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“SKYSCRAPER” RADIO
ALL-ELECTRIC AS WELL AS BATTERY-DRIVEN

Now the lighter evenings are testing your old radio set. It cannot give you the volume or the range you want because in the summer signal strength is reduced and foreign stations fade when you are using an ordinary set. Now is the time you need the “SKYSCRAPER” and now you have the longer evenings to build it in! “SkyScraper” Radio will give you even in summer-time all the volume and all the range you can possibly want — it will give you always a galaxy of programmes at full entertainment strength — it will make radio enjoyable all-the-year-round for you. There is such a reserve of power in the “SkyScraper” circuit that you will practically never want to use it at full strength.

And Lisson have made it simple for you to build. You can’t go wrong, for clear and in detail are the instructions and the many photographs given in the GREAT FREE ” SKYSCRAPER” CHARTS THAT SUCCESS IS CERTAIN. You can build it in the holiday period, and such a convenient Chart has been given to simplify the building of the home constructor. You can choose whether you will have an All-Electric or a Battery-driven “SkyScraper.” Whenever you buy and build you can be certain that you are getting much greater value by building yourself and a much more up-to-date receiver than if you spent the same money on any factory-built set.

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ALL-MAINS MODEL
The All-Electric “SkyScraper” is the first completely SAFE and completely PRACTICAL All-Mains Receiver ever produced for the home constructor. It embodies two special safety features never before put into a home constructor’s kit—a self-contained SAFETY MAINS POWER UNIT which you connect up just like a battery, and a SAFETY FUSE PLUG which gives your set absolute protection. One Dial Tuning with Single Knob Volume and Reaction Control—4 matched valves with Single Knob Volume and Reaction Control—4 matched valves with Full Power Moving Coil Loudspeaker.

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The Battery-driven “SkyScraper” is the most powerful battery set ever put into the hands of the home constructor. It is the ONLY battery set kit employing Metal-ised R.C. High-Mu Detector and Economy Power Pentode Valves, and is sold complete to the last nut and screw, including these three valves. Yet the current consumption of these three powerful valves is less than that of an ordinary three-valve set—less than 8 mA and makes the SKYSCRAPER economical to work off ordinary H.T. batteries.

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THE PAPER WHICH HAS BECOME FIRST!

Chasing the Nightingale

THE annual B.B.C. hunt for the Nightingale will take place during the period May 22nd to 27th, in the intervals of the late dance music transmission, when an attempt will be made to relay his song for the benefit of listeners. The engineers consider theirs a thankless job as, although a microphone is placed near a bush which has been located for several nights as one of the bird’s favourite spots, when the time comes for him to go on the air he either refuses to sing or it is discovered that he has flown elsewhere. However, stand by for the usual annual thrill, comparable only to the first call of the cuckoo in spring!

Belgian Colonial Transmitter

The Belgian Posts and Telegraphs have installed a short-wave transmitter, in the neighbourhood of Brussels, for the broadcast of news bulletins and wireless entertainments to the Congo. The station may be heard working in the early hours on 30 metres. The broadcasts are picked up at Leopoldville where, later, a station to work on a medium wavelength will be installed.

Germany’s Listening Concessions

Tests show that the Reichsfunk has granted free licences to no less than 358,125 listeners who come under the heading of unemployed, blind or war invalids; these figures represent twelve per cent. of the total number of licences in force at that date, namely, 4,692,989.

Spring-cleaning the Czech Rooster

Listeners may have noticed that the crowing of the cockerel, which opens the early morning Prague broadcasts, has lately taken on a more youthful tone. It is, in fact, a different bird. A record of the newcomer’s greeting to the rising sun was recently made on a farm in the neighbourhood of the capital. Several competitors were tested until the engineers were satisfied that they had, at long last, discovered an ideal cock-crow for their purpose.

The Dublin Relay Station

As reception of the more powerful Athlone broadcasts in the environs of Dublin is not entirely satisfactory to the users of old crystal sets, the Free State authorities may shortly bring the old 1 kilowatt transmitter into operation as a relay for listeners in the capital.

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This fact demonstrates that we have more closely approached the real definition of the word "service" than anything to which our readers have formerly been accustomed.

"PRACTICAL WIRELESS" has obviously filled the gap—how apt these clothes are!—which has existed for twelve years!

"PRACTICAL WIRELESS" exists to serve its readers and our efforts have been rewarded by many thousands of letters of praise from readers and manufacturers in the whole world over.

Our contributors are men specially selected, not for their journalistic abilities alone, nor for the use of their names, but also because of their sound technical knowledge of wireless, because of their extensive workshop experience, because they have all had drawing office and design experience, because of their knowledge of the needs of the home constructor, and because they combine those qualities with an accomplished style of writing easily assimilated by the non-technical.

"PRACTICAL WIRELESS," always has first-hand information of the latest developments, and it loses no time in preparing designs incorporating those developments. When our Laboratories are absolutely satisfied with the results obtained the design or the information is immediately placed before our readers. We do not strive to be first merely for sake of being first, but the fact that we have in most cases been FIRST WITH THE NEWS or the DESIGN is a tribute to the energy, enthusiasm and efficiency of our staff and our organization.

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To have become first shows progress. To have been first merely proves age.

THIS IS REAL READER SERVICE!

An Island in the Pacific Ocean

A GROUP of some two hundred members of the Hungarian professional classes who, owing to present economic conditions, are unable to earn a living in their native land, have approached the authorities to secure from some foreign country, preferably Great Britain, the loan or lease of an island in the Pacific Ocean where a new colony could be established. The settlers, it is stated, would remain in touch with the Mother Country by means of wireless; the installation of the necessary apparatus would be carried out by members of the party.

Italian Broadcasts for Albania

In view of the fact that attempts to establish a broadcasting system in Albania have not met with success, and that transmissions from the Bari studio are well heard in Durazzo, the Italian authorities propose to devote certain hours of the weekly programmes to special entertainments in the Albanian language.

Radio-Normandin’s Carillon Concerts

The Fécamp studio proposes to carry out regular relays of carillon and choral concerts from the Rouen Cathedral, to which the belfry contains twenty-nine bells. The first of these attempts may have already been heard by readers, as it was proposed to inaugurate this feature on Saturday, April 29th. They will take place at 8.30 p.m. B.S.T.

Broadcasts on 38,710 Kilocycles

The B.B.C. short-wave transmitter which has been operating experimentally on 7.75 metres (38,710 kc/s), is situated at the top of Broadcasting House; its power is roughly 220 watts. The transmissions are carried out by means of an aerial suspended from masts 35 feet above the roof of the building. Tests show that excellent reception of the broadcasts can be secured within a radius of about fifteen miles. Similar experiments on ultra-short-waves are regularly made in Germany by the Witzleben Telefunken station near Berlin. In this case the broadcasts, on 7 metres, are put out with a power of 4 kilowatts. It is the most powerful ultra-short-wave transmitter in the world.
Bach Between Items

To commemorate the death of Johann Sebastian Bach at Leipzig, both this and the Dresden broadcasting stations have adopted as their interval signal a short four-note theme composed of the notes, B flat, A, C, B, which, when translated into German, spell BACH. The signal has a sound reminiscent of a vibraphone, and is produced by small hammers striking metal rods. At the conclusion of the day's programme the Nazi Hour Wossed song is played, followed by the German National Anthem (Deutschland über Alles).

Choosing an Interval Signal

Most European broadcasting stations and other have appealed to their listeners for suggestions regarding a characteristic interval signal capable of identifying the station to foreign listeners, but it has been left to the Poste Parisien (Paris) to offer a prize of five-hundred francs for an original idea. As a result of a recent competition in which hundreds of suggestions were put forward, the station has recently adopted the five notes of a well-known melody of Charpentier's Opera, Louise. The electrical device for reproducing these sounds will be built at once and listeners will shortly hear Poste Parisien's new mechanical call.

Russia's Heavily Taxed Listeners

The Russian Radio Committees have decided to construct twenty 200 kilowatt transmitters during the next two years. To pay for these new stations, since the beginning of April, they have considerably increased the cost of listening licences which are now issued in six different categories. The owner of a simple crystal receiver is now taxed three roubles per annum or, roughly, 8s. 3d., but if a valve set is used, the cost yearly is 50 roubles (£6 17s. 6d.). Rates have been specially fixed for subscribers to the wired wireless distributing centres and for members of collective clubs. A large revenue is anticipated from these latter organisations which in future will be made to pay, as much as one tenth of their annual admission!

Vienna Launches Out

With the advent of the new high-power Vienna (Bismarck) transmitter listeners may expect better programmes from the Austrian capital. Twice daily a new station orchestra of thirty-two musicians will broadcast special concerts and in general, more wireless entertainments are to be given. In particular, during the latter half of May and throughout June, a number of relays are to be carried out from the Vienna Opera House as well as a series of outside broadcasts to celebrate the Austrian musical festival weeks. Arrangements are also being made for a Radio Congress, the purpose of which is to take place at 2 a.m. B.S.T. Definite dates have not yet been fixed.

Another High Power Station

The Turkish Government has decided to erect a super-power transmitter at Ankara, the output of which will equal the United States via Westinghouse Brake and Saxby Signal Company's short-wave transmitter. The station will take place at 2 a.m. B.S.T. Definite dates have also not been fixed.

Grahamophone Societies

It has been decided by the Public Performance Committee of the Phonographic Industry that, despite the prohibition at present in force for the use of phonograph records for giving public performances, such records may be used for educational purposes. The committee may continue their present activities on the understanding that permission to do so is revocable at any time after the members of the industry have definitely formulated their understanding.

Solve This!

Problem No. 34.

Robinson had a normal four-valve set, fitted with an output-filter circuit and complete with decoupling arrangements in each stage. After building a television, he connected the neon lamp in place of the loud-speaker, but found that the lamp only gave sporadic flashes and the received image was not at all clear. After some experimenting he found the cause of this. To what do you attribute it? Three books will be awarded to the first three solutions opened which correspond with the solution which will be published next week. Address your solution to The Editor, Practical Wireless, Ltd., Newsom, Ltd., 8-11, Southampton Street, London, W.C.2, and post to reach us not later than May 15th. Mark your envelopes Problem No. 34.

Solution to Problem No. 33.

Robots had found that the rectifying valve required a larger input to deliver the 500 volts, and therefore a new mains transformer was needed to get the benefit from his change-over. The following three readers received books in connection with Problem No. 33:

H. F. Leslie, 79, Holly Road, Aldershot, Hants.

H. Fraser, 10, 64 John Road, Watford, Herts.

D. V. Barmst, 80, Koolby Road, N.W.16.

Interesting and Topical Paragraphs

Radio Lisbon

Although but little has been heard of Portugal's forthcoming broadcasting system, work on the 20 kilowatt Lisbon transmitter has been progressing satisfactorily. The station, which in future will be made to pay as much as half of the cost of its Amateur broadcasts, is the latest station to adopt a tune on a musical box to be switched on during pauses in the broadcast programme. The theme chosen consists of the four first bars of an old Serbian folk song. As most of the short note combinations are easy to memorise, it will soon be possible to identify most transmitters by their individual signals in cases where no call is picked up.

The New Washford Station.

A close-up view of the building of the new B.B.C. station at Washford Cross, Somerset. This station will have a radius of 70 miles, and two programmes will be radiated simultaneously.

Radio Tax

According to the new law French listeners for suggestions regard-
DURING the long winter evenings, and at week ends, the fireside has been the usual gathering place of the household, and the radio programmes have, no doubt, formed one of the principal sources of entertainment. Possibly, also, the radio fan of the family has exercised his ingenuity and spent his spare cash on the construction of a new receiver, so that, for the time, at any rate, the home equipment is considered perfectly satisfactory.

With the coming of spring, however, the fireside has become more and more deserted. Evenings will be spent in the garden before very long, while country excursions and picnics will be arranged. Many listeners, therefore, are asking themselves to what extent radio can play a part in the open-air life of spring and summer, and what must be done by way of special arrangements in order to derive the maximum enjoyment from "al fresco" radio.

Two Main Divisions

To begin with, outdoor radio falls into two main divisions. To the hiker, motorist, picnicker and the river man it means a complete portable receiver which can be taken far afield, while to the home keeper and garden lover it means, generally, an extension line from the house receiver into the garden. The special needs and problems of successful outdoor radio are not identical for both classes of installation. They have many points in common, of course, but there are also individual problems peculiar to each type of equipment, so perhaps it will be best to deal with each separately. As the pulka portable set represents the requirements of a large number of open-air listeners, we will discuss this aspect first.

It is scarcely necessary to state that a portable receiver is a complete wireless equipment, consisting of a compact receiver, the necessary low tension, high tension, and grid bias batteries, a built-in loud-speaker and a frame aerial, all accommodated in a reasonably compact case, the total weight of the whole being kept down to a figure representing a not over burdensome load for an active outdoor man.

In technical design and mechanical construction, the portable wireless receiver of today is a vast improvement on earlier types, and its performance is correspondingly better. In fact, it is not too much to say that a high-class modern portable will give a performance, both as regards sensitivity and selectivity, which rivals that of the average household set. Indeed, in a great many homes, a portable set is employed for everyday indoor use. Many of the latest types use one or more screened-grid high frequency stages, although there are a number of excellent sets in which the H.F. stages are of the aperiodic type with triode valves. Since the introduction of special low consumption pentode valves, these have been adopted as output valves in many leading makes of portable sets, and recently portables with a pair of small pentodes in quiescent push-pull have appeared on the market.

Limitations

From a good portable set, therefore, the listener should expect to obtain with ease a choice of programmes including the alternative B.B.C. stations, and a goody array of foreigners, anywhere within the British Isles, and even a very ordinary equipment should provide at least a round half-dozen programmes at good strength. At the same time, the limitations of all portable equipment must be recognised.

In the first place, considerations of space and weight usually restrict the high tension battery to a small capacity unit and a maximum of 100 volts. This at once imposes some limitation on the efficiency of the high frequency valves, and also upon the total output of the power stage so that, although valve designers have spared no effort to improve the efficiency of two volt battery valves to the end that they should give the very best performance possible under "portable" conditions, the listener must not expect quite the power and volume which he obtains at home with a set having, perhaps, one or two fewer valves, but possessing the great advantages of an ample high tension supply and an outdoor aerial.

Again, the very fact that the portable set must use a small frame aerial means that the incoming impulses are very weak; moreover, the general absence of the successive tuned coupling normally available in a home set further cut down the effective frequency amplification, already restricted by the small H.T. battery, so that, on an average, two high frequency stages in a portable must be considered as equivalent in value to about one in a "cabinet" set.

Apparent Loss of Volume

Another point at which the portable set falls at a disadvantage is that, in addition to restricted power output, which, of course, means less actual volume of sound for a given signal, the apparent volume is further cut down simply because the limitation of all portable equipment must be recognised.

In a room, much of the sound travels to the walls and ceiling, and, although a proportion of it is absorbed, much is reflected back into the room. Out of doors, however, most of the sound travels outwards from the loud-speaker, and is not reflected back, hence all that affects the ear of the listener is the direct sound waves he or she intercepts. For this reason, some listeners feel that the volume from their portable is somewhat thinner and weak under
these conditions. However, there is usually enough for real enjoyment and, from personal experience, much greater volume would not greatly add to the owner's pleasure, and might considerably mar that of neighbouring parties.

In preparing for open-air radio, many listeners will now be overhauling their own particular portable equipment. If the set has been laid up and not used since last summer, a considerable amount of attention must be paid to it. It is to be hoped that the amplifier was treated properly before being laid up, and not stored in a partially uncharged condition with the acid in it. At all events, the battery should be cleaned up and sea'd to be charged, after which it will be as well to put the set into service at home for a week to see if the accumulator is in good condition and will retain its charge.

If it runs down immediately, the advice of the service man should be sought so as to ascertain if the battery can be reconditioned or whether a new one is necessary. The week of test will serve also to show whether the high-tension battery requires renewal (and do not forget the grid-bias battery at the same time) and if the valves and the circuit generally are in good order. The symptoms of trouble are identical with those in any other wireless set, so there is no need further to discuss this point. Mention may be made, however, of a few specially vulnerable spots in a portable set.

Vulnerable Points

Owing to the rather strenuous conditions of service by way of transportation and so forth, it is possible that the cone of the loud-speaker may need adjustment. Failure to operate may be due to broken connections in the wiring—accidents which are not very likely to happen in a set which is never moved. In many portables there are flexible connections between the frame of the aerial and the receiver proper, and these connections may be strained or broken by the repeated opening and closing of the lid, and hence require repair or renewal.

Attention should also be paid to the wander plugs which connect to the various batteries—they are apt to be shaken out of position in transit. In order to reduce weight to a minimum, many portable receivers are arranged for resistance-capacity coupling between the various amplifying stages. Breakdown of the resistance capacitors is another likely cause of poor performance.

Garden Extensions

We must now turn our attention to the listener who requires simply an extension of his radio to the garden. In principle, this involves nothing more than is required for an extension loud-speaker in another room in the same house, but there are one or two precautions which should be observed. In the first place, it must be remembered that leads taken out into the garden are far more liable to mechanical damage, and to the effects of moisture, than those between two indoor rooms. It is advisable, therefore, that stout, well insulated leads should be used. 'Tough rubber' or rubber-flexible, is very suitable for this job, but a length of lead-covered single or twin cable is even better, and could, if desired, be made a permanent fixture by running it along the fence to some convenient spot where it may be terminated in a weather-proof plug and socket, or in a water-tight junction box.

Another point to bear in mind is that where a loud-speaker is connected directly in the anode circuit of the output valve, as unfortunately often happens, the speaker terminals are charged to the full high-tension voltage of the set—indeed, in the case of a pentode valve output stage the peak voltage on the loud-speaker terminals may be considerably greater than the maximum voltage of the battery. Not only would such a state of affairs on the speaker leads, whether due to injury or to moisture, cause a serious short circuit of the H.T. supply, but anyone accidentally touching the lead to earth by reason of the special transport facilities provided for outdoor radio.

Suitable Extension Arrangements

It is a very wise precaution, therefore, if you intend to take your loud-speaker out into the garden, to fit an output transformer of suitable ratio in the output circuit, taking the speaker leads from the secondary winding of this transformer, and thus isolating the long extension lead from the high-tension supply as is shown in Fig. 1. Another method is to use a choke capacity output filter with high insulation constants, of, say, 2 mfd. capacity, in both speaker leads, as indicated in Fig. 2. Where it can be arranged conveniently, hooking up the earth return from the high-tension supply to earth through the medium of, say, a meat skewer, penknife blade, or a metal stake driven into the ground, then acts as the return supply to the set, when, of course, the negative of the high-tension is earthed.

Finally, although this is not a technical point, it is to be hoped that those readers who do indulge in garden radio will be considerate to their neighbours by not taking their volume to reasonable proportions and confining their listening to reasonable hours. It is not fair to have your loud-speaker blaring at full volume from early morning until midnight in the garden. Some people like to have a nap in the afternoon and many go to bed long before midnight. Besides, other people like to hear their own sets sometimes. No ordinarily reasonable neighbour objects to a little music in the next-door garden on occasion, provided quality is tolerably good, but not more noise, and that continued until after midnight and out of season. Besides, in many districts objectionable garden radio is an infringement against the law and attracts a stiff fine. It is a very simple matter to add a volume control " at your elbow " to save constant walks to the set itself in order to make adjustments. This should be adopted if felt desirable.
A Discussion in Regard to the Relative Merits of the Two Systems.

OR

CLASS

"B"

Again, however, we must add to this the L.F. transformer -7s. 6d.; (2) one special valve -holders -ls.; (3) one G.B. valves -2s.; (4) one medium size power valve -holders -2s.; (5) one high step-up radio transformer -7s. 6d.; (6) one shunt de-coupling resistance -ls.; (7) one shunt resistance for connecting in parallel with primary of input transformer -5s.; (8) one 5-pin valve-holders -2s.; (9) one small power valve -holders -ls.; (10) one small power valve -holders -ls.; (11) two pentodes -35s. We can see from our list that the total cost works out at about £3 10s.

Cost of Components

And what about the cost of the components in each case? We must first base this on the assumption that a separate amplifier is being made to follow directly after the detector valve in a normal receiver. For Q.P.-P. we shall require (1) one special P.P. input transformer -average cost, 15s.; (2) one tapped output choke or transformer -say, 10s. 6d.; (3) two 5-pin valve-holders, 2s.; (4) one B high-tension transformer -say, 1s.; (5) one shunt resistance for connecting in parallel with primary of input transformer -1s.; (6) two pentodes -35s. We can see from our list that the total cost works out at about £3 10s.

And now let us see how this price compares with that for a complete Class "B" amplifier, including, of course, the "driver" valve and the L.F. transformer which feeds it. The necessary components and their average prices are: (1) one small L.F. transformer -7s. 6d.; (2) one 5-pin valve-holder -10d.; (3) one Class "B" driver transformer -10s. 6d.; (4) one 7-pin valve-holder -1s.; (5) one tapped output choke or transformer -16s. 6d.; (6) one small power ("Driver") valve -8s. 6d.; (7) one Class "B" valve -14s.

The inclusive cost in this case is seen to be approximately £3 and thus the Class "B" shows a slight advantage in the way of initial expense.

In both of the above examples I have purposely left out the resistance and condenser generally required for reducing excessive high-note response, but these components are used in either type of amplifier, they will not affect the comparative price. We have already considered the question, we reach the conclusion that for a similar signal output the Q.P.-P. amplifier is rather more expensive in first cost, but since its L.T. and H.T. consumption is smaller, it will be cheaper to run. Class "B" scores in regard to "replacement" elements, being cheaper than both of its valves are cheaper than pentodes.

Converting an Existing Receiver

The figures we have obtained above apply only when a complete and separate amplifier is to be made, and they will be modified considerably.

REAL READER SERVICE

Every "Practical Wireless" Receiver carries a guarantee of FREE Technical Advice until the receiver functions in the manner claimed.

We do NOT make a charge for answering queries!

Current Consumption

The mean anode current of two high-efficiency pentodes connected in Q.P.-P. approximates to 6 milliamps when using a 120-volt high-tension battery, whilst that of Class "B" is a little higher -about 8 milliampere. But we have seen that the latter valve requires a "driver" valve for correct functioning, and thus it takes a further 2 milliamps or so, and thus brings the total current consumption up to 10 milliamps. As to L.T. current : the two pentodes in Q.P.-P. take 4 amp. between them, whilst the single Class "B" valve consumes the same amount.

Methods of amplification have been adequately dealt with in previous issues of PRACTICAL WIRELESS. Let us, therefore, proceed with an analysis of the more practical aspects of the little problem we set out to discuss.

Power and Quality

First of all it should be mentioned that the actual power output is approximately the same in each case if we assume the use of a similar H.T. voltage -preferably from 120 to 150. As a matter of fact, the output from Class "B" is slightly higher, but not greatly so; the difference in this respect is certainly not so great that it could easily be detected under normal circumstances. Furthermore, both systems are equally good regards the quality of reproduction which they afford.

Cost of Components

And what about the cost of the components in each case? We must first base this on the assumption that a separate amplifier is being made to follow directly after the detector valve in a normal receiver. For Q.P.-P. we shall require (1) one special P.P. input transformer -average cost, 15s.; (2) one tapped output choke or transformer-say, 10s. 6d.; (3) two 5-pin valve-holders, 2s.; (4) one B high-tension transformer -say, 1s.; (5) one shunt resistance for connecting in parallel with primary of input transformer -1s.; (6) two pentodes -35s. We can see from our list that the total cost works out at about £3 10s.

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Converting an Existing Receiver

The figures we have obtained above apply only when a complete and separate amplifier is to be made, and they will be modified considerably.
when it is required to convert the L.F. portion of an existing set to one of the new systems of amplification. For example, if the set is a three-valve having S.G., detector, and power valves, the cost of the small L.F. transformer " 4-pin valve-holder " and " small power valve " can be deleted from the estimated price of a Class " B " amplifier, but all the listed components will be required for a Q.P.-P. conversion. Moreover, we shall be left with a spare transformer and power valve in the latter case.

But if our present set uses a pentode output valve the position will be rather different, because we shall only require one additional pentode with the other components listed above to convert the set to Q.P.-P. This will bring down the price to about £2 12s. 6d. In converting the same set for Class " B " a small power valve would be required in place of the pentode (which would then be " spare "), but the ordinary L.F. transformer could be retained. In other words, the cost of conversion would be almost exactly the same as for Q.P.-P. And since Q.P.-P. is more economical of current we should decide in favour of this system. When the receiver which is to be modified contains two low-frequency valves, Class " B " would be our undoubted choice, because the first L.F. stage could remain unaltered to serve the function of " driver. " The only extra components then required would be the " driver " transformer, Class " B " valve, 7-pin valve-holder, and output choke, so that the cost would work out at something like two guineas.

**Operation of Class " B " and Q.P.-P.**

There is yet another side to the question — that of adjusting and operating our amplifier. Class " B " is most certainly to be preferred on this account because it does not require the rather delicate " balancing " of anode current, nor the correct setting of grid-bias voltage that quiescent push-pull does. In fact, no balancing of any kind is required, because all this is done by the valve-makers, and since the special Class " B " valve does not require any grid-bias, G.B. voltage adjustments are not called for as for the high-tension battery gradually runs down. At least, this is so in regard to the output valve, but a slight adjustment to the " driver "s G.B. will probably be required at intervals. This might not always be necessary, because the working characteristics of the latter valve are by no means critical.

From the above brief summary we can deduce that when modifying an existing set to include either Q.P.-P. or Class " B " our decision as to the better system will principally be governed by the circuit arrangement of our present receiver:

if it has a pentode output stage, Q.P.-P. will be favoured, but if the last valve is of the small-power type, or if the set has two L.F. stages, Class " B " will be somewhat more economical and convenient.

**Economy in H.T. Current**

For most " domestic " require-ments it will be found that the maximum possible output of signal current is scarcely ever required from either of the amplifying systems under discussion. When this is the case a distinct economy in running costs can be effected by reducing the H.T. voltage, or better still, by cutting down the signal input to the amplifier by means of a volume control. (The average anode current of either a Class " B " valve, or two pentodes in Q.P.-P., is proportional to the volume they are required to supply.) In some instances the reaction condenser, variable-watt potentials, and series aerial condenser, will serve the latter purpose, but with Class " B " a better plan is to connect a potentiometer across the secondary of the transformer preceding the " driver " valve. A suitable value is 250,000 ohms, and the method of connection is indicated in Fig. 3.

When full volume is never required the simplest thing is to replace the small power valve used as " driver " by one of the ordinary L.F. type. This will slightly reduce the consumption of grid-bias current, as well as that of high-tension, and will not have any ill effect on the quality of reproduction.

A _SWITCH_ for cutting out series aerial condenser, also H.F. stage and H.F. valve filament, can be made as follows: Cut a piece of ebonite to shape, as Fig., and arrange three contact studs on each side, the left side to have stops at each end. Drill a hole to take switch-arm spindle in the ordinary manner. The A _SWITCH DODGE_ is attached to a spare switch arm, and this is drilled to take two small screws, one of which is used to form a flexible lead to the L.T. positive terminal. The two studs at D are bridged underneath with a piece of copper foil and stud E is left blank. Stud A goes to first terminal of aerial condenser, B goes to second terminal of S.A. condenser, and C goes to top of detector coil. Studs D go to the filament terminal of the H.F. valve-holder. With switch arm on A or B the H.F. valve filament is glowing, but when on C the opposite side automatically cuts off the current to that valve. The aerial, of course, is connected to the centre spindle by any convenient method and the completed switch is screwed to the back of the baseboard alongside the earth terminal, or the earth terminal could be mounted on the opposite side of ebonite as the switch.

[The text continues with diagrams and further explanations.]
It is a favourite theory of mine that, because all faults in radio equipment are due to definite electrical or mechanical causes, it is only a matter of systematic and careful testing to discover the nature and location of any defect. In nine hundred and ninety-nine cases out of a thousand this theory works perfectly. Watch an experienced service engineer examining a faulty set. First, an apparently casual, but actually very searching glance is given to detect obvious disconnections or broken contacts; then, rapidly, a dozen simple tests are applied. Often the trouble is spotted right away in the first five minutes, for the skilled tester has a rare acumen for locating likely faults. If the obvious initial tests do not bring the trouble to light, however, each portion of the apparatus in turn is gone over systematically, and by a process of elimination the defect is tracked down, first to a particular stage, then to one component, and finally to a particular point in that component.

Many amateurs have also acquired a high degree of skill in adopting similar methods, and usually lose no very great difficulty in putting matters right. Very occasionally, however, a fault is encountered which eludes all attempts at discovery, and baffles even experienced engineers. I have collected a few notes concerning some of these, and the following selection refers to cases which, at the time, seemed very mysterious, but were afterwards found to have quite simple explanations.

Most Annoying
A most annoying type of fault is that in which a set behaves perfectly on the test bench, but as soon as it is replaced in its cabinet, immediately shows signs of the same trouble. My most recent experience of this kind was with a home-built set of the metal chassis type, which was subject to almost continual cracklings. On removing the chassis to a table and connecting it up, no amount of maltreatment would induce the least amount of noise—the performance of the set was normal and perfect. Then, as soon as the chassis was put back into its cabinet, on came the crashes and crackles.

After two or three repetitions of this, having already tested out every connection and component and found nothing wrong, I was about to give up for the evening, when I stumbled upon the solution quite by accident. The chassis was standing on the table at the time, and in order to give it one final scrutiny at close quarters I pulled it towards me along the table. Immediately came a fearful crash. After switching off, I turned the chassis on end and examined the underneath again—and discovered the trouble. There were several metallized resistors included in the circuit, and these were accommodated with some other small components under the chassis. Owing to the sagging of some of the connecting wires, one of these resistances just touched the surface of the table, and as I dragged the chassis along this resistance caught the roughness of the table, causing the connecting wire to bend sufficiently to allow the end cap of the resistor to touch lightly against a terminal (Fig. 1). The resultant intermittent short circuit was the cause of the crashes and cracklings. The same state of affairs occurred when the set was pushed into the cabinet, but when the chassis was withdrawn the springiness of the wires allowed the resistance to fly back into position. Judicious bending of the wire and the use of an inch or so of insulating tape completely cured the trouble.

Wire Continuity
One lesson which I learned early from experience, was never to trust a first test on the continuity of a wire. This point was driven home with considerable force on an occasion when I was endeavouring to cure bad crackle in a set. Everything pointed to a loose contact, but for the life of me I could not discover where it was. Every lead and wire had been separately tested for continuity, including the wire connecting the aerial terminal of the set to the aerial tube. Next, as a last resort, in fact, insulated with particularly thick and stiff rubber, and it tested out perfectly O.K. When this wire was still connected up again, all went well for a time, but soon the crackling recommenced.

I switched off to re-test, found nothing wrong, and connected up again; reception was now quite normal. Then, while fumbling about mindlessly with the wires, on came the crackling. Quickly I looked to see what I was touching; it was the aerial connection, and as I wobbled it about the grating crashes increased in intensity. To put in a new wire was but the work of a moment, and the trouble was cured. On conducting an autopsy on the discarded wire I discovered a break just inside the insulation (Fig. 2). The stiffness of the rubber kept the broken ends sufficiently in contact to pass test while the wire was lying quietly on the table, but when connected to the chassis, the hands bent, causing a rubbing, intermittent contact. Ever since, when testing a wire for continuity, I have twisted the ends about so that any fault which exists is exaggerated and more easily detected.

Heating Effects
When a fault occurs only after the set has been switched on for a certain time, always suspect some effect of heating, such as expansion. Metals expand when heated, and both short and partial open circuits can be caused in this way. There was the case of a set which always started crackling almost continually about an hour after it had been switched on. When I was asked to look at the receiver, I switched on and waited for the fault to develop, which it did in due time, and I then switched off and began my search for the trouble. The usual continuity tests were applied to all the various components, and the anode resistance of a resistance-capacity-coupled low-frequency stage came under special scrutiny, because such spots are always likely places to find a break. The fault, however, could not be traced. The set was reconnected and switched on again, and sure enough, in about ten minutes or so, the crackle recommenced. I still suspected the anode (Continued on page 294).
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 resistance, so switching off the set once more, I removed the resistance and tested it again—and found an internal disconnection, or rather intermittent connection. A new resistance was soon obtained, and after fixing it in place of the old resistance, the set functioned perfectly. Out of curiosity I then took another test on the discarded resistance, but now no sign of bad contact was to be discovered. It was not until I had opened it up for examination that I found the reason.

The end of the resistance wire had become unsoldered from the terminal, but was resting against it, making a light contact. Undoubtedly, when the resistance wire had warmed up owing to the heat generated in high-resistance contact, the end of the wire expanded and move wire away from the terminal, thus breaking the contact.

"Dry" Joints

The "dry joint" type of fault is sometimes very difficult to trace, especially if it occurs in a manufactured component usually considered quite above suspicion. On one occasion an A.C. mains set started to suffer from a most mysterious defect. As soon as anyone walking across the room passed a certain spot, the most alarming crashes would occur in the set. At other times very difficult to diagnose, gave no signs of trouble. Now I knew that there was a loose board in the floor at the critical spot, and immediately connected the trouble with the vibration set up by this board. Everything pointed to a loose contact which was jerked by the movement of the board.

But the most stringent tests failed to reveal any bad contact, and it was only after I had gone over every joint, both likely and unlikely, that I found the offender. It was one of the filament pins of the rectifier valve. A "dry" soldered joint between the leading-in wire and the filament pin had worked loose. The wire was long enough to touch the bottom of the pin, and the contact was sufficient to allow the filament current to pass. When the table on which the set stood was shaken by someone walking over the loose floor board (Fig. 3), however, the loose leading-in wire vibrated in sympathy and the contact was rapidly made and broken. A few minutes with a soldering iron resulted in a perfect repair, and the valve is still in service and doing good work.

**Fig. 3.—A loose floorboard causing trouble by jarring the receiver.**

**Fig. 1.—A switching arrangement for controlling dial lights.**

The majority of sets have the long-wave and the medium-wave stations inscribed on the same dial, and frequently one has to glance at the wave-change switch in order to ascertain which waveband one has to glance at the wave-change switch inscribed on the same dial, and frequently in the order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch. The station names in order to ascertain which waveband one has to glance at the wave-change switch.

**A NOVEL METHOD OF DIAL ILLUMINATION.**

These should be connected together. The two bulbs occupying these holders, must be made to give red and green lights respectively. This may be done by dipping them in suitably coloured ink several times, allowing them to dry between each dipping. A little gum mixed with the ink is very helpful.

Alternatively, each bulb may be covered with the thinnest tissue paper (tied round the base of the bulb and trimmed away, as shown in Fig. 1) before the bulbs are dipped. The wiring connections are shown in Fig. 2. The bulbs are a strip of springy brass screwed to the baseboard close enough to the wave-change switch to make contact with the leads when it is pushed in for the long waveband.

One other alteration remains. A strip of stout white paper, or better still, white celluloid, is fastened on to the dial over the existing station readings. If in your case the light shines through the dial, the original list of dial readings must be removed and replaced with a piece of white celluloid the same size and shape.

When the set is switched on, only the station names of the waveband to which the set is switched will be visible. If the medium waveband is in use, the light on the dial will be green. The station names printed in red ink will stand out as though in black. The names printed in green under the green light will be invisible.

When the wave change switch is pushed in for long waves, the light on the dial will change to red. The medium-wave stations printed in red will now become invisible, and the Green long-wave printings will appear. The effect is very pleasing.

**Fig. 2.—Diagram of wiring connections.**

**Floorboard Incident**

Another floorboard incident was still more mysterious, because the noise did not always occur when the loose board was stepped on. I was told that it never occurred during the day; I noticed it only in the evenings—and only sometimes then. A clue presented itself one evening when the set had been working quite satisfactorily for some hours. I went across the room and switched on a table lamp, connected to a wall plug. As I walked back to my chair I stepped on the fatal board, and at once deafening crashes came from the set. In fact, it had been observed for the first time that the loose board was in a direct line between the wall plug feeding the table lamp and the wall plug feeding the set; in fact it was now clear that this was the board which the electrician had removed when he wired the plugs next. I switched off the lamp, and once more tried standing on the loose board. No ill effects were forthcoming, but they reappeared immediately I once more switched on the lamp.

Finally, I switched off the lamp and took up the board. As I had guessed, the electric wiring—lead-covered wire—ran immediately below the board, notches having been cut in the bearers to accommodate it. Examining the board, and at the connections to the lamp plug, I found that a very poor contact was made between one of the lead-covered wires and the new terminal of the plug. When the wire was shaken, even quite gently, the contact resistance varied.

---

*PRACTICAL WIRELESS* May 13th, 1933

*Floorboard Incident*
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Manchester, Newcastle, Sheffield, Belfast, Cardiff and Dublin.
THE radio experimenter will find many uses for a good microphone, and the home-con-structed type, which is described and illustrated, is certainly not good in the question of sensitivity; the output from the microphone circuit to the grid of the first valve is of the order of 0.1 volt, or about one-tenth of the output of the average pick-up. This may not sound too encouraging, but it must be remembered that the commercial high quality microphones give about the same output, and that the condenser type of microphone, which is used extensively in talking picture recording, is considerably less sensitive.

The microphone is of the carbon type, working on the transverse current principle, that is to say, the current flows across the diaphragm instead of through it. This was the method used on the very early days of programme trans-mission but only intelligible speech. The home-con-structed microphone here described, and illustrated in Fig. 1, is of the order of 0.1 volt, or about one-tenth of the output of the average pick-up. This may not sound too encouraging, but it must be remembered that the commercial high quality microphones give about the same output, and that the condenser type of microphone, which is used extensively in talking picture recording, is considerably less sensitive.

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An Improved Earth

The accompanying sketch illustrates how I utilized a disused chimney-pot to improve my earth, which is extremely dry in its natural state. The device holds about two gallons of water, which is slowly fed to the surrounding soil, after percolating through the coke, grass, etc.—H. Iggalden (Birmingham).

Fixing Battery Leads

It is a good plan for experimenters to keep the battery leads separate—that is to say, H.T. from G.B. and G.B. from L.T., and so on, because in a set where all the leads are in one cord it is very easy to make a mistake, which would result in the destruction of all the valves. Besides, it is much more convenient for those who are always altering their lay-out. Here is a method of doing this. Obtain a quantity of twisted rubber-covered flex, one strand red and the other black.

The quantity, of course, is proportionate to the number of batteries. Also obtain a number of small wood screws with bevelled heads. The number is double the number of batteries. Also obtain a number of small wood screws with bevelled heads. The number is double the number of batteries. Obtain a quantity of twisted rubber-covered flex, one strand red and the other black.

To fasten the leads securely, take a piece of wood about 2ins. by 1¼ins. and cut it into the shape shown in sketch. An ordinary fuse-holder is then obtained and fixed on the piece of wood, which in turn is screwed on the cabinet side, just underneath the valve window. The two leads from the holder are then taken to their appropriate positions on the set, the bulb is screwed into its socket, and the gadget is completed.—A. Smitrurn (Manchester).

Reducing Hand-capacity Effects

The accompanying sketch illustrates an easily-made and efficient extension handle for a short-wave set which can be adapted for use with practically any slow-motion dial. All that is required is a

A Novel Indication Lamp

Many constructors have in their junk boxes an old valve window used in the days of bright emitter valves. These can be utilized in a simple way, in conjunction with a small lamp, to show whether the set is on or off. Firstly, decide upon the position of the lamp, and then cut a neat round hole to accommodate the valve window. Fix the latter into the hole and fasten securely. Then procure a piece of wood about 2ins. by 1¼ins. and cut it into the shape shown in sketch. An ordinary fuse-holder is then obtained and fixed on the piece of wood, which in turn is screwed on the cabinet side, just underneath the valve window. The two leads from the holder are then taken to their appropriate positions on the set, the bulb is screwed into its socket, and the gadget is completed.—A. Smirkturn (Manchester).

A novel method of improving an "earth."
length of hard wood in the shape of a pencil for the extension handle, a piece of ebonite tube about 2ins. long, which will fit tightly over the condenser anode, and a bracket which can be made from any stout piece of metal. A metal screen may be placed at the back of the panel and earthed, if desired.—E. J. Chapman (New Eltham).

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**RADIO WRINKLES**

(Continued from previous page.)

On the sockets I filed a flat on each side denser served medium waves, and a .0003 course of experimenting that a .0001 condenser long waves best, I adopted the (Fig. 1), and then screwed them up tight on coils I took out the metal plugs and sockets. Handy Change-over Sockets

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Improving Your Portable Set

For those whose portable sets are not fitted with turntables, or who cannot go to the trouble of fitting a turntable, the following idea is suggested. I have carried this out in practice for several months with success, using an indoor aerial and an earth. The aerial is placed near a window and the earth wire is taken to a buried earth immediately below the window, in the garden (a pipe earth would serve the same purpose). The aerial, of single stranded cotton or silk-covered wire, is plugged into the set with an ordinary plug-socket fitting and taken round the room as illustrated, being kept clear of walls as far as possible. Hooks screwed into picture rails fitted with a short length of insulated cord, will ensure the necessary clearance of walls. It will be seen from the sketch that the aerial is pointed in four different directions, which obviates the necessity for turning the set, as signals from nearly all directions will be brought in by this type of aerial. For those sets not already fitted with aerial and earth, this can easily be carried out by threading the flex through it. The other end of the frame aerial must be connected to the aerial and earth plugging into them from the outside. This aerial can be seen working in the dark, if there is bad static about, showing that it does its work.

—E. Thomas (Swansea).

---

**Method of using a speaker unit losing its magnetism, and there are probably a number of other readers who have experienced the same thing. The way in which I cured my trouble is as follows:**

I placed a horseshoe magnet (taken from an old unit) against the magnet of the unit, as shown in sketch, and the speaker was nearly twice as loud as before. Any shaped magnet will do.—L. Lawson-Durham (Holt, Norfolk).

---

**A Home-made "Split Anode" Adaptor**

For this simple device two valve-holders are required, and four or five valve legs, according to the type of holder used. The valve legs are inserted, threaded end first, into one of the holders, and retained by a blob of solder underneath.

---

**Using plugs and sockets for changing condensers.**

---

Method of using an additional aerial with a portable set.

---

Method of rejuvenating loud-speaker magnets.
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I. Frame Aerial Winding Details

Solder one end of the 24-gauge wire to the upper right-hand contact of the tuning condenser, and take the wire across to the upper slot of the nearest spacer. Run the wire across to the left, through the upper slot on the left-hand spacing and down to the lower spacer, across the lower edge, and so continue to the slot where you commenced. Carry the wire through this slot again, and make a further turn, repeating the process so that there are three turns in the first slot. Pass to the second slot, and wind three turns in this, after which two turns only are wound in each remaining slot until eight slots have been used. There now remains the two wide slots. The end of the 24-gauge wire must be cut, and it should be soldered, together with the beginning of the 34-gauge wire, to the upper terminal of the three-point switch. The long-wave winding consists of twenty-three turns in each slot, and the finish of the winding is joined to the lower terminal of the left-hand tuning condenser.

You will note from the list of components required (see bottom right-hand corner) that 2oz. of 24 D.C.C. wire are required for the medium-wave winding, and 2oz. of No. 24 D.C.C. wire for the long-wave winding. Upon completion of the frame aerial winding the slots may be sealed with sealing-wax or Chatterton's compound. The wiring diagram given last week shows how simple the wiring up really is, and how few wires are really used. Notice that low-tension negative and high-tension negative leads are connected to the three-point wave-change switch, and that H.T. positive is connected to the centre tapping of the speaker transformer; the L.T. positive lead, of course, goes direct to the on-off switch.

II. The Carrying Handle

Carrying handles may be purchased quite cheaply from the case. Two metal strips will be required to pass through the swivels of the handle. Two clamping plates will be required as well, one to go beneath, and one on top. The handle itself spans the two cross struts interposed between the front and back top rails, and the clamping plates (one above and one below) are bolted over these. This makes a very rigid form of attachment, and there is no risk of the handle breaking adrift.

The Batteries

The Ediswan high-tension battery is snugly accommodated in the bottom of the case. The Ediswan high-tension transformer is swung through the slot, and the on-off switch is provided with a metal covering, which is then fixed to the case with the bolts used by the constructor.
SHOWING THE WAY!

PORTABLE FOUR

by F.J. CAMM

The two extreme knobs at the top control the tuning, and they should be both moved to zero position to start with. Slowly rotate them, keeping them approximately in step until signals are heard, when final adjustment to their positions can be made. The reaction condenser can be used to build up volume, but for preliminary tuning it should be set to its minimum position. About 45 volts grid bias should be used, and, of course, the full 120 volts from the hightension battery. It is in the adjustment of the Featherweight Portable Four that you will realise the great convenience of the design. The swing hook at the top is merely released when the whole receiver front can be swung outwards and is immediately accessible. Considerations of design led me to use the flat form of frame aerial, and I naturally expected a loss of efficiency as a result. I have not experienced it, for the number of stations received, the volume, and the quality of this production equal the best portable on the market, and it is with every confidence that it will satisfy readers that I place it before them backed with my personal guarantee of free advice until it functions in the same manner as mine. A final note—do not forget to orientate the receiver to make full use of the directional properties of the frame aerial.

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The two extreme knobs at the top control the tuning, and they should be both moved to zero position to start with. Slowly rotate them, keeping them approximately in step until signals are heard, when final adjustment to their positions can be made. The reaction condenser can be used to build up volume, but for preliminary tuning it should be set to its minimum position. About 45 volts grid bias should be used, and, of course, the full 120 volts from the hightension battery. It is in the adjustment of the Featherweight Portable Four that you will realise the great convenience of the design. The swing hook at the top is merely released when the whole receiver front can be swung outwards and is immediately accessible. Considerations of design led me to use the flat form of frame aerial, and I naturally expected a loss of efficiency as a result. I have not experienced it, for the number of stations received, the volume, and the quality of this production equal the best portable on the market, and it is with every confidence that it will satisfy readers that I place it before them backed with my personal guarantee of free advice until it functions in the same manner as mine. A final note—do not forget to orientate the receiver to make full use of the directional properties of the frame aerial.

SHOWING THE WAY!

PORTABLE FOUR

by F.J. CAMM

The two extreme knobs at the top control the tuning, and they should be both moved to zero position to start with. Slowly rotate them, keeping them approximately in step until signals are heard, when final adjustment to their positions can be made. The reaction condenser can be used to build up volume, but for preliminary tuning it should be set to its minimum position. About 45 volts grid bias should be used, and, of course, the full 120 volts from the hightension battery. It is in the adjustment of the Featherweight Portable Four that you will realise the great convenience of the design. The swing hook at the top is merely released when the whole receiver front can be swung outwards and is immediately accessible. Considerations of design led me to use the flat form of frame aerial, and I naturally expected a loss of efficiency as a result. I have not experienced it, for the number of stations received, the volume, and the quality of this production equal the best portable on the market, and it is with every confidence that it will satisfy readers that I place it before them backed with my personal guarantee of free advice until it functions in the same manner as mine. A final note—do not forget to orientate the receiver to make full use of the directional properties of the frame aerial.

OUT OF THE ORDINARY!

Light enough for ladies to carry.

A REALLY FIRST-CLASS PERFORMER.

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H.F. valve.

band-pass type, coupled to a variable -mu 2,000 metres. The aerial input is of the is from 200 to 550 metres, and from 900 to employed for tuning, and the range covered arranged; that this receiver are unscreened, but are so customary screened coils, the inductances in receiver are very simple, but slightly differ-

arrangements of the cabinet stands an electro-mag-

to listen to that particular item. reject a record should it be desired not small push button which is employed to operates on either radio or gramophone cabinet record device.

Controls

The complete apparatus is divided up to form the most convenient assembly from the point of view of manufacture and operation. Inside the cabinet, the wireless receiver is fitted to the left-hand side of the cabinet and is held in a vertical position, with the valves horizontally arranged. To the motor-board are attached three controls, the main tuning knob, a tone controlling device and a three position switch, providing long waves, medium waves and gramophone points. Two tuning dials are visible through small windows and these are calibrated in wavelengths. To the left of these controls are arranged the pick-up, turntable and automatic record device. On the front of the cabinet is a volume-control which operates on either radio or gramophone reproduction, and just above this is a small push button which is employed to reject a record should it be desired not to listen to that particular item. More will be said of this later. At the bottom of the cabinet stands an electro-magnetic moving-coil loud-speaker. The tuning arrangements for the super-heterodyne receiver are very simple, but slightly different from the usual practice. In place of the customary screened coils, the inductances in this receiver are unscreened, but are so arranged, that there is no interaction between them. A four-gang condenser is employed for tuning, and the range covered is from 200 to 5000 metres, and from 900 to 2000 metres. The aerial input is of the band-pass type, coupled to a variable-mu H.F. valve. This is choke-capacity coupled to the first detector (a three-electrode valve) which operates on the anode-bend principle. The oscillator follows, and this has a tuned-grid circuit, magnetically coupled to the grid circuit of the first detector. The I.F. amplifier is also of the variable-mu type, and this is coupled to the second detector (also a triode), which employs the same method of detection as the first detector. The automatic bias resistance in the cathode lead of this valve is “split,” and a portion is front-oriented when the receiver is switched over to “gramophone,” so obtaining the correct bias for this valve when employed as an L.F. amplifier. The output valve, which is supplied by means of a resistance-fed I.F. transformer, is a P.X.4, giving an output of 2½ watts.

The H.M.V. Autoradiogram.

Tone Control

In order that the tone, on either broadcast or gramophone, may be adjusted to suit the acoustics of the room, or personal tastes, a 600,000 ohm resistance is joined from the grid of the output valve to earth, via a 2,000 mmf. condenser. This enables the reproduction to be modified to give brilliance to the top notes or to reduce the amount of top-note response and give that “mellow” tone which is favoured by so many listeners.

Automatic Record Changing

The mechanism to hold the records may be adjusted to take 10in. or 12in. records, and a large knob at the rear of the turn-table is suitably engraved for this purpose. The records are held in a pile (eight records) over the turntable, and the spindle is provided with an index to determine to which number. When the control is adjusted to provide automatic playing, the elaborate mechanism which is installed permits the first record to drop to the turntable (a distance of only a few inches), lowers the needle to the surface of the record, and record is played. A slight interval must, of course, between each record, so that it

the records to be played without undue surface noise. One interesting feature of the H.M.V. recordchanging device is that it gives off almost as much sound as the ordinary acoustic gramophone, and this is held by many to be a fault. Naturally, where the needle is arranged to have perfect freedom to follow faithfully the sound track on the record, it must in itself act as a small "sound-box," and this is a sign that it is of good design, not bad. However, the makers of this Autoradiogram have taken steps to avoid any unpleasant effects from this source, and to this end the entire lid is lined with felt. Furthermore, a notice is printed on the rear of the lid (inside) instructing the user to close the lid whilst playing records, and under these conditions no trace of needle chatter can be heard even when the volume is reduced to such a level that it offers no entertainment value.

Price

It might be expected that an elaborate piece of apparatus such as this would cost a fabulous sum, but actually it may be obtained, for either A.C. or D.C., for only 55 guineas, which, when it is remembered that the apparatus is scientifically balanced, is a very small sum indeed. There was a time when such a receiver could not be purchased for four times this amount, and it is therefore a real step towards better musical reproduction, which is within the reach of everyone.
Daylight Effect

A term used in reference to the difference noticed between the reception of wireless signals during the day and the night. It is a well-known fact that on the medium and long wavelengths reception after dark is considerably better than during the daytime. Reception over the greatest distances is obtained when the whole distance between the transmitter and receiver is in darkness. This accounts for the fact that the most favourable time for reception of American stations in this country is in the small hours. It is then night over the whole distance between the two countries.

Curiously enough, at short wavelengths the daylight effect seems to diminish and it is possible in some cases to communicate over long distances equally well in daytime as at night. However, there are certain peculiarities regarding the daylight effect at short waves, such as a kind of reversal of the effect at certain distances. For example, a station will become inaudible when darkness falls, but will be easily picked up hundreds of miles further away. Also, effects are different at 20 metres to what they are at 45 metres, and vary still again on the ultra-short waves.

D.C.
Abbreviation for direct current.

D.C.C.
This means Double Cotton Covered and refers to a well-known type of insulated copper wire. The bare wire is covered in two layers of cotton thread, wound in one direction and the second in the opposite direction. When used in a dry atmosphere, the cotton-covered wire has very good insulating properties and is quite suitable for winding wireless coils. If the atmosphere is damp, however, the cotton absorbs moisture from the air and loses its good insulation to a considerable extent. Under these circumstances the more expensive silk-covered wire is superior. Good enamel-covered wire is probably better than either.

Dead Beat
This term is used in reference to certain measuring instruments in which the pointer or indicating needle comes to rest very quickly. This desirable feature is obtained by what is known as damping (see under that heading) and is to be found in the majority of voltmeters and ammeters used for wireless purposes. Without damping of some sort or other the pointer of the meter would keep on swinging backwards and forwards for a considerable time before taking up its final position. This would be most noticeable with the better-class instrument, as the bearings are made to be practically frictionless.

Dead-end Effect
In the early days of wireless it was quite common to make a large tapping coil serve the purpose of several. This was done by taking tappings so that when tuning to the lower wavelengths a considerable portion of the coil was just "dead end." The dead end of the coil had a deleterious effect on the efficiency of the portion being used. Unwanted currents were induced in the unused portion due to its close proximity to the rest of the coil. These currents in turn reacted on the active turns and impaired their efficiency. Sometimes matters were improved by short-circuiting the unused turns, but later on it became customary to use plug-in coils. In this case there was no dead-end loss because there was no need to "short" any turns, a separate coil being used for each wave-band.

Nowadays it is usual to provide at least two separate windings on each coil—one for the medium waves and one for the long waves. The dead-end effect is overcome by short-circuiting the long-wave portion with a switch when the medium waves are being received. Fig. 1 shows the difference between dead-end and shorted turns: (a) shows a simple coil. If the upper turns only were connected in circuit and the lower end left free, then the lower turns would constitute a dead end. This is also represented diagrammatically at (b), while (c) shows how the dead end can be eliminated by means of a shorting switch.

Decibel
Unit used in the measurement of the strength of sound. One decibel is the measure of a sound just audible to the human ear.

Decoupling
Every wireless set using valves has to be supplied with high-tension current. This may be derived from a battery or
Decoupling is, as its name suggests, a means of preventing this. Curiously enough, the usual method used to combat the internal resistance of the H.T. supply is to introduce another resistance into the set. It is used in conjunction with a condenser. The usual method of arranging a decoupling resistance and condenser is shown in Fig. 2 and the upper circuit of Fig. 3. It is sometimes necessary to have a decoupling device of this nature fitted to every valve in the set. In the lower sketch, in Fig. 3, an example is shown of a decoupling device being used in the grid circuit as well as the anode circuit of a valve. This is because the valve is a mains valve and gets its grid-bias from the same source as its anode current—namely, from the mains. The decoupling used in the anode circuit is provided by a choke and a condenser instead of a resistance and condenser. This is because the valve happens to be the last one in the set and the choke is used to feed the loud-speaker.

The effect of this resistance is often to produce howling in the receiver. It is sometimes necessary to have a decoupling device of this nature fitted to every valve in the set. In the lower sketch, in Fig. 3, an example is shown of a decoupling device being used in the grid circuit as well as the anode circuit of a valve. This is because the valve is a mains valve and gets its grid-bias from the same source as its anode current—namely, from the mains. The decoupling used in the anode circuit is provided by a choke and a condenser instead of a resistance and condenser. This is because the valve happens to be the last one in the set and the choke is used to feed the loud-speaker.

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**Detractor**

A device for rectifying wireless waves. See also RECTIFIER, CRYSTAL DETECTOR, VALVE, etc. Several examples of detectors are shown in Figs. 5 and 6.
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ULTRA SHORT-WAVE RECEPTION

Some Hints for Improving Reception Below 10 Metres.

By ERIC JOHNSON

INTEREST is very rapidly increasing in reception on waves of the order of 10 metres and less. Although the ordinary type of short-wave receiver can give a very good performance on these high frequencies, nevertheless, better and more reliable working can be guaranteed if the set be designed with this special end in view.

One would not expect the ordinary broadcast receiver to function as satisfactorily on, say, 30 metres as 300 metres; firstly, the tuning condenser would be hopelessly large, and doubtless other components would not have the optimum values; secondly, probably only the average amount of care would have been expended on layout and general construction. In the same way reception on 5 metres is vastly different from reception on 50 metres. As much extra care will be needed here as in the first example.

Careful Layout Necessary

It is quite superfluous to point out that only the most careful layout and meticulous construction will achieve reliability. As in all short-wave receivers the L.F. department may be trusted to look after itself, so long as the average amount of trouble is taken; the detector stage is the all-important one. In the first case the tuning condensers must be of a reasonable size. Anything larger than .00005 mfd. is ridiculous, and, in fact, the latter size makes for difficult tuning unless a really good high-ratio slow-motion dial be used. An excellent tuning condenser may be made from the old multi-plate neutralising condensers. All except two plates should be removed, and for really easy tuning these may be double spaced. Generally, these condensers are fitted with some form of extension handle, which is all to the good. Most are without pigtail connections, however, and this deficiency should be remedied before fitting in the set.

The coil problem is an important one. There has been the practice until quite recently to make these of bare, spaced wire of fairly large diameter. As a consequence, it was found that it was extremely difficult to coax the set down to 10 metres even, the reason being that one found oneself trying to work on fractions of a turn of wire. Under these conditions obtaining sufficient feed-back for reaction was some-thing of a problem. As the success of all short-wave sets hinges on this, the ordinary amateur did not progress far. It was then that the amateur transmitting fraternity popularised the valve-base coil. These are constructed of quite thin d.c.c. wire wound in large turns until the wavelength is reduced to the required point. Series Tuning

Although the tuning condenser is generally connected in parallel with the tuning coil, series tuning is by no means uncommon in ultra-short-wave sets. The circuit is shown in Fig. 2. Even when the condenser is at its maximum the total capacity across the tuning coil is always less than the incidental circuit capacity. As a result, it is possible to go down to a very low wavelength. One disadvantage, which is quite important at high frequencies, is that the grid-leak has to be returned direct to L.T. positive; its self-capacity is, therefore, added to that of the valve, which we have already probably endeavoured to reduce to a minimum by a skeleton valve-holder. When connected across the grid condenser its capacity is added to the latter, but being such a minute proportion of the whole it has no appreciable effect; with the valve, however, it may well be compared with the grid- filament capacity.

One final word about aerial coupling. Although coupling through a very small area to the tuning coil is very efficient, the results surpassed all expectations. Owing to the small diameter, coils of a comparatively large number of turns could be made having the same inductance as one or two turns of the customary large size. Reaction coupling was simplified, and the receiver went much lower down in wavelength; furthermore, the external field was reduced, another favourable point. The ordinary valve-holder of the low capacity type is, of course, used as a coil-holder.

Making S.W. Coils

A word or two about the actual construction of these coils. The idea general idea may be gleaned from Fig. 1. Most listeners have a few discarded valves in the junk box. The actual glass envelope may be removed by immersion in hot water or methylated spirit. When the filament will dislodge, it will be necessary to pull away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire should be passed through the holes and soldered to the turn and the ends may be pulled away from the case by holding the latter in a small vice holes may be drilled adj
Part II: Resistances in a Mains Receiver

It is in the modern all-mains type of receiver that the greatest use is made of both fixed and variable resistances. A glance at Fig. 1 reveals no less than ten different resistances in a three-valve voltage-reducer type of receiver. There would, of course, be proportionately more in a four or five-valve receiver. However, the three-valve will serve to furnish us with at least one example of most of the uses to which resistances are likely to be called in present-day sets of the A.C. mains type.

For the purposes of this article I shall deal one by one with the resistances shown in the circuit diagram, Fig. 1. This circuit, with one or two slight modifications, is an A.C. version of the battery circuit given in Part I. Naturally, any resistances which are identical in function with those in the battery circuit will be dealt with as summarily as possible, while those which are necessitated purely owing to the mains operation will receive most attention.

Before examining the resistances themselves it is just as well to remind ourselves of the value of the voltages which are handled in a set of this description. Instead of a mere 120 or 160 volts H.T., as is used in the average battery set, the mains receiver shown here employs a maximum voltage of 350. This is obtained by stepping up the voltage of the mains by means of a transformer.

Voltage Dropping and Decoupling

Now let us take the various resistances in numerical order. The first one, R1, serves two purposes. Primarily it is a voltage-dropping resistance, that is, it is used to reduce the voltage applied to anode of the screen-grid valve to a value which it will stand without harm. Its secondary use is identical in function with that of the second resistance for decoupling purposes. Consider first its function as a voltage-reducer. The H.T. voltage available after smoothing is about 350 volts, and the particular variable-mu valve shown requires a voltage of no more than 200. We, therefore, have to drop 50 volts. To arrive at the correct value for R1 to give this drop, we look up the anode current of the valve from the pamphlet issued by the makers. In this case this is nearly 8 milliamps. We know from Ohm’s Law that resistance equals voltage divided by current (R = E/I), therefore the resistance required equals 6250 ohms, say, 6,000 ohms as a round figure.

For its decoupling function R1 is supplemented by the condenser C1. As R1 is of a fairly high value the condenser need be no larger than 0.01 mfd.

Before going further, I want you to understand that the values of the resistances I am giving here, although a useful guide to those employed in the average mains set are not hard and fast. Obviously, in a receiver employing a different circuit from the one shown here, and more particularly other valves the values might work out quite differently. However, my object is not to give values to suit all cases, but rather to explain to you the function of the various resistances and show how their values are arrived at.

After R1 we come to a network of resistances, R2, R3, R4, and R5. They certainly look rather formidable, but if we realise right away that they have only two main functions to perform between them their arrangement will not appear so complicated. The first function is to supply variable bias to the variable-mu valve, and the second is to give a suitable voltage to the screen of the same valve.

The resistances looking after the bias are R2 and R3, while R4 and R5 are the chief controllers of the screen voltage.

For an understanding of the working of R2 and R3 we must know how grid-bias is applied in an all-mains set.

Getting Grid Bias from the H.T.

The most obvious way of making the grid of a valve negative in respect to its filament is to connect a battery (known as a grid bias battery) between the two. This is shown in Fig. 2, and is the method employed in a battery set. In this example a 4.5-volt battery is shown.

Now there are two ways of looking at this biasing business—you can either take the filament as the zero point and say the grid is 4.5 volts negative to it, or you may consider the grid as the starting-off point and say the filament is 4.5 volts positive to the grid. With mains valves the cathode corresponds to the filament of a battery valve. The filament in a mains valve is merely used to heat the cathode. It is the latter which is the “business” element and gives rise to the electrons. Well, then to make the cathode positive in respect of the grid is the same thing as making the grid negative to the cathode. Now look at Fig. 3. Here you will see how a resistance R2 is used to obtain bias from the high-tension supply. The plate of the valve being connected to H.T. positive is at a high positive potential in respect to the grid, which is connected to H.T. Let us say for the sake of argument the difference is 100 volts. This drop in voltage will occur across the internal resistance of the valve denoted by the dotted resistance R1. If, however, a resistance R2 is included in series with R1, then the drop will be divided between them. Thus, for example, if R2 is the same value as R1 there would be 50 volts dropped across each. In other words, we should be getting 50 volts H.T. and 50 volts grid bias from the supply. If R2 were smaller than R1, then the voltage dropped across it would be proportionately smaller than that across R1. In practice, of course, R2 is made just sufficiently large to give the necessary few volts required for bias.

In the case under consideration it is necessary to be able to vary the bias applied to the valve, to this end, this is of the variable-mu type in which the variation of bias forms the volume control of the receiver. To arrange this the two resistances R2 and R3 in Fig. 1, are used in place of the resistance R2 in Fig. 3. R3 is the bias resistor proper which can be varied from zero resistance to a fairly high figure. R2 is included in series with it so that there is always a slight bias even when R3 is at zero. This is necessary because the valve is designed to work with a small minimum bias.

Bias Resistor Values

Now as to the value of R2 and R3. The usual way to calculate these is to ascertain the current flowing through them. This divided into the bias voltage required gives the necessary resistance. It is simply a further application of Ohm’s Law.

(Continued on next page)
is 361 metres and the power 20 kilowatts (unmodulated aerial carrier energy).

The nearest obtainable value to this would be 150 ohms, although a 200 ohms resistance would—perhaps be better in the interests of stability.

The value of R3 depends on what degree of volume control is desired. To give a fair range requires a variation of bias between 0 and about 40 volts; therefore to obtain this the resistance must drop 40 volts when "all in." The calculation is the same as for R2, namely, voltage divided by current. However, in this case the current is more than that passing through the valve. There is also that passing through the screen potentiometer composed of R4 and R5. This latter is about 3 milliamps, so that the total current passing through R3 is about 9 mA. plus 3 mA. = 12 milliamps. To give a voltage drop of 40 the value of R3 must therefore be $40 \div 0.012 = 3333.3$ ohms. A suitable value would be 3300 ohms.

Before dismissing R2 and R3 I must just say a word about their wattage dissipation. I think it is fairly obvious that R2 will not be overloaded even if from the smallest rating since it is not a very high resistance. Let us see how it works out.

We know that wattage equals voltage multiplied by amperage, thus the wattage required for R2 is $1.6 \times 9 = .0135$ watts.

Quite a modest dissipation and well within the capacity of the average metalized or spaghetti type of resistance. The wattage of R3 is a slightly larger amount.

The voltage in this case is 40, and the current 12 milliamps thus the power dissipation is 40 x 12 = 480 watts. Thus the average wire-wound potentiometer or variable control would be quite suitable, in fact most such components will stand 5 watts.

Now as regards the voltage on the screen of V1. This is regulated by the resistances R4 and R6 together with some part of R3 (the actual amount depending on the position of the slider). These three, as you see, form a potentiometer across the full H.T. supply.

The screen of the valve takes its voltage from the junction of R4 and R6. Naturally, the voltage applied to the screen will depend on the ratio of R6 to R4 and R3 together. If R6 is larger than the other two, then most of the 200 volts from the H.T. supply will be dropped across it and the voltage on the screen will be low. If, on the other hand R4 and R3 together form a higher resistance than R6 then the greater drop will be across these and so the potential on the screen will be high.

Actually there are three things which govern the values of R4 and R5. Firstly, there is the voltage required by the screen, secondly, the current it takes; and, thirdly, the amount of current which must pass through the resistances themselves. This last must be fairly large compared with the current taken by the screen in order to obtain a sufficiently steady voltage. It should be at least three times the screen current. In this case, therefore, the minimum figure is three amps.

In determining the values of R4 and R5 we shall ignore R3 for the moment by assuming it is set at zero. The correct voltage for the particular variable-mu valve we are using is 80 volts therefore to pass 3 milliamps at 80 volts R4 must be about 27,000 ohms. The nearest standard resistance to this is 25,000 ohms. Assuming we use this then it will pass 80 = $3.2 \times 10^3$ milliamps. Now, this current plus the screen current of 1 milliamp will have to flow through R5. To determine R5 we have to divide the voltage it has to drop, namely 250 less 80, by the current it has to pass, thus $170 \div (3.2 + 1) = just 1,000$ ohms. The actual amount depending on the position of the slider. These three, as you see, form a potentiometer across the full H.T. supply.

The screen of the valve takes its voltage...
MOVIE MYSTERIES

EXPLAINED

THE May issue of "Home Movies and Home Talkies" contains two pages of fascinating pictures showing how professional effects are obtained in the big Studios.

OTHER CONTENTS

Are you thinking of having a Cruising Holiday this year? If so, you should make a point of reading Adrian Brunel's article, "How to Take YOUR CRUISE FILM." Another illustrated article of special interest at this time of the year is "Making Movies at the Zoo"—that paradise of picture-makers. Also further information on Home Talkies, and particulars of TWO PRIZES of £10 and TWO of £5 offered to readers.

Obtainable at all Newsagents, Bookstalls and Dealers, or post free 7d. (Subscription rates: Inland and Abroad £1 per annum. Canada £1 per annum.) from George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.

For the wonderful little portable described in this week's issue the designer specifies two Utility Bakelite Condensers. Utility Bakelite Condensers are the finest of their type, they occupy a minimum of space and are accurately rated to the capacities stated.

WILKINS & WRIGHT LIMITED

Utility Works, Hollyhead Road, Birmingham

London Agent:
E. R. Morton, Ltd., 22, Bartlett's Buildings, Holborn Circus, E.C.4

Read this

QUALITY Produces

EFFICIENCY

TESTED BEFORE DESPATCH

The original BECOL ebonite low loss formers are thoroughly reliable. They are used in all parts of the world. Look for the BECOL trade mark. Ask your dealer. If unable to supply, write direct. SEND NOW, enclosing 6d. (post free) for up-to-date handbook of tuning coils for DUAL RANGE, BAND-PASS, and SUPER-HET circuits. Fully illustrated with data. A very interesting handbook.

RODS, SHEET, TUBES, PANELS

VARLEY CLASS B COMPONENTS

The following transformers illustrated by Messrs. Varley, Ltd., have been found to be particularly suitable for use with Class B valves. They are of a high order, and include a variety of sizes and types. The transformers are designed to give a wide range of output, and are suitable for use with any type of Class B valve. They are easy to use, and are suited to the requirements of the modern radio receiver.

LISSEN CLASS B HYPERNIK TRANSFORMER

The Lissem class B transformer is particularly suitable for use with Class B valves. It is easy to use, and is well suited to the requirements of the modern radio receiver. The transformer is designed to give a wide range of output, and is suited to the requirements of the modern radio receiver.

RADIOPHONE SCREENED DOWN-LEAD

The British Radiophone, Ltd., is making use of the new, thin, and portable type of lead. This lead is particularly suitable for use with the new type of Class B valve. It is easy to use, and is well suited to the requirements of the modern radio receiver.

NEW FERROCART COILS

The Ferrocarril, Ltd., have submitted new models of the famous Ferrocarril coil. These models are particularly suitable for use with the new type of Class B valve. They are easy to use, and are well suited to the requirements of the modern radio receiver.

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

May 13th, 1933

The new Fernocarril coil.
A REVIEW OF THE LATEST DISCS

By E. REID WARR

Recordings from the Programmes
Here are the best recorded versions of some recently broadcast items. The pieces have been carefully selected to give at least one to suit every individual taste.

Very English Music
Every composer's work bears traces of his nationality, and it would be difficult to find any music more typical of England than Eric Coates'. There was a programme of music a few weeks ago, and amongst the items was the suite From Meadow to Mayfair. Here is simple music which never bores one. There is a fine recording, done a few months ago. The two records are played by the London Symphony Orchestra on H.M.V. C2448-9 at 4s. each.

One for the Kiddies
Did you hear Alec Shaw, the Scottish Bird Man, in a Vaudeville hour recently? The hours he has spent with the songsters have given him a most unusual power of imitating their song. You will find all of his "turn," with its little explanatory remarks, on Columbia DB1625. It is 'sung to a harpsichord accompaniment, and its creative air haunts one for days. Its companion song Au Claire de la Lune is extremely good also.

A Seventeenth Century Gem
One of the loveliest songs you will find in any language is Plaisir D'Amour. It was sung by Lucienne Herval some time ago. There is a marvellous record of it made by Yvonne Printemps on H.M.V. DB1620. It is sung to a harpsichord accompaniment, and its creative air haunts one for days. Its companion song Au Claire de la Lune is extremely good also. It is a six-shilling record, but worth every penny.

Tauber and "The Merry Widow"
The famous Vidal (pronounced Villea) was sung in an afternoon programme recently. It is one of those songs which always seem welcome. Tauber has sung it, and splendidly, too, on a Parlophone Odeon R.O. 20188 (4s.). You can imagine that Tauber would sing this well!

A Very Tuneful Overture
That from Mignon. Played very creditably by the Northern Studio Orchestra. It contains music of the kind which is called "nice" -"jolly"-"pretty." There is an excellent performance of it by the Orchestra Symphonique de Paris on Columbia DX 2355 (4s.).

And Still Another
Offenbach's Orpheus in the Underworld. This is better than Thomas's "Mignon." A record everybody ought to have is that of the performance by the Berlin State Opera Orchestra on H.M.V. D1293. This is done in the grand manner with tremendous skill and power.

A "Best Seller" In Songs
Haydn Wood's Brown Bird Singing has had a tremendous run. It has been performed in every way imaginable (Reginald Dixon played it on the organ in a recent programme, which recalls the very delightful record H.M.V. B6184 (2s. 6d.), where it is played as a waltz by Ray Noble and the Mayfair Orchestra, and it is very appropriately backed by Bird Songs at Eventide in the same style.

A Schubert Song Worth Hearing Again
The song's the thing really, although Am Meer was played by an orchestra in a recent broadcast. There is a new Decca Polylode (No. DE7020, 2s. 6d.), on which the famous German bass, Schlusnus, sings it. He is quite in the front rank, and should be heard. The song on the other side, By the Weser, is very good, too. Both are, of course, in German.

An Operatic Star in a Popular Number
They are all doing it nowadays. That oft-played song, Her Name is Mary (and a very good little song, too), heard in tea-time music, has been most unaffectedly sung by that very good tenor, Kullman on Columbia DB1006 (2s. 6d.). He forgets that he is an opera star when he sings this -that's why it's so good.

A Spanish Triumph with Shakespeare
Some weeks ago Should He Upbraid was sung. It is strange that the most perfect singing of a song so essentially English should be by a Spaniard, but nobody can help but agree after hearing Conchita Supervia sing it on Parlophone B20186 (4s.). Inflexion and understanding of Shakespeare's words are perfect, the accent well-nigh so.

Spanish and Shakespeare side by side here are singularly impressive performances by the Milan Symphony Orchestra. You will find these favourites on Parlophone E11339 (4s.).

Then to Wagner. The British Symphony Orchestra, under Bruno Walter, have done Siegfried's Journey to the Rhine from the Götterdammerung on Columbia LX191 (6s.). Again, a very luxurious rendering of well-known music.

Gounod and Bizet follow-the popular classics again. I like Charles Kullmann's singing (in English, mark you) of All Hail, Thou Dwelling and the Flower Song, on Columbia DX443 (4s.). Both are sung without any tricks, cleanly and soundly.

(Continued on page 114.)
Lectures on Television

A SPECIAL course of four lectures on Television will be given by H. J. Barton-Chapple, Wb.Sch., B.Sc., A.C.G.I., D.I.C., A.M.I.E.E., at The Polytechnic, Regent Street, on Wednesdays, commencing May 10th, 1933, from 6.30 to 8 p.m.

The syllabus for the complete course is as follows:—


The course is intended for those who have attained a reasonable standard in electrical and high frequency technology.

Automatic Wireless Beacon

WIRELESS is being used in many novel ways for the guidance of navigators both in the air and on the sea, and an automatic wireless beacon of particular interest is being installed in the Irish lightship Count. The wireless beacon will have an energy in the aerial of 100 watts and will be operated in conjunction with a searchlight and flood light principles of working.

Illustration of principles of television.

A chain of twenty-three automatic wireless beacons is in operation around the coasts of the British Isles for the safeguarding of shipping, and the Marconi Company have a contract in hand for two new beacons for the Chinese authorities to assist navigation on the important routes to Shanghai and the Yang-tze-Kiang.

New Use for Radio

TALKING of ships reminds me of a novel instrument that I inspected in a large factory devoted to the manufacture of nautical and other instruments for recording purposes. This particular instrument is aboard and is being fitted to vessels in increasing numbers to obviate the need for “swinging the lead” in obtaining soundings as to the depth of water under the ship. Another frequent cause of parasitic oscillation, especially on long waves, is the use of a tapped circuit and a tuned circuit following an S.G. valve; oscillation then occurs at the wavelength of that portion of the coil whose frequency is equal to the number of miles the receiving ship is from the beacon.

The lightship will have a distinctive signal which will be emitted before each transmission. A chain of twenty-three wireless beacons is in operation around the coasts of the British Isles for the safeguarding of shipping, and the Marconi Company have a contract in hand for two new beacons for the Chinese authorities to assist navigation on the important routes to Shanghai and the Yang-tze-Kiang.

What Will the Show Reveal?

THIS year’s Radio Exhibition at Olympia, takes place from August 16th to August 24th. With what set manufacturers introducing new models in March, and the makers of accessories giving us new coils, valves and the “cold” detector so very “in the vogue” I almost feel as if there can be any more new things in so short a time. In the way of components, I must confess that I can only think of permanency-tuned coils. As regards complete receivers, I imagine that we shall find that all the better quality ones are fitted with automatic-volume control, some system of automatic tone compensation and, in the case of battery sets, with either Class “B” or “G.P.-F.” output. But we must wait and see.

Parasitic Oscillation

A CURIOUS difficulty one sometimes meets when trying out a new set is that caused by what is referred to as parasitic oscillation. It is due to some part of the set oscillating at quite a different wavelength to that which the set is actually tuned to, and the oscillation generally makes itself known by the fact that reaction control is not so effective as one would expect. When the knob is rotated, signal strength is not increased as it should be, and at a certain point a “click” is heard denoting that oscillation has actually set in. In the case of a broadcast “host”, it is impossible to distinguish between a signal and the noise, and the reaction strength is generally poor.

In other instances the effect of parasitic oscillation is merely to render the receiver intolerable, and is due to the sensitivity of the receiver being completely “turned off”, so that reception is impossible. Oscillation, in the latter case, can be detected by the usual method of touching the detector-grid terminal with a moistened finger; a loud “ double-plop” is a sure sign of oscillation.

When trouble of the kind referred to is experienced, it can generally be traced to long wires in the grid or anode circuits which are interacting to produce oscillation at a wavelength shorter than the set is tuned to. Another frequent cause of parasitic oscillation, especially on long waves, is the use of a tapped circuit and a tuned circuit following an S.G. valve; oscillation then occurs at the wavelength of that portion of the coil whose frequency is equal to the number of miles the receiving ship is from the beacon.

The most certain cure is to dispense with the tapping and make connection to the ends of the coil only. Sometimes it can be prevented, however, by inserting a 100 ohm resistance between the detector anode and the reaction condenser.

One-knob Control

I HAVE often wondered if the old hand at radio really views with approval the modern fetish for “one-knob” control. I know I myself have no great love for it. Even though I am not blind to the very obvious advantages it possesses for inexperienced “knob-twiddlers,” but think the experienced man has a tinge of regret at the loss of the opportunity of controlling the number of controls. Tuning-to-day is so elementary, and with the improvements in tuning,” it has become so simple a matter, that the radio expert of the family is no longer needed when a distant programme is required, in fact, even the baby can use some modern receivers. This is undoubtedly a very fine thing for the family, but it is a bit “tough” on the expert who has to explain years until perhaps television will give him another opportunity of demonstrating his prowess. Talking of ganging reminds me that it is as well not to change the value of your H.T. tappings too much in a ganged set, or you may put the tuned circuits seriously out of step. Variation of H.T. value might cause a change of input capacity, so that it is best to decide on the H.T. voltage before setting the trimmers.

Wavelength and Frequency

SOME of my readers may be confused between the calibrating of stations in wavelengths or frequencies, and it has long been felt that this subject should be made. We still know most stations by their wavelengths, whereas the separation between the stations by other matters is always considered in kilocycles. It is a simple matter to convert wavelengths into kilocycles by dividing the length of wavelength, the result will be the frequency, and vice versa, dividing 300,000 by the frequency in kilocycles will give the wavelength.

For many years the National Physical Laboratories have maintained a standard of frequency by the use of a crystal tuning-fork, and a properly designed and operated tuning-fork can form a standard frequency up to the highest frequencies, but not above 100 million. This is quite equal to the results obtained from the best pendulum clocks, with the advantage that the tuning-fork is less susceptible to earth tremors and disturbances. During a slight earthquake last year a small change was recorded in the rate of the pendulum based on a tuning-fork, and the error—about four parts in ten million—was recorded on the tuning-fork chronograph which was unaffected by the shock. It is probable that the pendulum would seem to be fairly accurate, accurate enough, at any rate, for all practical purposes.
A Receiver for Flat-dwellers Wanted

Sir,—I have been a reader of your journal from about the ninth week of its start and find it most helpful and interesting, but I am disappointed that although you said earlier that so many of your readers wanted particulars of a portable or trans- portable set suitable for amateurs to make up and at a reasonable price, that you hoped shortly to cater for them, I have watched in vain for the details. By the way, I have been explained to beginners why one cannot use any set on a frame aerial and no earth. The beginner's course never make this clear. I agree with your correspondent of a few weeks ago who pleaded for quality rather than quantity. Please do something for us flat-dwellers. There are thousands of us, and whilst there are sets of every description detailed for aerial and earth users, we only get an article on a portable set very occasionally.—M. J. RUSSEL (London, W.)

(There are several letters which we feel has not been given sufficient consideration in connection with the use of the new Class "B" valves, viz., the absolute necessity of providing such valves with an H.T. Battery of very low internal resistance capable of giving during its normal life peak currents of 40 to 50 milliamperes. Although the ordinary type of H.T. Battery will undoubtedly operate a Class "B" valve for a time, we are of the opinion that the full benefit to be derived from the new method of amplification will only be secured by the use of the tripole capacity of power type of H.T. battery. It is possible that objection to this type of battery may be raised on the score of bulk and weight, and also the fact that in existing sets which are modified for Class "B" amplification the accommodation for the H.T. Battery may be limited. In order to meet this objection we are introducing a 120 volts double capacity battery which, whilst retaining the normal length and breadth of the standard battery, is increased in height to about 31in. This battery is our No. 1168 size, measuring 10in. x 6in. x 31in. high, fitted with plug socket tapping in 10-volt steps. The list price is 17s. 6d. The normal discharge rate can be increased from 12 to 15 milli- amperes, i.e., the average discharge rate for a Class "B" amplification set.—A. WILLMORY, Siemens Electric Lamps and Supplies Limited.

WHAT IS SERVICE?

Every reader of "Practical Wireless" is entitled to FREE Advice !

(See Page 315)

" Practical Wireless" Receiver in India:

Remarkable Results

Sir,—After using the Newnes "Long Distance Four" (8 G., Det., and 2 L.F.) for one year in India, I think you will be interested in the results which I have obtained with it. The set was used in Quetta last year for eight months, and...

(Continued overleaf.)

DO YOU KNOW?

—THAT the grid bias applied to two valves in push-pull in the same as for one similar valve used alone.
—THAT a fuse may be connected to a battery to provide a very simple circuit tester.
—THAT interaction can take place between the anodes of two valves if these are of the same variety.
—THAT the presence of an earthed metal body seriously affects valves as well as coils.
—THAT interaction can take place between the anodes of two valves if these are of the non-metalized variety.
—THAT the average mains supply meter does not record the consumption of power below about 5 watts.

NOTICE.

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

CONVERT YOUR SET TO CLASS B

by simply adding this unit

For any use S.0UND SALES CLASS B

Component—as good as the best—and specified by "Practical Wireless.

Write for fully illustrated Catalogue N/13

SOUND SALES LTD., Tremlett Grove Works, Junction Rd., Ilfegate, N.19
since November has been in use here at Sir Walter. It has been excellent on short, medium, and high wavelengths. Throughout last summer I received Chelms-
ford, Rome, Paris, Moscow, all on medium wave. Through the good-power 1000 watts strength. The first two in particular, were very good.

The Empire Station at Daventry started in December, I have listened to the programmes nearly every night. Some stations have been so loud that I had to turn down the volume control. In addition to the Empire service for the Indian Zone, I have received the programmes radiated to the Australasia given Canadian and South African Zones. Recently, during a thunder-
storm, I used the lead-in only (12ft. of wire from door to set) and, a temporary earth, and received at loud-sounding strength FHI experimenting on 25 metres. The medium and high waves are sometimes spoilt by atmospherics, but otherwise are received clear and loud. The medium wave stations include London National, Hells
berg, Scottish Regional, Paris, Mülhacker, London Regional, Bombay and Calcutta. During the winter these stations were clear, but all short wave stations are now, owing to the lighter evenings, they are much weaker, and are received best at night. I have not devoted much thought to them at the moment, but Duntchen, the little time which I have spent, I have received Moscow, Tashkent, and two or three others.

Considering the distance of all of these stations (even Bombay, our local, is about 2,000 miles away) and the reception being of good loud-sounding strength, it speaks very highly of such an excellent receiver.

This is another case where the old two-pin short-wave station for the South African zone, and the little trouble taken in coil changing is worth it. — E. A. Clark (Simla, India).

From a South African Reader

Sir,—I am a regular reader of PRACTICAL WIRELESS, and I must offer my apprecia-
tion to the Editor and the staff for the amount of knowledge and skill that can be obtained from your paper, for every wireless listener and experimenter and I can confidently recommend it to all our readers.

Can you publish a set for overseas conditions, about five valves, with a range of 3,000 miles, that would be cheap and convenient? Long waves are not suitable for South African conditions as they only bring in noise and atmospherics. The British Empire short-wave station for the South African zone comes in very weak, and fades out at times. I have received your Constructor’s Encyclopaedia, and I am very pleased with it. Wishing your paper a very happy future. — M. Leverton (Cape Town).

A Beginner’s Appreciation

Sir,—I have just received one of the most remarkable books on wireless ever pub-
ished. Of course I refer to “The Wireless Constructor’s Encyclopaedia.” To the man in the street it will prove a rare treasure store of knowledge.

I cannot praise it highly enough, for above all it explains in simple language all that one could wish to know about the great “mysteries” of wireless, whilst at the same time it is presented in a manner attractive and entertaining. For years I have been interested in wireless and yet have feared to explore the realms of mystery which I thought surrounded it, until there appeared on the market your very excellent weekly,

(Continued from column 3)
REPLIES TO OUR READERS AND INQUIRIES

PRACTICAL WIRELESS

May 13th, 1933

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

The coupon on this page must be attached.

SPECIAL NOTE

We wish to draw the readers' attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction or operation 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) To suggest alterations or modifications of receivers described in our contents; (2) To suggest alterations or modifications to the wiring, we ask would-be correspondents to consult their own local technical staff. (3) An 8 mfd. fixed condenser joined to the earth terminal will show that the two terminals protruded sufficiently to touch the metal foil. than you should have done, and the point of this has obviously been overlooked the fact that the falling metal dust damaged it. Therefore, some of the metal filings have entered the gap. You will damage the condenser by leaving it in this state, and you must therefore completely dismantle it and clean away all metal dust and other matter which you will no doubt find in your baffle-board with a fine cloth bag to avoid a repetition of the trouble.

SCREENING THE AERIAL

"I am most unfortunately in my wireless hobby, and therefore, use the term "wireless" to denote a metal foil. I am living inside a house which is used as is used for the trolley-buses, and over a shop. There are two electric signs on the shop, and near door is a cinema. This has a flashing sign on the roof (not more than 20 ft. from my aerial), and the motor and other apparatus in the cinema kicks a most awful din during the evening. I did not know this until I bought a six-valve set. Now I can't use it, but can you tell me how I can do something to get a little clear music sometimes? I believe you will be able to help me, as I see from your letters page that you have helped others in their difficulties."—(W. L., Nottingham.)

You are certainly unfortunate in your position, W. E., but there is hope for you yet. As you have got a commercial receiver we do not recommend you to tamper with that, but your aerial and earth may be adjusted in such a manner as to defeat the minimum of interference which you experience. First of all, experiment over a number of positions, and at each position, take a coil of wire, say about 30 ft., loosely bunched up, and hang down so that it will stand and move on the same plane. (2) A sheet of copper gauge, or perforated zinc, about 6 in. by 4 in. is required. The weight of this sheet must be sufficient to prevent it falling in the gap. (3) The condenser is fixed to the earth terminal. One of these is certainly found as good as any other. It is a matter for your particular set. For your aerial, the smallest indoor wire will be sufficient, but if you must use outside wire, obtain a length of the special new type of screened lead in which is advertised in our pages, and connect the screening of this to earth. It will be found to create a vast improvement, and the combination of this and one of the above earths should enable you to receive many stations clear of the interference. Of course, your range will be somewhat reduced, but you must be content with it if you are to reduce the noises with which you are troubled.

SPARKS FROM THE FURY

"I have built the Fury Four, and have used a metal foil and a lead-box in order to ensure stability and to facilitate the earth return leads. When I switched on I had large sparks from the H.T. plug, which I connected in the H.T. lead, and it decreased when I added a second plug against the socket of the battery I get a flash. I wished to introduce a small, but it appears to get in the plug again, but get a spark every time. What does this show ? I expect something is wrong, but I do not know where to look."—(U. G. S., Brixton.)

"Obviously you are overtaking the high tension battery in some way, and although there are many places where you could do this owing to a mistake in the wiring, we think you will find that the fault has arisen through your using the metal foil on the base-board. The H.T. positive lead is taken to a soldering tag, which is screwed to the underside of the base-board, and you have probably used a rather longer screw than you should have done, and the point of this has prevented it from touching the metal foil. The moment's thought will show that the two terminals of the H.T. battery are thus connected, as the foil is joined to H.T. negative. Remove this screw before you look elsewhere for the trouble.

FUSE FOR BATTERY SET

"I have finished the construction of a three-valve set, and I refer to the latter in order to make sure that I have not been damaged owing to a short on the H.T. side !"—(A. W., M., Surbiton.)

The choice of a fuse is carried out in the following way. Firstly, you must total the filament consumption of all your valves, and then, from the line to line voltage, calculate the current which will be obtained. This is the maximum current which is obtainable, and which is just lower than the fuse rating. Therefore, If you must use an outside wire, obtain a length of the same wire as is used for the road as is used for the earth return leads. obviously, it would be possible to use a 20 milliamp fuse, or even a safety fuse. Where should this go, I wonder ?"—(W. H., Enfield.)

"I have just bought an 8 mfd. electrolytic condenser, but when I tested it with a flash-damp bulb it produced a light. Is this a sign that the condenser is faulty ? I understand that a condenser should not pass a D.S. and look as if a condenser back to the shop and got it changed, but the same thing happened. I understand that the valves will be blown unnecessarily. Where should this go, I wonder ?"—(A. W., M., Surbiton.)

An electrolytic condenser is not a condenser until it is polarized by a fairly high current. The two electrodes of this type of condenser are separated by a film of oil, and they conduct current in their normal condition. When this current fails the condenser value in time and pressure, and a sign that the condenser has failed. If you do not want to wind an output transformer for my receiver, which employs in the last stage a pentode valve, and have a speech-coil of just under 10 ohms resistance. The tuning and core size for the transformer, and gives me any other details. The core is a Marconi core, and the winding is of wire 20 to 21. Brain that oxide is just under 50 ma, so that the primary would have to consist of 3,000 turns of 34 gauge wire, and the secondary would obviously consist of 3,000 divided by 20, or 150 turns. For this, a number of wire gage may be used. No. 22, 24, or 26 may be used at your discretion. Terminal strips and fixing feet may be filed according to your own ideas.

ELECTROLYTIC CONDENSER

"I have recently bought an electrolytic condenser, but when I tested it with a flash-damp bulb it produced a light. Is this a sign that the condenser is faulty ? I understand that a condenser should not pass a D.S. and look as if a condenser back to the shop and got it changed, but the same thing happened. I understand that the valves will be blown unnecessarily. Where should this go, I wonder ?"—(A. W., M., Surbiton.)

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GRADED VOLUME CONTROL

"I have recently bought a volume control for use across a mouthpiece, and I find that it is supposed to be 'graded.' Does this mean that it is different from the ordinary potentiometer, or that it is classified according to its value ? Are the connections the same as in the ordinary case ?"—(F. C., Birmingham.)

A graded volume control is simply a potentiometer with the resistance element arranged with a larger area at one end than the other. Usually, these are wire wound, with the wire wrapped round a flat, but wedge-shaped former, and consequently, the movement of the control alters the resistance ratio in a greater variation from one to the next than at the other end of the element. The potentiometer, therefore, is used in an electrolytic condenser. It is a method of grading the tapping of the grading end of the resistance should be remote from the grid-bias connection.

FREE ADVICE BUREAU

This coupon is available until May 20th, 1933, and must be attached to all letters con-

PRACTICAL WIRELESS, 11/5/33,
Some readers trouble, we undertake to send out complete range of high-class power transformers, as a postcard, the names of the firms from whom you may purchase, and address of the nearest to your local. "RAWSOOD" MAINS TRANSFORMERS A USEFUL range of high-class power transformers is now available in the new catalogue issued by Rawson Electrical Co., Ltd., New Road, Wigan. The transformers are designed to function satisfactorily in many other conditions and are given in the catalogue with a complete description of each type and the various applications to which they are suited. The transformers are made with the highest quality materials and are supplied with a complete range of accessories, including power pack for use with A.C. Mains. A copy of the catalogue can be had on application to the above address.

C.A.V. BATTERIES A handy folder we have just received from C.A.V. Batteries, Ltd., details of this firm's Non-Spillable "Jelly-Acid" Batteries, together with a range of H.T. batteries suitable for portable and transportable receivers. The non-spillable type, which can be stored in any position, is very clean and compact and requires no more attention than ordinary batteries. They are recharged in exactly the same manner as the free acid type. Included in the folder is a useful chart of all the popular receivers showing the most suitable C.A.V. batteries. A copy of the folder will be forwarded to any reader on application to C. A. Vandervell, Ltd., Well Street, Birmingham.

NEW CLIX COMPONENTS A Most useful range of components recently introduced by Wego Condenser Co., Ltd., is a seven-pin pinboard mountings (a) with terminals, (b) without terminals. Each socket automatically aligns itself to any variation in the thickness of the pins, all at the same time giving maximum surface contact between sockets and pins. Other new small components made by this firm are non-sporadic spade terminals, and spade terminals for formation of high-tension particulars and prices are given in a leaflet entitled "CLIX Components," a copy of which can be obtained from Leotinco, Ltd., 70a, Rochester Street, West Bromwich.

"WEGO" CONDENSERS The firm of Wego Condenser Co., Ltd., is noted principally for batteries, but a most comprehensive range of condensers is also manufactured by this firm. The latest catalogue issued shows the complete range, and gives, in addition to the various types and values, complete physical dimensions of each type. The ranges include Wet Electrolytic, Dry Electrolytic, Moulded Mico, and in each type there are large and small units. The pages are illustrated with diagrams, and a description of the construction, operation, characteristics, and other interesting information is included. A copy of the folder can be had on application to Wego Condenser Works, Morden Road, South Wellingham, S.W. 16.

Replies to Broadcast Questions

Ultrav. (Beeston): 31Q, Krenischevskij (Germany), relaying programme to U.S.A. (29.16 m.), W.L.W. for Europe. W.W.F. M., W. F. McPherson, 12, Bedford Street, W.C. 2, London. Goblet, Hill, Kenilworth, Warwickshire; GOFV, Canary Islands; GOYX, Society of Great Britain, 53, Victoria Street, S.W. 1; GVX, A. E. Jones, 32, Brussels Road, Bedfont, Epsom, E.C. 9; GOFY, C. W. Parry, 12, Hadfield Road, Barnby, Yorks; GBUT, J. E. Fergie, 67, Arthur Street, Rooks, 1st of Wight; GOFX, J. C. Kesly, 5, St. John's, Bedford Road, Kempton, Beds.; GOYX, N. E. Read, 62, Earl's Court Road, Kensington, London, W. 8; FXXK, B. C. M. Joe, 13, William Street, Lonon, Bedfordshire; GOFZ, J. W. Parry, 13, Huddersfield Road, Barnsley, Yorks.

A Home-constructed Microphone (Continued from page 329)

holes, take the front piece off again and glue the diaphragm on the back of it, as shown in Fig. 3. Various types of diaphragm may be used, those suggested being oiled silk, thin rubber, thin muslin (which is usually much cheaper than leather and can be obtained from the local tailor). The best type has been oiled silk stretched across the front and glued. Keep the diaphragm under a weight till it is fixed, and the microphone is then ready for fitting with granules. These are the fine grade supplied for an instrument of this type. A Home-constructed Microphone (Continued from page 329)
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