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Practical Wireless

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Practical Wireless

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ROUND *the* WORLD *of* WIRELESS

Another 60-Kilowatt Threat

ACCORDING to a French daily paper, Monsieur Legrand, the Director of Radio Normandie (Fécamp), hopes to erect a 60-kilowatt transmitter somewhere on the coast of North-West France to take over the duties of the present station now working on 10 kW.

Ultra-Short Waves in Italy

BOTH at Rome and Turin experiments are to be carried out with ultra-short wave transmitters operating on channels between 3 and 7 metres. It is intended to carry out tests in both television and ordinary speech and musical broadcasts.

P.M. Speakers are Sensitive

SOME speakers do require a rather greater signal input than others, but this is in no way concerned with either high-tension or low-tension current. As a matter of fact, however, the average present-day permanent magnet moving-coil is at least as sensitive as a speaker of the older "cone" type.

Great Britain Still Forges Ahead

DURING January, 1933, the number of listening licences issued by the Post Office was roughly 958,000, which brings Great Britain to the top of the st with 5,364,000 licensed listeners. The war against radio pirates is still being carried on, and in the course of one month over two hundred prosecutions resulted in fines amounting in all to approximately £235.

Have You Logged these Short Wavers?

ALTHOUGH its power is only 250 watts, transmissions from YV11BMO, Maracaibo (Venezuela) are now frequently heard by listeners in the British Isles. The wavelength is 48.95 m. (6,127 kc/s), and the call between programme items *Aqui Estaçion radiotelefonica de Maracaibo, La Voz de Lago*. In addition to a broadcast news bulletin at midnight, sponsored concerts and studio entertainments may be picked up between 12.30 and 3.0 a.m. G.M.T. On a slightly lower frequency, namely 6,115 kc/s (49.1 m.) from 10.0 p.m. G.M.T. onwards it is also possible to hear YV1BC, Caracas (Venezuela), of which the interval signal consists of four chimes on a clock gong. Both studios announce in the Spanish language.

Paving the Way for Lucerne

UNDER the chairmanship of Admiral Sir Charles Carpendale, of the British Broadcasting Corporation, a conference of the *Union Internationale de Radiodiffusion* has been held at the Palais des Academies, Brussels. Its aim has been to prepare a new plan for the allocation of wavelengths to European broadcasting stations in order to mitigate the interference resulting from the ever-increasing number and power of the transmitters. The work was entrusted to the members of the U.I.R. by the Madrid conference in anticipation of the meeting of European State delegates which will take place at Lucerne during next May. It is hoped to draft out a new plan to replace that worked out at Prague in 1929 following the decisions taken at the Washington Convention of 1927.

Fading

THOSE readers who have been recruited to the ranks of radio amateurs during the last six months or so, will probably have been somewhat perturbed, when listening to a distant transmission, to find it gradually fade from full loud-speaker strength to inaudibility. They may at first have thought that their H.T. or L.T. was running down, but if they have left the set alone and kept on listening they will have noticed that after an interval the signals have come back again to full strength. The phenomenon is known as fading, and is caused by atmospheric changes. Fading is most common during hours of darkness when reception conditions are otherwise at their best. In the case of the average set, there is no cure for fading, but it is possible to overcome the trouble by means of an automatic volume control.

Amateur Transmission

FOR the past few weeks we seem to have received innumerable queries from readers who ask for particulars of wireless transmitters. In some cases we have been able to offer suggestions, in others we have referred querists to the paragraphs on transmitters given in our 'Wireless Constructor's Encyclopædia,' but in a few instances we have been unable to supply the information requested. Quite a number of querists have entirely overlooked the fact that a special kind of licence is required before operating even the simplest form of transmitter, whilst one querist had actually commenced transmitting without giving a thought to the licence question. In reply to the latter gentleman we were obliged to warn him that if he continued his activities he would be liable to heavy penalties.

The New Lisbon Station

IT is reported that the 20 kilowatt transmitter which is being erected at Barcarena in the immediate neighbourhood of the Portuguese capital will be ready to carry out tests towards the end of next August. It has been so designed that its power can be increased at a future date. The wavelength to be used is 283.6 metres, a channel which was originally conceded to that country by the Plan de Prague. In the meantime an irregular broadcasting service is provided by CT1GL, a small station owned by an amateur radio club at Parede, some eight miles from the capital, and by CT1AA, a 2 kilowatt transmitter operated in the centre of the city.

English Concert from Ljubljana

THE all-English concert which is broadcast from this station on 574.7 metres every Wednesday evening between 5.0 and 5.30 p.m. is provided by the same programme organisers who are responsible for the special transmissions to British listeners regularly made by Radio-Paris, Toulouse and Radio Normandie.

BUILDING THE A.C. FURY FOUR

SEE PAGES 1096 to 1098

THE Q.P.-P. THREE-FOUR

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SELECTIVITY SIMPLIFIED

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ROUND *the* WORLD *of* WIRELESS *(Continued)*

How Radio Prolonged the Life of Rabbits

A NEW YORK bacteriologist whose house had been ransacked by burglars induced his local broadcasting station to put out the following announcement: *The uninvited visitors who stole, amongst other articles, five rabbits from Dr. ——'s private house are warned that they were recently inoculated with a virulent bacillus—they should not be eaten.* The rabbits were sent back to their owner the next day!

The Voice of a Dusky Maid

AT regular intervals you may pick up Oriental concerts from Radio Algiers, Arab musicians singing to the accompaniment of native string instruments. To give these broadcasts their true atmosphere listeners are claiming that announcements should not be confined to the French language, and Radio Algiers will shortly appoint an Arab girl to fulfil these duties. Many have applied for the job, but as is customary with most French studios, listeners are to act as judges and select by vote the voice which pleases them most.

Welsh on the Ether

THE B.B.C. has accepted a recommendation made by the Central Council for School Broadcasting and from September next will give experimental courses on Welsh language, literature and history. These will be transmitted through the West and North Regional stations.

The New H.M.V. Super-power moving-coil loud-speaker.

First Official Egyptian Broadcaster

IN anticipation of a Radio Exhibition held at Cairo during the period February 10–25, a 500 watt station was formally inaugurated on February 1. The station has been working on 250 metres. The exhibition has been used for the purpose of popularising radio as it is now announced that the 15 kilowatt station at Abu-Zabal, constructed by the Egyptian branch of the Marconi Company, may be brought into operation next month.

Listen to Lithuania

RIGHT at the top of the "long" wave band, above Hilversum, you may hear on 1,935 metres a call—*Radio Kaunas*; it emanates from Kovno (the capital of Lithuania). The opening signal consists of a few chords struck on a piano followed by a ticking metronome. The main evening broadcast is at 8.0 p.m. G.M.T., and dance music is frequently broadcast from 8.45 until 9.30 p.m. The station closes down with the call *Labanakt Lietuvos Radio Kaunas* (Good night, Radio Kaunas of Lithuania), followed by a gramophone record of the National Anthem (*Lithuania, Our Fatherland, the Land of Heroes*).

New Wireless Bill in France.

UP to the present the owner of a wireless receiver in France paid no listening tax; he was merely required to register with the authorities and to procure a certificate costing *one franc*. The new wireless Bill calls for a higher tax, namely, 15 francs per annum for crystal sets; 50 francs for private owners of valve receivers; 100 francs for cafés, restaurants, etc., and double that amount yearly for public relays of broadcast programmes if an entrance fee is charged. In addition, the State will collect an extra 15 per cent. of the wholesale price of valves from all makers.

Athlone Calling

MANY listeners by now will have heard the powerful transmissions put out by the new 80 kilowatt Irish Free State station at Athlone. With the exception of Sundays, when it only comes on the air at 8.30 p.m. G.M.T., the station opens up daily at 1.30 p.m., with a time signal, stock exchange report, weather forecast, and gramophone concert. No further broadcast is made until 6.0 p.m., when records are again given and are followed by a children's hour (*Uair i/dTir na nog*). From that time until 10.30 p.m., when the last news bulletin is given, the Dublin studio provides a continuous broadcast. Announcements are made in both English and Gaelic. On Sunday afternoons, Cork and Dublin frequently relay running commentaries of athletic sports (football matches, etc.), but it is seldom that such items are mentioned in the published programmes.

SOLVE THIS!

Problem No. 23.

Pattersen's receiver was giving very unsatisfactory reproduction, quality being inferior and volume very poor for a Detector and two L.F. type of receiver. Purchasing a voltmeter he tested H.T., G.B. and L.T. batteries. L.T. was fully up to the requisite 2-volts; the Grid battery read the full 9 volts, and the H.T. also read the full voltage, namely 120 volts. The loud speaker was a balanced armature with a resistance of 2,000 ohms, joined direct in the anode circuit of the output valve, the anode current of which is 18 milliamps. The first valve is an R.C. type, coupled to the first L.F. valve which is in turn coupled to the output valve. What was the cause of his trouble? Three books will be awarded for the first three correct solutions opened. Address your solutions to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, London, W.C.2, and mark the envelope, Problem No. 23.

SOLUTION TO PROBLEM No. 22.

Dobson's H.T. battery had become nearly exhausted, and consequently the Grid Bias should have been reduced accordingly. As Dobson had left the plugs untouched, the bias was much too high for the H.T. voltage applied to the valves.

The following three readers received books in connection with Problem No. 21.

F. A. Prior, 38, Mountgrove Road, Highbury, N.5. H. B. James, "Hailsham," 204, Woodman Road, Brentwood. W. J. Blackmore, Mess 2, H.M.S. Duchess, c/o G.P.O

The Empire Broadcasts

POSSIBLY in the near future we may see a twenty-four hour British broadcast service as artists and other microphone personalities are showing interest in the Empire broadcasts to such a degree that they are offering to go to Portland Place at any hour of the day or night. To supply programmes to the five zones which are incorporated in the Empire Service, if the Blattnerphone is not to be used, entertainments must be given at very late hours. Recently the Prince of Wales turned up at Broadcasting House in the morning to give New Zealanders a midnight transmission. On March 2nd and 3rd A. J. Alan will tell the story of "A Joy Ride" to National and Regional listeners, and three hours and a half later will repeat it for the Canadian Zone. Thus British broadcasting draws daily nearer to a continuous service throughout the day and night if its transmissions are to be heard by all the colonies and dominions.

Vatican Ultra Short-wave Transmitter

ON February 11 the Pope opened the new ultra short-wave transmitter, which assures a two-way communication between the Vatican (Rome) and his summer palace at Castel Gandolfo. The station, the first in the world to operate on a 57 centimetre wavelength, was erected under the personal supervision of the Marchese Marconi, who broadcast the opening address. The ceremony was relayed to the Vatican transmitter and through this channel was picked up by the Columbia network for the benefit of listeners in the United States.

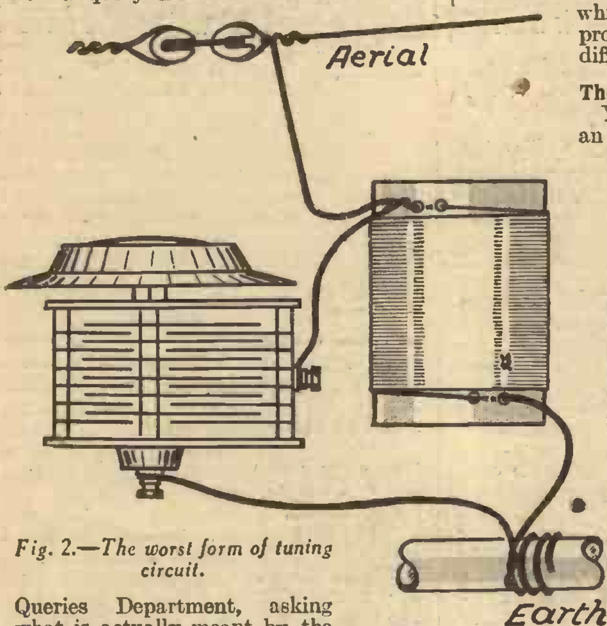
Where Hallo is Not Hallo

IF you happen to tune your receiver to a reading slightly above that of Buda-Pest, you should hear the Wilno (Poland) transmissions. If you do you may notice that the woman announcer does not give the cheery *Hallo* put out by, say, Warsaw or Katowice, but uses the Polish word *uwaga* (phon.: *oo-var-gha*). For most of its programmes the station turns to the capital, but it possesses a distinctive interval signal, the call of the cuckoo. Make sure, however, that it *is* Wilno you have heard before entering it in your log as Ljubljana (Yugoslavia) gives out a similar bird-call.

SELECTIVITY SIMPLIFIED

An Explanation of What is Meant by the Term "Selectivity," Together With Some Notes on How to Obtain It, by W. J. DELANEY

THE word "selectivity" is constantly appearing in articles in these pages, and on more than one occasion a query has been addressed to our Queries Department, asking what is actually meant by the term. It is, of course, quite obvious that it has something to do with "selective," which is an ordinary dictionary word meaning "choosing or picking."



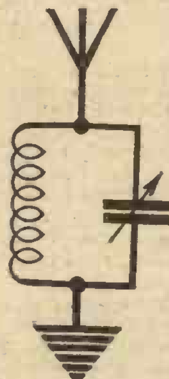


Fig. 2.—*The worst form of tuning circuit.*

Another expression which is often used in the same connection is "sharp tuned," and this also should be self-explanatory. There are many readers, however, who do not know sufficient about the electrical side of wireless to fully grasp what is meant by the term. I will, therefore, try to define, with a simply analogy, the expression "selective."

It is quite a common practice for writers of radio articles (especially those which are prepared for beginners), to try to draw a comparision between the tuning-in of different stations and the tuning of a musical instrument string to a certain note. This is not, in my opinion, a very clear explanation, especially for the young, or non-technical reader. I shall, therefore, ask you to forget any explanation which you may have read, and attack the subject from an entirely different point of view.

The Transmitter

Every listener knows by now that each transmitting station employs a separate wave-length, or in other words, the programmes sent out by each station are described as being "tuned" to a certain frequency. There is no need to bother about the method by which this is done, or even what is meant by the term. Simply remember that each station is of a different frequency, without even worrying about what "frequency" means. When the idea of reception has been fully understood, then is the time to study the meaning of the various electrical terms, but doing so now will only confuse you. Very well, then, we have got to the point where we are aware that each programme (by which I mean each station's programme), is sent out at a different frequency.

The Receiver

Your receiver is joined to an aerial which is erected, in most cases, out in the open. This provides the entry to the receiver, and therefore, all signals which you receive must pass to the receiver (and ultimately to the loud-speaker) *viâ* this aerial. It is, of course, quite obvious, without any electrical knowledge at all, that the aerial is in a position to pick up everything in the way of electrical energy without taking any notice of individual stations. It, is in fact, no more than a lightning conductor in this respect. We have now arrived at the point where a very interesting analogy may be made so that a perfect understanding may be obtained. Everyone is familiar with the steel ball-bearing which is used in the bicycle, motor-car, etc. These are obtainable in various sizes, and at the factory where they are made a very simple form of graduating device is employed. Look at Fig. 1. At the top of this illustration is a sloping trough, very narrow, and provided with high sides. These are removed in the illustration so as to show the working more clearly. At intervals along the bottom of this trough are punched holes, the one at the highest end being very small, and each succeeding hole being a fraction larger. At the bottom (lower end) of the trough we find the largest hole. All the ball bearings are mixed up when coming from the final polishing-room, and have, therefore, to be sorted into their individual sizes in order that they may be sent to the appropriate firms according to the uses to which they are to be put. A long chute (a sort of "helter-skelter") brings the balls in a continuous procession, one behind the other, to the sloping trough which we have illustrated. Can you see what happens now? As the balls run down this slope it is obvious that ball No. 1 in the sketch will run across the first few holes, but as soon as it arrives at a hole of the same diameter as itself it will fall through, and so be carried to its appropriate box. The smaller ball, 2, will drop through the appropriate hole, and so be carried to its box. This is quite a simple arrangement, and, I think, everyone will clearly understand the idea upon reading the above notes.

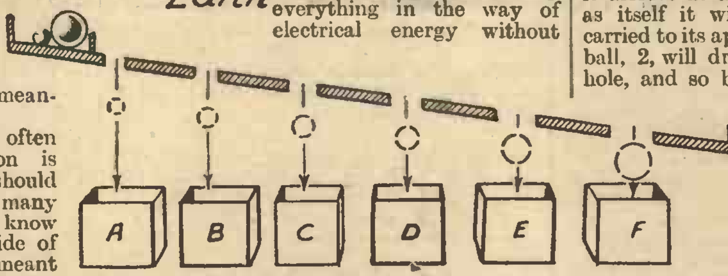
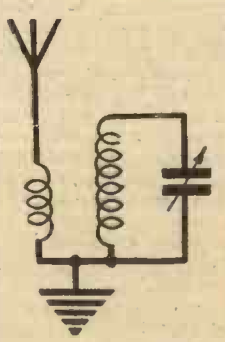


Fig. 1.—*A diagram explaining the principle of selectivity.*

The Tuning Condenser

The helter-skelter arrangement described above is the ether or, if you prefer it, the air between the transmitter and the receiver. The sloping trough is your aerial, and the boxes beneath are the means of conveying the signal to the speaker.



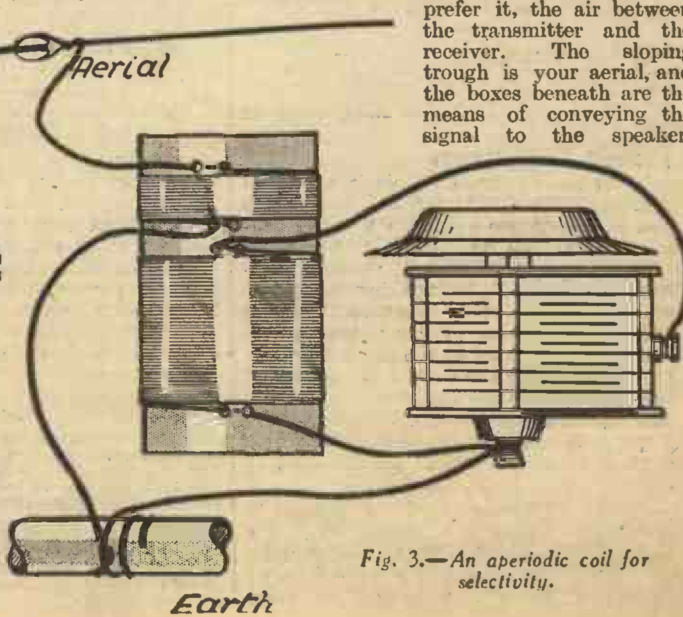


Fig. 3.—*An aperiodic coil for selectivity.*

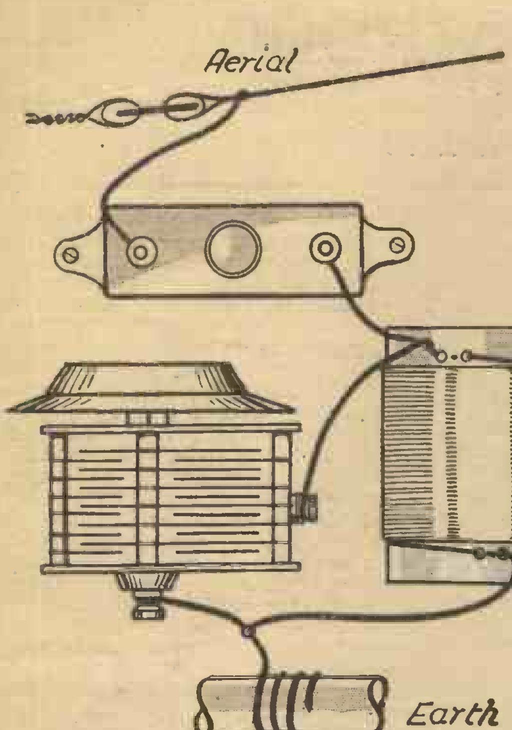


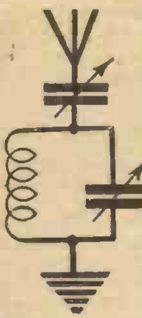
Fig. 4.—A series condenser used to improve selectivity.

The only part of the illustration which we have not compared is the holes. This is the whole secret of "selectivity," which, after the above explanation, you should now be able to see, simply means a separating into classes, or picking out one individual to the exclusion of all others. The aerial in every set is joined to a coil which is, in turn, joined to earth, and therefore, the aerial may be considered as one wire starting at the lower end of your garden, running down into your room, round and round a tube of either ebonite or cardboard, and then carrying on to a piece of metal buried in the ground. Consequently, all signals which may pass across your garden will affect your aerial, or you may imagine them as running down the aerial, through the coil, and so to earth. As you only want to hear one station, or programme, at a time, it is necessary to arrange that the particular programme will pass on to the valves, and that all others will go to earth without any effect on the coil. Can you see the analogy now to the ball graduating device above ?

Different Aerial Circuits

The simplest aerial circuit is shown in Fig. 2, and consists of a coil having one end joined to one side of a variable condenser, and the other end joined to the remaining terminal of a variable condenser. One end is also joined to the aerial, with the earth taken to the other end. This device is very unselective, and may be likened to the sloping trough, in which all the holes are more or less of the same size, with the result that small balls will drop through together with larger balls, and the boxes will, therefore, contain an assortment of balls instead of balls of only one size.

The next circuit is shown in Fig. 3, and is known as the Aperiodic Aerial circuit. Now, instead of the aerial and earth being joined to each end of the coil, only a few turns of wire are included between these points, and this small coil is arranged close to the large (or grid) coil. All the signals will still pass through the small coil to earth, but in addition, owing to the close proximity of the larger coil, some of the signal currents will be induced into this other coil. Another way of explaining this is to imagine the small coil to be the trough of our graduating machine, and the extra coil and condenser as the particular box in which we are interested. All the balls (signals) will pass along the trough, and the adjustment of the tuning condenser will correspond with the alteration in the size of the hole. When therefore the condenser is adjusted so that it corresponds with the size of ball we want, that ball will drop through, the others passing on. If the two coils are arranged close together, the effect will be the same as badly graduated holes, or in other words not only the required station, but others, will pass through. As the distance between the coils is increased, so we reduce the tendency for signals to pass across, unless the signal is of the same frequency (size) as the frequency of the second coil and condenser. If therefore your tuning arrangement consists of a non-tuned coil coupled to a tuned coil, as shown in this illustration, and you have difficulty in picking out one station to the exclusion of all others, you must contrive in some way to increase the distance between them. Obviously, as the distance is increased, less power will get across the gap, and this brings us to the first important statement. Improved selectivity can only be obtained at the expense of signal strength.



The Series Aerial Condenser.

A very common method, often recommended for increasing selectivity, is the inclusion of a small semi-variable or fixed condenser between the aerial and the tuning coil. This is certainly a good method of improving selectivity, but it has its drawbacks. If you have such a condenser in your receiver tune to Radio Paris and, when accurately tuned in, join a short piece of wire across the terminals of this condenser. In the majority of cases there will be a most marked increase in strength. Therefore the series aerial condenser should be provided with some arrangement so that it may be short-circuited when the coil is tuned to the long waves.

If your receiver employs a commercial coil, and you do not wish to interfere with it, a very simple arrangement for improving selectivity is to wind over the existing coil a few turns of fairly thick wire, say 22 gauge, D.C.C., at the end of the coil which is joined to earth. The lower end of this additional coil should be joined to earth, and the beginning of it to aerial. By experimenting with various sizes of coil, spacing between turns, and spacing away from the coil by means of match-sticks, etc., different degrees of selectivity may be obtained, and a compromise found between selectivity and signal strength (Fig. 5).

Probably the most selective tuning circuit to-day is the Band Pass filter, which consists of two separate tuned circuits (similar to Fig. 1), and these are each enclosed in a metal screening box, and therefore isolated. Obviously, from what I have already said, you will see that the signals will pass through the first coil to earth. This is the chute arrangement. The second coil of the Band Pass filter is the collecting box, and the hole graduating device is included by means of a condenser, a resistance or a small coil. This is joined between the lower end of the two coils, and when each tuned circuit is accurately adjusted to the frequency of the station you wish to hear, that frequency can pass through the coupling medium, and so it is possible to select that station to the exclusion of all others. There is not the slightest doubt that this method of tuning the aerial circuit is the most efficient, and although there is a slight loss of signal strength, as I have already pointed out, this is so small in a correctly designed Filter, that it may almost be said not to exist.

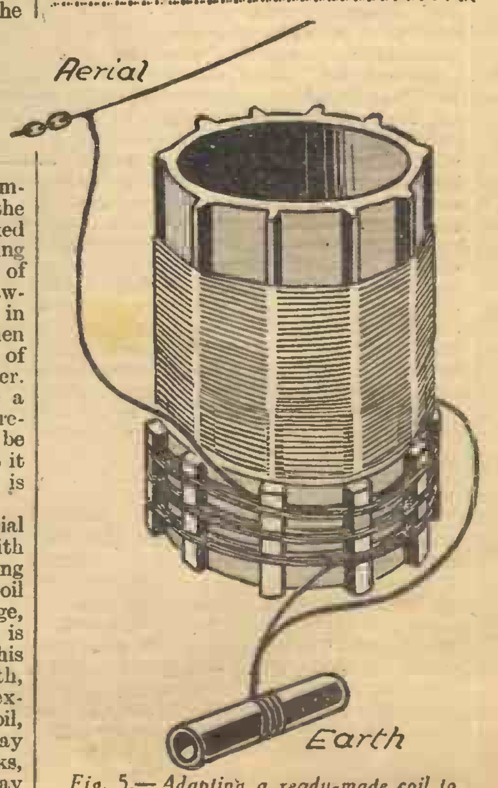


Fig. 5.—Adapting a ready-made coil to improve selectivity.

WHAT IS WRONG?-2

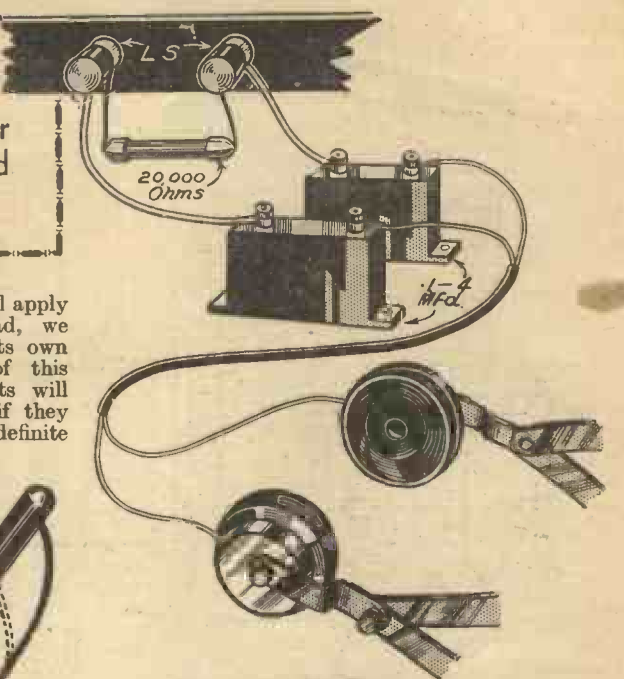


Fig. 7.—The method of connecting a pair of 'phones to the loud-speaker terminals of a powerful set operated from the mains.

In the Second Article of this Series the Author Deals with the Subject of Anode Voltage and Current Tests

By FRANK PRESTON, F.R.A.

LAST week I described the necessary apparatus for fault finding, and briefly mentioned a few preliminary tests. And now I want to explain how the more intricate forms of trouble should be dealt with by isolating the various circuits and testing each in turn. It is, of course, a difficult and almost hopeless proposition to attempt to diagnose a complaint by studying the receiver as a whole. Just as a medical doctor feels the pulse, listens to the heart-beat, taps the chest, and examines the tongue of his patient, so must the wireless "doctor" examine every part of the receiver in order to locate the region of the trouble. Having tracked it down to a certain part of the circuit, it should not be difficult to discover the actual source by following a process of elimination.

Causes of Trouble

Before proceeding further, let us set out in order the various kinds of troubles and ailments to which a set is heir. We can put these under the following headings :—

1. Entire absence of signals.
2. Weak reception.
3. Reception accompanied by "noises," or crackling.
4. Distortion or poor "quality."
5. Instability (often indicated by various noises).

We cannot treat the above five complaints as if they were all quite different, since very often, two or more of them go hand-in-hand so that one obscures the other. For the same reason we cannot formulate a series of tests which will apply in each case, but instead, we must consider each on its own merits; it is because of this that our preliminary tests will have been helpful, even if they have not given us any definite clues.

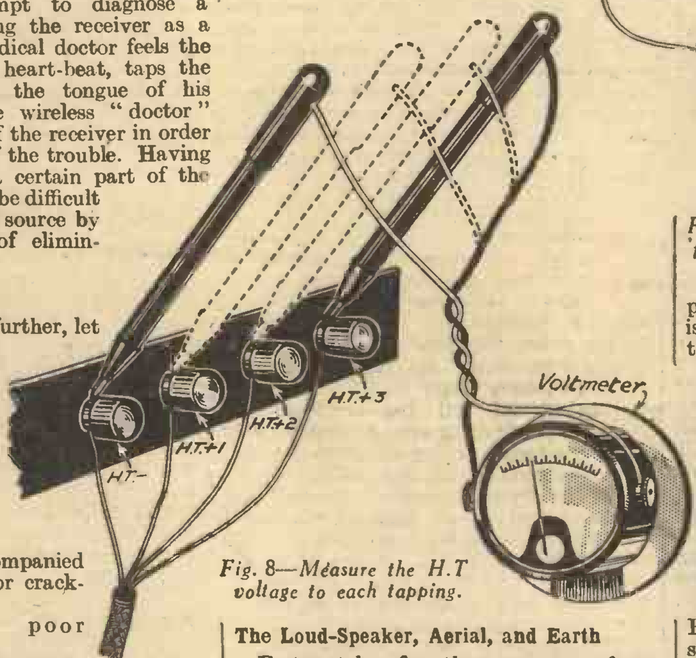


Fig. 8—Measure the H.T voltage to each tapping.

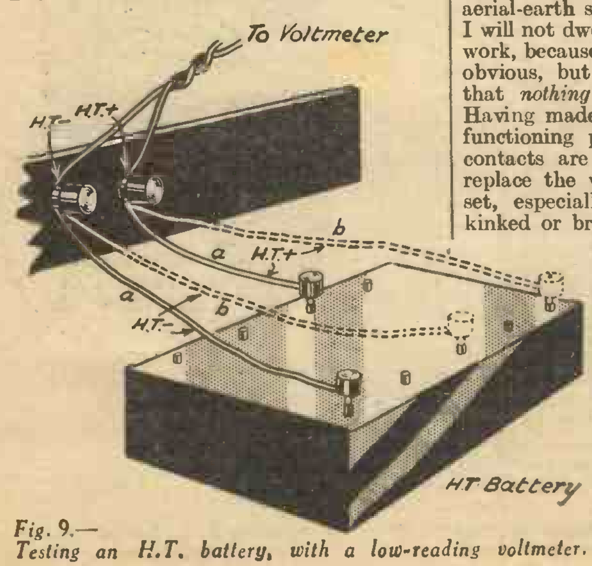


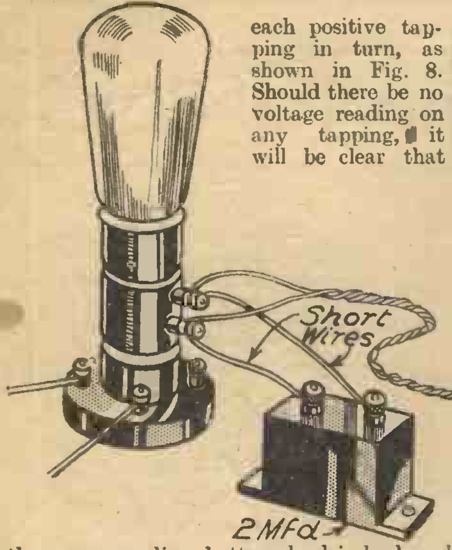
Fig. 9.—
Testing an H.T. battery, with a low-reading voltmeter.

The Loud-Speaker, Aerial, and Earth

Fortunately, for the purposes of our present tests, we can treat the complaints numbered 1 to 3 above in a similar manner, and so, for the time being, we will consider them jointly. Before testing the receiver proper it is essential that we should satisfy ourselves that the batteries, speaker, and aerial-earth systems are as they should be. I will not dwell too long on this part of the work, because most of the tests will be very obvious, but I would emphasize the fact that *nothing should be taken for granted.* Having made quite sure that the aerial is functioning properly and that its switch contacts are clean, it is a good plan to replace the wires from the switch to the set, especially if they are in any way kinked or brought through the window in such a manner that they are trapped between the frame and the sill. Any odd lengths of wire may be used for the purposes of test, and they may be replaced by new ones later, if this is found necessary. Should any doubt exist in regard to the speaker it may be replaced by a pair of 'phones, after taking care to reduce the volume control to its minimum position. This test should only be applied in the case of a set having a small power valve, because if the anode current is high there will be a danger of damaging the 'phones. On no account should the test be applied to a set operating from the mains or from an eliminator, unless special precautions are taken against the possibility of receiving a shock. Suitable precautions are to connect the 'phones through a pair of large-capacity (.1 mfd. to 4 mfd.) condensers, as shown in Fig. 7. The condensers will prevent the passage of D.C. anode current through the 'phones, and therefore, a by-pass resistance of some 20,000 ohms must be connected directly across the speaker terminals (also shown in Fig. 7). If this test indicates a fault in the speaker, try new connecting wires before rushing it off to the makers for repair.

Battery Tests

And now we can test the batteries. The first thing is to "break" and "make" the high-tension circuit, either by pulling out the negative wander-plug or switching the eliminator off, and then on again. As this is done there should be two distinct "plops" in the speaker; if not, there is probably either a run-down battery or a faulty connection. Next measure the voltage of the H.T. and L.T. batteries between the appropriate terminals of the set whilst the latter is switched on. Carefully make a note of the voltages and switch off; the reading for the L.T. voltage should remain *exactly the same,* and that for the H.T. should only be very slightly higher (the actual amount will depend upon the resistance of the meter; the higher the resistance, the smaller the change). It is best to make these measurements after the set has been in use for some time, so as to ensure that the batteries have "settled down" to their steady voltages. If the voltage of the H.T. battery is less than 60 per cent. of what it should be, the battery ought to be considered as definitely run-down, because it will not be fit for further service. After checking the total high-tension voltage, measurements should be taken between the negative terminal and



each positive tapping in turn, as shown in Fig. 8. Should there be no voltage reading on any tapping, it will be clear that the corresponding battery lead is broken, that the wander-plug or terminal connection is dirty, or that there is a short-circuit inside the set. The latter is unlikely, because it would have been responsible for a low voltage reading on the whole battery.

Some of the measurements just referred to could not be made if the maximum voltage of the H.T. battery was greater than the highest reading of the voltmeter, and, in that case, similar results could be obtained by putting the positive wander-plug into a lower tapping and so measuring the voltage of one part of the battery, and the negative plug into a higher tapping whilst measuring the other portion. This method will be more readily understood by making reference to the sketch of Fig. 9. When high-tension is derived from an eliminator, voltage measurements are more difficult to take unless the voltmeter has a resistance of at least 500 ohms per volt. If a meter of lower resistance were employed the voltage registered would be appreciably less than that actually supplied to the set. For this reason the voltage tests should be omitted, and we shall see later how almost equally useful indications can be obtained in another way.

Grid Bias

After having satisfied ourselves that the H.T. and L.T. supplies are in good condition, we must measure the voltage between the positive, and each negative, grid-bias battery connection. If there is any reason to doubt the efficiency of the G.B. battery, it is wise to replace it at once, since a faulty one can cause considerable harm. When the set employs a system of automatic biasing it is not easy to measure the actual bias voltage developed, but a very rough indication can be obtained by applying the voltmeter between the ends of the bias resistance. This matter will be dealt with more fully in a later article in which special reference will be made to mains receivers.

Anode Current Tests

Once we have made quite sure that the accessories are functioning properly we shall have narrowed down our field of inquiry to the receiver proper. But even this is much too wide for exploration as a whole, so we must sub-divide it into its various portions. We may split it up into the separate valve stages or into anode, grid, filament, and tuning circuits; as a matter of fact, we shall do both. First let us measure the anode current flowing to each valve in turn (and also the screening and priming grid currents where S.G. and pentode valves are in use), because this will provide us with much useful information and might, in fact, give us the solution to our problem.

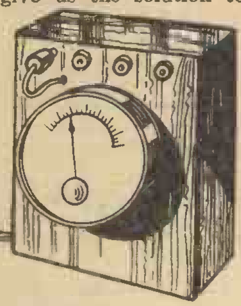


Fig. 10.—Measuring the anode current of a valve.

It need scarcely be mentioned that great care should be exercised when testing inside the receiver to make quite sure that no wires can fall and cause a short circuit, and that the H.T. is disconnected before making any alteration. Also be careful that loose wires do not come in contact with metallized valves or tuning-condenser vanes. When the set is mains-operated, or even if it is fed from a H.T. battery of more than 100 volts or so, the fingers should be kept away from the working parts whilst the switch is on. Even after it is switched off it must be remembered that large capacity condensers

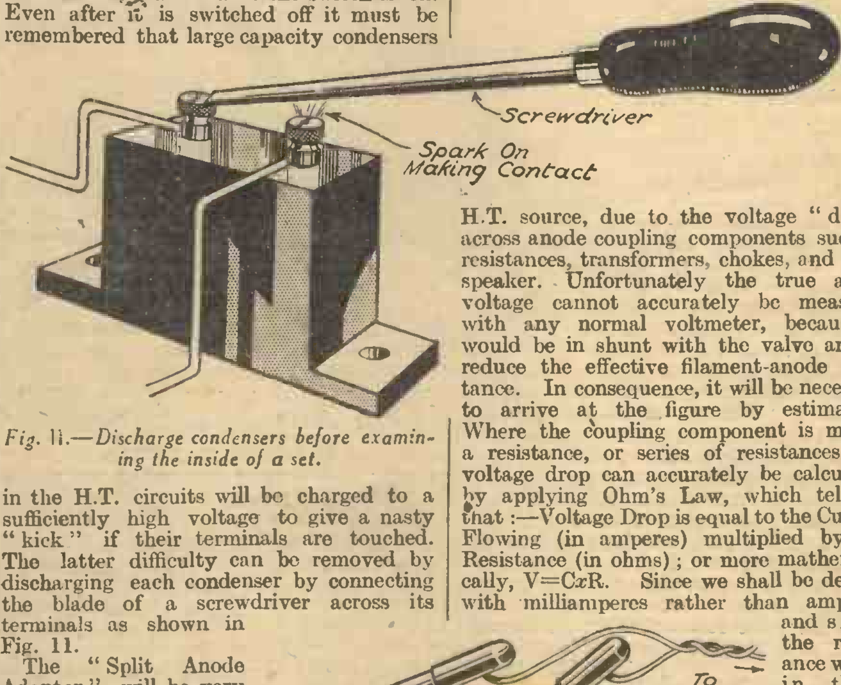


Fig. 11.—Discharge condensers before examining the inside of a set.

in the H.T. circuits will be charged to a sufficiently high voltage to give a nasty "kick" if their terminals are touched. The latter difficulty can be removed by discharging each condenser by connecting the blade of a screwdriver across its terminals as shown in Fig. 11.

The "Split Anode Adaptor" will be very convenient for measuring anode currents, and, with milliammeter attached, it should be applied to each valve-holder, beginning with the first (that nearest to the aerial tuner). In some cases the presence of the meter leads, and the added resistance of the meter itself, in the anode circuit, is liable to introduce complications in the form of instability or feed-back, and so to prevent any such effect it is advisable to connect a 2 mfd. condenser in parallel with the meter as shown in Fig. 10. The condenser connecting wires should be very short, and it is safer to use a condenser of the type built in a bakelite case to avoid the possibility of causing short circuits.

When any valve is working correctly its anode current should remain steady if the set is not tuned to a station, but might vary slightly when a signal is tuned in; it is best to apply the test under both conditions. The steady anode current should be approximately equal in amount to that specified by the valve makers for the anode and grid-bias voltages in use. In this latter respect it must be borne in mind that the voltage actually applied between the anode and filament will be less than that derived from the H.T. source, due to the voltage "drop" across anode coupling components such as resistances, transformers, chokes, and loud-speaker. Unfortunately the true anode voltage cannot accurately be measured with any normal voltmeter, because it would be in shunt with the valve and so reduce the effective filament-anode resistance. In consequence, it will be necessary to arrive at the figure by estimation. Where the coupling component is merely a resistance, or series of resistances, the voltage drop can accurately be calculated by applying Ohm's Law, which tells us that:—Voltage Drop is equal to the Current Flowing (in amperes) multiplied by the Resistance (in ohms); or more mathematically, $V=C x R$. Since we shall be dealing with milliamperes rather than amperes, and since the resistance will be in thousands of ohms, the formula can be simplified to read:—Voltage Drop is equal to Current (in milliamperes) multiplied by the Resistance (in thousands of ohms), or $V=C$ (m.a.) $xR/1{,}000$. When the anode circuit includes a choke, transformer, etc., the voltage drop cannot be calculated so accurately unless the D.C. resistance of the anode component is known. It will, however, be sufficiently accurate in most cases to assume the resistance of the primary winding of an L.F. transformer, or of an L.F. choke, to be about 2,000 ohms, whilst the resistance of an H.F. choke or tuning coil will be so low in proportion that it may be ignored entirely.

Fig. 12.—Measuring the anode current of an S.G. valve.

It should be remembered that when the

(Continued on page 1115.)

The DEVELOPMENT of the TUNING COIL

(PART 4)

By
H. J. BARTON CHAPPLE,
Wh.Sch., B.Sc. (Hons.), A.C.G.I.,
D.I.C., A.M.I.E.E.

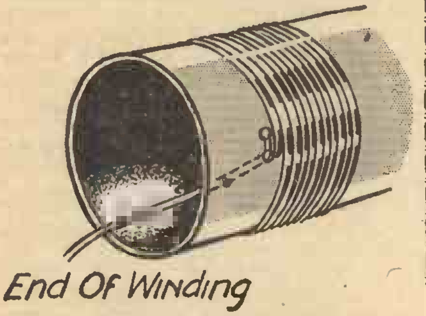


Fig. 1.—Anchoring the end of a coil by means of a loop through two holes.

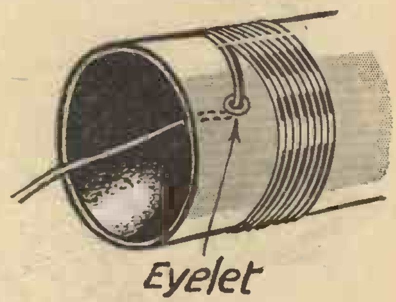


Fig. 2.—Another method of anchoring the end of a coil.

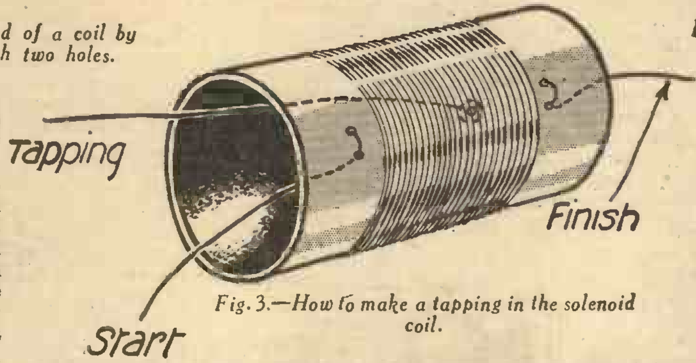


Fig. 3.—How to make a tapping in the solenoid coil.

IN this concluding article of the series, let me start first of all by giving one or two simple hints in construction. It is strongly recommended that home-made coils should not be of the dual range pattern. If both long and short waves are required, wind a coil for each, fit them in the set at right angles to avoid mutual action, and use a wave change switch.

For the medium wave coils, the usual paxolin or ebonite tube may be used, but quite good results can even be obtained by using dry brown or cartridge paper or thin card, rolled up to cylindrical form and well coated with shellac varnish.

Small Details

Before commencing the winding, provide a means for fastening off the two ends of the wire. The conventional way is to drill two small holes near the points where the winding will start and finish, and to thread the wire through the holes at the starting end, leaving a few inches for connection, making off the finishing end in the same way (see Fig. 1). An alternative is to fix terminals at the two ends of the winding, or small screws and nuts will serve equally well. Another successful and economical dodge is to get your local shoemaker to fix an eyelet at the points where the winding will begin and end. A rub with a smooth file will remove the black or brown enamel from the eyelets, and the wire can then be soldered to them, as shown in Fig. 2.

If a coil has to be tapped, holes must be pierced in the former at the tapping point, and a loop of wire drawn through and twisted up to form the tap (Fig. 3). Alternatively, the loop may be simply twisted up without being passed through a hole, but the former method is the neater. It is advisable to procure formers considerably longer than the actual length of winding, thus permitting brackets to be secured to them for fixing in the receiver. This is particularly necessary in the case of coils to be fitted in sets with metal bases, as it is fatal to efficiency if the winding comes too close to such a large mass of earthed metal.

A New Development

So much then for past and present considerations as far as coils and coil design are concerned. Can anything be said about the future? I always feel it is dangerous to prognosticate, but there is at least one development which appears to show promise of a very material character, and it is fitting to complete this short series by dealing with it. I have shown how the effective resistance of tuning coils plays a very important part in the performance of any wireless set. The lower the resistance, the greater becomes the stage gain coupled with an improvement in selectivity, and all commercial coils, within the limits of accepted methods of design, have endeavoured to aim at this ideal as far as mass-production methods allow.

To prevent interaction between the various tuned stages metal screens have been necessary, and this reduces the efficiency of the coil unless the "can" diameter is large compared with that of the coil. Many methods have been tried to counter these opposite effects, but the laboratory ideals have not been reached in their commercial counterparts. A German engineer, however, has produced a new magnetic material which has been named "Ferrocart," and by using this substance new types of coils are in process of development. Messrs. Colvern, Ltd., have secured the exclusive rights to manufacture and sell in Great Britain and Ireland components employing this material, but up to the time of writing the coils have not yet appeared on the market.

Magnetic Cores Not New

Readers will appreciate that the use of iron or magnetic cores for coils is by no means new; on the low-frequency side of the wireless set we have our chokes and transformers in abundance. Any attempt to use such components at high frequencies, however, has been productive of very high hysteresis and eddy current losses, and these have outweighed the decreased copper losses brought about by being able to use a smaller amount of wire for a given inductance than if an air core had been employed.

It appears that this new magnetic material, Ferrocart, consists of minute particles of a high-grade magnetic material of such a structure that they in themselves are very free from losses. These particles are so separated and arranged in the completed core by a special insulating process that the formation of eddy currents and the losses resulting therefrom are reduced very considerably.

Fig. 4.—Two of the magnetic cores made of the Ferrocart material.

Sample Cores

I have been successful in obtaining samples of these cores from the Continent, and in Fig. 4 will be seen two of them. They are seen to resemble "rings" some 2in. or so in diameter, but in outward appearance, reveal little that gives a clue to the correct structure. By cutting one in halves, however, with a hacksaw, it was found that the whole core was made up of layer upon layer of insulating material, and the magnetic

Fig. 5.—The layer effect of the insulating material containing the Ferrocart.

material is impregnated into this. In Fig. 5 I have shown an enlarged section of the core purposely separated in layer effect to give the reader a fair idea of its structure.

The coils themselves are built up as a toroidal copper wire-winding with a closed Ferrocart ring as a core, somewhat as suggested in Fig. 6, and more than one advantage arises from this form of construction. First of all, the toroidal winding in itself has quite a small stray magnetic field, but when it has a magnetic core as shown the field becomes much more concentrated, and hence external magnetic interaction effects are imperceptible at quite short distances away. Screening, from the point of view of magnetic linkage with other parts of the circuit, is therefore not required, but to prevent electrostatic coupling with other components a screen has to be used. It can, however, be placed in very close proximity to the coil without introducing losses, and the resultant "coil size" is reduced.

Furthermore, to produce a given inductance for covering, say, the medium and long-wave band tuning ranges, the coil made up in this fashion utilizes a much smaller length of wire than an air coil of similar inductance, and obviously the "copper losses" are reduced thereby. According to published data, a Ferrocart coil can be produced with a high-frequency resistance in the neighbourhood of one-third of a good ordinary commercial screened coil. Sensitivity and selectivity are, under these circumstances, greatly improved, and more compact receivers should be possible when these coils become available to both manufacturer and home designer alike.

New Form of Tuning

It occurs to me also that a magnetic

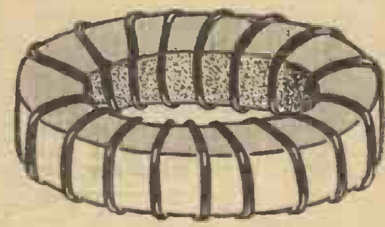


Fig. 6.—A diagram showing the method of making up a Ferrocart coil.

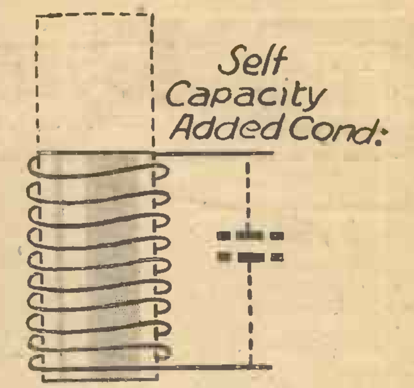
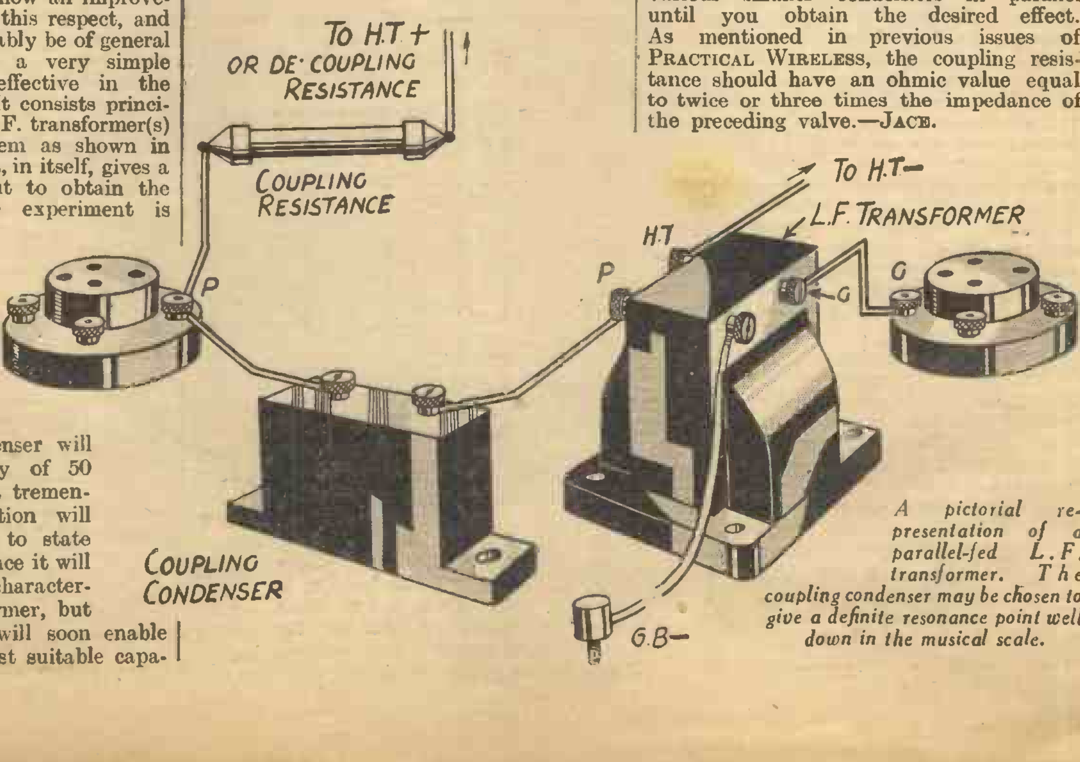


Fig. 7.—A new form of tuning which may be developed shortly.

material of this nature may lend itself very well to a new form of tuning. The inductance could be varied by altering the position of the core in relation to the coil, somewhat as shown simply in Fig. 7. Of course, the final details will not, perhaps, be so simple as that illustrated, but there does not appear to be any vital technical reason why such a scheme should not be put into operation. If that is the case, variable condensers for tuning purposes would become obsolete and we should return (with very material improvements, however) to our early (or pre) broadcasting methods of varying coil inductance when searching the ether for transmitting stations, the self capacity of the coil, or, if necessary, an additional fixed condenser, forming the second element to give the oscillatory circuit of inductance and capacity. In any case, many developments are sure to emerge from the four walls of the laboratory in the course of the next few months, and PRACTICAL WIRELESS readers can rest assured that this paper will be in the front rank in presenting all the details.

Improving Bass Response

MANY of the receivers made a few years ago give very poor response to bass notes, and as a result they cannot possibly do justice to "heavy" music, whatever kind of speaker they are used with. I am often asked how an improvement may be effected in this respect, and since the matter will probably be of general interest, I will describe a very simple method which proves effective in the majority of instances. It consists principally of connecting the L.F. transformer(s) on the parallel-feed system as shown in the sketch herewith. This, in itself, gives a definite improvement, but to obtain the very best results some experiment is necessary to determine the optimum value of the coupling condenser. The latter can lie anywhere between .01 mfd. and 2 mfds., but at some particular capacity the circuit comprising the transformer primary winding and the condenser will resonate to a frequency of 50 cycles or so, at which a tremendous gain in amplification will result. It is impossible to state even an average value, since it will depend entirely on the characteristics of the L.F. transformer, but a little experimentation will soon enable you to determine the most suitable capacity for your own set. Start by trying capacities of, say, .01 mfd., .1 mfd., .5 mfd., 1 mfd. and 2 mfds., if you have suitable condensers on hand. Having found the best of these, try connecting various smaller condensers in parallel until you obtain the desired effect. As mentioned in previous issues of PRACTICAL WIRELESS, the coupling resistance should have an ohmic value equal to twice or three times the impedance of the preceding valve.—JACE.



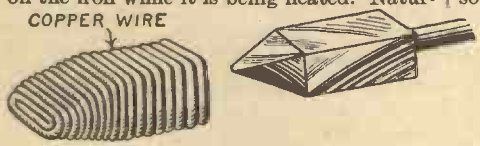
A pictorial representation of a parallel-fed L.F. transformer. The coupling condenser may be chosen to give a definite resonance point well down in the musical scale.

THE HALF-GUINEA PAGE

Radio Wrinkles FROM READERS

A Useful Soldering Dodge

THE average enthusiast who prefers to solder many of the connections in his set, but who, through not owning an electric soldering-iron uses the fire or naked gas light to heat the bit, which necessitates cleaning every time, will find this tip useful. Instead of throwing away the next handful of short copper wire ends you scrape up from the bottom of your junk box, fashion them to a coat for the soldering iron end, as depicted. This simple job can be accomplished with a light hammer. By hammering the twisted ends round the bit to mould the coat, the fitting becomes perfect, not too tight or loose, to allow the coat to remain on the iron while it is being heated. Naturally the iron itself takes a little longer to warm, but then, when hot, no time is wasted while cleaning. My practice is to leave the "coated" iron in the fire until the coat is red hot. I then find that the iron itself is just right for use with average solder.—W. WYMER (Leicester).



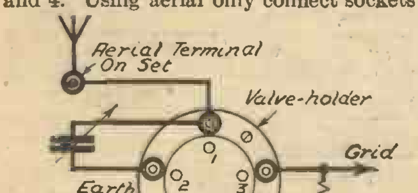
A useful dodge for keeping a soldering iron clean.

THAT DODGE OF YOURS!

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? For every item published on this page we will pay half a guinea. The latest batch is published below. Turn that idea of yours to account by sending it in to us, addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

Plug and Socket Switching Device

HERE is a switching device I use for the series aerial condenser on my S.G. set. The condenser is a small variable .0003 mfd. (bakelite-dielectric). This device is also useful for sets where the detector is the first stage. In this case either the aerial series condenser or the usual .0005 mfd. tuning condenser may be wired, whichever way is the most advantageous. The parts required are one 4-pin metal chassis mounting valve holder (which must be rigid, and not the anti-microphonic type), 4-valve pins or wander plugs and two short pieces of flex for connection to the plugs. The valve-holder is screwed into position near the input of the set (midway between the input terminals is a good position). The sockets can be numbered 1 to 4 with a fine brush and paint if desired. For series condenser connect sockets 2 and 3. For parallel connect sockets 1 and 3, 2 and 4. Using aerial only connect sockets 1 and 3. When the set is not in use connect sockets 1 and 4. As an alternative to the wander plugs the bases of four burnt-out or otherwise useless valves can be used. These could be labelled or painted: (1) Aerial, (2) Series, (3) Parallel, (4) Switch, and the pins on each base must be wired for their own particular purpose in switching.—ARTHUR TAYLOR (Knutsford).

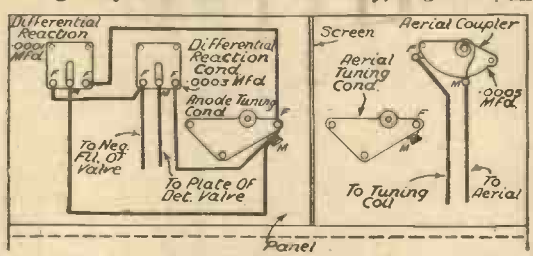


A handy plug and socket switching device.

Improving Selectivity

THE accompanying sketch shows how I have improved the selectivity of my straight-four wireless set. I was contemplating building a more modern set, but with this arrangement I have so greatly increased the selectivity, together with a stronger signal, that I have abandoned the idea. The modification is as follows:—

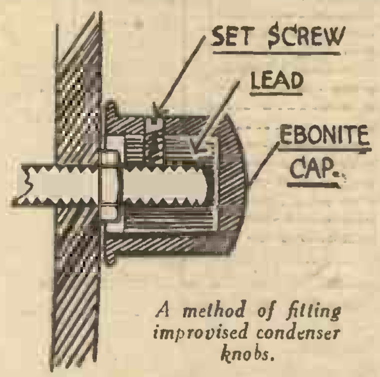
Remove the present .0001 differential reaction condenser in the reaction circuit and replace it by a .0003 mfd. differential reaction condenser. The .0001 is now used to make the set more selective by placing it in the anode circuit across the tuning condenser. Furthermore, a .0005 mfd. aerial condenser connected in series between the aerial and the high-frequency coil, to work in conjunction with the above arrangement, will prove an asset.—J. F. ODGERS (Camborne).



A condenser arrangement for improving selectivity.

Attractive Knobs for Your Set

THE ebonite screw-caps fitted to bottles of brilliantine, scent, etc., are often most attractively moulded, and if adapted in the following manner make excellent knobs for switches, reaction condensers and other components. First thoroughly clean and dry the cap and remove the rubber washer usually fitted at the top of the cap. Melt a little lead or solder in an old spoon, and pour into the cap, making sure it is held squarely upright, to within an eighth of an inch of the top. Allow the lead a few minutes to set and cool, carefully mark the centre of the lead filling, and drill to suit the spindle to which it is to be fitted. A small hole for the set-screw is then drilled through the side of the knob and tapped 6 or 4 B.A. A suitable set-screw can be made by cutting the head off a brass screw and cutting a slot with a hack-saw to take a screw-driver. You will find that the head, owing to the moulded threads in the cap, will show no tendency to work loose; besides, the set-screw, if you leave it just long enough, will prevent this. The space between the lead and the end of the cap, allows it to fit over the "one-hole fixing" nut of the component and lie flush with the panel.—ANGUS MACCOLL (London, W.).



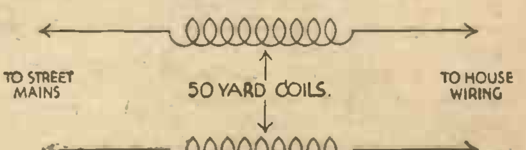
A method of fitting improvised condenser knobs.

Anti-Interference Choke Coils

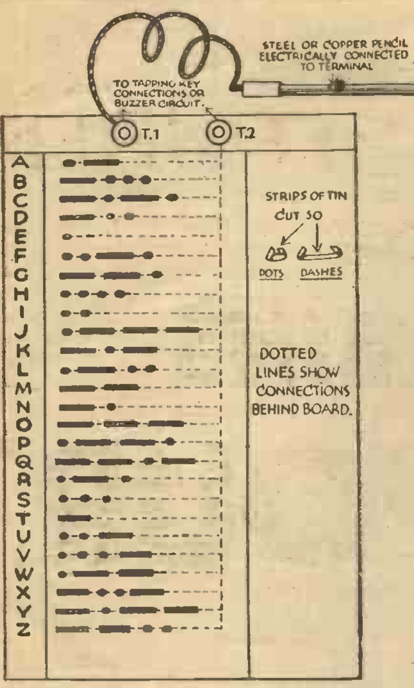
WIND 50yds. of insulated copper wire into a coil of 9in. diameter. Any round article having this diameter will do as a former. The number of turns, which will be about 65, may be piled on top of each other. The wire must be of a gauge able to withstand and carry the total maximum current it may have to carry at any time. (V.I.R. lighting cable is quite good enough.) Two coils are required, one in each side of the supply mains as indicated in sketch. Fifty yards makes one coil, 100yds. therefore are required to make two coils. A 9in. coil is rather large and bulky, but they can be made very neatly by binding with insulating tape after the winding is finished. They will be of high-frequency type and have an inductance of approximately 600 microhenries each. When wired in the mains on the consumer's side, near the meter, they will deal effectively with high-frequency interference which so often travels over the electric supply mains.—"SOLSHEEN" (Birmingham).

(*Continued on page 1086.*)

HAVE YOU RESERVED YOUR WIRELESS CONSTRUCTOR'S ENCYCLOPAEDIA YET? SEE LAST WEEK'S ISSUE.



Anti-interference choke coils inserted in the supply mains



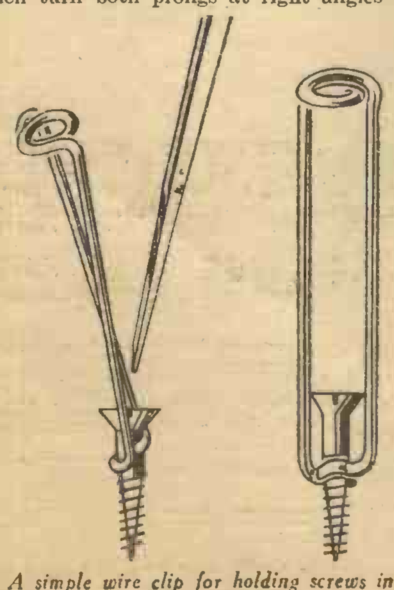
A simple method of learning the Morse Code.

Learning the Morse Code

HERE is an idea for quickly learning the Morse Code. A large piece of cardboard is used, and the dots and dashes made up of strips of tin which are pushed through and bent over behind the card. All the strips are connected to terminal T. 2. Simply draw the pencil across the strips from left to right and dot and dash signals are heard with correct spacing. The advantage of this method is that a person with no knowledge of the code can easily tap out messages.—T. J. TAYLOR (Stockton-on-Tees).

Holding Screws in Awkward Places

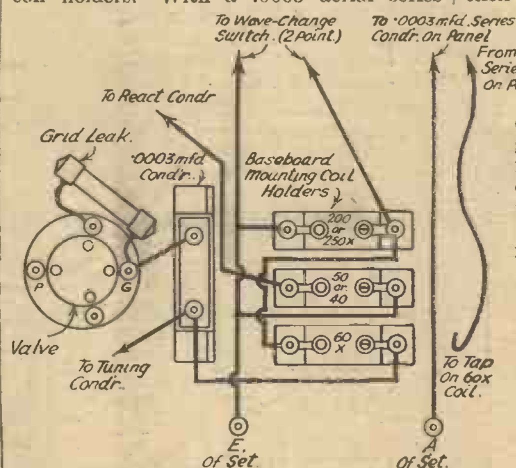
VARIOUS dodges and types of screwdrivers have been used by wireless constructors for starting screws in awkward corners. The sketch shows a very simple, but effective device for this purpose, made with a safety pin. Take the catch off the end and cut the other prong to the same length, then turn both prongs at right angles to the loop. Also turn the ends about a quarter of a turn in opposite directions and bend both in to form an ellipse parallel with loop. The blade of the screw-driver passes through loop into the slot of the screw while the looped ends go under the head. When the screw has a good hold, press the clip together and it will release it, slide the clip back up the blade and carry on with screwing.—J. COUSENS (Hamble).



A simple wire clip for holding screws in awkward places.

Wave Changing with Plug-in Coils

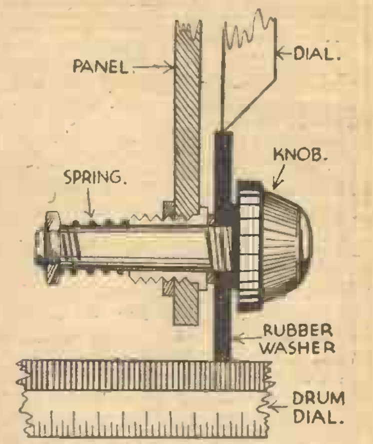
THE accompanying illustration shows a method of wave-changing with plug-in coils which I have found to work very satisfactorily. A study of the diagram will show that the principle is similar to that employed in a number of well-known dual-range coils. Possibly minor difficulties will crop up, especially with regard to obtaining equally satisfactory reaction on both wavebands; but if the coil-holders are just placed loosely in position, being wired with flex, they can be moved about for trial-and-error purposes. Several values of reaction coils may have to be tried, and possibly some adjustments to HT+1; but the ideal position for the coils will soon be found, and then the usual connecting wire can be used, after screwng down the coil holders. With a .0003 aerial series condenser joined in series with the aerial (fitted on panel), selectivity control will be simple. It should not be forgotten, when trying to find out the correct distance of the coils, that taking the aerial to the different tappings on the 60X coil tightens the aerial coupling, so that only a small adjustment should be made at one time. In some districts it is just possible that selectivity on the long waves will be difficult to obtain ordinarily, but it is suggested that in this case the aerial be taken to a suitable tapping on the long-wave coil when changing to long waves. A 2-point switch could be utilized for this work.—E. WILLIAMS (Llanelly).



A method of wave-changing with plug-in coils.

Special Note To Manufacturers.

No goods or components should be supplied to any person who has not the written authority of The Editor of "Practical Wireless"



A simple slow-motion device.

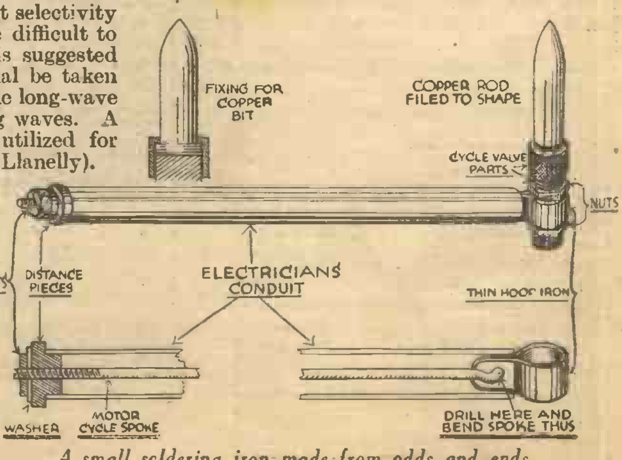
A Simple Slow-Motion Drive

THE parts for making this simple device consist chiefly of a knob and spindle taken from an old push-pull switch, and also the bush. Remove the knob, and screw a small nut on to the spindle. Next place on spindle a rubber tap-washer and then tighten up by means of the knob. Drill a hole for bush ⅛in. from edge of dial, insert bush, and then the spindle. Place a small coil spring on spindle and secure with a nut or original contact piece. This will be found to give a smooth drive with a reduction ratio of approximately 6 to 1 on a 4in. dial. The idea can be used equally well on both plain and drum dials (with thumb control) as shown in the illustration.—J. H. Heys (Blackpool).

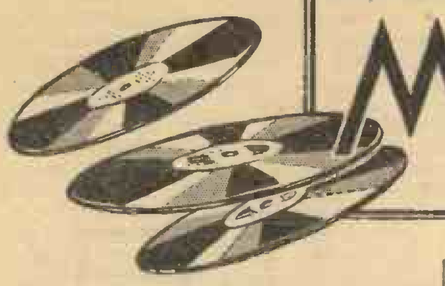
A Home-Made Soldering Iron

THE accompanying sketches illustrate a small soldering iron which I have been using for some time with great success. The various parts are odds and ends which constructors usually have on hand. The whole job is held together by three nuts and a knurled ring, and the size and shape of the "bit" make it very handy for "spot" soldering. The bit holder is held firmly in place at one end of the handle by screwing up the nut at the other end. Other details of construction will be clear from the sketches.—A. S. BANNISTER (Sheffield).

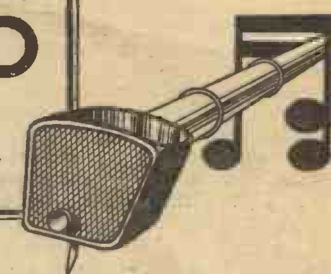
Next Week's FREE DATA SHEET IS ENTITLED "MAINS VALVES."



A small soldering iron made from odds and ends.



MOTORBOARD MUSINGS...



CONCERNING PICK-UPS

By H. T. GODLEY, A.Rad.A.

AS you probably know, before any signal can be broadcast from a transmitter, it is necessary to convert the sound-waves emanating from the speaker or artiste into an oscillatory electrical current, the oscillations of which will be a faithful copy of the original differences in frequency and intensity of the original sound-waves. For this purpose, a microphone is used, followed, of course, by an amplifier, the resulting speech currents being impressed on to a carrier wave and fed to the transmitting aerial. Gramophone recording used to be done by entirely mechanical means, but now a microphone is used in exactly the same way as in broadcasting, the microphone speech currents being linked up with a cutting needle in such a way that this needle is caused to vibrate from side to side, the degree of movement being controlled by the degree of variation in the microphone currents. For many reasons, among which is the greater possible range of frequency response, electrical recording enables much better fidelity of reproduction to be obtained than did the original mechanical method, which need not be discussed here.

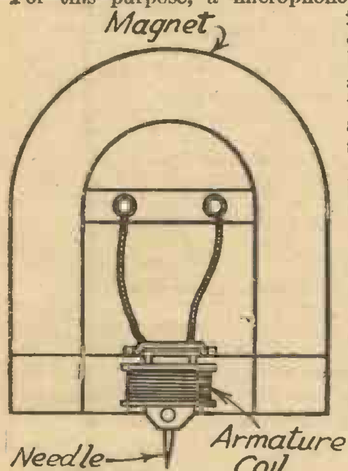


Fig. 1.—The construction of a gramophone pick-up.

The cutting needle is caused to cut into a soft rotating disc, a spiral groove commencing near the edge of the record and finishing somewhere near the centre, and as the needle is not inert but is constantly vibrating from side to side in sympathy with the microphone currents which actuate it, it will be clear that this spiral groove will assume a wave-like contour, the amplitude of the waves varying exactly in accordance with the tonal variations produced by the speaker or artiste.

Now if an ordinary replaying needle is caused to traverse this groove, the wavy character of the groove will cause this needle to move constantly from side to side, or in other words, to vibrate in exactly the same manner and to the same degree as the cutting needle did when it was cutting the groove. In the ordinary gramophone sound-box, these vibrations are transmitted mechanically to a diaphragm so that the resulting movements of the diaphragm cause air displacements and therefore actual sound-waves, which can be amplified only by means of some sort of horn. By using a pick-up, however, the needle vibrations are converted back into electrical speech currents which can be amplified to any desired extent, altering the tone and frequency response at will in exactly the same way as we deal with broadcast signals. Ignoring the mechanical methods of cutting and replaying, the chain of events between the original performance and the consequent gramophone reproduction is, in short, sound-waves to electric current, electrical current to vibrations of the cutting needle, vibrations recorded on disc—then back again, vibrations on disc to vibrations of needle, needle vibrations back into electrical current and electrical current back into sound-waves.

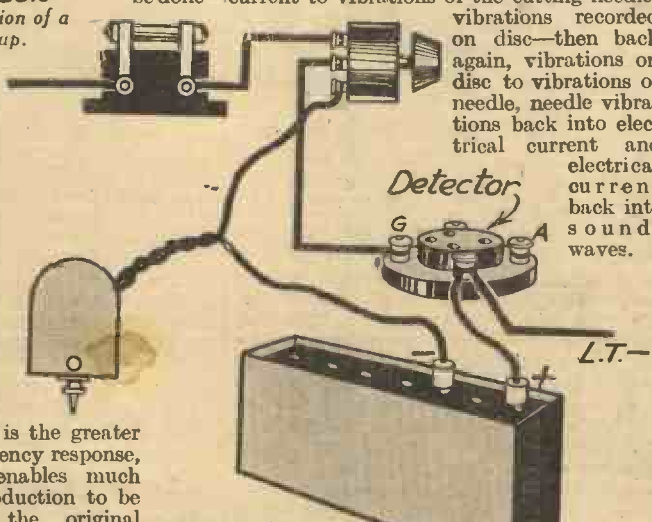


Fig. 2.—Wiring the pick-up into the grid circuit.

Working Principle

The pick-up works on the principle of "electro-magnetism." An "electro-magnet," is, in brief, a core of iron which becomes highly magnetized if a current of electricity is caused to flow through copper-wire wound round it. If, however, the iron core is already magnetized (as in the "permanent-magnet"), then if a fluctuating current is caused to flow through the copper wire (termed the "armature-coil"), then the magnetic flux or field strength of the magnet will vary in sympathy with the fluctuations of the current, and thus any piece of iron or steel within this magnetic field will be attracted to the magnet to a greater or lesser degree. As will be seen from Fig. 1, in the pick-up the armature-coil is not wound round the magnet but is situated between the ends or pole-pieces of the magnet, where the magnetic flux is at its greatest. The small piece of iron which is to be actuated by the magnetic field of the magnet (this piece of iron being "the armature"), is centred within the armature-coil and is mechanically linked with the gramophone needle. Thus, when the needle is moved from side to side by the wavy groove on the record, the armature also moves closer to or farther away from the magnet, causing the field of the magnet to become stronger or weaker accordingly and thus setting up a weak fluctuating current in the armature-coil. It will thus be seen that by these means, the mechanical vibrations of the replaying needle are converted into speech currents suitable for amplification through the familiar receiving valves.

That is the principle of the pick-up, but to apply it in a practical, commercial form gives rises to many difficulties and provides scope for considerable research work. There are three main points to be considered in designing a pick-up, these being firstly, avoidance of mechanical noise, secondly, avoidance of excessive record wear, and thirdly, small size and weight. The third point presents little difficulty, as a permanent magnet suitable for the purpose is quite small and weighs only a few ounces. The first and second points are, however, inter-dependent.

Damping

To avoid excessive wear on the walls of the record groove, the needle must be free to move easily from side to side, but if it is allowed to move too freely, natural resonances of the needle and armature will develop which will cause certain notes in

Fig. 3.—Controlling the output from the pick-up.

the reproduction to be amplified out of all proportion to the rest of the signals, and in order to prevent these resonances, it is essential to apply some restraining force or "damping," as it is called, to the armature to damp out these resonances. This damping must not, however, be so great as to cause sluggish movement of the needle and therefore excessive record wear. If, too, the armature and needle are

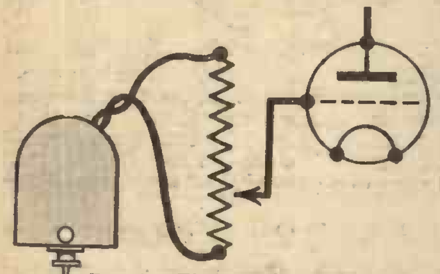


Fig. 4.—Theoretical circuit of pick-up with volume control.

allowed to vibrate too readily, a point is reached where these vibrations will actually produce sound-waves thus setting up an unpleasant "tinny" background. It will thus be appreciated that it is a most complicated matter to determine just how and to what degree, "damping" should be introduced, and it is in this respect that the difference lies between a cheap pick-up and an expensive one.

Voltage Output

The current developed across the armature-coil, although constantly fluctuating, naturally has a "mean," or average, value, and this is usually referred to as "the R.M.S. voltage output" (R.M.S. being root-mean-square), and this varies very considerably in different types of pick-ups, but usually is somewhere between two and three volts. In the needle-armature type of pick-up in which the gramophone needle is actually the armature, the R.M.S. output is usually very low and, in fact, seldom exceeds one volt, and while it has the advantage of imposing little wear on the record, it may very possibly be necessary to use an additional stage of amplification to compensate for the very low input from the pick-up. The R.M.S. output depends on many factors, but chiefly on the size of the gap between the armature and the pole-pieces, and the freedom of the armature. If the armature is heavily damped and the pole-pieces are set wide apart, then a weak output is to be expected, whereas if the armature is reasonably free and the gap small, a relatively high voltage will be developed. As the energy from the pick-up is actually in the form of speech-currents, the existing amplifying stages in the receiver can be utilized to amplify the pick-up energy also.

Usually one stage of amplification is not sufficient to provide the necessary volume, and therefore in the case of the average three-valve set having H.F., det., and power valves, it is necessary to utilize the detector valve as an amplifier also when playing records. Under these conditions the detector valve will obviously require additional grid-bias to allow it to accept a larger input voltage without distortion due to overloading. It will be seen from Fig. 2 that the lead from the grid-condenser to the grid terminal of the detector valve-holder is broken and a three-point switch is inserted in such a manner that in one position the grid is normally connected to the preceding tuned circuit, and in the other position is isolated from the tuned circuit and connected to one side of the pick-up. The other side of the pick-up is taken directly to the grid-bias battery, and thus any additional bias required by the detector valve is automatically applied through the pick-up as soon as the pick-up is in circuit—*i.e.*, as soon as the switch is in the gramophone position. It will be seen, therefore, that by the turn of a switch the detector valve is cut off from the earlier part of the set, the energy from the pick-up is impressed on to the grid of the valve for amplification and reproduction through the loud-speaker and the detector valve is additionally biased for the larger output, thus converting the broadcast receiver temporarily into a radio-gramophone.

Controlling Pick-up Output

Now, even with additional bias, in very many cases the output from the pick-up is more than the detector valve can handle, with the consequence that if distortion due to overloading is to be avoided, some arrangement must be provided whereby the input to the detector grid can be controlled, thus at the same time permitting regulation of the volume from the loud-speaker. For this purpose a potentiometer is used, as shown in Fig. 3. For the benefit of those who have not had occasion to use a potentiometer, it might, perhaps, be explained

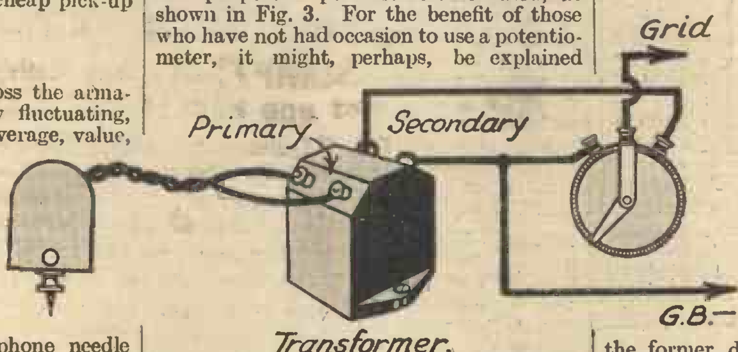


Fig. 5.—Using a transformer to isolate the pick-up.

that this component is a wire-wound resistance with a terminal at each end, but with an additional contact which can be adjusted over the full range of the resistance, thus enabling any portion of the resistance to be tapped off. The full pick-up energy is developed across the whole of the resistance, and if the sliding contact is at the top end of the resistance it will be clear that none of the resistance will be in circuit and the full voltage from the pick-up will be passed on to the detector valve. If, however, the sliding contact is moved half-way down the resistance, then one-half of the resistance will be between the pick-up and the valve, thus reducing the energy applied to the grid. Gradual adjustment of the potentiometer control, therefore, permits gradual adjustment of the energy applied to the grid of the detector valve, thus avoiding distortion due to overloading, and at the same time providing an efficient volume control.

The resistance of the potentiometer is of considerable importance, as too low a value will have a detrimental effect on quality of reproduction. The armature-coil of the pick-up itself possesses resistance, of course, and if a lower resistance (such as the potentiometer) is shunted across the pick-up, this additional resistance will in effect form an alternative path for some of the energy which should all flow through the pick-up coil. Actually, it will be the higher frequencies which will choose this alternative path, and these frequencies will not, therefore, be present in the amplifier and the resulting lack of "top-note response" will cause the reproduction to appear "boomy" and to lack brilliance. Generally speaking, the lowest value safe to use is 75,000 ohms, but this depends entirely, of course, on the resistance of the coils in the pick-up. In many cases a resistance of 500,000 ohms or more is necessary.

Potentiometer Control

When using an ordinary potentiometer as a pick-up control, it will often be noticed that the regulation of the volume is not proportional to regulation of the potentiometer. In other words, adjustment of the control will be effective over only a part of its full range, the effect on volume becoming rapidly greater over the lower half of the range. This is due to the fact that the sound-wave output from the loud-speaker is proportional to the "square" of the input voltage, or to put it more simply if the sliding contact of the potentiometer is a third of the way down, the apparent volume will not be reduced by a third or anything approaching it. This difficulty can now be overcome by using what is termed a "graded" potentiometer. In this component, the former upon which the resistance wire is wound, is not of the same width over its entire length as in the case of the ordinary potentiometer, but is very much wider at one end than at the other, it is "tapered." Obviously one turn of wire at the wide end of the former will contain a much greater length of wire than one turn at the narrow end and consequently will have much greater resistance. As the width of the former decreases uniformly down the entire length, so does the resistance of each turn of wire. By accurately proportioning the dimensions of the former, it is possible to compensate almost exactly for the disparity between input voltage variation and volume variation, thus obtaining a "linear" characteristic so that the reduction of one-third of the pick-up energy will produce a reduction of one-third in volume and proportion over the entire range. In fitting a potentiometer of this type, care must be taken to connect it the right way round.

(To be continued.)

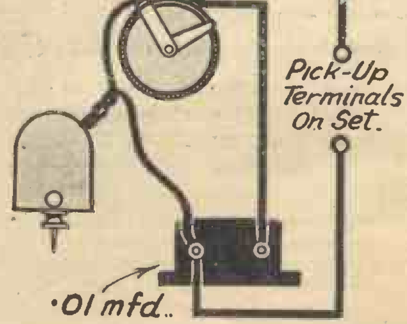


Fig. 6.—Controlling the tone and eliminating needle scratch.

TWELVE YEARS *of* RADIO PROGRESS

A Chat About the Developments which have Taken Place Since the Early Days of Broadcasting

By OUR TECHNICAL STAFF

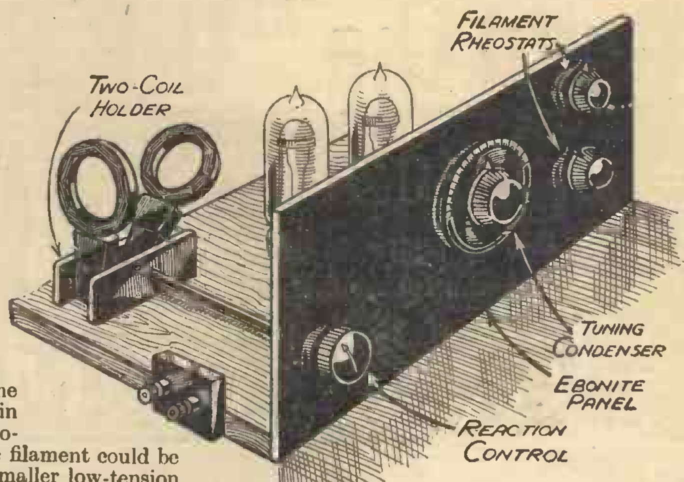


Fig. 8.—A two-valve receiver of about 1924.

AT the time of which we are now speaking the usual value of high-tension voltage was about 60 volts, and, in fact, valves were designed to function on a *maximum* of some 100 volts. The valves, by reason of their "plain" incandescent filament, had only a comparatively low emission, and so consumed a very small amount of high-tension current. In consequence, the high-tension battery usually had a life of several months. The low-tension supply probably offered the greatest difficulty because, as we have seen, the accumulator had to have a voltage of either 4 or 6 according to the valves in use. Contrary to present conditions, by the way, the 6 volt valves were noticeably more efficient since they gave a higher filament emission. And since each valve required nearly 1 ampere of current it can be seen that a simple three-valve set could only be operated for just over ten hours from a 30 ampere-hour accumulator before re-charging became necessary. Charging stations were few and far between, so that the wireless set was almost out of the question for those living in the country.

Dull-emitter Valves

Principally on account of the accumulator difficulty, numerous experiments were carried out by the valve manufacturers in an attempt to produce a valve whose filament could be operated from a smaller low-tension current; these experiments led to the introduction of the now universal dull emitter. At first it appeared an impossibility to make a filament emit electrons unless it were heated to incandescence, but eventually means were found of coating the tungsten or nickel alloy wire with certain oxides which would give off an electron stream at very low temperatures. The first dull emitters required a filament voltage of 4, and a current of about a tenth of an ampere. They were found to be almost as efficient as the previous bright emitters and the remaining difficulty was their high price of nearly fifty shillings each. This latter, however, was quickly reduced as the valves gained in popularity and mass-production methods were set in operation.

The 1923-24 Receiver

We have now come to about the middle of 1923, so it will be interesting again to turn our attention to the state of amateur receiver design. The "unit" form of construction has gradually fallen into disuse, because it has been realized that the system has certain drawbacks, mainly associated with the unnecessarily long wiring and attendant introduction of self-capacity, which is known to be the cause of losses in high-frequency amplification. The general appearance of the receiver has become similar to that depicted by sketches (*a*) and (*b*) in Fig. 6; these are two alternative designs, but the "desk-type" cabinet shown at (*b*) is a little more refined, since it houses all the batteries. The form of construction in each case is remarkably simple because all the components are attached to the same ebonite panel. An H.F.—Det.—L.F. circuit is most popular and high-frequency coupling is generally on the tuned anode principle, reaction being applied to the anode coil. It will be seen that the aerial coil is mounted some distance away from, and at right angles to, the reaction coil to reduce the effect of oscillation on nearby receivers. When reaction is applied to the aerial coil the set acts as a miniature transmitter when in a state of oscillation and so causes the whistle to be heard by neighbouring listeners. During 1923 the oscillation menace had become so widespread that in many localities interference-free reception was practically impossible. This had led to the prohibition by the B.B.C., through the Post Office, of aerial reaction, and accounts for the change mentioned.

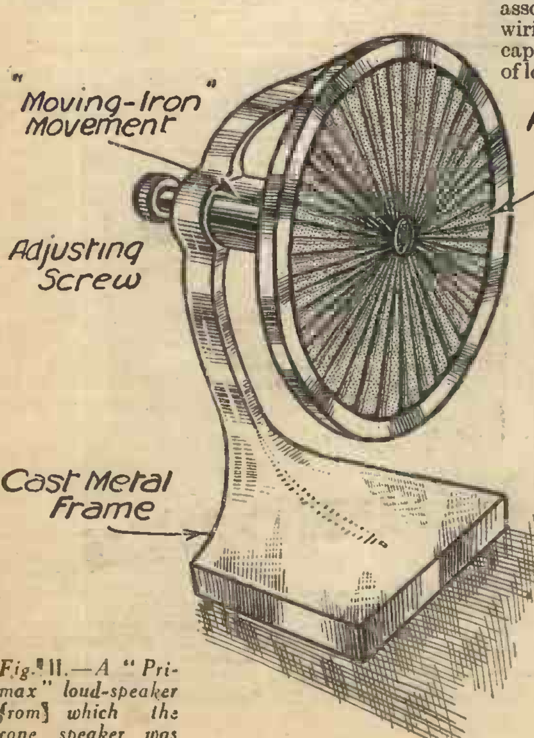


Fig. 11.—A "Primax" loud-speaker from which the cone speaker was evolved.

Tuned anode H.F. coupling was not the only kind in use, but shared popularity with the tuned transformer used in the set typified by Fig. 6 (*b*). The transformer consisted of a primary and secondary winding placed in slots made in an ebonite bobbin; the primary winding was untuned and connected in the anode circuit of the H.F. valve, whilst the secondary was tuned by a .0003 mfd. condenser, and fed into the grid circuit of the detector. These H.F. transformers were generally of the plug-in type and were made to fit into a standard valve holder. High-frequency transformer coupling offered certain advantages over the tuned anode system, the most important being that by careful design a small amount of voltage step-up could be obtained. The great disadvantage was in the difficulty of applying reaction to the unit and it was principally due to this that the tuned anode eventually became more or less universal.

But to return to the main features of the sets shown in Fig. 6. The valves were either bright or dull emitters (both kinds were then in use) and fitted into sub-panel holders. Whichever type of valves was used, filament rheostats were still employed for each, and these provided a means of obtaining a control of volume and reaction sensitivity. By this time small power valves were obtainable in both dull and bright emitter types and in consequence greater high-tension voltages up to 100 or so were coming into general use. The value of grid bias was also being appreciated and the bias battery became a standard fitting.

Loud-speakers

A gradual change-over from 'phones to loud-speakers was also taking place, but the only kind of speaker available was of the horn type having a "moving iron" movement. We know now that this type of speaker is incapable of anything like realistic reproduction, but in 1923 we thought it quite satisfactory. Even if other types had been available they would probably have been no better, because the performance of the sets themselves was limited by the valves, low-frequency transformers, etc., then on the market.

(*Continued on page 1095.*)

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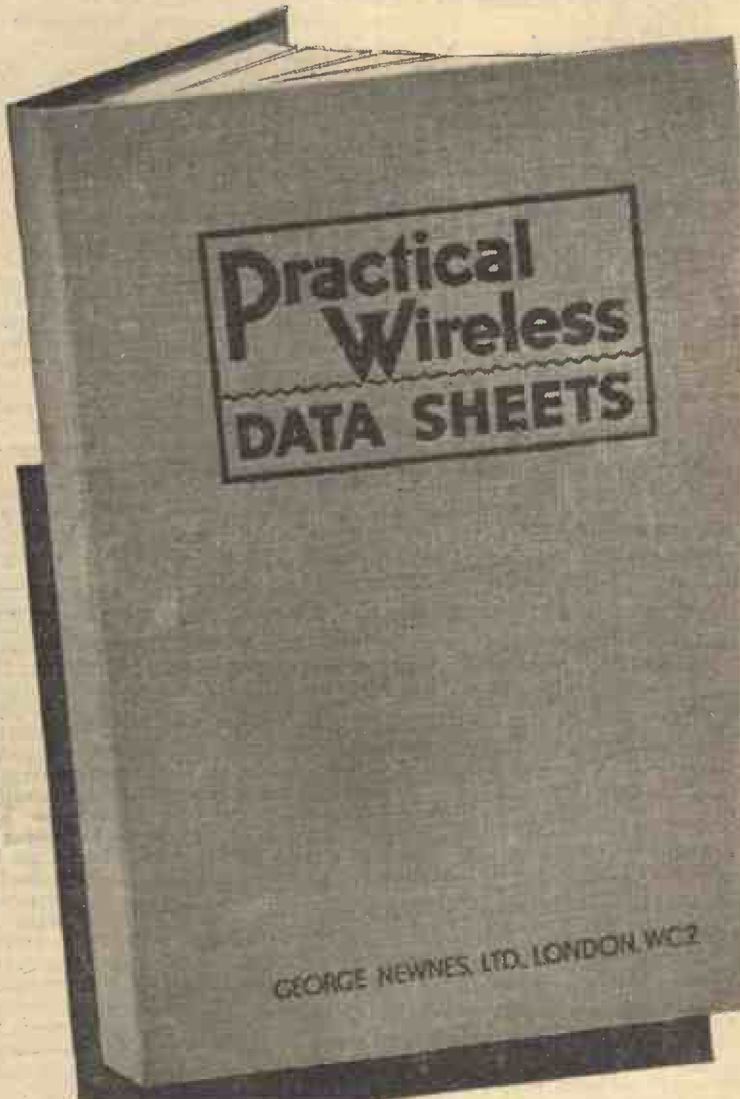

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Data Sheet No. 5— Wire and Wire Gauge	Jan. 14th, 1933
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(Continued from page 1092.)

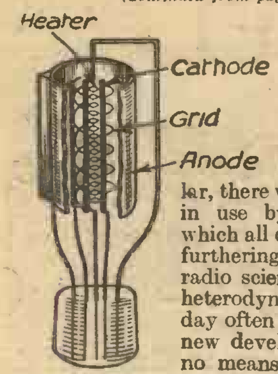

Fig. 13.—Showing the construction of an indirectly-heated valve.

"Super" Sets

At this juncture it might be mentioned that although sets of the types dealt with were by far the most popular, there were many others in use by experimenters, which all did their share in furthering the progress in radio science. The superheterodyne, which is to-day often looked upon as a new development, was by no means unheard of and was frequently regarded as the set of the (near) future. Its application was very limited at the time when the only valves obtainable were bright emitters, because eight valves were considered as a minimum, and their consumption of current was tremendous. But as the low-consumption valve came into being, the future of the super-het. seemed to be assured, at least so far as high-class receivers were concerned. But this idea did not last, for two very good reasons; the super-het. could only be made to function effectively on the short waves (medium waves according to present reckoning), and it could not give the quality of reproduction which came to be demanded. The former reason was a very strong one after the opening of Daventry on 1,600 metres, and the latter became more and more important as improvements in components and speakers were made. Other types of sets such as the Armstrong Super-Regenerative and Flewelling, in which one valve was designed to give the amplification of three, due to the application of an abnormally high degree of reaction, all received a measure of popularity, but demanded skilful operation, whilst reproduction was always accompanied by a high-pitched whistle. Consequently they never came into anything like general use.

Yet another way of attempting to obtain a maximum degree of amplification from a minimum number of valves was the adoption of "reflex" circuits. In circuits of this kind one valve acted as both a high-frequency and a low-frequency amplifier. Thus the signal current from the aerial was passed on to the grid of the valve, amplified and fed to a crystal detector, from whence it was passed back to the valve through a low-frequency transformer. In modifications of the original circuit a valve detector, with reaction, was employed and further stages of amplification were added. The system worked fairly well and was particularly economical, but had two distinct disadvantages. The more important of these was that it was impossible to operate any valve under such conditions that it would give proper amplification at both high and low frequencies; in consequence, some compromise had to be made which almost invariably resulted in a certain loss in quality of reproduction. The other disadvantage was due to the difficulty in obtaining a crystal suitable for this kind of circuit and in adjusting it to maximum sensitivity. Both of these drawbacks might have been tolerated but for the fact that the price of valves and other components were rapidly falling on account of the increasing demand, whilst the efficiency of every component part was being improved very considerably. As a result, the pendulum swung in the opposite direction and multi-valve sets of the "straight" type became increasingly popular. It might be explained that by a "straight" set we mean one in which every valve performs but one function—that of high-frequency amplifier, detector or low-frequency amplifier—and all the H.F. valves operate at the frequency of the signal being received.

Receivers having up to five valves became popular and were almost invariably used when loud-speaker reception of a fair number of stations was desired. The valves were arranged as two high-frequency amplifiers, detector and two low-frequency amplifiers. There was some divergence of opinion as to the best form of coupling to employ for the H.F. stages because the designer was always confronted with the difficulty of obtaining stability or freedom from unwanted reaction effects. The greatest contributory cause of instability was the capacity existing between the anode and grid of the H.F. valves, for when the anode and grid circuits were in tune (as they must be for maximum amplification) there was a feed-back of energy across the valve capacity which resulted in self-oscillation. Valve designers had reduced this capacity to the lowest possible limits and so the next move was with the set designer. Various methods of preventing feed-back were evolved, but all had the effect of reducing the overall amplification. One of these was to couple the valves on the choke-capacity or "aperiodic" principle and thus to leave the anode circuits untuned whilst tuning only the aerial circuit. This was satisfactory in preventing self-oscillation, but two valves so coupled gave only as much amplification as a single valve properly tuned. In passing it is interesting to observe that this system is still in use for one or two of the low-priced and much-out-of-date 5-valve portable sets on the market.

Another rather better system which attained some small measure of popularity was to tune the intervalve coupling of *alternate* valves, leaving the others untuned or semi-tuned. By semi-tuned I mean that the tuning was very "flat," such as would be obtained by winding the "tuning" coil with resistance wire and tapping it off for various wavelengths. I remember making in 1924 what was then regarded as a very successful receiver, using four high frequency valves coupled on this principle.

The Neutrodyne

The difficulties in providing stable high-frequency amplification were very much alleviated by the development, during 1925 and 1926, of the neutrodyne principle. The idea of this was to provide a means of neutralizing, or cancelling out, the capacity of the high-frequency valve. This was done in one of two similar ways, as shown in the sketches of Fig. 7. In the method shown at (*a*) the tuned anode coil is centre-tapped and the tapping joined to high tension positive; one end of the coil is connected to the anode of the H.F. valve and the other is connected to the grid through a very small capacity (neutrodyne) variable condenser. One half of the coil operates in opposition to the other, so that when the neutrodyne condenser is adjusted to have the same capacity as that existing between the grid and anode of the valve the two capacities balance out. The method shown at (*b*) is the same in principle but makes use of two separate windings arranged in the form of a high-frequency transformer; one winding is used in the usual way as a tuned anode coil and the other (connected to the grid circuit in series with the neutrodyne condenser) is used to provide the necessary neutralizing potential.

The neutrodyne method of high-frequency coupling was by far the best that had been so far developed. It enabled the valve to give its maximum degree of amplification with perfect stability and was thus almost revolutionary in effect. The chief difficulty associated with the neutrodyne system was that the "balancing-out" of capacities did not always "hold" over the complete wavelength range, and still less did it hold over both long and short-wave tuning scales.

Panel and Baseboard Construction

And now let us consider some of the other developments which occurred between, say, 1924 and 1926. Perhaps the most obvious of these was in respect to the appearance of the sets. The form of construction changed with almost surprising suddenness from that in which all components were attached to an ebonite panel to that making use of a horizontal baseboard and vertical panel. Why this change? In the first place it must be remembered that the wireless receiver was coming out of the purely experimental stage and was soon to be regarded as a necessary part of every home. In consequence, its appearance must be in keeping with the home furnishings, whilst the set must not be liable to be easily damaged. When the valves and coil holders were projecting from the panel the set was certainly not good to look at and appeared more like a scientific instrument (which it really was, of course) than a source of popular entertainment for the household. Moreover, it was liable to harbour dust which the lady of the house scarcely dare remove for fear of causing damage. These "domestic" reasons were probably more responsible than anything else for the change in style, but they were by no means the only ones. By making the set on the "baseboard" principle, the wiring could be reduced in length, and efficiency thereby increased. The change-over necessitated a modification in the form of construction of such components as valve holders which had to be mounted on the baseboard, but this matter was soon attended to by the manufacturers.

Reinartz Reaction

In the first receivers to be built on the new principle it was customary to mount the plug-in coils in a coil-holder attached to the baseboard as shown in the sketch of Fig. 8. This presented a difficulty in so far as the set had to be made fairly large to allow sufficient space for the movement of the reaction coil and, moreover, there was always a danger of the coil causing instability by reacting with other receiver components. From every angle the "swinging coil" method of providing reaction appeared bad and so the development of the capacity system of reaction control was warmly greeted.

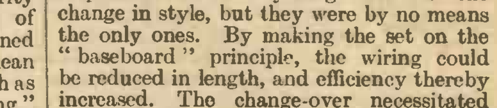

Fig. 14.—The original type of screened grid valve—the S.625.

BUILDING THE
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How to Construct this World-fa
Alternating Current Mains as a
Details will be

By F.

WIRING DIAGRAM OF THE A.C. FURY FOUR WILL BE GIVEN NEXT WEEK.

I HAVE received a veritable cataclysm of correspondence from enthusiastic readers who have already made the "Fury Four," and who write in glowing terms of its performance. They have all perceived that without introducing stunts merely to sell a particular component the "Fury" provides them with a powerful set of reasonable current consumption which may be used as a battery set or operated off the mains by means of an eliminator.

I do not wish to occupy valuable space (it is all too scarce) by printing these letters, but one reader a few days after the blue print was issued sent me a telegram which I have reproduced overleaf.

The fact that the "Fury Four" for the first time in the history of radio journalism is guaranteed by the designer and that the guarantee is backed by an offer of free personal advice to every builder of the "Fury Four" has appealed at once to that vast army of constructors who have gathered round the standard of PRACTICAL WIRELESS during the first twenty weeks of its very successful life.

That little more, how much it is! It is a service to my readers which I undertake

SPECIAL FEATURES: Quality, Power, Selectivity, Great Reach, Stability, Simplicity of Operation.

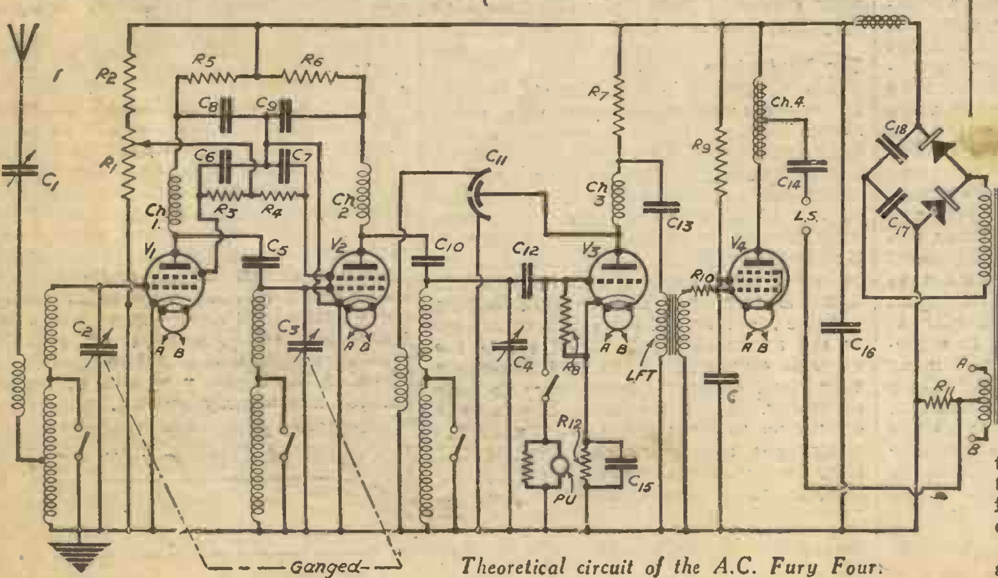
with real pleasure, and an inspection of the post up to date reveals that it has given universal satisfaction. A trade expert tested the set I loaned him by connecting it up to a battery and tuning it in to his local station with the reaction condenser so adjusted that the set was almost on the point of oscillation; leaving the adjustments set, he then disconnected the battery and coupled up an A.C. eliminator. He then found, to his surprise, that the reception was exactly the same as with the battery and that no additional decoupling was necessary. There was no sign of instability, low-frequency howling, or motor-boating which is usual when an unadapted battery operated set is connected to an A.C. eliminator.

An inspection of the circuit below will reveal that the A.C. version of the "Fury Four" is fundamentally the same as the original "Fury Four." The same system of decoupling and the same values of decoupling resistances are employed as they are found to be absolutely suitable. The decoupling condensers, however, for the H.F. valves have been changed to those of a non-inductive type to ensure stability, and, of course, automatic bias is introduced. The detector valve works both as a rectifier on the radio side and as a low-frequency valve for the radiogram. The grid leak is joined direct to the cathode, and the resistor in the cathode lead is introduced to avoid complicating switching. The output valve resistance is connected in series with the centre tap of the heater winding. I have introduced a metal A.C. Rectifier for the eliminator instead of valve rectification for several reasons. The smoothing choke maintains a constant inductance of 40 henries. You will note that the layout has been slightly modified to accommodate the high efficiency mains valves. To avoid metal work I have used a wooden baseboard covered with Konductite, the metal-covered paper which serves as efficiently as a metal chassis. Observe from the cover of this week's issue that the A.C. "Fury Four" is built into the Peto-Scott Adaptagram cabinet which makes a really imposing piece of furniture. The gramophone motor is electrically driven, so that a constant speed is obtained. The Amplion pick-up has its own volume control. Certain leads to be indicated in the wiring diagram which will be given next week are metal-sheathed to ensure stability; and the completed A.C. version is every bit as efficient in operation as the battery driven model.

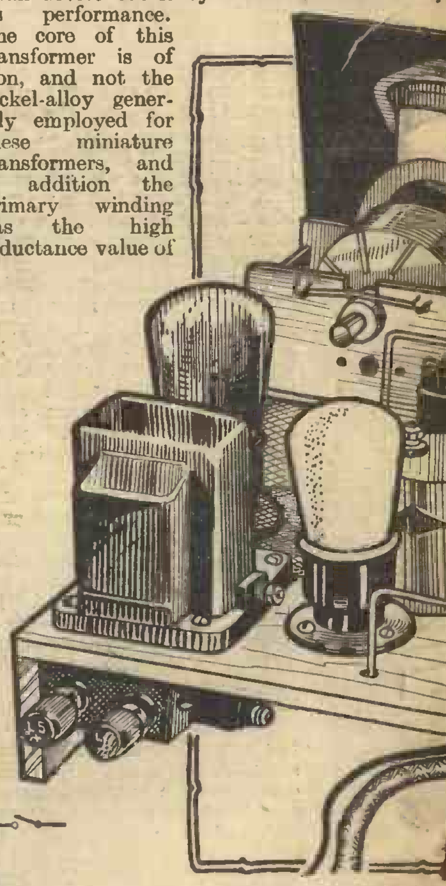
Note that you will require a special mains on-off switch—the Becker No. 460 mains switch, which retails at 1s. 11d.

You will notice from the list of components that I have incorporated as the low-frequency coupling device the Igranic Midget transformer. This is an exceedingly small device but is by no means small in its performance. The core of this transformer is of iron, and not the nickel-alloy generally employed for these miniature transformers, and in addition the primary winding has the high inductance value of 60 henries. This ensures that the bass response will be adequate, and to maintain the maximum value the whole time the transformer is parallel-fed. I have mentioned these details concerning this transformer because of the really excellent work done by such a small component.

Those readers whose homes are wired for alternating current and have already built



Theoretical circuit of the A.C. Fury Four.



The battery-operated F... by the addition of the ... illustrated ...

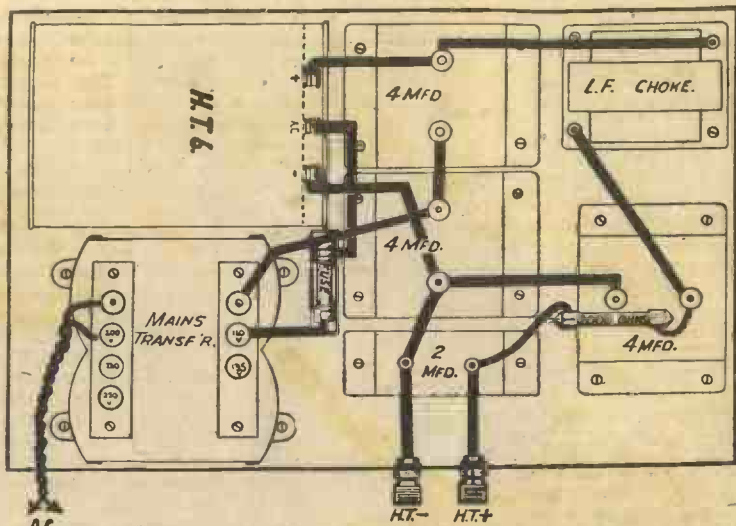
A.C. VERSION OF
...ry Four

...mous Receiver for Operating from ... Radiogram. Further Constructional ... Given Next Week.

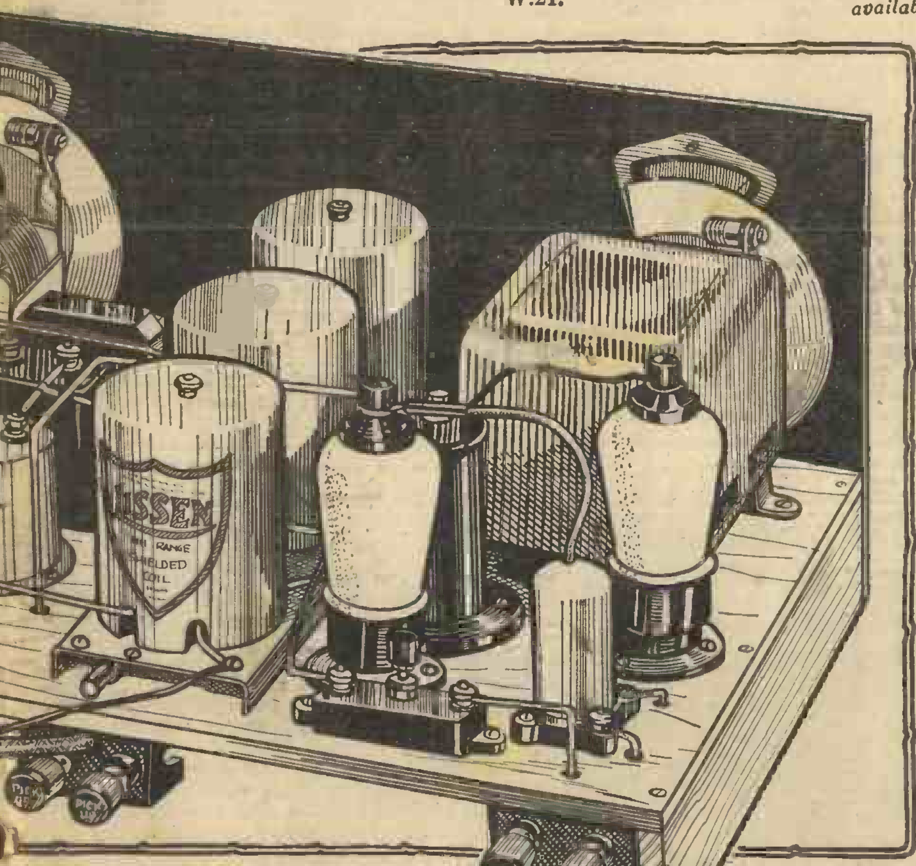
...J. CAMM

...up the battery version of the A.C. "Fury Four" will be interested to know that the Westinghouse Brake and Saxby Signal Company are putting out a set of parts for making a very efficient A.C. eliminator. When ordering ask for the "Fury Four" A.C. Power Unit. The components required for this unit are as follows:—

1 Westinghouse Metal Rectifier, Style H.T. 8.
1 Mains Transformer for use with Metal Rectifier style H.T.8. We recommend the Heayberd Type No. W.21.
1 L.F. smoothing choke, 800 ohms D.C. Resistance, Inductance 30-50 henries.
1 4mfd. condenser, C.1, 200v D.C. Working.
1 4mfd. condenser, C.2, 200v D.C. Working.
1 4mfd. condenser, C.3, 400v D.C. Working.
1 2mfd. condenser, C.4, 200v D.C. Working.
1 200 ohms resistance.
1 150 m.a. Fuse and holder (Bulgin type F.12 with K type fuse).
2 terminals (H.T.+ and H.T.—).
1 baseboard 12in. by 7½in.
Connecting wire, flex, etc., (Glazite).



The Westinghouse A.C. Power Unit for operating the Battery Fury Four from A.C. mains. Sets of parts for building this power unit are available from the company mentioned.



...ry Four. This will operate from the mains ... Westinghouse Fury Four A.C. Power Unit ...bove and described on this page.

Construction is quite simple, and should present no difficulty when working to the full-size blue-print supplied by the Westinghouse Brake and Saxby Signal Company. This blue-print is intended mainly to show the wiring and best layout of components, and the size of the complete unit may vary a little according to the actual components selected.

The Guarantee Given in Previous Issues also Applies to the A.C. Fury Four.

The baseboard may be covered with metal foil, and the whole unit enclosed in a well ventilated or perforated metal case, which should preferably be earthed.

With this eliminator you will be sure of a constant and lasting high-tension supply for your "Fury Four" as long as the set itself is in use.

In next week's issue I shall give wiring diagrams and photographs of the complete A.C. "Fury Four." I have included these advance details in this issue to satisfy those hundreds of readers who have asked for a circuit diagram and to assure them that my guarantee holds also for the A.C. version.

FOR LIST OF COMPONENTS SEE NEXT PAGE.

The Westinghouse H.T.8 Metal Rectifier for the Fury Four.

THE A.C. FURY FOUR RADIO-GRAM.

One Three-gang Coil Assembly. Lissen LN.5162.
One Lotus Two-gang Condenser Type P.C.2.
One Lotus .0005 Condenser Type P.C.1.
One Sovereign Compression Type Condenser, Type J.
One Wearite S.G. Choke, Type H.F.P.A.
One Bulgin S.G. Choke, Type H.F.4.
One Peto-Scott Screened H.F. Choke.
One L.F. Transformer, Ratio 3 to 1. Igranic Midget.
One Telsen Pentode Output Choke, Type W.72.
Six Dubilier 1 mfd. Fixed Condensers, Type BB.
Two Dubilier .0003 mfd. Fixed Condensers, Type 665.
One Dubilier .0002 mfd. Fixed Condenser, Type 665.
Three 4 mfd. Dubilier Fixed Condensers, Type BS.
Two 2 mfd. Dubilier Fixed Condensers, Type BS.
Four Clix 5-pin Chassis mounting valve-holders.
Four 1,000 ohm Erie Resistors, 1 watt type.
Two 30,000 ohm Erie Resistors, 1 watt type.
One 100,000 ohm Erie Resistor, 1 watt type.
One 5,000 ohm Erie Resistor, 1 watt type.
Two 350 ohm Erie Resistors, 1 watt type.
One Lissen 2 meg. Grid Leak with wire ends.
One Lewcos 50,000 ohm Potentiometer.
One Telsen .0003 mfd. Differential Reaction Condenser.
One Ebonite Panel 16ins. by 8ins. Becol.
One Heayberd Fury Four Mains Transformer.
One Westinghouse H.T.8 Metal Rectifier.
One Igranic C.H.2 Smoothing Choke.
One Becker Mains On-Off Switch.
One Bulgin Radio-Gram switch, Type S.85.
One Simpson's Electric Turntable.
One Amplion Pick-up with Volume Control.
One W.B. Loud-speaker, Type P.M.4.
One Adaptagram Radio-Gram Cabinet.
Two Cossor MSG-LA Valves (metallized).
One Cossor MHL Valve (metallized).
One Cossor PT.41 Valve.
One yard Goltone Flexible Metallic Screening Tubing.
Glazite, Flex, Screws, etc.
One sheet Konductite Metallic Paper for covering baseboard.
One Baseboard, 19in. by 12in.
One Belling-Lee Terminal Block.
Two Belling-Lee Terminals, Type B, Aerial and Earth.

A special word about the Peto-Scott Adaptagram cabinet. Although moderate in price it is attractively made, well finished, and is non-resonant, even at full volume. It provides ample room for the set, and additionally, should the reader at some future date desire to modify or add to the set, the roominess permits of this without having to hack the cabinet about. The turntable, of course, is disposed beneath the lid, and the back of the cabinet can be entirely removed so that the set can easily be adjusted or removed. The mains part of the A.C. "Fury Four" is placed on the floor of the cabinet. It is quite one of the most useful cabinets supplied to the home constructor, and its trade name of "Adaptagram" sums up its features and its adaptability.

An unsolicited telegram received from an enthusiastic builder of the "Fury Four."

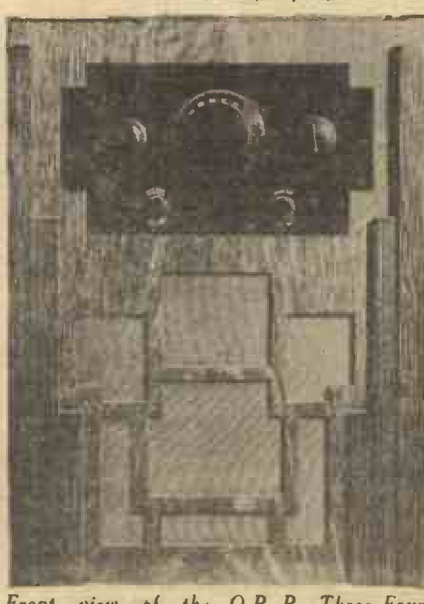
Readers whose houses are wired for D.C. will be interested to know that I have not forgotten them. I am particularly anxious that every reader of this paper should sample the delights of operating and listening to the "Fury Four," and whilst my experiments on D.C. have not yet been completed, and whilst also I make no definite promise, they may rest assured that I shall do all in my power to produce a D.C. "Fury Four," for I am of opinion that the reader who has D.C. has not been too well catered for in the past.

THE PRACTICAL WIRELESS Q.P.-P. THREE-FOUR

Details of the Set to be Described Next Week, Employing the New Quiescent Push-Pull System

In view of the large amount of interest which has been created by the new method of low-frequency coupling known as Quiescent Push-Pull, it was thought most desirable that we should produce a receiver employing this feature. On another page is described a simple amplifier which has been designed for incorporation with a reader's existing receiver. But, we also thought it necessary to produce a complete Q.P.-P. Set. We accordingly decided to design a self-contained receiver which would employ a really efficient Q.P.-P. output stage, and which contained the loud-speaker and batteries. In order to reap the benefit of this feature it is essential that the output valves shall be fully loaded, and, as has already been described in these pages, two pentode valves working on the quiescent push-pull method will handle a really powerful signal. After some experimenting, therefore, we decided that a three-valve receiver, employing the well-tried detector and two L.F. stages, would be most suitable for a Q.P.-P. Three.

The detector valve is resistance-coupled to the first L.F. stage, in order to ensure that the bass response shall be adequate. By using a special R.C.C. valve with a high amplification factor there is not a great deal of loss of amplification in this stage. The second valve is an L.F. valve, and this is used in conjunction with the parallel-fed method of coupling the output valves. The output valves are Mazda Pen. 220A's, having a really high gain, and giving an output of over 1,000 milliwatts.


Front view of the Q.P.-P. Three-Four housed in its attractive Clarion cabinet. Its construction will be dealt with next week.

The aerial circuit is quite simple, but at the same time selective, consisting of a Colvern T.D. coil which has a variable aerial coupling device. This consists of a small plug which is joined to the aerial terminal, and four sockets are provided on the ebonite coil base to enable the aerial to be tapped into the coil at the most suitable point for your own local conditions.

The illustration on this page reveals that a neat cabinet houses both the set and its batteries, in addition to the loud-speaker. The latter is one of the permanent magnet moving-coil speakers which have been developed in recent months, and which will give a really high-class performance over the entire musical scale. The inter-valve coupling transformer used in the Q.P.-P. stage is the R.I. component having a ratio of 8 to 1. This assists in ensuring that the output valves will be fully loaded before the first L.F. valve becomes overloaded, and this form of distortion is obviously easier to detect by the ear. The output coupling is a Varley Transchoke, and this also is a component thoroughly fitted for the task of dealing with the alternate anode currents and maintains a really high load the whole time.

So far as the actual constructional work is concerned, the now standard method adopted by us of sub-baseboard wiring is employed, and this assists in simplifying the wiring and accommodating some of the components below the baseboard. This naturally avoids crowding and assists in maintaining a neat appearance to the receiver. The panel is quite neat and contains the main tuning control, which is a slow-motion drive condenser; a reaction condenser; a wave-change switch; an on-off switch; and a tone control resistance.

With regard to the actual results, the receiver will give an output sufficient for the largest of rooms, and may be found in the majority of cases to be really too loud for a living-room. So much depends, however, on the furnishings of the room that not very much can be said about this. A large, barely furnished room will naturally resonate and give a hollow effect to the loud volume, whilst a heavily draped room will tend to soften the volume. The great advantage of having this volume available is, of course, that really low or loud notes are produced with a clarity of tone which hitherto has been possible only on mains-driven receivers consuming very high currents. This receiver, with a normal anode current of only 6 milliamps, compares very favourably with a mains set using an output valve requiring an anode voltage of 200 or so, and requiring a current supply of from 20 to 30 milliamps. Actual measurements of the receiver, and constructional details will be given next week, so make sure of your copy by placing an order with your newsagent to-day—if you have not already done so.

Very little has been said in the past of the method of employing two valves for detection purposes. These two valves are arranged in a very similar manner to those used in a push-pull amplifier, but they are designed to act as rectifiers. There are a number of advantages to be obtained from this arrangement, and next week's issue of PRACTICAL WIRELESS will contain, in addition to the Q.P.-P. Three-Four, and the Q.P.-P. amplifier, full constructional details of a three-valve receiver which employs push-pull detector valves. This is a very neat and simple receiver, and will appeal very much to the reader who is at heart a real constructor, inasmuch as the tuning coil of the set is entirely home-made. Many readers have written to us asking for a receiver employing home-made coils, but there is a certain amount of difficulty in designing a receiver which will employ a home-made coil to the best advantage. The push-pull detector circuit contains certain features which unfortunately cannot be adopted with the majority of the commercial coils which are at present available, and therefore a special coil has to be made by the constructor. This is a very simple operation, and will be found within the capability of even the youngest reader. For the benefit of those readers who do not feel able to carry out the constructional work on the coil, or who, for some reason or other, wish to employ the ordinary type of two-pin plug-in coil, will be pleased to note that we shall be giving size numbers and other details which will enable the receiver to be built up with this type of coil. It may be mentioned that one of the principal differences in the coil unit for the receiver is the tapping of the reaction coil at its electrical centre. In this respect, of course, it resembles somewhat the old form of centre-tapped tuned anode coil.

The receiver is quite neat, and has an ebonite panel eight inches by seven inches, and a baseboard only as large. Cossor valves are employed for the receiver, and these are 210 H.L. valves for the detector stage, and a P. 220A for the output stage. The volume is ample for all normal purposes.

Rear view of the Q.P.-P. Three-Four, showing the slide-in frame and the R. and A. moving-coil speaker.

ELIMINATING THE LOCAL STATION

By E. JOHNSON

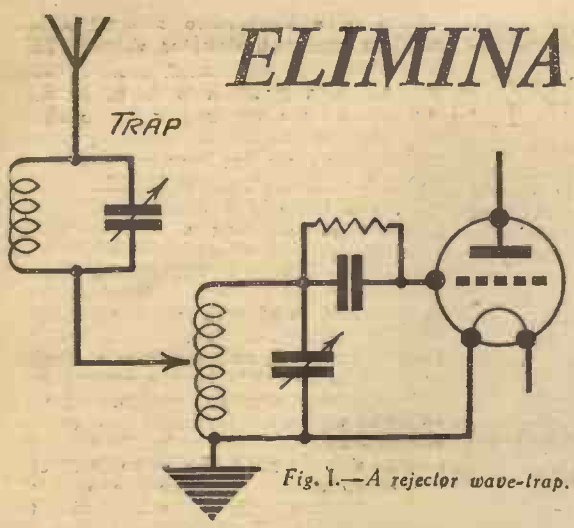


Fig. 1.—A rejector wave-trap.

THERE are still a large number of sets in existence which are hopelessly out of date, and quite incapable of separating the regional stations at short distances. These are mainly of the detector and L.F. type. On the score of economy many listeners are loth to discard an old set, and any scheme which may remedy this inherent defect is welcome. A certain amount of success may be obtained by improving the tuned circuit, but, unfortunately, sensitivity is very much reduced in most cases; there is no factor of safety in a receiver which depends for its performance on reaction. Some years ago, before the regional scheme was conceived, remarkable reception was possible on the familiar "det. and note-mag." Owing to the rush for increased power on the part of the broadcasting stations, it would seem at first sight that reception should be better nowadays. The regional scheme has defeated its own ends up to a point, for although primarily designed for the owners of simple and inexpensive sets, it has rather served to render them obsolete because of their poor selectivity. As mentioned above, addition of further tuned circuits, etc., only reduces sensitivity. The obvious solution to the problem is to install some kind of wave-trap.

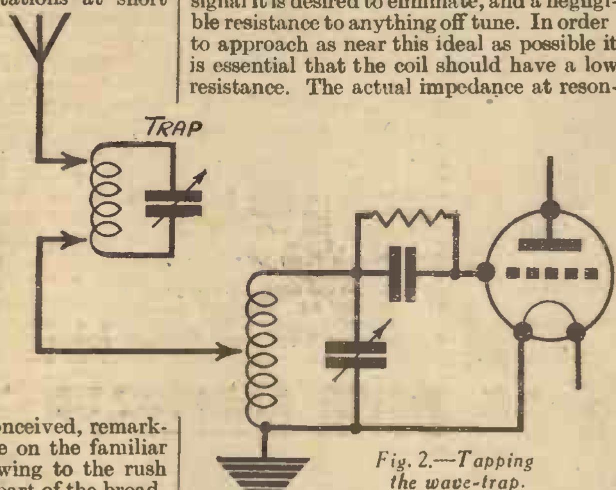


Fig. 2.—Tapping the wave-trap.

A Simple Wave-trap: The "Rejector"

A wave-trap, of which several kinds are in vogue, is a device whereby the offending station, in most cases the local, may be cut out, and the reception of all other stations unimpaired. The most popular type of all is undoubtedly the "rejector," as illustrated in Fig. 1. To be really effective the inductance must be large compared with the capacity of the trap. Theoretically, at resonance the tuned circuit should offer an infinite impedance to the signal it is desired to eliminate, and a negligible resistance to anything off tune. In order to approach as near this ideal as possible it is essential that the coil should have a low resistance. The actual impedance at resonance is given by the formula: $I=\frac{10^6L}{CR}$ ohms, where L, C, and R are expressed in henries, microfarads, and ohms respectively. The one disadvantage of this wave-trap in its present form is the tendency to not only eliminate the unwanted signal, but also to cut out a lot more besides; the resonance curve is not sharply defined. This difficulty may be overcome to a large extent by tapping down on the coil as shown in the next diagram. Probably the most effective device of this nature would be to wind a coil exactly to resonance without the aid of any external capacity at all, and arrange for suitable tappings. We should then be assured of possessing a trap of very high impedance.

"Acceptor" Wave-trap

The next type of wave-trap to receive our consideration is known as the "acceptor," depicted in Fig. 3. This consists of a coil and condenser connected in parallel with the usual tuned circuit. The acceptor trap differs from the preceding inasmuch as at resonance it offers a very low impedance to the unwanted signal. As a point of fact the actual impedance is equal to the "ohmic" resistance of the coil, or more correctly, the H.F. resistance. Thus, at resonance the interfering station finds an easy path to earth, whilst all others are passed on in the usual way to the set. Once again the trap is most effective when the coil has a low resistance. Elimination is very complete with a small inductance and large capacity, in fact too much so; it repays to experiment with various sizes. If interference is not very bad the best results will be obtained with a large coil and very small condenser; tuning will then be very sharp, and it will be found possible to receive stations on a frequency close to that of the unwanted one with the minimum reduction in strength. Considerable field for experiment is open by trying various tapping arrangements, as shown in Fig. 4.

"Absorption" Wave-trap

The final type of wave-trap to be described is the "absorption." Probably it is the simplest of all types. It consists simply of a tuned circuit placed in proximity to the tuning coil in the receiver, provision being made for varying the coupling. The arrangement is shown in Fig. 5. When the trap is tuned to the unwanted station, absorption takes place and the interference is eliminated. When the latter is very severe the coupling must be tight. For the best results, however, it is essential to work with as weak a coupling as possible, otherwise rejection will take place on other stations; furthermore, as the damping imposed on the tuned circuit is severe, it may be found difficult to obtain reaction. It is rather a paradox to state that all wave traps tend to reduce the *inherent* selectivity of any set by the consequent heavy damping, but in any case the type of receiver which requires a wave-trap is already unselective, so a little extra damping is not noticeable to any extent. In all traps, more

(Continued on page 1108.)

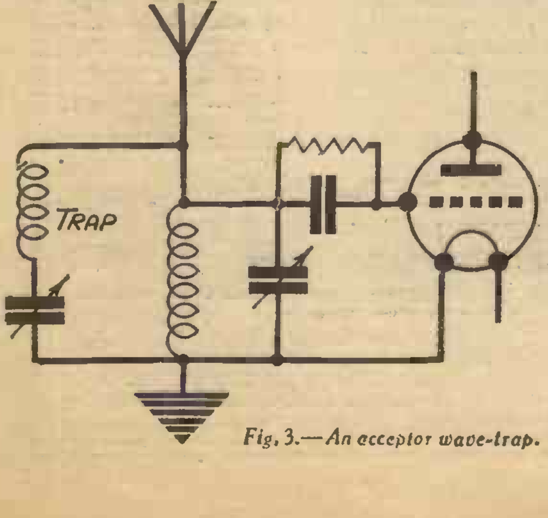


Fig. 3.—An acceptor wave-trap.

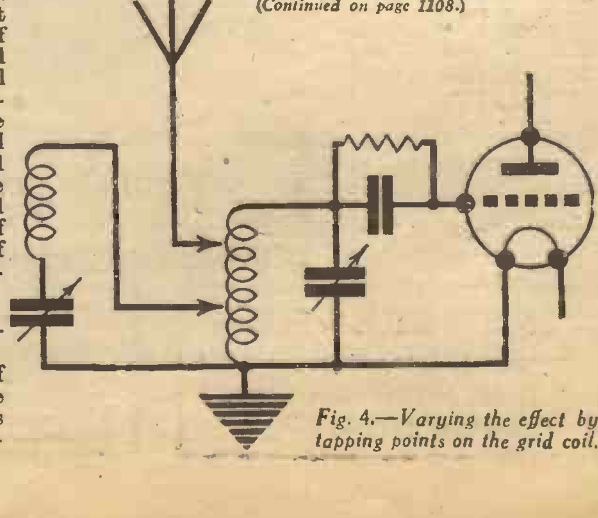


Fig. 4.—Varying the effect by tapping points on the grid coil.

The BEST SET OF THE YEAR SPEAKS FOR ITSELF

The Fury Four carries a definite performance guarantee by the Editor, Mr. F. J. Camm, and Direct Radio, Ltd. And now you should add your own verdict. Come and operate the Fury Four yourself and test its performance against other sets at the "Practical Wireless" Official Demonstration Room at 159, Boro' High Street, London, S.E.1. But even if you cannot come along you can order with perfect confidence, as every Direct Radio Kit is guaranteed to give the same outstanding results as the officially demonstrated model openly offered to "Practical Wireless" readers for test and criticism.

Official Demonstration of the FURY FOUR *by special arrangement with Mr.* CAMM, *Editor of* PRACTICAL WIRELESS *at*

159, BORO' HIGH ST.

"FURY FOUR" BATTERY KITS

KIT Model 1
As detailed specification, less Valves and Cabinet. **£6 : 19 : 3** or twelve monthly payments of 12/9.

KIT Model 2
As detailed specification (with Valves less Cabinet) or **£9 : 16 : 9** twelve monthly payments of 18/3.

KIT Model 3
As detailed specification (with Valves and Cabinet) **£10 : 17 : 9** or twelve monthly payments of 20/-.

KIT Model 4
As detailed specification, with Valves and "159" Fury Four Walnut Consolette Cabinet and Celestion PPM Soundex Permanent Magnet Moving Coil Speaker **£13 : 0 : 0** or twelve monthly payments of 24/6.

ACCESSORIES FOR THE "FURY FOUR."

BATTERY MODEL

	£	s.	d.
SIEMENS 120-volt H.T. battery, standard capacity ..		13	6
OLDHAM type 0.50 L.T. accumulators		9	0
SIEMENS 9-volt G.B. battery		1	0
BLOCK L.T. accumulators, 80 ampere hours capacity		11	6
OLDHAM 120-volt wet H.T. accumulators. (Or 12 monthly payments of 7/6	4	1	0
ATLAS A.C.244 H.T. eliminators	2	19	6
ATLAS D.C. 15/25 H.T. eliminators for D.C. mains ..	1	19	6
ATLAS A.K. 260 H.T. eliminators, with trickle charger. (Or 12 monthly payments of 8/6)	4	10	0
SPECIAL			
CELESTION PPM Soundex permanent magnet moving-coil speaker, with input transformer	1	7	6
W. B. PM4 permanent magnet moving-coil speaker, with input transformer.. ..	2	2	0

EXTRA SPECIAL

	£	s.	d.
Two matched CELESTION PPM Soundex speakers. Mounted on new type double packed non-resonant baffleboard. This arrangement eliminates booming, chattering and directional effects and gives wonderfully lifelike reproduction. Suitable for any battery or mains-driven receiver. (Or 10 monthly payments of 8/6)	3	17	0
BOWYER LOWE AED Mark III pick-up..	1	10	0
Volume control		3	0
COLLARO double spring gramo motor, automatic stop..	1	13	0
"159" type radiogram cabinet in walnut	3	10	0

FURY FOUR BATTERY MODEL

SPECIFICATION:

	£	s.	d.
1 Lissen Three-gang Coil Unit type LN5162	1	6	0
1 Erie 2-megohm Grid Leak with wire-ends	0	1	0
1 J.B. Unitune two-gang screened condenser .0005 mfd., with disc drive	0	18	6
1 J.B. Nugang Single screened condenser with disc drive ..	0	9	6
1 Ready-Radio .0003-mfd. Differential Reaction Condenser ..	0	3	0
1 Varley Pentode Nichoke.. ..	0	12	6
1 Erie 100,000 ohms resistance ..	0	1	0
2 Erie 30,000 ohm resistances ..	0	2	0
1 Erie 5,000 ohms resistance ..	0	1	0
4 Erie 1,000 ohms resistances ..	0	4	0
1 Set of 8 Erie Resistor coupling links	0	1	0
1 pair Panel Brackets	0	0	6
1 Ready Radio fuse holder and fuse	0	1	0
1 Wearite screened H.F. Choke Type HFPA	0	4	0
1 Ready Radio 3-pt. switch ..	0	1	6
1 Ready Radio S.G. H.F. Choke..	0	5	6
1 Kinva standard screened H.F. Choke	0	2	9
2 Dubilier .1-mfd. C.T. Condenser type B.E.31	0	6	0
Carried Forward	£5	0	9
Brought Forward	5	0	9
3 Dubilier 1-mfd. Condenser type B.S.	0	6	0
2 Dubilier .0003-mfd. Condensers type 665	0	1	0
1 Dubilier .0002-mfd. Condenser type 665	0	0	6
1 Lewcos 50,000 ohm Potentiometer	0	3	0
1 Sovereign .0003-mfd. Preset condenser	0	1	3
1 Ready Radio 3-1 ratio L.F. Transformer	0	8	6
2 Belling Lee Wander plugs G.B. +, G.B.—	0	0	4
3 Clix sub-baseboard valve holders, 4-pin	0	2	0
1 Clix sub-baseboard valve holder, 5-pin	0	0	9
1 Belling Lee 4-way Battery Cord	0	1	9
3 Belling Lee terminal mounts ..	0	1	6
6 Belling Lee terminals A.E.P.U., L.S.+., L.S.—	0	1	3
1 Permcol Panel 16" x 8" drilled to specification	0	5	6
1 Drilled and foil covered baseboard 16" x 10" x 3/8", and 2 side strips 10" x 2"	0	4	0
Connecting Wire, Screws, Flex, etc.	0	0	8
	£6	19	3

FURY FOUR A.C. MAINS RADIOGRAM

Additional components required in addition to those specified for battery kit.

SPECIFICATION:

	£	s.	d.
Brought Forward	6	19	3
1 Heayberd Fury Four Mains Transformer .. .. (Please state voltage and frequency of Mains supply.)	1	4	0
1 Westinghouse H.T.8 Metal Rectifier	0	18	6
1 Igranic type C.H.2 Smoothing Choke	0	9	6
2 T.C.C. 4-mfd. condensers 400-volt working	0	14	0
2 T.C.C. 2-mfd. condensers 400-volt working	0	8	0
Carried Forward	£10	13	3
Brought Forward	10	13	3
1 Erie Pentode Bias Resistor 350-ohms	0	1	0
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IS REACTION NECESSARY?

An Informative Article Explaining the Uses of Reaction and How to Control It.

By
H. J. BARTON CHAPPLE,
Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

FROM the days of the first single-valve broadcast receiver, if not before, the device which we know as "reaction" has played an important part in efficient radio reception. But a school of thought is arising in certain quarters, which suggests that reaction—the old and tried servant of the listening public, is due for superannuation; that the set of the immediate future should not incorporate this familiar and hitherto useful feature.

Before passing a definite opinion on this suggestion it is but fair that we should study the nature of reaction, in order to ascertain exactly what it does and can do, after which we can hear the arguments put forward by those who wish to see the reactionless set. We shall then be in a position to give an impartial judgment and to decide, in our own minds, whether the advantages claimed for the set without reaction compensates for the losses in efficiency sustained by the disuse of the device.

Work of the Detector

Most listeners know that no detector valve gives perfect rectification of the radio-frequency signals applied to its grid. As a result, there is always a certain amount of high frequency energy in the output or anode current of the detector valve. In other words, the normal detector acts primarily as a rectifier and low frequency amplifier combined, but to a certain extent also functions as a high frequency amplifier. The process of reaction consists in feeding back part of the high frequency energy remaining in the detector anode circuit to the grid circuit, where it is again rectified and amplified.

It is easy to see that the first effect of reaction must be to increase considerably the low frequency output of the detector valve, which will be reflected as increased volume in the loud-speaker. Another way of saying the same thing is that the detector valve, with reaction applied, has a greater sensitivity, and it is a fact that, by increasing reaction within certain limits, to be discussed later, stations previously unreceivable can be brought in at reasonable strength.

Another, and possibly more valuable advantage conferred by reaction is that when considerable reaction is applied the receiver becomes more selective, that is to say, the tuning becomes "sharper" and it is easier to separate stations operating on adjacent wavelengths. It is not easy to explain simply the reason for this added selectivity, but it may help matters if it is put in the following way: "Flat" or unselective tuning is due largely to the losses occurring in the tuning circuits. By feeding back high frequency energy from the anode to the grid circuit it is possible to make up for these losses, and therefore more nearly approach the ideal or perfectly uned circuit.

Applying Reaction

Properly designed and handled, reaction is under perfect control, and may therefore be used to vary the sensitivity and selectivity of the set. There are two main methods of applying reaction. In the original and now obsolescent method, the whole of the anode current of the detector valve was passed through a coil mounted side by side with the detector grid coil in such a way that the angle between the two coils could be varied, see Fig. 1. When the two coils were adjusted so that they were at right angles to each other, the magnetic coupling between them was a minimum, and the reaction effect was small. By swinging the reaction coil so that the angle made with the grid coil decreased, the reaction effect was increased.

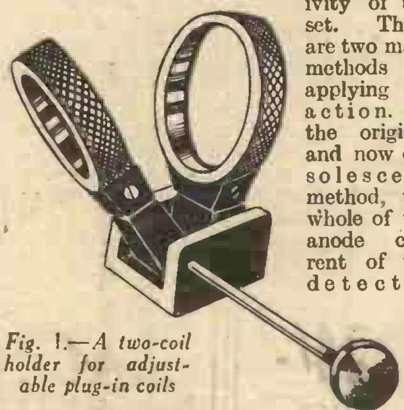


Fig. 1.—A two-coil holder for adjustable plug-in coils

This form of variable magnetic coupling is not now employed to any extent except in a few very old receivers. Even when, by careful adjustment of the anode voltage of the detector valve and the selection of a reaction coil having just the right number of turns, the control of reaction was comparatively smooth, it was somewhat difficult to apply reaction sufficiently gradually, especially when endeavouring to pick up a particularly elusive station. Moreover, as reaction was varied, so did the correct setting of the main tuning condenser vary, so that, in critical searching, it was necessary to adjust and readjust both reaction and condenser controls.

The Up-to-date Method

Several variants of the simple magnetic reaction were devised, but these are only of historic interest to-day. The up-to-date method of applying reaction, of which several slightly different forms exist, is to use a fixed amount of magnetic coupling between the grid and reaction coils, and to vary the amount of high frequency energy fed back to the grid by means of a variable condenser in the reaction circuit, see Fig. 2. Moreover, the reaction coil is not in series with the anode circuit but in parallel, a high frequency choke being included in the anode circuit to divert the high frequency component to the reaction coil. (This particular capacity reaction has many interesting features and in a subsequent article I propose to discuss some quantitative results I obtained in experiments carried out some time ago.) By this means, and with careful adjustment of anode voltage and the capacity of the reaction condenser, reaction control may be made as smooth and gradual as can be wished. What, then, are the charges which are laid at the door of our friend reaction, and that warrant its suggested discontinuation as a form of radio control?

One Complaint

In the first place, it is urged that reaction, when applied to excess, has the result of producing oscillation or howling which spoils the reception in nearby receivers. To a certain extent this is true. If an excessive amount of energy is fed back from the anode circuit to the grid circuit of the valve, not only will it make up for the inevitable losses in the grid circuit, but it will more than make up for them. This means that the valve and its associated circuits, instead of consuming high frequency energy, will actually generate energy; the circuit becomes unstable and free oscillations will be produced.

Two effects now follow; first, distressing howls are heard in the speaker, and second, if the high frequency oscillations can reach the aerial circuit of the set, they will be radiated from the aerial and will affect the aerials of listeners over a wide area, giving rise to howling in their sets also.

It is not necessary to stress this point, because the anti-oscillation campaign of the B.B.C. has almost completely eradicated this nuisance. Re-radiation is only likely to occur from receivers of old type where the reaction coil is coupled direct to the aerial coil. A well designed receiver having at least one high frequency stage and *efficient* inter-stage screening

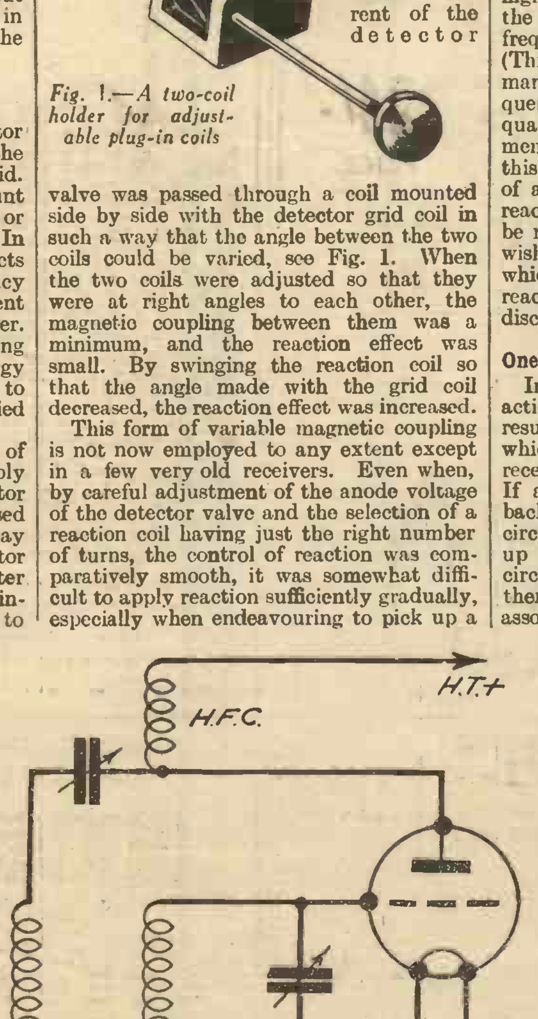


Fig. 2.—A typical reaction circuit.

is unlikely to cause re-radiation, even if the reaction control is seriously mis-handled. The cure for howling in your own receiver is simple—in the words of the B.B.C. —don't do it! In any case, to blame reaction as a whole for the effects produced by its abuse is a weak sort of argument.

A Second Objection

The next complaint made against reaction is that it adversely affects the quality of reproduction. Here again, it must be admitted that there is a certain modicum of truth in the statement. It is an undisputed fact that, as reaction is increased, there is a certain loss of the higher notes, which may become serious when the reaction control is moved to the maximum position. The reason for this "amplitude distortion" is that as reaction is increased, so is the selectivity increased as has already been explained; in other words, the band of frequencies accepted by the detector valve for a given setting of the tuning condenser is narrowed down. Sharp tuning of this nature means a certain cutting off of the side-bands, and this inevitably means a loss of high notes. Under these conditions, a violin begins to lose its characteristic tone and sounds more like a flute; speech begins to become gruff and guttural, and in a hundred ways the quality of reproduction deteriorates.

Can any reasonable defence be offered to this charge? I think so. The answer is, that each listener should realize the limitations of his set. If the design of his receiver is such that only a certain number of stations are receivable at good strength, and with good quality without pushing reaction to extremes, he should accept these as the normal output of the set, and should content himself with enjoying these programmes. If he wants to receive the "borderline" stations for interest sake, he must put up with the loss of quality; and if he still wants these elusive stations at good quality, he should be prepared to construct or purchase a more powerful equipment.

Begging the Question

Some of those who think reaction ought to be abolished use no argument at all, but beg the whole question by stating that a receiver possessing two efficient screened-grid stages, or perhaps a super-het. set, is sufficiently sensitive to receive all worth-while programmes without recourse to reaction. They are, of course, perfectly correct, it being well known that two screened-grid valves give wonderful range and selectivity. But sets of this type are not as a rule cheap instruments —and radio is, or should be, the hobby and entertainment of the man in the street, as well as the amusement of the plutocrat.

For every listener who can afford an elaborate four- or five-valve straight receiver or a super-het., there are hundreds whose means will not go beyond a three-valver at the most—and even the best three-valver employing a screened-grid valve in the first stage needs a gentle touch of reaction for pleasurable ether searching. It would be a pity, therefore, if we designers and technicians set our minds definitely against reaction, and thus deprived the "average listener" of his foreign programmes.

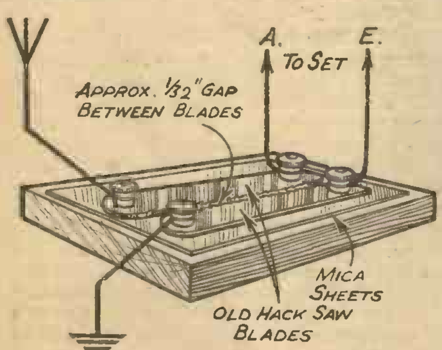
Undoubtedly a reasoned judgment on the question is: build your multi-H.F. sets without reaction, by all means, for quality reception of both local and foreign stations, but leave the judicious use of reaction for the three-valve man. Let those who have shallow pockets retain that little additional kick which reaction brings, to permit the modest two- and three-valve sets to give the users the variety brought about by an occasional trip abroad. We shall realize that possibly quality may suffer. Perhaps we may be able to afford a tone-control circuit to compensate—but, if this is impossible we shall not grumble, and if we really feel the urge for quality reception of the distant stations, we will willingly save up for a set employing an additional stage or so.

Reaction has always been a good servant to the listener who must study economy— to the great majority of listeners, that is. And at any rate, to justify this reasoning let me urge all readers to promise that they will not oscillate when it is known that interference is caused to neighbouring sets.

THREE PRACTICAL PARS

A Simple Lightning Arrester

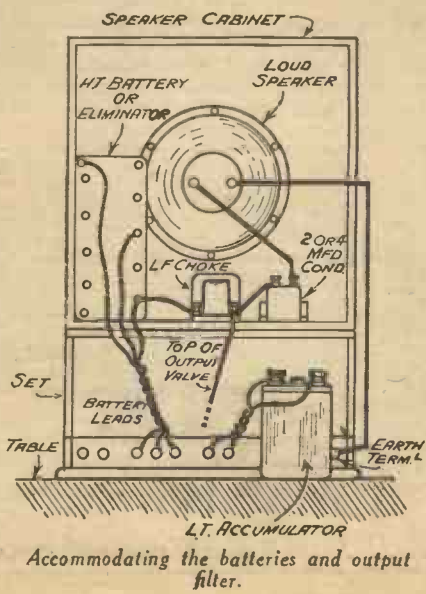
THE accompanying illustration shows a simple, but efficient, lightning arrester made from two pieces of a hacksaw blade. The holes in the saw blade can be punched out while the metal is hot, as it cannot be drilled satisfactorily while cold. The blades are mounted between two sheets of mica, as shown, on a hardwood block, which can be fixed in a convenient position near the aerial switch.—S. T. WICKS (Chelmsford).



Using hacksaw blades for a lightning arrester.

Housing the H.T. Battery and Output Filter

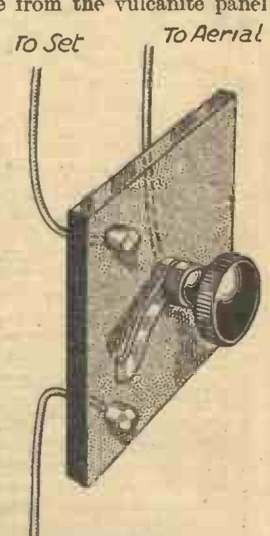
IN the majority of battery sets where no provision is made for housing the batteries and output filter inside the cabinet containing the set, it is usual to find that these are placed on the table at the rear or side of the set, which is both unsightly and a source of danger to the unwary. This is especially the case when a mains unit is in use, whilst the loud-speaker is enclosed in a separate cabinet and placed on top of the set. The attached sketch shows a method of avoiding this isolation without the necessity of providing an additional box. The idea is to accommodate the battery and output filter inside the speaker cabinet. No ill-effect to the reproduction of the speaker was observed when this was tried out. There is no reason, providing there is room, why the L.T. accumulator should not be included, but it is preferable to keep it away from metal parts which may be affected by gases arising from the vent. In the case of those sets where the battery leads are taken through holes in the side or back of the set, instead of from terminals, it may be desirable to fit a terminal strip to the back of the speaker cabinet. After this little modification is made, to all intents and purposes the owner now has a table consolette wireless set.—R. O. SURTEES (South Shields).



Accommodating the batteries and output filter.

Simple Aerial-Earthing Switch

NOT caring for the usual type of earthing switch, I made one from an old tuner taken from a discarded crystal set. Cutting a square from the vulcanite panel holding the tuner, I adapted it by removing all the centre brassstuds, leaving the two outside ones, and slightly bevelled these on the edges facing each other. The aerial lead was taken to the spindle at back of the tuning knob itself. One lead was taken from the nut, securing one stud to panel, to the aerial terminal of set and a lead from the other stud to earth. A turn of the knob and the set is earthed. The panel holding the gadget was screwed to a point near the lead-in. —GEORGE H. SPARKES (Tottenham).



A simple earthing switch.

The BEGINNER'S SUPPLEMENT

Conducted by
F. J. CAMM

HOW YOUR SET WORKS
Part 2.—The Detector Valve
By W. B. RICHARDSON

LAST week we saw how wireless waves are sent out and how they set up electric currents in the aerial circuit of your receiver. Now before passing on to consider how these currents are converted by your receiver into audible sounds I want to explain how the waves "carry" the speech and music.

The Carrier Wave

As soon as the broadcasting station is switched on, and before anyone speaks into the microphone, wireless waves are being radiated. These we likened to waves on the surface of water and as previously explained, they are all of the same height and follow one another at the same interval of time. What happens when anyone speaks into the microphone is that the waves no longer remain the same height, but fluctuate in accordance with every variation in the tone of the speaker's voice. Of course, they do not vary in *length* (distance between each crest) but only in *height*. Naturally the length of the waves must not vary, otherwise we should not be able to tune them in. We have already seen that in the pendulum illustration. This means that the waves will still cause electric currents to surge up and down your aerial, but they will vary in strength according as the waves vary in height, these variations in turn having been caused by the fluctuating sounds of the speaker's voice. I don't want to confuse you with meaningless diagrams, but a glance at Figs. 1 and 2 will show how the height of the waves varies while the length is constant. Fig. 1 represents the waves given out before any speech or music is imposed on them. They are all the same height and the same distance apart. Fig. 2 shows what happens when the announcer speaks or the band plays. They now vary in height.

How Fast the Waves Travel

It is perhaps as well at this juncture to make some mention of the velocity of wireless waves. Actually they travel incredibly fast, something like three hundred million metres per second. This means, for instance, that waves 200 metres in length sent out by a broadcasting station would strike your aerial at the rate of 1,500,000 per second. These in turn set up electric currents in your aerial circuit which surge up and down it at the same speed. Owing to their very rapid oscillations these currents are known as *high-frequency*

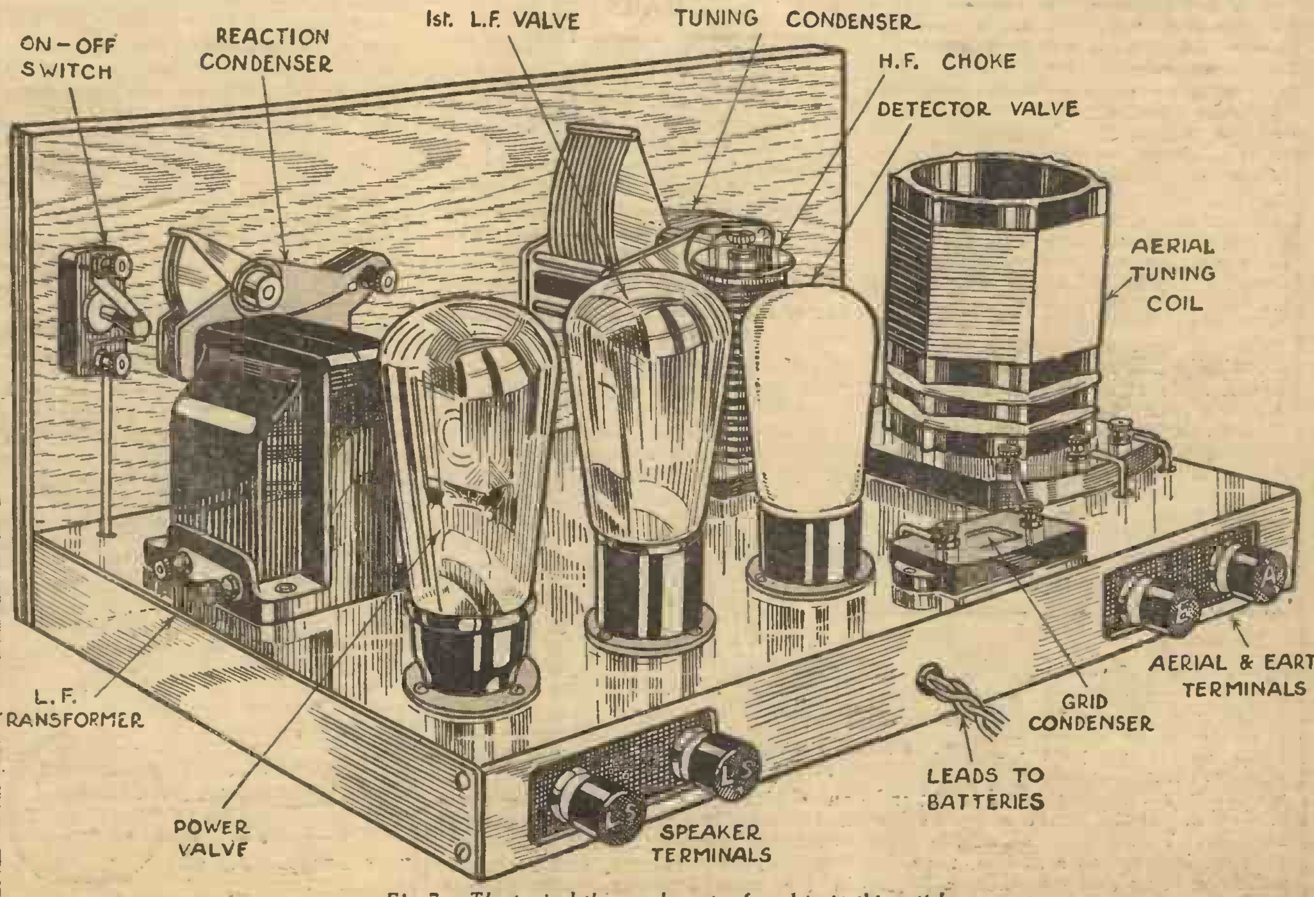


Fig. 7.—The typical three-valve set referred to in this article.

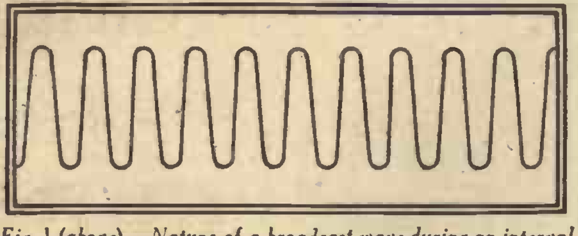
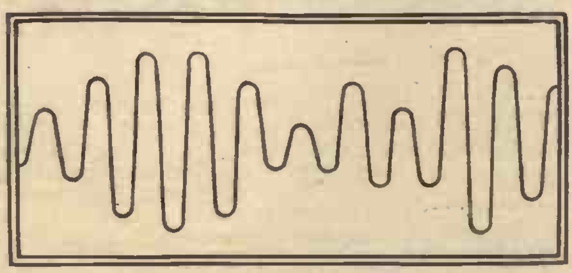


Fig. 1 (above).—Nature of a broadcast wave during an interval in the programme, and Fig. 2 (below) when the announcer speaks.



currents. It is with these that the first valve in our receiver has to deal. In order to explain the action of this valve we shall have to make one or two elementary studies of electricity.

What An Electric Current Is

The accepted theory of electricity is that all matter of whatever nature whether it be solid, liquid, or gaseous; whether it be metal, wood, stone, water, air, or anything else is composed of minute particles called atoms. This, every schoolboy knows. But these atoms are not simply tiny pieces of one sort of stuff. They in themselves are composed of a centre core or nucleus of *positive* electricity. This nucleus is surrounded by a number of *negative* particles of electricity. These latter are our old friends, the *electrons,* about which we hear so much from scientists. It is these little fellows—and by all accounts they are infinitesimally small—which are responsible for electric currents. These, unlike the positive nuclei, need not remain stationary in a substance, but can move about. If a number of them are induced to travel to one end of a wire, we say that an electric current flows along the wire.

Now in the ordinary way there are just sufficient electrons in each atom to electrically balance the positive nucleus; but if some of the electrons leave the atoms at one end of the wire and go to the other end, then the end to which they have gone will have a larger proportion of negative particles than normally and is, therefore, said to be *negative.* In the same way, the other end of the wire having a deficiency of negative particles will be *positive.*

Electric Currents In Your Receiver

If you look at Fig. 3 you will see how I have represented the currents flowing up and down the aerial circuit of your receiver. The little dots are electrons. First they travel to one end of the circuit as at (a) and then to the other as at (b). This is going on all the time your set is tuned to a station, the only difference being that sometimes a larger and sometimes a smaller flow takes place according as the wireless waves vary in magnitude with the speech or music being transmitted.

The first thing we have to do is to make these electrons do some useful work, so at G (Fig. 3) we connect a wire leading to the first valve.

Why the Valve Is Necessary

"What's that for?" you may ask. "Why can't we connect on the loud-speaker right away and hear the music?" Well, the reason is that the currents in the aerial circuit move too fast. We have already seen how quickly they oscillate backwards and forwards. The result is that the loud-speaker would be quite unable to follow them, for as soon as it had commenced to respond to the flow in one direction the current would have already changed and be flowing in the opposite direction. The average effect would be nil. What we do then is to cut off all the current in one

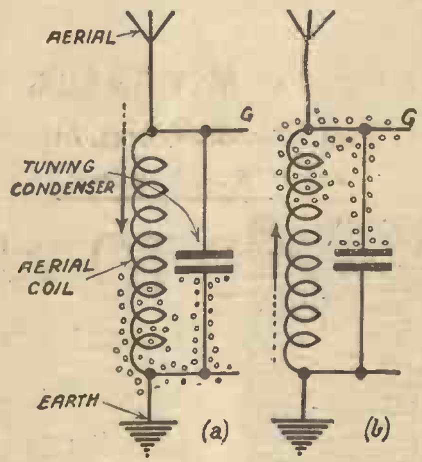


Fig. 3 (a) and (b).—Diagram illustrating the flow of electric currents in the aerial circuit of a receiver.

direction by means of a *detector valve.* The remaining currents are then all in one direction. Of course, they are still moving quickly, but instead of rising to their maximum value in one direction, and after dropping to nothing, rising to an equivalent value in the opposite direction and so giving an average effect of no current, they now rise to full value in one direction, drop to zero, and again rise in the *same* direction. This gives a definite average in that direction. It is this average current to which the loud-speaker responds and it is also this average current which varies in strength with every fluctuation of the transmitted music or speech. Thus, it is that the cone of the loud-speaker vibrates in accordance with these fluctuations, and so reproduces the sounds of the studio. Actually, there are two more valves between the detector valve in our set and the loud-speaker. They are used to magnify or amplify the currents before they reach the speaker, but we will deal with those later.

How It Works

Having seen the reason for the detector valve let us study the practical side and see how it is connected and how it works. The connections are shown in Fig. 4. For the sake of clarity the tuning circuit is not redrawn, but you can see that Fig. 4 is a continuation of Fig 3 (*b*). Of course, these two illustrations are purely diagrammatic. If you wish to see what the parts actually look like there is a "behind the panel" drawing of our typical three-valver in Fig. 7.

You will notice the aerial coil and tuning condenser and the wire "G" leading to the first valve. Actually, this wire leads first to a *fixed condenser* called the grid condenser, before connecting to the holder of the valve. This condenser is rather different from the tuning condenser in that the plates cannot be varied in relation to one another. They are "fixed," and to save space they are made of tin or copper foil, and separated by thin strips of some insulating substance, such as mica. This has much the same effect as spacing them in air in that it keeps them from touching one another, but has the advantage of taking up less room. This fixed condenser is represented on Fig. 4 by the two heavy lines at "C." Condensers are always shown in this way on circuit diagrams, the two lines representing two plates, although in practice they usually have more than two plates.

To return to Fig. 4. On the right of "C," the wire "G" passes on to a round object. This is the first *valve.* A valve as you probably know is a thing like an electric lamp. It consists of a glass bulb with no air in it. In the middle is a filament like that of a lamp but which does not glow brighter than a dull red. Surrounding the filament is a spiral of wire called the grid and surrounding the grid is a metal sheath known as the plate. These elements are shown diagrammatically in Fig. 4. You will understand that it is difficult to portray them in their true relation surrounding one another, so they are shown one above the

(Continued at top of page 1108.)

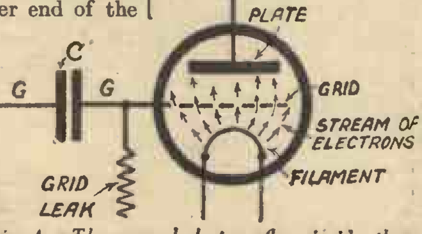


Fig. 4.—The normal electron flow inside the valve.

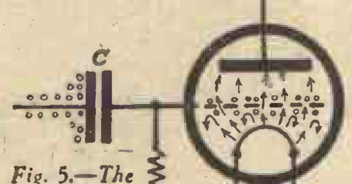


Fig. 5.—The signal electrons on the grid and grid condenser.

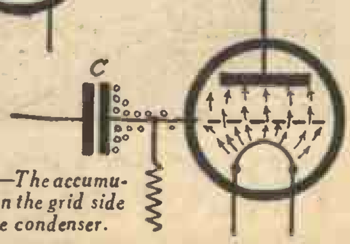


Fig. 6.—The accumulation on the grid side of the condenser.

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(Continued from page 1106)

other. Some early types of valves actually were arranged in this way.

Now let us see what goes on in the valve. The filament F is heated all the time from a battery, and this makes it give off a stream of electrons. These little electrons are flying off from it in all directions. Most of them pass between the wire turns of the grid, as shown by the arrows and stick on to the plate, that is to say, there is a steady flow of electrons from the filament to the plate. In fact, an electric current. It may at first seem strange that an electric current can flow through space like this, but it is nevertheless, a fact. Moreover, the plate is connected to the positive end of an electric battery, and so made positive. This has the effect of *attracting* the electrons from the filament, and so ensures that as many as possible get across. This attraction is due to the principle that like attracts unlike, or in this case, that positive attracts negative.

So far, we have two distinct electric currents flowing in our receiver—one the high frequency pulsating in the aerial circuit, and the other the plate current flowing steadily from the filament to the plate of the detector valve.

We have seen that the currents in the aerial circuit are due to the up-and-down movements of electrons, as in Fig. 3. Now when they are at the top end, as at (*b*), they travel along the wire "G" and crowd up against the left-hand plate of the condenser "C." (See Fig. 4.) These repel some of the electrons on the right-hand plate (like repels like) and sends them along to the grid. These electrons on the grid have a marked effect. Being right in the path of the electrons flowing from the filament to the plate, they repel some of these latter as in Fig. 4, and so reduce the plate current. This means that when the currents in the aerial circuit flow one way it reduces the plate current. Now when the aerial current flows the other way, as in Fig. 3 (*a*), the opposite thing happens. As there is now a deficiency of electrons on the left-hand plate of the grid condenser, electrons on the grid immediately rush along to the right plate of the condenser attracted by the positive state of the left-hand plate (positive attracts negative) as in Fig. 5. This rush of electrons away from the grid leaves it *positive*. It now attracts the electrons coming from the filament instead of repelling them. It actually helps them across to the plate and so *increases* the plate current.

What all this signifies is that every fluctation in the current in the aerial circuit causes a corresponding fluctuation in the plate current. It is the plate current which is passed on *via* the other two valves to the speaker as it is more powerful than the aerial current. However, there is rather more in it than this as I have not so far explained the "detector" action of the valve—how it cuts off the current in one direction as previously mentioned. This I shall have to leave over until next week.

IMPROVISED MICROPHONES—(Continued from page 1109)

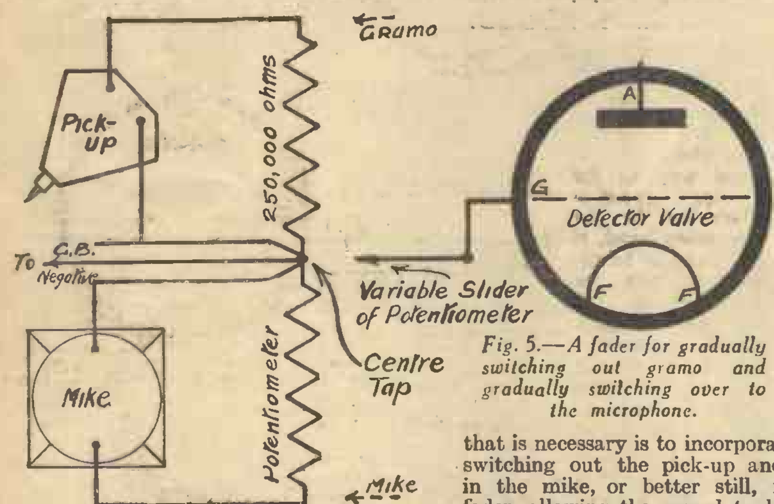


Fig. 5.—A fader for gradually switching out gramo and gradually switching over to the microphone.

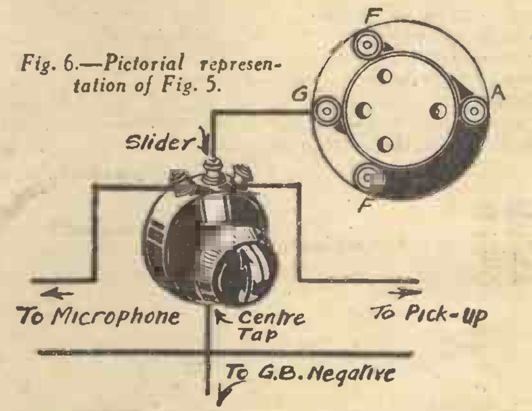


Fig. 6.—Pictorial representation of Fig. 5.

Microphones made up in this way are very handy and can be adapted to many uses: for instance, in a small dance-room where a radiogram is being used with records to obtain the dance music, the title of each piece can be announced through the mike. All that is necessary is to incorporate a switch, switching out the pick-up and switching in the mike, or better still, make up a fader, allowing the record to be gradually faded out and the announcer brought in. This obviates the objectionable clicks and other noises which go with switching. Such a fader is shown in Fig. 5 and Fig. 6. The resistance winding of the fader is centre-tapped and connected to grid-bias negative, so when the movable contact arm is over this centre-tap volume is cut down to zero, but when the arm is moved over towards the gramo terminal, the volume gradually increases until the volume from the record reaches its maximum; likewise when the slider is moved over in the other direction the maximum volume can be obtained from the microphone.

ELIMINATING THE LOCAL STATION—(Continued from page 1100)

especially the absorption type, there is a tendency for "pulling" between the tuned circuits. Adjustment of either trap or receiver near the resonance point tends to drag the other circuit in tune also, which makes tuning a trifle difficult. This trouble may be obviated very largely by working with as weak a coupling as possible in all circumstances. In passing it may be remarked that the absorption trap makes a very good wave-meter if properly calibrated, and thus may serve a dual purpose. It is, of course, essential that both coil and condenser should be well made and rigid articles in order to preserve permanence of calibration.

No remarks are really necessary concerning the actual construction of wave-traps, excepting perhaps the coil. For medium wavelengths the inductance should be about 200 microhenries, and in cases where a long wave-trap is needed, 2,100 microhenries. Full data for winding such inductances has already been published in PRACTICAL WIRELESS Data Sheet No. 2. As most listeners will only need to concern themselves with the medium-wave band, 45 turns of No. 26 D.S.C. on a 3in. former will meet the case. When the acceptor trap is used it will, of course, be necessary to use a larger coil as the tuning capacity is in series with the inductance. As a rough guide about 60 turns may be wound on.

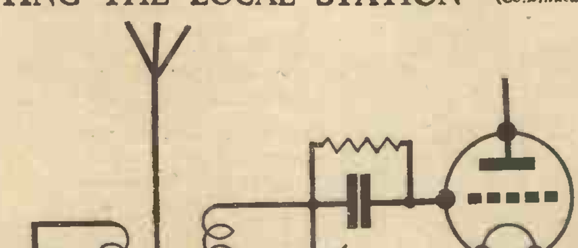


Fig. 5.—An absorption wave-trap.

IMPROVISED MICROPHONES

This Article Explains the Use of Loud-speakers, Headphones, etc., as Microphones

By GILBERT E. TWINING

IT is not generally appreciated that with the wonderful amplification of the modern receiving set it is possible to press into service as microphones such parts as headphones, loud-speakers, and gramophone pick-ups. It must be understood that they are not quite so sensitive as the ordinary microphone, and therefore singing and talking must be done close up to them; in this way they will give excellent results.

Headphones

When using headphones as "mikes" it is better to use both sides of them—that is to say, both ear-pieces, and cup them in the hands. Make a point of speaking right into the receivers, as this will then impart the maximum amount of vibration to the diaphragm. The more sensitive the 'phones are, the better, for then a truer and stronger reproduction of the voice will be the result. In Fig. 1 is shown the best method of holding the 'phones in the hands. It would probably be an advantage to make small funnels or paper cups to fit the outside diameter of the ebonite caps of the 'phones, thus making the voice more effective.

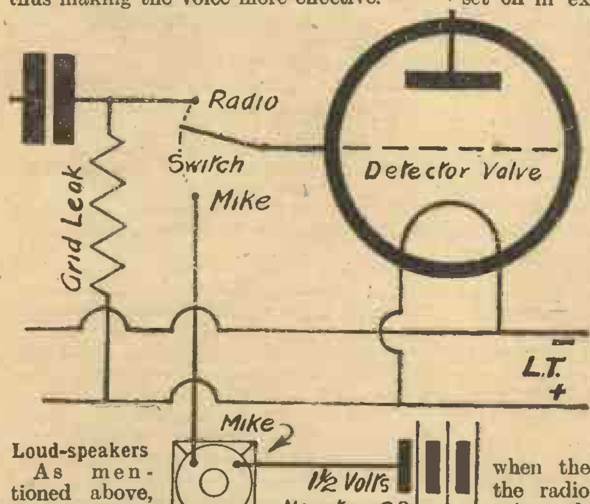


Fig. 3.—Switching in the microphone.

Loud-speakers

As mentioned above, loud-speakers can be pressed into service as mikes, and they are an advantage over the headphones, for it is not necessary to speak quite so closely into them, although the best position must be obtained by trial. To obtain the greatest volume, however, the sound waves must be directed into the cone, enabling the maximum amount of movement of the armature to take place, but a little experimenting will soon indicate the right angle for these sound waves of speech and music to strike the diaphragm. Fig. 2 shows such a cone in use. To indicate how a speaker of this type is so much more sensitive and not so directional as the headphones it should be placed in another room which is occupied; it will be found to be quite possible to detect the general conversation going on, together with the scraping of chairs, etc., almost in the same way as the correct microphone would do.

Pick-ups

It is often possible to use the ordinary gramophone pick-up as a small microphone by fitting it with a light paper cone fastened to the needle with a small light chuck; the pick-up must be of a very sensitive nature, however.

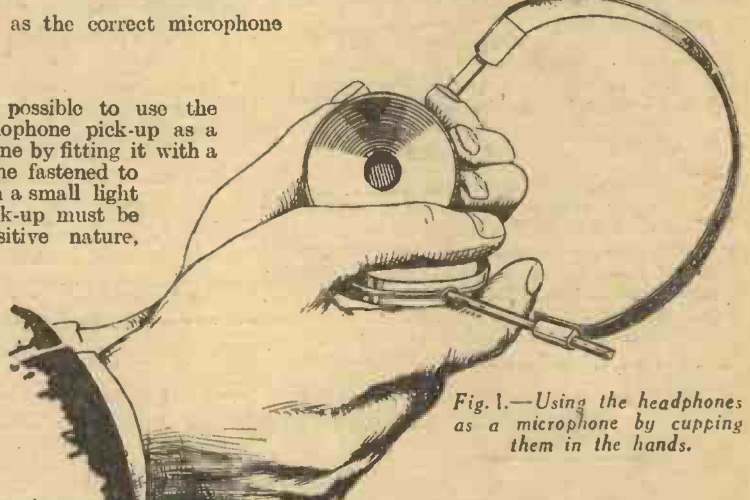


Fig. 1.—Using the headphones as a microphone by cupping them in the hands.

The Adaption to the Set

If provision is made on the set for a pick-up, then it is a simple matter to connect the two leads from the improvised microphone to the two leads intended for the pick-up, and switch the set on in exactly the same way as for playing gramophone records. On the other hand, if no pick-up terminals or jack are provided on the set, then it is quite simple to connect the mike to the grid circuit of the detector valve. In a three-valve set of the high-frequency, detector, and low-frequency type the best arrangement is to fit a switch in the circuit as shown in Fig. 3. Thus when the switch is in one position the radio programmes will be received, using the three valves, but when the switch is moved to the other position it cuts out the screened-grid valve—high-frequency side of the set—and the input from the mike is thus connected through the switch to the grid of the detector valve; the other lead from the mike goes to grid-bias negative 1½ volts. If the mike is to be used for some time, it may be worth while to also fit a low-tension switch in the high-frequency side of the set; for, as before stated, when the mike is switched in the H.F. valve is switched out—that is to say, not used, and therefore does not require low-tension current to the filament. It is possible to fit a two-pole switch for the mike and the low-tension current, so incorporating both operations at once (see Fig. 4).

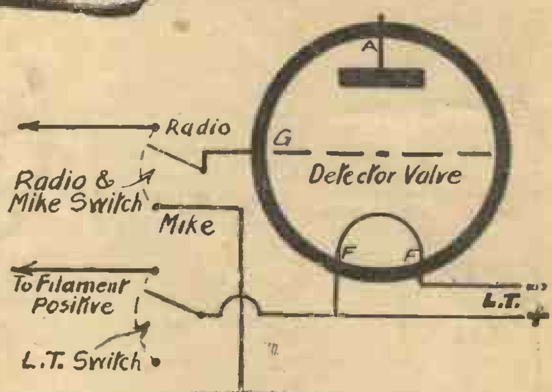


Fig. 4.—Fitting a 2 pole switch for switching in mike and switching out L.T. current of H.F. valve.

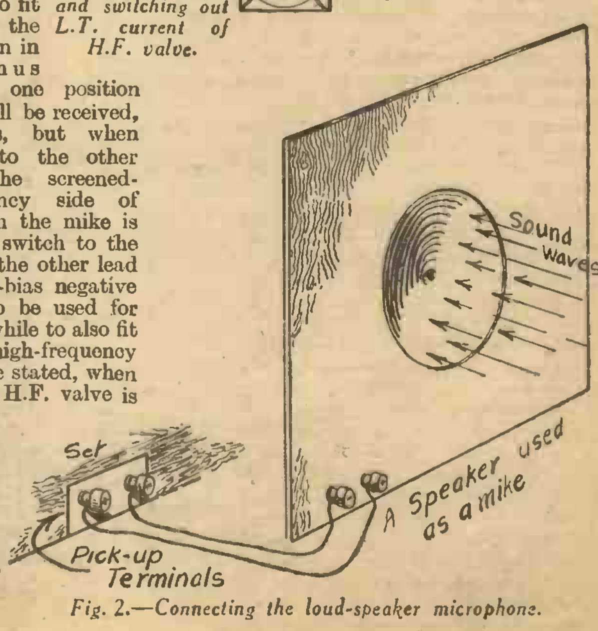
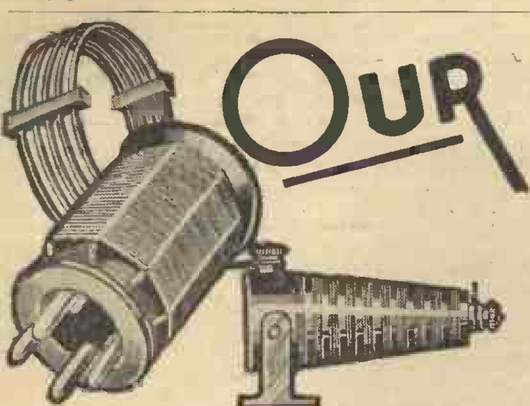


Fig. 2.—Connecting the loud-speaker microphone.

(Continued on page 1108.)



OUR SHORT-WAVE SECTION

ON THE SHORT WAVES

By J. GODCHAUX ABRAHAMS

THE possessor of a wireless receiver who daily captures with more or less ease a number of continental radio programmes feels at some time or other the urge to reach out to more distant regions; he is tempted to depart from well-known channels, and to adventure into a new field of exploration. He may have heard his friends boast of their captures of programmes from North and South America, Java, China, or the even farther Australian continent. In most instances, the beginner is debarred from such an attempt by the idea that transmissions on short wavelengths are difficult to tune in or, alternately, when found, to hold for any period of time. In addition, he may think that for the reception of broadcasts below, say, 60 metres, expensive sets are needed, and that to build a suitable instrument would be a costly and, probably, a difficult matter. Articles which have appeared in PRACTICAL WIRELESS have demonstrated by now that this is not a fact, and that quite to the contrary the construction of a small receiver suitable for the purpose, providing the usual amount of necessary care is taken, is no greater a problem than the building of an ordinary set for the reception of stations on the broadcast band. Moreover, tuning presents no snags, and the satisfaction of hearing transmissions emanating from the other side of the globe is such that, in most instances, the capture of the first distant signals amply compensates for any extra trouble taken in the matter. (If the listener does not care to build his own receiver, he has the choice of instruments made by various dependable firms who cater for this particular market). An incentive which, to-day, prompts us to turn to the short waves is the fact that during the last year or so a number of worth-while broadcasting stations on the European continents and in other parts of the world simultaneously transmit on the lower channels, and it will be often found, especially in the case of the European programmes, that where the reception of the original transmissions on some nights is fitful it can be more satisfactorily secured through the short-wave relay. As an instance, let me quote such stations as Königswusterhausen, Copenhagen, Rome, and even Moscow T.U., on occasion; through Zeesen, Skamlebaek, Prato Smeraldo, and so on, you may receive the respective entertainments without much trouble. In addition, the development of radio telephony on short-waves has been so great during the past few months, that there are a number of interesting broadcasts to be picked up throughout the day or night. It must, however, be borne in mind that individual transmitters only work to *scheduled times;* they cannot be always on the air. Much of the disappointment experienced by listeners who are trying out a new short-wave set is due to the fact that they search for stations according to a mere list of wavelengths, and, consequently, may be endeavouring to tune in at a period when no broadcast is taking place. It may be also that as many transmitters operate on different channels at various periods of the twenty-four hours, the wrong frequency for the time of day or night has been selected.

Working to a System

If good results are to be secured some system must be adopted. It is a good plan to divide the short-wave band (*i.e.*, channels between, say, 12.15 and 80 metres) into definite sections, and to devote a sitting or so to each in turn. Casual twiddling of the condenser on the off-chance of picking something up seldom leads anywhere. As a general rule, you may take it that there are *definite* times at which to listen to stations in various parts of the world, on *definite* bands of wavelengths.

The following will give you a rough guide for the next month or so :—

Midnight to 5.0 or 6.0 a.m. G.M.T., U.S.A. stations (Atlantic Coast and mid-west); South American States (30–60 metres); 6.0–10.0 a.m., Australia, New Zealand, U.S.A. (Pacific Coast) (30–50 metres).

10.00–14.00, European stations.

13.00–17.00, China, Japan, Java, etc. (30–50 metres); United States (16.28 metres).

17.00–20.00, South Africa, East Africa, India (30–50 metres); United States, Canada (18–28 metres).

20.00–24.00, United States, South America, Europe (25–50 metres).

In view, however, of their particular suitability, certain wavelengths are used according to the time of day or night. During daylight hours, as a rule, searches should be made on channels from, say, 12–17 metres, towards twilight from 19–26 metres, during the early evening on and around 31 metres and during the night, 48–60 metres.

By International agreement, as in the case of the "medium," and "long" waves, certain portions of the short waveband have been allocated to broadcasting stations for radio entertainments, as against commercial and other transmissions. If you study a list of such broadcasters, you will find that they are comprised in the following sections, namely, 11.27–11.7 metres (26,000–25,600 kc/s) as yet seldom used; 13.9–14 metres (21,550–21,450 kc/s); 16.85–16.9 metres (17,800–17,750 kc/s); 19.55–19.85 metres (15,350–15,110 kc/s); 25.2–25.6 metres (11,900–11,700 kc/s); 31.2–31.6 metres (9,600–9,500 kc/s) and 48.8–50 metres (6,150–6,000 kc/s). There are few exceptions and it is below, between and above these bands that you pick up morse signals, or "scrambled" telephony emanating from shipping, commercial, meteorological or public service stations.

In each of these bands you will find a number of transmitters at different times of the day or night. It may be interesting to point out at this juncture that amateur experimental stations may be heard talking to each other (telephony or telegraphy) on channels comprised between 150 metres (2,000 kc/s) and 175 metres (1,715 kc/s); 75 metres (4,000 kc/s) and 85.7 metres (3,500 kc/s); 41.1 metres (7,300 kc/s) and 42.9 metres (7,000 kc/s); 20.83 metres (14,400 kc/s) and 21.43 metres (14,000 kc/s) and also, but more infrequently, on the 10 metre (30,000 kc/s) and 5 metre (60,000 kc/s) bands reserved for them.

High-power Transmissions

Possibly, as a start, and as a matter of encouragement, it would be wiser to select a few stations which are most likely to be tuned in without difficulty. Try, for instance, for such powerful broadcasts as Moscow T.U. on 50 metres; HVJ, Vatican (50.26 m.); GSA, Daventry (49.6 m.), or even towards 10.0 p.m., G.M.T. W3XAL, Boundbrook (N.J.) on 49.18 m. It is more than likely that when searching for these —and there is every chance you will log them at your first attempt—you will also pick up neighbouring stations such as Skamlebaek, W8XK, Pittsburgh, Nairobi, Caracas, Lisbon, Madrid, and so on. Your search should be confined to a very small segment of the dial both above and below an identified and logged transmission. This will give you a true land-mark for finding other broadcasts in that particular section. Devote some time to the 24–50 metre band which is one of the richest to explore, as it includes not only a large number of European broadcasters but also stations working in the U.S.A., Australia, and Africa.

International Re-broadcasts

International broadcasts, or transmissions which are made by one State for the benefit of other countries, are now weekly features of the radio programmes; not only are they relayed by stations in the broadcasting band, namely, between 200-600 metres and 1,000–2,000 metres, but they are also taken by certain short-wave transmitters in order that they may reach beyond the limits of a continent. Special concerts provided by the Swiss stations are re-broadcast through Prangins; musical entertainments by Paris through Radio Coloniale Paris-Pontoise; from Berlin, by Zeesen or Nauen; from Madrid, by Aranjuez and so on. Moreover, a more or less regular interchange now exists between the United States and Great Britain, Germany, Holland, Switzerland, Italy, and even occasionally with Poland—and this policy is being steadily developed.

Special short-wave commercial and other stations as Rugby, Nauen, Rocky Point (N.J.), Hurlingham (Buenos Aires), etc., etc., are also used as channels for these broadcasts, and it is frequently possible to pick up these relayed programmes from such sources. Take the National Broadcasting Corporation of America, or the Columbia Broadcasting Corporation's programmes, as an example; these may be transmitted for European consumption through a number of channels which are given under in order of wavelength:—

16.36 m. (18,340 kc/s) WLA, Lawrenceville (N.J.)
16.66 m. (18,000 kc/s) WAJ, Rocky Point (N.J.), also on 22.26 m. (13,480 kc/s).
20.27 m. (14,800 kc/s) WQV, Rocky Point.
20.49 m. (14,650 kc/s) WND, Deal Beach (N.J.), also 32.71 m. (9,171 kc/s).
20.70 m. (14,490 kc/s) WKJ, Rocky Point (N.J.), also on 31.71 m. (9,460 kc/s).
22.35 m. (13,420 kc/s) WHR, New York.
40.54 m. (7,400 kc/s) WEM, New York.
43.11 m. (6,957 kc/s) WEO, Rocky Point.
44.61 m. (6,725 kc/s) WQO, Rocky Point.
57.03 m. (5,260 kc/s) WQN, Rocky Point.

(In parentheses, I should add that much experimenting is now taking place on even shorter wavelengths, and tests may be heard from time to time from WQJ, 14.12 m. (21,240 kc/s); WQX, 14.87 m. (20,180 kc/s); WQE, 15.86 m. (18,920 kc/s); WDS, 15.87 m. (18,900 kc/s); WQB, 16.72 (17,940 kc/s); WLL, 16.76 m. (17,900 kc/s).

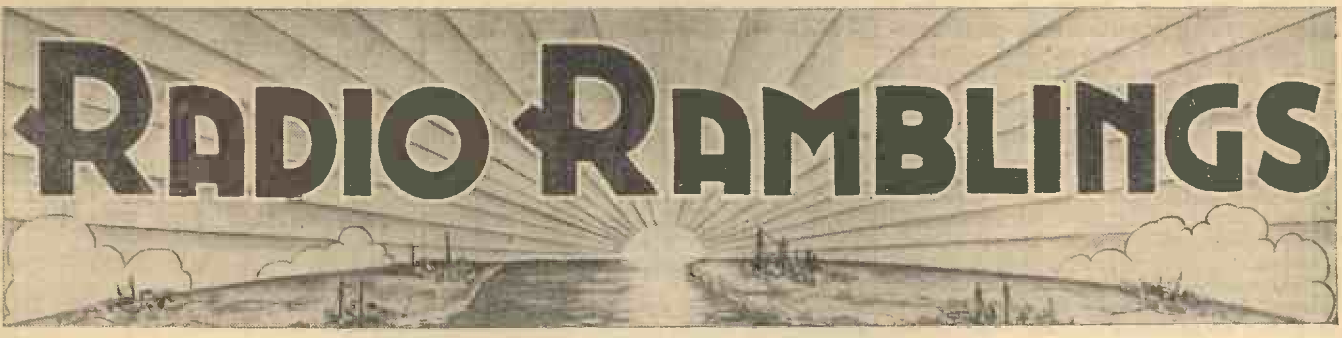
"Broadcast" and "Check" Transmissions

When transatlantic broadcasts are made

they may be conveyed through two or three separate channels, and you will come across another frequency used as an "observation post," namely, one reserved to the engineers for communication, and over which they compare notes in regard to the reception of signals, quality and so forth. On this side of the Atlantic the same procedure obtains, and the wavelengths most used for "broadcast" and "check" are as under:—

16.10 m. (18,620 kc/s), GBU, also on 24.41 m. (12,290 kc/s).
16.38 m. (18,310 kc/s), GBS, Rugby, also on 33.25 m. (9,020 kc/s).
16.85 m. (17,804 kc/s), Kootwijk (Holland).
16.88 m. (17,770 kc/s), DJE, Königswusterhausen (Germany).
17.51 m. (17,130 kc/s), HAT, Budapest (experimental).
19,737 m. (15,200 kc/s), DJB, Zeesen (Germany).
19.84 m. (15,120 kc/s), HVJ, Vatican (Rome).
20.64 m. (14,534 kc/s), HBJ, Prangins (Switzerland).
24.9 m. (12,050 kc/s), PDV, Kootwijk (Holland).
25.20 m. (11,900 kc/s) FYA, Radio Coloniale (Paris).
25.51 m. (11,760 kc/s), DJD, Königswusterhausen.
29.16 m. (10,290 kc/s), DIQ, Königswusterhausen.
30.3 m. (9,890 kc/s), Prangins (Switzerland).
30.4 m. (9,868 kc/s) EAQ, Aranjuez (Spain).
31.14 m. (9,630 kc/s), HBQ, Prangins (also on 40.3 m.).
31.31 m. (9,580 kc/s), HBL, Prangins (Simultaneous broadcast through HBP, 38,476 m. (7,790 kc/s).
38.65 m. (7,765 kc/s), PDM, Kootwijk (Holland).
49.83 m. (6,020 kc/s), DJC, Königswusterhausen.

To these, of course, must be added the Daventry Empire stations operating on 13.97 m. (21,470 kc/s); 16.88 m. (17,770) kc/s); 19.82 m. (15,140 kc/s); 25.28 m. (11,865 kc/s); 25.53 m. (11,750 kc/s; 31.30 m. (9,585 kc/s); 31.55 m. (9,510 kc/s), and 49.59 m. (6,050 kc/s) bearing respectively the call signs GSH to GSA inclusive.



Transmitting Circuits

As a number of readers continue to send in requests for a circuit diagram of a simple transmitter, it might help if I explain that a single-valve transmitter is fundamentally the same as a single-valve receiver. The only real difference is that the transmitting valve is constantly maintained in a state of oscillation, whilst the carrier wave (or steady oscillation) is modulated by impressing speech frequencies upon it. Perhaps the explanation is not quite clear, so let us look at the circuit of Fig. 1 which is, as you can see, an ordinary single-valve receiver with capacity reaction. Now you know that if reaction is increased beyond a certain point the valve commences to oscillate—that provides the carrier wave. The speech frequencies, or modulations, must next be attached to the carrier by some means or other. One way is to feed them into the grid-return circuit at the point shown by the cross marked "1," and another is to apply them to the anode circuit at the point marked with cross number "2"; in both cases the object is the same.

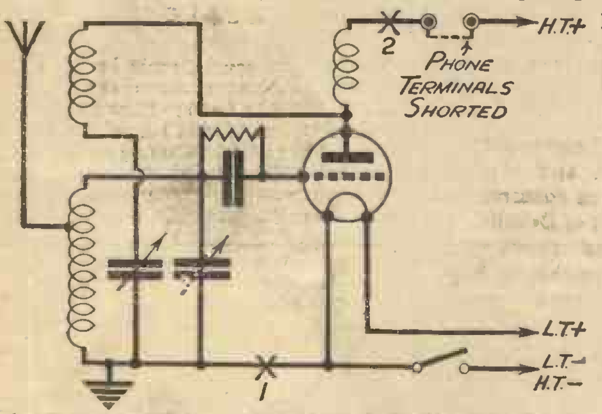


Fig. 1.—A standard one-valve set and the points to alter for transmission.

We must now see how the speech frequencies are produced, and how they can be applied to the circuit of the oscillating valve. As you know, a microphone is employed to change the sound vibrations into electrical vibrations, and this is connected in series with a battery and the primary winding of a high-ratio step-up transformer as shown in Fig. 2. When air vibrations (forming what we know as sound) strike the diaphragm of the microphone this vibrates in sympathy, and causes a fluctuating current to flow from the battery through the transformer primary. This fluctuating current is amplified by the transformer, and is then fed into the oscillating circuit by connecting the secondary winding at either of the points mentioned above. The two methods of connecting the microphone are known as grid-circuit and anode-circuit, modulation. There are, of course, numerous other ways of modulating the carrier wave, but all are similar in principle to those we have considered.

JOTTINGS FROM MY NOTEBOOK
By "DETECTOR"

Increasing the Range of a Milliammeter

Every wireless amateur knows the immense value of measuring instruments such as voltmeters, milliammeters, etc., when carrying out experiments or testing a receiver, but there are probably hundreds of readers who cannot afford to buy all the instruments they would like. A milliammeter is essential to anyone who takes more than a passing interest in his hobby, and for that reason is possessed by most enthusiastic amateurs. And since this instrument is similar in principle to all the others it can be employed for taking measurements of all kinds, provided that a few spare resistances of different values are available and that a little ingenuity is exercised. For instance, a milliammeter reading 0-10 milliamps can be used as a 0-10 voltmeter by connecting it in series with a 1,000 ohms resistance, or it can be made to read up to 100 volts by joining it in series with a 10,000 ohms resistance. Similarly, by choosing other resistance values (obtained from the formula—resistance equals maximum voltage to be measured divided by the full scale reading of the meter in milliamps, and multiplied by 1,000—any voltage can be measured. This idea formed the basis of the design of the Practical Wireless Multi-Meter" described in Practical Wireless No. 21. But besides using the milliammeter for measuring voltages it can also be employed to measure higher values of current than for which it was originally intended. To enable it to do this, it must have a resistance joined in *parallel* with its terminals, and the actual resistance value is entirely dependent on the resistance of the meter. As an example, a 0-10 milliamp instrument can be made to read up to 20 milliamps by using a resistance equal to that of the meter, or it can be made to read up to 30 milliamps by using a resistance equal to half that of the meter, and so on. The conversion is therefore a perfectly simple matter if the resistance of the meter is known. But in most cases the resistance is not known and, therefore, the simple calculation is of no assistance.

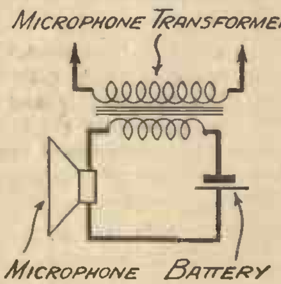


Fig. 2.—The microphone circuit.

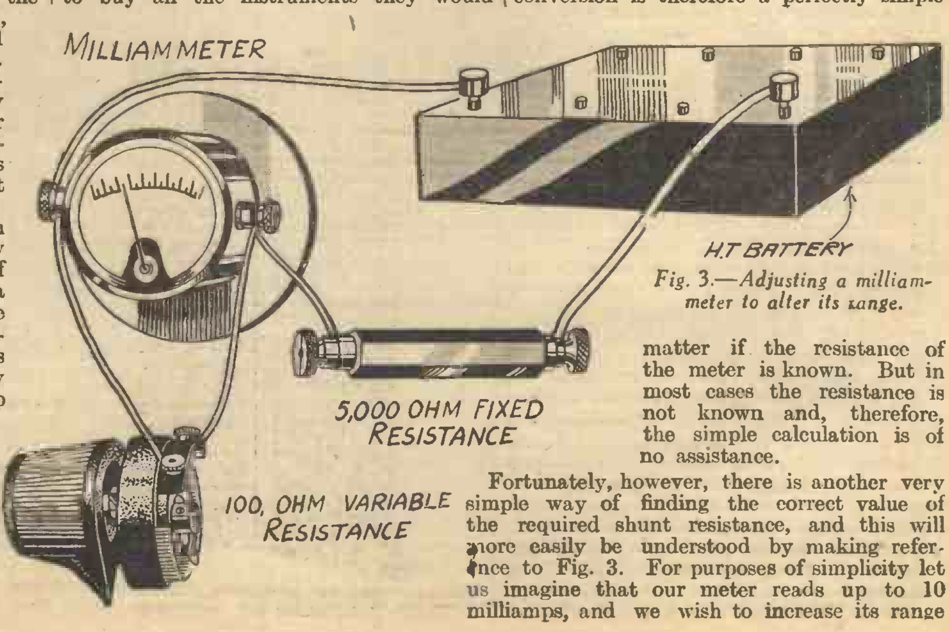


Fig. 3.—Adjusting a milliammeter to alter its range.

Fortunately, however, there is another very simple way of finding the correct value of the required shunt resistance, and this will more easily be understood by making reference to Fig. 3. For purposes of simplicity let us imagine that our meter reads up to 10 milliamps, and we wish to increase its range to 20 milliamps. First of all the milliammeter is connected through any convenient fixed resistance of about 5,000 ohms to a high-tension battery, and the voltage of the latter is adjusted until a full-scale reading is obtained on the meter. Next, a 100-ohm variable resistance is connected in parallel with the meter terminals and this is varied until the instrument reads 5 milliamps. As the current flowing through the circuit will be practically the same as before the scale reading will have been doubled or, in other words, 10 milliamps will be represented by a scale reading of 5 milliamps. Had the variable resistance been so adjusted that a current of 2.5 milliamps were registered the reading would have been quadrupled, and by following a similar system any desired " multiplication factor " could be obtained. It can be seen that it would be a simple matter to " calibrate " the variable resistance so that it could later be set to an appropriate position to provide any desired multiplication factor. If preferred, other readings could be marked on the scale of the meter to apply to the various ranges, but otherwise the reading obtained must be multiplied by the appropriate factor. The method described does not give perfectly accurate results, but the maximum degree of error will never exceed about 2 per cent., which is probably no more than the permissible discrepancy in any medium-priced meter.

Interest in Wireless.

SCEPTICAL folk are constantly telling us that wireless has gone nearly as far as it can, and that public interest is rapidly waning. They also say that sooner or later the amateur must tire of building new sets and experimenting with different circuits. I do not believe it, and I am quite sure the regular readers of PRACTICAL WIRELESS don't, because they are probably the most enthusiastic crowd of amateurs in the country. It is very clear from the numbers of letters and queries we receive every day that enthusiasm is keener than it has ever been since broadcasting began. I can honestly say that, although I have been experimenting and building sets for at least a dozen years I find more to interest me at the present time than I did during any part of my career as a wireless " fan." Oh, yes, I started as an amateur and, although I have since been engaged in various branches of the wireless industry, I can never bring myself to believe that I am a " professional." It is true that I now earn my living by radio journalism, but that does not alter the fact that I am an amateur at heart. I still take great delight in working out a new circuit.

Listen to the Amateurs

BY the way, if any reader is seriously contemplating the possibility of setting up a transmitter (and applying for the necessary licence) I would strongly recommend him to make a practice of listening to the amateurs who transmit very frequently on Sunday mornings, as well as at other times during the week. They operate principally upon wavelengths round about 160, 42 and 20 metres, and you will probably learn a good deal by listening to them and following the various tests they happen to be making. Of course it is no use trying to improve your knowledge by wasting time on the few who do nothing else but grind out gramophone records all the time; they are the black sheep who never seem to use their station for its ostensible purpose of serious experiment.

Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by his correspondents

Panel Mounting Washers: The "Selectone"

SIR,—On the fifth line from the bottom of column one on page 429 of No. 9 PRACTICAL WIRELESS Mr. Preston says, under the paragraph on "Panel-Mounting Bushes": "*When* insulating washers are required," etc. That's just it, *when* are they required? I have a Det. 2 L.F. set which has burnt out all sorts of things—a .0003 mica condenser in the aerial circuit, a bakelite tuning condenser, a transformer coupling the L.F. to the power stage, etc. I believe the set originally was designed for an ebonite panel, but I fitted a metal one, and properly insulated the reaction condenser with two bakelite washers and bush. Yet when I want to put a fuse bulb in the negative L.T. and earth lead it lights up, and stops the set. I take the bulb out and the set works all right. Perhaps an article on "when" insulating washers are required, and where, would be interesting to other constructors as well.

The "Selectone"

While this is not what I asked for in the letter of mine you published in No. 15, I am very much intrigued by the circuit published in No. 16, and shall make it up out of curiosity, but shall have to use ordinary L.F. transformers resistance-fed instead of the two new ones specified. Getting the components together, I notice you say: "1 Bulgin G.B. battery." I take it this stands for "1 pair clips." The wooden chassis also shows two side pieces. These must be as long as the baseboard is wide—viz., 8in., yet are specified "2 hardwood pieces 14 x 3½ x ½in," which I presume ought to read "8in. by 3½in. by ½in." But perhaps the next issue will enlighten me.—F. M. BECK (London, W.C.2).

Topping Accumulator

SIR,—Pressure of business has curtailed my reading time recently, so I have only now read Mr. Burchell's letter in your issue of the week ending December 31st, entitled "Topping Accumulators." I would like to draw your attention to the fact that Mr. Burchell's remarks *re* "careless operators at charging stations (so called)" are absolutely unfounded. Accumulator manufacturers advocate and instruct charging operators and car owners, etc., to "maintain the level of the electrolyte ⅛in. above the plates by the *addition* of distilled water," and this procedure is carried out at all charging stations.

The adding of distilled water to *neat, full-strength* acid is dangerous, not because of the temperature rise which is exactly the same as when acid is added to water, but owing to spluttering taking place. The addition of any amount of water direct into 1.350 S.G. acid (the highest gravity used in accumulators) causes no temperature rise. Personally, I have had a long experience of accumulators and their charging, and have never yet known a glass jar cracking or plates being injured through the simple operation of topping up in the usual manner. The method suggested by your correspondent is too lengthy and inaccurate to be entertained by an efficient charging station. Further, strong soda solution will not fully neutralize acid. Ammonia fortis should be applied immediately to acid spilt or splashed on clothes, and a saturated solution of baking soda to any parts of the skin. Wishing PRACTICAL WIRELESS that which it deserves—every success.—R. S. MENGES (Scarborough).

CUT THIS OUT EACH WEEK.

DO YOU KNOW?

—THAT special double valves are now obtainable which combine the function of detector and volume control valve.
—THAT the first thing to do when tracing hum in a mains receiver is to screen every choke.
—THAT the on-off switch in a battery receiver should be examined every month and the contacts cleaned if found necessary.
—THAT the shelf-life of a battery must not be overlooked when using a Q.P.P. circuit.
—THAT a 1 to 1 output transformer often proves most valuable in an unstable receiver.
—THAT a fuse should always be included in the secondary circuit of a mains eliminator transformer to avoid damage to the transformer due to short-circuits.
—THAT an ordinary flash lamp bulb will serve for the above purpose.
—THAT the value of the smoothing condenser in a mains eliminator should not be increased above that recommended by the valve or metal rectifier manufacturers.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Congratulations: D.C. Mains Sets

SIR,—I should like to congratulate you on the essentially practical character of your periodical. From my experience of journals dealing with the construction of wireless sets, during the past ten years, I have no hesitation in giving yours full marks as the best of the bunch. There is one way in which, I think, some improvement might be made, from my own point of view, and that is that more sets designed to run off D.C. mains should be included. The Wireless Press seem to agree to ignore a very large part of the total population of this country who are, and will be for some years yet, supplied by D.C. mains.—F. S. W. (Richmond).

A Tuned "Cage" Aerial

SIR,—In answer to various readers' inquiries I have much pleasure in giving the following details concerning my "Cage" aerial, mentioned in January 7th issue.

Ever since wireless has been practised we have all followed like geese our leaders who stated that an outdoor aerial is the "ideal" aerial. Well, we know to-day that a closed circuit consisting of a coil and a condenser can be tuned to a wavelength, or, in other words, we fix its resonance. Let us look at it from another view. We ought to say "We make it selective to one particular wavelength." If we could make an aerial of one very large turn of wire and tune it by means of a condenser, we can tune it to any desired wavelength. Then couple this to the tuning arrangement of a set by means of a high resistance or neutrodyne condenser. I prefer the latter. As it was impossible to make a one turn circular aerial, I tried a frame aerial, but owing to its directional properties it was not an unqualified success. I then wound it in cage form, fixing two 9in. discs 12in. apart, and the results were satisfactory. Having a three-gang condenser lying idle, I wound the cage with three windings, using a condenser to each, and took a common connection from one side of each condenser and coupled it to the set by means of a neutralizing condenser, keeping, of course, the connecting wires between condensers of cage and set as short as possible. The tuning is not so difficult as would at first appear, but unless the three windings are fairly accurate, tuning is comparatively flat.—V. DELEBECQUE (Hornsey).

A Veritable Gold-Mine of Information

SIR,—I have received my copy of Encyclopædia, for which many thanks. I must say it is a veritable gold-mine of information, and should be treasured by amateur and professional alike. I shall treasure it to the end of my radio days.—E. NASH (Stoke Newington).

Encyclopædia Far Exceeds Expectation

SIR,—Very many thanks for your "Wireless Encyclopædia" just received. I really cannot let this go by without showing my appreciation, as the book is far beyond my expectations, and I am proud to be the owner of it. The information contained therein is far more advanced than any other book of this nature I have yet seen. I am sure my opinion will not differ from any other of the lucky readers who have very wisely entered for this presentation. Wishing you every success in the new year. —A. KING (South Tottenham).

The Lighter Side

SIR,—I must admit your excellent journal is the only paper published that caters entirely and wholly for the radio enthusiast, and would like to say I agree with your correspondent, Mr. A. P. West, of Liverpool, in the January 28 issue, *re* studios and artists. My contention is that those readers interested in such items have a wide range of papers, books, and magazines to choose from for this information, and why should they want to take up the valuable space of the only journal we radio enthusiasts have to rely on now. What have studios and artists to do with PRACTICAL WIRELESS? How can we improve our sets and knowledge of wireless by reading such items?—E. STEWART-WALKER (Ilford).

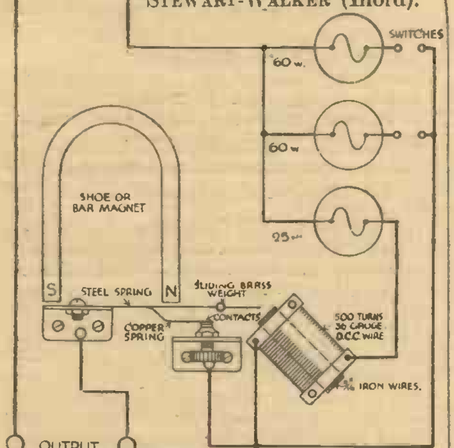


Diagram illustrating Mr. Mitchell's letter.

Vibrating Reed Accumulator Charger

SIR,—On your "Radio Wrinkles" page of December 3rd last you publish a vibrating reed accumulator charger made from an electric bell. This arrangement is rather wasteful inasmuch as the current working the coils is running to waste. I enclose a diagram of charger designed and constructed by myself in which this waste does not occur. The coil is worked by current passing through a 25-watt lamp, then through coil and over the contacts, and so on to the accumulator. This makes a very effective trickle charger, and if more amps are desired extra lamps can be switched on. In adjusting the reed the contacts must be just touching, otherwise the current will not commence to flow. Adjust brass weight on reed till it is in tune with phase of supply (the weight in my case is the leg of a valve straddled over the reed). When once in tune no sparking will take place at contacts. The contacts can either be magneto points or copper and carbon. Once adjusted, the charger requires no further attention.—GEORGE MITCHELL (Sunderland).

Next Week's Free Data Sheet
is entitled:
"MAINS VALVES."

WHAT IS WRONG?

(Continued from page 1082.)

grid circuit is returned to L.T. negative there will, in effect, be a slight negative bias applied to the valve, and when the circuit is returned to L.T. positive (for example, through the detector grid-leak), a small positive bias will be applied. The currents measured by the method outlined above will be those flowing in the anode circuit of all valves except the screened grid one, and in that case it is the screening grid current which will be indicated. To measure the anode current of an S.G. valve it is necessary to connect the milliammeter between the anode terminal, on top of the valve, and its connecting wire, as shown in Fig. 12. The priming grid current to a pentode is measured by connecting the meter between the terminal on the valve cap (or on the valve holder when a 5-pin pentode is used), and its connecting wire; this is also illustrated in Fig. 12.

THE HIRE PURCHASE SYSTEM
By a Solicitor

IN these days when there is hardly a firm in the country which does not offer to sell its goods on what is generally known as the Hire Purchase System or Instalment Plan, it is important that everyone should have some idea as to what this means and what rights and obligations the purchaser is put under when entering into such an agreement.

As a general rule, when the hire purchase agreement is perused, it will be found to be a hiring of the goods for a certain period worked out upon the price of the goods, and the amount of periodical payments, and it is not until the last payment has been made that there is an actual sale or agreement for sale. If a house were the subject of the agreement instead of a wireless set or whatever it may be, it would be a tenancy with an option to purchase.

It will be seen, too, that practically all these agreements contain a clause that the goods can be returned, subject of course to various provisions, at any time before the payment of the last instalment, and although this may be set out as an advantage—as it undoubtedly may be in a great many cases—it in fact assures that there has been no actual sale, and that the goods belong to the seller or hirer until the final payment, and do not pass to the buyer, or more properly the lessee, until that event happens. This discloses a point which seems to be least appreciated by those entering into such agreements, and one which they should consider well. In most cases the actual property or ownership in the goods does not pass to the hire purchaser, if we may so term him, on receipt of the goods, and so they are not in the proper sense of the term his to do what he likes with; he holds them in the same way that he would hold the house he hires on a lease, so that, provided he pays the rent and carries out the other terms it contains, he can keep it during the period of the lease and if it contains an option to purchase, buy it in accordance with the terms of the option.

Apart from the above there is usually nothing in a hire purchase agreement which could not be freely appreciated and understood by the prospective buyer; clauses under which the hire purchaser has to insure his set against fire, keep it in his own possession and in good condition, are things which every reasonable person would do with regard to his own absolute property.

In fact, so long as the hire purchaser does not undertake contingent liabilities which may be difficult to meet, I feel that the hire purchase system is one to be recommended, the use and benefit of the goods is derived immediately on the payment of the first instalment, and often it is found to be an advantage to allow investments to remain undisturbed, and pay for the articles out of income, since the additional cost is comparatively small.

The agreement should, of course, be very closely perused, and if it affects a large sum it would be a wise precaution to let one's solicitor look through it and approve it. In most cases it will be found to be in simple terms, and comparatively short, and the hire purchaser, so long as he understands that usually he will not be the "owner" in the proper sense of the term in law, will in fact have practically all the rights of an owner over the goods in question, and need have no hesitation in purchasing under this system.

RADIO CLUBS & SOCIETIES

HUDDERSFIELD RADIO RESEARCH SOCIETY

The Huddersfield branch of the A.-A.R. and T.S. visited the Manchester Studio on Saturday, February 4, for the performance of *The Lancashire Mummers*. Everyone enjoyed the show, and a good deal of surprise was shown by several members and friends at the method adopted by the artists. It gave a very interesting object lesson on the art of Broadcasting. Another visit to Moorside Edge Transmitting Station is to be arranged at an early date. These visits are not confined to members, and anyone is invited to accompany the party. Further particulars from the Secretary, J. Sutcliffe, 32, Mulberry Street, Moldgreen, Huddersfield.

THE CATFORD AND DISTRICT RADIO AND TELEVISION SOCIETY

Members of the above society were entertained to a lecture by Mr. G. Parr on Thursday, February 2nd. The lecturer chose as his subject "Pentodes versus Triodes," which could not fail to interest all radio fans. The various points of interest were described by means of lantern slides and diagrams, and in the discussion that followed the speaker was never at a loss to answer the various problems put to him. Full particulars from the Hon. Secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E. 23.

WOODFORD, WANSTEAD AND DISTRICT RADIO SOCIETY.

On Thursday, the 2nd inst., Dr. R. A. Fereday, B.Sc. Radio G.6.F.Y., of Leytonstone, gave a talk to the Leytonstone, Woodford and District Radio Society on the Latest short-wave circuits. Several of the local amateur transmitters were present. Very lucid details were given by the lecturer of home-made coils, and coils for short-wave super-heterodynes. The screened grid valve was said to be an excellent detector for this kind of reception. A pre-stage of high frequency was strongly recommended. Some details were also given of the Stenode Receiver, which proved most interesting. Hon. Secretary, Mr. H. O. Crisp, 2, Ramsay Road, Forest Gate, E.7.

ILFORD AND DISTRICT RADIO SOCIETY

This society is enjoying a successful twelfth year of working, and, of late, have had quite a number of first-class lectures and demonstrations at their weekly meetings. On January 26th Mr. H. L. Ranson lectured on "The measuring of the performance of a receiver," and described the procedure in the laboratory when testing a new receiver for selectivity, sensitivity, and response. Then he demonstrated in a practical manner the points mentioned, and by means of a valuable instrument from the laboratory, namely, Standard Signal Generator, he tested an A.C. receiver of commercial make. A curve was plotted on the blackboard, and the members could see both from this and the meters, how the response of the receiver changed with wavelength, and other conditions. The lecture and demonstration proved most popular with the members. At the last meeting, which was a "Practical Evening," the Society's apparatus was given a final run prior to being rebuilt immediately, and there were visitors from the Croydon Radio Society present.

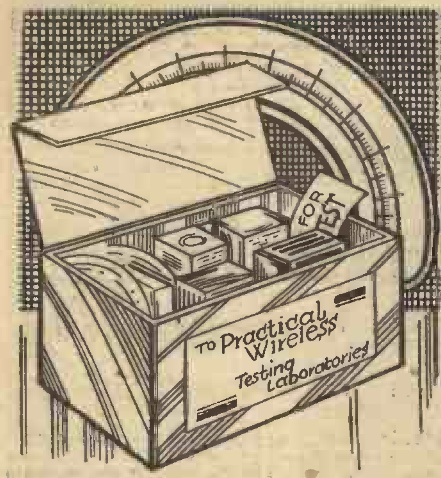
Details of the Ilford Society may be had from the Hon. Sec., Mr. C. E. Largen, 16, Clements Road, Ilford.

SLADE RADIO

"L.F. Amplification" was the subject chosen by Mr. A. F. Poynton for his lecture at the meeting of the above society held recently. After describing how an amplifying valve works, he went on to explain transformer coupling and how a transformer operates, reactance of transformers, and how it is determined. Core materials and permeability were followed by parallel, also resistance fed transformer coupling. Resistance coupling and how it works followed, together with details of values of resistances and leaks. A few words on transients came next, and this was followed by choke coupling. Coming to the output valve, a contrast was drawn between triodes and pentodes. The push-pull method was described together with quiescent push-pull, and also Class B amplification. This concluded a very interesting lecture, which was closely followed by those present. Hon. Secretary, 110, Hillaries Road, Gravelly Hill, Birmingham.

BRITISH EXPERIMENTAL SHORT-WAVE STATION

As most transmitting amateurs are probably aware, the Radio Society of Great Britain are now handling their own members Q.S.L. cards only, and that all applications in future from non-members of the society for Q.S.L. cards should be made to the undersigned, accompanied with a stamped addressed envelope, and not to the Radio Society of Great Britain. All communications should be sent to F. Postlethwaite (G5KA), 41, Kinfauns Road, Goodmayes, Ilford.



Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

PICTURE RAIL INSULATORS

THE erection of an indoor aerial is not always the simple proposition which it at first appears. The wire may, of course, be simply laid on the picture rail, or may even be tacked to the wall. It is always advisable, however, to keep the wire away from the walls, and theoretically it should not be nearer to the wall than 12ins. This would, of course, look a little unsightly. Messrs. Bulgin have produced a neat insulator which greatly facilitates the erection of the indoor aerial, and incidentally requires no tools whatsoever to erect it. It consists, in effect, of the upper part of an ordinary picture hook of the type which hooks over the picture rail. Attached to the upper part of this is a bakelite rod a few inches long, at the end of which is fitted a small spring clip. By hooking these fixtures on the picture rail at suitable intervals, the wire is held neatly in place, and is attached to the insulator by pressing down the spring, dropping the wire in the slot, and then releasing the spring. It is thus firmly held. The insulators are 9d. each.

ANTI-BREAK THROUGH CHOKE

A VERY common fault which most listeners experience, is the tuning-in of medium-wave stations at the lower end of the scale when the receiver is switched over to the long waves. With some types of dual range coil it is, in fact, impossible to use the first 50 degrees of the scale on the long waves owing to this nuisance. A very simple remedy, however, is the inclusion of a special choke in the aerial lead, between the aerial and the tapping on the tuning coil used for long waves. The inductance should be round about 800 to 1,000 microhenries, and a very neat commercial form of this choke is manufactured by Messrs. Lissen. This is called the Lissen Anti-Break Through Choke and sells at 4s. It is simple to fit, being simply joined up as mentioned above, and the only point to bear in mind, is to include an ordinary On-Off switch across the choke so that it may be short-circuited when listening on the medium waves. It proved most effective when tried on five different makes of commercial dual-range coil, which otherwise gave poor results on the long waves owing to this trouble. In appearance it is exactly the same as the standard Lissen choke and takes up practically no room on the baseboard.

IGRANIC VOLUME CONTROL

WIRE wound volume controls of the order of 50,000 ohms require very careful handling, owing to the fineness of the wire used for the resistance element. In addition, adequate ventilation is also necessary to prevent over-heating. The design of such a control is not, therefore, very simple, as the provision of ventilation generally precludes enclosing the element in a case, and this leaves an unprotected winding. Messrs. Igranic have produced a control in which both features are provided for in a simple manner. The element is wound in the customary manner on a flat strip, and this is curved to fit inside a substantial bakelite case. Distance pieces prevent it from coming into contact with the sides of the case. To keep dust, etc., away from the moving arm, a cover is provided for closing in the bottom of the case, but this is liberally provided with holes so that there is perfect ventilation to the inside of the case. The component is rated at 3 watts and will therefore prove very useful for a number of purposes. It is obtainable in values from 1,000 to 50,000 ohms and costs 5s. 6d. It is a thoroughly sound component.

MOUNT EVEREST EXPEDITION

AMONGST the many appliances carefully selected by the Mount Everest Expedition it is significant that Siemen's Full O'Power Batteries, etc., have been chosen for the transmitting and receiving apparatus. These batteries have been specially packed to suit the particularly rigorous conditions of transport.

A general description of the duties of the various batteries supplied for the purpose will, no doubt, be of great interest to our readers.

Regarding the climbing expedition the batteries are divided into three groups indicated below :—

Darjeeling Installation at Approximately 8,000ft.

This is the main base from which the Expedition will keep in touch with the outer world, particularly for meteorological reasons. The apparatus here requires a 200-volt H.T. battery capable of an output of 25 milliamps. For this Super Radio Full O'Power H.T. batteries, size V.6. 50-volt units, have been supplied. In addition, a 70-volt battery for balancing work in the transmission apparatus is used which requires a very small current of about 0.5 milliamperes, and for this duty Standard capacity Full O'Power H.T. batteries, size H.2, are to be used.

Base Camp (Everest) at Approximately 16,000ft.

This installation is situated at the foot of the Rongbuk Glacier, and will have to work back to Darjeeling and forward to Camp 3. At this camp there will be three Full O'Power H.T. batteries as follows :—

1 of 150 volts to supply a current of 15 milliamps.
1 „ 200 „ „ „ „ „ „ 20 „
1 „ 150 „ „ „ „ „ „ 30 „

For these batteries the Super Radio Full O'Power batteries, size V.6 50-volt units, are to be employed ; these are packed in boxes not exceeding 40lbs. gross weight each.

Camp 3. At Approximately 21,000ft.

This Camp is at the head of the Rongbuk Glacier and in the immediate vicinity of the final climbing operations. The conditions here are extremely difficult, and the temperature is likely to go down as low as 24 degrees F. below Zero. At this camp the question of weight is of the greatest importance as the maximum weight per package can only be 30lbs. The L.T. filament circuits require a current of 0.6 amperes at 2 volts, and for this duty large Siemen's Inert Cells are supplied, and these need only be energised when the installation is set up. The H.T. batteries will be of 150 volts capable of a current discharge of 30 milliamps, and as weight is such an important factor the "Power" type Full O'Power batteries, size V.5 (45-volt units), are to be used for this purpose. These batteries have round cells as compared with the square cells of greater weight in the Super Radio batteries mentioned above. For this installation also 9-volt Grid Bias Full O'Power batteries, size G.2, are being taken. The installation at this Camp is required for reporting back to the Base Camp.

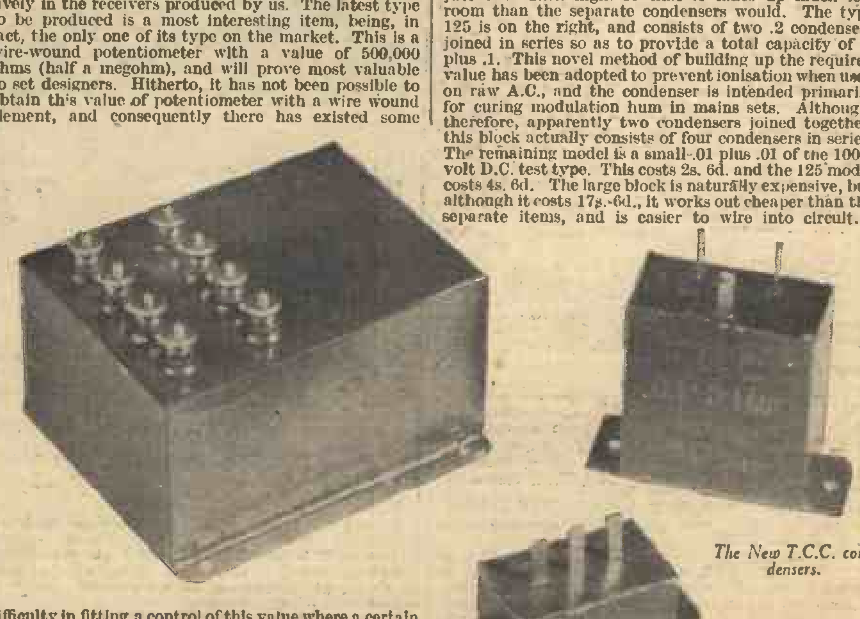
NEW LEWCOS POTENTIOMETER

THE Lewcos potentiometers are now well known to constructors, and have, in fact, been used extensively in the receivers produced by us. The latest type to be produced is a most interesting item, being, in fact, the only one of its type on the market. This is a wire-wound potentiometer with a value of 500,000 ohms (half a megohm), and will prove most valuable to set designers. Hitherto, it has not been possible to obtain this value of potentiometer with a wire wound element, and consequently there has existed some difficulty in fitting a control of this value where a certain amount of current has to be passed. The difficulty, of course, is in accommodating the large amount of wire which is necessary, and the manufacturers have overcome this in a novel way. The element is wound with fine wire round a core of thick cotton, very much like an ordinary spaghetti resistance. When the element has been completed, it is wound round and round a wide flat strip of paxolin, and the winding can, in fact, just be seen at the top of the illustration herewith. With the ingenious Lewcos swash-plate method of tapping there is absolutely no wear on the thin wire, and it has therefore made practicable this type of resistance. The movement is delightfully velvety and the control works admirably in circuits where this value of resistance is required.

The new Lewcos potentiometer.

T.C.C. SUB-DIVIDED CONDENSER BLOCKS

ALL-MAINS units require two or more fixed condensers for smoothing purposes, and practically without exception one terminal of each condenser is joined to H.T. —. Consequently when using ordinary condensers in a mains unit, one of the first jobs is to join up one terminal of each condenser with a long lead, and then attach this to H.T. —. To save the constructor this little operation the condenser manufacturers have introduced what are known as "condenser blocks," which are nothing more nor less than a number of separate condensers housed in one case, with one common terminal joined inside to one terminal of each condenser. This terminal is marked — on the case, and the remaining side of each condenser is taken to a separate terminal appropriately marked. The illustration below shows three of the new blocks introduced by the T.C.C. people, and these are the R.M.12, the 125 and the 87A/02. The first named is the large block on the left, and this contains two 4 mfd. and two 2 mfd. condensers of the 500 volt D.C. test type. The complete block only measures roughly 4 by 3 inches, and is just over 2ins. high, so that it takes up much less room than the separate condensers would. The type 125 is on the right, and consists of two .2 condensers joined in series so as to provide a total capacity of .1 plus .1. This novel method of building up the required value has been adopted to prevent ionisation when used on raw A.C., and the condenser is intended primarily for curing modulation hum in mains sets. Although, therefore, apparently two condensers joined together, this block actually consists of four condensers in series. The remaining model is a small .01 plus .01 of the 1000 volt D.C. test type. This costs 2s. 6d. and the 125 model costs 4s. 6d. The large block is naturally expensive, but although it costs 17s. 6d., it works out cheaper than the separate items, and is easier to wire into circuit.



The New T.C.C. condensers.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2

SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters.

We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

FUSES FOR MAINS USE

"As I am building a mains set for use on D.C. mains, I wish to incorporate fuses to avoid damage to the house wiring. Can you tell me where to put these fuses so that they will not interfere with the supply of voltage to the set? I suppose I could use ordinary fuse wire as sold at any electricians, and to avoid fire perhaps I could fit a small asbestos holder, or strip of that material round the fuse wire. What rating should I use for the wire, 5 amp. or more?"—(N. B. P., Enfield.)

It is quite true that ordinary fuse wire could be used, with a backing of asbestos, but a much more satisfactory job could be made if you purchase one of the special holders and fuse assemblies made by Belling-Lee or Bulgin. A fuse in each mains lead should be used, and twin fuse-holders are obtainable quite cheaply, with readily-replaceable cartridge type fuses. These components only cost about 8s., and will prove much more satisfactory than your other suggestion.

AUTOMATIC GRID BIAS

"I am fitting my pentode output valve with an automatic bias arrangement. The method I favour is to put a resistance in the cathode lead of the pentode, with a large capacity fixed condenser shunted across it. The only snag is that I am not sure of the value of the resistance. How can I work out the right value, please?"—(T. B. N. S., Harrow.)

We do not know, of course, how your circuit is made up, and cannot say whether there are any snags to your arrangement. However, if you have satisfied yourself on this arrangement all that is necessary is to total together the anode current and the auxiliary grid current of the pentode, and divide the answer, expressed as the decimal fraction of an ampère, into the voltage required for the grid bias. The answer will be the value of resistance required in ohms. If it should work out to some odd value, use the nearest commercial value, erring on the side of over-biasing rather than under-biasing.

DETECTION QUERY

"After studying the various articles on detection which have been published in your paper from time to time I am undecided what to do with my new receiver, at present in course of construction. From what I can see there are four methods, grid leak, anode bend, power grid, and the diode. All of these are excellent, according to your articles, but as I want the best, what must I use? The set is to be a mains-operated one, four valves in all, two H.F. stages."—(A. L. A. S., Sheffield.)

It is quite true that each of the methods of detection you refer to are good, but it should not be difficult to decide on the method you must use in your set. The diode gives no amplification, but rectifies only. Where a large number of stations are wanted, you cannot, therefore, afford to waste one valve. This rules out the diode. Anode bend detection is quite good from some points of view and may, therefore, be left in the running for the moment. The grid leak will be sensitive, but will not provide the quality of which the power grid method is capable, provided you have sufficient H.T. available. Power grid is better than anode bend as it will provide greater sensitivity with better quality. This, therefore, leaves you to choose between power grid or anode bend, and as the number of stations which you can hear is no doubt your principal consideration, we should recommend power grid.

VALVE OR METAL RECTIFIER

"Is there any advantage to be gained by using a valve rectifier in place of the metal rectifier? I notice the majority of the receivers made by one big firm all use the metal form of mains rectifier, whilst another firm uses always a valve. Is there much difference between them?"—(W. S. D., Camden Town.)

The principal difference between these two forms of rectification is that the valve may get broken, and in any case requires replacement some time or other. The metal rectifier is unbreakable (or nearly so), and does not wear out. On the other hand, the valve is cheaper, and will give a greater current output for a given size. The valve, in the larger ratings, gets hot, but the metal rectifier keeps cool. The valve takes up very little space, whilst the metal rectifier is rather bulky. It is, therefore, rather a case of swings and roundabouts, and the choice must therefore be left to your own preference.

JOINING LEADS

"When wiring up a set I notice that the plan often shows a wire coming straight away from another wire, either at an angle or straight out. Is this necessary? As the wireless waves travel along the wire surely there is no need to join it on, but could not a lead be taken from the same terminal and one wire run one way and the other wire run the other way?"

You are quite right in your idea, there is no need to join two wires which come from the same point.

DATA SHEET No. 23

Cut this out each week and paste it in a notebook.

FIXED CONDENSER VALUES

Purpose	Value.
Series Aerial condenser	.00005 to .0003 mfds.
Band Pass Coupling	.01 to .05 mfds.
H. F. Decoupling	.1 to 1 mfds.
H. F. Coupling	.0001 to .0005 mfds.
Grid rectification	.0001 to .0003 mfds.
L.F. Coupling.	.1 to 2 mfds.
L.F. Decoupling	2 to 4 mfds.
Pentode tone control	.01 to .1 mfds.

Usually, however, this is done in a diagram in order that the wiring may be shown in a clear, systematic manner. If all wires coming from one point were taken from that point, and run in different directions, the plan would be confusing, so that by taking one wire only from that point, and then showing all other leads as branches from that one wire, the wiring can be kept clear and more regular in its spacing.

VOLUME CONTROL

"I am going to purchase a differential condenser to connect across my aerial coil for volume control, as referred to in one of your articles. I am not certain, however, whether I should have a bakelite dielectric or air dielectric condenser for the purpose. Which is correct?"—(Y. G., Worthing.)

As the condenser is to be joined across the aerial coil you must introduce the least possible losses so as not to waste signal strength unnecessarily. Therefore, an air dielectric condenser is indicated. You may find that on the majority of stations there is no audible difference, but on general principles, the air dielectric is to be preferred.

TESTING HOME-MADE MAINS TRANSFORMER

"I have made up the mains transformer recently described in your pages, but would like to be certain that the heater winding is in order. I have adhered to your figures for the other windings, but owing to the fact that I did not have enough of the gauge of wire you specified, I used some other wire and tried to compensate for the difference in the gauge. What is the best way of testing the winding to see if I am getting more than 4 volts? I have not got a voltmeter, only a small milliammeter reading up to 10 m/A."—(G. Y., York).

There is quite a simple way of testing your winding, in conjunction with your milliammeter. Join this in the anode circuit of the L.F. valve of your set (providing it does not pass more than 10 m/A), and join an ordinary 4-volt accumulator to your valve. Note the current given when the H.T. from the eliminator is applied. Now remove the accumulator and join the heaters to the winding on the transformer and switch on. If the current is not so great, then you are not getting 4 volts, and *vice versa*.

REPAIRING PHONE CORDS

"I have a rather old set of one-valve type, with a pair of headphones. This is installed for my aged mother. Recently the leads of the phones broke and I have spent many hours trying to solder them. I do not seem to be able to join them at all, and yet they look as though they are only ordinary copper. Can you suggest how to carry out this operation, please?"—(A. M., East Finchley).

The phone cords are usually made of a tinsel material, and this burns before satisfactorily soldering. The best way to carry out the repair is to lap the bared tinsel, and then to bind it tightly with thin wire. By lapping the ends back over the binding and again binding on top of this, it will be found impossible to pull the joint apart. New leads are obtainable quite cheaply from any good radio shop, so you may find this better than wasting your time in carrying out the repair.

COMPLETE BREAKDOWN

"Will you please give me some information as to what is wrong with my portable wireless set? The H.T. battery and grid bias are up to scratch. The loud-speaker and aerial also appear to be quite all right. But when the set is switched on not a sound can be got."—(G. C., Hereford).

We regret that we cannot definitely diagnose the trouble from the available information, but if you have ascertained that the batteries are in good condition, and that there are no disconnected leads in the receiver, you will probably find that one of your valves is defective.

INSUFFICIENT REACTION

"By reading your paper and seeing the good advice you have given I wonder if you can enlighten me on this little subject. My set is an S.G. Det-L.F. I can get all stations perfect up to about 60 on the dials. As North Regional and Radio-Paris come above these numbers it is rather annoying. It is the same on long- and short-wave lengths: the dials read up to 100, above 60 you can get the stations, but very faintly. As soon as I increase the volume it screeches and whistles awfully."—(R. G., Papworth).

The lack of sensitivity above 60 degrees on the dial is probably due to insufficient reaction, and may be caused by low detector or S.G. H.T. voltage, or a defective intervalve coil. The coil, H.T. battery, and detector valve should be tested by one of the many methods which have been described in recent issues of PRACTICAL WIRELESS.

FREE ADVICE BUREAU
COUPON
This coupon is available until March 4th, 1933, and must be attached to all letters containing queries.
PRACTICAL WIRELESS 25/2/33

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To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed.

EELEX SHORT-WAVE CONVERTERS

J. J. EASTICK & SONS have recently put on the market a complete range of new Short Wave Converters known as the "Duplex," and we have just received a handy instruction book concerning these units. With one of these converters an ordinary set is quickly transformed into an efficient short-wave receiver. A popular model, which retails at 52s. 6d., has a range of 15 to 60 metres and is housed in a neat cabinet of small dimensions, the front of which carries the tuning condenser dial, reaction, and switch. Connecting leads for connecting to H.T. and L.T. are taken from the back of the cabinet. For the benefit of home constructors who prefer to incorporate a short-wave unit in the cabinet housing their broadcast set, Messrs. Eastick supply a converter in compact-chassis form. Either single or two-valve models are available. All readers interested in short-wave reception should obtain a copy of this interesting book. The address is Eelex House, 118, Bunhill Row, London, E.C. 1.

W.B. SPEAKERS

IN a new folder we have just received from Whiteley Electrical Radio Co., Ltd., particulars are given of a useful range of their well-known moving-coil speakers. The excellent results obtained from these speakers is largely due to the unique "Mansfield" magnetic system, developed by Messrs. Whiteley, which results in greater power from a smaller magnet. A popular model (P.M.5), which is priced at 27s. 6d., complete with tapped output transformer, will work from a small set, yet will handle volume more than enough for a large room. Two other permanent magnet models listed, the P.M.1 and P.M.2, priced respectively at £6 and £4 5s., complete with tapped output transformers, embody all the essentials of first-class speakers. A new energised model (E.M.1) is also listed for working on D.C. supply. Several speakers housed in attractive cabinets, either of polished oak or walnut, are also shown, together with a range of WB valve-holders and switches. A copy of this folder can be had on application. The address is 109, Kingsway, London, W.C.2.

BELLING-LEE PRODUCTS

TWO small booklets are to hand from Belling-Lee, Ltd., one dealing with their well-known terminals and connectors and the other with the Belling-Lee "Unit" Pick-up. Full instructions for mounting and working this high-class component are given in the booklet, a copy of which can be obtained from the above firm at Cambridge Arterial Road, Enfield, Middlesex.

GOODMANS' LOUD-SPEAKERS

MESSRS. GOODMANS have just issued an attractive folder giving a particularly useful range of their permanent-magnet moving-coil speakers. Heading the range is the "Dreadnought" P.M. Moving-Coil Speaker, housed in a polished walnut cabinet of modern design. A cobalt steel magnet of special design gives an intense flux density, and a specially treated "Veratone" cone is employed which ensures maximum sensitivity. The price of this speaker, including a universal output transformer, is 50s. 6d. The chassis alone, with transformer, is priced at 39s. 6d., complete with auxiliary baffle. The "Renown," another permanent magnet M.C. speaker, constructed on similar lines, is priced at 27s. 6d. as a chassis model, or 42s. 0d. housed in an attractive cabinet. Also included in the list is the "Sandringham" Cone Speaker, fitted with Goodmans' 4-pole balanced armature unit. This model, housed in a well finished, polished oak cabinet, sells at the very moderate price of 25s. 0d.

Broadcast Query Corner

UNDER the above title, with the assistance of a recognized authority on foreign broadcasting matters and a regular contributor to wireless publications both at home and abroad, we have inaugurated this special identification Service, which should prove of great assistance to our readers. When tuning in well-known stations it happens frequently that listeners pick up wireless transmissions of which they fail to recognize the origin. It is to solve these little problems that the *Broadcast Query Service* has been organized.

In order that a careful search may be made it is essential that certain data should be supplied to the best of the inquirer's ability and knowledge. When sending such queries to the Editor the following rules should be followed:—

1. Write *legibly*, in ink. Give your full name and address.
2. State type of receiver used, and whether transmission was heard on headphones or on loud-speaker.
3. State approximate wavelength or frequency to which receiver was tuned, or, alternatively, state *between* which two stations (of which you have the condenser readings) the transmission was picked up.
4. Give date and time when broadcast was heard. Do not forget to add whether *a.m.* or *p.m.*
5. Give details of programme received, and, if you can, some indication regarding the language, if heard.
6. State whether and what call was given and/or kind of interval signal (metronome, musical box, bells, etc.) between items.
7. To facilitate publication of replies, append a *nom-de-plume* to your inquiry.

Replies to Broadcast Queries

PATIENCE (Glasgow): (1) Details are too vague; the letters picked up need not be the call—as they stand they cannot be traced; (2) Amateur Experimental transmitter in 40 m. band; G6UH is the call sign of H. E. Smith, "Arawa," Granville Road, Limpsfield, Surrey; (3) Yes, all amateur experimental transmitters are pleased to receive reports on their transmissions; G5BK is the call sign of W. Brown, 52, Winstonian Road, Cheltenham (Glos.). ONE LUNGER (Enfield): Details far too vague to trace transmitter, but we suggest you heard a gramophone broadcast by an amateur in the 40 m. band. BRS 1038 (Herne Bay): W8XK, Saxonburg relaying KDKA on 48.86 m. TRANSMITTING SEARCHER (E.17): German relay of talk from Washington, U.S.A., relayed through Berlin and heard through Mühlacker, Hamburg, or Leipzig. AUDIO (Portsmouth): (1) Moscow (RW59), 50 m. (6,000 kc/s); (2) W8XK, East Pittsburgh on 48.86 m. (6,140 kc/s); (3) W3XAL, Boundbrook, N.J., on 49.18 m. (6,100 kc/s); (4) EARA, Las Palmas on 48 m. (6,250 kc/s); (5) Possibly quarter harmonic of Radio Normandie (Fécamp); namely, 55.6 m.); (6) Harmonic of Poste Parisien, possibly on 41 m.; (7) G6KZ, experimental transmitter, Leith; G6SR, Edinburgh; G2KU, Malton, Yorks; G6CB, cannot trace; write to the Radio Society of Great Britain, 53, Victoria Street, London, S.W.1. These are all in the 40 m. band, namely, on channels between 41.1 m. (7,300 kc/s) and 42.9 m. (7,000 kc/s). CONTACT (Peterhead): (1) Cannot trace call; write to Radio Society of Great Britain, 53, Victoria Street, London, S.W.1; (2) G6HR is the call sign of W. D. Keiller, 21, Newton Way, Cambridge Road, Upper Edmonton, N.18, London; (3) G2CW is the call sign of G. Hippisley, Stoneaston Park, Bath (Somerset). COUPON (Liverpool): Your details are too vague to trace transmission definitely; according to calculation, the wavelength would be roughly 465 m.; possibly Langenberg (gramophone records). C. BULL (Sheffield): (*a*) G6LF is the call sign of J. H. Goodcliffe, 97, Sheaf Gardens, Sheffield; (*b*) G5HK is the call of H. S. Beckett, 448, Redmire Road, Lodge Moor, Sheffield; (*c*) cannot trace in published list; write to Radio Society of Great Britain, 53, Victoria Street, London, S.W.1; (*d*) cannot trace in list; to ascertain identity write to Asociacion EAR, Mejia Lequerica 4, Madrid, Spain. STATION (Woolston): PPU, Rio de Janeiro (Brazil), on 15.576 m. P. J. X. (S.E.7): Cork.

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