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Practical Wireless

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SEPTEMBER 24th, 1932

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THE LONG-RANGE EXPRESS THREE

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"ATLAS" Mains Units bring a new realm of better radio to the battery set owners who are blessed with electric light. Abolishing the distortion of exhausted batteries. Ending the expense of continual replacements. And giving truer, more powerful and more reliable radio for less than one penny a week.

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Modernise your battery set; make it all-mains operated without alterations to set or valves. Get an "ATLAS" Mains Unit. No other can give the same service, performance and value.

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CHOKE.

Enables the impedances of pentode and speaker to be matched exactly. No other choke provides six tappings with nine output ratios. Inductance 35 H at 60 m/A D.C.

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A continuously variable resistance from almost zero to 2 megohms to carry 5 watts. One-hole fixing. "ATLAS" Push-On Knob. For Mains Units, Volume Controls, etc.

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STOP PRESS.
THE BULGIN 'TRANSCOUPLED' SPeciFICATED AGAIN.
See page 13 in this issue. 11/6

GREATER VOLUME & PURITY

For greater volume and purity fit a Bulgin Filter Choke between
H.T. plus and the anode of the valve. Then feed the loudspeaker
through a 0.02 condenser connected to the anode of the valve.
The other side of the loudspeaker should return to L.T.—or the
anode if the valve is indirectly heated. A Bulgin Milliammeter
is shown on the right of diagram, and where incorporated serves
as a valuable guide, not only on current consumption, but also
as a visual indicator of overloading or distortion. If meter kicks
to the left, valve is under biased; if to the right, over biased.
Keep the pointer steady by correcting bias.

BULGIN S.110 SWITCH
Rotary D.P.D.T.,
“OFF” position; with
engraved indicating plate. 2/6

Bulgin S.110 Switch is a D.P.D.T. type with central “OFF”
position. It gives complete control over the Radio, gramophone
and On-Off switching of a battery set. The diagram clearly shows
the connections. The normal connections for a Volume Control
for use with a pick-up are also shown.
The correct position for the Switch is close to the valve to be
controlled. If valveholder is well away from panel, use extension
control shaft E.H.4 with supporting bracket E.H.5; this allows
the leads to terminals 3 and 5 to be kept short—a most important
point.
ROUND THE WORLD OF WIRELESS

Introducing Ourselves

PRACTICAL WIRELESS makes its début in the confident belief that it will receive a hearty welcome from the large and ever-growing circle of wireless enthusiasts, more particularly those interested in home construction and the experimental side of wireless. Although in the brief space of a very few years the knowledge of this fascinating new world of the ether has grown to large proportions, we are still little more than on the threshold of the intriguing possibilities the future holds forth. Rapid as the advances have been, the near future will bring forth new discoveries, new ideas, and new technique; just as certain as day follows night, and every wireless enthusiast, if he is to derive full pleasure and interest from his hobby, will require as an absolute necessity that his knowledge be kept right up to date.

Keeping Up To Date

It will be part of the policy of PRACTICAL WIRELESS to keep its readers abreast of everything new. Writers, acknowledged as authorities in various branches of wireless and in touch with every new development, will contribute on every subject the benefit of a practical value to the reader. Skilled designers, with many successful sets standing to their credit, will exercise their ingenuity in the design of new sets combining for the constructor and experimenter the essentials of novelty with efficiency, bearing in mind also the important question of cost. Everything that is new, when tested and proved in its practical worth, will find its way into the pages of PRACTICAL WIRELESS.

Simplicity of Treatment

AND, of great importance, particular care will be taken in presenting the contents in clear and simple language. Highly technical terms will be dispensed with wherever simple description can be employed, and diagrams will be prepared and explained so as to be readily understood. Thus the reader with a modest technical knowledge, or even the keen amateur, will find PRACTICAL WIRELESS appeal to him as well as to the reader with a sound technical knowledge.

New sets appearing at frequent intervals will be an attractive feature of PRACTICAL WIRELESS. Every set described will first be thoroughly tested under varying and stringent conditions so that the reader may know that it is all that is claimed for it. It is the intention also to cover every detail of the home constructor in the sets featured. It will be explained how a set may be modified to suit particular conditions; how it may be adapted for use as a radio-gram or as a short-wave receiver; how flat dwellers with restricted space can adapt a set to meet those conditions. PRACTICAL WIRELESS plans to deal with each set adequately rather than to produce too many new designs, a policy which is apt to leave readers with difficulties to surmount after a set is made.

Our Laboratory

A WELL-EQUIPPED laboratory staffed by enthusiastic experts closely associated with the home constructor movement, will examine and test the latest components, the results of which will be reviewed in PRACTICAL WIRELESS. This feature will be of invaluable help to the home constructor in planning and making up sets. Every component used in PRACTICAL WIRELESS sets will pass our laboratory tests, and our Advice Bureau will help readers with their difficulties and problems. Expert advice is available and readers are invited to use it freely. In view of the constant and marked progress that is being made in the design and construction of components, this service will be of the greatest value to those planning and making sets.

Readers' Ideas Invited

New ideas from readers are invited. If you have a clever notion or an ingenious gadget you have discovered for yourself, it will be printed if approved and paid for at our usual rates. We shall also welcome suggestions and criticisms. They will assist us in carrying out our policy of fully satisfying the reader in the service we give him. Our Presentation Volume

ONE word more. To signalize the appearance of our first number we are offering to all who become regular readers a most attractive Presentation Volume which will be of the greatest help to wireless constructors. Read about this wonderful offer for yourself. Particulars are printed on pages 56 and 57. It is an opportunity that should not be missed.

Radio Luxembourg

THE new 400-kilowatt Radio Luxembourg transmitter has started its preliminary tests on 1,275 metres, despite international protests regarding the choice of wavelength. A young German woman, who is a fluent speaker of French and Dutch and Telegraphs, will devote the Sunday programme hours entirely to broadcasts sponsored by British commercial firms. Publicity transmissions are also to be carried out on week-days for French and German concerns. As no tax is payable by listeners in the Grand Duchy of Luxembourg the expenses of running the service will be entirely defrayed by revenue secured from advertisements.

Budapest May Change

THERE is a possibility that the 255-metre channel now used by Budapest may be abandoned in favour of a wavelength of 210 metres when the high-power station to be erected at Lakeg (Hungary) is brought into being. Work has already been started on the plant which is hoped may be completed before the end of the year.

Another French Transmitter

THE French Posts and Telegraphs department propose to erect a 120-kilowatt station at Toulouse, in the immediate neighbourhood of Lyons. This will be the third high-power transmitter to be constructed under the General Poste scheme for the continuation of the French broadcasting system.
Round the World of Wireless

INTERESTING AND TOPICAL PARAGRAPHS

A New Idea in Radiogram Cabinets

A cleverly designed Radio-Gram cabinet is shown above, in the open and closed positions. The cabinet is of the ordinary small table type, and the top portion houses a turntable and pick-up. This lets down after the manner of a flap, permitting the gramophone to be used. The receiver is mains operated and fitted with a Magnavox moving coil loud-speaker.

Do You Listen to Buenos Aires?

Under favourable conditions broadcast programmes from three of the principal studios in Buenos Aires (Argentine Republic) can now be picked up between 3.30 and 3.40 a.m. British listeners report reception of L44, Radio Splendid (303 m.); L45, Radio Nacional (316 m.) and L52, Radio Prieto (390 m.). Transmissions from Buenos Aires are also relayed at regular intervals to the United States and re-transmitted through WABO, New York, and the Columbia network.

What a Medley!

Although no definite date has been fixed, listeners to the Danish programmes via Kalundborg may hope to hear during the autumn and winter months a series of concerts in which Eskimo musicians and singers will take part. The relay will be carried out from the Juliansahab wireless telegraphy station in Greenland.

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Ladies Only!

Contrary to the principle adopted by Continental countries, with the exception of one male official at Milan, the Italian broadcasting stations only employ women announcers. With the opening of Bari, when it joins the Columbia network, the normal listening receivers solely for broadcasting studios will be one of the highest a round dozen.

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Lucky German Scholars!

In Germany the normal listening bay of 2 marks (roughly 2s. 6d.) has been reduced to 9d. per month in the case of schools utilizing their receivers solely for the reception of educational broadcasts.

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Where the Mormons Are!

With the completion of its 50-kilowatt transmitter, KSL, Salt Lake City, (Utah), U.S.A., will be one of the highest powered stations in North America. It will start operations by the end of September, when it joins the Columbia Broadcasting system by linking up with WABC, New York. The wavelength is 265.5 m. (1,130 kc/s.). Other U.S.A. stations to work shortly on increased power are: WHAS, Louisville (Kentucky), 396 m.; WCCO, Minneapolis, 370.4 m.; and WCAU, Philadelphia, on 256 m.

High-Power Transmitter for Alexandria.

The Egyptian Government has placed a contract with an Italian concern for the supply of a high-power transmitter to be built at Alexandria, and to be similar to the one recently erected at Colombo. It is to be used for both telegraphy and telephony, and may eventually take over a radio programme service. Egypt possesses four small privately owned broadcasting stations, namely: Radio Heligopolis (370 m.); Radio Szabo (504 m.); Amir Farouk (321 m.); and Port Said (285 m.), the latter being operated by an Anglo-French association, the Radio Club of the Isthmus of Suez.

Solve This!

No. 1.

A WEEKLY WIRELESS PROBLEM.

Truant books will be awarded each week for the first three correct solutions received. Mark envelopes Problem No. 1, and send to The Editor, Practical Wireless, Gee, Newce, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. To reach us not later than Sept. 25th.

(a) Brown owns a wireless set, and is being troubled by chronic motor-boating decided to introduce a decoupling device. He accordingly fitted a Spaghetti resistance and condenser—the actual values he chose being 560,000 Ohms and 2.2 mfd. The detector valve was the one he chose for decoupling, and this was coupled to the next valve by an R.C.C. unit. When the alteration was complete, signals were very much reduced—in fact, almost inaudible. Wireless, etc.—What do you think was the reason?

Don't Try This!

In some ways I admire the man who admitted to a valve manufacturer that he had tried unsuccessfully to mend one of their valves. He mentioned that he had had difficulty in soldering the filament, but he broke the grid. When asked (with a suppressed smile) how he intended to replace the bulb, he said that he would not have worried about that, as he would have protected the electrodes with a wooden box!

The Berlin Show.

WAS not very impressed by the Berlin Radio Show, except by its size; one hall alone had over five hundred stands in it. There was one item of particular interest, however, which took the form of a kind of valve with innumerable grids; the idea is that the two anodes are connected across the output of an ordinary valve, and the various voltage tappings provide the various voltage tappings. The great advantage of this is that the voltages of the tappings do not vary with the current drawn as is the case with the conventional arrangement.

A "Show" Note.

At the Show I noticed no less than ten little, 211 different three-valve mains sets, only two four-valve battery sets and, incidentally, only one five-valve "straight" portable.

A New Spanish Custom.

I often hear people grumbling about their electric light mains for one reason or another, but they do not know when they are well off. I am designing a gadget for a harassed friend who is in Spain and has an A.C. supply, but when it fails (which is often) the company switches over to D.C. and bang goes the mains transformer in the unfortunate radio set.

The Variable Mu.

The variable-mu valve has come to stay, and listeners who are troubled with snapping from a powerful local should fit one if it is humanly possible.—JAC.
IS your output valve overloaded? When you tune in to a loud station, or when a loud passage of music or a very low note is received, does your reproduction sound coarse, or is it accompanied by a “rattle”? Unless your loud-speaker gives forth the rattle, and if either soft or loud signals, then overloading is taking place in the receiver. There are two remedies for overloading—one is to increase the handling capabilities of the valve by applying more H.T., and the other is to cut down the signal strength.

A number of receivers have the reaction control labelled “Volume Control,” but this is not strictly correct. A volume control should be able to cut down the strength of any signal, but the reaction control can only build up the strength of received signals, and cannot cut down below the original strength received by the detector. There are several different forms of volume control, but there are very few which do not possess some fault. However, it should be a simple matter to decide upon which type of control will suit your particular receiver, and the following notes describe the more common forms of control and their advantages or disadvantages.

The Transformer.

In conjunction with the ordinary type of low frequency transformer there are two possible arrangements. These are shown in Figs. 1 and 2. In Fig. 1 is shown a simple form of control in conjunction with the L.F. transformer.

Overloading the Valves.

It is not always in the L.F. side of the receiver that overloading troubles arise. In sets fitted with one or more H.F. stages the detector valve may be overloaded, and it is, therefore, necessary to introduce some form of control in the aerial circuit. A very common form of control is a series aerial condenser—Fig. 4—but this will affect the tuning adjustment, and when two or more valves have to be adjusted for tuning, this alteration of the aerial tuning condenser may make it difficult to get an accurate setting. It is not, therefore, ideal, but will be found good enough for simple sets, and can, in fact, be used with a simple

Fig. 3.—A potentiometer used instead of the grid leak in an R.C. amplifier.

Fig. 4.—The series aerial condenser.
The final method we shall deal with is shown in Fig. 8, and for this a potentiometer of 50,000 ohms is required. It is joined across the aerial coil, the arm being taken to the grid of the first valve. This is a very good arrangement, provided the tuning coil is not seriously affected by the resistance shunted across it. Some coils will be badly upset, but in most cases this will be found as good an arrangement as Fig. 5.

Practically every receiver, of two valves or more, should be fitted with one of the volume control devices mentioned, and improved quality on the local station will be the result of the outlay for the extra parts necessary, which will vary, for the devices described, from Is. to 5s.

**Programme Mixing**

**How** often have you listened to a radio play and wished that a background of soft music was available? Or has the occasion often arisen when you have played on your gramophone some dramatic speech or recitation, and would have preferred a light musical accompaniment. These effects are possible if you possess a radio gramophone, and the only outlay necessary is for a component known as a fader. This is a Potentiometer with a centre tap, and when connected in the circuit it is possible to arrange that radio signals are faded out to nothing and gramophone music is brought up to full volume by the mere rotation of one control, or by suitably rearranging the connections, the two reproductions may be mixed to provide the effects mentioned in the opening sentences.
September 24th, 1932

PRACTICAL WIRELESS

AN EXPERIMENTER'S BASEBOARD

Here is a baseboard which will enable you quickly to test out any particular circuit—no drilling is required.

By W. H. DELLER

The wireless history of many fans can be traced by the collection of baseboards and panels, which are collected from old odd-out-of-the-way corner, that had once formed the necessary anchorage for the component parts comprising the very latest thing in radio circuits. As the fashion changed so were numerous wood screws removed to release the parts from their respective positions and certain pieces of apparatus re-used in the building of another set. The new layout would not often accommodate itself on the old board, and the panel was a certain absentee from the new scheme of things. These considerations have delayed the reconstruction of many a set until conditions of reception became so bad that something simply had to be done. The rapid progress in design led the writer to devise a simple and rapid means of securing components in their relative positions for "wiring-up," and when rearrangement became desirable the change-over could be made with the utmost ease.

The New Method

Having fulfilled these requirements, a description and instructions for making it should prove of interest to those who are keen on trying out new circuits, and more especially concerns the advanced experimenter. Briefly, the method employed consists of a slotted board carrying a terminal strip and panel mounting strip along the rear and front edges respectively. Special bolts fitted with milled nuts, sliding in the slots, secure components on the face of the board, and additional fixing is provided by means of small finger clamps. Regular panel-mounting components, such as variable condensers, may be fixed by the usual means to small individual panels which are provided with holes along the bottom edge to pitch with the holes drilled in the panel-mounting strip and fixed thereto with screws and nuts. Thus, a rack of fixed, variable condenser so mounted could immediately be used in the formation of any circuit calling for such a condenser. Regular panels may also be attached to the strip in similar fashion. It is, therefore, apparent that all classes of components are readily mountable by the adoption of this method.

Constructional Details

The base described is 18 in. in length by 12 in. in width, and one made up to these sizes should provide sufficient area for normal requirements. Should a larger board be required, it can be made any suitable length, and the width can be increased or decreased by multiples of the distance of the slot centres. A piece of 1-in. plywood, cut and planed on all edges to 18 in. x 12 in., forms the foundation of the board.

The following strips are 1 in. hardwood (American whitewood is admirably suited for the purpose) are also required: 11 pieces 3/4 in. wide; 1 piece 1 in. wide; 10 pieces 3/4 in. wide; 1 piece 1/2 in. wide; and 1 piece 3/8 in. wide. All these pieces are cut square on the ends to a length of 18 in. It would be as well to point out that these strips must be of uniform thickness and must also be parallel in their width. This is most important, as any irregularity in thickness will have a direct bearing on the flatness of the working surface of the finished board. For this reason it is desirable to have the strips machine-sawn from a prepared board 3/8 in. thick.

Fixing the Strips

The next step is to fasten the ten strips 3/8 in. wide to the underside of ten of the 1/2-in. strips with a little liquid glue uniformly spread between, taking care that they are centrally placed, as shown in Fig. 1, and held in place with three fine panel pins. When dry, drive in with the points flush with the under face of the 1/2-in. strip. The remaining 1/2-in. strip is fixed to the 3/8-in. strip in like manner, excepting that they are placed with their edges flush. The 3/8-in. strip is also attached to the 1/2-in. strip in the same manner. These completed pieces are now fixed to the plywood. Commencing with the 1/2-in. and 3/8-in. strips joined together, glue along bottom edge and place on to plywood with the plain edge flush with the 18-in. edge of the board, driving the three pins home. The ten 1/2-in. and 3/8-in. strips are now fixed likewise, the 1/2-in. portions being exactly 3/8 in. apart. The best means of ensuring this happening is to use a gauge consisting of a piece of material of the correct width between each strip as it is secured in position. The remaining piece is also attached; reference to Fig. 2 should make the foregoing remarks clear.

The panel-fixing strip is a piece of 1/2-in. hardwood, 2 in. wide by the same length as the board. This is drilled with 3/8-in. dia. holes 3/8 in. down from the top edge, equally spaced 1/4 in. apart. This is fixed with wood screws in the position shown.

Fixing Bolts

Reference to Fig. 3 shows that the fixing bolts consist of countersunk-head screws with additional heads in the form of 3/8-in. square of 3/8-in. ebonite, the object of these pieces being to prevent the bolts from turning in the slots whilst nuts are being tightened. The difference between the head and width of slot allows the bolt a side movement of 3/8 in. Drilled and countersunk, a tapping hole, to suit the screw thread used, in the centre of each ebonite piece. The most convenient screws for the present purpose are No. 5 B.A., 1/2 in. long. For use in cases with four-hole fixing components, where two of the holes may not line up with the slots, make several small finger clamps 3/8 in. long by 3/8 in. wide by 3/8 in. thick from ebonite. Each one is drilled with a 5 B.A. clearance hole in the centre.

Fig. 1.—How to assemble the T-pieces.

Fig. 2.—Part plan and section of the baseboard.

Fig. 3.—Details of the fixing bolts.

Fig. 4.—Photograph of the completed baseboard, showing methods of using the clamps.
WHEN reaction with a differential condenser is too "fierce," the necessity for removing some turns from the reaction coil can often be overcome by connecting a condenser of .0001 or thereabouts between the fixed plates which are earthed and the moving plates of the differential.

Faulty Potentiometer Contacts

In cases where a potentiometer gives trouble, the fault is usually due to a bad sliding contact. One result of this is that either partial connection is made or there is no connection at all. If a high-resistance potentiometer which is faulty in this way is used, for instance, in a screen-grid circuit for volume control, you will get awkward places, for instance, in a screen-grid circuit. Faulty Potentiometer

A Reaction Hint

When using a pot in conjunction with two L.F. stages, the usual panel switch or jack arrangement for bringing the pick-up into circuit generally involves a long grid lead and return. This can be obviated by using two old plug-in coil-holders as shown.

Increasing Selectivity

A D D E D selectivity can often be obtained by connecting a .0002 fixed condenser in the earth lead. This condenser may always be used effectively if the earth lead is long, or if it is ultimately taken to a water main. It reduces the net capacity of the aerial-earth system. It will also neutralise the effect of coupling by other sets which may be earthed to the same water main. It cannot be used in mains-operated circuits. In this case the capacity should always be placed in the aerial.

Improving the Layout

When wiring a modern circuit it is not necessary to have all the controls on the front panel. A main condenser knob and the reaction knob should be at the front, but the volume control, wave-change switch and radio-grum switch can conveniently be at the side. This facilitates wiring, too, and where possible, group the connecting wires to the front of the panel as they may have to run close to high-frequency components.

Dual Capacity Batteries

WHERE possible, it is advisable to use dual capacity high tension batteries because they last more than twice as long as do the cheaper sort. The E.M.F. is greater and more constant. Consequently, tone is purer, and for reasons that can easily be understood, weak stations are received at greater strength.

Motor-Boating

THIS trouble, which often crops up in a set, is largely due to the regeneration being too acute, and to an excessive mode of the potential of the detector valve. In such cases this potential should be reduced. Another remedy is to use a low resistance.

That Dodge of Yours!

Every reader of "PRACTICAL WIRELESS" must have regretted some little dodges which would interest other readers. Why not pass it on to us? For every item published on this page we will pay half a guinea. The item this week has been contributed, but in future we want readers of this paper to supply the items. Turn that idea of yours to account by sending it in to us, addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 4-12, South-ampton Street, W.C.2. For your name and address on every item. Please note that every notion sent in must be original.

Interference from Neighbouring Sets

To minimize interference from neighbouring sets it is a good plan to arrange your aerial at an angle to the nearest aerials instead of parallel to them. An independent outside earthing should also be provided. It is better to use a capacity earth than to connect your set to a water main which may be used by dozens of others. If you cannot arrange an outside independent earthing, try connecting a .0002 fixed condenser in series with the earth lead.

L.F. Instability

After an H.T. battery has been in use for several months a set may develop a high-pitched whistle and reception becomes distorted. The reason is that the voltage of the battery has dropped, causing an increase in its internal resistance sufficient to produce instability in the L.F. amplifier. The addition of another battery in series with the old battery will not stop the trouble, as the resistance of the old battery remains the same. The remedy is to replace the old battery with a new one, and then the trouble will cease.
The well-known firm of Lissen, Ltd., have been making wireless components practically since the inception of broadcasting in this country, and their progressive policy has contributed in no small measure to the efficiency and reliability of the home-constructed set. It was, therefore, with pleasant anticipation that I received the kit of components (complete down to the last screw) by means of the really well-done wiring diagram supplied with it. I should like to give a word of praise concerning the manner of presentation of this wiring diagram. Attractively produced in colour, it had no difficulty whatever, and did not worry me as to where to begin tuning up.

I tuned the kit of components (complete down to the last screw) by means of the really well-done wiring diagram supplied with it. I should like to give a word of praise concerning the manner of presentation of this wiring diagram. Attractively produced in colour, it had no difficulty whatever, and did not worry me as to where to begin tuning up.

The attractive lines of the new Lissen Skyscraper Three Consolette may be gauged from this photograph.

The receiver is fitted for the use of a gramophone pick-up, and terminals are provided for the addition of an extra loud-speaker if required. The Consolette kit, complete with valves and a specially matched loud-speaker, costs £6 5s., and the table model £5 5s. The kit alone, exclusive of cabinet but complete with the three valves, costs 89s. 6d. I must accord my meed of praise to the cleverly-designed cabinet; it is well made and beautifully finished, and coupled with the very modern lines of the set itself it should meet the most exacting requirements.

A Simple Set to Erect
It is the work of an evening to erect the set, and it worked straight away without tedious tuning up. I gave a kit of parts to a raw amateur to erect, and in point of fact he had never made a set before. He had no difficulty whatever, and did not worry me as to where to begin tuning up. Upon connecting the set on to my aerial, I tuned in Regional at full volume, and it is in no sense of flattery, but purely because I wish to accord praise to a worthy article, that I say at once that this famous factory has really surpassed itself in producing the Skyscraper kit. Before concluding with my description of the actual test, may I explain that the Lissen Skyscraper constructor's kit employs the new Lissen shielded coil in conjunction with a screen grid detector and pentode circuit. A Lissen metallised H.F. valve is used in the first stage, the second stage is a Lissen De valve, and the output valve is the Lissen economy power pentode valve. The transformer is, of course, the well-known Lissen Hypernik. All of the components are mounted on an aluminium chassis, fitted with a neat and attractively-finished panel.

Fitted for a Gramophone Pick-up
The receiver is fitted for the use of a gramophone pick-up, and terminals are provided for the addition of an extra loud-speaker if required. The Consolette kit, complete with valves and a specially matched loud-speaker, costs £6 5s., and the table model £5 5s. The kit alone, exclusive of cabinet but complete with the three valves, costs 89s. 6d. I must accord my meed of praise to the cleverly-designed cabinet; it is well made and beautifully finished, and coupled with the very modern lines of the set itself it should meet the most exacting requirements.

Over Forty Stations
Reverting now to my test, in one evening I received over forty stations, the weakest of them being at comfortable loud-speaker strength. Over a half of this number were foreigners, from which it will be gauged that the set reachest out. No difficulty whatever was experienced in separating any of the stations, either British or foreign, and in no instance did I experience jamming. The tuning is delightfully easy and selective—no finicky knob-twiddling—and the reaction is smooth; it does not come on with a bump, and weak stations can be "built-up" to comfortable volume without distortion and without working too near to the point of oscillation. I welcome, too, the provision of pick-up terminals for more and more are listeners tending to combine radio with the gramophone.

I repeat—a splendid kit, which will satisfy the most exacting requirements.

F. J. C.

---

**THE LATEST KITS REVIEWED**

**THE LISSEN SKYSCRAPER**

**KIT:**
- The Lissen Skyscraper
- MAKERS: Lissen Limited, Worple Road, Shepperton, Middlesex.
- SPECIFICATION:
  - All-metal chassis, shielded coils, screened grid, detector, and pentode valves; metal panel, two styles of cabinet—plain Consolette and Table model. Pick-up terminals fitted. Complete with valves, matched speaker and cabinet (no loud-speaker). Constructional chart in two colours included.
- PRICE:
  - Consolette, 46s. 6d. Table model, 65s. 5d. Kit only (excluding valves), 89s. 6d.

---

Another style of cabinet for the Lissen Skyscraper—The Table Model.
THE "DOLPHIN"

A splendid economy receiver, on modern lines, with extremely selective, and will reach

Owing to the minimum number of components included, the wiring will be found practically "fool-proof"; owing to the limitation in the number of control knobs, the tuning-in of stations will also be found "fool-proof"; and, finally, owing to the type of inter-valve couplings which have been included, the quality of the reception will satisfy even the most critical listener.

The first inter-valve coupling includes, besides the usual L.F. transformer, two additional components, which remove a certain amount of external wiring. In addition, the method of connection employed in the component enables a high standard of quality to be obtained.

The coil includes a wave-change switch, an on-off switch, and a variable selectivity (or volume control) device. These three controls are combined in the one knob. It will be seen, therefore, that although the circuit consists of the rather orthodox detector and 2 L.F. arrangement, there are sufficient novel features included in the receiver to warrant its inclusion in a new periodical in the year 1932.

Testing Out

When the wiring is completed, plug a Mullard FM12DX valve into the detector-valve holder, that is the one in front of the tuning coil; a PM11LF into the next holder, and a PM2 into the last holder. Then begin working on the connections.

First, lay out the various components on the baseboard in the positions shown in the wiring diagram. Note the arrangement of the two inter-valve couplings before screwing them down, so that the wiring will be correctly carried out without, for instance, having to remove one of the transformers and turn it around. It is little points like this that sometimes make the construction of a receiver irksome. Do not drive in a single screw until you are quite certain that each component is in its correct position, and the right way round. In this particular receiver all the components may be screwed down before any of the wiring is carried out. Note that a small hollow must be filed in the lowest port of the terminal block carrying the pick-up terminals. This hollow should be just large enough to hold the battery cords firmly in position. Mark out and drill the panel in accordance with the panel lay-out, and then attach the two condensers by means of the fixing bushes. No problems of any kind should have arisen so far, and the receiver is now ready for wiring, a process which will take a little longer than the previous part of the work, and one which will require just a little care, although it will not be found actually difficult.

Wiring

In any receiver it is always preferable to wire up in a systematic manner rather than by just putting in a wire here, and then another wire there. Personally, I have always adopted the procedure of wiring low potential parts first, then wires carrying high voltages, and so on. I would therefore suggest that the same idea be carried out in this set, that is, wire the filament leads first, then the leads to the plate and plate terminals, and so on; as each wire is put into its place, cross out the corresponding wire on the wiring diagram. By working in this manner one is assured of putting each wire in its correct position, and when the job is finished no wires will be found to have been omitted or put into the wrong position. Note that one terminal on the transformer is not used in this particular circuit arrangement.

Fig. 1.—The set is housed in a cabinet constructed on modern lines, including a sliding frame, space for speaker, batteries and accumulator.

Fig. 2.—A drilling diagram for the front panel.

Fig. 3.—A three-quarter front view of the set showing the attractive lines of the cabinet, and the operating controls.

Complete Wiring Diagram is on page 13.

Fig. 7.—Details of the speaker baffles.

Certain modifications, of course, would be necessary to render the set suitable for frame aerial reception. This is a matter, however, we hope to deal with next week.
many novel features. Cheaply constructed, it is out in an astonishing manner

By

F. J. CAMM.

SPECIFICATION FOR THE "DOLPHIN" STRAIGHT THREE.

1 Ready Radio Dual-range Coil Unit
2 Jackson Bros. J.B.0005 mfd. Variable Condenser, mid-log line, with slow-motion dial.
3 Imperial .0003 mfd. Reaction Condenser.
4 Bulgin Transcoupler.
5 Sektun Coll 5-1 L.F. Transformer.
6 W.B. 4-pin Valve-holders.
7 T.C.C. .0002 mfd. Fixed Condenser, three-terminal type.
8 Lisen 2-meg. Grid Look.
9 Belling Lee Terminal Mounts.
10 Belling Lee Terminals (Aerial, Earth, Loud-speaker +, Loud-speaker —, and Two Pick-up).
11 Belling Lee 3-way Battery Cord.

In this position the valves are turned off. Now turn this knob a few degrees to the right and the receiver is switched on, and is in its most selective condition, which means, of course, that signals will be at their weakest. Rotate the centre dial, which will enable you to tune to various wavelengths, and you should soon be able to hear your local station, which you will find will only occupy a very small space on the tuning dial. You may be in a good district, and be able to hear two or three stations with this particular setting of the first dial, and without the use of the third or right-hand dial, This controls the reaction condenser and serves to enable you to tune to various wavelengths, and you should soon be able to hear two or three stations with this particular setting of the first dial, and without the use of the third or right-hand dial, This controls the reaction condenser and serves to increase the strength of the stations. Having rotated the tuning dial to the end of its scale, advance the left-hand dial a few degrees further to the right, and again run round the tuning dial. You will find now that other stations are audible owing to the increased coupling afforded by the aerial coil. When the left-hand dial is rotated completely to the right the receiver is automatically tuned to the long wave band, and Daventry, Radio Paris, Hilversum, and other long-wave stations will be heard.

On the normal waves, in order to listen to some of the weaker foreign stations which transmit on wavelengths, and you should soon be able to hear two or three stations with this particular setting of the first dial, and without the use of the third or right-hand dial, This controls the reaction condenser and serves to increase the strength of the stations. Having rotated the tuning dial to the end of its scale, advance the left-hand dial a few degrees further to the right, and again run round the tuning dial. You will find now that other stations are audible owing to the increased coupling afforded by the aerial coil. When the left-hand dial is rotated completely to the right the receiver is automatically tuned to the long wave band, and Daventry, Radio Paris, Hilversum, and other long-wave stations will be heard.

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WIRING DIAGRAM OF
THE "DOLPHIN" STRAIGHT THREE

Simplicity of wiring, ease of operation, cheapness of construction, excellent selectivity, and fair range of reception are some of the characteristics of this set. Full details are given on pages 12, 13 and 17.
WHERE ONLY THE
BEST WILL DO

You cannot obtain anywhere, at such a moderate price, a more dependable transformer than the Slektun Colt.

It has been specified by many well-known designers for its sound construction and its unvarying quality reproduction.

For years of faithful service choose Slektun components always. They will give you better results and complete satisfaction.

FOR BETTER RESULTS USE Slektun

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H.F. and L.F. Chokes
Mains Transformers
Loud-speaker Units, etc.

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All Good Radio Dealers Stock "Slektun" Quality Radio Components. In Case of Any Difficulty Write Direct To:

SLEKTUN PRODUCTS LTD., 21 DOUGLAS STREET, WESTMINSTER, S.W.1
CONSISTENCY

The employment of Mica Bridge Mounting in Cossor Valves ensures microscopic accuracy in the assembly of the electrode system. As a result the characteristics of every valve are identical with those of the original design developed in the laboratory. Variation is impossible. The performance of each valve is therefore safeguarded—the Mica Bridge is a virtual guarantee of performance and reliability.

SPECIAL OFFER

Send for a free copy of one of the most comprehensive valve catalogues ever published. This, the Cossor 72-page Valve Catalogue, contains full technical data, characteristic curves, operating conditions etc., of all types of Cossor Valves. Please use the coupon.

Cossor Valves

A. C. Cossor Ltd., Highbury Grove, London, N. S.
Depots at Birmingham, Bristol, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield, Belfast and Dublin.
A Fuse Tip

In many sets a flash-lamp bulb is connected between the H.T. negative and L.T. negative to act as a fuse. Sometimes this bulb is "fused" and a spare one is not at hand when the set is wanted in a hurry for a particular item. In such cases there is no need to short the bulb holder or to alter the wiring of the set. All that is necessary is simply to remove the wire connecting the negative of the H.T. battery to H.T. negative terminal from this terminal, and join it instead direct to the L.T. negative terminal.

Shielding Transformers

Many transformers and chokes are supposed to be sufficiently shielded by their own covers, but it is often found in practice that these covers are sadly lacking in shielding properties. One result of this is that in a mains-operated set, you will get a hum owing to the circuits interacting with one another.

To properly serve as a shield the cover of the component should be of much thicker material than that generally used. The usual precaution to place transformers—for instance, the power transformer and any near-by inter-Valve transformers—at right-angles to one another goes a long way to avoiding trouble, however, and if you are not sure about it you might try connecting the inter-valve transformer by means of leads a few inches long, so that you can shift it about and turn it in different positions until you get the best result.

A Fuse Tip

In many sets a flash-lamp bulb is connected between the H.T. negative and L.T. negative to act as a fuse. Sometimes this bulb is "fused" and a spare one is not at hand when the set is wanted in a hurry for a particular item. In such cases there is no need to short the bulb holder or to alter the wiring of the set. All that is necessary is simply to remove the wire connecting the negative of the H.T. battery to H.T. negative terminal from this terminal, and join it instead direct to the L.T. negative terminal.

Loud-speaker Hints

It is a good plan to go over the loud-speaker occasionally and to tighten up all nuts, screws and terminals. If any of these are loose all sorts of rattles may be set up.

"Boomy" results from a loud-speaker are sometimes due to cabinet resonances, and a good way of overcoming this is to pack the interior surfaces of the cabinet with sound-absorbing material such as thick felt.

In cases where the loud-speaker is totally enclosed in a cabinet of the console type, improved results can often be obtained if a large hole—about six inches diameter—is cut in the back of the cabinet. It can be covered, on the inside of the cabinet, with thin gauge like the speaker fret.

Smoothing Reaction

For short-wave working smooth reception is essential, for on this the entire sensitivity of the set depends. Incorrect operating conditions of the detector valve usually causes "plump" reaction, and to remedy this try a lower plate voltage—not more than 60 volts should be needed with the average detector.

If this does not cure the trouble it may be that the positive bias on the grid of the detector, as applied through the grid leak from the positive side of the filament battery, is too great. Try a higher value of grid leak. Anything up to 5 megohms is suitable for short-wave working, with a 0.003 micro-farad fixed grid condenser.
THE LOTUS "BUD"
A.C. MODEL

17in. high by 8in. deep, houses the set. A frosted aperture (in simulation of the Lotus flower) occupies the top front portion, immediately below which is situated a neat metal escutcheon of the design in "Cornish Bronze." The tuning dial is of the drum type horizontally disposed, and a generous part of the milled edge projecting makes this control particularly pleasing to handle. The "on-off" snap switch is arranged underneath on the same plate. On the left and right of this, respectively, are the "long-short" wave switch knob and volume control knob.

NEXT WEEK:
THE VARLEY D.C. MODEL

The back of the cabinet is removable by releasing two flush-fitting bolts. Along the bottom of this side are arranged earth socket, mains plug, mains aerial plug, two aerial sockets and a selectivity control.

A well-tried straight circuit is employed, a low damping detector and 4-electrode power valve with an output of 900 milliwatts A.C. being incorporated.

An all-metal Westinghouse rectifier is followed by a very efficient smoothing arrangement, and the Magnavox moving coil loudspeaker is provided with sockets for attaching an independent speaker. By moving a plug into one or three sockets at the base of the mains transformer, the set is readily adjustable for use on supply voltages of 200 to 250 and over. Both mechanically and electrically the whole assembly is a good sound job.

The primary intention of the designers was to produce a set that would give perfect reception of a few stations, and the number of listeners whose requirements are thus fulfilled must be considerable.

We had the pleasure of testing an A.C. model of the Lotus "Bud" taken at random from stock. It was tested approximately twenty-five miles from London, and, notwithstanding the conversations amidst the designer, the reproduction of both speech and music, vocal and instrumental, was unusually clear, with complete absence of mains noises or interferences from other stations, and the volume strength was truly robust, free from resonance, and pleasing to the ear. Without using an outdoor aerial, that is, by transferring the mains aerial plug into one of the aerial sockets at the rear of the set, perfect reception of the National, London National, and London Regional programmes were obtained. This consideration should be of especial interest to residents on premises where the erection of an outdoor aerial is a practical impossibility. The quality when using an outdoor aerial was equally as good, two aerial lead sockets being fitted, one for maximum volume and the other for use in conjunction with the selectivity control. Several Continental stations were tuned in, notably Radio-Paris, König Wasserhausen, Nürnberg, Eiffel Tower, Stenhamo, Stockholm, and Budapest. The total number of stations logged was much in excess of this.

To those who are looking for a receiver of this description, this one can be thoroughly recommended. The capabilities must be heard to be appreciated, and will soon convert the listener to an enthusiastic owner. The values are Magnavox A.C./2H.L. and Cosser 41 M.P.

The price of the A.C. model is 10 guineas, and that of the D.C. model is 11 guineas; these prices include royalty.
When the higher notes are missing—**RECTATONE** restores them.

**OVER 1,000 CYCLES—A RISING CURVE**

The growing ether congestion calls for still more selectivity. The superheterodyne and special ultra-reaction circuits have been developed to meet this requirement, the tuned circuits being made sharply resonant, deliberately cutting off the high notes. It is clear that a low-frequency coupling device is required which will restore these weakened high notes to their correct value. The new **RECTATONE** transformer does this. Its frequency response curve is straight up to 1,000 cycles per second and then rises, reaching a maximum at approximately 4,500 cycles.

**RECTATONE, THE IDEAL L.F. COUPLING**

The degree of compensation is variable and may be suited to the particular tuned circuits in use or employed to correct deficiencies due to the loud-speaker or to the acoustics of the room. **RECTATONE** is thus the ideal L.F. coupling for all selective sets—particularly useful for those using a pick-up or for radio-gramophones, since the tone control so valuable on radio can be cut out on "gramophone" where it is usually unnecessary.

**FREE BOOKLET**

**Varley**

**List No. DP.33.**

**Ratio** - 7 : 1.

Compensation is controlled by a variable resistance of about 5,000 ohms connected externally between the terminals H.T. + and RES. With a pentode output valve a 2,000 ohm fixed resistance may be connected in series with the variable resistance in order to prevent excessive amplification of high frequencies with consequent liability to self-oscillation.

When bass and treble are correctly present, Rectatone preserves them .................. When the higher notes are missing, Rectatone restores them.


Please send me, free and post free, the "**BOOK OF THE RECTATONE**"

Date............................

Name ........................................

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THE NEW RANGE OF REGENTONE MAINS UNITS

5 STAR FEATURES

Change from battery to mains but change with Regentone—and follow the experts

If you have a battery operated receiver, make it all-electric with one of the new Regentone Mains Units. Regentone Mains Units are specified by famous set manufacturers for their sets; experts choose them for star circuits, the Press pays tribute to their efficiency and reliability. Choose Regentone—the one the experts all recommend.

THE SYMBOL OF INDIVIDUAL CRAFTSMANSHIP

Regentone, Ltd., Regentone House, 21, Bartlett's Bldgs., Holborn Circus, E.C.4. Tel.: Central 8745 (5 lines); Irish Free State Distributors: Kelly & Skid, 14L, 47, Fleet St., Dublin.
Radio Fads and Fallacies

In this interesting article W. B. C. Richardson explodes some commonly-accepted notions about wireless.

Why always put an H.F. choke in the plate circuit of the detector valve?

Power-grid detection does not make weak signals powerful.

Limits of Slow-Motion Dials

Mention of controls reminds me that many amateurs still think that a slow-motion dial will give them more stations, and that the kilocycle and square-law type of condensers, by spacing out the stations, will provide greater selectivity.

Actually, of course, slow-motion devices merely enable the ham-handed to move the condenser round slowly instead of in a series of jerks and thus lessen the risk of a station being missed. "Straight line" condenser gives a smoother reaction control. Width of the dial only.

Our Advice Bureau

LET OUR ADVICE BUREAU
SOLVE IT FOR YOU! See page 65.

The greater "clearness" of crystal detection is a fallacy. A value is just as clear if the volume is cut down to that of the crystal.
THE PHOTO-ELECTRIC CELL

A GREAT interest attaches to the photo-electric cell because of its potentialities as a source of electricity. The cell consists of a small glass tube—very similar to a wireless valve—and it contains two metal plates—a Cathode and an Anode. In the type illustrated, an ordinary valve-base is fitted, the Anode being joined to the Anode-pin, and the Cathode to the valve pin. The glass envelope is not evacuated, but contains a gas. The peculiar peculiarity is that when a light is applied to the Cathode electrons are emitted, and if no positive potential is applied to the Anode the electron current set free will drift to the Anode. The circuit shows how the P.E.T may be arranged in the Grid circuit of a small L.F. or Power valve, so that the application of any light on the cell will operate the relay in the Anode circuit of the valve. If the cell connections are reversed the reversed circuit of operation is also reversed, that is, a light shining on the cell will give a steady current in the Anode circuit of the valve, holding the relay closed and, on the light source being interrupted, the relay will open.

There are a great many uses to which this cell may be put, amongst which may be mentioned burglar alarms, switching on or off lights at predetermined times, or giving warning of the arrival of a customer in a shop. The enthusiastic amateur may devise many interesting experiments which will be made possible by the operating of a relay by means of light control.

One or two suggestions may perhaps be given before closing these notes, but very small watt lamps are most suitable for this particular cell, and it should be arranged, with the circuit shown, at a distance of 3ft. or so, and then gradually brought toward the cell. If before the lamp has been brought to the required distance from the cell the relay is operated, then it is necessary to reduce the cell potential. Alternatively, if the lamp has to be brought closer than 6in., before the relay is operated then the resistance across the grid circuit must be increased in value. Where it is desired to operate the relay with only a weak source of light, the grid-bias should be reduced until the anode current is brought just below that value required to operate the relay. A slight increase in current caused by a weak light on the cell will then be sufficient to work the relay. Where any special requirements are to be met, and any doubt is felt as to values of either applied potentials or resistance of relay, etc., the engineers of the B.T.H. Company will supply the necessary information.

The standard method of connecting the photo-electric cell,
**COLVERN**

- **T.D. COIL**

**AN UP-TO-DATE COIL WITH UP-TO-DATE FEATURES**

TYPE T.D., an entirely new COLVERN COIL, designed to give super selectivity on both long and broadcast wavebands.

The coil is completely screened, giving a very neat appearance, and incorporates tapped aerial coupling and reaction, while the four alternative aerial tappings are arranged as sockets with a wander plug.

The first two tappings give aerial couplings similar to those normally employed, but with greatly increased selectivity.

Nos. 4 and 5 give a high degree of selectivity with weak aerial coupling—suitable for use in a "swamp" area.

A most important feature of this coil is that there is no break through on the long waveband from B.B.C. stations.

**TYPE T.D.**

**PRICE**

8/6

Wire-Wound.

For Voltage Regulation and Volume Control.

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**VARIABLE COLVERSTATS**

- **Type S.T.5C.** Protected Windings. Rating 5 watts. Standard values 25 to 25,000 ohms. 5/3.

**Type S.T.10.** Rating 10 watts. Standard values 300 to 50,000 ohms. 5/6.

**Type M.T.** Rating 3 watts. Standard values 25 to 10,000 ohms. 4/6.

---

**STRIP RESISTANCES**

Wire-wound. For Mains Units and Decoupling. Rating 5 watts. Fitted with terminals and soldering tags. Price—values up to 25,000 ohms. 1/9. Price—values from 25,000 to 50,000 ohms. 2/3.

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*Our 1933 Booklet Radio List No. 10 is now available and free on request.*

**COLVERN LIMITED**

MAWNEYS RD., ROMFORD, ESSEX.
WHAT IS DISTORTION?

A Critical Survey of Causes and Suggestions for Remedies


The other evening I went by special invitation to a friend's house to help him to install a newly-built listening room in which he had great expectations. When everything was finally connected up and he switched on and tuned in one or two stations, he had to admit that something was wrong, for the reproduction was very poor indeed. In asking my advice, the conversation finally turned into a long explanation of what was really meant by the term distortion and how, unfortunately, it could so easily arise in a wireless receiver unless the proper precautions were taken.

Obviously, for perfect reproduction, the sound heard in the comfort of your own home from the loud-speaker should be an aural replica of what is taking place at the broadcasting station of the device greatly used in the very early days, usually by means of swinging coil holders.

The term distortion and how, unfortunately, was wrong, for the reproduction was very poor, and that is the high-tension wire. You may be able to get your connection to the grid is half a megohm, the lowest frequency 50, and the fraction just mentioned \( \frac{1}{50} \) so that is calculated to be about 12 milliamps., so be very careful not to make your condenser of low value if you want to pass through the low frequencies.

A Question of Bias

It may be that the valve is over-biased or under-biased, to say what the faithful replica of the sounds handed on to the grid of the valve, the incoming grid swing must take place over the straight portion of the characteristic, and that distortion will occur. If a valve is over-loaded, that is to say, has a grid swing applied by greater than it can handle on its linear portion, the characteristic, then distortion is most marked—one gets frequently what is known as amplitude distortion. The product of a modulation of the wave if the original sound and the incorrect use of valves is one of the principal causes.

The H.F. Side

First of all it may come as a surprise to many, or to popular belief, the high-frequency section of a wireless receiver is often the cause of more distortion than the low-frequency side. The introduction of so many high-powered broadcasting stations has made the question of selectivity the most acute one. When a station is sending out speech or music it broadcasts, in addition to the carrier-wave, other frequencies which are known as sidebands. These are spaced equally on either side of the carrier frequency and may extend as far as 7,000 to 8,000 cycles either side.

A receiver of the ordinary type boiling of radio receptors is cut off as a large section of these side-bands, or at least reduces their amplification to such an extent that they can be very unfavourable with the amount of amplification accorded to the lower frequencies. Any normal musical interval will realise that the higher frequencies bring about the brilliance or timbre, and if they are not present then quality must to a certain extent be reduced.

Band-Pass Tuning

If the constructor of a wireless receiver finds himself in a tight spot, owing to his desire for adequate selectivity without cutting side-bands, he can adopt what has come to be known as band-pass filtering. To effect this method is a modified version of the device greatly used in the very early days of broadcasting, which is obtained by employing two tuned circuits, with variable magnetic coupling between them, usually by means of swinging coil holders.

In the modern arrangement we have three main types, and these are shown simply in Figs. 1, 2, and 3. In every case it is noticed that there are two tuned circuits, and energy is transferred from one circuit to the other by mutual magnetic interaction. (1), a coil common to both tuned circuits (2), or a trolled-capacity. The frequency each circuit is, and it is possible the complete range may be rejected by the other words, and reproduced with selectivity. Faulty Components

Another very marked cause of distortion is the use of valves. The components of a doubtful origin, "Penny wise and pound foolish" is an old adage, but it strikes a very true note when wireless is concerned, so do not be tempted. It is better to economise on the total output of inter-valve coupling stages and expend the money saved on good quality components.

Keeping for the moment on the question of false economy, there is one item amongst a wireless set's accessories which is so often neglected, and that is the high-tension battery. Except for sets with a very small anode current consumption, do not use those of small capacity because they are cheaper. H.T. battery renewal is a problem which has got to be faced, and it is a step in the right direction towards the cure of distortion if batteries are chosen of high capacity and ample voltage.

The initial expenditure admittedly is proportionately high, but they stand up to the current demands without a rapid drop in voltage, and their life, of course, is much greater than the cheaper models. Too often is a set blamed for distortion when all the time the fault is located in the fact that it is starved of its H.T.

Valve Couplings

Returning now to our question of frequency distortion, the items chiefly responsible for this are the methods of couplings between the valves and the loud-speaker itself. Taking the first name it must be remembered that if L.F. transistors are employed, the primary or input windings must have an adequate primary induc-tance. This does not necessarily mean that the transformer with the largest size is going to give the best results. Modern development has produced transformer cores which are quite small compared to the early types. It is also necessary to maintain the inductance high even when quite large anode currents from the valve pass through the primary winding, so in this case it is necessary to learn whether a manufacturer guarantees the inductance in henries to be a certain value up to a given current and then take steps not to exceed that current. With inadequate primary inductance in transformers, there will be a loss of the base frequencies, so that even if you have the best sound reproducer coupled to the set, if the base frequencies are lost in the set, they will not be heard from the loud-speaker.

Resistance Capacity

If now we turn to resistance-capacity coupling the secret of success here lies primarily in the selection of suitable values. More perhaps the value of the anode resistance should not exceed about four to five times the valve impedance. The grid leak on the other hand may be about five times the value of the anode capacity, while the capacity value of the coupling condenser depends primarily on the value of frequency to be amplified, the intrinsic value of the grid leak and the fraction of maximum capacity. The greater this last-named fraction the greater will be the capacity of the condenser. For example, if the grid leak is half a megohm, the lowest frequency 50, and the fraction just mentioned \( \frac{1}{50} \) so that is calculated to be about 12 milliamps., so be very careful not to make your condenser of low value if you want to pass through the low frequencies.

Passing now from frequency distortion, which, as has been pointed out, arises from the exaggeration or, alternatively, the suppression of particular notes, frequencies or bands of frequencies, we come to what is known as amplitude distortion. This produces a mutilation of the wave because the original sound and the incorrect use of valves is one of the principal causes.

(Continued on page 62.)
"GIVING THE FIRST CLASS SERVICE WHICH WAS EXPECTED OF THEM"

"... Radio enthusiasts can purchase them with every confidence. Their outputs are above the average and they give a clean, steady output ..."

says the Technical Editor of "Popular Wireless"

You can end all your H.T. battery troubles—you can take all the uncertainty out of battery buying, for Ediswan H.T. Batteries are now GUARANTEED against failure to give absolutely satisfactory service. No battery manufacturer could afford to give such a guarantee unless he had complete confidence in his product. Every single cell in every Ediswan battery must successfully pass four separate tests before it leaves the factory, and special precautions are taken to ensure perfect insulation between cells.

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Send for your FREE copy of "How to get the most out of your H.T. Battery." Full of useful data, hints and tips.

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The IGRANIC Logarithmic Volume Control is wire wound and fitted with a specially graded resistance track. It has been evolved to afford a uniform control of volume where a valve or valves of the Variable Mu type are employed in a circuit. The graded resistance makes the volume control obey the same law as the valve. Sizes: 5,000, 10,000, 50,000 ohms, and they can also be supplied with combined switch. Price 5/6 (with switch 7/6).

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The IGRANIC DIFFERENTIAL CONDENSER has a perfectly balanced maximum capacity of 0.00015 mfd. on each side, and is an extremely dependable component with a very low minimum capacity. Soldering tags are fitted. Price, complete with bakelite knob, 3/6.

IGRANIC MIDGET RADIO SWITCH
A neat, compact component specially suitable for switching filament current "on and "off." Moulded bakelite with heavily plated metal front—one hole fixing. 1 amp at 250 volts, 3 amps at 125 volts. Price, with terminals, 1/6, 6d.

IGRANIC PUSH-PULL SWITCH
Smooth action and positive contacts. Terminals and soldering tags on ebonite strip. All metal parts nickel plated, reducing resistance to a minimum. One hole fixing. Price 9d.
Is Your Set Off Colour?

If you ask the average listener, "How's the wireless going?" how often do you get the reply, "Oh, not too badly, but it doesn't seem so good as it used to be"? In other words, how often do you find a set which has been in use, say a year, functioning as well as when new? Very rarely, I suggest. And the reason is not simply because the valves are not new or because the H.T. battery is running low. Admittedly, these are amongst the most obvious causes, but, on the other hand, the valves and batteries may have just been renewed or a mains unit may take the place of the latter and still the set is not so loud or clear as it was before.

The Effects of Dust and Damp

In the early days of radio, when sets looked horribly "scientific" and bristled with exposed valves, coils, crystal detectors, and terminals, etc., we were taught that dust and damp were the chief enemies of good reception, and accordingly always kept a duster handy. Nowadays, however, this fact is hardly mentioned, with the result that sets are often placed near the window to receive all the dust and rain that happens to blow in. I think this is partly because most modern sets are being enclosed, appear to be weatherproof. That they are not weatherproof I had very strikingly brought home to me a short while ago. I was asked to examine a set which the owner said was working very poorly, although he had done everything possible to keep it in good order. The batteries, he informed me, were well up, and the aerial and earth connections in good order. Then I switched on. The set certainly sounded very wheezy, so I looked inside. It was full of dust, and smelt rather musty. It was then that I noticed the state of the aerial coil. It was of cotton-covered wire on a cardboard former, and was actually covered in mildew!! This was, of course, an extreme case, and yet the set had not been left open. It had merely been standing for a couple of years right under a window, and the dust and damp had somehow found its way through the hinges of the lid and back.

A Surprising Fact!

It is really astounding how dust will accumulate in a set which has apparently a close-fitting cover to the case. There are, I know, quite a number of commercial sets which are genuinely dust-proof, but if your set is home made, or of the kit type, or has to be opened frequently for adjustments, it is almost certain to get dusty. The reason that dust is injurious is because it forms a partial conductor. Dry dust does not conduct very readily, but it is usually associated with atmospheric moisture which gives it definite conducting properties. Thus a layer of damp dust over your set has much the same effect as would an infinite number of high-resistance grid leaks joined between all the various terminals. Each grid leak sneaks a fraction of your set's power!

While on the subject of dust and dampness, without, let me mention that in the case of battery sets and portables, dampness may also come from within. Spray from the accumulator is well known, but how many people realize that the H.T. battery is only dry in name? As a matter of fact, it wouldn't work if it were dry; therefore it should always be wrapped before it gets to the stage when the zinc rolls inside are eaten through and the salts ooze out and moisten the cardboard container. Furthermore, the state does not usually set in until the voltage has dropped below a working figure, and the battery is discarded on that account, although I

Fig. 1—In dusting, particular care should be taken to clean between the various terminals.

Fig. 2—To dust the grid lens, remove it from the clips. Also dust between the clips before replacing it.

Fig. 3—After dusting see that terminals have worked.

Fig. 4—A frequent cause of poor reception is dirty filament switch contacts.

Fig. 5—Why you should re-make terminal connections. Corrosion due to acid-evaporating extends up the wire under the insulation.

The Cure

If your set is not giving of its best it may be due to one of the foregoing causes, or to dirty or faulty connections, and a complete cure can usually be effected by giving it a little tuning-up.

First of all, disconnect all leads, at the same time noting where each was joined, unless they are all marked, and then take the set out of the cabinet. Dust is thoroughly, taking particular care to clean between all the terminals, especially those which are close together (see Figs. 1 and 2). The best way to remove dust from the vanes of the variable condensers is to blow it out with a bicycle pump or with a pair of bellows.

Having completed the dusting it is just as well before proceeding further to try the whole thing in front of the fire or to stand it in a warm gas oven after the gas has been extinguished. Do not allow it to get hot, as excessive heat will warp wooden and melt the wax used in fixed condensers. If the gas oven is used it is best to leave the door on the set to avoid condensation, which, needless to add, would have disastrous effects.

Go Over All Connections

Before returning the chassis to its case inspect all the connections, seeing that all the terminals are screwed down tightly (a twist with a pair of pliers will do) and examine the contacts of the switches (see Figs. 3 and 4). The filament switch is often a source of trouble, as after constant use little splinters of metal rub off the electrodes and cause bad contact. The symptoms are easily diagnosed when (Continued on next page)
you switch on or when you touch the switch, and sometimes you have to switch off and on again before you get proper reception. Cleaning the switch carefully with a non-fluffy rag will make all the difference. In the case of a mains-operated reception, cleaning the contacts on the mains, these reproach, undue house lighting switches for emplewRise two sp;tcn'! shmvn.

Cleaning Spade Terminals

The receiver should now be replaced in the cabinet and reconnected. It is best to remove wander plugs and spade terminals from the aerial and battery leads, and re-fit them. This particularly applies to the L.T. leads where an accumulator is used, as although it is not noticeable until the covering is removed, the wires often corrode just where they join the terminal owing to the action of creepage and acid fumes (see Fig. 5).

Don’t Forget the Aerial and Earth

Finally, let me say just a word or two about the aerial and earth system. If they have been in use for any length of time, the leads should be examined, and all connection to both lead-in and lighting switch re-made. Fig. 6 shows the points needing attention. The wire usually becomes very brittle at these points, and if you have a n o u g h wire to spare it is best to cut off the old ends and re-clip the strands and join up again. If necessary, re-make the joint between the earth wire and the earth tube or wherever connection you have (see Fig. 7). The porcelain insulation of the aerial lead-in tube should also be wiped over with a cloth. See also that it has not been painted over, as may happen if the house has been redecorated. Painters seem to delight in blueing insulators! Now lower your aerial, clean the insulators, and haul it up again. If you pull it tight, it will probably be several feet higher in the middle than previously. This is one of the many little things which, taken together, will bring your reception back to its pristine brilliance. Having finished, you will now be able to sit down and listen to a set which has regained its lost youth!

USING A PENTODE

When using a pentode valve a tone control is a valuable refinement.

MOST amateur-made sets are not fitted with a tone control, and the addition is well worth while. A tone control is most desirable when a pentode is employed in the output stage, because this type of valve tends to emphasise the high notes, so making reproduction rather "screaky." The two systems shown in A & B, however, are equally applicable to either pentode or ordinary three electrode valves, and although indirectly-heated valves are illustrated the same connections apply equally well to battery-fed ones.

Diagram “A” shows a 50,000-ohm variable resistance and .01 mfd. condenser connected in series across the primary winding of the output transformer. Decreasing the circuit resistance gives a gradual “cut-off” to the higher frequencies, so making the lower notes more prominent. The resistance and condenser are equally effective, whether connected across the primary winding of an output transformer, across an output choke, or across the terminals of a directly-fed speaker. Diagram “B” illustrates a less common form of tone control and applies when the speaker is connected on the choke-capacity principle. With this form of coupling it is usual to employ a fixed condenser of about 1 mfd., but experience shows that low-note reproduction is often improved by reducing the capacity of the condenser to about .25 mfd. Good tone control can therefore be obtained by using, say, three condensers of .1 mfd., .15 mfd. and .25 mfd., and so arranging them that they may all be connected in parallel, or that one, or two, can be used separately. The connections will be as follows: connect one terminal of each condenser to the plate of the output valve and take each of the other terminals to three of a rotary switch of which the slider is joined to the loud-speaker. The switch should be wired so that capacities of .1 mfd., .25 mfd. or .5 mfd. can be obtained by using the first condenser by itself, putting the first two in parallel or by connecting all three in parallel.

In addition to the above schemes, special types of pentode output transformers and choices are obtainable. These enable the impedance of the valve to be correctly matched.

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ORMOND Permanent Magnet M.C. LOUDSPEAKER

One of the most popular exhibits at Olympia was this speaker, which offers reproduction of the best, at a price within the reach of all. Its performance is admirable, excellent response being obtained throughout the frequency range. Its construction is robust, the fitting of a large cobalt Permanent Magnet ensuring long life and reliability. Complete with Input Transformer, it measures 8 ins. in diameter by 4½ ins. in depth. Cat. No. R/475.

386

FOR PUNCH POWER & PURITY

ORMOND M.C. CABINET LOUDSPEAKER

This Ormond exhibit also provoked widespread interest at the exhibition. It incorporates the chassis described above, in a figured Oak cabinet of handsome appearance and acoustically correct design. It is supplied complete with Input Transformer and provided with terminals for connections. Size 14 ins. x 7½ ins. x 8½ ins. Cat. No. R/477.

This speaker may also be obtained incorporating the Electro Magnet Moving Coil Unit. Cat. No. R/476. Price 51s.

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**Faulty Connections:**

And How to Avoid Them

Many a well-constructed set is handicapped in its performance by faulty connections. There is really no excuse for this, but because it takes no longer to wire a set correctly than it does to make the connections in a haphazard manner. In the first place, there is the question of what sort of wire to use. Some constructors still favour the stiff self-supporting bare-tinned copper wire, which certainly is neat and easily traced out when checking a circuit. In modern sets, however, about the best connecting wire to use is No. 18 gauge tinned copper wire covered with an insulating sleeve. Different-coloured sleeving can be used for different parts of the circuit to facilitate checking and testing. Most radio components have terminals for those who cannot do soldering work, but whenever possible a soldered joint should be made in preference to clamping a wire under a terminal nut.

**Soldered Joints.**

The soldering of wireless connections is quite a simple matter if a few simple rules are borne in mind. The materials required are a soldering iron, tinned copper bit, a stick of solder, and a small tin of flux. Don't make the mistake of thinking that a very small soldering bit is best. Get a good size bit, at least 1 in. diameter and 2 in. long. Always heat the soldering bit in a clean flame, such as that given by a gas ring, and well "tin" the nose of the bit before using it. To do this, well heat the bit, quickly clean the end with an old file, dip it in the flux, and press it on a piece of solder till the latter melts. Turn the bit till the solder adheres all round the end. A small tin lid is very handy for storing the solder, as shown in Fig. 1. Next, well clean the ends of the terminals to be soldered, apply a touch of flux with a match-stick, and a spot of solder with a hot bit. Dip the end of the connecting wire in the flux, hold it in place on the terminal stem, and apply the hot bit for a few seconds till the joint is made.

Instead of just soldering the straight end of a wire to a terminal stem (A, Fig. 3) when many modern practices, it is much better to bend the end of the wire into a loop (B) of a diameter a little less than that of the stem, over which it can be forced by the soldering iron. This joint is strong and quite simple to make. Each joint should afterwards be rubbed over with a piece of rag to remove all traces of flux.

In this article A. J. Budd explains how faulty connections are often responsible for poor reception, and gives sound advice on how to wire a set correctly.

**Making Connections Without Soldering.**

Where it is desired to make the connections without soldering it should be remembered that there is a right and a wrong way of forming the loop at the wire for clamping under a terminal nut. The proper way is to bend the loop in a clock-wise direction, as shown at C, Fig. 3, so that when the nut is tightened the wire tends to wrap itself more closely around the stem. When the loop is placed over the terminal the wrong way round it will tend to come out. This point is important when the terminals are of small size, those on a valve holder, for example. In connecting up to or three wires to a single terminal, a dependable joint can seldom be made by bending each wire into a separate loop and then fitting them one on top of the other. A better plan is to solder a small tag to the end of each wire, or, if only two wires are to be connected, they can be soldered to a single tag. When connecting the end of fine wire, such as that from a tuning coil, to a common terminal, it is a good plan to twist the wires together before bending them, to form a loop.

**Important Details.**

To obtain the best results from a set particular care should be taken with the grid and anode connections, which should be as short and clear from adjacent wires as possible. This is especially the case when it is the wire to wire the grid and anode circuits first, and then to arrange the other wiring in the next most convenient manner. Where the connection is not done by the grid and anode circuits of the chassis or screen, it is a good plan to twist the wires together before connecting them, to form a loop. Anode and grid connecting wires should be kept well away from metal screens and the metal end-plates of variable condensers. Where the wire from the plate of a screened-grid valve passes through the metal screen, capacity losses may be minimised by drilling a hole of about 1/16 in. diameter in the screen and pushing in a rubber accumulator vent plug. The connecting wire, which can then be threaded through the central hole in the plug, as shown in Fig. 4, will be rigidly located in the centre of the hole in the screen, and will have the advantage of the additional insulation provided by the rubber plug.

**Look to Your Connecting Cords.**

Untidy flex leads are not only unsightly, they also cause trouble—sometimes serious. This is especially true where malleable apparatus is used, and in such cases the flex leads, particularly the ends, should be regularly overhauled, and kept tidy. A wrapping of adhesive tape, or the fitting of spade ends or eyelet-tags, is a good plan, and will conceal a good deal of the crockling noises which the untidy leads are likely to set up.

It sometimes happens that one or two strands of wire in a loud-speaker cord become frayed. This will set up mysterious noises when the set is working, and the first remedy is to fit a new cord. Where part of a cord has become frayed, but is otherwise in good condition, the frayed part should be bound with adhesive tape, as shown in Fig. 2. If the covering is allowed to wear away, a short circuit is likely to result. Disadvantages are wire cords pass through holes in any part of the set, particularly the metal chassis or screen.

An all-mains receiver or one employing an eliminator, has a cord to connect up to the supply main, and after a time this cord may show signs of wear. Usually the fault occurs at one of the ends, and it is as well to examine the cord occasionally for any signs of wear because a short circuit here is likely to prove expensive, if not dangerous.

**Loud-Speaker Connections.**

It is not an uncommon thing for a loud-speaker to be connected up wrongly. Some loud-speakers have incorporated some form of filter or transformer, but most of the more inexpensive units are designed to be connected up in a certain way, the reason being that making a filter arrangement is used, the loud-speaker windings are called upon to carry the full anode current of the power valve. If the current is not flowing in the right direction through the coils, it will tend to weaken the sound. If your speaker terminals are marked "positive" and "negative," correct connection is easily done. If, however, the markings have got rubbed off, you can determine which (Continued on page 60)
"Our Best Wishes"

We have received dozens of messages from prominent members of the Radio Trade conveying good wishes for the welfare of Practical Wireless; a random selection is published below. Others will appear next week.

From D. P. Wheeldon (General Manager, Six-Sixty Radio Co., Ltd.),

"Your intention to supply a highly useful service to amateur constructors will, in our opinion, meet with very keen interest, and we are sure there is ample scope for a journal with your excellent aims. Having ourselves made so prominent a feature of the construction of radio sets for all valve users, we are glad to offer you our heartiest good wishes.

From A. R. Rathbun, Sales Manager, of Matts, Wright & Wears.

"We, as probably the oldest-established firm of wireless component makers in the industry, send you our greetings and welcome the advent of a new force that, we hope, will make a drop impression upon the amateur builders throughout the length and breadth of Great Britain. We commend your policy and are quite sure that such a policy, steadily maintained and vigorously pursued, will have far-reaching effects upon the industry. It is an axiom: There is always room at the top; and we are sure, under the policy you intend to commence with, you will not only read the name but remain there in an unchallenged position. We trust that in bunching out on your new venture you will make many friends who will support you through the coming years."

From E. M. Lee, B.Sc. (Belling and Lee, Ltd.),

"With the ever-growing army of amateur constructors we are in close touch, for the simple reason that we are one of the largest manufacturers of radio connections in Great Britain. We are certain that your new publication, dealing in simple language with the practical side of wireless, fills a real need, and we wish you all success in your new venture."

From L. E. Beaton (Joint Managing Director, Lectro Linx Ltd.),

"I should like to take the opportunity of wishing you every success on the occasion of the first issue of Practical Wireless. Everyone has read about the tremendous interest displayed by the public at the recent Radiosymphonies, and from my own experience I am satisfied that the amateur constructor is still on the increase. From your policy it is clear that Practical Wireless will be run on the soundest lines, and I am sure the public will welcome your new venture."

From W. F. Taylor (Telegraph Condenser Co., Ltd.),

"On behalf of my company, I should like to take this opportunity of welcoming you into the popular wireless field with your new paper, Practical Wireless. We feel sure that any publication which has the backing of Messrs. George Nocem, Ltd., and the technical experience of your good self, is bound to be a boon to every amateur constructor. We particularly welcome your scheme for solar specifications of any particular make or component. The present arrangement followed by some of the set designers of specifying for the different makes for any one particular component leaves a lot to be desired. The different characteristics of different components very often make it essential that the type used by the designer should be duplicated by the constructor. We are following up this opinion with advertising support, which in itself is indicative of our feelings."

From Lt.-Col. G. D. O'Gara, M.C., M.I.E.E.,

"I welcome the appearance of Practical Wireless as a paper which will do much to foster the love of radio constructing among the younger generation, and will undoubtedly contribute to the maintenance of that radio-minded spirit which is responsible for the premier position held by British Radio in the world to-day. I wish the enterprise every success."

From W. Scott Worthington (Managing Director, Peto Scott Co., Ltd.),

"It is with great interest and appreciation that we welcome and recommend Practical Wireless to new readers. I say with interest, because the practice of building sets by home constructors is growing every day. It is with appreciation that we recommend your policy of publishing articles. During my thirteen years' experience in supplying the needs of the home constructor, I have had ample opportunities of proving my assertion that if an author claims certain performances for the set he is describing, the amateur constructor must build a faithful reproduction of the author's original if he is to obtain results which duplicate the author's. Hence my firm's Peto Author Kit policy."

"I feel sure, sir, that your publication will infuse a new enthusiasm into those discriminating constructors who decide to subscribe to your welcome contribution to the ever-growing multitude of home radio constructors. Every wish for a successful first number, and a long life."

From R. H. Nunn (Managing Director, Messrs. Regentone Ltd.),

"As manufacturers of main units, some of which are specially designed for use by the home constructor, we congratulate you on your first issue, and we shall watch your future activities with interest. There is no doubt that a magazine of the type of Practical Wireless will be of great practical value to the radio public."
My Favourite Circuit

Some Famous Set Designers Discuss the Advantages of Their Pet Circuits

From Frank Preston, F.R.A.

A

From W. J. Delaney

M

From W. B. Richardson

L

Indeed, it is so much so that there is a decided "cut-off" of high notes. The cut-off is purposely arranged for in the tuning circuit, but all the higher notes can be restored to any desired extent by adjustment of the variable resistance operating on the tone-control transformer. It will be observed that an L.F. coupling unit is employed between the detector and first L.F. valves, and this also serves to decouple the anode circuit of the former valve. A permanent magnet-coil speaker (complete with suitable input transformer) is connected in the anode lead to the last valve. Battery feed is illus-

trated for simplicity, but the circuit is equally well suited for use with A.C. valves.

My favourite circuit is, of course, the one which I employ in my home receiver, and, being a musician, I must have a receiver which gives adequate volume with a degree of quality which is above reproach. The circuit consists of three stages only—S.G., detector, and output stage. The detector valve works on the power grid principle, and to ensure the maximum anode potential a 300 henry iron-cored choke is included in the anode circuit. To supply the detector with an adequate signal, an efficient H.F. stage precedes it, a modern variable-mu valve being chosen for this stage to enable volume control to be carried out without distortion. Band-pass filtering is fed from this stage by means of a tapped push-pull choke in place of the usual customary output transformer. For gramophone record reproduce, a pick-up is included in the grid circuit of the detector valve, and to enable the same quality standard to be obtained from records the output from the pick-up is compensated by a McLachlan Compensator. The circuit shown probably looks rather formidable, but the results, in my opinion, justify the arrangement.

One circuit which I have found it almost impossible to pick out any receiver, and, being a musician, I claimed as being my favourite. Perhaps I should explain that I am in the very happy position of having numerous sets in my laboratory, and it is usually fairly easy, therefore, to select one specially suited to any particular purpose.

Despite the undoubted popularity of screened-grid high-frequency amplification, my choice lies with the older and well-known Det. 2 L.F. type of circuit. No doubt it should be hailed as old-fashioned, but I would point out that I speak from experience of every kind of set. Although the sequence of valve stages is an old-fashioned one, my favourite circuit includes a number of quite up-to-the-minute features, such as adjustable tone-control, resistance-fed L.F. coupling, and a highly selective tuning circuit.

All these features are illustrated in the accompanying diagram. The aerial is connected to an untuned winding through a pre-set condenser, this winding being very loosely coupled to the tuned grid winding to which reaction is applied. Due to the very weak aerial coupling and accurate reaction control, tuning is extremely sharp; indeed, it is so much so that there is a decided "cut-off" of high notes. The cut-off is purposely arranged for in the tuning circuit, but all the higher notes can be restored to any desired extent by adjustment of the variable resistance operating on the tone-control transformer. It will be observed that an L.F. coupling unit is employed between the detector and first L.F. valves, and this also serves to decouple the anode circuit of the former valve. A permanent magnet-coil speaker (complete with suitable input transformer) is connected in the anode lead to the last valve. Battery feed is illus-


(Continued on page 64)
The ONLY Metallised S.G. High-Mu Detector and Economy Power Pentode SET you CAN build for yourself!

FROM GREAT LISSEN FREE CHART

Lissen have published a 1/- Constructional Chart, giving the most detailed instructions ever printed for the building of a wireless set. Every part, every wire, every terminal is identified by photographs. This new LISSEN SKYSCRAPER KIT SET is the only one on the market that you can build yourself employing a Metallised Screened Grid, High Mu Detector, and Economy Power Pentode Valve. Around these three valves Lissen have designed and produced a home constructor's kit the equal of which there has never been before. It is the only battery set delivering such power — yet the H.T. current consumption is far less than that of the average commercially designed 3-valve set.

You buy the Lissen Skyscraper Kit complete with valves—a Lissen Metallised S.G., a High Mu Detector, and a Lissen Economy Power Pentode Valve—and the price is only 89/-6. Or you can buy the Lissen Walnut Complete Skyscraper Cabinet and Loudspeaker combined as illustrated. It holds all batteries, and accumulator and loudspeaker as well. It makes everything self-contained. A special Lissen Pentode Matched Balanced Armature Loudspeaker of great power is supplied with the cabin and the price of the Skyscraper Kit complete with valves, and this cabin and loudspeaker is only 40/-6.

LISSEN LTD. (Dept. P.R.1), WORPLE ROAD, ISLEWORTH, MIDDLESEX.
A Fine and Ultra-Modern Variable Mu Screened-Grid Detector and Amplifier

The Long Range Express

A circuit diagram appears on page 29.

For Wiring Diagram
See the Free Blue Print given with this issue.

The Output Stage

This is of considerable importance, and reference to the theoretical circuit will show that considerable care has been taken. A pentode is used to ensure a really generous output for a low value of H.T. consumption, while a center tapped choke limits.

LIST OF COMPONENTS FOR THE

(Variable Mu)

2 Pair No. 2 .0005 mfd. Variable Condensers.
1 Pair Tannoy coils.
1 Wearite Standard Screened H.F. Choke.
1 Wearite Special Screened H.F. Choke.
2 T.C.C. .0001 mfd. Type S. Fixed Condensers.
1 T.C.C. .001 mfd. Upright 3-cup type Fixed Condenser.
1 T.C.C. .01 mfd. Fixed Condenser.
1 mfd. Mansbridge Type Cond. (Lissen).
2 mfd. Mansbridge Type Cond. (Lissen).
1 Dublier 35,000 ohms. 1 watt fixed resistance.
1 Dublier 10,000 ohms. 1 watt fixed resistance.
1 Lissen 2 megohm grid lead.
2 Clix 4-pin chassis mounting valve holders.
1 Clix 5-pin chassis mounting valve holder.
1 Wearite 16 Henry 15 Mf. L.F. choke.
1 Wearite Ganged Wave-change switch.
THE EXPRESS THREE

and Pentode Set, incorporating the very latest components. It has very wide peccially designed by our experts, and is here described by PERCY RAY.

output choke is provided in order to match the impedance of the average load-speaker to suit the correct load of the valve. All load-speakers, except

moving coil types, have characteristics that make them unsuitable for use with a pentode valve, which is the reason why pentode valves are not generally realized. This fact has been taken into account in the design of this set, and the necessary compensation fitted which takes the form of a resistance and condenser placed across the wide-speaker terminals. A pentode valve should never be used without this time compen- sator unless a moving coil type of load-speaker is used. After explaining the details of this receiver it will not be necessary to warn the constructor that it is absolutely fatal to change any of the components to vary the layout of a single box. Arrangements have been made to have available a metal chassis ready drilled with perfect accuracy, so that every Long Range Express that is built will give the same remarkable performance as the designer's original. The blue print available will naturally be the chief guide to assembly, but there are no one or two points that should to carefully noted, as accidents may occur or part of the assembly may have to be pulled down to obtain access for fitting certain components, unless the correct order of procedure is preserved.

The Assembly

Begin by mounting the valve-holders, taking care to fix them with their terminals in the position shown on the blue print, and not reversing the holder so that the live pin holder has to be at the end nearest to the loud-speaker terminals.

It is advisable not to fix the coils until all other components are secured in position, as there is danger of pulling one of the leads and cutting the insulation on an edge of aluminium: the reason for the flexible leads is to obviate the uncertainty of small terminals in impossible positions, which is a fault found with most other coils.

Next, complete the top of the chassis, being careful to mount the standard choke with countersunk head screws, other wise one of the underside components is prevented from lying flat. When all the components are fixed, with the exception of the coils, the lower side of the chassis may be commenced, but do not attempt to reverse this order. The two Wearite chokes earth their metal cans by means of an eyelet on one of the fixing holes, and it is therefore imperative that these eyelets should not be interwoven with, but that a screw of the correct size be used.

Next mount the coils in position; access is obtained by removing the can from the base, which is detached by a small rotary movement like removing an extra lamp

LONG RANGE EXPRESS THREE

Screened-Grid)

1. Lissen Precision .0003 mfd. Reaction condenser.
2. Lissen 3 point "On and Off" switch.
3. Lewcon 50,000 ohms potentiometer.
5. Clix Spade terminals (Aerial, Earth, H.T.+,-).
6. Clix Wander plugs (G.B.-2, G.B.-1, 
H.T.+,-, H.T.+1, H.T.+2, G.B.-+)
7. Coils Lewcon Glassie.
8. Parousi Long Range Express Three 
16 gauge metal panel (12 in. by 6 in. 
and 6 X 3 inch panel 12 in. by 13 in.)
9. Bulgin 7-way battery card.
11. Ediswan 60-volt, super capacity H.T. 
batteries.
12. Lissen 9 bolt grid bias battery.
13. Three 90 volt 80 anode hour L.T. 
accumulators.
15. Cossor Valves 220 H.T., Metalised.

Fig. 4.—This photograph very clearly shows the extremely attractive lines of the Panel and Cabinet of the Long Range Express. The two large chats are the tuning condensers, the top centre knob is the wave-change switch, the lower centre the on-off switch, the left lower knob the volume control, and the right lower knob the reaction condenser.

Fig. 5.—Three-quarter rear view of the chassis.
from its holder. When the coil leads have been slipped through their corresponding holes in the base and the latter bolted in position, the cans should be replaced and turned firmly to lock them in position; it is advisable to connect the leads to their respective points so that they are out of the way. As it is difficult to make a join in these leads, make sure that the correct lead is selected and measure twice before cutting.

Wiring Up
The wiring-up can now be commenced; the valveholder legs will only comfortably take one piece of Glazite, which should be used for making the connections, so when making the connection between the three positive filament legs a single piece must be used. Many of the leads are taken to the chassis, and in some cases the nearest point has not been taken; there is a reason for this, so do not be tempted to vary the connecting points shown.

When the internal connections are completed and checked, the flexible battery leads can be added, the actual length being governed by the individual requirements, but in general it may be remarked that too long leads are as troublesome as unduly short ones.

On the Ether
Next make sure that all connections are quite in order, as a mistake may be expensive. If satisfied that everything is exactly in accordance with the illustration, connect the accumulator, grid-bias battery and, lastly, the high tension battery; with the exception of H.T., this order is the safe sequence. Now insert the valves in their correct order and connect the lead from the choke to the top terminal of the variable valve. Insert the H.T. plug, connect aerial, earth and loud speaker and switch on and the set will be ready for its first run on the ether. A fuse is not fitted, as these components usually fail to give the protection they should, and it is better to be without a fuse and use adequate care than rely on a fuse which fails.

Set the wave-change to the wavband required—in for long and out for short. Set reaction condenser to minimum (plates out of mesh) and volume control to maximum. Tuning is, of course, effected by the

(Continued on page 39.)
Here's your radio railway train

Shrill whistles, hissing steam, the clank of wheels, the gathering speed ... all these noises are produced in the Effects Studio by means of simple mechanical devices like the roller skate and the compressed air cylinder you see above. The result is amazingly realistic; and that realism you can retain in your reproduction by using the pure power of a Lissen Battery in your set. There is a process used exclusively in this Lissen Battery which produces power of remarkable purity; power so sustained that over prolonged periods of time it remains steady, noiseless and abundant always. Every radio dealer sells the Lissen High Tension Battery: ask for it firmly by name.

Lissen H.T. Battery

lasts longest and provides a pure high tension current that will give stage realism to your radio drama!
THE WHY AND THE WHEREFORE - 1

A series of weekly articles dealing with the function of the various components of a Broadcast Receiver

By JACE

Before we can commence our analysis of the receiving set it is necessary for us to briefly go over the method which is adopted to get the broadcast matter to our homes. There is no need to delve deeply into the technical side of the transmitter, but in order that we can understand certain functions in the actual receiver, we must acquaint ourselves with the manner in which the broadcast music or speech is converted into a form which may be transmitted far and wide. One or two of the terms must be remembered as they will be referred to in certain parts of the receiving apparatus, but we shall only mention those technical terms which are absolutely necessary.

Everyone knows, nowadays, that the broadcast matter takes three in the studio, and that the most important item in the studio is the microphone—familiarly referred to as “mike.” This piece of apparatus is, in effect, a glorified telephone mouthpiece—that is, it picks up the sounds which are made in its vicinity and converts them into electrical impulses. These impulses are passed into certain apparatus, which amplifies or magnifies them in order that they shall be strong enough to operate certain other parts of the transmitter. Another part of the transmitting apparatus generates electrical currents, which change their form very rapidly, and this particular form of current is known as “High Frequency Oscillations.” This is one of the terms you will have to remember, and it simply means that the current “oscillates” a large number of times per second.

The Tuning of a Wireless Circuit

The electrical currents from the microphone are conveyed to this H.F. generator, and by means of the apparatus the two different currents are combined, and in the combined form are radiated, or shot off, from the transmitting aerial. In order that all the different transmitting stations may work at the same time without confusion, it is necessary to keep each station on one particular path, and this process is known as tuning. The majority of you know how a harp or violin string alters its tone as it is tightened, and this provides a very good example of the tuning of a wireless circuit. If the string is just joined to the key and the tail-piece of the instrument without any tension, it will give off a certain note. Now, as the key is turned, and tension applied, the tone of the string will rise simply because it cannot vibrate so freely. Now in the transmitting circuit, and directly connected to the aerial, is a tuning device which causes the H.F. oscillations which we have just discussed, to be sent out at a definite number of times per second. This tuning is known as the “frequency,” and is referred to by the term “kilocycles.” If you look at the Wireless Programme column in your daily paper, you will see beside the London Regional programme, the figures 356.3 metres, and then just brackets, 842 kc/s. This last figure is the number of oscillations per second, and is really a last resort method of referring to individual broadcasting stations. The other figure, in metres, is the distance from the top of one oscillation to the top of the next.

The Aerial

We have now got, travelling through the air, a definite frequency, high frequency oscillations upon which are superimposed the sounds received by the microphone, and we can now receive the combination of these sounds. Obviously, the first thing to do will be to “tap” the waves or oscillations, and this is done by converting something in the air in the path of the waves. Now a peculiarity of these oscillations is that they adopt the same course as lightning—that is, they take the easiest path to the earth. Therefore, any conductor of electricity erected in the air and joined to earth will act as a lightning conductor, and convey the oscillations to the ground. This gives us a first consideration in erecting our aerial—a barrier must be placed at the end so that the oscillations are directed through our receiver and are not permitted to travel down the pole or mast to which the aerial is attached. Porcelain, chinaite, or any good insulating material has therefore to be attached to the ends of the wire which we use for the aerial, and this insulating material is in turn attached to the pole or mast. As the oscillations travel on the surface of metal, we must provide as large a surface as possible, and this is most readily carried out by using stranded copper wire. Copper because of its conductivity, and stranded, in order to get the large surface without using an unduly large thickness of single wire. The most common type of wire consists of seven strands of No. 22 gauge wire—familiarly referred to as 7/22’s.

We have seen how one end of this aerial wire has had to be insulated, and now the other end has to be led down to the tuning device in our receiver. Still bearing in mind the tendency of the oscillations to get to earth, we must take care that nowhere does the aerial wire come close to, or in contact with, anything connected to earth. If the wire is led in through a wall or window, a porcelain or chinaite tube should be used to conduct the wire into the house (Fig. 2).

The Tuning Coil and Condenser

We have now got to provide a means for putting our aerial in tune with the transmitting aerial, and this gives us our tuning coil and tuning condenser. In effect, we use a length of wire, which, for convenience, is wound round a tube, to add to the length of wire which is suspended outside the house. In order to avoid altering the amount of wire for each particular frequency which we wish to receive, we connect across the tuning coil a variable condenser, and these two components form a circuit which, according to the size of the coil and the size of the condenser, will tune over a wide band of frequencies (Fig. 2). The most efficient condition is met when the amount of condenser which has to be added is small. That is, a frequency of say 1,000,000 cycles—which is 1,000 kc/s, may be obtained with a coil of 5 or 6 turns of wire and a condenser or very large dimensions; or a coil of 60 turns and a very small condenser. The latter arrangement will, however, pass on the largest amount of energy at that particular frequency. We see, therefore, why dual-
It is possible now to buy most of the well-known types of gramophone pick-up in the form of a "pick-up arm"—that is, the actual movement with, of course, a case of bakelite or some similar material, but without the tone-arm, or more correctly, the pick-up arm. These pick-up heads are provided with a short junction piece exactly similar to the acoustic sound-box, and may be plugged into the tone-arm of any ordinary gramophone in order to reproduce gramophone records through the medium of the wireless receiver and loud-speaker. There are one or two important details, however, which are not always explained to the purchaser, and the quality of the reproduction and even the length of life of the record is greatly influenced if attention is paid to the following details.

Needle Angles

Firstly, the needle must, as in the case of the acoustic gramophone, be absolutely vertical when viewed from the front. This applies to every type of pick-up. If the needle travels across the record in a non-vertical position, obviously one side of the sound groove will be receiving unnecessary pressure, and this will result in the modulation of the recording, leading eventually to very few playings, to the ruination of the record. It is important to observe that the point of the needle fits into the groove, and to avoid the effect of side pressure due to slope away from the vertical.

The Long-Range Express

(Concluded from page 36.)

main tuning condensers. If the station is too loud, reduce it by means of the volume control; if, on the other hand, it is not loud enough, use the reaction, remembering to make a point of slightly readjusting the tuning condensers after making an adjustment to the reaction.

To Separate Stations

If two stations are overlapping, proceed as follows: turn the volume control down until the unwanted station has nearly disappeared—do not worry about the wanted one—and then by increasing the reaction and careful turning the wanted station will return clear of the interference, if it is at all possible. This procedure applies to the elimination of a powerful local station, which is a relatively simple matter compared with the difficulties found with an ordinary s.g. set. The constructor will now be able to reap the reward of the few hours spent in tuning in a feast of stations and enjoying the quality and volume that is usually associated with an all mains equipment of high quality.

range coils are employed for tuning to the number and the long wavebands, in preference to a very large tuning condenser and one coil covering the entire range.

To complete the aerial system, we must provide the earth connection, and this is simply a continuation of the aerial after passing through the tuning coil. The principal requirements of the "earth" are good contact and a short and direct route. The best contact is obtained by burying in the ground a short piece of galvanised iron pipe—and soldering or otherwise connecting the earth wire to this. In order to provide a good contact, it is preferable to bury the metal amongst coke or similar rubble, and keep this well dampened (Fig. 3). Where it is not possible to use buried earth, the water pipes make a good substitute.

Secondly, the needle should be drawn along the grooves of the record at a trailing angle in order not to scrape the bottom of the groove away. This angle is quite critical, and with practically every make of pick-up will be found to be identical. On the ordinary acoustic sound-box the junction piece is usually fitted with a small grub-screw or pin, and the end of the tone-arm is provided with a slot, into which the grub-screw fits—after the fashion of a "bayonet catch." This ensures the correct angle for the sound-box, but as different makes of gramophone are fitted with different types of sound-box, the majority of pick-up heads are not supplied with this bayonet-catch fitting. Consequently, the pick-up head may be fitted on the end of the tone-arm and rotated to any position.

The Angle of the Needle

The angle which has been found to be most suitable is approximately 55 degrees. It will be appreciated that, as there are so many different types of pick-up head available, it would be difficult to make a drawing applicable to any type of pick-up, so that by showing the acoustic sound-box the needle portion of the stylus bar can be drawn, and it is therefore only necessary to examine this part of your pick-up when determining the correct angle. As already stated the needle should be at an angle of about 35 degrees from the horizontal. Some commercial types of gramophone are provided with a needle angle as low as 30 degrees, whilst others favour 60 degrees, so that a position midway between these limits should be found suitable. It will be found difficult to detect any audible difference in these angles, and sound of wear on the record is also almost indetectable.

Weight of the Pick-up

The weight of the pick-up on the record will affect wear, but if the pick-up is no heavier than the sound-box which it replaces there will be no necessity to make any adjustment in this direction. If, however, the pick-up is much heavier than the sound-box, it would be preferable to fit a counter-balance to the tone-arm to relieve some of the weight. There are one or two commercial types of counter-balance on the market, but one can be improvised by attaching a screwed rod to the tone arm, with 2 or 3 inches of rod projecting beyond the tone-arm pivot point. A large threaded weight may then be screwed on to the rod and then adjusted to such a position that the majority of the weight of the pick-up is removed from the record. If the pick-up is made too light by this method, it will be found to jump the grooves on loud passages or low notes, and therefore the correct weight should be chosen.

Circuit diagram of the Long-Range Express Three.
Convert your set to the KENDALL-PRICE S.G.3 A.C. MODEL

A powerful set which will give you a minimum of thirty medium and long wave stations—and probably double this figure—as well as short wave stations from all parts of the world.

Mr. G. P. Kendall, B.Sc., the designer of many famous sets, and his assistant, Mr. H. D. Price, the famous short-wave experimenter, have written a book containing complete instructions, photographs and diagrams of ten modern circuits both battery and mains-operated. It shows you how, at a cost of a few shillings, you can bring your present set right up to date. At its published price of 1s. it represents remarkable value-for-money. Full-sized dimensionedBlueprints of these ten wonder circuits are also available at the exceptionally low price of 1s. for the set of ten. Send 1s. in stamps for the blueprints and we will also send you a FREE copy of the "Kendall-Price" Book. Post coupon now!

To Ready Radio Ltd. (Book Dept.), Eastnor House, Blackheath, S.E.3.
I enclose 1s. for ten full-sized blueprints. Please send me in addition—FREE—the wonderful Kendall-Price Book of ten circuits.
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The Kendall-Price Book is packed full of useful information which will prove invaluable to you, whatever type of set you are using. Even if you are satisfied with your present set you should read this wonderful book.

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Ready Radio Ltd., Eastnor House, Blackheath, S.E.3.
Do You Understand Your Loud-Speaker?

Don't always blame your receiver when results are not up to standard. It is more than likely that your speaker does not match the output valve.

Most listeners look upon a loud-speaker and a wireless set as being two entirely separate pieces of apparatus, whereas actually they are two members of the team working together for a common end. It is in common with all other teams the efficiency is that of the weakest link. If a set of only moderate efficiency is possessed there is little point in using a loud-speaker of the first class. It is a common mistake to fit a moving coil loud-speaker to a set that is incapable of giving an output worth listening to as, after all, the loud-speaker can only deliver what it is capable of giving and if any imperfections are present the better the loud-speaker the more noticeable they will become.

Fig. 1.—The magnet system of the true balanced armature loud-speaker.

A good loud-speaker is a thing that the owner may be justly proud of, and a little trouble taken to ensure that it is working efficiently is well worth while.

Old Telephones

Many loud-speakers that are offered for sale are little more than a telephone ear-piece with an armature for attaching it to the floor; in fact, there is actually one loud-speaker which may be seen in many shops that actually uses the inherently small magnets taken from obsolete headphones.

There are many so called balanced armature loud-speaker units available; the expression "so called" needs qualifying, as it is probably true to say that there is not more than one or two true balanced armature units obtainable. Fig. 1 indicates the balanced armature principle, and it will be noticed that the armature is pivoted in the middle and that the magnets are so arranged that both ends of the armature have equal magnetic forces brought to bear.

Fig. 1A indicates the general idea of what is popularly supposed to be a balanced armature. It will be seen that the armature is pivoted at a distance from the magnets, and in order to prevent the former from flying up and hitting one of the pole pieces some form of mechanical damping, such as a spring or a piece of rubber, has to be used. This, unfortunately, makes a compromise between sensitivity and volume handling capacity necessary, as a light spring will render the loud-speaker sensitive, but will not stop the armature from crashing on the magnet when heavy volume is handled, while a stronger spring sacrifices sensitivity.

In spite of this obstacle the popular balanced armature loud-speaker is in general use and well deserves its popularity. This type of loud-speaker usually gives disappointing results with a pentode valve as some means of limiting the impudence is wanted but is seldom fitted. This should take the form of a corrector circuit which is described below.

The Inductor

The most recent member of the loud-speaker family is the Inductor type, or, to give it its full title, the Dynamic Inductor. For use in a home on an ordinary receiving set this type of speaker, has, in the writer's opinion, certain drawbacks.

In the first place, the response is very unbalanced, being mostly bass and very little treble, which results in a somewhat choked, harp effect. Many readers probably prefer a slight predominance of the low notes, but, unfortunately, a serious loss of treble results in the characteristic loss of the low notes being lost.

Moving Coil

The moving coil loud-speaker is rapidly gaining in popularity, and the greatly reduced price of these loud-speakers and amplifiers could cover.

The above illustrates where, in the writer's opinion, the inductor fails, but after all the best loud-speaker from the user's point of view is the one that gives him and his family the greatest pleasure to listen to; if a listener likes a loud-speaker that gives the impression of being low pitched, there is no reason why he should not please himself.

The inductor requires the greatest care in matching its output valve, and some arrangement like that shown at Fig. 2 is highly desirable.

If any imperfections are present the better the loud-speaker the more noticeable they will become.

The piano has a range of a little over seven octaves, and ranges from 20 vibrations per second, or cycles as it is called, up to 4,000 cycles at the highest note. Bearing in mind the range of the piano, which is an excellent instrument for comparison, the range of frequencies necessary to make certain sounds realistic will come as a surprise: it is convenient to think of the piano as ranging from approximately 25 to 4,000 cycles.

The sound of footsteps approaching the microphone on a wooden floor requires from 350 to no fewer than 10,070 cycles for its origin character to be retained. If a means is arranged to cut off in a receiver the notes between 8,000 and 10,000 cycles a definite difference in the sound of the footsteps will be noticed.

The actual range required by various instruments is surprising, in particular a sixteen inch cymbal has no frequencies below about 300 per second, although many people are under the impression that the crash of a cymbal is lower than that of a drum.

Therefore, as the double bass actually goes lower than the piano, and certain stage effects require a range up to 13,000 cycles, it is apparent that the perfect reception of vaudeville requires an amazing band of frequencies that few loud-speakers and amplifiers could cover.

The above illustrates where, in the writer's opinion, the inductor fails, but after all the best loud-speaker from the user's point of view is the one that gives him and his family the greatest pleasure to listen to; if a listener likes a loud-speaker that gives the impression of being low pitched, there is no reason why he should not please himself.

The inductor requires the greatest care in matching its output valve, and some arrangement like that shown at Fig. 2 is highly desirable.
by the presence of the battery currents flowing through their windings, and it is well worth while, therefore, to build a simple choke output filter as shown at Fig. 3, which, incidentally, has the additional advantage of passing the speech current to earth instead of through the batteries, which often results in motor boating. For an ordinary type valve 25 henrys and upwards should be used, while for a pentode 60 henrys or about should be used.

For a super power valve 20 henrys is adequate, but, of course, higher values may be used. The illustration shows a condenser having a capacity of 2 mfd., but with an ordinary balanced armature speaker 1 mfd. is sufficient, but the higher value will do equally well if already possessed. When using a moving coil loudspeaker with an output transformer incorporated, it is desirable that it should be choke fed in the manner shown at Fig. 4, in order that the transformer core shall not be circulating by the high tension current, and also to prevent back coupling and consequent motor boating. When using a pentode output valve, considerable care must be taken to see that the loudspeaker used has suitable characteristics, or alternatively that the circuit is arranged to overcome the shortcomings of the loudspeaker. As already mentioned, it is necessary to use a corrector circuit, except when a moving coil loudspeaker is used. If, however, a corrector circuit proves itself to be necessary with a moving-coil speaker, it indicates that the latter has some peculiar characteristics and is a serious reflection upon its design.

Fig. 5 shows a simple corrector circuit, which may consist of 10,000 ohms resistance joined in series with a 0.1 condenser and connected across loud-speaker terminals. These values will, of course, be unsuitable under certain circumstances, but generally speaking they are satisfactory, and at any rate provide a starting point for experiment.

If desired, the 10,000 ohms fixed resistance can be substituted by a variable one for 25,000 ohms so that tone control is provided. It has been said that the pentode valve does not come up to the ordinary valve in quality of reproduction. This is due to the unsuitability of the average one type loud-speaker which is really designed to work with a power or super power valve, but if the corrector circuit is used everywhere becomes quite satisfactory. When using a pentode valve, taking a high H.T. current it is necessary to choke feed, in which case the corrector circuit should be applied, as shown in Fig. 6. As, however, the average loud-speaker is also lacking in impedance, the use of a tapped choke is an advantage. This is diagrammatically shown at Fig. 7.

Another Problem

The other problem that may present itself is the use of a moving coil loud-speaker having an output transformer fitted to it that is suitable for a power valve, but it is a simple matter to use with a pentode valve if a tapped choke is used, it being quite unnecessary, of course, to use the corrector circuit. As it is not easy to ascertain at what point the choke should be tapped, it is advisable to purchase a choke provided with a number of tappings and various ones tried until the best is arrived at. When choosing a loud-speaker, it is necessary to bear in mind the purpose for which it is required: if only moderate volume is required a balanced armature type has much to be said for it. If, on the other hand, something like radio gramophone volume is contemplated, a moving coil speaker is essential. When mains are not available, an energised type is not practicable, and a permanent magnet model must be employed. Although this type of speaker is extremely good and will do all that is required of it, it is always advisable to use a mains energised type when possible, also do not forget that the loud-speaker and output valve work as a team and, therefore, it is useless to use a loud-speaker of large size and expect big volume if the output valve is too small and vice versa, and remember that an output valve can only deliver its full amount of undistorted music when the impedance of the circuit connected to its anode is sufficiently high. Fortunately, many loud-speaker manufacturers quote the impedance of their loud-speakers, and it is only necessary to choose the valves that have an optimum load (quoted by their makers) of approximately the same figure.
SUPER-SHARP SELECTIVITY FOR THE DOLPHIN THREE

When you build the ‘Dolphin’ Three you are assured of selectivity and sensitivity far above the average obtained from a Det-2 L.F. circuit. It incorporates the wonderful Ready Radio Dual Range Coil Unit, fitted with four-in-one control, which acts as combined on-off switch, wave-change switch, selectivity and volume control, thus greatly simplifying wiring and construction. Instructions are included with every unit. From all radio dealers.

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ADDRESS: Practical Wireless 24/9/32
EVERY user of a radio receiver has his own pet ideas regarding the "features" or "extras" which are most desirable, so it would be almost impossible to design one instrument which would meet exactly the requirements of all listeners. Manufacturers favour the policy of simplifying their sets as much as possible, and therefore reduce the number of knobs or controls to the lowest possible figure. Receivers described in wireless periodicals usually have some refinements and additional controls, but readers often wish to add to these in order to satisfy their own particular fancies. In view of the facts just outlined, it is proposed to show how most of the desirable refinements can be added to any type of receiver in the simplest possible manner. The various additions and modifications will be dealt with briefly under separate headings.

**Volume Controls**

Volume controls are perhaps the most popular features of all, and though it is possible to vary the volume of any set by some means or other, many of these latter are unsatisfactory, because they have an effetion on tone quality as well as upon the volume. Detuning and reduction of high-tension voltage come within the latter category and both are equally bad from the point of view of "quality." The subject of volume control comes within two distinct classes. The first is "pre-detector" volume control, which means, of course, that the control precedes the detector valve. This form is the most satisfactory when the receiver is situated near to a powerful transmitting station, because it prevents overloading of the detector valve and consequent distortion. Four methods of effecting pre-detector control are shown in Fig. 1. At "A" pre-set or variable condenser is inserted in the aerial line.

The control shown at "C" is remarkably simple, but is only applicable when a screen-grid valve is employed. The negative filament lead is removed from L.T. negative and taken instead to one terminal of a 15-ohm rheostat, of which the other terminal is connected to L.T. — . Variation of resistance alters the temperature of the valve filament and at the same time causes a slight variation in grid bias. When A.C. valves are employed we have a wider choice in the way of volume control methods. A system which proves very satisfactory with valves of this type is shown at "D." A .1 mfd. condenser and a 100,000-ohm potentiometer are wired in series across the aerial tuning, whilst the normal bias resistance is connected to the potentiometer slider instead of to L.T. — . Operation of the potentiometer has a two-fold effect; it increases the grid bias on the S.G. valve and at the same time reduces the effective resistance across the tuning, so lowering the amplification of the S.G. valve and also reducing the input to it. As a result of the combined action the control is perfectly distortionless.

The post-detector volume control is generally easier of accomplishment and more efficient when the set is not so near to a powerful transmitter as to make detector overloading possible; that is, at a distance of not less than about 15 miles. Two forms of post-detector control are shown in Fig. 2. At

DO YOU KNOW?

- That high-frequency currents travel along the surface of conductors, not through them. Therefore all H.F. leads need to be as thick as conveniently may be used — or alternatively of stranded wire.
- That it is possible for the wiring or coils of a receiver to pick up the signals from a near-by powerful station, resulting in difficulty in cutting-out the interference. The remedy in such cases is to screen the coils, or even the complete receiver in very bad cases.
- That hum in an all-mains receiver employing a moving-coil speaker with an excited field can often be traced to interference between the field of the speaker and the wiring of the set. A metal screen between speaker and receiver, with a good earthed connection, will prevent such troubles.
- That leads from a pickup in a combined radio-gram should preferably be of the metal-sheathed variety. By connecting the cabling of these leads to earth instability is avoided.

(Continued at foot of page 65.)
Making Your Radio a De Luxe—(Continued from page 45.)

“A” resistance capacity-coupling is shown between the detector and low-frequency valves. To fit a splendid volume control it is only necessary to replace the normal fixed anode resistance by a potentiometer of similar value. The lead from the grid condenser to the “plate” end of the resistance must be transferred to another point and taken to the potentiometer slider instead. As an alternative the grid leak might be replaced by a potentiometer, the anode resistance remaining unchanged. The grid of the L.F. valve would then be connected to the potentiometer slider instead of one end of the leak. A form of volume control for use with the transformer connec-
ting is illustrated at “B.” A quarter meghhoun potentiometer is connected between the transformer secondary terminals (gener-

The individual who can boast of even a partial knowledge of wire-
less usually is called upon to under-
take a fair amount of testing work and

Another method of potentiometer

Malformed Construction

It is intended that the use of a valveholder, say, between grid and filament. This leakage may not be apparent in the ordinary way, but

Making the Tester

One way of making up the tester is
to use a small D.C. dry cell set and

Modified Construction

If readers prefer, they can make up the apparatus without buying the finished parts by mounting a batten type lamp-

How to Make—A Simple Wireless Tester

By H.J.B.C.

insulating sleeve
metal prod will
the point to
remain. The
arrangement
proves very
when it is
to get at
a wire
for test.
see if all the
contact. Cells,
sees, resistances,
continuity, etc.,
each end
visible, ment
useful
internal
resistance
connections,
circuit
Fig. 2—This illustration clearly shows the completed
wireless tester.

examined, and a test of this character is
more stringent than the battery and head-
phones method.

Using The Tester

The actual current consumed
is only a few milliamperes, but
owing to the voltage employed
insulating material will some-
times show a leakage which
would not be apparent otherwise.

In the case of condensers,
especially fixed ones, this test
proves very searching. If the condenser
insulation is imperfect and the test-handles are
left under the condenser terminals for,
say, a couple of minutes, a flicker of light
will be noticed in the lamp. With the
progress of another few minutes the
frequency of the flashes will gradually
increase until ultimately there is prac-
tically a continuous light, this proving that
the insulation has broken down and needs
replacement. On several occasions insula-
ting material which, on the megger,
seemed quite satisfactory, has gradually
cured the neon lamp to flicker after a time,
whereas if it were perfect no lighting up of
the lamp would take place. Another
important use is in the tracing of leakage
in the insulation of a valveholder, say,

Making Your Radio a De Luxe

September 24th, 1932
Here is your Opportunity—Make Wireless Batteries—It is a Paying Proposition.

Whether you are a Wireless Enthusiast or not, you know what an enormous demand there is for Wireless Batteries—a demand which is ever increasing by leaps and bounds. If you are a Wireless Enthusiast you know also that you and millions of others are constantly on the look out for Better Batteries.

Here is a way in which you can meet the demand for Better Batteries and Profit Financially—Make them yourself in your spare time with our Patent Method and Formula. By making your own Batteries you can save money—by supplying your Friends and Relations you can make Money—and you may make up to £30 a year per licence!

Anyone can do it! It has probably never crossed your mind before. You have thought of Batteries as “technical” things—always regarded them as something mysterious.” This is not the case. Study the pictures on the left and you will see how really simple it is.

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We will tell you how. You may know nothing about Wireless or Electricity—it does not matter in the slightest. We will tell you how to do it—FREE.

After receiving our instructions you can start right away to Make the work is intensely interesting as well as easy—more fascinating than making your own Wireless Set.

This saving in huge, average returns can complete a ten volt B.T. Battery in 9 hours at a cost of 2s 6d approximately! Compare this with Shop Prices!

Make your friends Wireless Batteries and make money. Consider what this means to you. Not only can you save money on your own Batteries—and get BETTER RESULTS—but you can help your friends get the same, too. You can help us make a profitable Battery Business and reap a Golden Harvest from the Wireless and Electrical Market.

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Practical Wireless 24/3/32

SAY “T.C.C.”—for SAFETY

Here are illustrated the 2 mfd. non-inductive type condensers, price 3/10 each. Note the double mounting bracket—a feature of great importance for sub-chassis wiring. Made in capacities from 0.05 to 2 mfd. Working voltage 320 D.C.

is simple enough to be sure of absolute reliability in the condensers you buy—just say “T.C.C.” and you will get a condenser that is backed by a quarter of a century’s specialized research—a condenser that has won the approval of radio technicians and set designers the world over. Judge for yourself—see the specifications of press receivers—look at the best of commercial sets—you will always find “condensers by T.C.C.”

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ALL-BRITISH CONDENSERS

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Programme 1932-33

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6 Wander-Fuse. With 150 ma. fuse... ½d.
7 "Scru-Fuse." Not bulb, not cartridge, yet both... 6d.

5 different colour-coded ratings 60 to 750 ma.

SPARE FUSES—Shown Actual Size.
LONG FUSE. All ratings, 60, 150, 250, 500, 750 ma., 1 amp., 2 amp., 3 amp. SHORT FUSE. For Wander-Fuse only, 60, 150 and 500 ma.

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Set manufacturers, Government Departments, technical experts, the leading Wireless Journals—ALL use and specify Belling-Lee Radio Connections. Make them your choice.
A complete range for every requirement, including Insulated Terminals, Terminal Mounts, Plugs and Sockets of every description, Wander Plugs, Battery Cords, S.G. Anode Connectors, Accumulator Connectors, etc., etc.

Write for Complete List
New West Regional Station.

During a recent "hike" from Minehead and across Exmoor I made a considerable detour—considerable, that is, if you are walking—to take a look at the new West Regional station in course of erection at Wavishford Cross. The masts are already up and the station buildings well on the way, and it is believed that the new station will be on the air early in the New Year. Manufacturers have nothing to do with the efficiency of the station, and there is not much doubt that they have, the new West Regional will be a signal to be reckoned with. Situated well above sea level, they soar up goodness knows how many feet in the air, and have a peculiar appearance of being most insecure.

Demand for Selective Sets.

A MATTER of interest in the West Country are already feeling somewhat perturbed as to conditions when the station gets going, and many with sets of doubtful selectivity are looking around for new circuits. A local dealer told me that nowadays nine out of ten customers, when inspecting sets, first of all ask, "Is it selective?" "Will it cut out the local station?" He also told me that in spite of his assurance that certain sets would, it is making business rather difficult. People are somewhat inclined to carry on with their old sets until the new station starts transmitting. With one exception, however, the purchaser of one of the new season's sets of reputable make need have no fear on the score of selectivity: that seems to have been the first thought of manufacturers this year. And the second—well, I think ease of control and neat appearance are pretty closely.

Fans at Radiolympia.

I wonder what the exact risk figures were that must have been calculated by the Publicity Department of that enterprising valve firm who distributed fans to every "fan" that wanted one during the first few days of Radiolympia. It was a master stroke of publicity and proves that British manufacturers are far more awake than certain people would have us believe. Of course, it might have been cold and wet, we have had Augusts like that, and as the fans must have been printed and made weeks before the exhibition, it was a decided feather in the cap of these responsible. As it was, everybody carried one, and it was so hot that representatives of rival firms had no qualms about giving free publicity to their competitor so long as they managed to keep moderately cool themselves.

Eliminating Pick-up Capacity.

The other day a friend asked me to have a look at his new radio-gram he had just completed. It was a splendid job so far as appearances go, but it appeared it was not working as well as the designer said it would. Signal strength on distant but powerful stations left much to be desired, there was an annoying whistle on certain wavelengths, and reaction was decidedly "ploppy." After some minutes "truddling," I noticed that the pick-up was switched directly into the grid circuit by means of an alleged low-loss switch inserted in one lead of the pick-up. This was evidently not good practice, for the pick-up wires were connected to two terminals on the baseboard, and attached to the grid circuit was the capacity of the length of wire comprising the pick-up leads, the winding of the pick-up itself, and probably some of the switch and the terminals. Anyway, on disconnecting the pick-up from the two terminals the set immediately started working splendidly, reaction became beautifully smooth, and about 80 per cent. more volume issued from there. It is making business better. I advised my friend to fit a plug-in connecter instead of the terminals, and any other reader who is troubled with pick-up capacity might do so as well. It is but the work of a second or two to plug the connecter together when it is desired to listen to records.

Improving Quality of Pick-ups.

Incidentally, those readers who use a pick-up in connection with a set utilizing two stages of transformer-coupled L.F., may have noticed that raising the grid bias of the first low-frequency valve when switching over to the pick-up has the effect of improving the quality a great deal. Some pick-ups are particularly critical in this respect, and it is worth trying. A matter of one and a half to three volts makes a great difference and helps to keep down the "blasting." "Sami" from Paris.

The figures tabulating the results achieved at the Radio Exhibition make interesting reading, but anybody who was under the impression that battery sets are dying a natural death will have a bit of a shock when they see that out of 2,000,000 sets sold at Olympia over 1,200,000 of them were battery-operated. It is also interesting and gratifying to learn that over three-quarters of a million more sets were sold this year than last, resulting in some 20,000 more work people being taken on. The greatest strides, however, have been made in the radio export business, through which Britain has moved up to third place in the world's export market. Over six times the number of foreign buyers visited Olympia this year than in any other year. Altogether it looks like a boom year for the British wireless industry.

Long-wave Interference.

If you live within twenty miles or so of a medium-wave regional station you have probably been troubled by the programme from that station "breaking through" on the long-wave band, and so interfering with the reception of foreigners. Perhaps the break-through has even been so bad as to spoil the programme of the Duventry National transmitter. This difficulty is often experienced even with receivers which are normally quite selective, and a cure would, therefore, seem to present rather an awkward problem.

(Continued overleaf.)

One of the novelties seen at the recent Wireless Exhibition.

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Splendid Handbook entitled: "All About Tuning and Tuning Coils." ORDER YOUR COPY NOW!
Radio Ramblings—continued.

"Test Voltage" and "Working Voltage."

Most manufacturers have now abandoned the foolish practice of giving only the "test voltage" of their condensers and instead state the more useful "working voltage." But even this can be misleading, for although the working high tension voltage of a mains set is, say, 250 volts, it does not follow that a condenser having a working voltage of 250 volts is suitable. This is because the actual voltage when the set is first switched on, and for some time after, is probably twice the normal figure. It gradually falls to the normal voltage as the valve heaters reach their working temperature, but until this point is reached there is a negligible load on the high tension supply. When ordering condensers for use in an A.C. set it is thus always wise to specify those having a working voltage twice that of the set. Cheap components of foreign manufacture should be carefully examined whatever voltage is stamped on them, for it is rarely of any significance whatever.

The New L.F. Coupling Units.

There are now two or three L.F. coupling units on the market which will best serve the purpose they are receiving. The units consist of a small transformer, a coupling condenser, and a feed resistance. I need not mention any names because readers will have recognized the components in question. Reasons for their great superiority over ordinary transformers have also been explained. What I want to point out, though, is that ordinary transformers, and cheap once at that, can be used in conjunction with a suitable resistance and condenser to give the same effect as the special coupling units. The correct method is to employ a fixed resistance and a fixed condenser. The best value for R depends upon the type of the preceding valve (V), but will generally lie between 25,000 and 50,000 ohms. It should have a resistance of from two to three times the A.C. impedance of V. Thus for a Cosmos 210 H.F. (A.C. impedance 20,000 ohms), 50,000 ohms would be just about right: the actual figure is not critical. The capacity of C can be anything from .4 to 2 mfd., but .25 mfd. is a good average value.

A Nasty Breakdown.

Only a few days ago I was asked to look over a home-made A.C. receiver which had suddenly "gone off" after only a few hours' use. When I switched on, the valve heaters were all seen to glow at their normal brightness, but otherwise everything was absolutely dead. There was no click in the speaker when switching on or off, and tests with a millimeter showed that there was a high-tension current flowing to any of the valves. This at once suggested a fault in the high-tension supply circuit, although everything looked O.K. My suspicions were aroused when I saw that most of the fixed condensers were of a cheap, apparently foreign, and nameless type. The only marking on them was "500v." The 4 mfd. condenser connected in shunt with the metal rectifier was removed from the set and tested. As I feared, it showed a dead short, but that was only a mild beginning; further investigation showed that the metal rectifier was completely ruined and that on the rectifier and transformer and causing the demise of both. The moral is two-fold. Had a fuse been included in the circuit it would have "blown" and prevented further trouble. But if good quality condensers had been employed the entire trouble would have been avoided.

Marconiphone "Big-Ben" Loud-speaker.

In more ways than one we are hearing a lot about the giant loud-speakers on top of the Marconiphone offices in Tottenham Court Road, which every quarter of an hour booms out the chimes of Big Ben. You won't need telling that the volume is almost as great as the original; in fact, I think the reproduction was even better than the original—but I do hope the idea won't spread. Our big cities have enough noise as it is, and some of us would like to forget, more and again, our biggest enemy, Father Time.

Individual Sets for the Family Circle.

A gathering in Birmingham Sir William Morris prophesied that before very long families would be buying "suites" of motor-cars for different members of the family circle, and for different occasions. A tiny "baby" for the "kid brother," a super-sports for the big sister, a large limousine for weddings, funerals, and other ceremonial and concerted family occasions, and so on. The real radio enthusiast has already realized the advantages of such a scheme, and even if his pocket has not allowed him to own a complete "suite" at once, at the same time, he has at any rate tried each kind in turn. There is the set for short waves, one for family use—really foolproof, that even Auntie can use—one for long-distance work, and the portable for picnics and outings and for annoying the neighbours in the garden on Sunday afternoons. Even so, human nature being what it is, I am afraid there would still be trouble. Everybody would be wanting to use the same set at once!
A TRIUMPH OF PRECISION

Similar in construction to the "NUGANG" Condensers, but the trimmer of front section is operated from the receiver panel by means of a second knob concentric with the main tuning knob. Rigid one piece chassis, very robust construction. Trimmer to each stage. Heavy gauge wide spaced aluminium vanes. Special bearings to rotor ensure permanent accuracy. Capacity .0005.

Matched to within ± mmfd. plus ± per cent.
Complete with disc drive and bakelite escutcheon plate.
2 gang - 18/6
3 gang - 27/-

The essence of Success—TEAM WORK

To attain perfect efficiency each component must function correctly with its neighbour—they must work together as a team. That is why Formo Dual Range Coils, matched with scientific care, ensure the efficiency you need.

Each Coil, too, has its own distinguishing colour and permanently fixed connecting chart. You cannot go wrong when building or re-wiring your set.

Every Formo Coil you buy is perfectly matched to any Formo variable condenser. That is why the Formo complete band-pass tuner has reached the culminating point in selectivity and sound performance.

Use Formo components always and be sure of perfect results.

If you cannot obtain Formo components locally, send the name of your radio dealer to:

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Badly-placed components are frequently the cause of poor reception, often giving rise to interaction.

This article by "Ingot" tells you what pitfalls to avoid and how to avoid them.

The actual placing of components in a receiver is of great importance, far greater than the majority of constructors realise; a sound circuit and good, well-chosen components are two features that go to make an efficient receiver, but if they are badly arranged the results are often disappointing, while in some cases the constructor is rewarded by a degree of success.

Some years ago a noted wireless authority, in describing a set, wrote "Keep all wires very short and space the components wide apart." While this advice indicates the ideal state, it is unfortunately not possible to place two objects wide apart and join them with a short piece of wire. The placing of a receiver can be grouped into two headings: (1) the actual placing of the components themselves, and (2) the wiring; the former is perhaps, of major importance, as it will determine to some extent the actual course that the latter will have to follow.

The theoretical circuit is primarily intended, of course, to indicate the nature of the components used and the connections between them, but though few people realise it, a general idea can be gained of the best arrangement from a study of the diagram. The reason for this is that a skilled designer naturally endeavours to make a diagram as clear as possible to those who read it, with the result that components are arranged in a drawing so that those connected together are placed near each other, which is exactly the state of affairs that should exist in a receiver.

Take, for example, the diagram shown at Fig. 1, and compare it with the practical diagram shown at Fig. 2. Many points of resemblance are apparent: the aerial terminal is in the top left-hand corner in both diagrams, the aerial tuning coil is similarly on the extreme left-hand side with the tuning coil next to it, the only difference being that the condenser in Fig. 2 has been drawn towards the panel for obvious reasons. Continuing a study of Fig. 1 we find that the next item is the valve, which is placed in an exactly similar position in Fig. 2, except, of course, the actual valve holder is shown in place of the symbol of the valve; continuing this comparison, it will be seen that the anode valve leg is connected to the anode resist-

**Fig. 1.** Note the similar positioning of the symbols above to the position of components on the practical drawing Fig. 2 below.

**Screened Grid Receivers**

A receiver employing one or more screened grid valves is more difficult to arrange than the theoretical diagram often given, and even better idea of baseboard layout in one sense may be obtained by considering a thick slab of wood or a broken line where this screen is placed and consequently which components go on the aerial side, and which on the anode side. When the screened grid valve is actually mounted through a hole in the screen, it is usual to indicate this by allowing the valve to break the screen, as shown at Fig. 3. Similarly, when coils of the screened type are intended by the designer, it is usual to indicate it by surrounding the coil with a dotted line, which will also indicate the position that the coil should occupy on the baseboard.

The only deviation that is usually necessary when planning the baseboard from the theoretical diagram is brought about by the use of a screened condenser, in which case the various sections will lie in very close proximity to each other and not spaced as the diagram will indicate: this is done for clearness, but it need not cause the constructor undue worry, as the rest of the components can be mounted in the usual way, and the coils will usually be in a convenient position for connecting to the condenser, provided that the former are not placed too far apart. This figure is, however, usually controlled by the length of the ganging rods which link up the switches, which, with few exceptions, is placed in the base coil. It may be mentioned in passing that it is not always desirable to have switches in the base coil, as the blades occasionally require cleaning, which is a difficult matter when they are inaccessible placed.

Another type of construction which is of late gaining in popularity is all-metal chassis-building, which is full of many obvious advantages and will save the constructor spending many weary hours trying to trace the cause of strange motor kinking and instability; with a blue print of a commercial set, this point, naturally, does not arise.

**Pitfalls to Avoid**

The chief snag to be avoided is the use of "motor bus" return, which is the name given to the practice of connecting to the nearest point of the chassis any lead that has to go to earth. Such an arrangement is liable to cause trouble, as unless the components are positioned with great accuracy and foresight, stray currents flowing over the chassis set up an accumulation of stray fields which may be so placed that they make the set violently unstable; the reader will be aware that a current of electricity flowing through a conductor always acts on a magnetic field around the conductor through which it is passing. It is not the intention of the writer to condemn the use of a metal chassis, but rather to (Continued on page 54.)
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CHASSIS 7/6
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Sovereign Products, Ltd., Sovereign House, Rosebery Avenue, E.C.1.
How to Place Your Components  
(Continued from page 53)

suggest that wires coming from a source where high frequency current is flowing should be connected by means of a piece of wire straight to earth if this is their correct destination. It is a common mistake when building a mains set to connect wires to earth that should be connected to cathode, for example, the condenser connected to the screening grid of the valve to earth instead of cathode, and similarly to connect the earth end of a choke fed loud-speaker to earth instead of cathode; when a pentode is used, such a procedure would often result in a considerable loss of bass. The chassis can profitably be used to carry one side of the low tension accumulator to the valves, and it is usually quite in order to connect H.T. — and G.B. + to the chassis, and such things as decoupling and H.T. by-pass condensers.

Earthing the Coil Cans

Generally speaking, the coil cans can be earthed by bolting them to the chassis, but cases have been known when stability is only possible when the tuned grid coil can is insulated from the chassis, and taken direct to the earth terminal. Baseboard planning is of vital importance, but the constructor should find little difficulty in arranging the components correctly if the theoretical diagram is carefully followed in the manner indicated above and deviations used only where necessary, such as the mounting of variable components on the panel and the bodily twisting round of the H.F. end, when a ganged condenser is employed that is so constructed that each section lays behind the other from back to front. This arrangement follows the same principles, because the relative position of the different components is adhered to, the only variation being that the H.F. end is at right angles to the detector and output valve layout.

In addition to the placing of the actual components there is, of course, the question of placing external leads and components. Unfortunately, the disposition of aerial, earth, and loud-speaker terminals will enforce the connections at those points, but where possible these leads should not pass each other. That is, if the aerial terminal is at the left-hand side of the set and L.S. terminals at the right, endeavour to arrange the set in such a position that the lead-in comes from the left, and does not pass near L.S. leads, as it is possible to get instability from this practice. For the same reason, batteries which are at earth potential, should not be placed in such a position that the leads to them are permitted to trail near H.F. coils or leads on the H.F. side of a receiver.

Careful attention to all the points mentioned in this article will result in getting that little extra from the set.

---

PRACTICAL WIRELESS  
September 24th, 1932

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**FILT.**

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IS THE ALL-BRITISH PICK-UP RECOMMENDED BY THE DESIGNER OF THE "LONG RANGE EXPRESS" described on page 34 in this issue.

PRACTICAL WIRELESS
1932

PAGE 44

SEPTEMBER 24TH, 1932

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What Is Distortion?

(Continued from page 24.)

...are a good guide of acceptance or handling powers, in order to be on the safe side and avoid distortion it is preferable to apply a smaller signal voltage than that at which the valve is apparently capable of handling. In this way you will have a margin to spare and no attempt will be made to run the receiver all out.

Reaction.

Unfortunately, absence of space prevents my dealing with several other points fully, but in conclusion mention must be made of reaction. Keep this control adjusted so that it is as far off oscillation point as possible, and bear in mind that reaction badly designed or badly handled is a notorious agent for detracting from good reproduction.

Then, again, we have to consider the detector valve. If working as a "leaky grid," care must be taken that the impressed signal does not overpower the bottom end of the valve characteristic. There is a risk of this when strong signals are handled at this stage, and if this does occur a secondary, or what is known as anode bend, rectification will occur and introduce serious distortion. For strong signals one should resort to normal anode-head rectification or, alternatively, use what has recently come to be known as "power-grid" detection.

Enough has been said, however, to show that at almost every point in your receiver distortion can occur, and in future articles this very important side of wireless work has been just touched on here will be gone into more fully.

Broadcast Query Corner.

Under the above title, with the assistance of a recognised authority on foreign broadcasting matters and a regular contributor to wireless publications both at home and abroad, we are inaugurating a special Instruction includes American development and practice in addition to British. It is a modern education in radio, covering every department of the industry, and gives an outline of the principles and possibilities of television.

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CONCERNING ATMOSPHERICS

ALTHOUGH atmospherics seldom make wireless reception impossible in this country, they are, nevertheless, very disturbing at times, especially with long-distance reception during warm weather. Common causes of atmospherics are lightning discharges in the atmosphere, or the gradual equalising of potential between charged clouds or a cloud and the earth. Unfortunately for the listener, these atmospherics have no particular frequency, so that they cannot be tuned out by ordinary means. Another point to bear in mind is that the atmospherics may be much stronger than the signals from a distant station, consequently, when conditions are bad, it is useless to introduce very much amplification, because in that case the atmospherics would be amplified as well as the incoming signal.

Background Noises

Sometimes you may be doubtful as to what is causing the background noise in your receiver—it may be atmospherics or only a failing battery. A simple method of proving this point is to disconnect the aerial and earth. If the trouble ceases it is evident that atmospherics were the cause. When atmospherics are about, the listener soon discovers that, no matter how carefully the set is tuned, they still persist in coming through, but with decreasing intensity as the lower wavelengths are tuned in. The aperiodic nature of atmospherics makes it extremely difficult, if not impossible, to entirely eliminate them. Engineers and scientists have been trying ever since wireless was first introduced—to get rid of atmospherics, but so far without any real success. Different methods have been tried out, but they are too complicated to be of any use to the average amateur.

Cutting Down Atmospherics

One of the simplest ways of cutting down the intensity of atmospherics is to lower the aerial. A long, high aerial seems to be a much more efficient collector of atmospherics than a low one. When altering the aerial, however, it must be borne in mind that when in a lower position its signal-pickup efficiency will be reduced, which will mean more amplification for bringing in a distant station. The extra amplification might increase the intensity of the atmospherics, but if the required signals can still be heard at good strength on the lowered aerial, without additional amplification, then the effect should be a reduction of interference.

A By-pass for Static Discharges

A high resistance connected between the aerial and earth terminals of a receiver is sometimes effective in cutting down atmospherics, by acting as a by-pass for the static discharges. Try various values of resistance until the desired result is obtained without unduly diminishing the signal strength. A spaghetti resistance is very handy for this purpose, as shown in Fig. 1.

Another dodge worth trying is to use the earth as an aerial by disconnecting the latter from the set and connecting the earth lead to the aerial terminal, as in Fig. 2, leaving the earth terminal disconnected. This reduces the range of the set, but often completely cuts out atmospherics, so that reception from the local station can be enjoyed even when conditions are bad.

My Favourite Circuit—And Why

(Concluded from page 33)

because it gives more "punch." No output filter is used as the speaker incorporates a transformer.

From Mr. W. J. Barton Chappell, Wh. Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

I find it difficult to isolate any one particular circuit and call it my favourite. I have designed some which I have built to fulfil a definite function, that I can only say that the diagram shown on page 32 represents one of my favourites.

Let me give readers the reasons for choosing the four-valve shown. First of all it is simple to operate and can be handled by any member of the household, a factor which, in my opinion, is most important one. Four valves are chosen because this enables one to reach out for stations without "forcing" the set.

Selectivity is amply provided for by the condenser combination on the aerial input side and the degree of magnetic coupling between the tuned circuit and the aerial coil. Incidentally, the differential condenser connected in the aerial circuit is most effective as a volume control. Choke feeding between the screen-grid and detector enables the tuning arrangement to be properly ganged with the moving plate at earth potential, while the single H.T. feed simplifies the receiver from the point of view of a home-station. A National M.E.P. type 6 or 6A. produces tremendous output, ample provision for decoupling being given in each anode feed.

On the low-frequency side we have a first stage R.C. coupling and a resistance fed transformer linking up the output valve. There is a choke feed to a transformer, which latter can be tapped to match with the speech evil impedance, assuming a moving coil model is employed. Automatic bias is arranged for.

From F. J. Cann

I CANNOT answer this question in the singular, for I have several favourite circuits. If you press me, however, to be more precise than this, I still think that a detector with leaky grid rectification followed by two stages of low-frequency amplification requires a great deal of beating if everything is taken into consideration. The equalisation has it that "you have to give it all ways," and if we consider that the Det. 2.E.F. circuit as a basic one from which other medium circuits have been developed, we shall probably find that the introduction of one in part of the circuit has introduced corresponding complications in another. It is true that there are certain disadvantages with the arrangement named, but, taken all round, its very simplicity, its ease of construction and operation makes it a delightful circuit for the non-technical amateur.

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MAIN VALVES.

One valve, or more, are used. A valve is a device which is a changeable resistor, and is used as a switch. It is a vacuum tube which has two electrodes. In the simplest type, the valve consists of an anode and a cathode. The anode is the positive electrode, and the cathode is the negative electrode. The valve is used to control the flow of current between the two electrodes, and to amplify or diminish the electrical signal.

ADDITIONAL AERIAL FOR PORTABLE.

If you have a portable receiver, you may wish to add an additional aerial to improve the reception. This would consist of a wire or a length of wire, which is attached to the receiver. The wire should be long enough to reach the ground, and should be connected to the receiver using a suitable connector.

LOUD-SPEAKER RAFFLE.

A raffle is being held to give away a loud-speaker. The loud-speaker is a device which converts electrical signals into sound. It consists of a diaphragm, which vibrates when the electrical signal is applied to it, and a speaker cone, which radiates the sound waves.

A.A. WEATHER REPORTS.

The weather reports are broadcast from one of the London aerodromes. You can tune your receiver to this station, and listen to the report. The report will include information on the weather conditions, and may also include information on the state of the electrical grid.

ADDITIONAL SMOOTHING.

““My set is supplied with H.T. from a commercial mains supply. The H.T. voltage is too high. What can I do to smooth it?” (E. B., Hammersmith).

You could use a smoothing circuit to reduce the voltage. A smoothing circuit consists of a capacitor and a resistor, which are wired in series with the power supply. The capacitor acts as a reservoir, storing energy when the voltage is high, and releasing energy when the voltage is low. The resistor limits the current flow, and prevents the voltage from rising too high.
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COLWERN COILS.
In the new season's brochure received from Colvern, Ltd., particulars are given of a new dual-range coil known as the T.4, among their other numerous types. These new coils can be used in either a detector or a triode circuit.

PERMANENT MAGNET MOVING-COIL SPEAKERS.
In a novel form just issued by Whitley Electrical Radio Co., Ltd., a description is given of their own well-known permanent magnet moving-coil speakers, including a new model with coil steel magnets which are at the same time of a cheaper class. Readers interested in moving-coil speakers should make a point of getting a copy of this folder.

EDISWAN H.T. BATTERIES.
Some useful information concerning the Ediswan H.T. and grid-bias batteries is given in the form of a booklet issued by the Ediswan Electric Co., Ltd. Some of these batteries which wish to know how to obtain the maximum length of life from them, together with the highest quality of reproduction from their sets, will find the information in this booklet, which contains a handy two-page chart for logging stations.

A USEFUL T.E.G. CATALOGUE.
Two pages have been added to the design and construction of power units, which has a most useful gadget. Every constructor should get a copy. In the form of a calculator showing how many days are needed to change almost any number of voices with any number of millamps that may be passing. It costs sixpence, but it is well worth it.

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By The Editor of PRACTICAL WIRELESS

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