser. This completed the job.

It was hooked on to the aerial and earth, and a 35 turn coil was inserted in the primary, while a 50 turn was plugged into the secondary. On the phones being connected 2BL was heard loudly and clearly by turning the dials of the condensers. One 100 turns (primary) and one 150 turns (secondary) honeycomb coil was used for 2FC, and the church service was heard to advantage. We needed something like a church service, and so that my brother



Front Panel View.



Back View of Panet.

also should be catered for another pair of phones was hooked up. We both listened until the collection stage (Scotch again), and by plugging in a 25 turn coil in the primary and a 35 turn in the secondary 2UW was heard nicely on both sets of phones. A most useful item is a spare headset, and I for one always keep one pair handy. Next week I'll have something else for you.

BITTEN AT LAST.

You may not believe it but there are actually people in this world who live in a daily atmosphere of wireless and yet are not affected in the slightest degree. Sooner or later, however, they fall. One there was on the Wireless Weekly staff upon whom the daily bombardment of questions and answers—who is U6JAZZ—how many turns on the primary, etc., had not so much effect as a summer Zephyr.

Then one day, the bug descended and bit good and hard.

And so, the last remaining member of Wireless Weekly not so far possessed of a set is now building a crystal receiver. There will be no more knitting at night, for the latest convert is a lady.

TABLE OF HONEYCOMB COILS

KEEP THIS BY YOU.

Wavelength.	Primary Coil (turns).	Sec. Coil (turns).	Tickler Coil (turns).
120-240	25	25	35
210-550	35	35	50
550-700	75	100	50 or 70
900-1400	100	150	75 to 200
1650-2750	300	300	100 to 200
8000-15000	600	750	300 to 500
10000-20000	1000	1250	300 to 500
18000-25000	1250	1500	400 to 600

The above table is approximate. Different sized aerials will require slightly different primaries.

The Amateur Operator's Proficiency Certificate

By Wireless Weekly.

A SIMPLE transmitting set is not an expensive item. From our correspondence we know that there are many readers in both city and country who are anxious to obtain experimental transmitting licenses. Under the existing regulations this entails passing of an examination. In this isue and two or three subsequent ones will be given a series of instructional articles which will be made as simple as possible so that the average non-technical person may understand them.

Magnetism and Electricity.

In this article the elementary principles of magnetism and electricity are dealt with, in so far as they affect radio and the circuits used in the development of radio. The modern theory of electricity is called the "Electronic Theory." This is not quite so difficult to understand as it sounds, and it is of the greatest possible help in explaining the action of valve. Readers we feel sure will realise the difficulty in explaining in a few brief paragraphs all the difficulties and limitations met with in the study of molecular physics, but a brief summary of some of the modern conceptions of the constitution of atoms may enable them to get a good idea of what is taking place.

Matter.

Matter is anything (except the ether) which occupies space—anything which has weight and size is matter. Some kinds of matter are invisible, such as pure air, coal gas, oxygen; but since they occupy space and have weight they are matter. Matter is made up of myriads of distinct or separate material particles with spaces between them. The particles are known as molecules. A molecule is the smallest portion of any substance which cannot be subdivided further without its properties being destroyed. It is the smallest complete and normal unit of any substance.

The Atom.

The molecules are made up of smaller particles called atoms. An atom is the smallest particle into which matter can be divided by chemical separation. A molecule may consist of one, two or more atoms of the same kind, or it may consist of two or more atoms of different kinds. Viz., two atom of hydrogen (H) will combine to form a molecule of hydrogen (H2). Two atoms of hydrogen and one atom of oxygen will combine and form a molecule of water (H20). The number of atoms in a molecule varies with different substances. In a molecule of salt there are two atoms, whereas in a molecule of alum there are about 100 atoms. Different kinds and combinations of atoms can be arranged in an endless variety of ways to form different substances. It is believed that there are no more than 88 different kinds of atoms, and molecules of all known substances consists of combinations of these atoms.

The Electron.

Atoms are made up of minute particles of negative electricity termed "electrons," and of a central nucleus in which practically the whole mass of the atom resides. This nucleus is positively charged as a whole, and the mass of the nucleus is most probably due to the charge which it carries. Outside this nucleus probably at considerable distances from it, are sufficient negative electrons to make the whole electrically neutral, the positive charge of the nucleus being neutralised by the negative charges of its attendant electrons. It is almost impossible to form any mental picture of the size of an electron. If a drop of water were magnified to the size of the earth its atoms would be about the size of footballs. Now the electrons are so small as compared to the atoms, they go to make up, that they occupy the same proportional space in them as a fly would in a large hall. The number of electrons in the universe is constant and unvarying. Electricity can neither be created nor destroyed. Electrons can be set in motion and caused to move from one location to another, as is the case with the vacuum tube or valve, but electricity electrons can be neither made nor eradicated. It therefore becomes evident that electricity can be neither produced nor generated, in spite of the fact that the term "generation of electricity" is used so frequently.

When we state that electricity is generated by a dynamo, what we really mean is that the dynamo forces some of this electricity, which is already in existence, to move. It exerts an electro motive force or E.M.F. A dynamo does not generate electricity in the wires connected to it any more than a pump, which is impelling a stream of

water in a pipe, generates the water. As previously stated, every normal atom comprises a certain number of electrons in combination with positive electricity, just sufficient to neutralise the negative effect of the electrons. Normally, atoms exhibit no electrical properties, because the positive electricity in them neutralises the negative. But if an atom has an electron too many or an electron too few, then it does exhibit electrical properties which can be detected by the attractive and repulsive effects thereby produced and the atom is then said to be ionised. Thus when an electron is taken from or added to a previously neutral atom, the charged particle which is thus formed is called an ION. The whole process is called ionisation. In other words an ion is what is left after an electron has been knocked from a

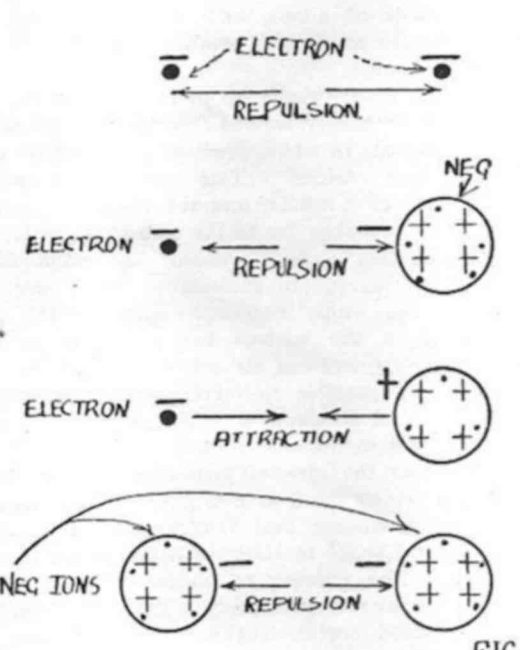


FIG 1.

neutral atom, or an ion is what exists after an electron is added to a previously neutral atom. If an electron is knocked from a normal atom, the atom then becomes a positive ion, having a deficit of negative charge. If an electron is added to a normal atom, that atom then becomes a negative ion having a surplus of negative charge. Fig. 1 illustrates diagrammatically the attraction or repulsion between electrons and positive or negative ions. It will be seen from Fig. 1, that two electrons, two positive or two negative ions repel each other, a negative ion repels an electron, a positive ion attracts a negative ion and an electron. There is weak attraction between normal atoms and strong attraction between a normal atom and an electron when they are near.

Positive and Negative Electrification.

When there is an excess of electrons associated with any body, it then acquires certain properties and is said to be negatively charged. When a body has less than the normal number of electrons, it is said to be positively charged or electrified. Electron current always flow from the "negative pole" to the "positive pole" in spite of the fact that it is usually assumed that electricity flows from positive to negative. This unfortunate state of affairs is due to the fact that one of the pioneer electrical experimenters arbitrarily named an electrification involving a deficit of electrons, a positive electrification, before the nature of electricity, as we understand it now, was appreciated. When a negative pole is spoken of a surplus of electrons is meant, when a positive pole is spoken of a deficit of electrons is meant. This is the one real difficulty involved in the electrionic theory; special attention will therefore be drawn to the actual direction of the electron current in batteries, transmitting and receiving valves, etc., to be published in later articles.

Electric Currents, Conductors and Insulators.

Solids are divided into two classes, conductors and insulators accordingly, as they do or do not conduct electricity. We have by now come to connect electricity with electrons and hence an electric current is a flow of electrons between two points of different potential. A conductor can, therefore, be regarded as a substance containing electrons which are free to move under the action of an electric field, while in non conductors (or

insulators) the electrons are fixed and unable to move or follow the impulse of the electric field, although they can be slightly displaced.

How are these electrons set free in a conductor? The only real good conductors of electricity are metallic substances, the atoms of which will readily part with an electron under the slightest influence of an electric current. It is well known

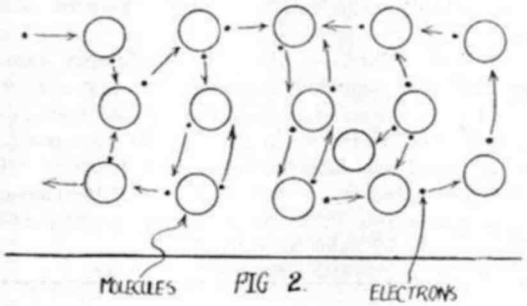


FIG 2.

that a charged body attracts light uncharged substances; probably every reader at some time or other has rubbed a stick of sealing wax and caused it to attract small pieces of paper. Hence an electron in one atom, is attracted by a neighbouring uncharged atom, and in the case of the atom only too ready to part with its electrons, the attraction may well be sufficient to enable it to make its escape under favourable conditions. Thus, a conductor when not acted upon by an electric current, may be looked upon as composed of molecules from which electrons are continually escaping for a moment. These electrons, if no electric force be acting, will be moving in all directions, so that if we take any cross section of the metal, the number of electrons crossing in one direction will be the same as the number crossing it in the other direction and so the transference of electricity across the section will be zero. If, however, we apply an E.M.F. to the body there will be a force on each electron urging it in the direction of the E.M.F. Thus in addition to the heat energy of the body, there will be a steady drift of the electrons as a whole in the direction of the flow of current.

Fig. 2 is an attempt to illustrate the conditions prevailing in a metal conductor when not acted upon by an E.M.F. and Fig. 3 shows the same conductor when acted upon by an E.M.F. and shows the electrons all moving in the same direction. It should be remembered that the conductivity of a substance depends solely on the number of electrons which are normally free from the molecules at any given instant.

Insulating Substances

are those in which the electrons are held tightly bound in the atoms. Thus electric currents cannot flow readily in an insulating substance because its electrons cannot move from atom to atom. Remember also, that there can be an electric current only when electrons are moved. Thus the difference between good and bad conductors or bad and good insulators is nothing more nor less than the readiness or otherwise with which their atoms will pick up and give out electrons. If, on an E.M.F. being applied, electrons are transferred readily from one atom to another, the substance is a good conductor. If the same E.M.F. is applied to another substance and only a very few electrons are transferred through the substance, the substance is considered a bad conductor. It will readily be seen from this that if no electrons are moved out of their atoms at all, the substance is a perfect insulator.

Definitions of Electrical Terms.

A number of terms are met with in almost every radio journal, which it is necessary to know the meaning of if we wish to understand the subject. Those most commonly used are: the ampere, the volt, the ohm, and the watt, whilst the joule, and the farad also need explanation. These terms may be defined as follows: The ampere is the name of the unit by which the rate of flow of a current of electricity is measured, or as it is more popularly termed, the strength of the electric current.

The volt is the name of the unit denoting electrical difference of potential or electro motive force (E.M.F.).

The ohm is the name of the unit denoting electrical resistance. All conductors offer more or

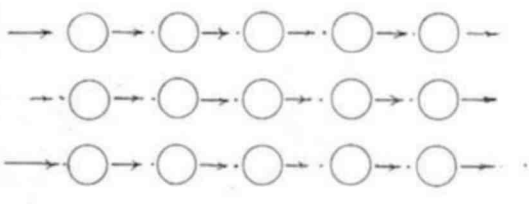


FIG 3

less resistance to the flow of electricity along them, the amount of such resistance depending upon the material of the conductor, its sectional area and length.

The watt is the name of the unit representing

electrical power, or by which the rate of doing work electrically is measured. Watts equals amperes x volts. One horse-power equals 746 watts. A kilowatt equals 1000 watts.

The joule is the name of the unit representing work done in an electrical circuit in a specified time.

The farad is the name given to the unit representing electrical capacity. The farad is too large for ordinary use and therefore a microfarad or one-millionth part of a farad is usually taken as the practical unit for radio purposes. A few questions which might reasonably be expected to be answered before the would-be transmitter can expect to be in possession of the necessary proficiency certificate. Each of these questions is governed by this article and from week to week these articles and questions will appear to assist our readers, not only in preparing them for the necessary examination, but also to add to their general knowledge of radio.

(1) Explain what you know about electronic theory.

(2) What is a molecule, atom and electron?

(3) Explain what you know about a dynamo.

(4) What is ionization?

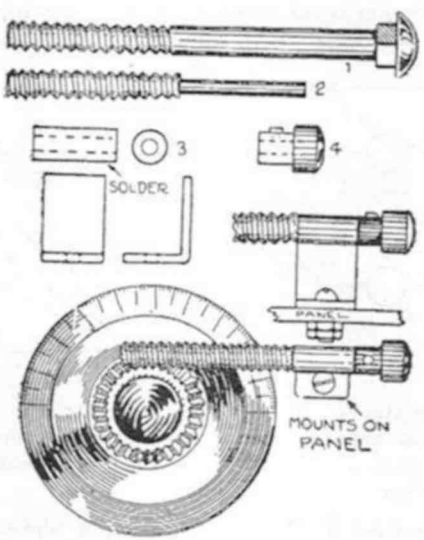
(5) Explain what you know about good conductors and bad insulators and bad conductors and good insulators.

(6) Define the following: volt, ampere, ohm and watt.

(Editor's Note. — Since the proficiency exam. also calls for knowledge of the Morse Code, we are now endeavouring to arrange regular transmissions of slow Morse from 2WW. If this matter can be finalised satisfactorily, this practice will be supplemented by a brief course of instruction in the paper, so that the acquiring of the code will be made as easy as possible.

VERNIER ATTACHMENT FOR DIAL OR KNOB

The vernier attachment shown can be applied to almost any one of the different types of knobs and dials in use. It is simple in construction, and efficient in operation and can be made without the purchase of any parts. The device consists of a bolt (1) which is cut off and turned down, as shown in sketch 2. The bracket and knob for this bolt are shown in 3 and 4. The bracket holding the bolt mounts on the panel in such a position where the threads will come in contact with the ribs of the knob or dial. The illustration is self-explanatory.



ATTACHING LEADS TO TERMINALS.

THERE is a right and a wrong way of attaching a wire to a terminal. If you hook the end of the wire round the shank of the terminal in an anti-clockwise direction and then turn down the milled headed nut, which is, of course, moved clockwise to tighten it, you will find that it tends to push the wire out. Reverse the process—that is to say, take a clockwise turn with the wire round the shank—and the nut will pull it in as it goes down. This may seem a pretty obvious hint, but it is surprising how many people either do not know it or disregard it. When making connections with flex, always twist the strands of wire tightly together with the fingers as a preliminary. If this is done all the strands are held by the terminal, but if it is neglected a good many of them make no contact at all. Where two or three leads have to be connected to one terminal it is sometimes difficult to get them all satisfactorily gripped. It will generally happen that one or more of the leads are fairly permanent connections, whilst the others are frequently connected and disconnected. In this case it pays to put an extra nut upon the shank of the terminal and to fix the permanent wires by means of it. The rest are gripped between the milled-headed nut and the extra one. When making several flex connections to a terminal it is best to twist them all together before placing them in the terminal. Where plain wire is used efficient connections will be ensured if a loop is made at the end of each lead with a pair of round-nosed pliers.

DUST COVERS FOR CRYSTAL DETECTORS

WHEN a crystal is purchased, it is usually soldered into a metal cup which is about a quarter of an inch in diameter. Connection from this side of the crystal to the circuit is therefore easy of accomplishment. The lead taken to the other side of the crystal to the circuit is therefore easy of accomplishment. The lead taken to the other side of the crystal, however, required delicate adjustment, and this is sometimes obtained by means of a fine wire spring joined to the end of the lead.

The area on the crystal covered by the end of the wire is therefore very minute, and the presence of a speck of dust or dirt between the crystal and the wire will render the crystal inoperative. The possibility of trouble in this respect can be greatly minimised by providing the crystal detector with a dustproof cover. One of the easiest methods is to procure from a chemist's or a draper's shop an empty celluloid powder box, large enough to cover the mounted crystal. It costs 1/6. Remove the lid and place the box, inverted, over the detector. Small holes can be pierced in the celluloid in positions convenient for the admission of the necessary wires connecting the crystal to the set. If a carborundum crytal is used, or any type to which a small voltage is applied, the leads from the crystal to the outer circuit should be well insulated. This method of supplying the crystal with a cover has the advantage of mobility.

The crystal will require constant adjustments if it is very sensitive and unless the cover can be removed and replaced quickly, the process becomes irksome. Another and perhaps better way, is to place the entire detector in the bottom of the box, taking the leads through notches in the edge of the lid and the box. It will then only be necessary to remove the lid of the box to adjust the crystal.

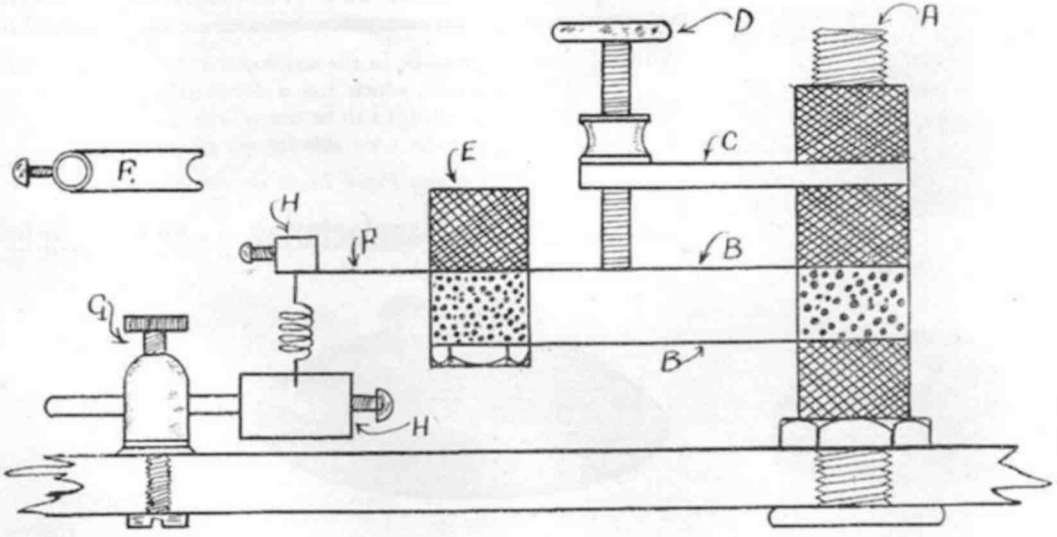
When winding coils it is best to keep the wire over a stove so that it will be warm when winding. It will then be found that after the coil is finished that the wires will hold tightly in place without the use of any shellac, collodion, etc.

This is due to the fact that the wire expands when it is heated and after it is cool it contracts, the result being that the coil becomes very taut.

A Universal Crystal Detector

By E. G. PATERSON.

THE instrument about to be described is one which should prove very useful to the experimenter as well as to the B.C. listener. In a few moments it may be changed from a cat-whisker type detector to the perikon type or the carborundum-steel type of detector. A diagram of the apparatus assembled as a cat-whisker detector is given in Fig. 1. The construction is very simple, nearly all the parts required being obtained from ordinary bicycle valves. For the standard "A" the body part of a valve is required, together with five bicycle nuts assembled as shown. The lowest nut clamps the standard to the baseboard, the next three act as distance pieces, and the top one clamps the whole rigidly together. "B" "B" are two pieces of thin springy brass (the brass case of an alarm clock does admirably) about $\frac{3}{8}$in. wide and $1\frac{1}{8}$in. long, having a hole at each end at $1\frac{1}{4}$in. centres, the holes being of such a size as to just be a snug fit on the standard "A." "E" is a piece of the body part of a valve about $\frac{3}{4}$in. long, and carries three nuts assembled as shown. "C" is a piece of stiff brass about $1\frac{1}{4}$in. long, $\frac{3}{8}$in. wide, and 1/16in. thick. One end is bored out to fit the standard, the other end has a nut soldered to it to carry the adjusting screw D. "F" is a piece of thin brass slotted at one end so that it may be slipped on to the standard E by slightly unscrewing the top nut. The other end carries H soldered to it to take the cats-whisker. H was obtained from an old lamp socket, and is the part the electric light flex is attached to. When the instrument is to be used as a perikon detector the part F is replaced by another slotted piece bearing a crystal cup at the other end, while for the carborundum-steel type of detector a slotted steel plate replaces F. The parts are changed in a moment; all that is necessary is to slacken off the top nut of E, pull out F, insert the required piece, and tighten up the nut again. The lower crystal cup consists of a small crystal cup soldered to a piece of stiff brass wire, which slides backwards and forwards in the terminal G. This allows the whole surface of the crystal to be readily searched. The two brass springs "B" "B" ensure a perfectly vertical movement of E and the part attached to it, which is absolutely necessary in the case of a perikon detector. The complete instrument might be mounted on a small slab of ebonite, together with a potentiometer and small battery, and in this form should prove very handy in experimenting with various crystal circuits.



. . High Frequency Resistance . .

By E. JOSEPH.

EVERY book on the subject of radio mentions the fact that the resistance of a conductor is higher when it carries a high frequency current than when it carries low frequency or direct current. This is a very loose, although convenient, way of stating the facts.

Actually the resistance of any metallic conductor —with, as far as we know at present, one exception —is quite independent of the nature or amount of current flowing in it. Of all physical quantities electrical resistance is probably the easiest to measure to a wonderfully high degree of accuracy. As an example, the author has in ordinary commercial work measured the resistance of a coil reputed to be 1 ohm, and has been able to ascertain the error even when the coil has actually been .99999 ohm, a departure from the reputed value of only 1/1000,000. In radio work there is only one metal with which we need concern ourselves. The resistance of copper has been the object of much close observation and research extending over the last 60 years, and very reliable data is available. There are only three factors controlling the resistance of copper. These are purity, hardness, and temperature. The admixture of almost infinitesimally small amounts of various impurities has the effect of greatly increasing the resistance. The hardening of copper by pressure such as is experienced in rolling sheets or in drawing wire, or by stretching, may increase its resistance by about 4 per cent. The resistance also rises 1 per cent for every 5 degrees Fahrenheit rise in temperature of the metal, and, of course, falls by the same amount on experiencing a fall of temperature. The investigation of the subject has been so thorough that it is possible to pre-determine the resistance of a piece of copper wire to a high degree of accuracy even before the wire is made, and our most accurate method of measuring temperature consists of noting the variation in resistance of a length of wire suitably arranged in the space of which the temperature is desired. The effects of hardness and temperature are small, and in comparison with the effect we are considering are negligible. The copper used for all electrical purposes is now so pure, being at least 99.9 per cent., that we may neglect this also, and may say that the resistance of a copper conductor is solely determined by its dimensions—that is, by its length and by the area of its cross section. Whence, then, arises the misconception that the high frequency resistance is higher than the D.C. resistance? Resistance is that property of a conductor which causes heat to be generated in it when a current passes through it. Heat being a form of energy, it follows that energy is wasted or lost in sending a current through a conductor. A large electric power supply system wastes many thousands of units in sending current through its mains. The resistance of a conductor may be measured by dividing the voltage maintained at its ends by the amperes flowing in it:

$$R = V/A \qquad (1)$$

From this we see that

$$R = A \times R \qquad (2)$$

This enables us to ascertain the voltage required to send any given current through a resistance. The power expended is measured in watts:

$$W = A \times V \qquad (3)$$

and if we put in place of V the equivalent value as given in (3), we have

$$W = A^2 \times R. \qquad (4)$$

From this we note the important fact that doubling a current in a given resistance causes four times the loss of power. This is easily seen, for double current requires double voltage, and doubling both V and A must quadruple W. Let us consider a bunch of 10 wires insulated from each other, each having a resistance of 1 ohm. Let them be formed into a single conductor by soldering them together at the ends as in Fig. 1. Let each wire carry a current of 1 ampere. Then using equation (2) we see that we use 1 volt. Using number (3) the loss in each wire is 1 watt. In 10 wires the loss is 10 watts and the current is

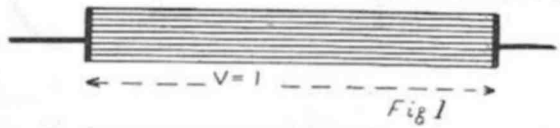


Fig 1

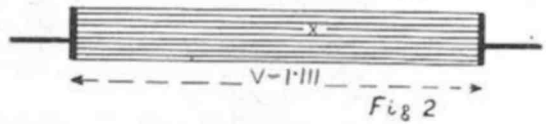
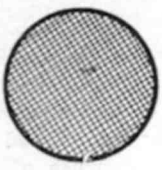


Fig 2

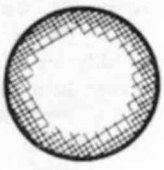
10 amperes. The pressure is still 1 volt, so that using number (1) the resistance is 1/10 ohm.

Now, suppose one of the wires to be broken at X, Fig. 2, without our being aware of the break, and that we still send 10 amperes through the system. Each of the 9 wires must carry 1 1/9 or 1.111

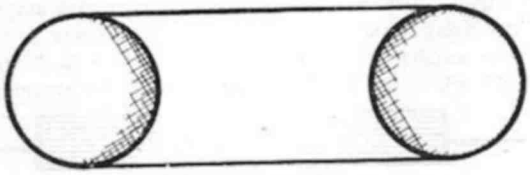
amperes. This will necessitate a pressure of 1.111 volts, and the power is 11.11 watts. The resistance is, therefore, 1/9 ohm. There is just as much copper in the arrangement of Fig. 2 as in that of Fig. 1, but it is not all utilised. In Fig. 1 the current is uniformly distributed over the available cross section, but in Fig. 2 it is not uniformly distributed. We may make the following generalised statement. Anything which causes a non-uniform current distribution, causes an increase in the resistance of a conductor. This is precisely what occurs when we send an alternating current through a conductor. The current does not spread uniformly throughout all the copper provided for it, so that we have less material available for use than we have provided. The disused portion is that at the centre of the conductor, so that the current flows mainly in the outer layers or in the skin. The phenomenon is therefore known as the "skin effect." It is more marked in an iron wire than in a copper one, is greater in thick conductors than in thin ones, and is less marked in conductors made of high resistance metals like german silver. It increases with the frequency, and while it is noticeable on 50 and 100 period circuits it is not important, but on 50,000 to 5 or 10 million periods it is very important, indeed. Truly it is a



DC
Fig 3



HF AC
Fig 4



HF AC Coil
Fig 5

mysterious phenomenon, but, more mysterious, it is more marked in a wire wound into a coil than in the same wire laid out straight.

I have prepared some diagrams to illustrate the effect. The thick circles represent the section of a conductor. The cross-hatching indicates the density of the current. Fig. 3 is to indicate what happens on D.C. Fig. 4 on H.F. and Fig. 5 represents H.F. in a wound coil. Note in the latter that the current is densest on the inside of the turns. There is, of course—as there is for all natural phenomena—a reason for this peculiar behaviour of the current. A current always tends to take the path offering least resistance to its flow. Anything which causes a loss of energy requiring the current to do work has the

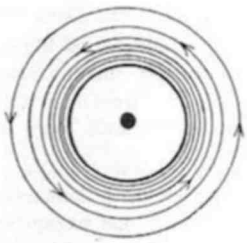


Fig 6

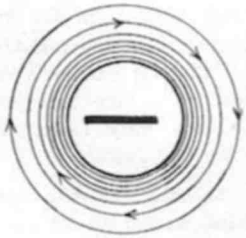


Fig 7

effect of apparently increasing the resistance, therefore the current, like humans, avoids as much work as possible by "going round another way."

A wire carrying a current is surrounded by concentric rings or lines of magnetic force. These lines have apparently a rotary motion, the direction of rotation being easily illustrated by a corkscrew. To insert a corkscrew we turn it clockwise. Fig. 6 shows the wire as before surrounded by its lines of magnetic force. The point in the centre represents the point of a corkscrew coming upwards through the paper, and the arrows indicate the direction in which a North Pole tends to move along the magnetic lines. Fig. 7 shows the reversed effect. The handle of the corkscrew is seen. It is going downwards through the paper and the arrows are reversed.

If the current is reversing in direction, the lines must reverse their direction of rotation. A current cannot instantaneously reverse its direction. It must fall to zero and then rise in the reversed direction. As the current falls, the magnetic lines collapse into the conductor and then the reversed series are thrown out. Now, remember that—arguments which apply to the current as a whole must apply also to any part of that current. Whenever magnetic lines move they induce in the medium through which they move a voltage which tends to cause a current to flow in the medium. The voltage depends upon the rapidity of the movement of the lines, and the direction of the current is such that it is opposite to the current which causes the lines to move. The strength of the current depends upon the resistance, of course. It will therefore be a maximum if the lines have to move in copper and minimum if they move in air. Our original current, true to reputation for avoiding work, must flow in such a path as will cause as

much as possible of its magnetic field to lie in the air outside the conductor, and as little as possible inside it. This is achieved by the current flowing as much as possible on or near the surface of the conductor.

It is now easy to see why in iron the skin effect is very marked, for owing to its magnetic properties it has the effect of increasing the number of lines and thus increasing the induced voltage and therefore the opposing current. In resistance wire like German silver the current is smaller, therefore the effect is less. In a coil the field inside it is more intense than in the space outside, therefore to minimise the opposing effect the current moves to the inside of the turns and forces most of its magnetic lines into the air space in the coil. The magnitude of the skin effect is very great. It has been proved that in a galvanised iron wire the current flows practically wholly in the thin zinc covering, and not in the iron. Heavy copper conductors, unless in the form of thin flat strips, are no better than light tubes, so that in powerful radio stations the inductances are wound of copper tube; air being far cheaper than copper, is used for the centre portion, which would carry no current. The measurement of high frequency resistance is impossible except in a few cases, and then only in a properly equipped laboratory and with considerable difficulty. Its pre-determination by calculation is not yet capable of great accuracy, but is sufficiently so to enable us to apply the calculations usefully towards reducing the lost power in transmitting stations and to increasing the efficiency and range of receivers. Dr. J. A. Fleming carried out many tests, and he found that a straight length of No. 14 S.W.G. copper wire had, at a wavelength of 340 metres, a resistance 7½ times as great as its D.C. resistance, and at 600 metres 6 times. A straight No. 16 wire at 600 metres had 4½ times as great as it D.C. Coiled up into an open spiral, the same wire at the same wavelength had 5¾ times as great a resistance. A No. 17 German silver wire at 600 metres gave a figure of 1-1/3. For the benefit of readers of "Wireless Weekly" who asked for information on this point, and for others who may care to apply it to trying to reducing the losses in their apparatus, I give the following method of ascertaining the H.F. resistance of copper:

R^1 = H.F. Resistance
R = D.C. Resistance
λ = Wavelength in metres
d = Diameter of wire in inches

$$\frac{R^1}{R} = \frac{1710 \times d}{J\lambda}$$

This means multiply 1710 by the diameter of the wire in inches and divide by the square root of the wavelength. The result is the number of times the H.F. resistance is greater than the D.C. resistance. As an example we will take a No. 16 wire 20 yards long. Its diameter is .064 inches and its D.C. resistance .15 ohm. Used on a wavelength of 300 metres we have the following:

R = .15 ohm
λ = 300
$J\lambda$ = 17.3
d = .064

$$\frac{R^1}{R} = \frac{1710 \times .064}{17.3}$$

$$= 6.32$$

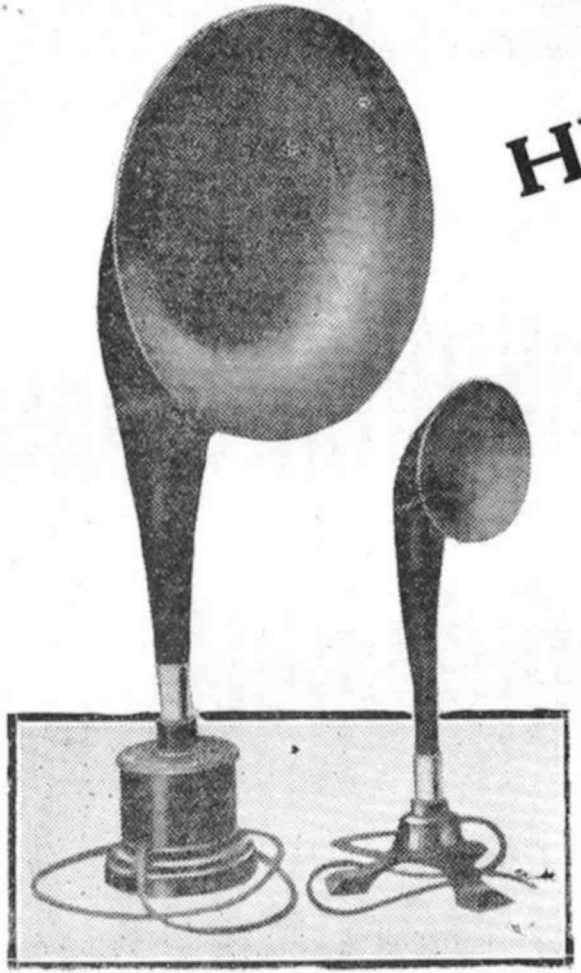
$R^1 = 6.32 \times .15$
$= .948$ ohm.

The above length of wire would be approximately doubled in resistance by being coiled into a close spiral. R^1 would then be 1.9 ohms. About 30 feet of such wire would be used in making a receiver for KDKA. Let us see what the resistance would be at 63 metres:

R = .075
λ = 63
$J\lambda$ = 8 nearly
R^1 = 1.02 ohm.

and spiralled it would be about 2 ohms. As to the use of information of the value of the H.F. resistance, it might be concluded that to make our losses a minimum, we should use as few turns as possible of large wire and use a correspondingly larger capacity. This is not the case. A tuned circuit may consist of a large inductance with a small capacity or a small inductance with a large capacity. They will both be tuned to the correct wavelength, but the current in the former will be small, that in the latter will be large. The voltage in the former will be large and in the latter small. By calculation of H.F. resistance and of other factors entering into the problem, we may determine the best proportion of inductance to capacity and the most convenient size of wire to use.

An outside aerial should be inspected at least twice a year. Insulators covered with soot and dirt should be cleaned thoroughly with a brush and gasoline. A layer of soot on the aerial, along the insulators to the pulley and thence to the pole or other supports, allows a lot of energy to leak off the aerial. If it can be afforded, it would be a good investment to replace the corroded and blackened aerial wire with bright new wire. Enamelled wire will not corrode and is worth while.



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Regarding Short Waves

To the Editor.

Dear Sir,—I trust the reception of short waves is still being carried out. To No. 1 (Mr. Deane), without the use of an aerial or earth or both. Feb. 20. To No. 2 (Mr. Allsop), who regards all aerials used in short wave reception to be aperiodic, and who when disconnecting his receiver from a loop and gradually moves way from the influence of the loop, beckoning his assistants to avoid disturbing the dying signals, is furthering his experiments in that direction. ("W.W.," Feb. 20.) To No. 3, Dit Dah ("W.W.," Feb. 27), who doubts the rudimentary aerial's efficiency and outlines an aerial for best reception of short waves, is still erecting them.

Now to business:

I intend to be as brief as possible in my remarks and statements, so to No. 1. "The practice of receiving signals minus aerials is as old as station ARK. The number of stations exceeding 1000 miles is as skimp as the hair on a bewigged gent.'s head." However, I do not wish to deery his attempts, and if he is still carrying out the good work, allow me to add: "Assuming your aerial has been dismantled, instal a 3 coil regenerative circuit; add, if you wish, one stage of L.F. Your receiver now should be one primary coil, earthed and shunted by a variable (low value) condenser to allow tuning of this circuit to the wavelengths of the stations sought (apply it to any wave), and the rest of the receiver will do the rest. Result—an increase in your list of stations heard compared with those (two Yanks) published in "W.W.," 20th February.

Turning to No. 2: The latter portion quoted to No. 1 and a little added will apply to No. 2 when he disconnects his loop or aperiodic aerial from the receiver. I am at a loss to refer to signals from KDKA on 63 metres, for with a monthly mail service the information regarding tests has passed, and discussions have commenced upon receipt of "Wireless Weekly," but I understand signals from that station were easily readable when the receiver was connected to the "aperiodic" primary circuit used by No. 2, and according to his own words signals disappeared when the disconnected receiver was removed from the influence of the aerial. When a circuit containing inductance and capacity (the aperiodic aerial circuit) say loosely coupled to another circuit (tuned secondary) is entirely removed from the latter, the necessity to retune the secondary circuit is obvious, and referring to signals of a readable strength, you can still hold those signals. 'Tis done at Port Moresby and Sydney. Why not at Randwick?

To No. 3. "Dit Dah, 'W.W.,' February 27." The foregoing remarks apply to reception of signals without aerials. Now, let's turn to employment of aerials. The use of an aerial is obvious, and the general practice is to erect an aerial whose fundamental wavelength nearly coincides with the wavelength normally used. This holds good on land commercial stations working at 600 metres, and what is the result? (Excluding a large capacity aerial to prevent brushing when transmitting with an output of 3 k.w. until late years, when lower power valve transmitters using 2 k.w. and less input have been employed.)

Receiving:

By the use of a tuned primary circuit, selective tuning and a maximum strength of signals for a given number of valves in the receiver. Substitute the tuned aerial circuit for an aperiodic circuit. Result: Everything that a commercial operator avoids—i.e., non-selectiveness and a bunch of harmonics.

Now, if an aerial whose fundamental wavelength nearly coincides with that of the wavelength to be received permits us to have selective tuning, a maximum transfer of energy from the primary to the secondary circuit, using (say) one valve, why not apply the theory to shorter waves? Before commenting on short waves, let's compare two aerials, one being approximately 600 metres, the other 1000 metres fundamentally. It is possible to use either aerial for the reception of stations transmitting on 600 metres. Having selected 1000 metres aerial, which is higher and presents a greater surface to the incoming waves, proceed to tune the primary circuit to 600 metres by inserting a condenser in series with the aerial. What happens? The received signals as the case may be are strong, with a roar of atmospherics (if present). I will purposely omit an aperiodic primary circuit. Right; the 600 metre aerial is then connected to the receiver, keeping the same station under observation. Result: Signal strength still strong, less atmospherics. Exit 600 metres and down to short waves. The fact of the use of an aerial, the fundamental wave being approximate to the received wavelength has always satisfied me in the past. In regard to signal strength, I am more than convinced that "the shorter the wave the shorter the aerial" to permit of the use of a tuned primary circuit. I admit having made use of an aperiodic aerial circuit for 40/120 metres only once, substituting for it one aerial circuit, TUNED, keeping out condenser capacities in the aerial circuit as much as possible by lengthening

the aerial in preferenee to condenser capacity and increase of primary coil inductance, for little inductance is necessary to transfer the aerial signals. I possess an aerial 15 feet high free end, 10 feet long, which permits me to use a tuned circuit. Am attaching last night's log for a few minutes, and also this evening's (15th). To those who perhaps may give short aerials for short waves a test, I would be pleased to see their results published.

Yours, etc.,

HARRY STEWART.

Radio Station, Port Moresby.

Calls heard between 10.25 p.m. and 10.40 p.m., Sydney and Port Moresby times, Saturday, 14/3/25—

At 8 p.m. station 4AC calling 4AA—prolonged call, about 40 metres STR 8.

Aus. CQ de 3BK, str. 9 (Sig. str. 1/9).

CQ de 2CM, str. 9.

3BK, str. 9.

CQ de 3JH, str. 9.

9DAW de 5BG, str. 9.

2YG, str. 9. Remarks: He says was first trying out set to give to wounded soldiers. Made it this afternoon—2 valves, 3 coil circuit, 3LO, QRN. No QRM from 2FC. Used Freshman Mercury condensers very selective, etc., etc. QRN bad here, etc. Aerial used here 15 feet high, 10 feet long—tuned primary, 3 coil circuit, 1 det., 1 L.F.

Calls Between 5.20 p.m. and 5.50 p.m., March 15th.

YANKS: 2BR, 6ABK, 6BRA, 6CGN, 6CGW, 7UI, 6RY, 6VC, 8CHK, 6CHX, 6CEI, 2ALE, 6CSO, 6RN, 6WP, 6DAH, 6CAN, 6BMO de N.K.F., 9AIO, 6AJI, 7CY, 7SE, 5ZAI. NKF/5ZAI logged 6.10 p.m. Aerial as above.

Will forward a list of stations heard on this aerial and circuit next boat. I will confine results to one evening, and give the exact times each station was transmitting. To date, best phone, 2HM, not strong. QRN generally A.4.

A Tuned Radio Frequency Amplifier

By W. A. STEWART.

THE receiver about to be described has numerous salient features, and will be found of use where an efficient radio frequency receiver is required.

Anyone who has tried an ordinary radio frequency amplifier has probably found that the set is too prone to self-oscillation, and is particularly hard to control. A potentiometer is required to control the oscillations, and as this piece of apparatus introduces losses, this is something we want to get away from. The receiver which I have just built has none of these disagreeable features, and is particularly simple to handle; the set has but three controls, and as all the dials are on practically the same setting for any given station, the tuning is simple.

The circuit is shown in Fig. 1, and a few moments' study will show that it is merely a standard circuit, the only difference being the way in which the coils are wound. They are what are known as "D" coils, and while they are nothing new, they have only been featured in a recent issue of an American publication. The wavelength range of the receiver is from 200 to 600 metres approx. But this is no drawback, as it is generally believed that before long our own broadcast waves will be in the vicinity of 600 metres. This receiver will then be ideal, although even at present there are plenty of stations in this band, broadcasting excellent programmes. Seeing that success or failures lies in the inductances themselves, we will get straight on to them. To make them you require three pieces of three-inch bakelite tube each 3½ inches long. With a hacksaw saw a slot an inch wide down the side of each tube, and saw it to within an inch of the bottom of the tube; directly opposite the slot saw another one on the other side of the tube. When this is done you have three pieces of tube which are shaped as follows: On the bottom there is a circle one inch deep and extending upwards from it are two sections of tube each two and a half inches high, and separated from each other on each side by a space of one inch.

Around the bottom of each tube drill four holes, and mark them 1, 2, 3, 4. In each of these holes place a contact stud. Next get two half-pound reels of 24 d.c.c. wire, and wind the transformers as follows: Take the end of the wire from one reel and secure it to stud No. 2. (This is the primary winding.) Take the end of the other reel and fasten it to stud No. 3, winding both wires on together as shown in Fig. 2, and keeping careful check of the number of turns. When a complete turn has been put on the formation of the wire should be as a "figure eight." If this is not so the coil has not been wound correctly.

When fourteen turns have been wound on, break the wire connected to stud No. 2, and take the end back and connect on to stud No. 1. This completes the primary winding, and it will be noticed that it is closely coupled and untuned, or aperiodic. Continue winding with the other wire until you have wound on 56 turns. Fasten off this winding and connect the end to terminal marked 3. The trans-

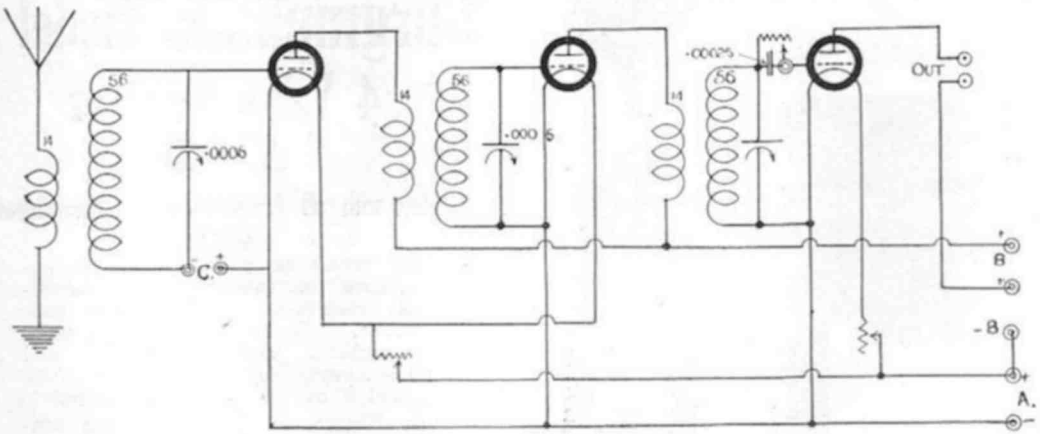
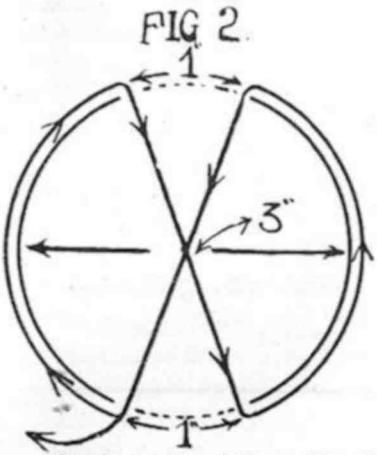


FIG 1.

former is now complete, and you can go ahead and wind the other two in the same manner. It is a good plan to test for short circuits, or breaks in the windings with a pair of phones and a battery.

The secondaries of each transformer are connected across a .0005 mf. variable condenser, which should be of the low loss variety for best results. Having built the transformers it is only a matter of connecting them up. Here you must be careful, as a wrong connection will throw the whole set out of balance. Terminal No. 1 of the aerial transformer is connected to earth, the aerial being connected to the start of the winding No. 2. Terminal No. 3



connects to the filament, and No. 4 to the grid. In the case of the second and third transformers, the plate of the valve connects to terminal No. 2, and the B battery to No. 1. The secondary connections are the same as in the first case.

After this it is plain sailing, and it is quite a simple diagram to follow. In mounting the coils keep them at least three inches apart, and if possible at right angles to each other. A variable grid leak is a necessity, and will be found of use. Only good gear should be used throughout, and all leads should be as short and direct as possible. The condensers particularly must be of a good make. In operation the set will be found to be dead quiet and quite simple to handle. If the volume is not loud enough, an audio amplifier can be connected to the output terminals in place of the phones.

The A and B battery voltages are not a bit critical, and in operation it will be found that the same station will come in on the same settings on the three condensers, that is, if the set has been properly built.

I think you will find this one of the best radio frequency amplifiers you have built, and on account of its low cost should be very popular.

WIRELESS KNOWS NO STATE BOUNDARIES.

Last week one of the engineering staff from Waddamana Hydro Electric Station, Tasmania, visited Farmer's Broadcasting Station to say how much the staff enjoyed listening to the programmes from 2FC.

In the course of conversation he stated that owing to the great amount of electricity in the atmosphere Waddamana could not pick up transmissions from Hobart, while Melbourne was also rather unsatisfactory. Station 2FC, Sydney, however, was extremely clear. The peculiarity of the listening-in lies in the fact that the best results from station 2FC are taken upon a receiver with only one valve in operation.

Waddamana is about 700 miles from Sydney.

Further proof of the all-Australian service being given from station 2FC, Sydney, is borne out by a choice from one morning's mail:—

M. Linklater, of Semaphore (S.A.), writes: "Am receiving your programmes perfectly."

C. H. Tuckey, of Sale (Victoria): "Receiving your transmissions 100 per cent. better than 3LO."

W. L. Moon, of Laidley (Queensland): "Heard every bit of your transmission on Sunday last."

W. J. Curtin, of Exeter (S.A.): "Listen-in successfully every night."

THE BEST KIND OF WIRE FOR WINDING TUNING COILS.

A GREAT deal depends upon the type of coil which is to be constructed and the method for varying the number of turns in a circuit. Enamel-covered wire is most suitable for coils to which a slider is to be fitted. Double cotton-covered or double silk-covered wire are about equally suitable for winding tapped inductances, the cotton-covered wire having perhaps a slight preference, because the thicker covering ensures a greater spacing between the actual wires of adjacent turns. Incidentally the cotton-covered wire is much cheaper. For honeycomb, basket, or duolateral coils double cotton-covered wire is most suitable. The silk covering frequently becomes damaged during the winding, especially upon the removal of the steel rods of the former of "spider." Single silk-covered wire is not recommended for use on any type of wireless receiving coil.

TRANSFORMER TESTS.

The excellence of AWA transformers is amply proved by this testimonial from David Jones Ltd.:—

(Copy.)

David Jones Ltd.,
Departmental Stores, opp. G.P.O.,
Sydney, 17th March, 1925.

Messrs. Amalgamated Wireless,
Clarence Street, Sydney.

Dear Sirs,—

We have much pleasure in handing to you a report of test carried out on the two particular A.W.A. audio frequency transformers supplied to us for test.

The test was conducted on a purely comparative basis against six other high-class well-known makes of audio frequency transformers as procurable on the Australian market. The apparatus was so arranged during transmission that it was possible by means of switches to throw in or out any particular combination of transformers, one make with another, or similar makes together, etc.

The result of the test proved that your transformers, as you claim for them, are equal to any of those which to date it has been our pleasure to test. I can thoroughly recommend these transformers to any person as two of the best yet that has been on this market.

In conclusion, I thank you for the opportunity of letting us have these instruments for test.

With compliments.

Yours faithfully,

(Sgd.) R. C. MARSDEN.

(For David Jones Ltd.)

CUTTING OUT INTERFERENCE.

For a long time radio fans in Stanford, U.S.A., were bothered with interference from the high power lines of the local lighting company and the railroad system; the latter being electrified, the trouble was believed to be coming primarily from that source. The interference finally increased to a point where it was practically impossible for fans to listen to broadcasts.

Finally, members of the Plate and Grid Club, a radio organisation composed of both listeners and amateurs of the American Radio Relay League, decided to take the matter into their own hands. The co-operation of the "Stanford Sentinel," a morning newspaper, was sought, and a committee appointed to interview railroad officials. Unaware previously that their lines had been causing trouble of this nature, these officials agreed to render any reasonable help even to the extent of de-energising the power temporarily.

The operators of several amateur stations, including K. O'Toole, city manager of the A.R.R.L., installed an eight tube super heterodyne receiver and a loop aerial in an automobile, and set out to locate the leaks. They visited first those sections of the city where the interference was known to be serious. Most of the electric light interference was found near the poles supporting transformers.

According to Mr. O'Toole the decrease in signal strength was not as pronounced while the car was running parallel to the lines as it was when passing through side streets at right angles. About half a dozen bad leaks were discovered and reported to both companies, with the result that the interference no longer exists.

MARINE MAN APPOINTED ACTING TRAFFIC MANAGER OF THE AMERICAN RADIO RELAY LEAGUE.

Hartford, Conn., Feb. 00.—F. E. Handy, of Orono, Me., has been appointed acting traffic manager of the American Radio Relay League for six months, during which F. H. Schnell, traffic manager, has been called to active duty as a lieutenant in the navy in order that he may accompany the Pacific Fleet for its forthcoming manoeuvres. Mr. Handy was formerly assistant division manager of the A.R.R.L.'s New England Division and operator of amateur stations 1XAH and 1BDI. He has been highly successful in communication with foreign amateurs.

The traffic department of the league, which has grown tremendously in the last few years, provides the only means by which messages may be sent to any part of the United States or Canada without charge. The membership of the A.R.R.L. at present numbers 20,000 amateurs, most of whom operate transmitting sets. The efficiency of the traffic system has been substantially increased by the appointment of official relay stations, owners of which are bound by promise to forward all messages received.

Mr. Handy will bring to the office the viewpoint and the experience of an amateur who has been in the field many years. He arrived in Hartford yesterday, and will begin his duties immediately pending Mr. Schnell's absence starting in March. While Mr. Schnell is with the fleet, he will conduct tests on short waves with amateurs in this and foreign countries. He will keep in touch with the A.R.R.L. headquarters by amateur radio.

2UW

THE LITTLE STATION WITH THE BIG KICK.

THIS station was among the first to start transmitting in N.S.W. The circuit used in those days of flat tuning and Q.R.M. was a Hartley, using a variometer and the wavelength was frequently among the commercial stations. However, after numerous complaints had been sent to Melbourne signals were sharpened up.

After experimenting with different circuits and methods of modulation it was decided that a 3 coil Meissner was the best. This circuit is still in use and has proved successful in all requirements, namely, selectivity, modulation and range. (Full details of circuit, studio, etc., will be published in this paper shortly). Over two hundred and fifty reports have been received during the last three months from Interstate listeners-in. These reports are on fone only and not Morse. They have greatly helped the advance of the station in as much as the modulation has been altered from time to time to rectify any faults mentioned.

2UW is extremely thankful for all reports received as they have helped to get the station to its present standard. A welcome is extended to any further reports all of which will be answered "over the air" and by card also. Your candid criticism and any suggestions will be extremely welcome.

The power of the station will be increased shortly (from the present 15 to 400 watts). It has been decided to clear the Studio of all sets and materials on hand to make room for the higher power transmitter.

Would listeners please note that 2UW is not an amateur station but a "B" class broadcasting station with authority to carry out regular programmes. Times as stated are:

Monday, Wednesday, Friday, 7-7.30 Bedtime stories; 8-10 evening programme.

Sunday: 9.30-1, 1.30-3, 7-7.30 bedtime, stories, 7.30-10.

THE PROGRAMME FOR SUNDAY, APRIL 12th, FROM 2UW.

7-7.30 Bedtime Stories.

7-30-10 Evening Programme. Miss Jean Kennelly (SSoprano).

(a) "Ulalty Song" from Toom Jones.
(b) Loves Cigarette.

Miss Bellamy (Piano)
(a) The Witch's Dance.
(b) Romance, by Salman.

Mr. Harold Bennett (Tenor)
(a) Mother Machree.
(b) Macushla.

Miss Anderson (Contralto)
(a) Slumber Sea.
(b) Auld Lang Syne.

Miss Dorothy Durant and Mr. Bennett (Duet).
Paradise for two.

Miss Roberts (Violin). (a) and (b) to be announced.

Miss Bellamy (Soprano)
(a) I wonder if Love is a Dream.
(b) Happy Song.

Mr. Dalton (Tenor)
I passed by your Window.

Miss Jean Kennelly
"At Dawning."

Miss Dorothy Durant
(a) Life's Lullaby.
(b) Love's a Merchant.

— - - - —

A PLAYLET

Actors: Jones (a clerk) and Brown (Wireless Weekly representative).

Scene: A sub post office in the city of Sydney.

Time, 4 p.m. Month, March.

ACT 1.

Brown: Approaching counter hurriedly, "I want to send a radiogram to the 'Aorangi.'"

Jones: Gazing blankly—"Aorangi, Aorangi, I don't know the name. Must be a foreign ship."

Brown: "She was lying at Circular Quay for a week and has been featured in every daily paper in Sydney. She left Sydney six or seven days ago."

Jones: "I didn't know it"—reaches for a list hanging on the wall—" hm, hm, she's not on my list yet"—scans it carefully—"No, I don't see it. She must be a foreign ship, so the rate will be 11d. per word."

Brown: (Reaching for his gun) "She belongs to the Union S.S. Co. and runs between Sydney and Vancouver on the All Red Route. If the rate to the 'Niagara' is only 6d., why 11d. for the 'Aorangi' of the same line and on the same run?"

Jones: "If she's not on my list, I can't tell you"—reaches again for list.

Brown: (Getting peeved) "Your list is fly-blown." Fires six shots rapidly, killing Jones, two messenger boys and a couple of counter attendants. Laughs loudly, takes his toothpick from his pocket and departs leisurely, humming a tune.

ACT 2.

Time: Ten minutes later.

Scene: G.P.O. Telegraph Counter.

Brown: (Entering hurriedly, approaches counter): "I want to send a radio to the 'Aorangi,' and . . . ."

Counter Attendant: "Yes, she arrives at Suva to-morrow, and is in touch with Pennant Hills. The rate is 6d. per word."

(Curtain)

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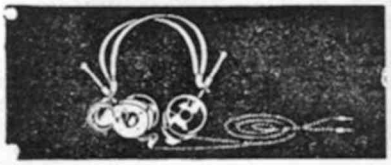
Your Dealer Can Suppiy You At These Prices



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One to four valves; can be put together with screw-driver and a pair of pliers. Prices, 5 to 11 **guineas.**

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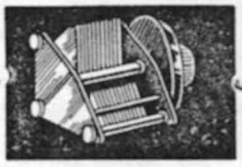
The de Luxe Loud Speaker. Has an amplifying bell of resonant wood. Price, £12.



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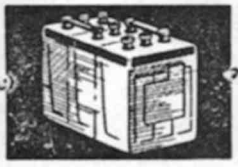
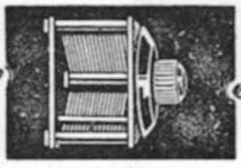


"UNITED" BATTERIES.
Made by the Clyde Engineering Co., Ltd. Announcements later. . .



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Guaranteed, correct, efficient, true inductance. Prices, 2/- upwards. Mounted & unmounted.

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Efficient. Fulfilling requirements of the Underwriters. Price, 2/6.

QUICKHEAT GRID LEAKS.
13 different capacities. 10,000 to 100,000 ohms. ½ meg. to 5 meg. Accurate.

"SIGNAL" DIALS.
Best grade bushings, absolutely true. Inlaid with fast white enamel.

BRANDES TABLE TALKER.
Strong and distinct. As mellow in tone as an old violin. Price, £4/15/-.

"SIGNAL" FIXED CONDENSER.
Grid and phone. Guaranteed. All capacities. .0001 to .004. Price 1/6

"SIGNAL" PUSH AND PULL POWER TRANSFORMERS.
—for more amplification. £3/3/- the pair.

DE LUXE COIL PANEL & COUPLING PLUGS.
Genuine Bakelite. True connections. Perfect fit. Easy adjustment.
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"ECHO" LOUD SPEAKER.
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2,000 ohm. Aluminium ear pieces 32/6
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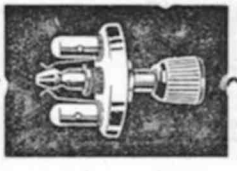

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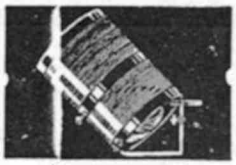

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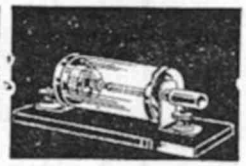

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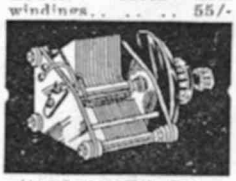

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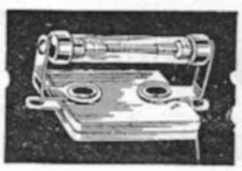
Brass or aluminium plates. Grounded end-plates. Self-centring bearings. Adjustable rotor. All capacities.



"MUTER" FIXED CONDENSERS.
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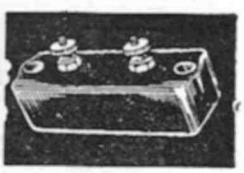

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Two valves. Added to any set increases strength of signals. For Crystal Sets, £4/4/- Power for Valve Sets, £5/5/-.

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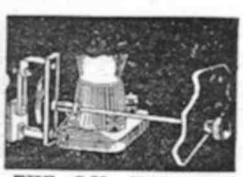
The scientific rheo.—for control of the ¼ amp. UV 201A-C301A type receiving tubes, & the UV199-C299 type.



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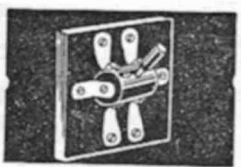

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Double throw. Double and single pole switches. Nickel plated. Mounted on ebonite. Suitable for use on panels or separate.

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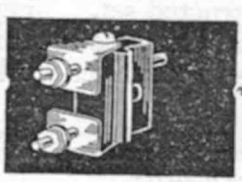

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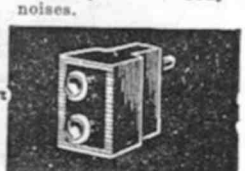

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PORCELAIN INSULATORS.
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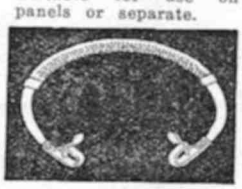

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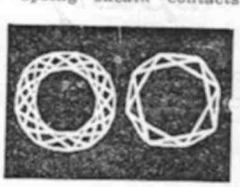

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