Practical Wireless, March 11th, 1933

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Practical Wireless

3D

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Please send me FREE copy of your 1/- Skyscraper Chart.

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LISSEN "SKYSCRAPER" KIT 3

EDITOR:
Vol. 1. No. 25 || F. J. CAMM || March 11th, 1933
Technical Staff:
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.
Frank Preston, F.R.A., W. J. Delaney, W. B. Richardson.

ROUND *the* WORLD *of* WIRELESS

New Aerial System for Vienna Super-power Station

TO secure a more directional broadcast and thus ensure better reception in the eastern and south-western districts of Austria, a new aerial system has been devised for the 120 kilowatt station now nearing completion on Mount Bisamberg, overlooking the capital. Two masts, about 430 feet high, have been erected, one of which carries the aerial, and the other made to serve as a reflector tower, both being connected to the transmitter. The conventional metallic earth ring has been dispensed with, and in its place a counterpoise earth has been adopted, consisting of a network of copper wire—there are roughly eight miles of this cable used—supported by thirty-six smaller masts. The transmitter will radiate an energy equal to that of the new Leipzig station, and has been equipped with two giant 300 kilowatt valves.

Chicago Also Tries Out New Aerial System

ALTHOUGH good signals at present are being received from a number of U.S.A. transmitters, KYW, Chicago (Ill.), on 293.9 metres (1,020 kc/s), does not yet figure very prominently in our logs. Within the next week or so, however, according to an American report, broadcasts from that station may be better heard than hitherto on this side of the Atlantic, as the engineers have now erected what they term a "concentrator aerial." Not only are signals greatly increased in intensity by this means, but they have been found less liable to fade. The main aerial, or "exciter," is a vertical copper rod 204 feet high, fixed on a wooden mast, 200 feet in height. The "concentrator aerial" is also of copper, and of a similar structure. Situated at some distance from the exciter and adjusted to respond to the frequency used for the station's broadcasts, its object is to reflect the waves emitted from the former, and thus help to intensify them over the area required. Experiments have proved that with the new aerial installation a transmitter rated at 10 kilowatts, and working on a frequency between 550 and 750 kilocycles, will radiate a signal equal in power to the average 50-kilowatt station. In the course of the tests a series of experiments were made with various earthing circuits, but the engineers finally adopted, as the most favourable system, a large copper sheet with a number of strips radiating in all directions.

Dutch S O S Calls

SIMILAR to the S O S calls sent out by the B.B.C., the Dutch transmitters broadcast daily a number of police messages. According to recent statistics these transmissions, in the course of a few months, have led to the arrest of a number of criminals. In addition to this service, by arrangement with the Post Office authorities, the Hilversum and Huizen studios also broadcast the text of private telegrams in such cases where, through some cause, such as an error in an address, they cannot be delivered in the usual manner. They need not necessarily be the conventional S O S calls launched by hospitals, etc., but may be purely communications of a private nature.

Regular Relay of Madrid Programmes

RADIO Ibero-Americana (EAQ), the Spanish short-wave transmitter on 30.3 metres, in addition to special broadcasts organised for the benefit of European listeners, frequently relays programmes from the Madrid EAJ7 studio. These are usually carried out at 10.30 p.m. G.M.T. and last until midnight. During March these relays will be given on the following dates: 4, 9, 11, 16, 18, 23, 25, and 30.

How They Do Things in America!

THE installation of Franklin Roosevelt, as President of the United States, has induced the National Broadcasting Company to carry out a broadcast on a larger scale than has hitherto been attempted for any previous National demonstration. Fifteen different sites have been found for microphones, in addition to five mobile short-wave transmitters, for these both motor lorries and aeroplanes are to be used. The relay necessitates the service of some thirty engineers and ten N.B.C. announcers, who are to be assisted by a dozen or more commentators to describe the historical event. Arrangements have been made to give a "bird's eye" view of street scenes from the airship *Akron*, and aeroplanes may be employed for the same purpose. In the procession, it is reported that the N.B.C. have been authorized to include a travelling short-wave transmitter equipped with parabolic microphones in order to secure a background of military music and the cheering of the crowds. The broadcast will be carried out through all U.S.A. transmitters, including a number of short-wave stations in the various networks. There appears to be little doubt that our American cousins intend that the entire world shall assist at these festivities. . . . Oh, Boy!

Possible Broadcasting Developments in Spain

IN the course of eighteen months, much has been published regarding the reorganization of the Spanish broadcasting system, and many attempts have already been made to carry out a new scheme, but up to the present none has matured. It would appear, however, that with the backing of the new Republican Government a start will shortly be made to put Spanish broadcasting on a semi-official footing and the authorities have secured, as a consultant, Dr. Hans Bredow who was, until recently, the High Commissioner of the German Reichsfunk. In these circumstances it is expected that a complete reorganization of the Spanish network will be carried out in 1933-4.

Also in this Issue!

THE FIRST MILESTONE!

NEXT WEEK'S ISSUE completes Vol. 1 of "Practical Wireless." An Announcement regarding Binding Case & Index will be made next week.

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

Extension of Empire Broadcasts

FROM April 2nd, the hours of Empire broadcasting to the Indian, African and West African Zones are to be extended. Transmissions will begin at 1.30 p.m. and will last until 5.30 p.m. This increase in the programme time, whilst satisfying listeners within the Indian Zone, will also provide dwellers in Western Australia with an increased service, since the same two wavelengths, namely, GSC 31.30 metres and GSD, 25.53 metres, are used for both Zones.

The B.B.C. S O S Transmissions

DURING 1932 a total of 1,007 S O S and similar messages was broadcast and, generally speaking, the results were slightly more successful than in the previous twelve months, the percentage working out at 40.91 as against 40.21 in 1931. The number of unsuccessful messages in which the results are unknown also continued to drop, and now stands at 3.28 per cent. It has been ascertained that an S O S put out through the National stations is more likely to reach the interested party than if sent through the Regional network.

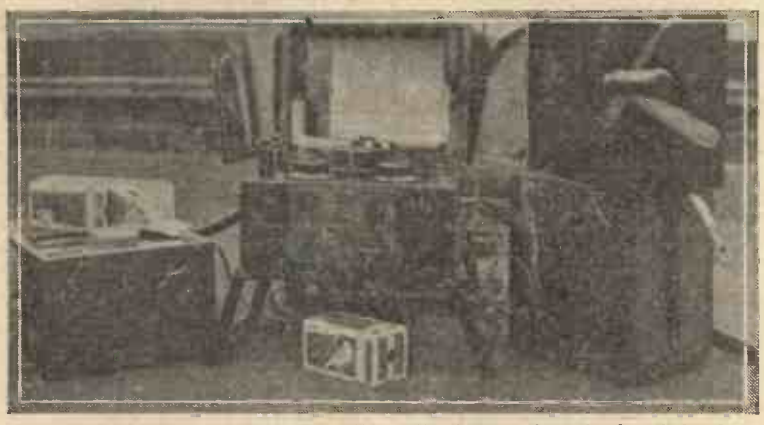
The Secrets of the Brussels Conference

NO official information has yet been obtained regarding the work carried out by the *Union Internationale de Radio-diffusion* at its last meeting at Brussels, but it is reported that a preliminary plan for the re-allocation of wavelengths has been prepared for submission to the meeting of delegates at Lucerne in June next. The difficulty of the problems to be solved may be judged by the fact that when the Prague plan was drawn up in 1929, Europe possessed 200 broadcasting stations with an aggregate of 420 kilowatts. To-day a totally different situation must be faced, as the number of transmitters is now 254, without taking into consideration some stations under construction and others of which the installation has been proposed and the power radiated has reached 4,600 kilowatts.

If an improvement is to be made in the general reception of broadcasts in individual countries, and heterodynes between transmitters working on neighbouring channels are to be avoided, an 11 kilocycle separation must be obtained. Moreover, a new re-allocation of wavelengths is necessary and a better geographical allotment of channels. By this is meant that stations working on neighbouring channels must be at the greatest distance possible from each other. Steps must also be taken to limit the output of the new transmitters. Finally, the question of the large number of relays taking the same programme in one country needs careful consideration; the transmitters must be synchronized by crystal control or other means, if interference is to be avoided. The number of common waves used by stations in different States may have to be reduced as, although in many instances, they are widely separated, they cause trouble in the ether. To achieve a workable plan, some European States may be called upon to give up one or two wavelengths as an extension of the waveband does not appear probable; if no sacrifices are made it is difficult to realize that a mere shuffling of channels will achieve success.

INTERESTING and TOPICAL PARAGRAPHS

THE MOUNT EVEREST EXPEDITION
SOME INTERESTING FACTS



The portable transmitter taken by the Mount Everest Expedition was designed and supplied by Loomes Radio, of Earls Court Road (G6RL and G6US).

The ex W.D. Mark III transmitter was chosen as a basis to work on, as this instrument was designed originally for very hard and rough usage, being built of half-inch hardwood and the whole being covered with canvas for weather protection.

The transmitter was redesigned to work on wavelengths of 60, 85, and 110 metres. The transmitter, with its associated components of six spare valves, hand generator and Siemens inert cells can be carried by one man, the weight being about 40 pounds. The high tension is supplied by a hand generator, and low tension by Siemens inert cells.

Batteries and valves are carried in specially made teak cases lined with felt to protect them from shock and the extreme cold. The transmitter will be used at camp No. 3, which is to be erected at an altitude of 21,000 feet; this will be linked in turn with the final camp by land lines.

The base camp transmitter is a high power commercial job which will keep the members of the Expedition in touch with the outside world.

SOLVE THIS!

Problem No. 25.

Being attracted by the claims of the Fury Four (Battery Model), Simpson decided to make it up. He thought he would improve on the design by using a Screen-Grid valve in the Detector stage, and accordingly fitted an additional H.T. positive lead for the screening grid, using the correct value of resistance. No other alterations were made to the circuit, but on test, results were disappointing. He took the set round to a friend's house, and tried it against a Fury Four made to specification. The latter gave louder results. Why did Simpson's arrangement fail to give the results he expected from the S.G. valve? Three books will be awarded to the first three correct solutions opened. Address your solution to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Mark your envelope "Problem No. 25," and do not enclose any other correspondence with your solution.

SOLUTION TO PROBLEM No. 24.

The metal coating of the mains valve was, of course, joined direct to the cathode. When Jackson connected this coating to earth by means of the wire, he was joining the cathode to earth, and as the biasing resistance was inserted in the cathode lead, he was short-circuiting the bias resistance. This naturally led to instability.

The following three readers received books in connection with Problem No. 23:—

Wm. C. Hand, 58, Raymond Road, Redruth, Cornwall.
J. H. Braddy, 4, Harbledown Road, Fulham, S.W.6.
A. G. Stock, 7, Alfred Street, Bargoed, South Wales.

Carrier Pigeons and Wireless Waves

FROM experiments recently carried out in Italy, it has been observed that in racing competitions, in which a large number of carrier pigeons were released, those birds whose route took them in the neighbourhood of wireless stations, lost their sense of direction and, in most instances, flying blindly, failed to reach home. Tests made conclusively demonstrated that such was not the case when the stations were "off the air." In consequence, the Italian clubs are negotiating with the broadcasting authorities with a view to fixing the times at which these pigeon races can be run, namely, at periods when the local station is resting.

Will India Build a High-power Station?

ACCORDING to a report from the Continent, there is a possibility that India may install a high-power broadcasting station with a view to the relay of the Empire programmes. Such a transmitter would make them available to a larger number of listeners, as the majority of them do not possess receivers capable of tuning in the short-wave channels on which the British wireless entertainments are sent.

The New Moscow Super Transmitter

ALTHOUGH no definite news has yet been broadcast regarding the formal opening of the 500 kilowatt Noghinsk station it is unofficially stated that it will be testing shortly on a wavelength between 900 and 1,000 metres. The actual frequency to be adopted will only be decided after experiments have been made.

Danish Radio to Help Theatres

AS in Austria, Denmark proposes to assist the Copenhagen theatres by granting an annual subsidy taken from the income derived from wireless licences. The matter is to be thrashed out in Parliament as, in general, Danish listeners declare themselves against such a step taken, inasmuch as they consider that the Copenhagen National Theatre is enjoyed by the inhabitants of the capital only and, consequently a loss, if any, should not be borne by country subscribers.

Chicago, Classical Music and Dyspepsia!

MANY curious tales emanate from the United States, and it is difficult to believe that they are published in all seriousness. A Chicago medical practitioner appears to have stated that following intensive study he has discovered that radio has valuable medicinal properties. He is a specialist in digestive disorders, and from experiments made affirms that a broadcast of classical music is an excellent remedy for indigestion! Jazz is likely to give the listener considerable pain. We can imagine the doctor's prescriptions in the near future: "A little light symphony taken after meals will keep you fit!"

(Continued on page 1176)

REAL TELEVISION IS HERE!

A Reply to Armchair Critics

BY
J. L. BAIRD, H. J. BARTON CHAPPLE, WH. SCH.
AND F. J. CAMM

Mr. J. L. Baird demonstrating the first crude television images at Selfridge's in 1925.

The very latest televisor.

WHEN so many mis-statements of fact are given for the public to read, I suppose it is only natural that the true explanation of what television implies and what it can now give should be misunderstood by so many. I therefore welcome the opportunity which has been afforded to me by PRACTICAL WIRELESS to voice a few personal comments on the matter.

The world's first demonstration of true television was given by me as far back as January, 1926, before Members of the Royal Institution. Steady and very material progress has been made since that date, and the present transmissions now sent out by the B.B.C., using the Baird System, give sufficient evidence that Television is worth while.

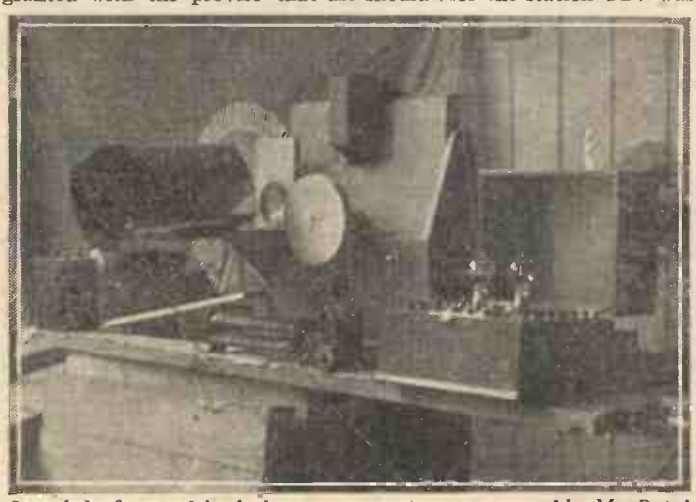
The general public are under the impression that television was first broadcast through the B.B.C. only a relatively short time ago, and it may therefore be a surprise to many to learn that this is not the case, for the first broadcast of television through the old 2LO Station took place as far back as 1926. It was in July of that year that an application was made to the B.B.C. for permission to send out television from Motograph House, then the headquarters of the Company, and the permission was granted with the proviso that use should not be made of it for propaganda purposes. Several transmissions took place through 2LO, and were received by our engineers, but these were brought to an abrupt conclusion by the Post Office authorities, and it was then resolved that we would send out

Mr. J. L. Baird.

our own television programmes. A licence for the station 2TV was obtained whereby we were authorised to transmit television on a power of ¼ kilowatt and a wavelength of 200 metres. The experiments through the B.B.C., however, short though they were of duration, had been sufficient to show definitely that the available sideband of 2LO was sufficient to send out television images. That was as far back as 1926, and, having witnessed a successful transmission through that station (a fact which then could not be made public), I was, to say the least, "amused" by the dogmatic assertions of "authorities" who, by making elaborate calculations based on the entirely erroneous assumption that television was transmitted by dots, "proved" to their own satisfaction that television on a side-band of 10 kilocycles was quite impossible.

To what extent television images may be improved within the present side-band limitation is a matter upon which it would be a mistake to dogmatize, but it must not be taken for granted that television is bound by the same laws which govern cinematography. In essence, there is really no need to send as many as 24 pictures per second. At the present moment only 12½ pictures per second are sent, but if, for example, we used a screen upon which was impressed a permanent or semi-permanent image, the recording point being preceded by an obliterating point, that is to say, that on each traversal of the screen, the previous image being obliterated by a point immediately preceding the recording point, then the limit of picture speed would be fixed by the rapidity of movement of the person or scene being televised, and not by any question of flicker. I reiterate, the speed of picture transmission in television is not bound by the laws of cinematography, and those who endeavour to fix limitations to the progress of television by basing their arguments upon established arts, may fall into as grave errors as those who based their calculations upon half-tone blocks, and assumed the television image to be made up of dots.

Real television is definitely and undeniably here, and I would urge everyone to take steps to see for themselves what can be offered by the service which is now being given by the B.B.C.



One of the first models of television receiving apparatus used by Mr. Baird. Its age can be calculated from the old type "R" valves used in the wireless amplifier.

Mr. H. J. Barton Chapple giving an address on television recently to the Rotary Club at Nottingham.

THE greater the progress made in every pioneering scientific work the greater seems to be the incentive for ill-advised and misinformed critics to burst forth into print and present the case in an entirely incorrect light. How easy it is for the critic to castigate! I suppose that is the function of a critic; but why, oh! why, does he not *make sure of his facts* before lauding an opinion?

I have been tempted to write in this strain after reading some of the remarks which appeared recently in a contemporary. First of all let us obtain an actual conception of what we imply by real or *true* television. It is the ability to see, with the aid of electrical methods of transmission, an image reproduction of moving or stationary objects situated at some distance from the observer. Don't confuse the issue by attempting to set up personal standards of the performance required before it will suit individual tastes. We are still doing that with wireless and it gets us nowhere. To-day the transmission of sight by radio is a matter of *accomplishment*, not *speculation*.

I do not propose to *prognosticate indiscriminately*—that does untold harm. So also does the cynical and biased criticism of those who rely on hearsay. Wireless and the telephone have satiated the desires of one of our senses—hearing—but complete intelligence will never be conveyed until *both* the senses of sight and hearing are harnessed and move together.

When one starts making comparisons with something of quite a different character in order to strengthen an argument the weakness of the argument is disclosed. Of course the cinema gives genuine pleasure to the people, but is the pleasure derived from the system used to make and project the "celluloid" events on to the screen or is it because of the nature of the subjects shown.

Reference was made in a contemporary to the Baird system of television and an effort was made to show what stopped this system from becoming real television. The ideas put forward, however, dodged the issue all along the line. For example, the system was blamed for the artificial limitations imposed by the vehicle used to transmit the signals, that is, radio. Would you condemn your loud-speaker, which you know to be good, because the sound you heard from it was of poor quality owing to using it in conjunction with a wireless set that was incapable of passing through its various stages an undistorted signal?

The system is not at fault, but the apparatus built has to conform to certain frequency standards which at once throttle it or hold it back while all the time the system has equipment calmly waiting to show better results. Yet the writer in question says the *system* is doomed to failure because of a limitation imposed by an external body!

Again, it was said that *mathematically* it can be proved that television is impossible with present-day knowledge and technique. To this I would say that mathematically I can prove that one equals two, but I do not shout this fact from the housetops, for the simple and sufficient reason that the original premises were wrong. [*Of course, one can prove without mathematics that a critic knows something less than nothing, but it still remains a matter of opinion.*—ED.]

I can well remember the early mathematical theorists "proving" quite conclusively by using the ridiculous "dot" theory that a television transmission such as we now have presented to us by the B.B.C. service was absolutely impossible. No one can deny that television has a difficult furrow to plough, but why strew hypothetical obstacles in its path? It is beyond my comprehension why so many people have attempted to deal with the question by quoting a picture point analogy and referring to newspaper illustrations, when strip scanning is used almost universally for television purposes.

In detailing all the so-called drawbacks which are alleged to make the future of television gloomy, mention is made of distortion due to incorrect amplification, together with fading and heterodynes in the ether. Surely this is carrying things too far—cannot we say the same about ordinary reception of sound—they bear no relation to television as television? At the present moment television signals in this country are being broadcast by only one B.B.C. station, and if the same single service of short duration was offered to listeners for the use of their sound-receiving apparatus would you blame the system when you encountered fading outside the station's service area—of course not.

Allusion is also made to the inadequacy of brilliance in the source of illumination at the receiving end, and this is given as one of the reasons why more pictures per second are not presented by the television apparatus. This, again, is a travesty of truth. The Baird grid cell working in conjunction with a projection lamp of high intensity gives brilliant images and increasing the speed or adding to the number of lines in a complete scan would still give sufficient brilliance in the final image. Then, again, there is the sodium lamp developed in Germany by Fernseh A.G. who sponsor the Baird interests in that country.

If we had adopted the same attitude of drawing up so-called standards of perfection for radio transmission and reception in those early days when we listened with rapture to what were travesties of sound by wireless, where would the industry be to-day?

IGNORE CRITICS OF TELEVISION

By F. J. CAMM.

IT is unfortunately a fact that in all branches of science there are two classes, the pioneers and the plodders. Standing a comfortable distance away from these two classes you will find a smaller but unclassified group—the critics, and now and again the critics combine with the plodders and go out to attack the pioneers.

Television is no exception to this. One has only to do something in this life to arouse the critics, who batten themselves like barnacles on to anything which can be criticised and provide them with matter for a few lines at a penny a line. It is a very wise axiom that if you have no knowledge of a subject it is wise not to rush in and exhibit the fact. Critics of Television above all very much remind me of the old proverb about the blind trying to lead the blind. I have watched the growth of television from the time of Mr. Baird's first demonstration down to date, and PRACTICAL WIRELESS is in the fortunate position of being able to say that it will always be the first paper to publish details of television developments as they happen. I strongly advise all readers of this paper to ignore the criticisms, inspired and ill-informed, which have hampered its development in the past. Those who villify, condemn and disparage, are seldom more than arm-chair critics knowing little or nothing of the subject. You can find a parallel in the case of aviation. Wilbur Wright, having successfully demonstrated his aeroplane in America, arrived at Pau to fly it before some French experts, only to find himself surrounded there by the office-boy type of scribe anxious to prove to him that his machine could not possibly fly. His retort was: "Parrots talk; they cannot fly." We all know the story of the man who visited the Zoo and did not believe the giraffe! Uneducated, the inspired critics unfortunately are too easily endowed with critics' talons by lay editors who do not take sufficient trouble to investigate the qualifications of their contributors, and they permit untrained and uneducated people to join that reprehensible if select band of critics who, being unable to assimilate ordinary facts, bury their heads in the sand like the ostrich. Whilst one is always delighted to have criticisms from capable critics, I feel very strongly that television has not had a square deal, and for this reason I have opened the columns of this paper to Mr. Baird and to Mr. Barton Chapple, so that they can state their case. Television is inevitable; real television is here waiting on the doorstep, and none of the vapourings of youthful critics will stop it.

IMPROVEMENTS AND REFINEMENTS

By GILBERT E. TWINING

This Article Describes the Benefit to be Obtained from Fitting Some Exterior Refinements to any Good Standard Receiver

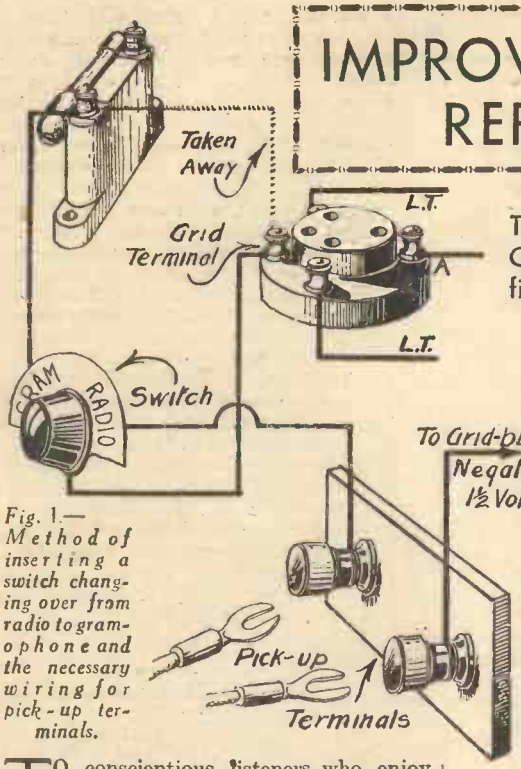


Fig. 1.—Method of inserting a switch changing over from radio to gramophone and the necessary wiring for pick-up terminals.

TO conscientious listeners who enjoy experimenting to improve their sets, also to those who have sets which are more than a year old and have not the latest gadgets incorporated in them, the following notes should be of interest. A good set will give excellent reproduction over a long period and the deterioration which takes place does so very slowly apart from actual breakdowns; from this it will be seen that a set which is slightly out of date in the way of refinements, but still giving good service, can very easily be brought up to modern requirements by the addition of inexpensive components. Naturally, all the refinements suggested here will not be applicable to all old sets, for some may already have them incorporated, but there must be some receivers, however, that will benefit from at least one of the following additions.

Pick-ups

Perhaps one of the most outstanding refinements a set can have is the fitting of pick-up terminals, enabling by means of a switch, gramophone records or radio reception to be obtained at will. There are several different methods whereby a pick-up may be fitted, some being cheaper than others, however. It is possible to get results if one side of the pick-up is connected to one end of the grid-leak, which is joined to the detector valve, the other lead of the pick-up being connected to low-tension negative; this is not generally considered good enough, and usually distortion is noticeable on account of lack of bias to the valve. A better way, in a set having a low-frequency stage where the power valve is fed by the detector, is to connect one of the leads from the pick-up to the grid terminal of the detector valve-holder; the other lead going to grid-bias negative, 1½ volts. In some cases the G.B. can quite well be altered to 3 volts provided it does not result in distortion. Bias is introduced to prevent the pick-up output from overloading the valve. In Fig. 1 is shown the

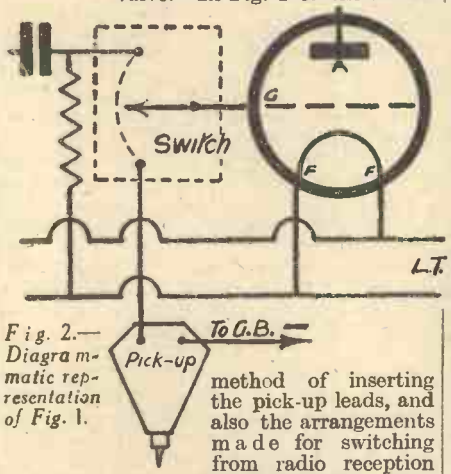


Fig. 2.—Diagrammatic representation of Fig. 1.

method of inserting the pick-up leads, and also the arrangements made for switching from radio reception to gramophone. Fig. 2 is the diagrammatic representation of Fig. 1. It is necessary to fit a volume control if one is not already built into the pick-up arm, and this should be a potentiometer of approximately 100,000 ohms. The best position is, naturally, on the motor board, where it can be easily operated. The slider of the potentiometer is connected to the grid of the detector valve through the change-over switch, the two other terminals on the volume control are joined to the two pick-up leads (see Figs. 3 and 4).

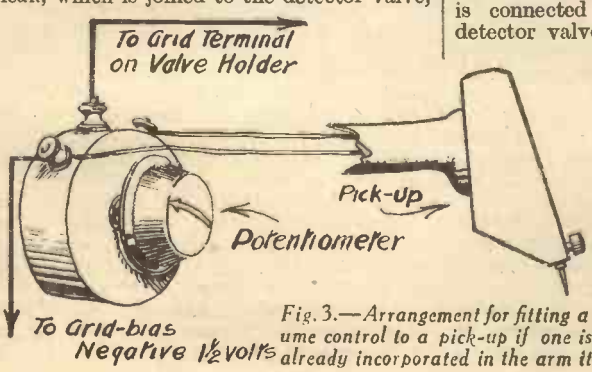


Fig. 3.—Arrangement for fitting a volume control to a pick-up if one is not already incorporated in the arm itself.

A L.F. Volume Control

An excellent method of controlling volume is shown in Figs. 5 and 6. It has the advantage that even when the volume is cut right down to a whisper the quality does not suffer. It is a potentiometer of 250,000 ohms, and is connected directly across the secondary windings of the low-frequency transformer. The grid-bias wiring is left intact, but the grid of the power valve is connected to the slider or moving arm of the potentiometer. As the slider moves towards the end of the secondary windings of the transformer, remote from the grid-bias, the voltage applied to the valve is increased and likewise when moved in the opposite direction the voltage decreases.

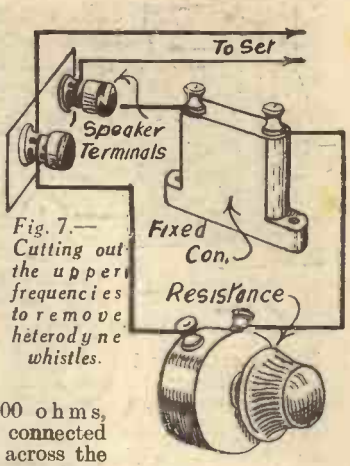
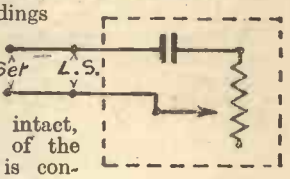


Fig. 7.—Cutting out the upper frequencies to remove heterodyne whistles.



Heterodyne Filter

Most people are acquainted with the annoying interference of the high-pitched heterodyne whistle, especially noticeable in districts where jamming of stations tends to upset reception. Many of the foreign stations have increased their power to such an extent that this kind of interference presents a big problem. It must be understood that a carrier wave of any given frequency is always accompanied by side-band frequencies. Thus two powerful stations working with a separation of only 9 kilocycles are likely to cause interference by the heterodyning of the side-band frequencies of the unwanted station with the carrier frequency of the wanted station. The action of a whistle filter is to cut out all the very high frequencies of approximately 5,000 cycles and

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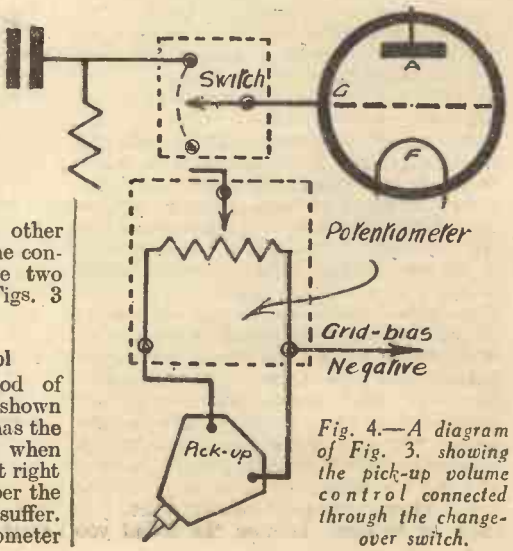

Fig. 4.—A diagram of Fig. 3. showing the pick-up volume control connected through the change-over switch.

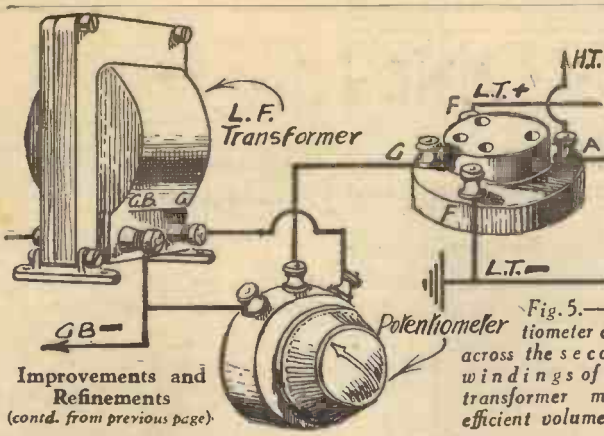

Fig. 5.—A potentiometer connected across the secondary windings of the L.F. transformer makes an efficient volume control.

Improvements and Refinements
(contd. from previous page)

over, and as the frequency of the whistle is probably far greater than this, it obviously will be lost. When eliminating this type of interference it must be remembered that the set's frequency response must not be cut down too low otherwise a great sacrifice in quality will be the result. Where a choke output circuit is incorporated in the set, similar to the one about to be described, it is an easy matter to add a high note cut-out. One of the simplest forms of control is shown in Fig. 7—this will effectively remove the upper frequencies. It consists of a condenser of suitable value in series with a variable resistance shunted across the loud-speaker terminals. A variable resistance of approximately 10,000 ohms and a fixed condenser of 0.25 mfd. is used. The more resistance in circuit the less the upper note cut off and, therefore, as the value of the resistance is reduced so will the cut-off of the high notes be greater. The point to remember is, that for good reproduction, frequencies from approximately 50 cycles up to 3,400 cycles are sufficient for the loud-speaker to respond to, for anything much above these will also reproduce the high-pitched whistle formed by the adjacent carrier waves.

Output Units

An output unit of the choke-capacity type is one of the simplest additions that can be made to a set. The advantage to be gained by this scheme is that it enables mains operation with high voltages to be used without fear of damaging the loud-speaker caused by the mains current passing through the speaker windings, for unless a filter is used the windings have to carry the full anode current of the power valve. If this current is not flowing in the right direction through the coils, and it will not be if the positive lead of the loud-speaker is not connected to the positive terminal of the set and also the negative to negative, it will tend to weaken the magnets; as a matter of fact, if used in this manner for any length of time, it will actually demagnetise them considerably. But, with the output filter circuit, it does not matter which way round the loud-speaker leads are connected to the set. It is also possible to correct any fault in the tone of the speaker by altering the values of the two components, in any case the speaker is working under more satisfactory conditions if it is isolated from the set. Speaker extensions can be carried out with safety and no fear of receiving an electric shock if the two wires are inadvertently touched. The essential components are a high inductance choke and a low impedance by-pass condenser. The choke should not be less than 20 henries and the condenser of 2 microfarads at least. The connections can easily be followed from Fig. 8.

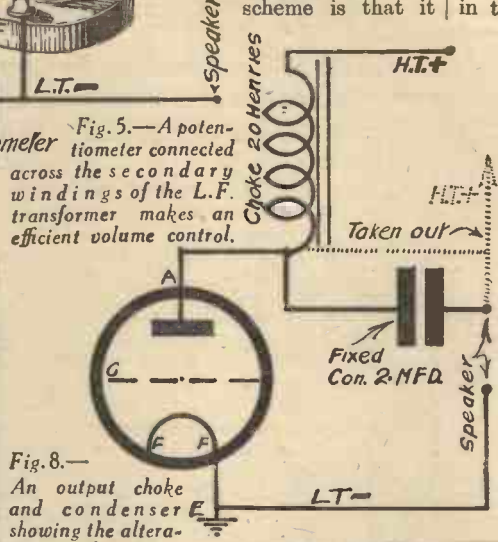

Fig. 8.—An output choke and condenser shown in the alteration in the wiring.

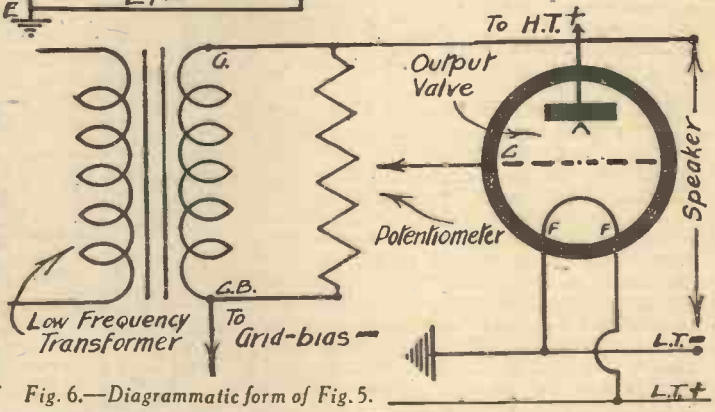

Fig. 6.—Diagrammatic form of Fig. 5.

ROUND THE WORLD OF WIRELESS—*Continued from page 1172*

Gramophone as Safety Device for Miners

IT is believed that a novel idea of the manager of a large South Wales colliery will be responsible for minimizing the number of accidents in coal mines. When the miners at the Wyndham Colliery are about to descend the pits a stentorian voice warns them of the chief points of danger in underground working. A bell tolls and a voice then says: "Hullo! Manager Calling! Safety First. Search your pockets for matches, etc., before you go down the pit. Don't carry tools and blocks of timber in the cage with you. Take care of your Safety Lamps, hang them up in a safe position. Don't walk the engine plane when the ropes are in motion. Don't go in front of the trams where the gradient is over three inches per yard. You must not work under overhanging coal or ground unless securely spragged. Hauliers, take care of the horses under your charge, don't abuse them, treat them kindly, take your horses safely to the stables at the end of the shift. Cases of ill-treatment will be severely dealt with." Special gramophone records have been made by "His Master's Voice," which are played through loud-speakers situated at the pit-head whenever a party of men go on duty. Mr. D. Llewellyn Richards, the manager of the mine, conceived the idea of gramophone warnings when he was listening to an S O S broadcast by the B.B.C. He had found that after the men had once read a printed warning they look little further notice of it. He realized in this case how much stronger an appeal through the ear would be than through the eye. He at once communicated with The Gramophone Company in London, who made two special records on which are warnings. In order that these should not become too familiar, different ones are played from day to day. It is reported that the number of small accidents has been reduced since the gramophone has been installed at the colliery, and Mr. Richards has demonstrated his innovation before a number of inspectors of the Ministry of Mines with a view to the adoption of this method of warnings in all collieries in the country.

Wireless and Sound Beacon for Irish Waters

A NEW Marconi automatic wireless beacon is to be installed in the Irish Lightship *Comet* to the order of the Commissioners of Irish Lights. The wireless beacon will have an energy of 100 watts in the aerial, and will be operated in conjunction with a submarine sound signalling device to enable navigators to ascertain not only their position in respect to the lightship, but also their distance from it. During the transmission periods the wireless beacon will transmit a warning dash, followed by a series of dots at regular intervals. The submarine sound signalling device will transmit a signal, the beginning of which will be synchronized with the end of the five seconds warning dash of the wireless. Wireless waves travel with the speed of light and are therefore received practically without time lag by any receiving station within the service area of the beacon, while the sound waves emitted by the submarine signalling device travel through water at the rate of 4,800 feet per second. The signals will be arranged so that the number of dots received by wireless before the reception of the submarine signal will be equal to the number of miles the receiving ship is from the beacon. The navigator will thus be enabled to ascertain his distance from the beacon without computation. The lightship will have a distinctive signal, which will be emitted before each transmission.

The provision of lightships with wireless beacons working in conjunction with submarine sounding devices is a development of considerable interest to coastal authorities, and the practice has been adopted at home and abroad. A combined beacon of this type was recently fitted to a

(Continued on page 1178.)

WHAT IS WRONG?—4

This Week the Author Deals with a Further Series of Tests which should be Applied when Locating Faults in a Receiver.

By FRANK PRESTON, F.R.A.

Cutting Out L.F. and H.F. Valves

If the receiver passes all the tests so far referred to and yet fails to operate in the desired manner, a further series of experiments will become necessary. Those to be described are particularly useful as a means of finding the cause of crackling noises and distortion, but they will prove very effective in detecting the source of any other kind of trouble.

This time we start by cutting out the last valve, which involves the transference of the loud-speaker wires to the anode circuit of the previous valve. To do this the connections of the coupling component (transformer, L.F. choke, or resistance) in the anode circuit of the penultimate valve should be removed and joined to the loud-speaker leads, as shown in the sketch of Fig. 16. When the set embodies only a single L.F. stage, there will probably be insufficient power to drive a speaker, and therefore, it will be desirable to employ 'phones instead. If reception is normal and the distortion or crackling no longer exists, it will be obvious that the fault was in the output stage, and by applying the tests already mentioned, there should be no difficulty in tracking down the defective part. But if the fault still remains, we must eliminate the first L.F. stage (when two are used) and follow a similar system of deduction.

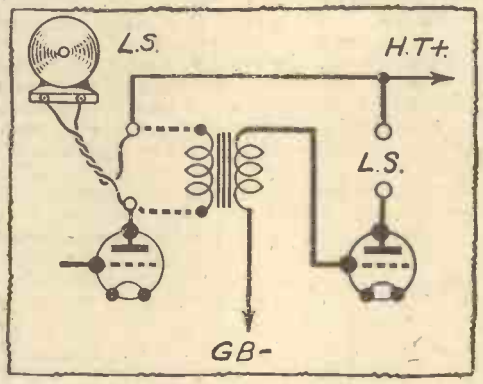

Fig. 16.—Cutting out an L.F. valve by connecting 'phones or loud-speaker in the anode circuit of the previous one.

Having arrived at the detector we shall know with certainty that any remaining defects must be concerned with either this or preceding valves. Rather than test the detector at this stage, we will eliminate the preceding valves one at a time. To put the first valve out of action the aerial should be removed from its terminal and connected to the anode terminal of the first valve through a .0001 mfd. condenser (see Fig. 17). The set should function on the remaining valves, but it will not be so sensitive to weak signals. If the fault has been eliminated it must be associated with the first valve; if not it must be in the remaining H.F. stages or in the detector circuit. Other stages can be cut out by transferring the aerial to subsequent valves until it is connected to that immediately preceding the detector.

Testing the Detector

Should the fault still persist it is obviously in respect to the detector, whose anode current should be measured, and all the components examined. When reaction is employed an attempt should first be made to induce oscillation by operating the reaction condenser. If this proves impossible, even though the valve passes a normal amount of H.T. current, the grid leak should be removed and replaced by another. Still no improvement; try another grid condenser. We have now tested everything except the tuning and reaction circuits, so our attention must be directed toward these. All the wiring will be checked as a first measure, and then the tuning condenser disconnected to make certain it is not short-circuiting the tuning coil. Next we must see that the reaction condenser is functioning, and that the reaction winding is not disconnected from its terminals. By this time it is almost certain that the trouble will have been located, and if it has not we are left with the probability that the tuner is faulty and we must therefore remove it for further examination. The subject of testing this and other components will be dealt with in the next article.

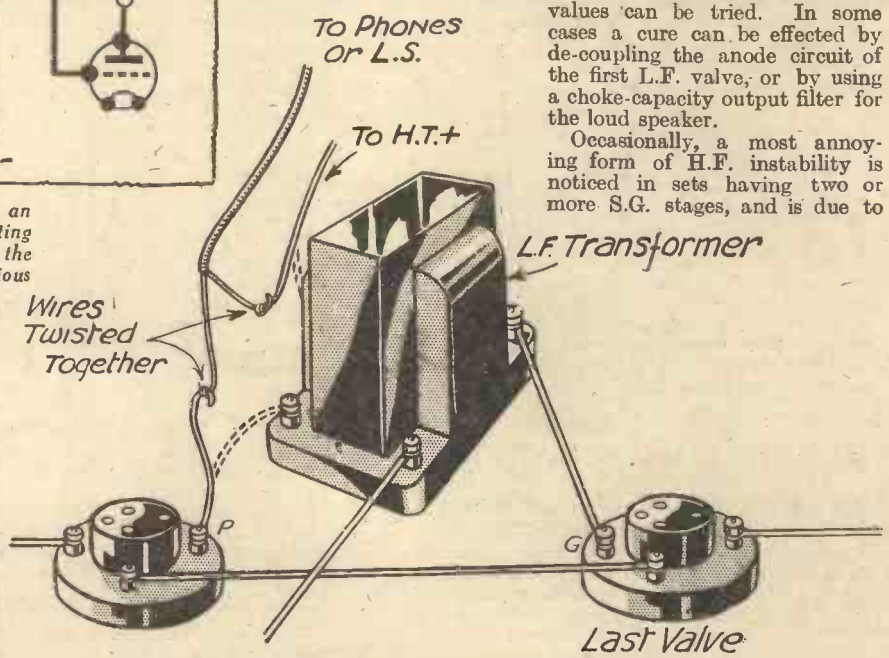

Fig. 17.—A pictorial diagram showing the scheme depicted in Fig. 16.

Other Forms of Trouble

At this juncture it will be interesting to deal with a few specific forms of trouble which are of common occurrence and which might not have been traced in previous tests. Let us treat these under separate headings.

Instability

This heading covers a multitude of faults, such as sudden bursting into oscillation of the set, a very high-pitched whistle (generally accompanied by weak reception, and lack of "range"), or a constant "groan" from the speaker. All these things, and many more, can be due to a poor earth lead, but as that should have been tested before we will not make further reference to it. Both of the first two faults might be due to the use of a high tension battery which is well past its prime of life, or to insufficient de-coupling. We cannot deal with the latter possibility in detail here for that is more the concern of the set designer. It can just be pointed out, however, that a higher value of de-coupling resistance might be tried in the anode circuit, or that the resistance might temporarily be replaced by a variable component so that the effect of alternative values can be tried. In some cases a cure can be effected by de-coupling the anode circuit of the first L.F. valve, or by using a choke-capacity output filter for the loud speaker.

Occasionally, a most annoying form of H.F. instability is noticed in sets having two or more S.G. stages, and is due to uncontrollable or parasitic oscillation. This is usually evidenced by the fact that the set is comparatively insensitive and the tuning not so sharp as it should be. The fault is often, but not always, indicated by a constant "whine" of extremely high pitch. Sometimes it is only present on one wavelength range, or even over only a portion of the tuning scale. It is almost invariably due to lack of screening or to the fact that screening is not effectively earthed; it might also result from poor contact between two portions of a shielding system, for example, between the base and cover of a coil can.

Motor-boating

This is a term which has been badly misused during recent years, and, although it is intended to apply more particularly

(Continued on page 1178.)

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to the sound it resembles, it is now taken to mean any form of low frequency feed-back, which might give rise to a noise resembling that made by a motor boat, or by a fog signal for that matter. But, whatever form the sound may take it is invariably due to back-coupling. The usually-prescribed remedy is to use more liberal de-coupling arrangements; in the case of an experimental receiver this might help, but we are more concerned with sets which have been properly designed, and which have previously behaved in an exemplary manner. With a set of the latter kind the trouble is more likely to be traced to the disconnection of a coupling, or by-pass condenser, or possibly to a fault in one of these components.

Microphonic Valve

When a continuous "ringing," or "booming" sound is heard which starts as a faint hum and gradually builds up to full intensity, it is a sign that a valve is "microphonic." The noise is due to sound vibrations from the loud-speaker impinging on the glass bulb and setting the electrodes into vibration. The rather obvious cure is to place the speaker in such a position that it cannot react on the valves, but this is seldom possible. It therefore becomes necessary either to replace the offending valve, or to insulate it from vibration by wrapping it in thick felt, or cotton wool. If the valve is mounted in a rigid holder, an improvement might be brought about by replacing the latter for one of the "anti-microphonic" type. It should be pointed out in passing that the fault under consideration is of rare occurrence with modern valves and most makers will willingly replace a new component which gives trouble in this respect.

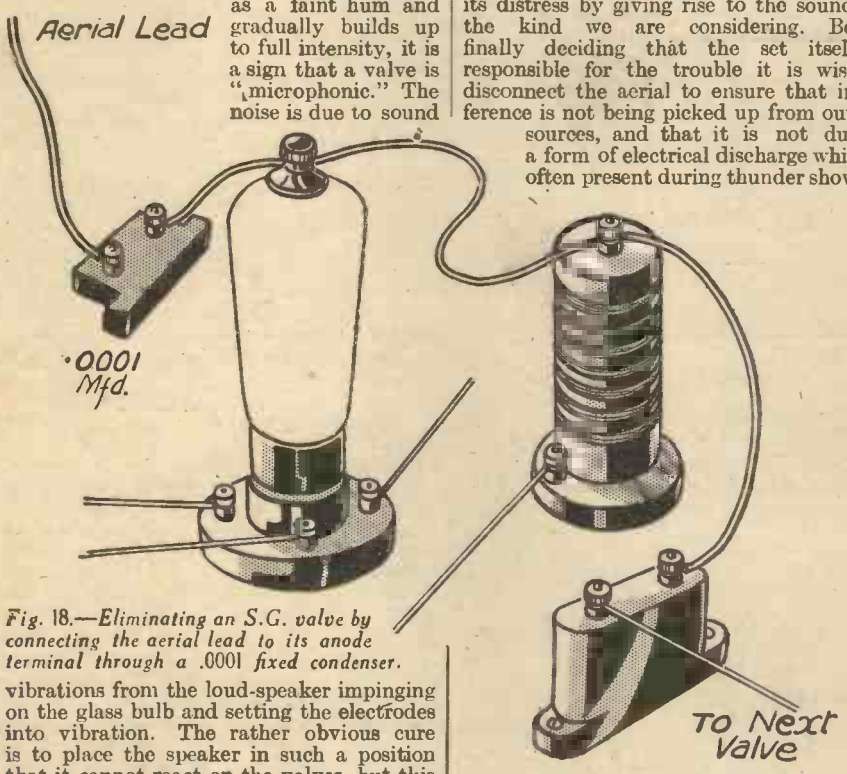

Fig. 18.—Eliminating an S.G. valve by connecting the aerial lead to its anode terminal through a .0001 fixed condenser.

There is no difficulty in finding which valve is wrong, for if each is tapped in turn with the finger nail, the defective one will cause a very audible "pong" in the speaker. The fault will generally be traceable to the detector, but this is not invariably the case since S.G. and L.F. valves occasionally become microphonic after long usage.

Continuous "Hissing" Sounds

These might be picked up by the aerial, but if so they will disappear when the aerial lead is disconnected. A faulty high-tension battery or even a gassing accumulator can also give rise to this form of interference, but these two are not very likely sources. Screened-grid valves, especially earlier models of the A.C. type, are much more probable sources of "hiss," and in such cases it might be impossible to overcome the difficulty entirely, without changing the valves concerned. The trouble is generally much worse when a grid leak is included in the circuit of one or more S.G. stages; replacing the leak might occasionally effect an improvement, but it is generally necessary to re-design the circuit, so that a leak is unnecessary, before a complete cure can result. Some slight hiss often occurs due to the use of an unsatisfactory grid leak even in the detector or L.F. stages, and it might be worth while to try replacements. In a similar way an overloaded feed resistance of the composition variety (as opposed to wire-wound and metallized) often shows its distress by giving rise to the sounds of the kind we are considering. Before finally deciding that the set itself is responsible for the trouble it is wise to disconnect the aerial to ensure that interference is not being picked up from outside sources, and that it is not due to a form of electrical discharge which is often present during thunder showers.

Electrical Interference

It is almost astonishing to observe the multitudinous variations of sounds which can be produced by different kinds of electrical machinery. Practically every form of noise which a set makes when suffering its numerous disabilities can be imitated by electrical means, and so care must always be taken in diagnosing complaints that they are not due to electrical apparatus in the vicinity. Most small electric motors such as those used in vacuum cleaners, hairdressers' drying machines, coffee grinders, etc., cause a "whir-r-r-ing" sound, whilst larger motors produce a noise of a "grinding" character; the ignition systems of some cars and gas engines give a regular "click-click-click" in the speaker; flashing beacons and robots produce a chirp. And so we could go on—but these things are only mentioned to emphasize the fact that one should not always blame the set until other possibilities have been considered.

Tuning Circuits

We have now considered most of the troubles with which the amateur is likely to meet, but we have not given any attention to the question of defective tuning. When selectivity appears to be much worse than when the set was new it is very probable that an S.G. valve is passing grid current, either due to lack of grid bias or to deterioration of the valve itself. In either case an improvement can generally be effected by applying a slightly higher bias voltage or by reducing the voltage to the screening grid. When any doubt exists in regard to the proper ganging of coils and condensers some useful tests can be made by using the little instrument described in the first article of this series. Unfortunately the tests can only be applied to coils and condensers which are not fitted in screening boxes, but in any case they should not be necessary when using components of the latter type, which would probably have been accurately matched by the makers before despatch.

First of all tune in a station near the bottom of the condenser scale and then bring the wire loop towards the end of each coil in turn. This will slightly reduce the inductance of the coil under test and should therefore cause a reduction in signal strength; if signal strength becomes greater it will be seen that the circuit is tuned to too high a wavelength and, therefore, that the trimmer of the associated condenser section must be reduced in capacity. Should the capacity already be at its minimum value the same result can be obtained by increasing by an equal amount the capacity of all the other trimmers; this will make it necessary to re-tune to bring in the signal again. An "opposite" test can be made by touching the aluminium disc against the moving plates of one condenser section. The additional capacity formed between the disc and fixed vanes will increase the wavelength of the particular tuning section and should make the signal weaker; if it does not, the capacity of the condenser is too low and the trimmer should be increased.

In the next, and final, article of this series we shall deal with some of the faults peculiar to mains-operated receivers and I will show how tests of individual components can be made by using the simple instruments we have collected.

ROUND THE WORLD OF WIRELESS

(Continued from page 1176.)

light-vessel off the Uruguayan coast, in addition to two wireless beacons in light-houses.

First Micro-wave Radio Telephone Service

THE first regular micro-wave radio telephone service in the world, between the Vatican City and the Palace of the Pope at Castel Gandolfo, near Rome, was inaugurated by the Pope recently. "Micro-waves" is the name now generally given by technicians to radio wavelengths of less than one metre. The installation of the micro-wave stations in the Vatican City and at Castel Gandolfo, which will operate on a wavelength of 60 centimetres, has been personally supervized by Marchese Marconi, the Vatican authorities having been the first to decide upon the adoption of the micro-wave system for telephonic communication following a demonstration of two-way communication given by Marchese Marconi in Italy early last year.

BELOW 10 METRES

In this Article FRANK PRESTON, F.R.A., gives you some Useful Information in regard to the Design of an Ultra Short-Wave Receiver

IT would be rather a difficult matter at the present time to give a satisfactory definition of the expression "short waves." Quite a few years ago all wavelengths under 1,000 metres were considered as short; later the term was applied only to waves of 200 metres or less, and then the limit fell to 100 metres, whilst to-day it seems that it can be fixed at any point from 1 metre to 80 metres, according to individual ideas. One thing is certain, however, and that is that shorter and shorter wavelengths are coming into use, and this is not surprising when one considers the facts that have become very obvious during recent times.

Up to some ten years ago it was generally thought that long-distance reception was impossible on wavelengths of less than 1,000 metres, but, principally due to the endeavours of amateur transmitters, the world can be spanned by signals on 50 metres and less with an infinitesimally small power, only a mere fraction of that employed by long-wave commercial stations. It has also been found that long-distance reception is possible, not only during hours of darkness as heretofore, but at any time of the day by choosing (short) wavelengths appropriate to the hour and the distance which it is required to cover.

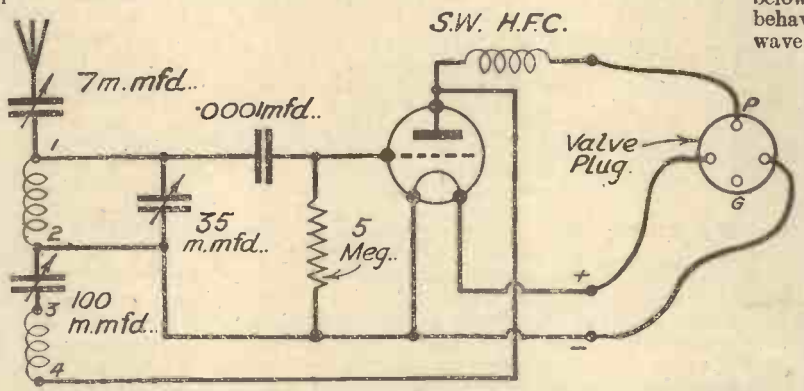

Fig. 1.—A simple and useful circuit for an ultra short-wave receiver or adaptor.

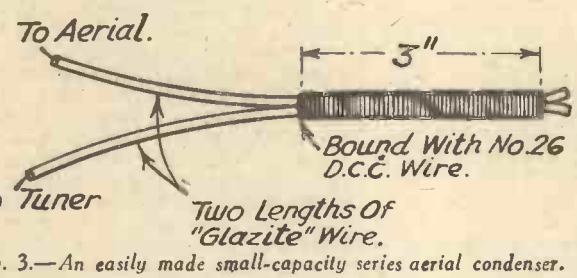

Fig. 3.—An easily made small-capacity series aerial condenser.

Another very great advantage of the shorter wavelengths is that a much larger number of stations can be accommodated in any one particular waveband. This can more readily be appreciated when it is realized that the frequency range embraced by wavelengths between 7.5 and 10 metres is 10,000 kilocycles. Compare this with the paltry 1,000 kilocycles between 200 and 600 metres and you will see that ten times as many wavelengths are available within the former as in the latter band. (Incidentally, both of these ranges can be covered by a single coil and variable condenser.) This advantage is particularly significant in view of the present congestion of the "broadcasting bands," and it seems feasible to imagine that in the not too-distant future the shorter waves will come into still more general use, especially by transmitters intended for broadcasting over long distances. As television transmissions become more general the advantages of shorter waves will be still more pronounced, because, as you know, each television transmitter requires not just one but two wavelengths—one for "vision" and one for "sound."

Theoretically, wavelengths below about 10 metres should behave very much like light waves, and could thus be sent over "optical" distances only, but the results of numerous experiments point to the fact that much greater distances can actually be covered. It is therefore most probable that as soon as sufficient data has been collected and the transmitting range of these ultra short-waves—as they are frequently called—has been determined, several under-10 metres stations will be set into regular operation. Since there is already a good deal of fun to be had by experimenting on these very short waves, no doubt many readers will wish to participate, and so perhaps a few practical notes in regard to my own experiences will be of assistance.

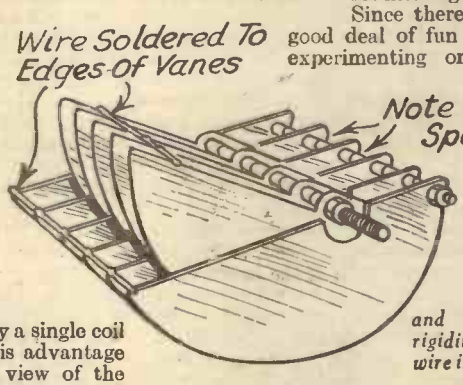

Fig. 2—A good way of ensuring perfect contact between condenser vanes and of improving rigidity; a length of wire is soldered across the edges.

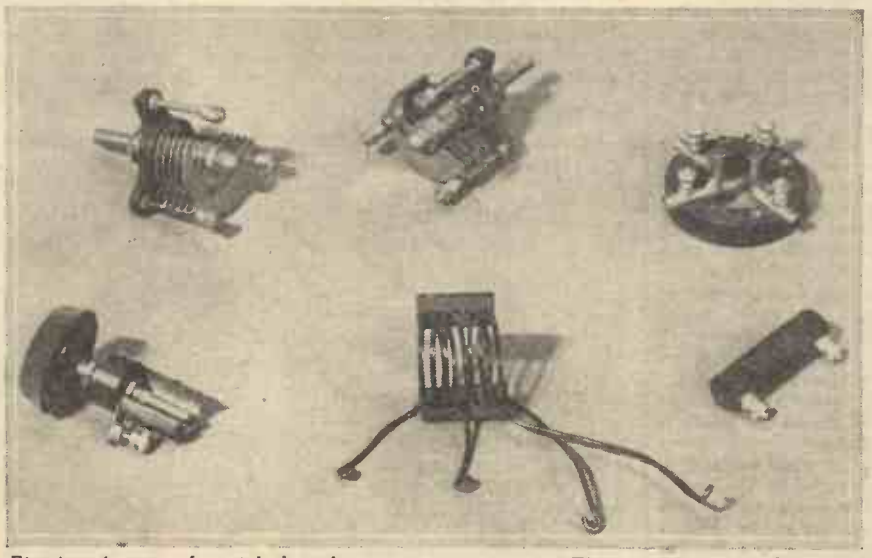

Fig. 4.—A group of special ultra short-wave components. They are:—top (reading from left to right), a 35m.-mfd. tuning condenser (note the double spacing of vanes); a 100m.-mfd. reaction condenser; low-loss valve holder. Bottom (reading from right to left), a 10 metre H.F. choke; 6-8 metre tuner; and a 7m.-mfd. variable series aerial condenser.

A Suitable Circuit

In my first 8–11 metre receiver I used a single valve adaptor having the circuit shown in Fig. 1, and after very little trouble succeeded in receiving a local amateur working on just over 10 metres. For the "aerial" I employed a 7ft. length of wire going from aerial terminal of the set to an insulated hook in the corner of the room, and I dispensed with an earth lead entirely because this was found

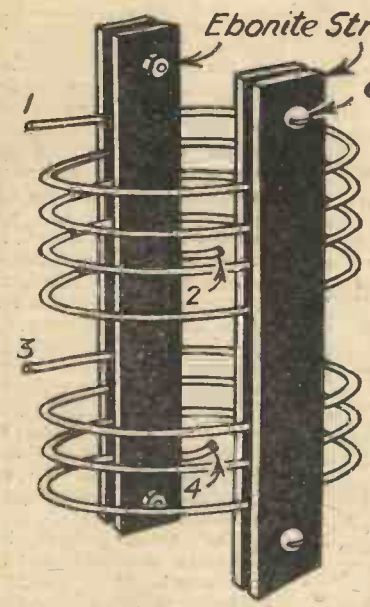

Fig. 5.—Constructional details of a 10 metre tuner.

to stop the valve from oscillating at certain settings of the tuning condenser. For some time no other stations were received, and so as to check up the set I made an oscillator (really a miniature transmitter), using the very same circuit as the receiver, except that it was connected directly to the H.T. and L.T. batteries and had no aerial connection. By setting this in operation a few yards away from the receiver I was able to pick up its heterodyne note and so make quite sure that the receiver was functioning correctly. As a matter of fact, the oscillator enabled me to do far more than this, because by making various adjustments and alterations I was able to improve the set fairly considerably; the improvement was evidenced, of course, by the increased strength of the heterodyne note. It appeared that the most important consideration was the correct choice of valve, and it was eventually found that a metallized one of the "L" type gave best results, principally because oscillation could more easily be maintained. Other modifications were of a minor character, and rather than explain them all it might be better to describe the whole receiver, and especially those components which were home-made or improvised.

The diagram of Fig. 1 shows that the circuit arrangement is quite conventional, being the same as that used for any short-wave receiver. One misses the usual earth connection, but otherwise there is nothing to distinguish the circuit from that of a normal broadcast set. On looking at the component values, however, vast differences are at once apparent. The series aerial condenser has a maximum capacity of 7 *micro*-microfarads instead of the more usual 100 micro-microfarads (or .0001 mfd.), whilst the tuning and reaction condensers are of but 35 and 100 micro-microfarads respectively. The capacity of the aerial series condenser is made so small to prevent undue damping by the aerial of the tuned circuit, which would prevent the valve from oscillating. The comparatively low capacities of the other condensers are chosen because capacity has a much greater effect on the shorter wavelengths and higher values introduce a detrimental amount of loss. Besides, the smaller condensers can be adjusted much more accurately, since for any particular amount of spindle rotation the change in capacity is less.

Low-Loss Condensers

In my receiver I employed specially-made low-loss condensers of the type illustrated in the photograph, Fig. 4, but as many readers will not wish to go to the expense of new parts for their initial experiments it should be explained that excellent results can be obtained by using ordinary S.W. condensers after removing some of the vanes. The best method is to dismantle the condensers and then to reassemble, using fewer vanes and double-spacing them by fitting two washers between each. By so doing the minimum capacity will be considerably reduced and the condensers will be much more efficient in consequence. It is very important that the contact between all fixed and moving vanes shall be absolutely perfect, and for this reason it is a good idea to solder a piece of wire across them as shown in Fig. 2. Whether the condensers are specially made or improvised ones, it is essential that a good slow-motion drive should be used for the tuning condenser at least, whilst this is also desirable in the case of that used for reaction control.

Those who have one or two neutralizing condensers on hand, of the type which were employed in neutrodyne receivers, will find that these make excellent substitutes for the special condensers referred to above. They generally have a maximum capacity of some 25 m.-mfd. and a particularly low minimum, so that a single one can be used for tuning and two may be wired in parallel for reaction. Having a "screw-thread" operation, they can be adjusted with extreme accuracy without the need for any additional vernier drive. The only difficulty is that they cannot very well be calibrated and, therefore, it is impossible to make a note of tuning positions. A good substitute for the series-aerial condenser can be made from two lengths of "Glazite" insulated wire bound together with a length of 26 gauge d.c.c. wire, as shown in Fig. 3; connections are made directly by means of the two wires themselves.

The Tuner

As might be expected, a tuner for wavelengths of the order of 10 metres must be very diminutive, and a good idea of the appearance of this component can be gained from Fig. 4. For a waveband of, approximately, 8 to 11 metres, the aerial coil should consist of four turns of 16 gauge enamelled wire, the turns being 1½in. in diameter. The reaction winding may then have three similar turns of the same material. In both cases the turns should be spaced by ¼in. and the two coils are mounted with their ends ¼in apart. It must be understood that these particulars are only approximate and that they might have to be varied slightly according to the capacity of the valve in use and the lengths of the connecting wires. The simplest way to make the coils is to wind the wire round a 1in. diameter wooden rod, putting on one more turn than is required. After winding, the turns will spring open and attain approximately the correct diameter. When they have been wound, the two coils can be clamped together by means of short strips of ebonite, as shown in Fig. 5. The best way to mount the tuner is to connect the ends of the winding directly to the other components in the manner illustrated in Fig. 6. (The numbered connections given in Fig. 5 correspond with those in the circuit diagram.)

The H.F. Choke

The grid condenser and leak have the fairly usual values of .0001 mfd. and 5 megohms, and any reliable components can be used. A special high-frequency choke is called for since even an ordinary S.-W. choke has too high a capacity. A suitable component can be bought, or may be made at home very simply, by winding fifty turns of 24 gauge d.c.c. wire on a ½in. diameter ebonite tube. The latter must be of the thinnest material obtainable, so that capacity may be kept down to the very lowest figure, and it is preferable slightly to space the turns with the same object in view. The valve-holder should be of the short-wave type, having a minimum of solid insulating material; the idea is, of course, to cut down capacity, and some experimenters prefer to dispense with a valve-holder entirely, soldering connections directly to the valve pins. Others even go so far as to remove the valve cap and make connections to the wires coming through the glass "pip." I do not consider this to be necessary, and my own experiments have failed to reveal any great advantage from such "ultra-low-loss" measures, so long as a suitable valve is chosen in the first place.

(Continued on page 1212.)

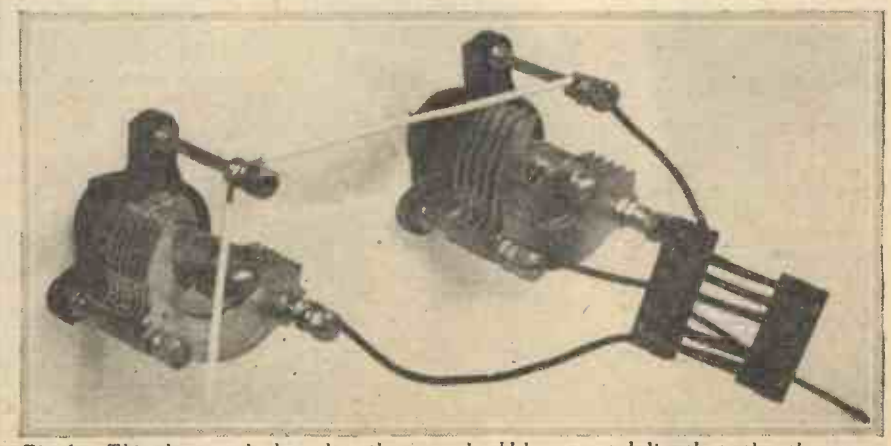

Fig. 6.—This photograph shows how the tuner should be connected directly to the other components; the actual tuner illustrated is for approximately 6 to 8 metres.

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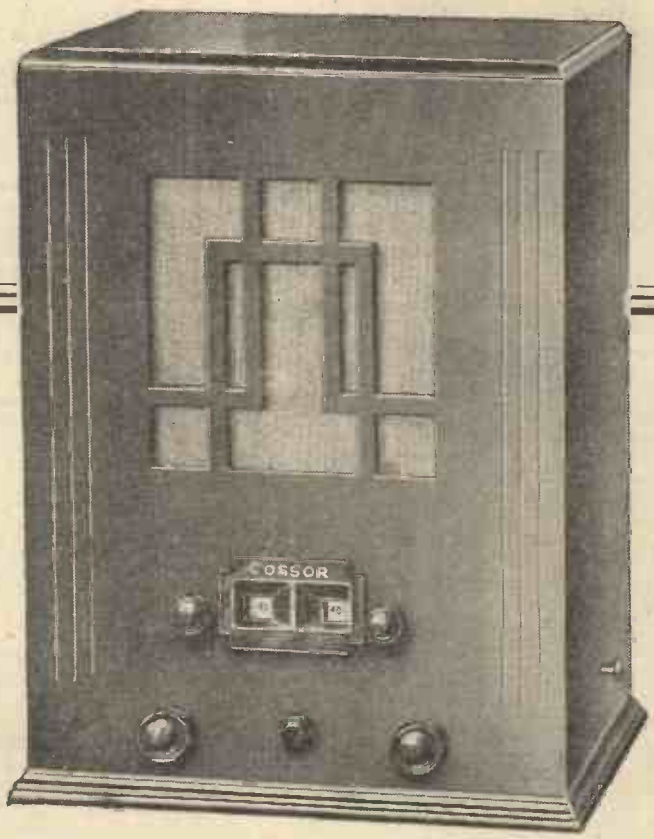

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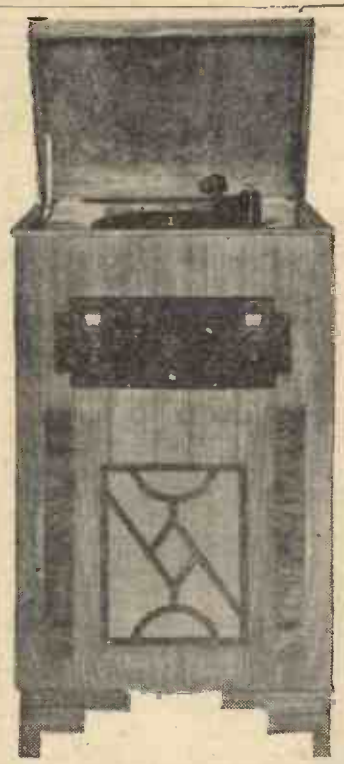


MORE ABOUT—

THE A.C. "FURY FOUR" RADIO-GRAM

The Amazingly Successful Receiver with the Editor's Personal Guarantee!

IT will have been noted that the leads from the gramophone motor were not discussed last week, and the following point now arises. Obviously, it is necessary to connect these to the mains, and if they were joined direct to the input terminals on the mains transformer in the eliminator section of the "Fury" the motor would be switched on all the time. A switch must, therefore, be interposed so that the motor will only be switched on when required, and the small Bulgin Type S.80 will do admirably for this purpose. It should preferably be mounted on the motor board in close proximity to the radio-gram. switch or, if taste so demands, on the opposite side of the turntable. The connections will therefore be, one lead from the motor to one of the input terminals on the mains transformer, the other input terminal on the mains transformer to the gramophone motor switch, and the other side of the switch to the motor. It will be noted that the makers of the motor supply a very long length of flex, so that there is ample to enable you to run it round the side of the cabinet and so preserve a neat appearance.

The Pick-up

The pick-up is joined in series with the radio-gram. switch which is simply an on-off, or short-circuiting switch. One pick-up lead goes to one side of the switch, and the remaining pick-up lead is taken down to the nearest earth connection, which is the core-earthing terminal on the Telsen Pentode Output Choke. The remaining switch terminal is taken down to the junction of the grid condenser, leak and grid of the detector valve. It will be noticed, therefore, that the grid of the detector valve is connected always to the tuning circuit and, consequently, the preceding H.F. stages. There is nothing detrimental in this. A large number of readers have written me to asking whether this is not a misprint, but I can assure them that it is not, and furthermore, it is a simple way of introducing radio-gram. switching. The method usually adopted is to join the grid to the arm of a single-pole-change-over switch, but this always results in a terrific bang when the arm is moved, as the grid is temporarily disconnected, and in my opinion this is an objectionable effect, which is overcome by the method of switching here adopted. It is true that if the receiver is being used to receive a powerful station, and then the gramophone pick-up is simply switched into circuit and placed upon a record the radio signals will break through, but this is not the way to employ the arrangement.

Cutting Out Radio

When it is desired to use gramophone reproduction, the correct procedure is as follows. First of all turn the H.F. potentiometer to zero. This completely eliminates the wireless signals; then switch in the gramophone pick-up, and there will be no background whatsoever. The motor is switched on by means of the additional switch, and the turntable must be given a start. Just place the forefinger on the edge of it and give it a good spin in the correct direction, and it will be found to run into step very speedily and keep a nice constant speed. The best needles to use with the pick-up will depend to a certain extent upon individual taste. I prefer the needle known as the Columbia Talkie, as I have found these give longest life to the records, whilst preserving the musical characteristics very well. Some may prefer a softer tone needle, but a little experimenting in this direction will enable the best type of needle for individual taste to be easily found. The volume control on the rear of the pick-up arm will enable the degree of sound to be adjusted so that the output valve is not overloaded, and the results on the gramophone side will be found particularly pleasing, giving plenty of body, with a very good overall response.

An Independent Test Report

Readers may be interested in the following report, taken from the current issue of a certain publication.

THE "FURY FOUR" ON THE TEST BENCH

Best Radio Principles Incorporated

By Norman Eccleston

The "Fury Four" marks a milestone in technical press history, as it constitutes a properly designed receiver that both looks and behaves like a factory-built instrument in the top rank.

From the really thorough decoupling at the H.F. end to the tapped output choke, the "Fury Four" embodies all principles that are recognized as the best practice among Radio Engineers, and it is far removed from the tangled collection of ill-placed components and consequent untidy wiring so often presented to the public in the form of a blue print.

On the right is the circuit diagram; a glance will show that all chance of hit and miss is eliminated, all possible precautions being taken to ensure stability and consistency under varying conditions; the decoupling network is in itself noteworthy as being really thorough and complete.

A small point that means a lot is the use of a single high-tension tapping, the advantages of which our readers will appreciate too well to necessitate further mention here.

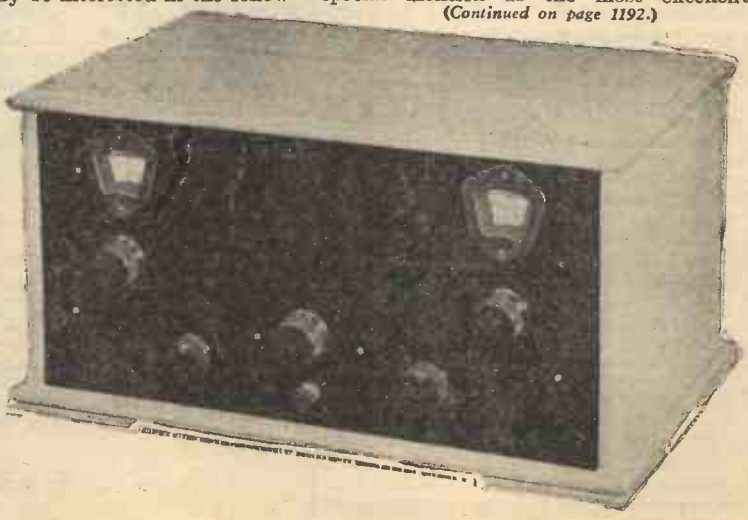
Mr. Camm, the designer, has realized the great difficulties that confront the constructor when faced with a triple-ganged condenser, and has used two-knob tuning (one controlling a twin condenser, the other a single condenser) which is an ideal compromise between maximum efficiency, simple manipulation and ease of initial construction.

On test the "Fury Four" proved itself to be all that the circuit diagram suggested, the range and volume were such that all the worth-while European stations and a good many others could be tuned-in on a Cossor Moving Coil Loud-speaker, type 495.

The selectivity was very good, and there is no question that the separation of the two dials gave a decided advantage assisted by the very delightful reaction control which was free from any undesirable backlash.

The quality of reproduction is well worth special mention as the most excellent

(*Continued on page 1192.*)



The DESIGN of LOUD-SPEAKERS—2

A Continuation of the Article which Commenced Last Week. In this section the Fundamentals of the Moving-coil Speaker are Discussed

By W. J. DELANEY

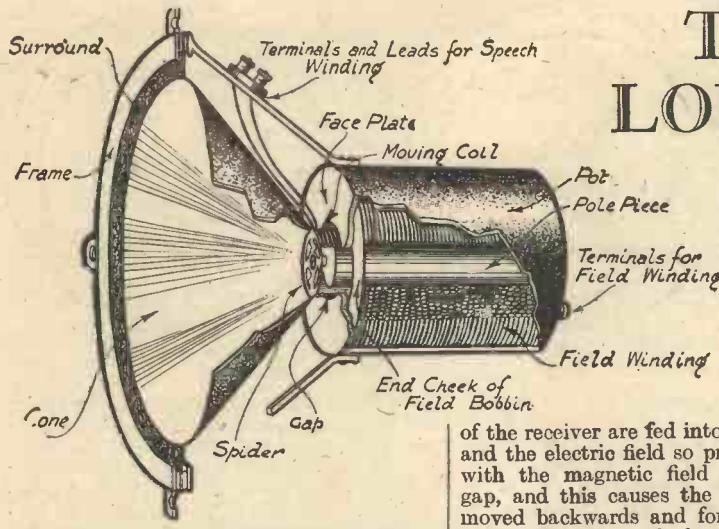


Fig. 1.—A complete diagram of a moving-coil loud-speaker.

I SHOWED last week how the ordinary, or moving-iron type of speaker, was not able correctly to deal with the 50 cycle note produced by the drum which was the basis of our discussion. The article closed by giving a rather sketchy description of the moving-coil (or electro-dynamic) loud-speaker, and before analysing the make-up of this type of speaker, with all its commercial refinements (and drawbacks), it would perhaps be as well to recapitulate the *modus operandi* of this type of sound reproducer. In Fig. 1 is a rather elaborate illustration of a commercial moving-coil loud-speaker which was on the market some time ago. This consisted of a cast pot in the form of a jar, or cylinder, about 6ins. in diameter, by about 8ins. long. Running down the centre of this pot was a solid rod of steel 2ins. in diameter. The lid of this pot fitted tightly round the end, and in the centre was a hole 2¼ins. in diameter. The pole piece was of such a length that its upper surface was level with the lid, or as it is more correctly called —the face plate. A cone of stiff paper had the apex cut away, and cemented to this was a short cylinder of similar paper, 1in. deep by 2 1/16ins. in diameter. Round this cylinder was wound a coil of very fine wire having a resistance of 2,000 ohms. The ends of the wire were stuck to the cone, and heavier gauge flex soldered to the end and taken to two terminals mounted on a small piece of ebonite attached to a heavy metal framework, which was bolted to the pot. The periphery of the cone was stuck to a thin rubber ring which was clamped between two rings of three-ply wood, which were bolted to the metal rim of the framework. *The whole arrangement weighed 33lbs.*

The Parts of a M.-C. Speaker

To simplify the points which I am now going to deal with, this illustration has been fully referenced, and you will be able to see from this what every part of the moving-coil speaker is called. Although many changes have been made in the actual design of the loud-speaker, these terms are still used, and the illustration will therefore serve as a model. The essentials are a speech coil (more commonly known as the moving coil) attached to a cone, and a magnet with a small annular gap in which the speech coil is suspended. The signal impulses from the output valve of the receiver are fed into this speech coil, and the electric field so produced interacts with the magnetic field surrounding the gap, and this causes the speech coil to be moved backwards and forwards according to the direction of the currents flowing through it. The first part to consider is the magnet. In the model illustrated the coil of wire known as the field winding

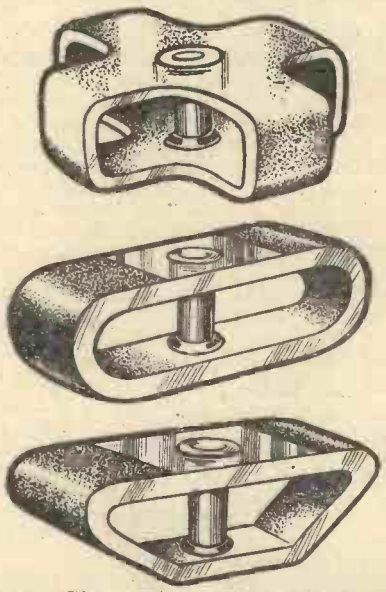


Fig. 2.—Three different types of permanent magnet used for loud-speakers.

was intended to be joined to a source of direct current having a voltage of 10, and it consumed a current of about 1 amp. The effect of this current flowing round the pole piece was to turn it into an electro-magnet, and so produce the magnetic field across the gap. These lines of force so produced may be measured, and the strength of this field is quoted in so many lines per sq. cm. In this particular model the strength was about 5,000 lines.

The Permanent Magnet

The necessity for the energising battery prevented many listeners from using this type of speaker, and consequently there was not a great demand for what was, in fact, a great improvement on the speakers which were in existence at that time. The result of this lack of interest was an attempt on the part of the manufacturers to produce a speaker which required no exciting medium—in other words, an attempt was made to produce a "permanent magnet." To be effective, a magnet must be so designed that there is a minimum of leakage, and consequently it is not a simple matter to construct such a magnet. At Fig. 2 three representative types of permanent magnet are illustrated, and it will be seen that the principle is exactly the same in each case—namely, a pole piece surrounded by a magnet, and a face plate joining up the poles of the magnet. The face plate has a circle cut out, and the pole piece is fixed centrally with relation to this cut-out, and so provides the air gap. The design of this type of magnet has now reached such a high degree that it is possible to obtain a magnet with a gap having a flux density of over 10,000 lines. You can see how this compares with the older form of energised magnet. The magnet, therefore, must have as high a value of flux density as possible, and in order to obtain this, the air gap must be as small as possible. Obviously, as the speech coil must be situated inside this gap, there is a limit to the size of the gap. The majority of speakers possess a gap of ⅛in. or less.

The Speech Winding

The speech winding, as has been already stated, has to be accommodated inside the air gap, and as this has to be as small as

(*Continued on page 1184.*)

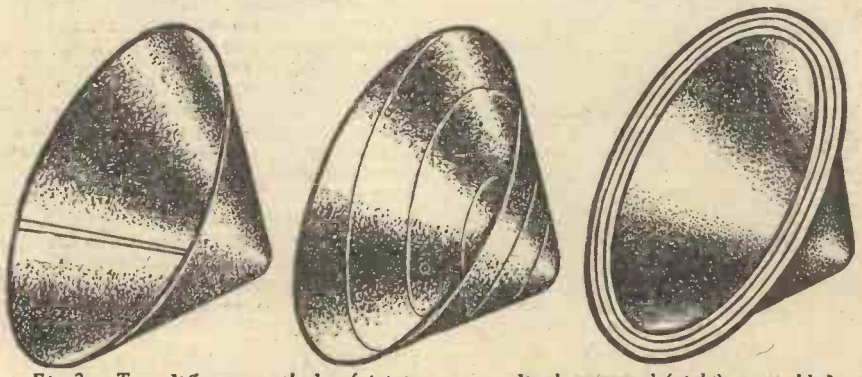


Fig. 3.—Two different methods of joining a cone diaphragm and (right) a moulded seamless diaphragm.

(Contd. from page 1183)

possible it naturally follows that the speech coil must also be as small as possible. In the early days the winding was intended for inclusion direct in the anode circuit of the output valve, and consequently a resistance of 2,000 to 4,000 ohms was necessary. To accommodate the necessary amount of wire it had to be extremely fine, and this made a naturally flimsy or fragile coil which was easily destroyed. To-day it is the custom to make this winding of only a few ohms resistance—actual figures taken from manufacturers' catalogues showing various values from 0.9 ohms to 7 ohms. Fairly thick wire is employed for this coil, but as it has to be moved in sympathy with the speech currents flowing through it, it must be extremely light. The actual former upon which the wire is wound has therefore to be made of the very minimum of material, and in one form of speaker no former at all is employed. Instead, the wire is wound round a jig at the works, and the entire winding doped with collodion. This causes it to set practically solid, and when the jig is removed, a self-supporting coil is the result.

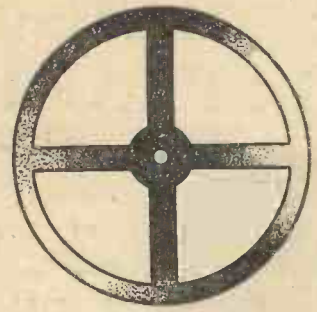


Fig. 4.—The crudest form of centralising spider.

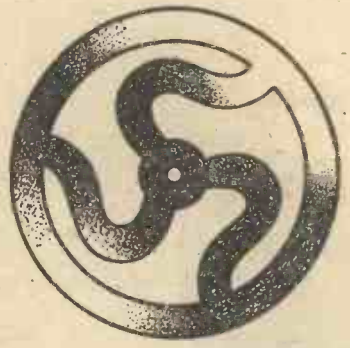


Fig. 5.—Two popular commercial forms of spider.

The Cone

The speech winding will not, by itself, reproduce any sounds, as it is necessary (as explained in the first part of this article) to set the air into motion in order to reproduce the original musical sounds. To enable this to be done, the speech winding is attached to a cone, and as we have already seen that lightness is the first consideration, the actual material used for the cone has to be chosen with some care. If made of very thin paper, the vibrations which are produced by the movement of the speech coil will result in "dithering" or other obnoxious sounds. If made of a thick material the reproduction will be "woolly." The diaphragm (or cone) has therefore to be designed with the utmost care, and must, moreover, be designed in conjunction with the speech winding and flux density in the air gap. If the latter is small, then the cone and speech winding (or cone assembly, as the total is called) must be very light; if the flux density is very high, then we can afford to have a slightly more robust cone assembly. The method of making up the cone has received a great deal of attention from manufacturers, and various materials have been used in the course of experiments. One loud-speaker at present on the market employs buckram, pressed out in one piece without a seam. Yet another utilizes the thinnest of paper, with thin card stiffenings glued to the cone in different positions, so as to break up the resonances set up in the thin paper. In some diaphragms the join runs straight from the periphery to the centre, whilst in others it winds in a spiral, beginning and ending on the same radial line. Some representative diaphragms are illustrated in Fig. 3.

The Spider

To ensure that the speech winding will remain central in the air gap some form of centralizing device is necessary, and this is called a "spider," and has probably received even more attention than the diaphragm. It was pointed out, when speaking about the moving-iron type of speaker, that the principal drawback was the fact that the armature had a natural restoring force, or, in other words, when drawn towards the magnet it tended all the time to spring back to its normal position of rest. The moving-coil speaker, therefore, as it is capable of a freer movement, must be made up so that there is no restoring force, and this is where the majority of moving-coil speakers fail. It is exceedingly difficult to arrange the speech winding so that it maintains its central position, and at the same time is not held by some means which will introduce this restoring force. So far, I have only discovered one loud-speaker on the market which answers to this requirement. However, more of that anon. At Fig. 4 is illustrated a very simple form of spider, and this consists simply of a disc of paper from which sections have been cut to leave four "spokes." This will be found to permit of the edge being drawn backwards and forwards whilst the centre remains at rest, but it will also permit of some lateral movement, and this must on no account take place. The spokes must therefore be shaped differently, and two of the most popular patterns are illustrated at Fig. 5. It is obvious that, with either of these patterns, the edge of the disc is perfectly free to move backwards and forwards, but no lateral movement is at all possible. The centre of the spider is bolted to the centre of the pole piece, and the edge is stuck to the cone.

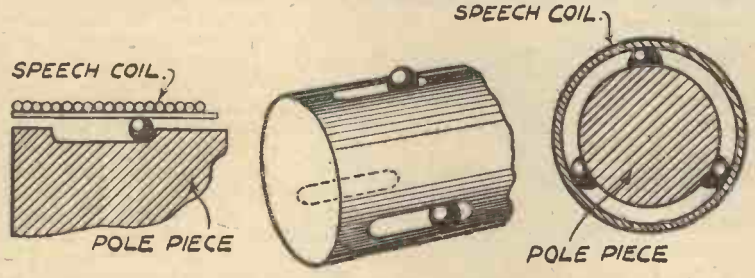


Fig. 6.—An ingenious centralising device which avoids the spider.

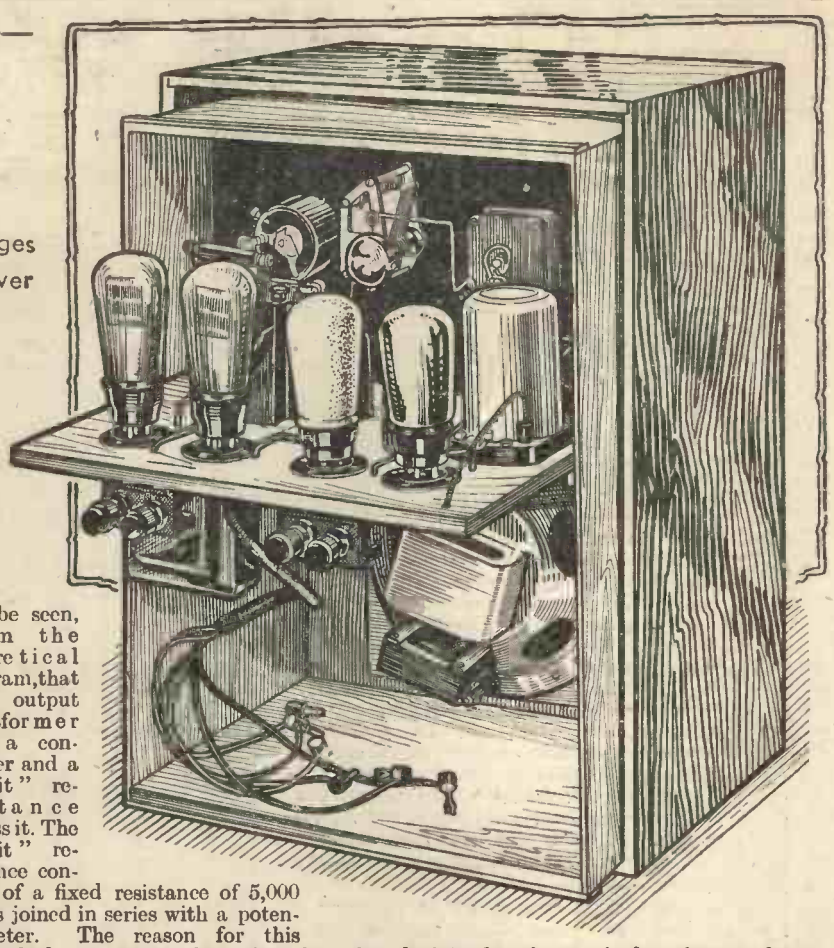
In an attempt to do away with the spider cut from paper, many novelties have been produced, amongst which may be mentioned the patented arrangement used by the Film Industries Public Address loud-speaker. A thin disc of duralumin is provided with corrugations concentrically disposed, and a large hole in the centre permits of the cone being cemented direct to this disc. The edges of the disc are then attached to the edge of the magnet pot, so that the arrangement resembles very much an ordinary gramophone sound-box, with the cone attached to the centre of the diaphragm. The corrugations permit great flexibility in the direction of correct movement, but there is absolutely no possibility of side play. With any form of spider, however, there is always a tendency for the spider to return the diaphragn to a normal position, that is, the position of the cone when at rest. This will always be with the disc in a "flat" position. This is not, therefore, very much better than the ordinary moving-iron arrangement, except in so far as the spider or other centring device does not have the same tension as the moving-iron movement. Before ending this section dealing with the centring device, therefore, I must refer to the most ingenious of all movements, that of the Lanchester speakers. Here is a device which definitely has no restoring force, and yet maintains a perfectly centred speech coil, permits of perfect flexibility, and yet allows of no lateral movement. It is illustrated in Fig 6, and it will be seem that the pole piece has three equally disposed longitudinal grooves cut in it. Resting in these grooves are three small rubber balls with a diameter such that the former of the speech coil will just rest on these three balls, as shown at the right of Fig. 6. It is obvious that by this arrangement, the balls are free to travel up and down the slot, the speech coil former is free to travel along over the balls, and the combination of these two movements will permit of absolutely perfect flexibility and a true "piston-like" movement, with no side-play. This is, in my opinion, the most perfect solution yet offered to the question of accurate centring. But, as yet, we have only dealt with the centring of the apex of the cone, and there is still the edge of the cone to be dealt with. I must leave this till next week.

ADJUSTING AND OPERATING—

THE Q.P.-P. THREE-FOUR

Some Notes on the Correct Operating Voltages of the Output Valves in the Interesting Receiver which was described last week

By W. J. DELANEY



THE article last week which described the Q.P.-P. Three-Four was completed in a rather hurried manner in order that those listeners who wished could use the receiver as soon as it was finished. There are, however, one or two points which should receive careful attention. The use of reaction and the adjustment of the tuning condenser are only normal in use, and therefore those instructions which have been given in these pages repeatedly concerning this part of a receiver apply. The tuning condenser should be adjusted until the station is received at its loudest, and then, if not sufficiently loud, the reaction dial should be turned to permit the signal to gradually build up. On no account adjust this condenser so that the receiver actually oscillates. That is, do not permit the speech or music to be gruff or accompanied by what may be called a "rattle." This introduces distortion and prevents full advantage being taken of the valuable feature of the Quiescent Push-Pull Stage. The coil used in the receiver is provided with four sockets on its base, and the aerial is joined to a small plug.

Varying Selectivity

The socket at the extreme right—viewing the coil from the back of the cabinet, gives loudest signals, but poorest selectivity. In localities which are situated a long way from a powerful station this is the socket which should be employed. The other sockets increase the selectivity, and naturally result in a weaker signal, but as they will only be used when it is necessary to improve the selectivity, the loss of strength must be tolerated. No series aerial condenser is included in the receiver as the selectivity obtainable with this particular type of coil is sufficient for all normal requirements. As the receiver does not employ a S.G. stage there is no need for ultra-selectivity as the receiver will naturally not be used for logging every European broadcasting station.

Tone Control

The knob on the extreme right of the panel is provided for the purpose of varying the tone produced by the output stage. It will be seen, from the theoretical diagram, that the output transformer has a condenser and a "split" resistance across it. The "split" resistance consists of a fixed resistance of 5,000 ohms joined in series with a potentiometer. The reason for this method of connection is that it is bad for the output transformer to completely remove the resistance. Therefore, by arranging the 5,000 ohms resistance in a fixed form it is impossible to reduce the value of the resistance below this. The remaining 50,000 ohms may be adjusted by the panel control and the brilliancy of the top notes reduced to that required by the individual requirements. The points which have been dealt with so far are only normal adjustments which may be required on practically any type of receiver, and we now come to the most important part of the setting up of this Q.P.-P. Three-Four. This adjustment may make or mar the receiver, and the following notes should therefore be studied in detail if it is desired to get the very last ounce out of the set.

Balancing the Output

If the reader owns a milliammeter the adjustment of the output stage should be carried out in the following manner. The lead which joins the H.T. positive tapping to the centre terminal of the output transformer should be disconnected, and the *negative* terminal of the milliammeter should be joined to the terminal on the transformer. The H.T. positive lead should then be joined to the positive terminal on the meter. (The meter should be one capable of reading up to, say, 10 milliamps). Now, remove one of the Pen. 220A valves (it does not matter which one), and insert the lead marked G.B.2 into the 15-volt socket on the battery. Insert the two H.T. positive leads (those marked H.T.1 and H.T.2) at some point slightly lower than 120 volts. Switch on the L.T. supply and note the reading shown by the milliammeter. It should be just over 2mA. Switch off, and insert the other pentode in the same socket in place of the valve which you have just tested. Upon switching on the L.T. supply again the same current reading should be obtained. If it is not, then your pentode valves are not matched, and you should proceed as follows. Adjust the grid bias to 15 volts permanently. Plug in one of the valves only, and adjust the H.T. lead joined to the priming grid of that valve until the current does read 2mA. or nearly so. It may be that the H.T. battery tappings do not permit of the valve receiving just the right voltage to produce the exact reading of 2mA. but the nearest reading to it should be easily found. When this has been done, remove that valve, and insert the other valve *in the other socket*, not in the socket you have just used.

Exactly the same procedure is carried out—that is, the H.T. applied to the priming grid is adjusted until the current is 2mA. or thereabouts. When this has been done, the remaining valve may be inserted in its socket, and the output stage is balanced.

NEXT WEEK: Balancing the Q.P.-P. Three-Four Without Using a Meter.

COMPONENTS FOR THE Q.P.-P. THREE-FOUR.

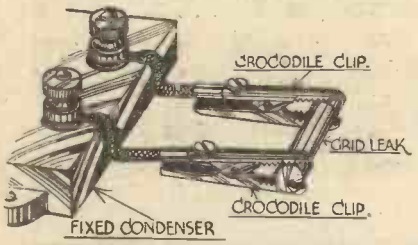
1 Colvern T.D. Coil.
1 J.B. .0005 Slow Motion Condenser, Type D.
1 J.B. .0003 Differential Condenser.
4 T.C.C. Fixed Condensers.
.0001 mfd. (Type S) .05 mfd. (Type 50).
.01 mfd. (Type S), .1 mfd. (Type 50).
6 Graham Farish Ohmite Resistances.
2-1 megohm, 2-100,000 ohms.
1-5,000 ohms, 1-30,000 ohms.
2 Watmel 20,000 ohm Variable Resistance.
1 R.I. Q Type Transformer.
1 Varley Transchoke D.P. 39.
2 Clix 4-pin Valve-holders.
2 Clix 5-pin Valve-holders.
3 Clix Wander Plugs, G.B. +, G.B.1, G.B.2.
1 Belling-Lee 6-way Battery Cord.
1 Becol Panel, 12in. by 7in.
Speaker.—R. & A. Bantam.
Cabinet.—Clarion Q.P.-P.
Valves.—Mazda, L.2, H210 and 2 Pen. 220A.
Batteries. Drydex Special Q.P.-P. H.T. Battery.
Drydex 16 volt G.B. Battery.
Accumulator. 2 volt Block Battery.

THE HALF-GUINEA PAGE

Radio Wrinkles FROM READERS

An Improvised Grid-leak Holder

WHEN experimenting it is often necessary to try different values of grid-leaks. A handy holder can be quickly improvised by the use of two crocodile clips and a few inches of stiff wire. They are arranged as shown in the accompanying

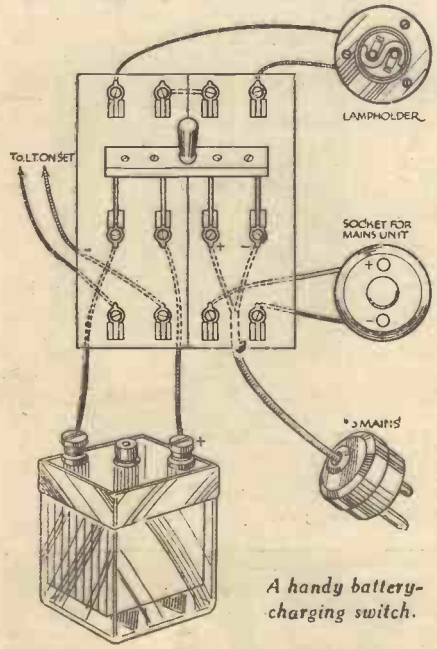


A useful dodge for holding grid-leaks.

diagram. The arrangement besides ensuring a good electrical connection possesses the additional feature of being easily adapted to different sized grid-leaks.—W. F. DAVEY (Selhurst).

An Accumulator Charging Switch

FOR obviating the nuisance of disconnecting the accumulator when it is desired to trickle charge it, the accompanying scheme will be found very useful to users of D.C. mains. It consists of a four-pole double throw (or two double-pole double-throw switches joined as in the sketch, a lampholder) and a two-pin socket. The switch is wired in such a way that when it is down, the accumulator is connected direct to the set, and the mains



A handy battery-charging switch.

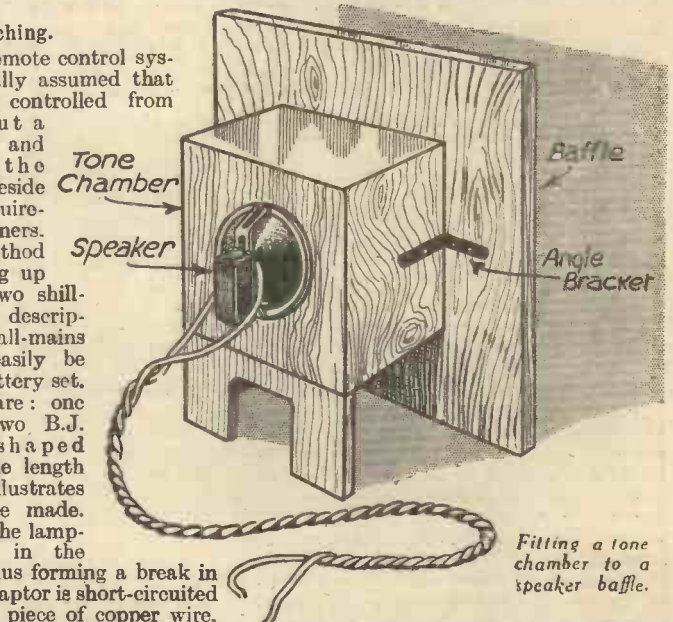
unit to the lighting mains. When the switch is up, the mains unit is entirely disconnected from the mains, and the accumulator from the set. This is also put on charge. The lamp for the lampholder depends upon the charging rate of the accumulator, but generally for small accumulators a 60 watt lamp will be found quite satisfactory.—J. S. BROSTER (Liverpool).

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 in this section 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*, and that we cannot return unaccepted contributions unless a stamped addressed envelope is enclosed. Mark envelopes "Radio Wrinkles."

Remote Control Switching.

IN the majority of remote control systems it is generally assumed that the set should be controlled from different rooms, but a simple form of "on and off" control from the easy chair by the fireside would meet the requirements of many listeners. Here is a simple method which anyone can rig up at a cost of about two shillings. The following description applies to an all-mains set, but this can easily be modified to suit a battery set. The parts required are: one B.J. lampholder, two B.J. adaptors, a pear-shaped switch and a suitable length of flex. The sketch illustrates the alterations to be made. It will be seen that the lampholder is inserted in the mains supply flex, thus forming a break in the circuit. A B.J. adaptor is short-circuited by means of a short piece of copper wire, and secured close to the lampholder with a suitable "whipping" of twine or silk, the other adaptor being connected to the pear switch through a sufficient length of flex to reach the position from which it is desired to control the set. If the short-circuited adaptor is inserted in the lampholder, the normal control is operative. To use the distant control, remove the short-circuited adaptor and insert the one connected to the switch. Close the switch on the set, and having adjusted the dials for the required station, the listener can then switch "on" or "off" at will without getting up from the chair.—D. TANGUY (Portsmouth).

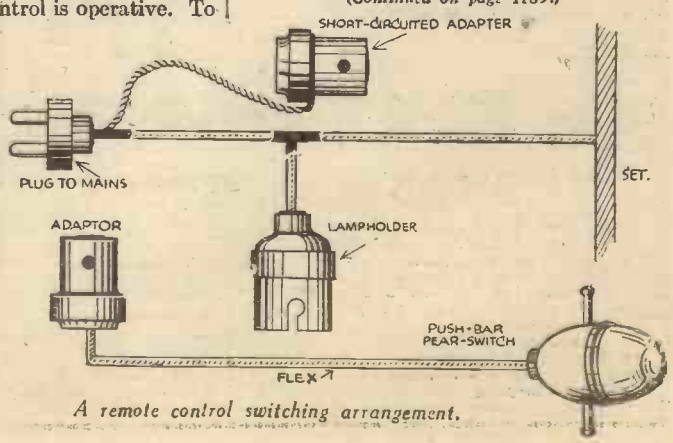


Fitting a tone chamber to a speaker baffle.

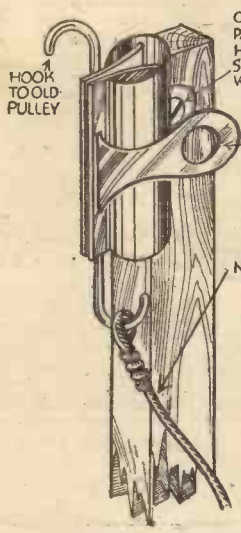
The Tone Chamber Idea

THIS tone chamber for a loud-speaker gives such excellent results, that I am passing it on to readers who are owners of home-made sets. My set is a straight two, fitted up with a switch for cutting out the power valve, and using phones without the speaker. This is a good idea, seeing that if only one member of the family wants to hear the programme, he can do so without bothering others. The speaker is a first-class balanced armature type, and was formerly housed in the cabinet. It is now connected to a tone chamber, which is a box 12in. square, made of ½in. wood, and this, in turn, is connected to a baffle of 2ft. square of six-ply wood. Instead of the usual practice of attaching the chassis direct to the baffle, a hole is cut in the box about 1in. less in diameter than the chassis. The tone is excellent, and the volume is such that it became necessary to fix a volume control. With an ordinary keyhole saw I cut an aperture in the baffle 12in. square.—G. DAVIS (Felling-on-Tyne).

(Continued on page 1189.)



A remote control switching arrangement.



A method of replacing a broken aerial.

RADIO WRINKLES

(Continued from page 1187)

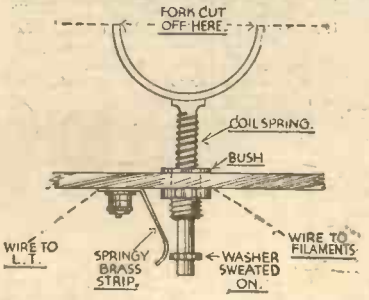
Replacing a Broken Aerial

SOME time ago my aerial broke and it was not possible to take the mast down as this was an iron pipe set in concrete. To hook up another aerial pulley on the existing mast I procured a fair-sized paper clip and screwed one of the gripper handles to a length of wood lath as shown in the sketch. I then secured the new aerial system to an "S" hook (a 2d. meat hook), and placed same between the jaws of the paper clip. I was thus enabled to hook the new aerial to the old pulley as the strength of the spring of the paper clip was sufficient to hold the weight of wire and "S" hook. When I had got the hook in position, a sharp "snatch" released it from the paper clip and left it suspended in position. I have also replaced broken "guy wires" by the same method, as, provided that there is something to hook the "S" hook to, the job is quite simple.—W. G. ELVY (Crewe).

A Pick-up Support

A SUPPORT for a pick-up, which at the same time acts as an on-off switch for the valves, may be easily constructed from an old headphone "fork" and one or two odds and ends from the junk box.

As will be seen from the illustration, an old panel mounting bush from a scrapped

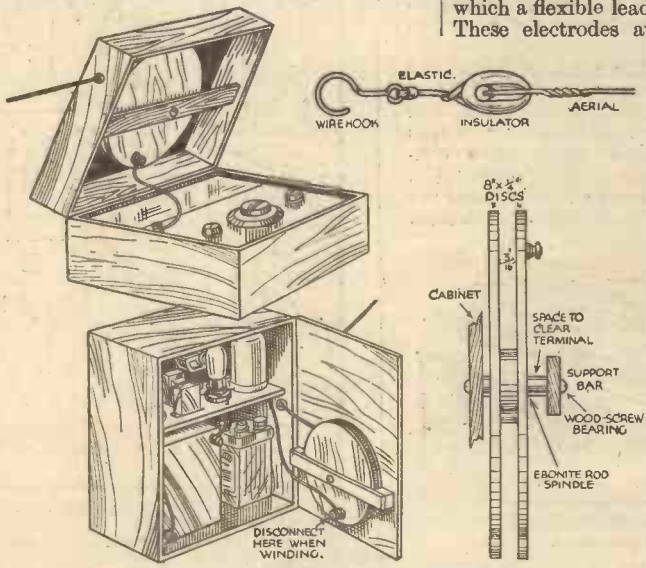


A novel pick-up support.

condenser, rheostat or similar component is fitted to the turn-table panel, and the stem of the headphone "fork" with a short spring on it is slipped down through this. It should be a nice smooth fit; if the hole is too large, a small piece of tubing should be fitted into the bush and reamered or drilled to take the stem. Next, a washer is sweated on to the stem, and a piece of springy brass strip is bent as shown and screwed in such a position that when the spring lifts the fork up, the washer is in contact with it. When the pick-up arm rests in the fork, this is pushed down and breaks contact. A wire connects the bush with one side of the on-off switch, and another wire connects the brass strip with the other side of the switch.—E. H. OLIVER (Oxford).

Self-contained Aerial for Portable Sets

THIS is a device for making either one or two valve sets really self-contained with regard to the aerial, and with a little ingenuity the device could be used for the earth wire as well. As can be seen from the illustration below, the principal part of the gadget is a large pulley with deep groove made from three-ply wood discs, screwed together. The two side pieces shown are 8in. in diameter and ¼in. thick, and the centre piece is 1¼in. diameter and 3-16in. thick. An ebonite rod, ¼in. diameter, is used as a spindle, preferably with a hole down the centre,

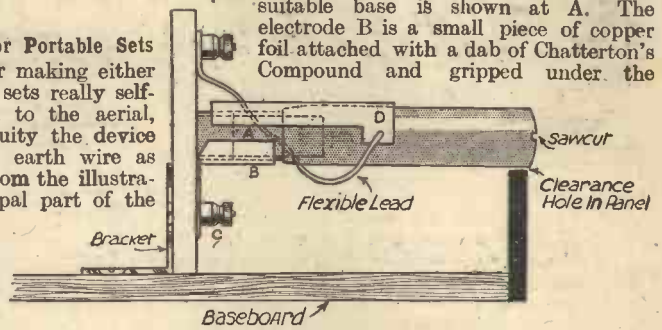


Housing an outside aerial in a portable set.

which enables two small screws to be used as bearings when mounting the pulley in any convenient place in the receiver. The aerial wire is pushed through a hole in the cabinet side, through a side hole in the pulley, and from thence to the aerial terminal on the set. When it is desired to pack the set up for transportation it is only necessary to turn the pulley and draw the aerial in like a hawser, a suitable stop being fixed to the end to prevent it going through the hole in the cabinet. The insulated hook shown above can be carried in the pocket, and then, to run out the aerial, fix it to the insulator, and hook the latter on to a picture rail is but a moment's work.—D. W. GREY (Malton).

A Band-pass Condenser

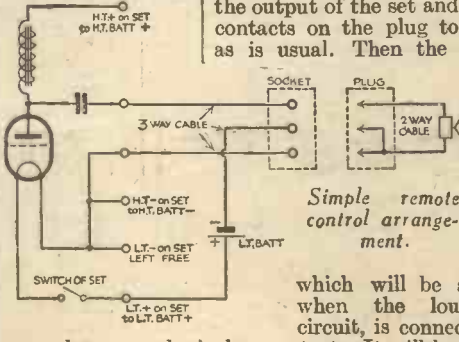
ON a surprisingly large number of occasions the amateur finds that he has need of a variable condenser with an exceptionally small minimum capacity. The condenser illustrated here proved extremely satisfactory, and was made from an old fountain pen. The diagram is self-explanatory. The shortened barrel blocked with wood and screwed to a suitable base is shown at A. The electrode B is a small piece of copper foil attached with a dab of Chatterton's Compound and gripped under the terminal C. The other electrode D is similarly cut from a piece of specially-shaped foil attached to the fountain pen cap, also by means of compound, to which a flexible lead has first been soldered. These electrodes are kept apart by the thickness of the cap and by a simple twisting motion the capacity can be varied between wide limits. I have found such a condenser to give perfect results in a top-capacity band-pass filter. This condenser can, if required, be controlled from the front of a panel by mounting it as illustrated.—STANLEY C. FISHER (Palmer's Green, London).



An improvised band-pass condenser.

Simple Remote Control

FOR this simple remote control arrangement, all that is needed is a 3-contact plug and socket. One loud-speaker lead must be at earth (L.T.—) potential, so that choke and transformer output is essential. Two points on the socket are connected (through the extension wire) to the output of the set and the corresponding contacts on the plug to the loud-speaker, as is usual. Then the third contact on the socket is connected to the negative terminal of the low-tension battery, leaving the L.T. — terminal on the set free. Finally the contact on the plug, which will be at earth potential when the loud-speaker is in circuit, is connected to the third plug contact. It will be seen from the diagram that to switch on the set the loud-speaker plug is pushed in the socket, when the low tension circuit is completed, and to switch off the plug is simply pulled out.—E. J. STEADMAN (Eastcote).



Simple remote control arrangement.

OF INTEREST TO EVERY EXPERIMENTER

FITTING UP A RA

HUNDREDS of thousands of home-constructed radio sets are built every year, and I suppose that a good ninety per cent. of them take shape in kitchens, in attics, in bedrooms, and in almost every conceivable place, with the exception of in a radio workshop.

It's really remarkable, isn't it ?

Surely there is no other hobby, which is taken quite so seriously, and yet to which so little official floor space is allotted. Take the average car owner ! His garage at least boasts a workbench, and usually quite an efficient array of implements of repair, to say nothing of log-books, maps, and so on. The photographer has his dark-room ; the philatelist, the gardener, the woodworker, they all have their hallowed domains, and yet the average wireless constructor persists in performing almost unbelievable contortions on the corner of the kitchen table.

It certainly does seem a mystery, and yet I don't suppose that the reason is far to seek.

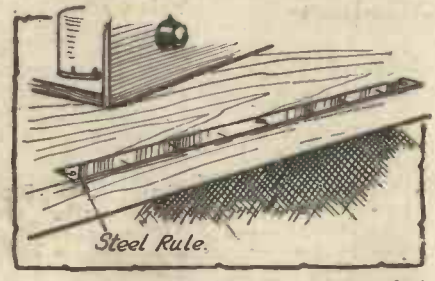


Fig. 2.—A steel rule screwed to the bench is handy for measuring wire, etc.

He probably starts off by building a simple two or three-valver in odd moments and in odd places. Later, a pick-up is added. Again, in spare moments and odd places ; and so it goes on.

If you happen to be one of this band of enthusiasts, the following particulars of a radio workshop will probably interest you. Surely you have that spare room, or a shed, or outhouse in the garden ! Why not spring-clean the spare room, clean out the garden shed or the outhouse, and put a label on the door, "Radio Workshop, PRIVATE" ! Having obtained a lease on suitable "premises," the rest is easy—if a little thought is given to the job in hand. We will assume that the room is small (as it will be in the majority of cases) and, therefore, every cubic inch is valuable.

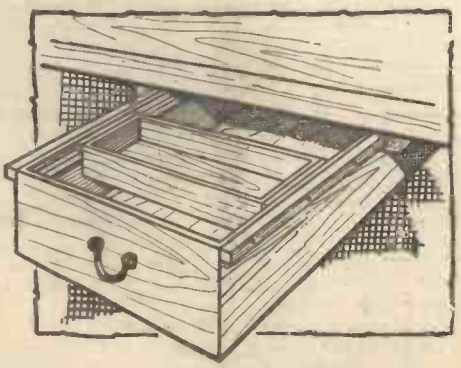


Fig. 3.—The more delicate tools should be kept together in the sliding tray of the tool drawer.

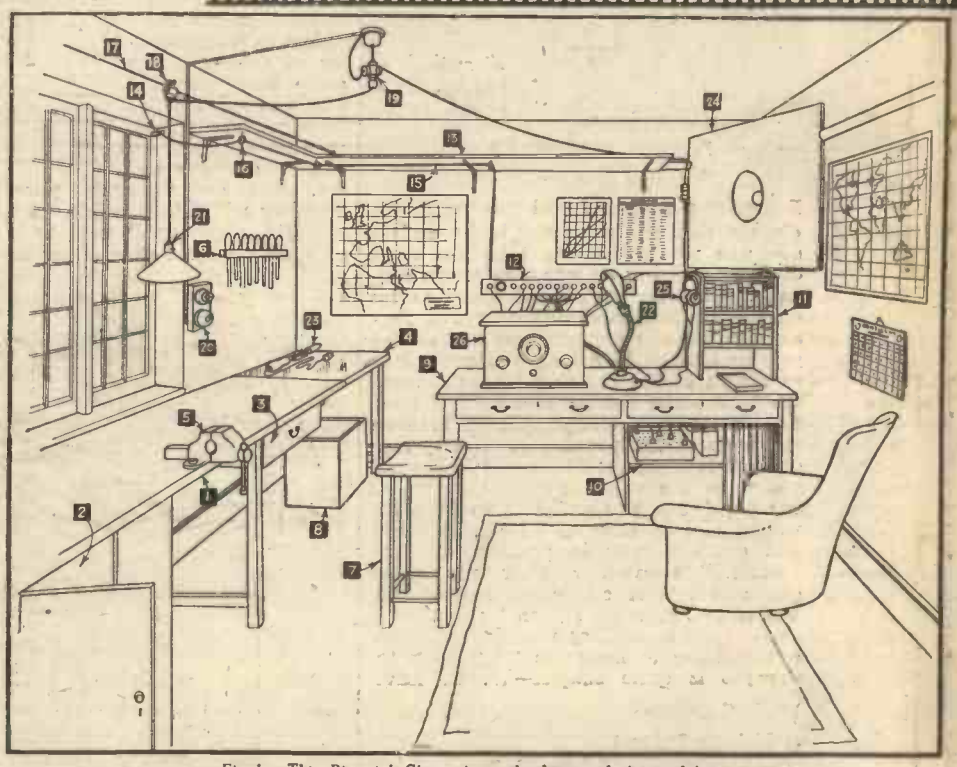


Fig. 1.—This Pictorial Chart shows the layout of the workshop.

Item No. 1.—The work bench.
" " 2.—A useful cupboard.
" " 3.—The tool drawer.
" " 4.—Sheet of zinc.
" " 5.—The vice.
" " 6.—The tool rack.
" " 7.—The bench stool.
" " 8.—The scrap box.
" " 9.—The testing bench.
" " 10.—The battery compartment.
" " 11.—Bookshelf.
" " 12.—Universal terminal strip.
" " 13.—Shelf.
Item No. 14.—Lead-in tube.
" " 15.—Aerial lead-in.
" " 16.—Insulated hook.
" " 17.—Stout galvanized wire.
" " 18.—Sliding Clip.
" " 19.—Three-way adaptor.
" " 20.—Wall-plug and switch.
" " 21.—Light plug and switch.
" " 22.—Adjustable lamp.
" " 23.—Electric soldering iron.
" " 24.—Loud-speaker mounted on baffle-board.
" " 25.—Headphones.
" " 26.—A set under test.

General Layout

A glance at Fig. 1 will give an idea of the layout suitable for a small room. It is impossible, of course, to give a hard and fast layout (as the rooms will vary in almost

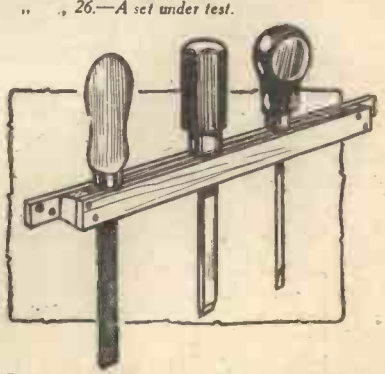


Fig. 4.—A handy rack for files, screwdrivers and chisels.

RADIO WORKSHOP

A PRACTICAL ARTICLE BY A. ASHDOWN

HOW TO RIG UP A HANDYMAN'S INEXPENSIVE RADIO DEN FROM ODDS AND ENDS

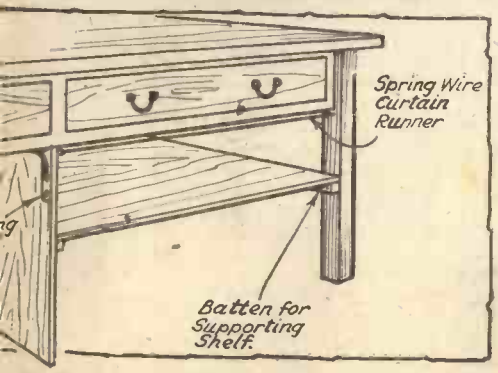
every case), but as we must start somewhere, we will assume that the room has four walls, a door and a window.

In this pictorial chart it will be noticed that the various "furnishings" are numbered and indexed, so if we take them in numerical order we will have cleared up most of the points.

Item 1.—The bench, a most important fitting in any workshop. The construction of a bench of this description is very simple, as will be appreciated from the drawing. Whilst it is not necessary to have a very hefty affair for radio work it is as well not to go to the other extreme and have a flimsy one that bends at each sawcut. The supports should not be less than 2½in. square and ordinary floor-boarding will be found very suitable for the top. It will be noticed that the bench takes up the whole length of the wall, in front of the window. Although this position is claimed at the expense of a short aerial-lead-in, it will be justified by better lighting on the job in the vice.

Item 2.—A cupboard, housed under the bench, will be found very useful for storing the enormous amount of oddments, which only a wireless fan can hoard! If this cupboard is judiciously sub-divided a remarkable degree of orderliness may be maintained.

Item 3.—The tool-drawer, a "close-up" of which is shown in Fig. 3, is supported on wooden runners which are screwed to the underside of the bench. The sliding tray, shown here, will be found very handy for smaller tools, such as gauges, callipers.



t. 5.—The "power-station" or battery compartment.

small screwdrivers, etc., which otherwise have a nasty habit of hiding themselves under the larger tools in the drawer.

Item 4.—A sheet of zinc covering one end of the bench will be found useful for the soldering department.

Item 5.—The vice. Although this need not be of cumbersome dimensions, for radio work, it is as well to have something fairly sturdy, as some of our jobs (such as metal chassis construction) may call for a solid foundation. Just a word about the mounting of the vice. Place it fairly near a bench support for rigidity, but not directly over one, as some awkwardly shaped job, which we may have to tackle, may require space directly underneath the vice.

Item 6.—A rack for files, screw-drivers and chisels. The latter especially should be kept in this maner, as the cutting edges will soon become sadly out of condition if the chisels are kept in the tool drawer.

Item 7.—The bench stool may be frowned upon by the serious-minded mechanic as a luxury. Many back-aches, however, may be avoided by this means.

Item 8.—The scrap-box, if regularly and judiciously employed, will maintain the tidiness of our workshop.

The Electrical Side

Well, these items—1 to 8—give us the main essentials for our constructional department. Now let us step into our electrical and testing laboratory! It is here that the fruits of our constructional labours come up for judgment, so let's be fair and give them a good trial!

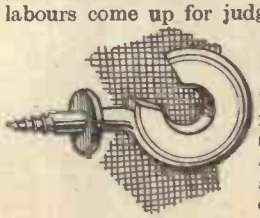


Fig. 10.—An insulated hook.

Item 9.—The testing bench. As may be readily seen from our chart, this is really a common or garden kitchen table. A couple of drawers will come in handy for storing our logbooks, slide rules, pencils, pens, and all the "clerical" records of our "works."

Item 10.—The generating station, otherwise known as the battery cupboard, is shown in detail in Fig. 5. The shelf should, for preference, be covered with a sheet of rubber (an old rubber mat will do nicely), so that any acid spilt, will do no damage.

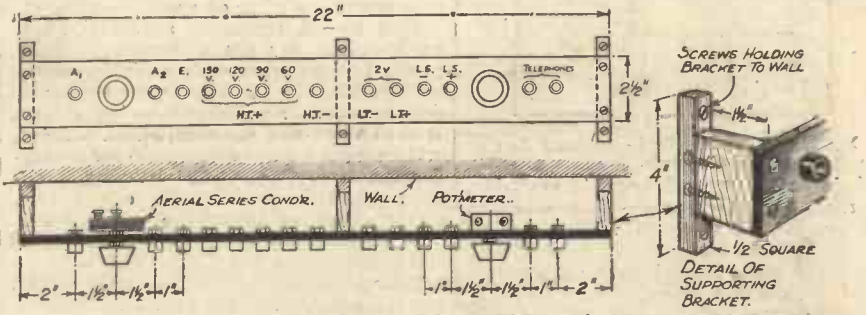


Fig. 6.—The lay-out of the universal terminal strip.

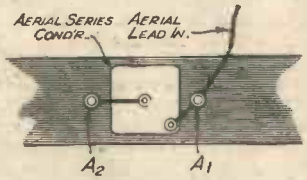


Fig. 7.—Connecting up the aerial series condenser.

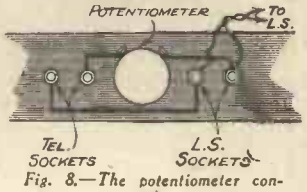


Fig. 8.—The potentiometer connections.

Item 11.—The bookshelves, for our works of reference, can easily be put up, and this will complete all the constructional additions to our testing bench.

Item 12.—The power distribution department, or to be more homely, the universal terminal strip. This is simply an ebonite strip mounted on wooden brackets and fitted with sockets. Fig. 6 shows the

Fig. 9.—A flexible connection for use between the terminal strip and the set.

constructional details and layout. Two refinements will be noted; namely, the aerial series condenser and the potentiometer. The wiring up of the former is shown in Fig. 7, and by this arrangement we can either test a set directly from the aerial (by connecting to A) or through the aerial series condenser by plugging in to A2. The object of the potentiometer will be fairly obvious from Fig. 8. It is wired between the loud-speaker and the telephone terminals, in series and enables 'phones to be used in comfort, irrespective of the output of the set. A multi-flex battery cord connects the terminal strip to the power supply and thus a choice of voltages is available for use. The L.T. side may, of course, be elaborated with further plugs and a switch, so that

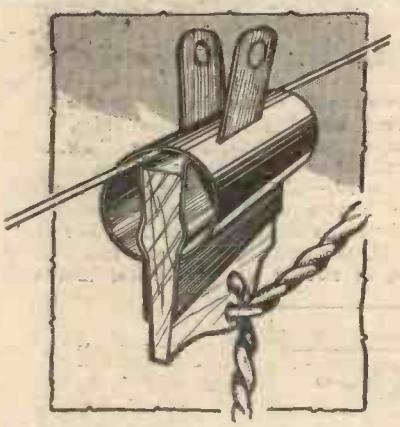


Fig. 11.—The sliding clip for supporting the bench light.

a choice of 2, 4 or 6 volts is available. As most sets incorporate the grid-bias battery, it is not worth while, in view of the additional amount of wiring, etc., to include grid-bias tappings on the terminal strip. Fig. 9 shows a connecting lead suitable for use between the terminal strip and the set under test. If each of these leads is of a different colour it will obviate the risk of making incorrect connections.

Item 13.—As will be readily seen, this is a shelf and as such justifies itself. Its purpose, however, is twofold, as it also forms the support for the aerial lead-in.

Item 14.—The aerial lead-in tube.

Item 15.—The aerial lead-in is carried under the shelf (as suggested above) direct to the A plug on the terminal strip.

Item 16.—Insulated hooks, shown in Fig. 10, support the aerial under the shelf.

Now we come to the lighting arrangements of our workshop.

Item 17.—This is a stout wire running parallel to and directly over the bench, and carries the bench light.

Item 18.—A sliding clip of this description enables the light to be moved to any position over the bench. This clip,

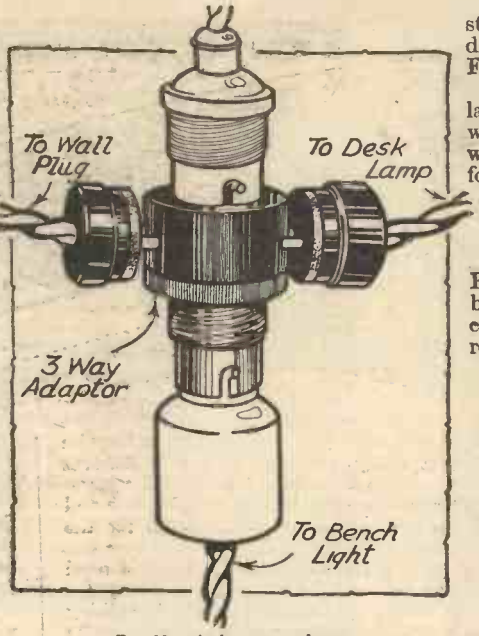


Fig. 12.—A three-way adaptor.

as will be seen by a glance at Fig. 11, is made from an ordinary spring paper-clip, gripping a piece of wood.

Item 19.—A three-way adaptor. There are innumerable ways of tapping a lighting point, but the three-way adaptor, shown in Fig. 12, will be found very useful for our purpose. An alternative suggestion is to fit a two-way adaptor (which, perhaps, will be more readily obtainable) for supplying the two lights. The wall-plug flex is then taken direct from the ceiling rose, either above or below the ceiling. This wiring should be encased in a lead covering if carried below the ceiling; it may be supported by staples driven into the rafters above the plaster. When the position of the first rafter has been found the subsequent

Fig. 14.—A useful lamp for the testing bench.

staples may be carefully driven in at distances equal to the pitch of the rafters. Fig. 13 illustrates this method.

Item 20.—This consists of a batten type lamp-holder and a switch mounted on a wooden base. This complete unit, when wired up, serves as a useful point of supply for the electric soldering-iron.

Item 21.—A lamp-holder incorporating a switch in its construction will be found most suitable for the bench light.

Item 22.—This table-lamp (shown also in Fig. 14) is very handy on our testing bench, for the flexible tubular standard enables the light to be directed in any required direction.

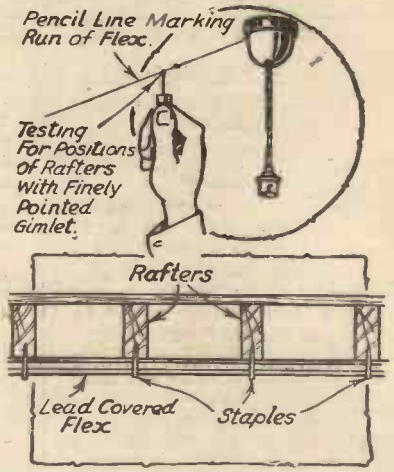


Fig. 13.—These pictures show how to support the lead-covered flex.

Item 23.—An electric soldering-iron will be found a great time, labour, and temper saver.

Item 24.—The loud-speaker (preferably of the moving-coil type) should be mounted on a baffle-board as large and as thick as possible. For space economy reasons the loud-speaker may be mounted in the corner of the room as shown and supported by brackets to the picture-rail. It is as well to remember to have a space of nine inches to one foot from the top of the board to the ceiling.

Item 25.—A pair of headphones will be found almost indispensible for short-wave work.

Item 26.—A set under test. This brings us to the end of our list and more or less completes the job.

These twenty-six items are, of course, just the "bare bones" of our workshop. Maps, charts, lists of stations, calendars pipe-racks, will all gradually find a place allotted to them and give a homely and individual atmosphere. Why not turn out that spare room *now*, for when you've a proper room for practising your hobby it will be twice as interesting.

THE A.C. "FURY FOUR" RADIO-GRAM.

(Continued from page 1182.)

quality was possible at really good volume, two features that all too seldom go hand-in-hand. This is largely attributable to the careful design of the detector circuit and adequate output arrangements.

The set is necessarily one using a large number of components and there has admittedly been a certain reluctance in the past for constructors to build elaborate receivers, but the method of presentation is to some extent unique, and has introduced the would-be constructor to each step and part by slow degrees, which will in my opinion completely overcome any doubts. In addition, further encouragement is offered by the personal guarantee of satisfaction given by the author.

Cossor 220 S.G. metallized valves were used in the S.G. stages, 210 H.F. metallized in the detector stage and 220 P.T. in the output stage.

In conclusion, I would remark that the set used on an eliminator gave exactly the same performance as when used on batteries of similar voltage.

The A.C. "Fury Four"

In the article concerning the A.C. "Fury Four" it was stated that the Westinghouse Brake and Saxby Signal Company were supplying sets of parts for an eliminator for use with the battery version of the "Fury." We regret that this was incorrect, and that the reference should have been to the blue print only. The Westinghouse Company only supply the blue print, and the rectifier which is the type H.T.6. The parts required for the eliminator are obtainable from any good radio dealer, and we have pleasure in rectifying the former mis-statement.

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The BEGINNER'S SUPPLEMENT

Conducted by F. J. CAMM

HOW YOUR SET WORKS

Part 4.—AMPLIFYING THE SIGNALS

I WANT this week to pass on to a consideration of the work of the second valve in our set. You will remember that in Parts 2 and 3 I showed that the currents flowing in the plate circuit of the first or *detector* valve fluctuated in accordance with the speech or music being transmitted from the broadcasting station.

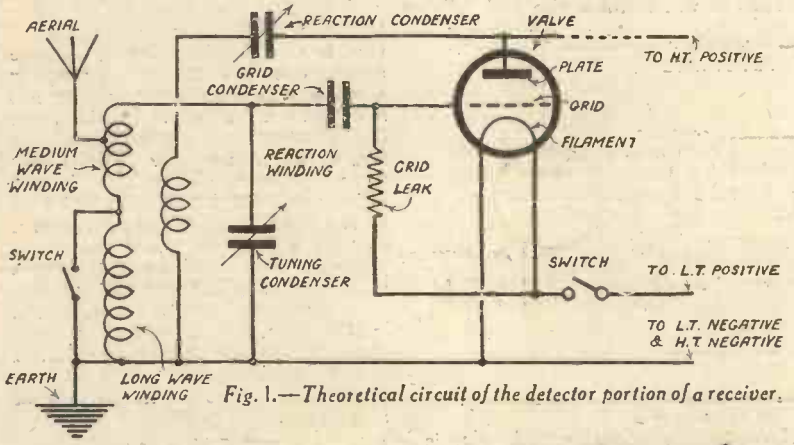


Fig. 1.—Theoretical circuit of the detector portion of a receiver.

This meant that if we were to connect a pair of headphones, or a loud-speaker in this circuit, we could hear the music. By doing this we should be using our receiver as a one-valve set.

However, with such an arrangement, signals would not be very strong, therefore we amplify the currents by passing them through the other two valves in the set. They are then many times stronger, and capable of producing correspondingly louder signals.

To Refresh Your Memory.

If you look at Figs. 1 and 2 you will see illustrated diagrammatically and pictorially respectively the parts of our set which we have already dealt with.

These diagrams may look a little more complicated than previous ones, but I don't want you to bother over that for the moment. The reason is that they show *all* the parts of the set we have so far studied, whereas most of the previous diagrams have been confined to the one particular section under examination at the time. Also, there are one or two little modifications shown here which would be found in the average receiver, but which, to avoid confusion, I have hitherto omitted. However, as I say, we will not bother over that for the moment—I shall explain all such little details later on. Why I refer to these illustrations here is because I want to refresh our memories as to the general scheme of things up to the present stage.

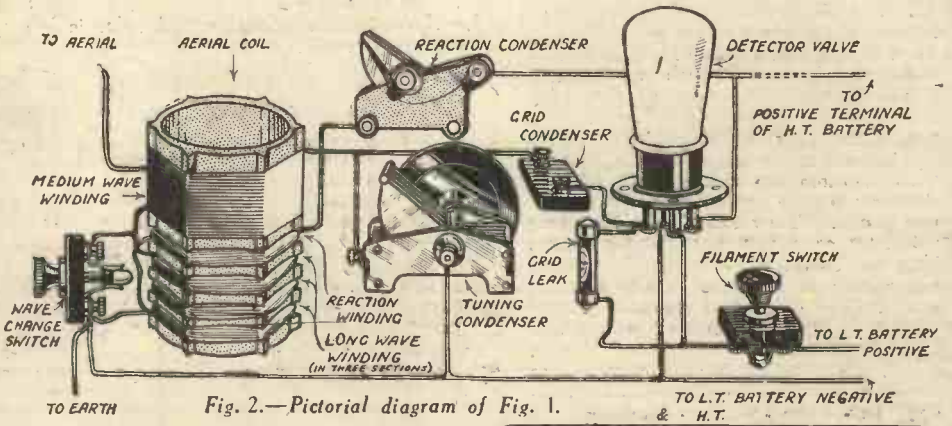


Fig. 2.—Pictorial diagram of Fig. 1.

Starting from the left, we have first of all the aerial to receive the wireless waves, then the tuning arrangements, including the reaction coil. Next comes the detector valve with its grid leak and condenser, and, finally, we have the wires leading to the batteries. I have not actually shown the batteries here because this is not the end of the set. They will come after all the valves, at the extreme right.

The Use of a "Resistance"

Now let us see how the second valve is connected up, and how it increases the currents produced by the first one. There are two methods of connection in general use. One is by means of a *resistance*, and the other by the use of a *transformer*. In the set under discussion the former method is used.

A resistance, as its name implies, is something which resists the passage of an electric current. Actually all conductors of electricity offer *some* resistance. Even a thick copper wire opposes the flow to a small extent. It is something like the flow of water through a pipe. However large the bore of the pipe it still offers *some* resistance to the passage of water through it.

However, the "resistance" used in this case is comparatively high. It might be likened to a constriction in a water pipe. If you look at Fig. 3 I think you will see what I mean.

At (*a*) is shown water flowing from a rubber pipe of generous dimensions. It offers very little resistance, therefore the flow is only impeded to a small extent. At (*b*) someone has gripped the pipe, so making it small in one place. It now offers a high resistance to the flow of water, and only a little dribbles out. If

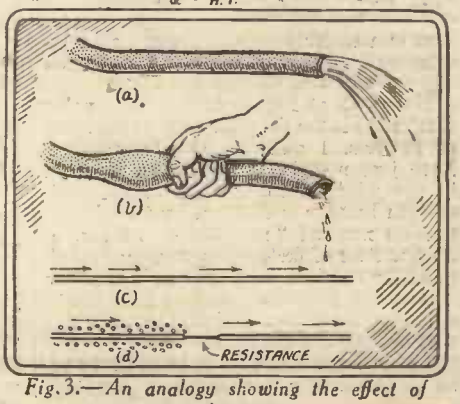


Fig. 3.—An analogy showing the effect of resistance.

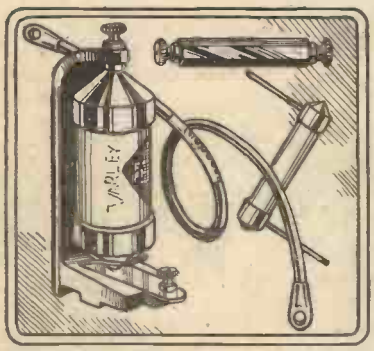


Fig. 4.—Typical resistances used in wireless receivers.

the pressure is sufficient there will be an accumulation of water behind the constricted part, causing the tube to swell as shown. Figs. 3 (*c*) and (*d*) show the electrical counterpart, (*c*) shows a wire with a current flowing through it as indicated by the arrows, and (*d*) represents the same wire with a "resistance" included. In this case the resistance is simply a very much thinner wire. What happens is that the flow of electric current is reduced in the same way as the flow of water is reduced in (*b*). The little dots represent the pressure of electrons due to the resistance corresponding to the pressure of water behind the constriction in the water pipe.

A Difference in Pressure

Now I will show you how a resistance is used to couple our two valves. You will remember that an electric current flows in the plate circuit of the detector valve. That is to say there is a current flowing along the wire connecting the plate of the valve to the high tension battery. What we do then is to include a resistance in this wire at the point shown by the dotted line in Fig. 1. This resistance may take various forms. Typical examples are shown in Fig. 4. Two of them are little stick-like things similar to the grid leak previously mentioned. They are about the same thickness as a pencil, about two inches long and composed of some composition, the nature of which is usually a trade secret. The other two are each wound with very fine "resistance" wire which is made of a special metal like German silver. The presence of the resistance causes a difference in pressure or "voltage" to use the proper term between the one side and the other just as a constriction in a water pipe would cause a difference in pressure between the water on the one side and that on the other.

Now look at Figs. 5 and 6. The valve on the left is the detector—the same valve as in Figs. 1 and 2. The resistance I have just mentioned as being connected in the wire from the plate to the high tension battery is denoted by the zig-zag portion marked "resistance" in Fig. 5. As a matter of fact, it is generally spoken of as the *anode resistance* since it is in the "anode" (another name for plate) circuit of the valve. There is also another wire coming from the plate which was not shown in Figs. 1 and 2. It leads first to a fixed condenser called the *coupling condenser*, and thence to the grid of the next valve.

A Water Pipe Analogy

This wire might be compared with a branch pipe rising from the water pipe just before the constricted part. See Fig. 7 (*a*). The presence of the constriction causes water to rise in the branch pipe, whereas without it as at (*b*) no water would go into the branch pipe. If the upper end of the branch pipe were stopped up the pressure inside would be the same as in the main pipe. (I am neglecting the effects of gravity, of course.)

In the same way the pressure, or voltage, in the wire to the condenser is the same as in the main wire from the plate to the resistance.

Now we have already seen that the current flowing in the plate circuit of the detector valve fluctuates in strength and speed in accordance with the variation in power and tone of the music which is being received. Naturally this rise and fall in current will mean a rise and fall

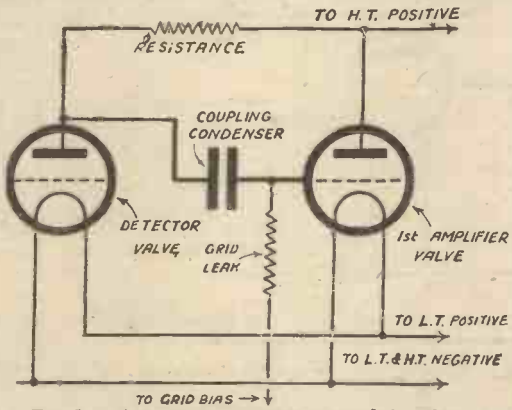


Fig. 5.—A resistance capacity coupled valve in theoretical form.

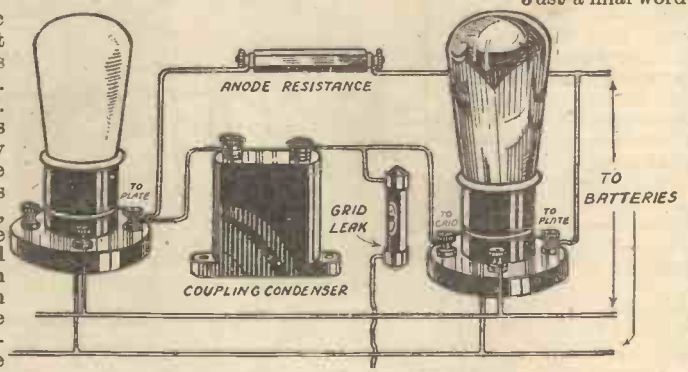


Fig. 6.—Pictorial illustration of Fig. 5.

in pressure, thus the pressure or voltage in the wire to the coupling condenser will rise and fall, too. We will not go into details regarding the action of the coupling condenser, suffice it to say that like the detector grid condenser it passes on these variations in pressure to the grid of the amplifier valve.

How the Valve Amplifies

You remember how when the grid of the detector valve became alternately positive and negative it accordingly attracted and repelled the electrons flowing from the filament to the plate and so increased or decreased their flow. Well, the same kind of thing goes on in the amplifier valve. Actually, the grid does not vary from positive to negative. It is connected by means of a grid leak to a battery known as the *grid bias battery*, which keeps it negative all the time. This is done for certain reasons, which we need not go into here. However, the effect is the same, but instead of varying from positive to negative it varies in its degree of "negativeness." This variation in the state of the grid causes a variation in the number of electrons flowing from the filament to the plate, in other words a variation in the plate current. What causes the valve to amplify is that *small* variations in the voltage of the grid cause *large* variations in the plate current.

Perhaps this all sounds rather technical to you. That I cannot tell because I do not know just how much of the previous articles you have been able to follow. If I have not always made my explanations clear to you I must ask you to forgive me. As I said in the beginning some points are very difficult to explain in everyday language. Whenever possible I have tried to give simple analogies, but here again, one has to go very warily because a *simple* analogy may not always be a *true* one. For instance, I said that an electric current was like a flow of water in a pipe. This is easy to understand, although it is not strictly correct. However, I feel that it is better to give *some* idea even if it is not a complete one than to leave you with *none* at all, as might result if I persisted in laboured explanations at each awkward point we came across. If, therefore, you cannot quite grasp the idea of what goes on inside a valve I will simply remind you that the final effect is one of magnifying or amplifying.

Grid Leak and Grid Bias

Just a final word about the grid-bias battery referred to. You will notice in Figs. 5 and 6 that the amplifier valve has a grid leak, the same as the detector valve. The lower end marked "to grid bias" is joined to the negative terminal of this grid-bias battery. It is similar to an H.T. battery but smaller, and is included to ensure that the amplifier valve works correctly.

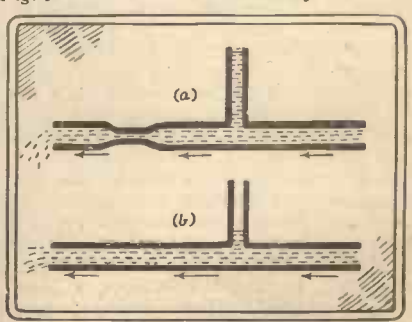


Fig. 7.—An analogy to demonstrate the action of the coupling condenser.

SOME SNAGS AND SUGGESTIONS

A Chronicle of Drawbacks for the After-Lunch Assimilation of the Component Manufacturer

By "CYNIC"

NO doubt there are many other readers who, like myself, keep at least two receivers in commission—one of a fairly simple nature for the use of those members of the family who wish to listen seriously, and the other a more elaborate set, incorporating the latest devices, for distant reception and for general experimental use. As a matter of fact, I often have a third set in being—or, rather, in process of construction, or destruction, to try out some of the latest developments.

Perhaps it has happened to you as it did to me just before Christmas, that the Family petitioned that the existing "house" set should be modernized, or at least made more presentable. In an expansive mood I succumbed, and promised them a really "posh" radiogram in time for Christmas. I kept my promise, and this is the chronicle of the snags I encountered.

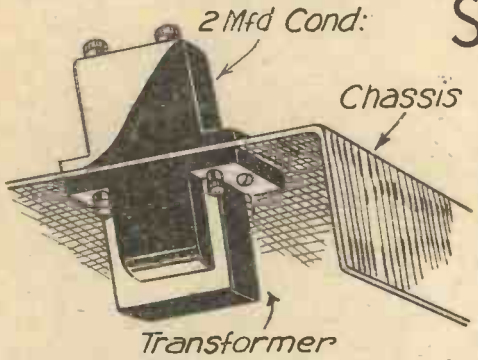


Fig. 1.—Simplification of mounting components by standardized spacing of fixing holes.

In the first place, I decided upon an A.C. mains three-valver with a variable mu H.F. stage, power grid detector and pentode output valve. Band pass aerial tuning, tuned grid high frequency coupling, ganged condensers and automatic bias were also specified and, to crown all, this set was to be built upon an aluminium chassis. In the interests of economy as many components as possible were to be taken from the existing set and from my own stock of parts. It is in this connection that some of the worst snags were encountered.

Standardization

I will make no attempt to recount these snags in any particular order, but just mention them haphazard in the hope that they may prevent others from falling into similar troubles. In the first place, the size of the chassis was chosen to give reasonable room for a kit of ganged coils, ganged condensers, valves and low frequency transformer on the top, while the sides of the chassis were made deep enough to permit all the other components to be accommodated underneath. Such small parts as fixed condensers (other than the big 2 mfd. chaps), resistances and grid leaks were included in the run of the wiring and were not screwed down. Heavier parts were secured by 4 B.A. screws and nuts to the chassis.

Now there was ample room for all the components, yet it was a difficult matter to fit them all in. You see, not only had they to be arranged in positions which suited the circuit and avoided any unwanted couplings, but they also had to be so located that there was a convenient fixing for each which did not foul components mounted on the other side of the base plate. As I arranged and re-arranged and played "chess" with the items I wondered why radio component manufacturers had not got together years ago and standardized the distances between the fixing holes of all components, or, failing that, at least similar ones. Then, don't you see, components on the underside of the chassis could be mounted on the same bolts that secure the components mounted on the top of the chassis, as depicted in Fig. 1. I understand that a committee of manufacturers has now been formed for the purpose of standardization—here's wishing strength to their arm and an early realization of their labours.

Fig. 3.—Longer wire ends to resistances.

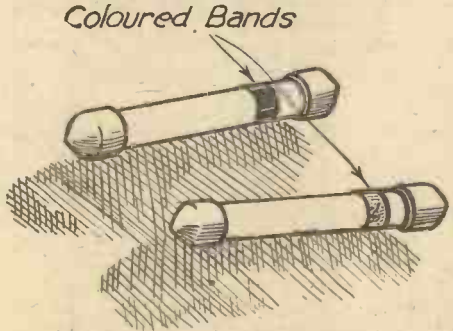


Fig. 5.—Colour coding of resistances.

Here is a tip if you think of building on a metal chassis. Make a temporary chassis of three-ply wood, or even tin, and do your preliminary arrangement on that. It will save cutting unnecessary and unsightly holes in the final chassis. (See Fig. 2.)

Resistances

Another thought which occurred while I made soldered joints to nineteen fixed resistances of the metallized type. In only some of the cases were the wire ends of these resistances long enough to make the necessary connections, so that usually extra wires had to be soldered on. A rather more generous length of wire ends, as shown in Fig. 3, would, I am sure, be appreciated. My pentode was a modern valve taking 30 milliamperes high tension, but I experienced a certain amount of difficulty in finding a semi variable resistance for automatic bias of the order of 1,000 ohms capable of carrying this current. Fixed resistances were available in shoals—but I have a weakness for adjustable bias on a big output valve.

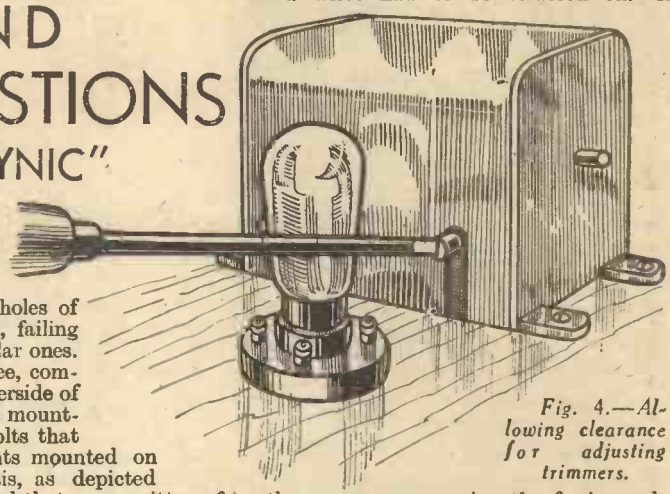


Fig. 4.—Allowing clearance for adjusting trimmers.

The next snag concerns the variable resistances and potentiometers which were mounted on the front side of the chassis. They were of an excellent and well-known make and were taken from another set which was being dismantled at the time. It was not until just before the final test that I realized that the spindles of these components carry current and were earthed to the chassis, a fact which did not in the least suit this particular circuit. I had therefore to dismount them and re-drill the holes through which the spindles passed, inserting suitable insulating bushes. As a matter of fact, this discovery was made late on a Saturday night, and no suitable bushes were to hand, but a temporary bush was made by winding a narrow strip of the gummed paper tape used for doing up parcels round the spindle.

Remember then, if you are building on a metal chassis, or with a metal panel, to find out whether the spindles of any components should be insulated from the panel and see that you are provided with insulating bushes where necessary. Many modern components are sent out complete with such bushes, but if you are using up parts you have on hand, you may be caught napping.

Trimmers and Coding

A very usual arrangement in a set of this character is to place the ganged condenser centrally on the base, the kit of coils at the left-hand edge, and the high-frequency valves, or valve, between the coils and the condenser. This layout is

(Continued on page 1198.)

Some Snags and Suggestions

(*Continued from page 1197.*)

very convenient for wiring and conserves space, but in my case it nearly ended in disaster, for when the set was completed it was almost impossible to reach the small trimmer condensers built into the ganged tuning unit. Actually, by removing the valves from their holders it was just possible to engage a small screw-driver with the trimmer screws, and fortunately this set required little or no adjustment for ganging up.

The moral is, therefore, when building a set with ganged condensers to see that a "right of way" for a long screw-driver to the trimming adjustment is left available, as in Fig. 4. Incidentally, condenser makers would do well to place the trimmers at the top of the condensers whenever possible, and not at one side and near the bottom as is done in some designs.

I mentioned just now that there were nineteen fixed resistances in the set. Each one was clearly marked by the maker with the rated resistance, but when the wiring was completed this marking could not be seen in most cases. I make a strong plea for the universal adoption of the international colour code for marking resistances. (See Fig. 5.) In a complicated circuit it is often impossible to check over the run of the wiring except by identifying the various components to which the different wires run, and with so many resistances in the circuit easy identification is greatly facilitated if the resistance values can be quickly checked. Many leading resistance makers have adopted the colour code. I wish they all would.

Earthing

My set was intended to fit into an existing radiogram cabinet which could accommodate the usual seven inches high panel. Unfortunately, with the tuning condenser mounted on a chassis the top of the tuning dial came just over the seven-inch limit. I got over the difficulty by scrapping the escutcheon supplied with the condenser and turning the slow-motion device round a quarter of a circle, using a separate window for the dial reading instead of the elaborate escutcheon. But there is a demand for a compact and efficient slow-motion drive and dial.

No other serious difficulty arose in construction, but in view of previous troubles I had had, I resolved not to rely upon the chassis alone for the common negative connection. All points which were supposed to be at earth potential were connected together by wires, and in addition there were several bonds to the chassis. It is not easy to make a good electrical connection to aluminium by bolts, as the aluminium is always covered by a thin film of oxide, and the conductivity of the junction is not to be relied upon. The same remarks apply to all screening cans and other metal covers. All were screwed to the chassis, but were also connected to the earth wire, which ran all round the set.

Most of the leads between the receiver proper and the power unit, which lives on a lower shelf in the radiogram cabinet, are metal covered flexible cable. I particularly wanted to make a neat job of this part of the wiring, but was at a loss for some method of fixing the wires in position. As a temporary measure, I ran the wires down the corners of the cabinet, and kept them in position by loops of black insulating tape attached to the woodwork by drawing-pins. (Fig. 6.)

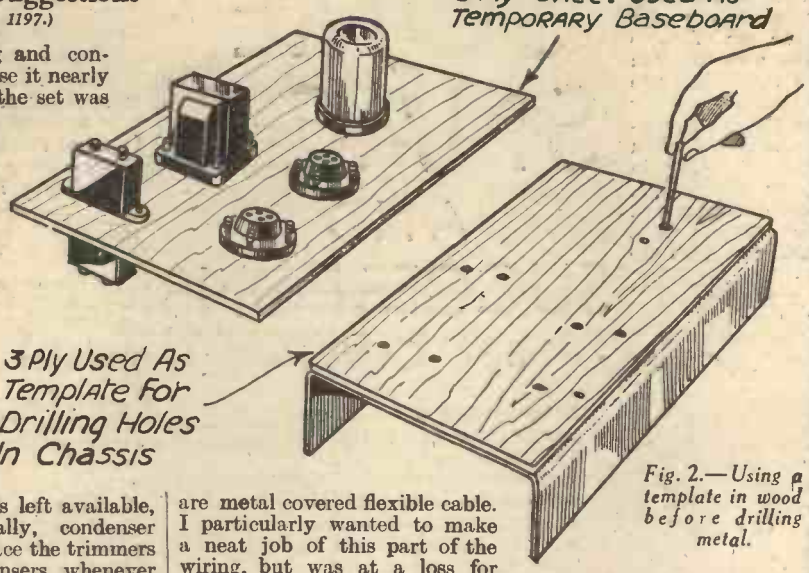


Fig. 2.—Using a template in wood before drilling metal.

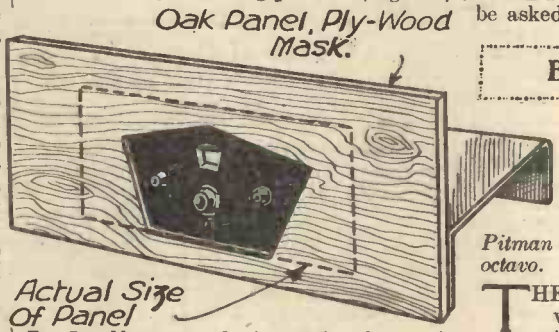


Fig. 7.—Using a mask of wood for the panel.

Eventually I made some brass bridge clips wide enough to accommodate all the cables lying side by side, and fixed them with small screws to the inside of the woodwork.

The panel space in my standard radiogram cabinet is 18ins. wide by 7½ins. high. My panel, for the sake of economy, was only 14ins. by 7ins., but I filled up the gap by making a mask of oak-faced plywood 18ins. by 7½ins. with a hole cut with a fretsaw in an artistic shape, and big enough to allow that part of the panel carrying control knobs to be seen, as in Fig. 7.

Finally, it should be mentioned that, in spite of the snags met with, the set was finished to time and functioned without a hitch. The decision to build it was taken exactly a week before Christmas; construction was carried out during the evenings only, and the set given its trial run about midnight on Christmas Eve. I am no D.X. fan—much less my family—but a very large number of stations are receivable at enjoyable volume, most of them quite consistently, and probably more could be picked up if it was thought worth while to search about critically, so what more could be asked of a straight three-valver?

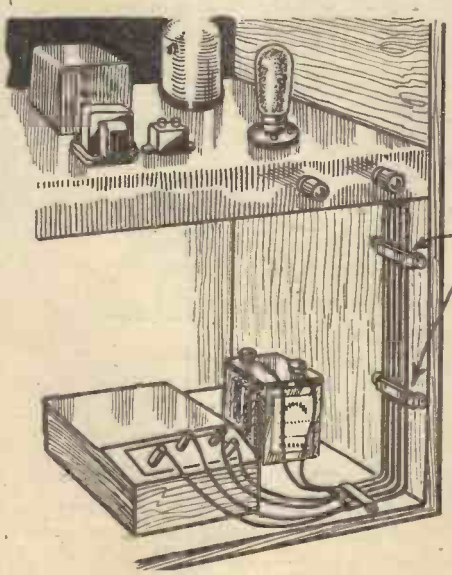


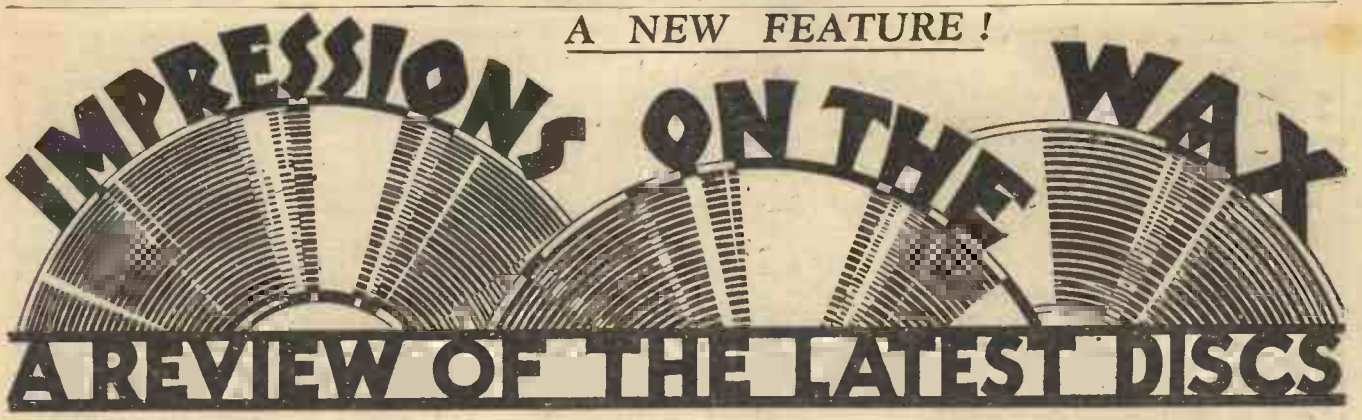
Fig. 6.—Holding wires in place with metal clips.

BOOKS RECEIVED

"*Television To-day and To-morrow*," by *Sidney A. Moseley and H. J. Barton Chapple, with a foreword by John L. Baird, 3rd Edition, 7s. 6d. net. Sir Isaac Pitman and Sons, Ltd., 198 pages, demy-octavo.*

THE third edition of this authoritative work is published at a time when television is on the threshold of great developments. Mr. H. J. Barton Chapple is, of course, a well-known authority on the subject, and it is easy to detect his extensive knowledge of the subject on almost every page. This volume is the only work of its type, for not only does it cover the entire history of the subject, but also it deals in a non-mathematical and practical way with this most modern of all sciences. Every reader of PRACTICAL WIRELESS should obtain a copy of this book, the chapter headings of which show the comprehensive nature of the work. They cover: History of Television, General Details; The Baird Disc Transmitter; The Baird Televisor Receiver; Synchronism, Photo Electric Cell and Neon Tubes; The Wireless Receiver for Television; The Tele-Cinema and Tele-Talkies; Noctovision and the Noctorvisor Receiver; Daylight Television and Phonovision; Colour and Stereoscopic Television; Latest Developments, and Television in Other Countries. The volume is crammed with excellent illustrations, both in line and in half-tone, and it is printed on excellent paper. Interest in television continues to increase now that the B.B.C. is co-operating by putting out a regular programme. This volume will show the way in an easy and interesting manner, and we congratulate Mr. Chapple in the manner in which he has covered his subject.

A NEW FEATURE!



OF ESPECIAL INTEREST TO THE GRAMO-FAN

By E. REID WARR

Standard

THERE are several good records of light music of the teatime wireless programme type, all of which one can hear again and again. First comes *Vienna Life*, *Columbia DB*1037 (2*s*. 6*d*.). This is a Strauss medley, very nicely played by the Bohemians, a little orchestra which knows everything about playing such music. A twin record is that by the famous Marek Weber's Orchestra on *H.M.V. B*3898 (2*s*. 6*d*.). The titles are the well-known waltz *Du and Du* (*Fledermaus*) and *Morning Papers*. Again, the catchy, haunting airs of Vienna.

Now, two tunes often heard on the wireless—*Pavane* (backed by *Passepied*) from *Le Roi S'Amuse, by Delibes*. The first is a really charming thing, "old-world" throughout, and the London Symphony Orchestra play it delightfully. This record is *H.M.V. B*4237. Gounod is not so far removed from the last, so make a note of the *Mirella Overture* on *Columbia DB*1039 (2*s*. 6*d*.). Here the Wireless Military Band give a fine performance. We owe a lot of good music to this band, by the way; they tackle pieces which many similar bands avoid, and Columbia have built up a fine repertoire of their performances. I believe every healthy human gets a great thrill out of a military or brass band now and again. Here is one which *is* a thrill—*Under the Banner of Victory* and the dear old thing we footslogged to, *El Abanico*. On *Regal-Zono MR*749 (1*s*. 6*d*.) they are played by Massed *Brass* Bands, and I will say just that this record is a real thrill. You will also like *Semper Fidelis* and *Steadfast and 'rue* by the same bands on *Regal MR*813 (1*s*. 6*d*.).

A violin solo next, a real gem. On *Columbia DB*1038 (2*s*. 6*d*.) Albert Sandler plays *Pale Moon* (an Indian Love Song) and *Allegro* (*Fiocco*). These pieces are widely contrasted. The first is a melodious thing, and Sandler's playing is a feast of mellow harmony. The second is a brilliant show piece. A first-rate record, this. Now to the organ. Almost everybody knows the tune of *Sicilian Mariners*, even if they never knew the name. The late Arthur Meale played it with *The Magic Harp* on the organ of the Central Hall, Westminster. You will find these on *H.M.V. C*2453 (4*s*.). Two very restful pieces which explain the popularity this organist always enjoyed.

Nothing adversely affects the popularity of the ballad. It is, indeed, a fact that it marches from strength to strength despite the "crooner" invasion. Four new records stand out as good examples of this school. First is Raymond Newell with his robust baritone singing *Devil May Care* and *The Song of the Tramp* on *Columbia DB*1040. A well-worn theme, but they go with a splendid swing. Then a good tenor, Eric Bertner, sings *The World Laughs On* and *Red Lips Unkissed* on *H.M.V. B*4335 (2*s*. 6*d*). These songs are becoming almost famous and are really well sung here.

IMPRESSIONS ON THE WAX

Recorded music plays an enormous part in modern broadcasting. Apart from the great popularity of record programmes, listeners in increasing numbers appreciate the opportunity to recapture their favourite pieces—an advantage which only the record affords.

"Practical Wireless" will treat the latest record releases entirely from the *listener's* point of view. There will be news of unusual records—notes on the best recorded versions of current radio music—favourite artists and their best records—and hints on matters radio-gramophonic. Any reader is invited to write to our contributor for information or advice on any question concerned with gramophone records. This exclusive "Practical Wireless" service will prove a convenience to readers, and their queries and criticisms will be cordially welcomed.

No mention of ballads can omit Ireland, so we have Tom Burke singing *Macushla* (with *Love Everlasting*) on *Imperial Z*137 (2*s*.). Apart from a few notes a trifle flat, this is a fine performance. And last, Titterton on *Decca F*3379 (2*s*.) sings that lovely song, *The Snowy-Breasted Pearl*—and *Rose of Tralee*. The second is the better, but there is fine singing in both.

Burns's songs everybody loves, of course. There are nine of them sung by the Light Opera Company on *H.M.V. C*2511 (4*s*.). If only all the singers had been Scotch! Never mind: their performance is a real treat—they have captured the spirit of Burns's songs splendidly. This is a very enjoyable record indeed!

Variety

In this section we will start with a German record of a piece whose jolly melody is most infectious. This is *The Village Band* on *Parlophone R*1425 (2*s*. 6*d*.). Somewhere in Germany the villagers have gathered and they and the band enjoy themselves tremendously. So will you, if you listen to this (and *Mousey*) done by the Tanz Orchester Dobbrindt. Whilst on the Continent we should hear Edith Lorand and her Viennese Orchestra. Her Tango Medley, entitled *Let's Have a Tango*, is splendid. On *Parlophone R*1438 (2*s*. 6*d*.).

Now an American cameo—the tragic "Bread Line" in New York. *Brother Can You Spare a Dime?* on *Regal-Zono MR*821 (1*s*. 6*d*.), as sung by "The Velvet Voice," is harrowing but well done. It is backed by *I Guess I'll Have to Change My Plan*—a more cheerful effort.

Hawaiian Guitars seem to follow. *Imperial* 2808 (1*s*. 3*d*.) is an attractive rendering of *In a Shanty in Old Shanty Town* and *While We Danced at the Mardi Gras*. These are by Roy Smeck's Vita Trio. Similar is *Aloha, Sunset Land* and *Hawaiian Eyes* by José Norman's Novelty Band on *Regal-Zono MR*783 (1*s*. 6*d*.).

There are lots of laughs in Wee Georgie Wood's *Black Hand Gang* on *Broadcast* 925 (1*s*.). This little artist is always good.

Here is a record for the cinema fan of the "silent" days. Quentin Maclean brings back old times in *Cinema Memories* on *Columbia DX*382 (4*s*.). He plays the organ of the Trocadero, Elephant and Castle, in fine style in all these old pieces.

Now for some Dance Records. There is one head and shoulders above the rest—*Every Woman Thinks She Wants to Wander* and *When Anybody Plays or Sings*—*Columbia CB*550 (2*s*. 6*d*.). These are from "Mother of Pearl" (Oscar Straus). The band is a German one—Eddie Saxon's. Don't miss this: the contralto vocal is worth the money alone!

Having recovered from the shock of the titles, *Tantalizing Trovatore* and *Rigoletto Ramblings*, one can enjoy these one-steps by Debroy Somers' Band on *Columbia DX*437 (4*s*.). First-class band, this.

I must mention another German dance record—one by Jack Bund's splendid Bravour Dance Band. This is *Parlophone R*1440 (2*s*. 6*d*.), the titles being *Pipsy! My Black Baby* and *The Mystery*. The pianist is especially brilliant in this—one of the very best recorded dance bands. Our own Ambrose has a fine pair on *Regal-Zono MR*800 (2*s*. 6*d*.)—*Balloons* and *Fit as a Fiddle*. This is a real bargain. There are two very good foxtrots—*Strange Interlude* and *Always in My Heart* on *Brunswick* 1414 (2*s*. 6*d*.). These are by Anson Weeks and his Orchestra. And, finally, the story of that unfortunate lady, *Wheezy Anna*, is told in a novelty foxtrot by Harry Roy and his Café Anglais Orchestra with *I Wish I Knew a Bigger Word than Love* backing it up on *Parlophone R*1433 (2*s*. 6*d*.).

RADIO RAMBLINGS

Reducing Electrical Interference

I HAVE recently been carrying out a few experiments in an endeavour to find a means of reducing electrical interference. For some time I had been annoyed by regular "chirps" caused by a nearby electric flasher, and after trying the effect of removing the earth lead, connecting condensers of various capacities in series with the earth, and other similar well-known palliatives I was beginning to think my only hope was to approach the owner of the offending apparatus. However, as a last measure I decided to try a shielded lead-in cable in place of the ordinary bare wire one which had previously been in use. A length of this material (which has just recently been put on the market, by the way) was therefore obtained and fitted, and, to my astonishment I confess, the interference was almost entirely eliminated. In case you have not yet made the acquaintance of this new cable I might say that it is of rather ingenious construction, consisting of a single wire passing through the very centre of an insulated tube built up of a number of short lengths which are knuckle-jointed together. The outside is covered with woven metal braid similar to that used for ordinary shielded wire.

Our contributor, Mr. K. E. Brian Joy, who is also an expert transmitter.

Due to the form of construction the cable is quite flexible, and yet there is an appreciable air space between the central wire and the outside metal shielding. In consequence the added capacity is not very great; actually it appeared to be about .0003 mfd. for the 20ft. length in use. When the capacity of the series aerial condenser was slightly reduced, signal strength was found to be practically as great as before. If you are troubled by electrical interference I can recommend you to try this new lead-in idea. By the way, it is no use employing ordinary screened wire because the capacity of this is much too great and it will probably prevent the aerial from functioning at all.

Another Method Worth Trying

IN the course of my experiments I ran across another little method of reducing interference, and it seemed to work quite well on the shorter wavelengths. The earth lead happened to be very long as the set was installed in an upstairs room, and on closing the aerial-earth switch before turning off the set I found that reception was still possible, although the electrical interference was barely noticeable. I should explain that the switch was of the single-pole type and although it connected the aerial to earth there was still a connection between the earth terminal and the earth lead. On transferring the latter wire to the aerial terminal results were better still, and in fact, signal strength was not very greatly below par. If you care to try the idea all you have to do is to connect both the earth and aerial leads to the aerial terminal. Of course it will not work unless the earth lead is long and of insulated wire. Even under these conditions I cannot give any guarantee, because the system does not follow any recognised principle and I might just have struck a "fluke." If you do get any results I should be pleased to hear of them. If you will write to me c/o the Editor.

JOTTINGS FROM MY NOTEBOOK

Remote Control of Volume

IT often happens that a loud-speaker is used in a different room to that in which the receiver is installed and it is rather awkward to have to go from one room to another each time you wish to alter the volume. And if you are anything like I am you will often wish to "tone-down" when a brass band or full symphony orchestra comes on, and to increase the volume for speech. Besides, you sometimes want to carry on a conversation whilst the set is in operation, and this is most trying when the speaker is going "full blast." There is a perfectly simple way of fitting a convenient volume control to the speaker itself. The only component required is a 50,000 ohm potentiometer so the modification is certainly not costly. All you have to do is to connect the outside terminals of the potentiometer to the leads from the set and to wire the speaker between the centre and one outside terminal. To make matters quite clear a sketch of the connections is given in Fig. 1. You might find that reproduction becomes rather shrill when volume is reduced to a fairly low level; if you do, connect a 1 mfd. condenser between the two potentiometer terminals indicated in the sketch.

A Q.P.-P. Difficulty

YESTERDAY a friend asked me to have a look at his new Q.P.-P. amplifier which was distorting badly. He had used new components throughout, his batteries were all in perfect condition, and yet reproduction was distinctly poor. I first suspected that the valves might have been over-biased—you *can* overdo this sort of thing, you know, even with Q.P.-P.—but examination failed to reveal any fault in this direction. It eventually came to light that both priming grids were connected to the same positive terminal,

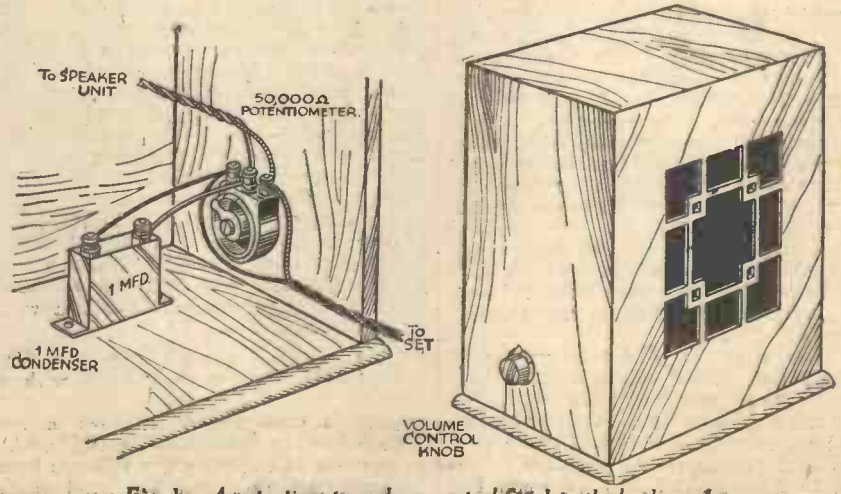


Fig. 1.—A potentiometer volume control fitted to the loud-speaker.

and on measuring the anode current to each valve a difference of nearly half a milliamp was noticed. By connecting the priming grids to separate wander plugs and putting these into different battery sockets we were soon able to equalise the anode current to each valve.

Special H.T. Batteries

IF by chance you did not know, it is very important that both valves in push-pull, either quiescent or otherwise, should work under identical conditions. When using triodes the usual method of ensuring this is to employ a centre-tapped input transformer and apply separate grid-bias voltages, but with pentodes it is easier to accomplish the same result by independent regulation of priming grid voltages. The fact that the latter can be so critical has led to the introduction of a special high tension battery having a series of 1½ volt tapping points at its positive end. Naturally it would not be a very likeable proposition to buy a new battery if the one already in use was not run down, so the simplest thing is to connect a 9 or 16-volt G.B. battery in series with the H.T. Accurate adjustments of priming grid voltage can then be made quite easily.

Athlone

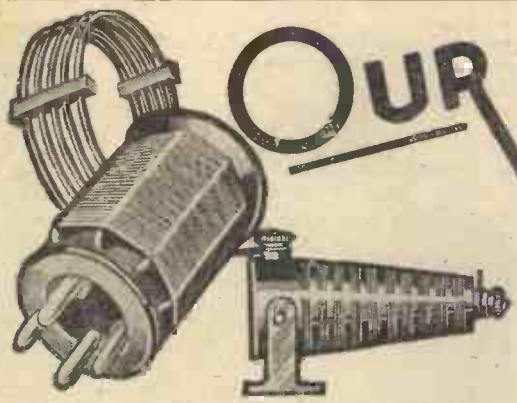
HOW is the new 80 kW. Athlone transmitter affecting your reception? Apparently this station is not yet working to a full time-table, but I have heard a few programmes from it on recent evenings. Despite several complaints that have reached me to the effect that Athlone drowns all the "smaller fry" between about 390 and 420 metres, and even interferes slightly with Midland and North Regionals, I must confess that I have found no difficulty whatever in cutting it out in favour of Berlin-Witzleben, working on 1.5 kW., and separated by only 10 kilocycles. Frankly, I have been rather disappointed at the poor strength of Athlone, which with me is no louder than Toulouse and nothing near so powerful as Rome, Trieste, or Fécamp. Perhaps it is not yet working on full power, and there is "worse to come."

'Plane Transmissions

I WONDER if any readers were successful in picking up signals from the Air Ministry's 'plane, which recently made the record-breaking non-stop flight to the Cape. With the call-sign GEZAA, the machine was to have sent out a short transmission every two hours on 33.71 metres. I listened for it on two or three occasions, but without any success.

D.C. to A.C. Conversion

IT was recently mentioned in these columns that the Fleetwood Ratepayers' Association were up in arms against the refusal of the local Council to contribute towards the cost of converting radio receivers consequent upon the change over from a D.C. to an A.C. supply. The Association are determined to thrash the matter out, and started a "shilling fund" to enable them to take the matter to the Courts if necessary. They have recently received a reply to their inquiry directed to the Electricity Commissioners, in which it is pointed out that, since the Council consented to the change in supply they cannot disclaim responsibility for the alteration of wireless apparatus. What will the next move be, and by whom?



OUR SHORT-WAVE SECTION

AS already stated in a previous article, in order to avoid disappointment at the outset, it is wise to carry out your first search in a portion of the short-wave band which contains the more powerful transmitters. From my log I find that from 25 to 50 metres will prove the richest field for the beginner. This section, judged from the standpoint of the ordinary broadcast listener, would appear to be a small one; in effect, it is an *enormous* band when kilocycles as against metres are taken into consideration. Whereas the difference between 200 metres (1,500 kc/s) and 555 metres (545 kc/s) is only 955 kc/s, between 25 metres (12,000 kc/s) and 50 metres (6,000 kc/s) we find a separation of 6,000 kc/s. Taking, therefore, the conventional 9 kilocycle separation between transmissions, in the above-mentioned broadcast band, we could place, roughly, 106 transmitters; on the same basis the band from 25 to 50 metres could accommodate over 660 channels on which transmissions could be made without mutual interference. To make the illustration clear it is only necessary to add that this would represent considerably *more than twice the number of broadcasting stations at present working in the United Kingdom and on the Continent of Europe!*

Now it is for this reason that searching for signals on the short waves must be carried out much more carefully than when tuning the average set for the reception of signals on longer channels. The condenser dial must be turned *very* slowly, otherwise most of the transmissions will be missed. It is possible that some may be tuned in, but this will be due to mere luck if such an event takes place, and the chances of finding the station again at a future date are exceedingly remote. Most short-wave condenser dials are equipped with a slow-motion movement with a comparatively high ratio; in fact, the higher the better. Another important point to bear in mind is that whatever the circuit of the receiver may be, it is impossible to hear telephony if the set is in a state of oscillation; you will pick up the carrier waves, and also morse signals when valves are in that condition, but to hear speech or music it is necessary that reaction should be thrown back or reduced so that the receiver may be brought to *just below* oscillation point. Experience will soon teach you the procedure. In the case of strong signals you will find that to secure stability and steadiness of reception reaction must be reduced still further. Where separate coils are used to cover distinct bands of wavelengths, they invariably overlap to some extent; this, of course, is all to the good. If, say, three coils are required to cover from 15 to 18 metres, roughly, they would be wound to tune to (1) 13 to 28 metres, (2) 24 to 50 metres, (3) 40 to 80 metres. The overlap existing would then permit you to tune in such a station as Rome 2RO, working on 25.4 metres, at either a high-condenser reading of coil No. 1, or at a low-dial reading of coil No. 2. This alternative is a useful one; it also avoids definite gaps in the sections covered. It is essential, if success is to be assured, that some kind of log should be kept; don't simply jot down the dial readings on odd slips of paper or on the backs of envelopes. A more exact method may be adopted in the shape of a graph, but a log and a list of wavelengths of the principal short-wave stations, as published in "The Constructor's Encyclopædia," will be sufficiently helpful at the start. The details to be entered are the call (if heard), the location of the station, accurate dial readings, time at which transmission took place, and interval signal, if any, as well as any other details which may facilitate the tuning in of that particular station at a future sitting. It will be realized that one factor, namely, wavelength, may be roughly estimated, as soon as a few transmissions on different channels have been accurately identified, if they are spaced over the band on which a search is being instituted. For instance, should a station at 10 degrees be found to correspond with, say, 25 metres, another at 60 degrees estimated at 32 metres, and a third on 175 degrees (all on 180 degree dial) to tally with 50 metres, it is not difficult to gauge approximately the position at which the condenser must be set to tune in, say, 40 metres. At least, these loggings will give you useful landmarks or jumping-off points, and will obviate a search over the entire dial, thus limiting the movement to some 10 degrees or so of the correct position either way. Gradually, as the gaps in the log are filled up, so the actual searches are narrowed down to closer limits.

ON THE SHORT WAVES

(*Continued from page 1110, Feb. 25th issue*)

By J. GODCHAUX ABRAHAMS

Now let us take the 25 to 50-metre band and start on our tour of investigation. Probably one of the first transmissions picked up will be one from Pontoise, Paris, on 25.20 metres (11,900 kc/s). The call is *Allo! Allo! Ici Radio Coloniale, Paris*; the best time is between 16.30 and 19.30 G.M.T.; at 18.55 you may hear a news bulletin in English. The station relays concerts, operatic and dramatic performances, etc., for the benefit of French listeners overseas. Immediately above, a matter of a degree or so, you will find Rome (2RO), on 25.4 metres (11,810 kc/s). You cannot mistake this transmission, as announcements are made by a woman—it is the same voice you are familiar with on 441 metres. *Eh-yah-Radio-Roma*, coupled, perhaps, with Naples (*Napoli*). Rome opens its transmissions with a noisy gramophone record, of bells, organ, choir and orchestra. Try for it at 18.00 G.M.T.; the opening melody and call are followed by a time signal lasting until 18.15, it consists of a series of dots and dashes with verbal announcements by a man. Between Rome and Radio-Coloniale, on favourable nights, you may log W8XK, East Pittsburgh (Pa.), on 25.27 metres (11,870 kc/s). This short-waver works from 19.00 G.M.T. (2.0 p.m. New York time, E.S.T.). Here, a slight movement of the dial should bring you in the earlier hours of the evening, 25.51 metres (11,760 kc/s), DJD, Königswusterhausen, which is often used for the relay of the Berlin programme to America; after twilight the broadcast is carried on through DJC, on 49.83 metres (6,020 kc/s). A hair's-breadth away is GSD, Daventry, Empire

(*Continued on page 1203.*)

A "PRACTICAL WIRELESS" READER'S WIRELESS DEN.

A reader whose modesty compels him to remain anonymous sends us this photograph of his den. Note the prominence of "Practical Wireless."

(*Continued from page 1202.*)

Broadcasting Station, on 25.532 metres (11,750 kc/s), which provides a programme to the Australasian Zone daily, between 09.30 to 11.30 G.M.T. Just 20 kilocycles lower, namely, on 25.57 metres, you will probably hear tests by the 40-kilowatter at Eindhoven (Holland), which, under the call sign PHOHI, puts out announcements in Dutch, German, French, English and Spanish. For the present, at least, its old wavelength of 16.88 metres (17,770 kc/s), now shared by GSG, Daventry, is also being used towards 8 a.m. on some mornings for experimental purposes. Barely a degree further on, we again find Radio-Coloniale (Paris), on its 25.63 metre channel between 21.00 and midnight. As you may well judge from the foregoing, all these broadcasters are fairly close together, but their kilocycle separation is reasonable; in most instances careful tuning will permit you to log them, although, possibly, not at your first attempt. From this point we make a jump to the 30-metre region. At odd times within this gap you will hear calls from Transatlantic or other telephony services, such as GBX, Rugby, on 27.55 metres; SUV, Cairo (28.83 metres); LSM, Buenos Aires (29.15 metres); and so on. On exactly 30.43 metres (9,868 kc/s), if you listen at 18.00 G.M.T. (on Saturdays), or towards 23.30 daily, you should pick up the Madrid (EAQ) broadcasts to the South American States. (Call: *Aqui Madrid, radio Ibero-Americana*, and sometimes in English—*This is Radio Ibero-Americana, Madrid.*) The transmissions are not limited to news, but include some very good concerts. Here, again, we come to a portion of the band which will give a number of entries in our log. A cuckoo call (repeated *ad lib.*) on 31.19 metres (9,620 kc/s), between 21.00 and 23.00 G.M.T. (Wednesdays or Fridays), will tell you that you have tuned in Lisbon (CTIAA). The station styles itself *Radio-Colonial Lisbon.*

Then follow a number of important stations in quick succession, namely, VK2ME, Sydney (N.S.W.) on 31.28 metres (9,590 kc/s), best heard on Sunday mornings between 09.00–11.00, and again between 16.00–18.00 (Interval Signal—Song of the Lyre Bird—Kookaburra); GSC., Empire Broadcaster (Daventry) on 31.297 metres (9,585 kc/s); HBL, Prangins, Switzerland (31.31 metres) (9,580 kc/s) with its League of Nations transmission on Sundays (G.M.T. 22.00) and WIXAZ, on 31.35 metres (9,570 kc/s), relaying WBZ, Boston, in the National Broadcasting Corporation of America network. Only slightly above the "Yank" we tune in on most evenings DJA, Zeesen, on 31.38 metres (9,560 kc/s). Through this channel you may receive the Berlin programmes without interference, from G.M.T. 19.00; until that hour, the broadcasts are usually carried out on 19.737 metres. And then for another well-known American, W2XAF, relaying on 31.48 metres (9,530 kc/s), WGY Schenectady, and other stations in the N.B.C. network, from midnight until 3.0 or 4.0 a.m. G.M.T. The announcements are in English, and as a rule you are told that "*you are listening to*—"; approximately every fifteen minutes the interval signal is heard; it consists of three clear notes on an instrument akin to a xylophone. A degree or so further up the scale gives us a relay of the Copenhagen programme *via* Skamleback on 31.51 metres (9,520 kc/s), which, although only of a power of 500 watts, when conditions are favourable, will provide a loud-speaker reproduction. Broadcasts from Radio Maroc (Rabat) which are difficult to secure on the medium wave-band may be picked up fairly easily on Sundays (G.M.T. 19.00–22.00) on 32.26 metres (9,300 kc/s). They may be identified by the peculiar metallic sound of the metronome adopted as an interval signal.

By slow and sure stages—but interspersed with much morse—we have reached the 40 metres amateur band to which I referred in my previous article. Between 41.1 metres (7,300 kc/s) and 42.9 metres (7,000 kc/s), you will come across a welter of calls of almost every nationality, and an interesting hour or so may be spent in jotting down the call signs, which can be later traced to find the country of origin.

Do not be misled by the names of countries or towns used in such calls; the names are frequently adopted to avoid a misunderstanding. I have often heard a Frenchman state that he was, say, *Eff-whit-Canada, Yokohama.* This would show his call sign to be F8 (French: *huit*) CY, the country or city mentioned thus, clearly giving the letters. In the course of a two-way communication the amateurs will sometimes drop the first letters and retain the names. Thus *Canada, Yokohama* (F8CY), may call *Espagne Angleterre* (F8EA) and so forth. In the same way British amateurs adopt proper names: G6VH, for instance, might announce himself as *Six Victor Henry*, the G (Great Britain) being understood. This international amateur band includes Clubs, such as EAR58, Radio Station, Las Palmas, Grand Canary on 41.6 metres (7,212 kc/s), and which may be found working on Saturdays and Sundays between 20.00–22.00. G.M.T.

(*To be continued.*)

HEADING A NEW MOVEMENT

By "PUSH-PUSH"

When I set out to write these notes I looked around for a "pen-name" to typify modern development. I chose "Push-Push"—which is another name for Quiescent Push-Pull. And didn't I pick a winner?

Quiescent Push-Pull is this season's outstanding development. It has been compared with the coming of the Screen Grid. Now, I'm not one of those enthusiastic chaps who hails every small development as the dawn of a new day, but I've got to hand it to Q.P.-P. I've got to say that the battery set without it is only giving half the entertainment value that it could. And when one adds that Q.P.-P. economises in H.T., that is the final, unexpected bit of gilt on the gingerbread.

It's not a difficult matter to add this refinement (but it's more than a mere refinement!). There are Q.P.-P. components, eliminators, batteries and speakers on the market by most of the leading makers. Or, if you want a commercially-built set, famous manufacturers have produced Q.P.-P. receivers which will be a revelation to you of what a battery set can be.

And, as usual, Coradio, the part-exchange people, are ready to help you to better radio by the most economical path. All that is necessary is to send in particulars of the apparatus you want to get rid of and they will tell you how much they can allow in part exchange for the new stuff you require.

It's an attractive idea from the point of view of economy. At the same time an enquiry doesn't commit you to anything, and they are helpful people who do make an individual effort to fix you up.

So whether it's for "Push-Push" or something else, here's the address you want.

REACTION POINTERS

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

IN my previous general article on reaction I mentioned that some time ago I carried out a series of tests dealing with capacity controlled reaction, and it occurred to me that readers of PRACTICAL WIRELESS may be interested in the results obtained.

First of all we know that the capacity reaction circuit consists of a variable condenser and coil C_2 and L_2, see Fig. 1, the last named being either a separate coil magnetically coupled but fixed relatively to a tuned grid coil L_1, or alternatively it

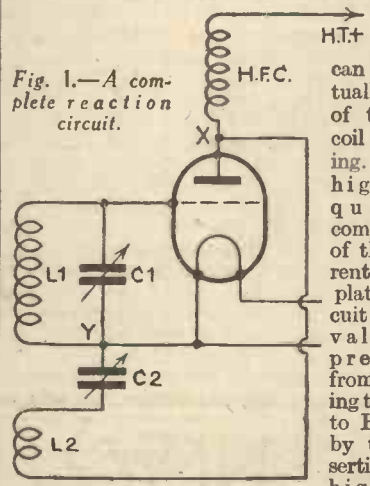


Fig. 1.—A complete reaction circuit.

can be actually part of the L_1 coil winding. The high frequency component of the current in the plate circuit of the valve is prevented from flowing through to H.T. + by the insertion of a high frequency choke, and these checkmated currents find a low impedance path provided to the valve filament *via* L_2 and C_2.

Reaction Resonance

This reaction circuit between valve plate and filament, *i.e.*, X to Y of Fig. 1, offers a certain impedance to the flow of the H.F. currents and by varying C_2 this impedance will alter, being decreased when C_2 is increased and vice versa.

If this impedance is expressed in mathematical terms the expression below is obtained :—

$$Z=\sqrt{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}$$ where

ω = the frequency of the H.F. current multiplied by 2π (6.2832).

L = the inductance of the coil in Henries.

C = the capacity of the condenser in Farads.

R = the H.F. resistance of the coil in ohms together with the equivalent losses in the circuit which, of course, can be expressed in terms of ohms.

Examining this quantity, it is easy to see that up to a certain point any increase in the value of the condenser capacity will cause a decrease in the impedance and correspondingly there will be an increase in the amount of current flowing in the circuit. The point at which this ceases to be a true statement is at resonance when $\omega L=\frac{1}{\omega C}$, for then the quantity inside the bracket becomes zero and the only impedance in the circuit is the high frequency resistance R. Any further increase in C will only serve to increase the impedance and consequently bring about a reduction in the flow of current. In actual practice the resonant condition for the reaction circuit mentioned above is seldom, if ever, reached. The primary object of the arrangement is to feed back sufficient energy into the tuned grid circuit so that the inherent losses are actually overcome and a state can then be reached where the valve will oscillate at the frequency to which the grid circuit is tuned.

Varying Coil Size

If a large reaction coil is used and a small reaction condenser, then the size of this coil L_2 when compared with the tuning coil L_1, in, say, a straightforward three valve set of the detector and two L.F. type, will depend on the degree of magnetic coupling between L_1 and L_2, the looser the coupling the larger being the reaction coil. With a large reaction coil an uncontrollable oscillation may evidence itself if the magnitude of the self and stray capacities is sufficient to cause the coil to tune the same wavelength or frequency as the tuned grid circuit. Then, with this loose coupling, it is necessary to bear in mind considerations of space, the large coil size making a compact design somewhat difficult.

If in order to overcome these points the size of the coil is reduced, then the degree of coupling between L_1 and L_2 must be correspondingly increased to permit sufficient energy feed back. Another drawback arises here, however, owing to the damping on L_1 introduced by the close proximity of L_2, this, of course, being additional to the existing valve and aerial damping already present in the coil.

(Continued on page 1205.)

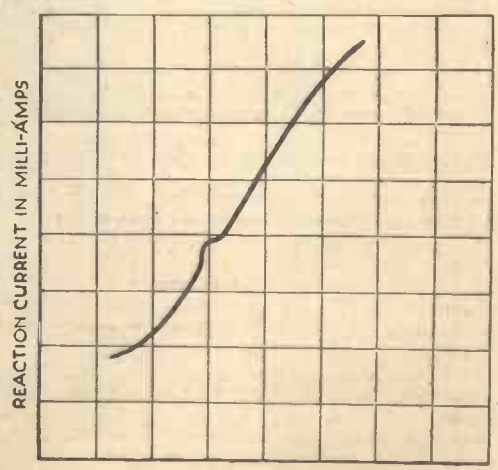


Fig. 2.—A graph showing the result obtained on actual test.

REACTION POINTERS

(Continued from page 1204.)

Apparent Solution

From this reasoning it would appear that the best solution lies in the adoption of a small reaction coil fairly tightly coupled to the tuned grid coil and a large reaction condenser (.0005 mfd). While smooth reaction control can undoubtedly be effected with a large reaction coil there is apt to be a lack of uniformity in the relationship between the settings of the tuning and reaction condensers, and a small coil tightly coupled would therefore appear to offer additional advantages.

Some of the tests I carried out were directed towards finding if there was any truth in this reasoning, but I will not bother the reader with all the experimental details. My tests were quantitative as well as comparative, but in passing it may be interesting to learn that I actually measured the magnitude of the reaction current in several cases by employing special high frequency meters. The value of this high frequency current was less than a milliamp up to the condition of oscillation, and then rose to about 2 milliamps as the resonance condition was approached. The curve of Fig. 2 will show how the variations took place, the "hump" being where the set broke into oscillation. Near the top end of the scale the current increment per ten degree change of reaction setting starts to drop, indicating that the resonance condition is being approached. It will be noted, however, that the resonance condition is not reached in the reaction circuit. If it had, the current would have started to fall and, of course, this is not desired.

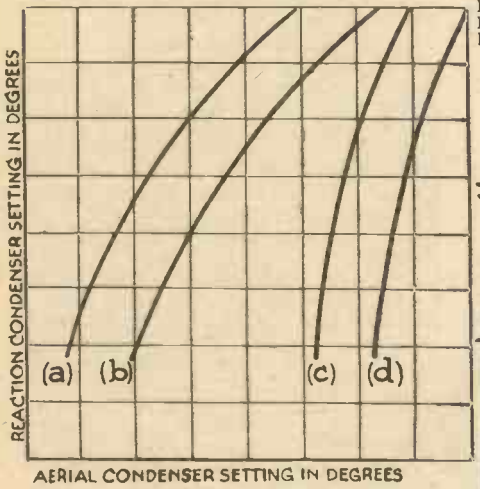


Fig. 3.—Graph showing effect of reaction obtained on different sets.

Smoothness of Reaction

The next point of interest deals with the smoothness of the reaction control. The procedure adopted here was to connect up the set and to note the readings of the tuning condenser and reaction condenser for the set just to oscillate first with no aerial and earth, and then with the aerial and earth leads joined to the appropriate terminals. Curves were then drawn to show whether the reaction control was reasonably smooth over the whole of the scale.

Reaction Variations

In Fig. 2, are shown the average types of curves I secured with three valve sets (detector and two L.F. stages), using a .0005 mfd. reaction condenser.

(To be concluded next week.—Ed.

A BALANCE METER for PUSH-PULL CIRCUITS

A Unique Visual Indicator for Adjusting Valves in Q.P.-P. Circuits

By DEREK ARCHER

IT is preferable in order that Quiescent Push-Pull arrangements function correctly and without distortion that the anode current of each valve used in the output circuit should be matched. This matching of anode currents is usually performed with the aid of a milliammeter, which must be inserted into one circuit and a measurement taken, and then inserted into the other circuit and the voltage on the screen terminals of the valves adjusted individually until a balance of currents is obtained. The little instrument to be described here is connected into both anode circuits at the same time, and the high-tension voltages adjusted until the pointer comes to rest in a central position. It is possible with this little instrument to get an exact balance of both currents, which is not quite possible with a single instrument, because adjustments which are made on one circuit may affect the other and this is not noticed, for the milliammeter is then in the other circuit.

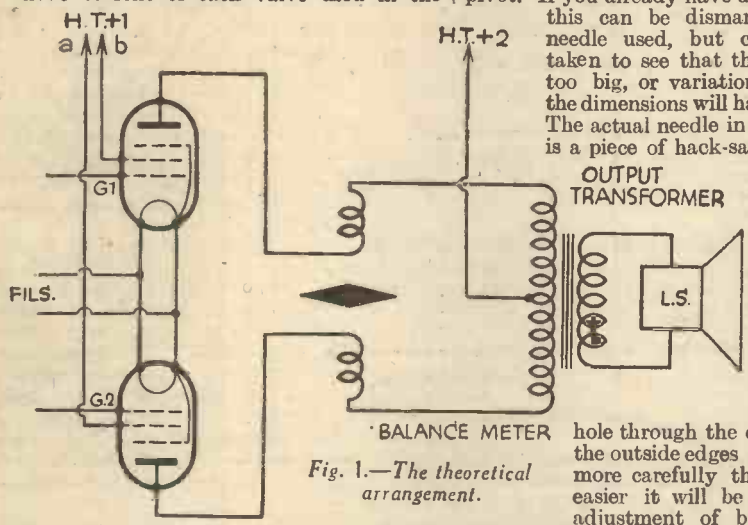


Fig. 1.—The theoretical arrangement.

This balance meter is not difficult to make, and all the parts which went to make the original model were taken from the scrap box. No special tools are required, but care should be taken to get everything just right, especially the number of turns of wire on each coil, and the distance away from the needle. The two coils, one of each being connected in the anode circuit of each valve as shown in the diagram, Fig. 1, are connected so that the field of each is in opposition to the other, and the magnetic needle in the centre takes up a position in a neutral position. If the needle goes over to one side it indicates that one of the anode currents is stronger than the other, and this can be corrected immediately by adjusting the voltage on one of the screens, H.T.+1, a or b, as the case may be.

Details of Construction

The most important part is the magnetic needle and its pointer and the suspension pivot. If you already have an old compass, this can be dismantled and the needle used, but care should be taken to see that the needle is not too big, or variations in some of the dimensions will have to be made. The actual needle in the instrument is a piece of hack-saw blade. This should first of all be made soft by making it red-hot for a minute or two, and allowing it to cool off. Mark off with a steel scriber the needle shown in Fig. 2. Drill the hole through the centre, and file the outside edges to shape. The more carefully this is made the easier it will be for the final adjustment of balance. Next make the brass bush, shown in Fig. 3. It is essential that this should be of brass and not iron. Take a piece of brass rod, the actual model used the straight part of a brass wood screw, and drill a No. 42 hole down its centre. Then file the shoulder, using a hand brace for turning, so that it just fits into the hole drilled in the piece of hack-saw blade. Cut off any excess metal at the top. This can be gauged by a depth gauge, or by the more rough and ready method of trying the depth of the hole with a piece of wire. Make a very small slot across the top, and then make the needle red-hot and plunge it into water to harden it again. Press the brass bush into the hole, right up to the shoulder. The needle is now very hard and brittle, and care must be exercised when pushing the brass bush into the hole not to force it too hard, or the needle will snap and another will have to be made. Now the drill which you have used will have made the end of the hole flat and not sharp pointed as shown in Fig. 3. When the needle has been fixed re-drill the hole with a spear point drill which has been sharpened to a very fine point. This is very important, and if this does not receive attention the needle will take up a new position on the pivot each time it moves, and extreme difficulty will be experienced in getting the needle to balance. Final drilling is best done by rotating the drill with the fingers.

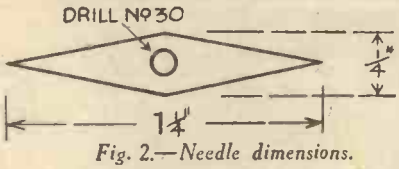


Fig. 2.—Needle dimensions.

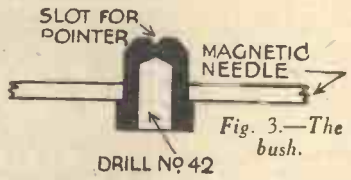


Fig. 3.—The bush.

Fitting and Adjusting the Pointer

Next fit the pointer. This is a piece of fine enamelled copper wire about 5in. long. The enamel is scraped off about 2½in. from one end, and the wire then carefully soldered in the small slot already made in the top of the bush. The longer end of the wire is then coiled up round a No. 26 drill, until its axis is 5/16in. from the pivot hole. The other end of the wire is then formed up to the dimensions given in Fig. 4. The end of the wire will require nipping off so that it is 1⅞in. from the pivot hole. A temporary pivot is then made by pushing a soft tone gramophone needle through a piece of wood and the needle dropped on to it. The soft tone needle is not a catch, as apart from a wood or special needle, any needle may be used, but a soft tone needle is much longer than a loud tone needle. First balance the pointer. If the pointer goes up, nip a turn or two off the coiled up wire. If the needle goes down press a little piece of plasticine into the coil, adding or taking away sufficient until a correct balance is obtained. Then balance the needle sideways. This can easily be done by setting the coiled balance weight to one side or the other. It is, of course, important, while the balancing is being carried out, that the needle is kept away from magnets or iron, or a wrong setting will be obtained. Place the needle in a safe place until it is required, and commence the construction of the coils.

These are constructed from pieces of 1/16in. cardboard, four of the large pieces and four of the small pieces shown in Fig. 5 being required. Two of the small pieces are glued together to form the centre of the bobbins, and one large piece then glued to each side to form the flanges. Whilst the glue is drying the base can be prepared. Cut a piece of three-ply, ¼in. thick, to the dimensions and shape shown in Fig. 6. With a marking gauge, score all

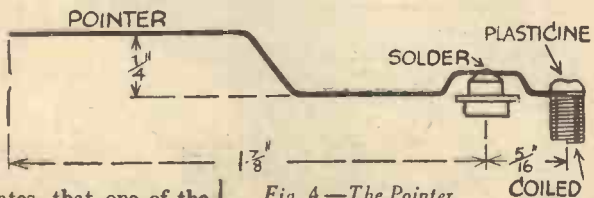


Fig. 4.—The Pointer.

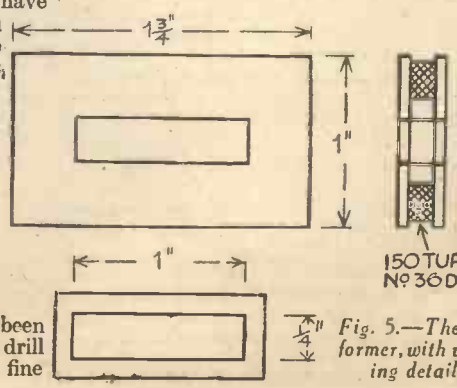


Fig. 5.—The coil former, with winding details.

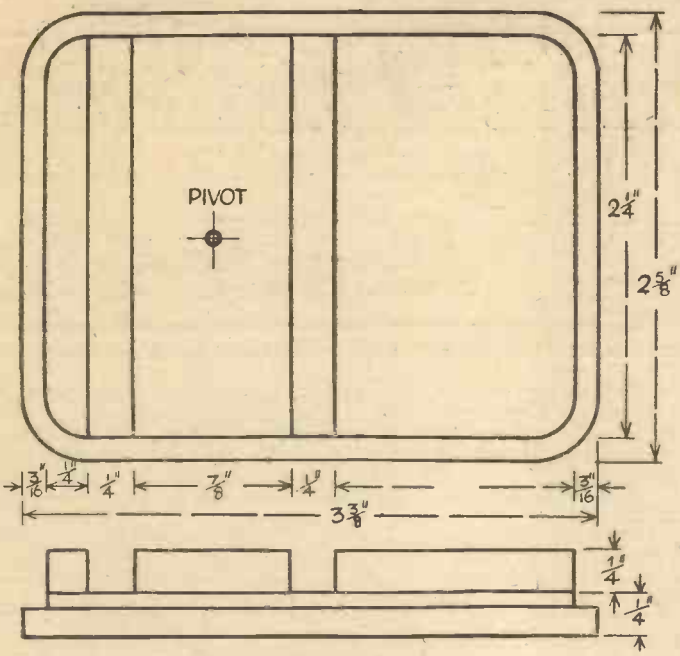


Fig. 6.—The containing case.

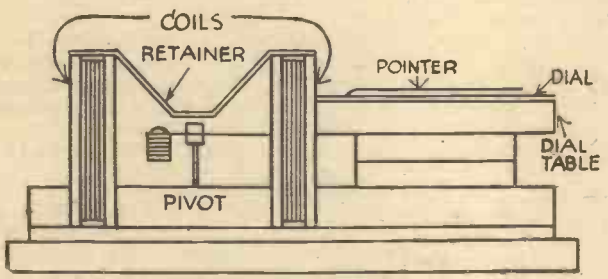


Fig. 7. The complete assembly.

round the edge for the depth of the top-piece of ply for 3/16in. and remove the strip of ply, which then forms a rabbet for the sides, which will be fixed later. The three smaller pieces of ply are then cut and glued or fixed with brass screws to the base. The two gaps between the three pieces of ply should be just a ¼in. so that the coils when they are wound will fit snugly into these grooves.

Winding the Coils

Next wind the two coils with 150 turns of 34, 36 or 38 S.W.G. enamelled or silk-covered wire. This is not important, any wire you have by you can be utilised, but both coils must be wound with the same number of turns of the same gauge wire. The number of turns also is not important, provided that both coils have exactly the same number. The wire is taken into the coil through a small pinhole near the core at one side, and the finishing end brought out through another pin hole on the same side and at the same end of the bobbin. Both coils can be wound in the same direction and the wires brought out at similar ends. The winding can be covered with a thin strip of passe-partout, but this is not essential, but it is a good idea to give the coils a coat of shellac or cellulose paint to keep the cardboard dry and to prevent it from warping. Inspect the aperture through each coil and see that it is clear and free from ends of paper or drips of dope, as this might prevent the needle turning.

Mark off the position of the pivot, which is at the centre of the cross diagonals of the centre piece of ply fixed to the base, and pierce a small hole right through from the underside of the base. Push a soft tone gramophone needle into the hole, leaving about a 1/16in. protruding on the underside. Then glue the two bobbins in position, so that their centres are dead in line with the pivot, the wire ends of one coil on the left-hand side and the wire ends of the other coil on the right-hand side. Figs. 7 and 8 show just where the coils have to be fixed.

Then magnetize the needle from another magnet. It does not affect the working of the instrument if the needle is strongly magnetised or weakly, providing that it is magnetised. Pass the needle carefully through the core of the front coil and drop it carefully on to the pivot. See that it swings freely. Adjust the height of the needle, so that it swings freely through the apertures in the bobbins, by pushing the pivot through the base to the required distance. If the dimensions shown in the sketches have been followed the back end of the pivot will be just flush with the underside of the base. If the pivot projects, four small feet should be glued to the underside of the base to keep it clear of the table. If it does not, give more attention to the bottom of the hole in the bush. Then glue into position on the top of the coils the retainer strip. This is just a thin piece of cardboard about 3/16in. wide, to prevent the needle coming off when it is carried about. It must not, however, touch the needle or the pointer will not move.

Next paste a piece of thin white card to a piece of ply, and cut it to the shape shown in Fig. 8. No markings need appear on the scale except one straight line drawn dead down the centre, which is under the pointer in Fig. 8. Other markings can, of course, be made if desired, but these have no particular value and any effort to grade the readings in milliamps would be unnecessary and inaccurate. The dial is supported in position by two small pieces of three-ply glued to the base as shown in Fig. 7.

Making the Casing

The sides of the instrument can be made from cardboard or metal or any material which can be bent round the base, provided that iron is not used. The actual model used cardboard, which was given a coat of black cellulose paint after it had been glued up. The width of the material is 1⅛in., and is glued down to the base on the rabbet made by cutting away one layer of ply. The four terminals are then fitted as shown in Fig. 8. Soldering tags should be used, and of course, if a metal case is made, these will have to be insulated. The two wires from each coil are soldered to the tags on the nearest side, and these can be connected to whichever terminals are most convenient, the correct direction of the current being made outside with the anode leads to the instrument.

The top cover should now be made.

(Continued in col. 1, page 1209.)

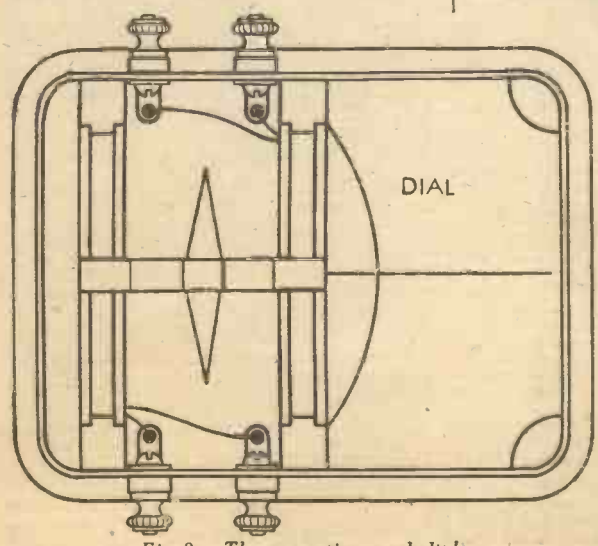


Fig. 8.—The connections and dial.

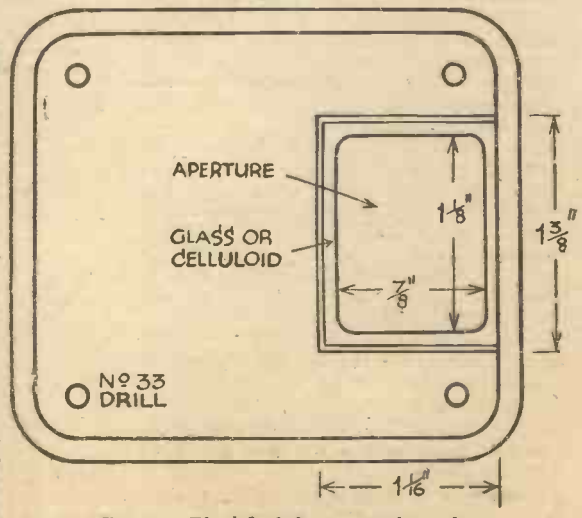


Fig. 9.—The lid of the case with window.

Practical Letters from Readers.

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

Suggestions for Articles

SIR,—May I respectfully suggest articles in "Ours" on the following subjects, which I feel sure will interest many readers.

Advanced Wireless Mathematics

One full page weekly dealing with this and its practical application to set design, such as Resistance, Capacity, Impedance, Reactance, etc. Most people know where, say, a fixed condenser should be used. Let us know the reason why—the correct value, etc.

Fuses

Your correspondent (R. C., Liverpool) struck a good note here. As an enthusiast of many years standing I have yet to see a really comprehensive article on these. Let us have a detailed article on values, position, purpose, etc., in: (*a*) Battery sets; (*b*) Battery sets, H.T. eliminator fed; (*c*) All-electric sets.

Super-het Theory

As the super is attracting more and more attention, whilst most people are in a fog as yet as to its many modifications, etc., why not give us a series of articles somewhat on the lines below: (*a*) Frequency changing methods—their merits and demerits; (*b*) Pre-H.F. amplification. The pros and cons *re* number of stages, practical values, etc.; (*c*) Intermediate amplification. Maximum stages possible—effective value compared with pre-H.F. amplification, etc.; (*d*) First and second detector pros and cons. S.G., Pentode, Triode.

Super-het Practical Experimenting

Why not let us have some articles on the following lines: (*a*) Building a five or six valve super from odds and ends; (*b*) Gradual conversion of a S.G.-Det.-L.F. set into a eight-nine valve super; (*c*) Amateur construction of I.F. coils; (*d*) Amateur construction of oscillator coils.

Unusual Single-Dial Circuits

How many people can accurately gang two (or more) condensers? How many circuits have been published necessitating this, where an H.F. stage is required? Why not cater for the individual who really wants only *one tuning condenser*, together with a more or less helpful degree of H.F. amplification, even if not up to the full value possible when using a tuned H.F. stage. On the lines of: Kilodyne—Aperiodic Aerial—Tuned H.F. Transformer. Bijou 3—Tuned S.G. H.F.—Untuned Detector. Valves are so cheap nowadays that many people would not minding using two to get the same effects as with one, if the tuning can be simplified.

In conclusion, may I add my words of praise for "Ours." I do not like to draw invidious comparisons, but it simply puts all competitors "in the shade," my wireless experience extends back to *long before* broadcasting commenced—my excuse for feeling competent to pass judgment on "Ours."—F. B. (Accrington).

"A Very Fine Volume"

SIR,—I have read PRACTICAL WIRELESS since it started and I find it most enjoyable. I was one of the lucky ones who were able to get your "P.W." Encyclopædia and I am glad to say I received my copy safely. After looking through it and reading various articles, I felt that I must write and congratulate you on a very fine volume, useful to any practical wireless enthusiast. Wishing your paper every success.—J. J. GASCOIGNE (Coventry).

"A Wealth of Knowledge"

SIR,—I have received the de luxe copy of the Wireless Encyclopædia and I am pleased to say that I was surprised at the finish and binding and the wealth of knowledge inside, far beyond my dreams of what I was expecting. I have nothing but praise for it, just the mine of information that every wireless enthusiast could wish for, and in such a plain straightforward manner that anyone could understand. Please accept a reader's thanks for a very valuable book at such a small cost. Now about PRACTICAL WIRELESS. I have been a reader from the No. 1 and can say that it is just the book, at a small price, that everyone interested in the practical side of wireless construction should read. Every item is so plain and understandable that the merest novice can enjoy it. Please continue the future issues as you have begun, striving to please the ordinary man in the street. Wishing PRACTICAL WIRELESS every success in the future.—ENTHUSIAST (Eastwood).

CUT THIS OUT EACH WEEK.

DO YOU KNOW?

—THAT if the cone of a M.C. speaker moves more easily in one direction than another, second harmonics will be produced.

—THAT for direction finding purposes, two frame aerials are used, one inside the other at right-angles.

—THAT cabinet resonance in a box-type loud-speaker may be avoided by filling the cabinet with non-resonant material.

—THAT new coils will shortly be available to the home-constructor which divide the present two-range wave-band into three sections for easier tuning.

—THAT amateur transmitters now use the term "megacycles" for the wavelengths employed by them.

—THAT television is now increasing daily in popularity, and the items broadcast by the B.B.C. cover a most interesting range of subjects.

—THAT it is preferable to use separate heater supplies for valves in push-pull operated from a mains unit.

—THAT a MHO is the unit of conductivity. It is the reciprocal of resistance.

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 and 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.

"An Invaluable Reference Book"

SIR,—Many thanks for Encyclopædia just received. It is obviously an invaluable reference book and possesses a remarkably pleasing appearance. Heartiest congratulations.—D. C. GREEN (Clevedon).

"A Very Useful Book"

SIR,—My copy of Wireless Encyclopædia arrived safely, for which many thanks. It is a very useful book and I am delighted with it. That and PRACTICAL WIRELESS will supply me with all the knowledge for all constructional work.—A. S. RALPH (Catford).

"Inert" Dry Batteries

SIR,—Our attention has been invited to a paragraph appearing on page 1008 of the current issue of PRACTICAL WIRELESS in which it is stated that Inert Batteries are not available for the use of colonists situated in remote districts. As this article is liable to convey an impression that British manufacturers either do not realise or are displaying insufficient interest in the requirements in this direction of overseas customers, we venture to draw your attention to the fact that we have been manufacturing, *inter alia*, Dry and Inert cells and batteries for more than sixty years, and for many years past have manufactured batteries of the Inert type specially for H.T. purposes in connection with wireless apparatus. We may say that we have supplied and are still supplying many thousands of this type of battery annually to British and Colonial Government Departments for use overseas. In view of the above facts may we suggest that in a subsequent issue you dispel the apparent belief that no effort is being made to cater for the requirements of overseas customers.—M. A. STAPLEY, for Siemens Brothers and Co., Ltd.

A Norwegian Reader's Appreciation and Suggestions

SIR,—I have been reading PRACTICAL WIRELESS Nos. 1 to 19 inclusive, and hope I may live long enough to read many more of them, and I am also a satisfied possessor

of the Wireless Constructor's Encyclopædia. I am glad you intend to issue semi-annual indexes and binding cases. —A READER.

BALANCE METER FOR Q.P.-P. CIRCUITS

(Continued from page 1207).

This is another piece of three-ply, cut in similar manner to that of the base, but it has in addition an aperture through which the pointer is sighted. The dimensions are given in Fig. 9. The outside edge of the aperture should be rounded off. The dimensions 1⅝in. and 1 1/16in. are for the layer of ply which is removed in the same manner as the rabbet round the edge.

The Balance Meter is now ready for use. Connect the terminals as shown in Fig. 1, one pair of terminals going to one side of the circuit and the other to the opposite side. Rotate the instrument so that the pointer is directly over the line drawn on the scale. This is the only drawback to the meter, that is, it is controlled by the earth's magnetism and must therefore be arranged correctly in the earth's field. This actually is a very small point but must, of course, be remembered or a wrong setting will be obtained. If the valves have not previously been matched the needle will in most cases swing hard over to one side. The anode which is passing most current can easily be found by short-circuiting with a piece of wire or a screwdriver each pair of terminals in turn. If on shorting one pair the needle swings hard over to the other side of the scale, then that pair of terminals is connected to the anode taking most current. If the needle swings to the same side whichever pair of terminals are shorted reverse one pair of leads. The terminals can then be marked for future reference. Adjust the screen voltage of the lower valve until the needle is over the line on the scale. It may not be possible to get an exact balance if the tappings of the H.T. battery are relied upon only, but the meter is sufficiently sensitive to show a discrepancy of less than 0.1 of a milliamp on either side.

RADIO CLUBS & SOCIETIES

THE SOUTHALL RADIO SOCIETY

That this Society considers that pentodes have better characteristics than triodes for modern circuit design was a motion which was lost in a debate held at a meeting of this society recently. The speakers for the motion were Mr. G. Lee and Mr. L. Swan; against, Mr. A. Stephens and Mr. H. Rayner. Points from the speakers in favour of the pentode were: (a) High amplification factor, (b) High frequency response was useful in Superhet and band pass designs to make up for attenuation, against: (a) Small grid swing; (b) Tone correction necessary with added expense.

SMETHWICK WIRELESS SOCIETY

At a recent meeting of this society, Mr. Valentine gave a most interesting lecture-demonstration of various L.F. circuits. By using a dual gramophone amplifier, the lecturer demonstrated the different effects produced by various couplings between valves and between output valve and speaker. He also showed the effect of using valves of different amplification factors and how reproduction was marred by incorrect bias and output couplings. He then went on to show how tone could be adjusted first by means of a tone compensating transformer, and then by means of introducing intentional resonances in the L.F. amplifier. Hon. Sec., Mr. E. Fisher, 33, Freeth Street, Oldbury, Nr. Birmingham.

HACKNEY RADIO AND PHYSICAL SOCIETY

At our meeting held on February 20th we had great pleasure in listening to a most interesting lecture on "Tone Control," given by Dr. L. E. C. Hughes. The talk covered the whole subject of sound reproduction, measurement and control and the lecturer's remarks were amplified by lantern slides. Two slides in particular were of great interest. The first of these showed a graph of amplification plotted against frequency, and the second slide dealt with the directive and sound-distributing qualities of various types of loud-speakers.—A. F. Rogerson, Hon. Secretary.

CROYDON RADIO SOCIETY

At a recent weekly meeting held at the Horse and Groom, Cherry Orchard Road, East Croydon, Mr. Parr demonstrated the Cathode Ray Oscillograph. Describing its construction, he said the cathode was an ordinary loop filament, in front of which was the positive anode having a hole in its centre, through which shoot the electrons. Means were taken that these should be conveyed to a beam which showed on the fluorescent screen on the other end of the bulb as a fine green point. Then by a positive plate placed above and a negative one below the beam, and just in front of the anode, the beam was deflected upwards. Thus, with a linear time scale and different frequencies applied to the deflecting plates, these frequencies could be seen as a green line in the mirror, vibrating up and down. Applications were numerous, such as the human voice *via* a microphone, though the society's technical adviser made the line zigzag until it shot off the screen! The output from a wireless receiver was connected, and it was seen what the weather forecast looked like against jazz. Actually, both were interesting pictorially, but not orally! The Society is anxious to send its full programmes to PRACTICAL WIRELESS readers interested in its activities. Hon. Sec., E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

GOLDERS GREEN AND HENDON RADIO AND SCIENTIFIC SOCIETY

At a recent meeting of the Golders Green and Hendon Radio and Scientific Society, held at the Hampstead Art Gallery, an interesting lecture and demonstration of 16 mm. Home Talkies was given by Mr. Humfrey Andrewes, B.Sc., A.C.G.I., A.M.I.E.E.

At another meeting of this society, held recently, a talk by Mr. Alexander Black on Tone Correction was eagerly followed.

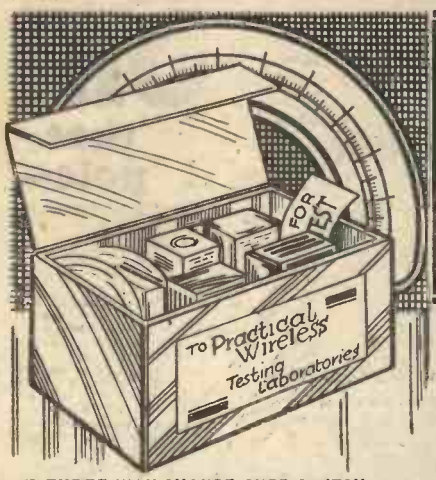
A specially interesting meeting has been arranged for March 22nd, when Mr. G. G. Blake, M.I.E.E., F.Inst. P., will describe and demonstrate his new *Radiometric Condenser*, controlling an oscillating circuit by radient heat, also a Crookes Radiometer and a Thermopile. A copper Oxide photo-electric cell will also be constructed and then tested, and if time permits, other scientific experiments will be shown. It is hoped that Sir Ambrose Fleming, M.A., D.Sc., F.R.S., will be able to take the chair. H. Ashley Scarlett, President.

THE CREWE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY

An interesting evening was spent by members and associate members of this society recently, when Mr. Hornby lectured on the manufacture of the modern Superheterodyne. The lecturer dealt with the subject in a most interesting and clear manner, and by means of diagrams, explained the action of the Automatic Volume Control applied to mains sets, also the new "Push-Push" output stage incorporated in battery models. Anyone interested in Radio is invited to communicate with the Hon. Secretary, Mr. R. Peach, 84, West Street, Crewe.

SLADE RADIO

A lecture entitled "The Output Stage," was given by Mr. F. Youle, B.Sc., A.C.G.I., A.M.I.E.E., at the meeting of the above society held recently. After giving a brief outline of the various forms of L.F. amplification from the old Push-Pull of 1914-15, he went on to describe the present systems of Quiescent Push-Pull and Class B. Dealing with the subject in an unusual manner some extremely interesting points were raised and many of the side issues explored. Hon. Sec., 110, Hillaires Road, Gravelly Hill, Birmingham.



Facts and Figures

Components Tested in our Laboratory

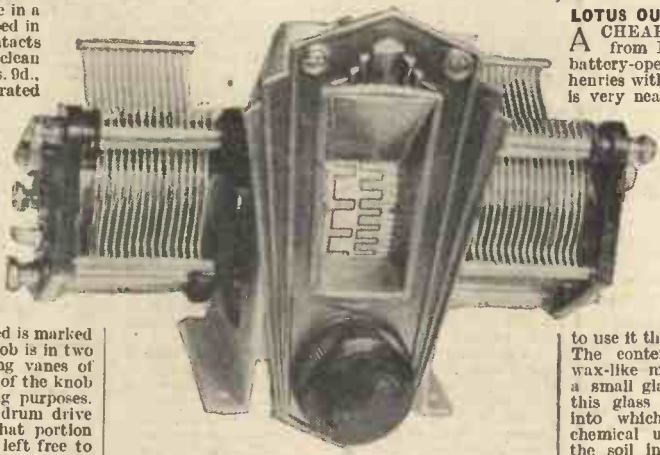
BY THE PRACTICAL WIRELESS TECHNICAL STAFF

W/B THREE-WAY CHANGE-OVER SWITCH

A NOVEL development in switches of the rotary type is illustrated herewith. This is a production of the Whiteley Electrical Radio Co. (manufacturers of the famous W/B Speakers), and is a very substantial component. The operating mechanism is an ebonite triple-cam arrangement, shown in the centre of the illustration, and this operates against the spring contacts shown round the edge of the back plate. There are very many uses for a device of this type in a modern receiver, and it is also being developed in two-way and single-way models. The contacts are of nickel silver and have been found to clean very well in use. The single-way will cost 1s. 9d., the two-way 2s. 6d., and the model illustrated will cost 3s. The mechanism is the subject of Letters Patent.

TELSEN DRUM-DRIVE ASSEMBLY

THE ingenious assembly shown on the right is a complete two-circuit tuning arrangement possessing many novel features. Two .0005 logarithmic condensers (with right-hand and left-hand drive) are fitted on each side of a very rigid assembly containing a drum-type drive. This operates by means of a cord drive, which is held in tension by springs at each end. A very neat oxidized escutcheon is fitted, and the actual scale which is provided is marked in wavelengths in metres. The control knob is in two sections, one of which rotates the moving vanes of the two condensers, and the other portion of the knob acts in an ingenious manner for trimming purposes. The two condensers are attached to the drum drive by means of one-hole fixing nuts, and that portion which received the left-hand condenser is left free to move over a small area. The front knob is connected (by a cord drive) to this section of the drum, and therefore the whole of the stator of the left-hand condenser may be moved through a few degrees. To enable the user to ascertain what movement has been made, a small pointer is attached to the moving part of the dial, and this is located immediately at the rear of the ivorine scale. The latter is illuminated by means of a small pilot lamp, and the pointer casts a shadow on the dial. The accurate re-setting of the tuning condensers for any station is therefore an extremely simple matter. The complete assembly costs 17s. 6d.



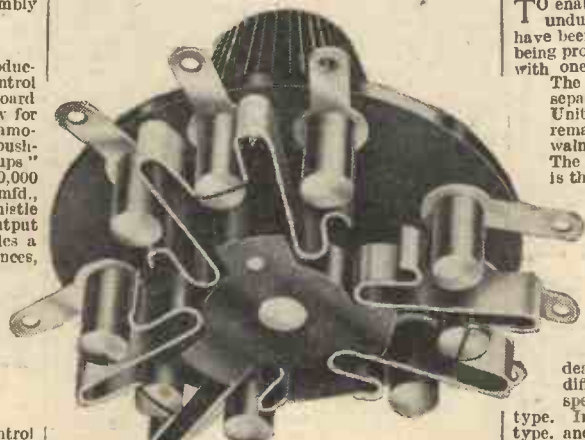
The Telsen drum drive assembly.

Q.P.-P. AND P.A. TONE CONTROL

MESSRS. Ward and Goldstone are shortly producing two new tone controls. The Q.P.-P. control is a single bush panel fixing or two screw baseboard mounting. It includes a Q.M.B. Switch to allow for proper audio-frequency control on radio and gramo-pick-up. As an impedance limiting device with push-pull pentodes, its effect is more severe on "pick-ups" than on radio. The values of .005 mfd. and 20,000 ohms total have been chosen for radio and .005 mfd., and 5,000 ohms for pick-up, or heterodyne whistle elimination. Another type of normal pentode output arrangement called "P.A." Tone Control includes a .01 mfd. condenser with the above values of resistances, 20,000 or 5,000 ohms. This unit is also suitable for quiescent push-pull where a more severe degree of radio control is considered desirable. On single pentodes the degree of audio high-frequency control on the "P.A." is similar to the Q.P.-P. type used with push-pull. The price is 5s. each, complete. Direct mounting on metal panels is possible, as the "live" parts of the Q.M.B. are insulated from the frame. The condensers in the units are tested to 1,500 volts D.C. No electrical breaks occur in the tone control circuit when switching with Q.M.B., and, consequently, large voltages cannot build up in the pentodes owing to accidental "open" loud-speaker circuits.

WARD & GOLDSTONE MAINS CHOKE

ALTHOUGH a D.C. Mains user considers himself lucky in not needing rectifying apparatus, it is still essential, in many cases, to smooth the supply, as there is very often a very distressing commutator ripple with this form of supply. This is especially the case for listeners who have D.C. operated valves of the indirectly-heated type. Messrs. Ward and Goldstone, makers of the well-known "Goltone" apparatus, have produced a most interesting form of H.F. choke for this purpose, and it will be found a very effective component. A paxolin former, 2in. in diameter, is wound with heavy gauge green-covered wire to an inductance of approximately 270 μH, and the D.C. resistance is .75 ohm. The former is attached to a moulded bakelite base fitted with two substantial terminals. The makers state that the choke will carry current up to approximately .6 ampere without an appreciable increase in temperature. They also claim that an increase of efficiency in D.C. mains sets of 10 to 25 per cent. is assured by using two of these chokes, in addition to the elimination of the hum. The price is 3s. 6d. To enable the Goltone coils to be conveniently mounted and ganged, metal chassis are now available in 2, 3 and 4 coil mountings. The 2 coil costs 1s. 6d., the 3 coil 2s., and the 4 coil 2s. 6d. The holes are arranged so that vertical or horizontal mounting is possible, and by means of the slots and special extension terminals provided under-baseboard wiring is possible. Thus two coils, with chassis, and the special sub-baseboard terminals will cost 13s. 10d. complete. This represents a saving of twopence over the purchase of the coils, chassis and terminals separately. Messrs. Ward and Goldstone also inform us that later in the season they intend to produce new types of chassis, complete with internal switching, thus completing their entire range of coils.



The new W/B rotary switch.

BULGIN "FUSEPLUG"

A VERY ingenious "Fuseplug" is being sold by Messrs. Bulgin and will be found invaluable to the listener who uses a mains-operated radiogram. In appearance it resembles the normal 5-amp. two-pin plug for insertion into a power point. It is in two parts, however, and contains two 1-amp. fuses in the leads between the pins and connecting screws. It therefore prevents the house fuses from blowing in the event of a short-circuit in the wireless apparatus. The standard 1in. type fuses are used, and these are obtainable at 6d. each. The "Fuseplug" costs 2s. complete with the two fuses.

LOTUS OUTPUT CHOKE

A CHEAP but efficient output choke is obtainable from Lotus Radio. This is intended for small battery-operated power valves, and is rated at 20 henries with a D.C. resistance of 720 ohms. The choke is very neat and will be found very useful for small receivers where the output valve does not pass more than about 10 mA. The price is 5s. 6d.

FILTRON

THE importance of a sound earth connection has continually been brought to the notice of our readers, and one of the latest methods of ensuring a continually damp earth has just been brought to our notice. This is known as "Filtron," and is a chemical contained in a small copper pot. A terminal is attached to the side of this pot, and to use it the earth wire is attached to this terminal. The contents of the pot are covered with a red wax-like material from the centre of which projects a small glass tube. When ready to use the device, this glass tube is removed, and this leaves a hole into which water may pass, and so reach the chemical under the red seal. If the condition of the soil in which it is to be buried is very dry, several more holes may be pierced in the red sealing compound with a nail. The copper pot should be buried about a foot below the surface, and a pint or two of water poured over it. The earth connection is then always in a very damp condition, and even the hottest summer day will not result in weak signals owing to dryness of the soil surrounding the earth connection. The device is marketed by Amplion (1932) Ltd., and costs 2s.

DIRECT RADIO BAFFLE-BOARD

TO enable really large volume to be handled without undue baffle resonances many interesting schemes have been proposed. A very interesting design is now being produced by Direct Radio, and is being marketed with one of the Celestion Matched Units attached. The baffle consists of two 30in. square boards, separated by a small air space. The Speaker Unit is attached to one of these boards, and the remaining board is veneered with a polished walnut front to present a neat appearance. The interior air space separating the two boards is then packed with Kapok, and this results in a perfectly non-resonant baffle, with a much better musical response. Booming, chattering, etc., are removed, and the design certainly represents an improvement over the normal type of baffle. The complete assembly, with the Matched Unit Celestion speaker, is £3 17s. 6d.

CELESTION Q.P.-P. SPEAKERS

A FURTHER interesting feature of the dual Celestion speakers which was not dealt with last week is that there are three different types available. In one, the two speakers are of the permanent field magnet type. In another, the two fields are of the energized type, and in the remaining model, one is of the permanent magnet type and the other has an energized field. The price in each case is £4 5s. The single model Celestion Speaker is of the Hy-flex type and is of similar characteristics to those employed in the dual unit. With all types of speaker used in the Q.P.-P. circuits it was found desirable to retain the tone compensating arrangement of resistance and condenser with values of .01 mfd. and 10,000 ohms, across the anodes of the two output valves.

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.

SPEAKER FIELD FOR BIASING

"I have a well-known make of moving-coil loud-speaker with a field resistance of 2,500 ohms. I do not want to use this for smoothing the H.T. supply, as this only delivers 200 volts, and I cannot afford to waste the voltage which would be dropped through the winding. On the other hand, I do not wish to buy or make up a separate eliminator for this winding. I understand that I can, however, use the winding for biasing the output-valve. Is this so? How do I adjust it to give me the correct voltage—it will give much too high a voltage as it stands, as the anode current is 50 mA, and only 33 volts grid-bias are required. I do not want to interfere with the actual winding of the field."—(R. T., Guildford.)

We presume that your output-valve employs a filter circuit for the loud-speaker, and, therefore, the following method should be adopted for using your field winding for bias purposes. The filter condenser should be joined to the anode of the output-valve, and the loud-speaker should have one lead joined to the other side of the filter condenser. The remaining speaker-lead should then be joined to one side of the field winding, the other side of which is joined to H.T.—. The centre tap of the heater winding should be joined to the junction of the loud-speaker and field winding, and from this point one end of a 13,000 ohm resistance should be connected. The other end of the resistance is joined to H.T.—. It may be found necessary to decouple this circuit with the usual values of condenser and resistance (250,000 ohms and 2mfds.).

The "FURY FOUR"

"I intend, after arriving home on the 17th, to make up the 'Fury Four.' We use a D.C. eliminator with three positive tappings, No. 1: 40 to 100 variable suitable for screen voltage, also for anode voltage of detector valves taking not more than 2.5 mA.; No. 2: 80 to 130 variable suitable for valves up to 10 mA, and No. 3: 150 volts fixed total capacity 15 to 50 mA. As the 'Fury' is designed as a battery set, with resistors instead of H.T. intermediate tappings, I should be much obliged if you could give me instructions to suit the eliminator or other idea."—(J. P., Gibraltar.)

We would not advise you to remove any of the resistors in the "Fury," as these serve not only as voltage droppers, but as decouplers, and, therefore, if your eliminator tappings are provided by, for instance, a potential divider, you may find that the receiver will be unstable. Our advice is, therefore, to make up the receiver exactly as described, and to use only the third tapping on your eliminator, that is, the one delivering the maximum voltage. You will find, then, that the receiver will function exactly in the same manner as with a battery, providing perfect stability with maximum amplification in all stages.

DUAL-WAVE COIL

"I should be glad if you could instruct me in the making of a reaction coil for a four-pin coil with a reaction winding to suit the high-wave coil (900 to 2,000 metres). What gauge of wire would be required?"—(W. J. B., Swansea.)

The winding should consist of, approximately, sixty-five turns of No. 34 or 36 D.S.C. wire. This should be wound in a hank, and situated on the former about ¼in. from the commencement of the long-wave winding, and with a space of about ¼in. from the end of the medium-wave winding. The finish of the reaction-winding should be joined to the finish of the long-wave winding, and all windings should be in the same direction. The four pins will be (1) commencement of medium-wave winding; (2) commencement of reaction-winding; (3) junction of finish of medium-wave winding and commencement of long-wave winding, and (4) finish of long-wave winding and reaction-winding. The wave-change switch (of the ordinary on/off pattern) is joined from (3) and (4).

SHORT-WAVE ADAPTOR

"I have a 5-valve American set, differing from the ordinary set in that the coils are fixed. It is a neutrodyne circuit, having two stages of high frequency, detector, two stages of low frequency. The reception I have had since I bought it has been trouble-free, but could you please inform me why it is that the adaptors and converters usually made that will operate on other sets I have been informed will not work on my set? I notice in this week's 'Practical Wireless' a converter that seems to be just the thing I require to bring in the short waves. Will it combine with my set? If not, can you put up a circuit that will?"—(C. E. S., Towns River, Union of South Africa.)

The most suitable arrangement for use in conjunction with your set is the adaptor described on page 905 of PRACTICAL WIRELESS, No. 19. This is plugged into your detector-valve socket, and, therefore, your neutrodyne stages are isolated, and the fact that fixed coils are employed will not affect the functioning of the receiver. With this arrangement, you will be employing a detector valve followed by two L.F. stages and you will find that this has a really excellent range, and is very simple to handle. We would not advise the use of a converter with the particular make of receiver which you have got.

DATA SHEET No. 25.

HANDY FORMULÆ.

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

Resistances and capacities in series and parallel.

Resistance in series: $R = R1 + R2$

Resistances in parallel: $R = \frac{R1 \times R2}{R1 + R2}$

Capacities in series: $C = \frac{C1 \times C2}{C1 + C2}$

Capacities in parallel: $C = C1 + C2$

LONG-WAVE DIFFICULTY

"I have a small home-made two-valver employing detector and power valve, operated by an eliminator from the mains. I get remarkably good results on the short waves, but reception on the long waves is very poor indeed. Could you tell me the cause of this? I am using a commercial dual-range coil. Perhaps you could kindly suggest something to cure this."—(A. H. N., Taunton.)

The failure to get good reaction effects on the long waves may be due to an inferior H.F. choke, or a bad aerial and earth system. Overhaul the latter, and make quite certain that the earth connection is not broken, and then try the effect of a new or different H.F. choke. If this has no effect, then the dual-range coil itself, or the wave-change must be blamed for the fault.

LOW VOLTAGE MAINS

"Four months ago I bought an H.T. mains unit for use with 220-volt mains. I am now moving, and the house where I am going has a voltage supply of 110. Could you tell me the best course to take; I don't want to part with it, as it has never caused any trouble whatever and always gives good results."—(H. E., Wimbledon.)

The periodicity of 110 volt mains is usually lower than the higher voltage supply, and really the best course to adopt is to try to find someone locally who is situated in the reverse position to yourself. That is, someone who is moving to a district where the supply is higher, and try to get the two units exchanged. The unit as it is at present will not be suitable for the new supply, and the only method of using it is to get a transformer manufacturer to make you up a transformer with an input suitable for your present supply, and a secondary suitable for connection to the input of the unit. There is no other solution.

S.G. ANODE COMPONENT.

"I am making up a small receiver in which I wish to use a screened-grid valve as a detector. Is it advisable to use an ordinary L.F. transformer direct coupled with this valve? What I mean is, may I include the primary of the transformer in the anode circuit direct? I appreciate that the S.G. type of valve has a rather high impedance, but I do not know whether this precludes the use of a transformer in the manner I suggest. Your advice would be esteemed."—(R. X. S., Hanwell, W.)

The high impedance of the S.G. valve demands that the anode impedance shall also be high if full advantage is to be taken of the principal features of this type of valve. Therefore it is always preferable to use a resistance having a high value in the anode circuit, and so parallel feed the L.F. transformer. You will find that by this means you will obtain the maximum amplification, as well as a more even response over the entire musical scale.

NEW TYPES OF COILS

"I see from previous articles in your pages that in the near future some new types of coil will appear on the market. I should like to make up one of the receivers which you are at present featuring, but I am rather anxious to know whether this will not be obsolete by the time I have finished it, owing to the introduction of these new coils. Shall I go ahead with the receiver, or would you advise me to wait for the new coils?"—(D. J., Windsor.)

The new coils will not be cheap. Furthermore, as with the majority of new ideas, some time must elapse before the arrangement becomes perfected. In addition there are other points which lead us to say, go ahead with the present set. If at some future date you wish to take advantage of the new coil development, you will not find it difficult to incorporate them in an existing set. If you wait to see the new development, the same thing will be continually recurring in wireless, and as soon as one idea is brought forward some new scheme is proposed, and you would never get a receiver made up if you kept postponing the construction pending the arrival of a new idea.

SCREENING

"My receiver is a S.G., detector, and L.F. set, and I use a single coil of the dual-range type in a metal can. I have just bought this, as I am modernizing the set. The H.F. choke is a home-made one, wound on a 1in. tube, and I wonder whether I ought to buy a screened choke to match the tuning coil, or whether the present choke will still do? It is a most efficient component, and works on the two wavebands in a perfectly satisfactory manner."—(W. L. K., Cleethorpes.)

There is no object in screening the choke. As you only employ one tuning coil, and this itself is screened, there is no risk of interaction between the choke and the tuning coil. Of course, we assume that there is no other component in your receiver with which it is possible for interaction to take place. If, however, you use two chokes, or have some other component which possesses inductance, then the two should be arranged at right angles. But provided the choke is working to your satisfaction, there is no need to buy a screened one.

FREE ADVICE BUREAU COUPON

This coupon is available until March 18th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 11/3/33.

CATALOGUES RECEIVED

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.

COLUMBIA RECEIVERS AND RADIOGRAMS

WE have received an attractive catalogue from the Columbia Graphophone Co., Ltd., dealing with a wide range of their receivers and radiograms. Amongst the various types included are two- and three-valve battery sets, four-valve all-electric and seven-valve superhet models. In the radiogram section there is the popular Radiograph Four, a highly efficient 4-valve instrument embodying all the latest improvements. The selling price is 32 guineas for the A.C. model and 34 guineas for the D.C. instrument. Also listed are Auto-Radiograph Superhet Seven, and the Auto-Radiograph "De Luxe Ten." Readers interested should obtain a copy of this catalogue by applying to the firm at 98-108, Clerkenwell Road, London, E.C.1.

BELOW 10 METRES

(Continued from page 1180.)

Your first tests on ultra-short waves may not be very inspiring due to the absence of signals, but remember there are not many to be had as yet, although this state of affairs will undoubtedly be remedied in the very near future. If you try again later your persistence will probably be well rewarded, and you will have the great satisfaction of knowing that you are right up to date and ready to take full advantage of the very imminent future developments. But even if this knowledge fails to comfort you, make other coils having more turns, and use the adaptor temporarily as a normal short-waver. A tuner made in the manner previously described, and having seven turns for the aerial coil and five for reaction, will carry you over the 20-metre waveband, and by using still more turns other wavelengths can be reached. It is not worth while to make a large tuner and short-circuit tuners for wavelength adjustment.

Having made the receiver, the first difficulty will be to make it oscillate, but this may be overcome by experimenting with different aerials and by adjusting the capacity of the series-aerial condenser. In my experience the best aerial is a short one, consisting of not more than 15ft. of wire and erected vertically, but it might often prove beneficial to reduce the length to only 5 or 6ft.; you must experiment in this direction. Oscillation can be detected by a distinct "double-plop" heard when the aerial terminal is touched with a moistened finger. A better way, however, is to connect a milliammeter between the H.F. choke and the valve plug; the reading will suddenly drop as oscillation sets in and rise again as reaction is slacked off.

Replies to Broadcast Queries

FRISKY (Southend-on-Sea): WCAU, Philadelphia (Pa) on 256.3 m.; Columbia Broadcasting System. NIBLICK (Ealing): Nyiregyhaza (Hungary), relays Budapest on 267.8 m. BRS 1038 (Herne Bay): (1) Yes, WIXAZ, East Springfield on 31.35 m., relaying Boston (Mass.); (2) VK2ME, Sydney (N.S.W.) on 31.28 m.; (3) Rabat (Radio Maroc) on 32.26 m.; interval signal heard apparently CTIAA, Lisbon (31.25 m.); (4) HVJ, Vatican (Rome) on 50.26 m. SEARCHER (Cheshire): (1) Tropical Radio Telegraph Co. New Orleans (La). U.S.A.; (2) American Tel. and Tel Co., Lawrenceville (N.J.); (3) Possibly PAOARS, Amsterdam, 80 m. (3,750 kc/s); (4) Radio Colonlale, Pontoise, Nr. Paris, France. ONE VALVE (Faringdon): G6PS, A.F.M. Parsons, 358, Beverly Road, Hull (York); G5SZ, J. W. Riddiough, Tranmere Park, Guiseley (York); G2XP, J. P. Payne, 53, Otley Dr., Ilford, Essex, GFHK, regret, cannot trace; G6NF, A. D. Gay, 49, Thornlaw Road, West Norwood, S.E.27, London; G5ZI, regret cannot trace; G2EE, cannot trace; O5RO, cannot trace; G5WE. cannot trace; G5JB, J. S. Bamford, 14, Fountainhall Road, Edinburgh; G5RS, E. W. Rawlings, 20, Hedgeway, Onslow Village, Guilford, Surrey; G6LI, A. E. Livesey, Stourton Hall, Horncastle, Lincolnshire; G5YK, G. W. Thomas, 169, Hills Road, Cambridge; G2YI, R. C. Horsnell, "St. Neots," Wick Drive, Wickford, Essex; G5PQ, W. F. Moore, 17, Lawn Road, Uxbridge, Middx. G2OB, cannot trace. For unidentified calls advise you to write to Radio Society of Great Britain, 53, Victoria Street, S.W.1. W2HY. Geo. Petersen, 820, 40th Street, Brooklyn, N.Y.; W2OCJ, cannot trace.

THE PROBLEMS OF FAITHFUL REPRODUCTION

(Continued from page 1137, March 4th issue.)

FORTUNATELY the use of a pentode valve in the output stage gives us a convenient and simple method of correction for such cases, for the pentode tends to give undue prominence to the high notes. Also, the use of a condenser across the output terminals in this case gives us an easy and correct means of varying this effect as we please. The need for any specified value can be avoided by using a value larger than necessary with a variable resistance in series, by which its effect can be varied. In the cases where a pentode valve has replaced a triode, the same method will often assist in removing the "screech" which is usually produced.

Many sets, well designed in the first place or carefully adjusted later, will give very faithful reproduction of what they receive in the form of signals. But stations will heterodyne, and needles will scratch, and so what we receive is not always what we want (or deserve), and so we must sacrifice to some extent our ideal of perfection, and try to achieve the nearest we can to it under difficulties.

In general the solution to both problems lies in providing some means of maintaining the high-frequency response at its correct value up to a certain point, and then providing a sharp cut-off.

ADVERTISEMENT INDEX

MOVIE MYSTERIES EXPLAINED

SOME remarkable "behind-the-scenes" photographs showing how parts of London were rebuilt in Hollywood for the film "Cavalcade" are a feature of the March issue of "Home Movies and Home Talkies". How to develop your own 9½ mm. films at low cost and numerous other hints for home cinematographers help to make it a "bumper" number. Scouts will be particularly interested in a description of how the famous scout film "The Trail of Youth" was made in Devonshire, and how many of the thrilling incidents were "faked."

P. W. Gift Stamp No. 24

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Presented with PRACTICAL WIRELESS, dated March 11th, 1933.

"PRACTICAL WIRELESS" DATA SHEET No. 12

HANDY FORMULÆ

AMPLIFICATION.

Of a tuned circuit .. $= \frac{\omega L}{r}$

Where r = equivalent series resistance.

CAPACITY.

Capacity of a condenser :

(a) With parallel plates $C = \frac{Ak}{11.31 \times 10^6 \times d}$ mfd.

(b) Spherical plates $C = r/9 = 10^5$ mfds.

Capacity of a horizontal aerial :

$$C = l \div \left(4.144 \times 10^6 \log_{10} \frac{4h}{d}\right) \text{ mfd.}$$

where l = length in cms.
d = diameter in cms.
h = height above earth in cms.
A = total area in cms. of one plate.
r = radius in cms.

Capacities in series $C = \frac{C_1 \times C_2}{C_1 + C_2}$.

Capacities in parallel $C = C_1 + C_2$.

FREQUENCY.

$$f = \frac{\sqrt{10^6 \times 10^6}}{2\pi\sqrt{LC}}$$

INDUCTANCE.

Inductance of a straight wire $L = 2l\left(\log_e\left(\frac{2l}{r}\right) - 1\right)$ cms.

Inductance of a solenoid $L = 4r^2 a^2 N^2 b^2$.

Inductance in series (with no mutual inductance)
$L = L_1 + L_2$.

Inductances in parallel (with no mutual inductance)

$$L = \frac{L_1 \times L_2}{L_1 + L_2}$$

L = Inductance in cms.
N = Turns per cm.
b = Overall breadth of coil in cms.
r = radius of wire in cms

IMPEDANCE.

In a circuit with Resistance, Inductance and Capacity in series.

$$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2} = \sqrt{R^2 + X^2}$$

OHM'S LAW.

$$I = \frac{E}{R} \qquad E = I \times R \qquad R = \frac{E}{I}$$

For A.C. circuits $I = \frac{E}{2\pi fL}$

REACTANCE.

Of a coil .. .. $X = 2\pi fL$

Of a condenser .. $X = \frac{1}{2\pi fC}$

Net reactance .. $X = X_L - X_C$

At resonance .. $f = \frac{1}{2\pi\sqrt{LC}}$

RESISTANCE.

$$R = \frac{E}{I}$$

Of a tuned circuit .. .. $R = \frac{L}{C \times r}$

Where r = equivalent series resistance.

Resistances in series $R1 + R2$

Resistances in parallel $\frac{R1 \times R2}{R1 + R2}$

WATTAGE DISSIPATION.

$I^2R = EI$

WAVELENGTH.

Wavelength (in metres) $= \frac{\text{Velocity}}{\text{Frequency}}$

Of a tuned circuit — $\lambda = 1885\sqrt{LC}$

Where L = microhenrys.
C = microfarads.
$\lambda \times f = 300{,}000{,}000$

To convert Wavelengths (in metres) to Frequency (in kilocycles), divide 300,000 by the Wavelength.

To convert Frequency (in kilocycles) to Wavelength (in metres), divide 300,000 by the Frequency.

VALVE FORMULÆ

AMPLIFICATION FACTOR.

$$\mu = \frac{\text{Change in anode volts}}{\text{Change in grid volts}}$$

IMPEDANCE. (This is actually A.C. resistance)

$$Ro = \frac{\text{Change in anode volts}}{\text{Change in anode current}}$$

MUTUAL CONDUCTANCE.

$$= \frac{\text{Change in anode current}}{\text{Change in grid volts}}$$

TABLE OF SYMBOLS USED IN WIRELESS AND ELECTRICAL FORMULÆ

Amplification	A	Henry (unit of inductance)	H
,, factor	μ (Mu)	Impedance	Z
Ampere (unit of current)	A	Inductance	L
Current (R.M.S. value)	I	Mutual inductance	M
,, (instantaneous)	i	Ohm (unit of resistance)	Ω
Capacity	C	Power	P
Energy	W	Resistance	R
E.M.F. (voltage—R.M.S. value)	E	Reactance	X
E.M.F. (instantaneous)	e	Wavelength	λ
Farad (unit of capacity)	F	2πf	ω