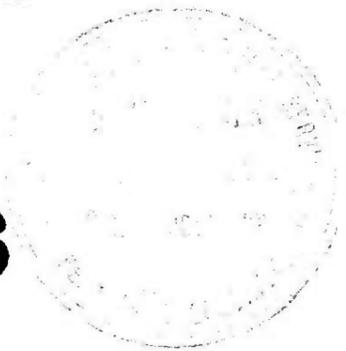


CATALOGUE OF

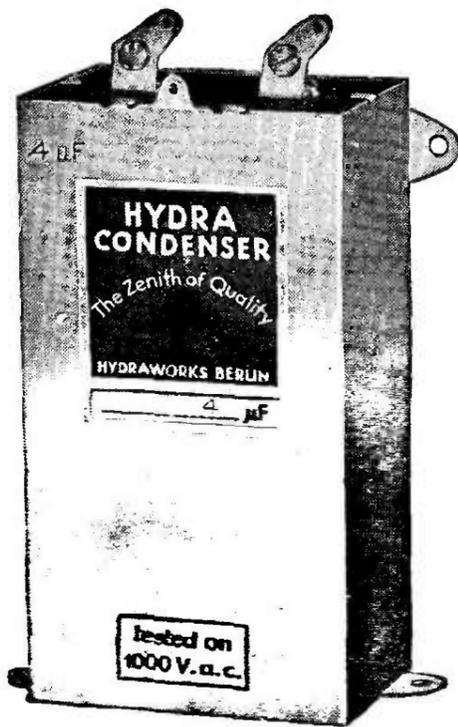
HYDRA

Fixed CONDENSERS



A
HIGH SAFETY
FACTOR,

AN
ACCURATE RATING.



A
LONG LIFE,

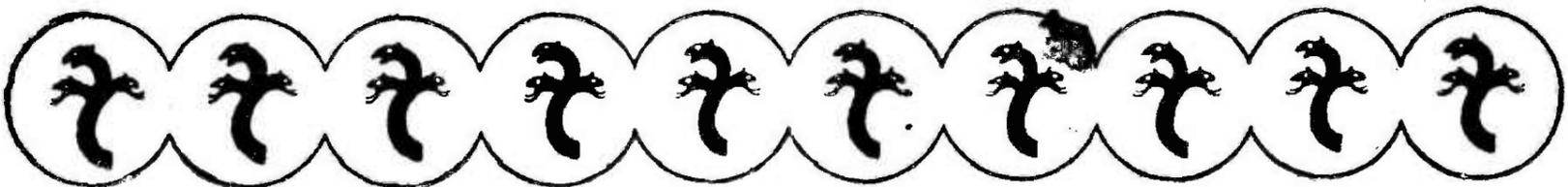
A
MODERATE PRICE.

INCLUDING FULL CONSTRUCTIONAL DETAILS
OF A

Direct-coupled Receiver

Reprinted by Special Permission of "Wireless Weekly"

Eastern Trading Co. Ltd., Sydney and Melbourne



This list contains the most useful types of

HYDRA-CONDENSERS

which are made by a special process that has proved successful during the last thirty years. They distinguish themselves through their:

Superior electrical characteristics
Maintaining their values
Thorough dependability in service
Solid and practical design

Hydra-Condensers cope with all the demands in the electrical and radio industries.

The main fields of application are:

LONG DISTANCE TRANSMISSION:	Telephony and telegraphy, telephone boosters.
RADIO:	Transmitters and receivers, Eliminators, power amplifiers.
SPARK INTERFERENCE:	Motors, generators, electrotherapeutic apparatus, light, advertising, etc.
SPARK BLOW-OUT:	Electrical horns, switch clocks, interrupters, rapid pressure regulators, etc.
PROTECTIVE SYSTEMS FOR POWER PLANTS:	Selective protection, high tension cable protection.
HIGH FREQUENCY:	Electro-therapeutical apparatus, violet ray sets, etc.
VARIOUS LINES OF APPLICATION:	Smoothing of alternative current pulsations in rectifiers, equalizing of pressure points when disconnecting electromagnetic chucks, automobile ignition, railway protection (Automatic rain stop device), power factor correction, etc.

The life of Hydra-Condensers when properly treated, is unequalled, since, due to the very exact manufacturing methods, any alteration of the inner structure through variations of temperature or atmospheric influence does not affect same. This means that the electrical values remain constant.

The capacity of Hydra-Condensers has been strictly adhered to. Standard types measure to +10% or +5% of the nominal value, but for certain fields of application, condensers of a capacity within +2% can be supplied.

The insulation resistance is extremely high and does not fall below the practically admissible limit, even after a service of many years. With supply, 200 megohms minimum per μF are guaranteed.

The dielectrical losses of the Hydra-Condensers are extremely low. The angle of loss in standard types amounts to approx. 20 or 25 minutes, measured at 50 or 800 cycles.

Each condenser, when completed, passes an exact control, where it is tested at the voltage prescribed.

Condensers which do not appear perfect when being tested are set aside immediately. The rigorous final control gives the guarantee that only condensers are supplied which will satisfy the required conditions in every respect.

The condensers, shown in this list as standard, can be supplied promptly, in most cases, ex stock.

Enquiries for special types and also groups of Condensers in single containers will receive prompt and careful attention.

The technical data required when asking for these special designs, includes the following:—

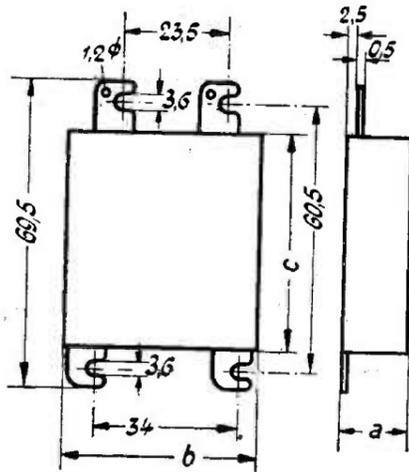
Capacity, capacity-variation permissible, service and test voltage, nature of current, frequency, duration of service, maximum dimensions, position of soldering and fastening lugs, and use.

“FIT HYDRAS AND BE SAFE”

Group Ia

Tested on **500-650** VOLTS **D.C.**

Catalogue No.	Capacity	Dimensions			Test Voltage
		A	B	C	
1004	0.01 MFD	15	45	50	650v. D.C.
1011	0.5 "	15	45	50	500v. D.C.
1013	1 "	15	45	50	"
1150	1 "	15	45	50	650v. D.C.
1017	2 "	25	45	50	500v. D.C.
1018	2 "	35	45	50	650v. D.C.
1023	4 "	45	45	50	500v. D.C.



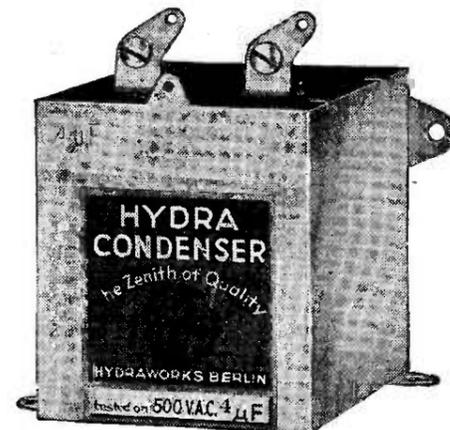
Other capacities made in this group are as follows:—0.001, 0.002, 0.005, 0.01, 0.02, 0.025, 0.05, 0.1, 0.2, 0.25, 3, 5, 6, 8 and 10 Microfarads

Group II

Tested on **500** VOLTS **A.C.**

Catalogue No.	Capacity	Dimensions			Test Voltage
		A	B	C	
4002	0.25 MFD	15	45	50	500v. A.C.
4003	0.5 "	15	45	50	
4004	1 "	25	45	50	
4005	2 "	45	45	50	
4007	4 "	65	55	60	

Other Capacities made in this Group are as follows:—
0.1, 5, 6, 8 and 10 Microfarads.



"DO NOT COMPROMISE WITH QUALITY"

Group III

Tested on **1000** VOLTS **D.C.**

Catalogue No.	Capacity	Dimensions			Test
		A	B	C	
5001	0.1 MFD	15	45	50	1000v. D.C.
5003	0.5 "	20	45	50	
5004	1 "	35	45	50	
5005	2 "	65	55	60	
5006	4 "	45	45	115	
5008	8 "	45	85	115	

Other capacities made in this group are as follows:—0.25, 6 and 8 Microfarads.

Group IV

Tested on **1000** VOLTS **A.C.**

Catalogue No.	Capacity	Dimensions			Test
		A	B	C	
6004	1 MFD	45	45	50	1000v. A.C.
6005	2 "	65	55	60	
6007	4 "	45	65	115	

Other capacities made in this group are as follows:—0.1, 0.25, 0.5, 5, 6, 8 and 10 Microfarads.

Group VIIa

CONDENSER BLOCKS

Catalogue No.	Capacity	Dimensions			Test
		A	B	C	
8504	{ 2—2—8 1—1—1—1 4—6—2—2	65	92	125	500v. A.C.
8553		65	92	125	500v. D.C.
		65	92	125	500v. A.C.

BRIDGE CONDENSERS

Catalogue No.	Capacity	Dimensions			Test
		A	B	C	
6017	0.1—0—0.1	20	45	50	1000v. A.C.
1141	3x0.5	35	45	50	500v. D.C.

The four types indicated in this group are regularly kept in stock, but other combinations to suit manufacturers' individual needs can be made. Further particulars and illustrations can be obtained upon application.

"SAFETY FIRST MEANS HYDRA ALWAYS"

HYDRA TRANSMITTING CONDENSERS

Catalogue No.	Capacity	Dimensions			Test
		A	B	C	
7400	0.1 MFD	30	130	130	4000v. D.C.
7600	0.1 "	30	130	130	6000v. D.C.
7603	1 "	60	130	130	6000v. D.C.
7005	2 "	60	130	130	2000v. D.C.
7411	2 "	160	148	215	4000v. D.C.
7030	4 "	100	130	130	2000v. D.C.
7611	4 "	160	148	260	6000v. D.C.

Other capacities made in this group are as follows:—

2000v. D.C. Test 0.1, 0.25, 1 and 5 Microfarads

4000v. D.C. " 0.1, 0.25, 1, 5, 6, 8 and 10 Microfarads

6000v. D.C. " 0.1, 0.25, 0.5, 2, 3, 5, 6 and 8 Microfarads

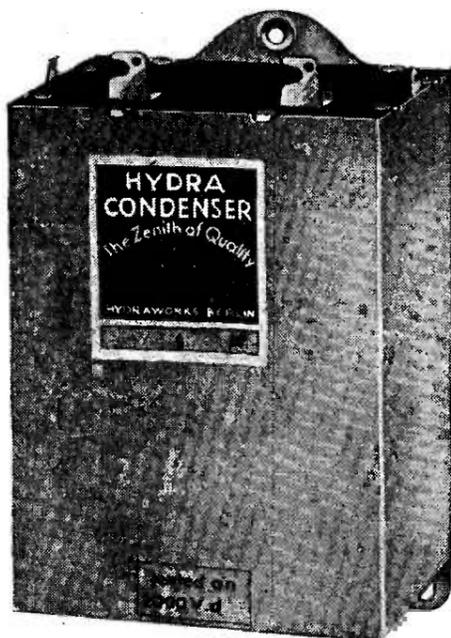
Enquiries for special tests and capacities will receive prompt attention.

The illustration below depicts a suitable type of Heavy Current Condenser for use with Single Phase Induction Motors.

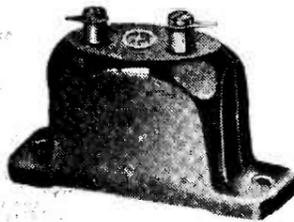


Hydra Works manufacture a wide range of Transmitting Condensers, as illustrated on the left.

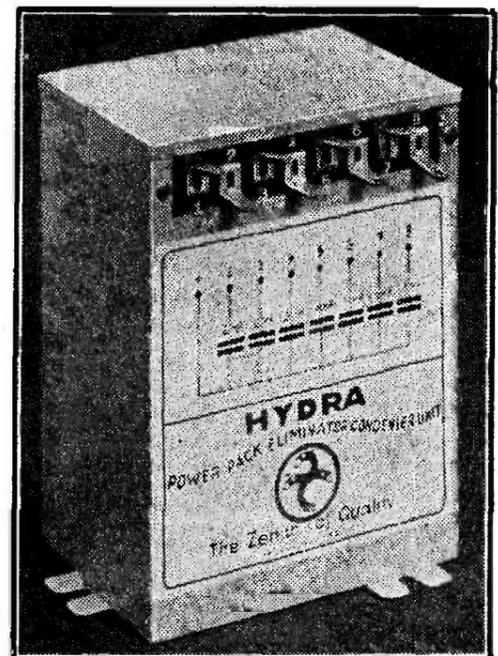
A good many of these are usually in stock for prompt delivery.



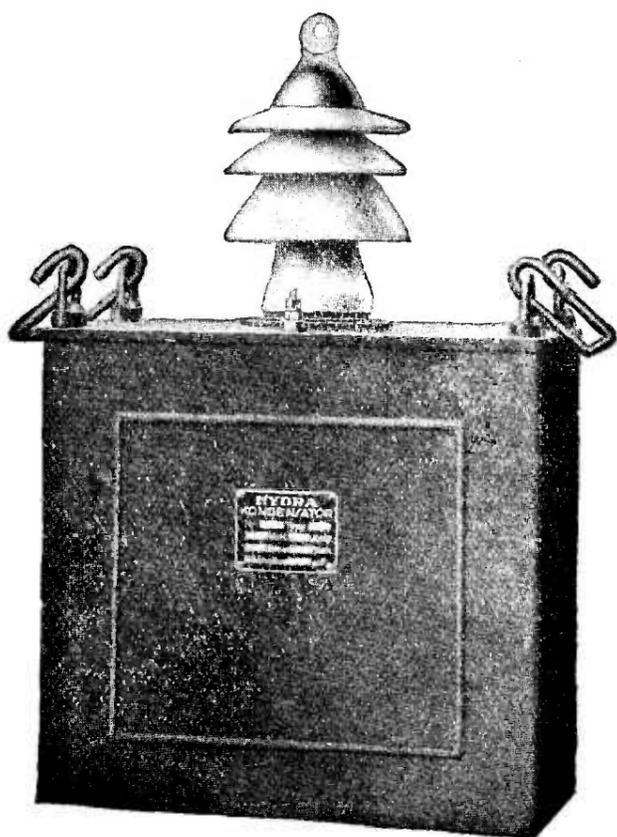
Condenser Blocks similar to that illustrated on the right can be supplied to suit manufacturers' individual needs.



An example is shown above of a non-inductively wound Condenser in Brown Bakelite Case.



"SANELY AND CONSERVATIVELY RATED"



HYDRA

High Voltage

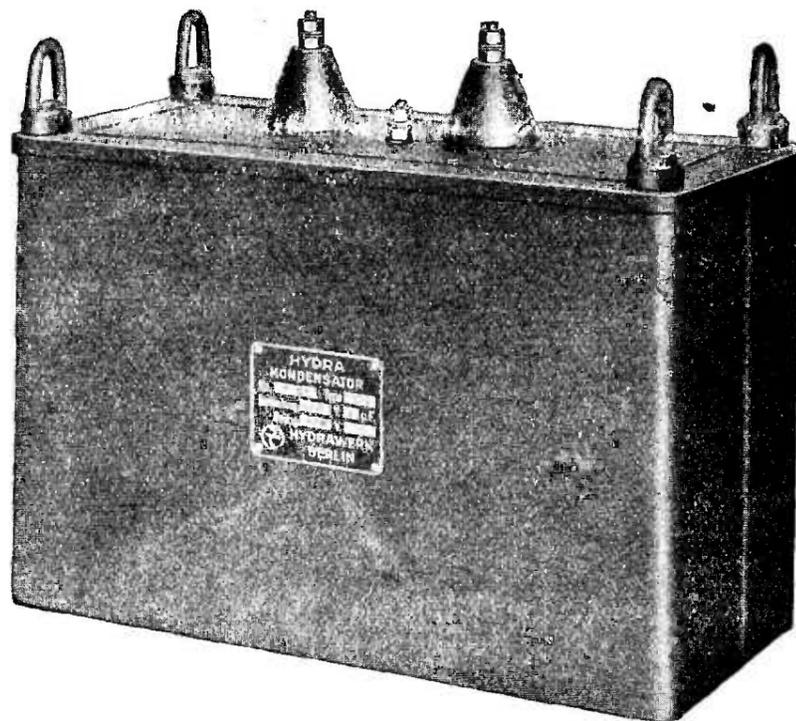
Condensers

FOR USE IN BUILDING UP HIGH VOLTAGES FOR TESTING ELECTRICAL PORCELAINS, INSULATORS, INSULATING MATERIAL, HIGH VOLTAGE AND OIL SWITCH GEAR, CABLES, ETC.

HYDRA CONDENSERS

FOR
POWER FACTOR
CORRECTION

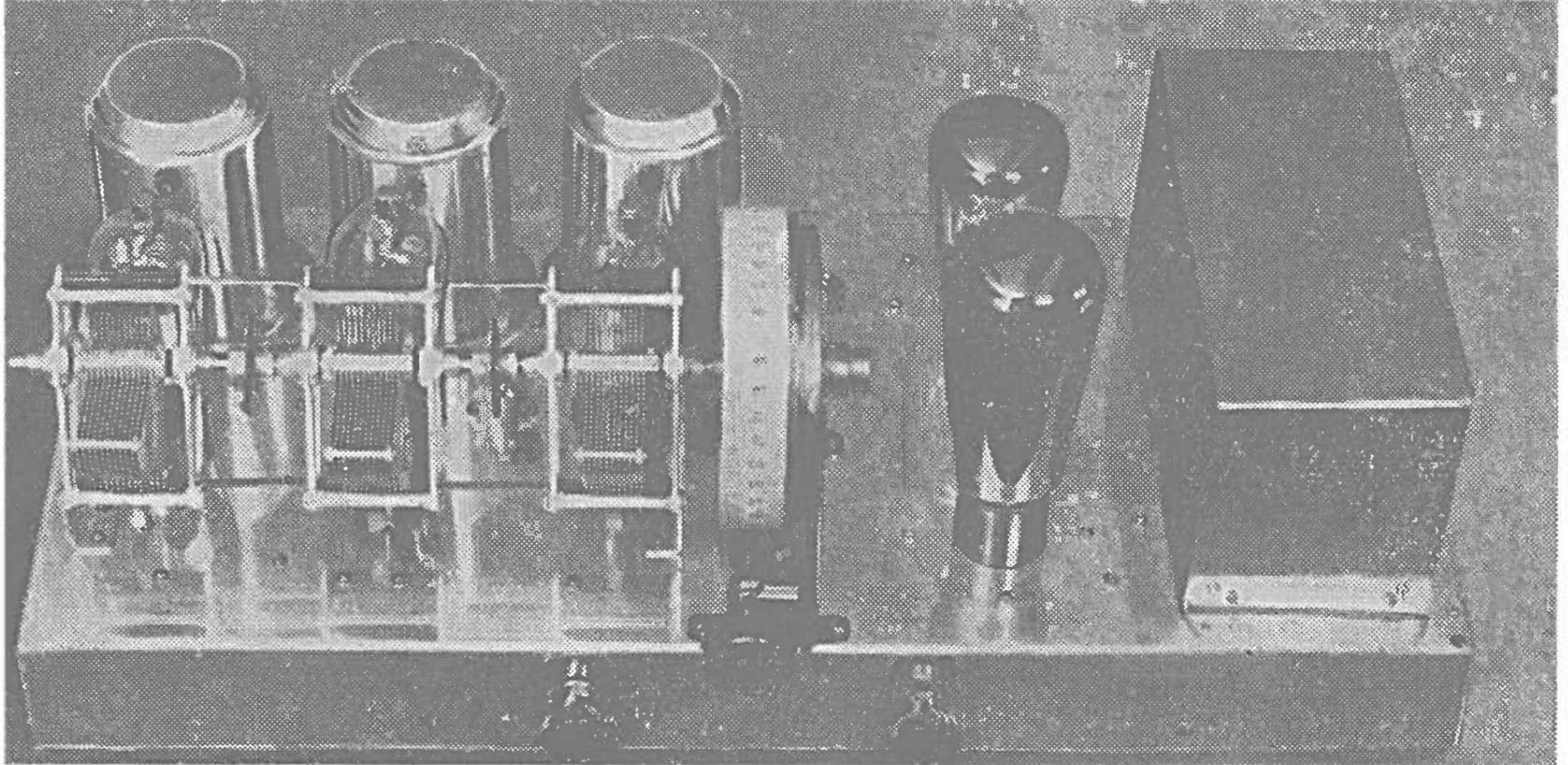
220 Volts to 500 Volts.
2 B.K.W. to 20 B.K.W.



"HYDRA CONDENSERS HAVE BEEN MADE SINCE 1898"

Complete Constructional Details for Direct-Coupled Receiver

The Original Direct-coupled Receiver designed from the Loftin-White data by Ross A. Hull, is here published with many later improvements and modifications, and an alternative resistorless version of the circuit.



The completed "1930-Four." All the wiring is below the base, and the chassis becomes a clean piece of engineering for mounting in a cabinet similar to that illustrated on another page.

IN OUR issue of January 24 there appeared details of a new circuit. Many times old circuits had reappeared in new guises, but this particular circuit was entirely different from any other in use. Its remarkable features were soon appreciated and in the issue of March 28, full details of a set, embodying the new circuit, were published. A few enthusiasts were brave enough to try this circuit, and, when they found the splendid quality of the reproduction, they soon convinced the most sceptical that the new set was really different from anything else ever made. The result was that within a few months hundreds of these sets had been made and stocks of component parts throughout the whole of Australia became exhausted.

Now that stocks have been replenished we are pleased to again publish full construction details of the set, which has been slightly modified after the thorough tests that have been imposed upon it during the past few months. There is only one point where it is possible for a reasonably intelligent set-builder to strike trouble. This is in the matter of grid-leak type resistors. Unfortunately, it would appear that it is not possible to produce these resistors with any great accuracy as to their value.

However, should trouble occur with these, it is an easy matter to convert the set into a slightly modified design, which does not employ these resistors.

It is now accepted all over the world that nothing can compare with the direct-coupled circuit for quality of reproduction.

The modified design is not quite so perfect in this respect, but is still far superior to the ordinary transformer-coupled type

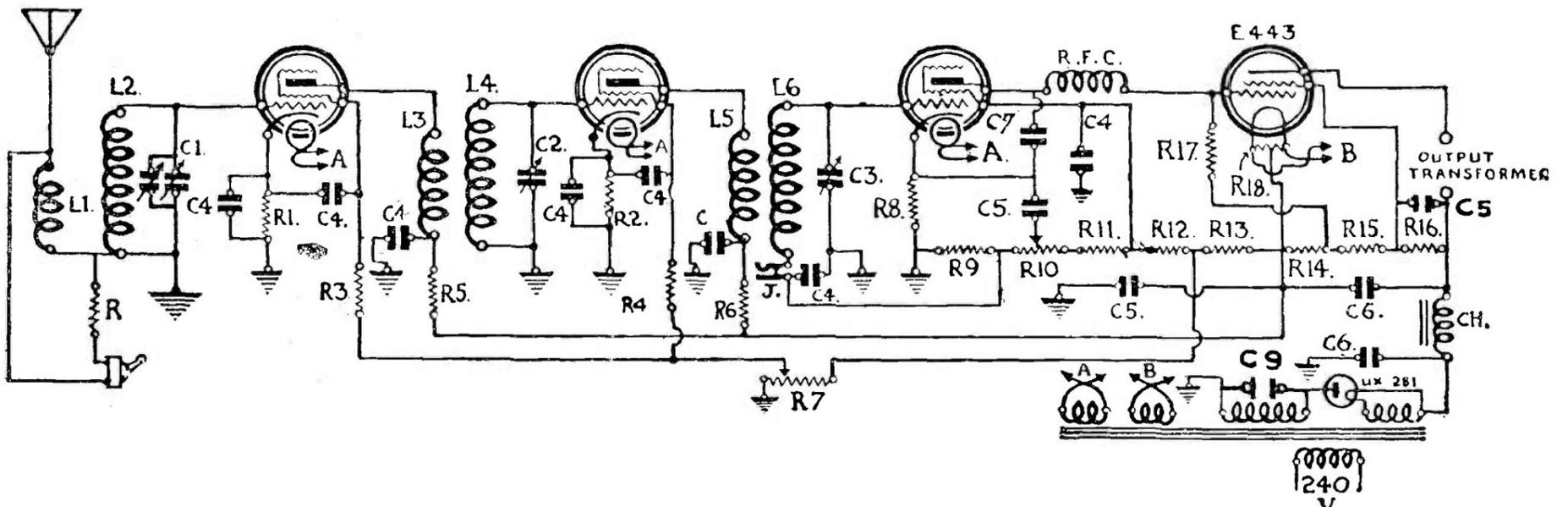
Loftin and White

ALTHOUGH improvements have been made from time to time in the construction of transformers, it has not been possible to produce one which will give equal response to the musical frequencies which it has to handle. The direct-coupled circuit, as its name implies, has a direct coup between the detector and output valves, so that all music frequencies are passed on equally, and almost perfect reproduction is obtained.

The circuit was perfected by two prominent American engineers, Loftin and White. Details of the circuit, for us an amplifier, were published in American papers, but the set to be described which embodied this circuit, so far as known, appeared in the "Wireless Weekly." For some time it was maintained in America that the circuit could not be used for radio work, it is now admitted to be

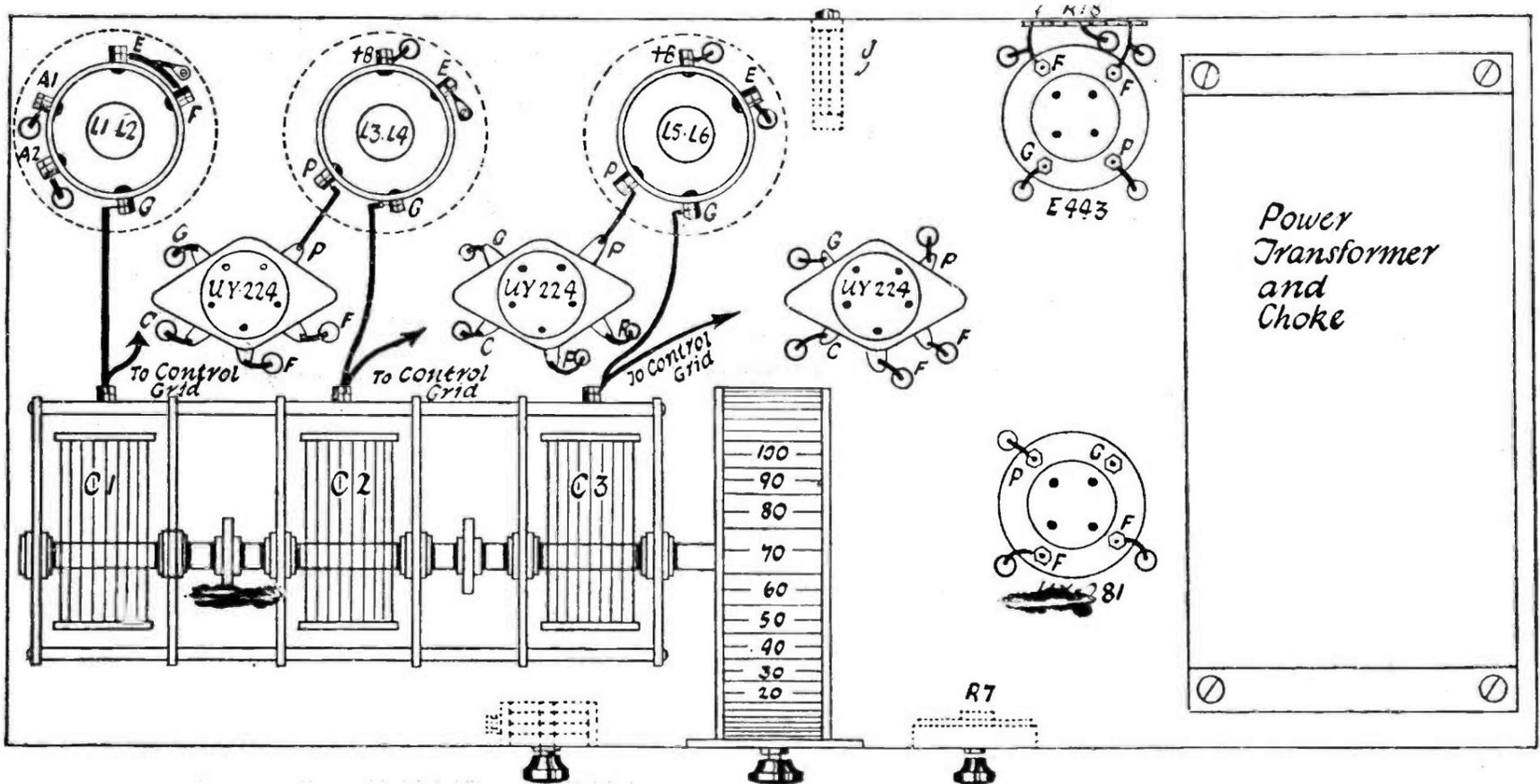
particularly suitable, and is receiving the attention that it merits, many manufacturers marketing sets embodying the circuit. Several of the leading technical magazines are also describing direct-coupled circuits, some of them being almost identical to the original published in this paper. No one need have doubt as to the set being fundamentally sound, and not merely up to date, but ahead of times.

HYDRA
the
Zenith of Quality



THE CIRCUIT DIAGRAM OF THE ORIGINAL 1930--FOUR.

It should be noted that C1 comprises a variable condenser of .0005 mfd. capacity, with a 5-plate midget condenser placed between one of the terminals of the fixed, plates of the main condenser and earth. The condenser, C5, which is placed across the resistor, R16, can be of either .5 or 1 mfd. capacity, and can also be placed as running to the centre-tap of the output valve filament instead of to the high voltage supply as shown. In each case the "tone" of the set is altered. Different tastes prefer different arrangements of this condenser. A trial in the positions mentioned will soon reveal the difference in tone. The gramophone pick-up jack shown as J, must be of the closed circuit type, so that the grid circuit of the detector valve is complete when the plug is removed from this jack. The filament wiring is not shown, being indicated by the arrows at A and B. The wiring must be carried out in twisted flexible wire, to minimise the effects of the a.c. hum



THE LAY-OUT OF THE TOP OF THE SUB-PANEL.

This diagram and the diagram of the wiring of the under side of the sub-panel are both arranged for the E443 Pentode, fitted with four pins and a terminal on the base. Should it be desired to use a pentode employing a UY type base, the only alteration is that the cathode terminal of the socket should be used for the connection of the lead from R16, instead of the terminal mentioned. It is really better practice to arrange the coils and valves so that the length of the leads to the control grids (caps) of the valves are all the same length. This may help in the matter of having the condensers adjusted so that they will operate from the single control, without giving better selectivity at one end of the scale than at the other. A considerable saving can be effected in the length of the control grid leads by tilting the condensers C1, C2, C3, so that the terminals are closer to the caps of the valves.

Parts List—Original 1930-Four.

- 1 Prima Donna or Radiokes Aluminium Sub-panel, size 20½ x 9½ x 2½.
- 1 Set of three Prima Donna or Radiokes Coils (L1, L2, L3, L4, L5, L6).
- 1 Set of Shields for same.
- 1 Prima Donna or Radiokes Power Pack.
- 4 Pilot, Emmco, or A.W.A. UY-type Valve Sockets.
- 1 Pilot, Emmco, or A.W.A. UX-type Valve Sockets.
- 3 A.W.A. Variable Condensers, Capacity .0005 mfd. (C1, C2, C3).
- 2 Sets of Couplings for same.
- 1 Pilot Single Drum Dial.
- 1 Radiokes or Pilot Midget Variable Condenser, 5-plate type.
- 1 Hydra Fixed Condenser of .1 mfd. Cap., 1000-volt a.c. test (C9).
- 3 Hydra Fixed Condensers of .5 mfd. Cap., 500-volt a.c. test (C4).
- 2 Hydra Fixed Condensers of 1 mfd. Cap., 500-volt a.c. test (C5).
- 2 Hydra Fixed Condensers of 4 mfd. Cap., 1000-volt a.c. test (C6).
- 1 Renrade Fixed Condenser of .00025 mfd. Capacity (C7).
- 1 Carborundum, Mullard, or Renrade Grid-leak type Resistor, 50,000 ohms. (R8).
- 3 100,000 Carborundum, Mullard, or Renrade Grid-leak type Resistors, (R3, R4, R14).
- 1 Carborundum, Mullard, or Renrade Grid-leak type Resistor, 300,000 ohms. (R15).
- 1 Carborundum, Mullard, or Renrade Grid-leak type Resistor, 500,000 ohms. (R17).
- 1 Federal No. 24 type 200 ohm Potentiometer (R10).
- 1 Pilot 200,000 ohm Potentiometer (R7).
- 1 Radiokes or Renrade Special Tapped Resistor (R9, R11, R12, R13).
- 1 Mullard, Radiokes, or Renrade 10,000 ohm. Wire-wound Resistor (R16).
- 2 Radiokes, Pilot, or Renrade 2000 ohm Wire-wound Resistors (R5, R6).
- 2 Radiokes, Pilot, or Renrade 450 ohm Resistors (R1, R2).
- 1 50 ohm centre-tapped Resistor (R18).
- 1 Radiokes, Lewcos, or Renrade, Radio Frequency Chokes (R.F.C.) Valves—3 Philips F242 or Radiotron UY224 Screen-grid Valves.
- 1 Philips 1562 or Radiotron UX281 Rectifying Valve.
- 1 Philips E443 Penthode Output Valve.
- 2 D.C. Jacks, Syds. Flex Wire. Adaptor, odd scraps Bakelite, 9 lengths Spaghetti, 1 coil "Glazite" wire, 3 clips for valve caps. 3 "Clix" terminals, 7doz. ½ x ¾ screws and nuts, soldering lugs, etc.
- 1 Jensen Dynamic Speaker.
- 1 Philips or Blue Spot Gramophone Pick-up.
- 1 Austral-lectric Gramophone Motor.
- 1 Suitable Cabinet.
- Power Switches as required, etc. etc

Several local manufacturers have turned their attention to the direct-coupled circuit and others are bound to follow suit.

Volume Regulation

AN illustration of the power of this set is given in the circuit where a local-distance switch is shown—a device which shorts the aerial, to earth, through a short length of fine wire. An affair of this type is essential to cut down the strength of local stations, but the same effect can be obtained by using an aerial of about two feet long for local stations and only connecting the outside or large indoor aerial when reception of interstate stations is desired. It is essential that the volume control be operated at more than half strength, otherwise the selectivity is impaired and two or more stations may come in together. As the volume is so terrific it is necessary to make some arrangement as mentioned above. When operating the gramophone pick-up it is also essential to have a volume control incorporated in the pick-up, as the volume control of the set does not operate when the pick-up is used. It may, however, be found that the reproduction is better when the volume control of the set is in the position of lowest volume.

Selection of Components

NOW let us look over the shopping list and see what we will require. The base specified is of aluminium, and it will be found that this is very nice to work with. It is little harder to drill than wood, and much wiring can be saved by earthing all negative leads instead of providing double wiring. Bases can be purchased with the holes already drilled, which is a great convenience and will save a lot of time.

The coils can be wound by hand, but again we strongly recommend the manufactured coils, which are carefully matched and have terminals neatly attached. The drum dial can be of any suitable type, but care should be exercised to see that the control knob is symmetrical to the other knobs when the numbers on the drum appear in the middle of the front panel. The variable condensers should be handled carefully as they can easily be damaged. It is a good plan to fit them to the chassis to get the right alignment, and then take them off again, putting them aside until the rest of the set is completed, If left mounted on the base they will probably be damaged when the set is inverted during the process of wiring up the components under the sub-panel. The sockets should be of first-class quality, as nothing is more annoying than sockets which make occasional contact. A slight defect like that is harder to find than many greater troubles. The midget condenser is not a very important

part, and either a three, five, or seven plate will serve the purpose.

The next items on the list are the fixed condensers. They are most important. It is essential to have condensers capable of standing up to the high voltages which are used. The actual condensers specified are suitable if the same test voltage is obtained. In some other brands of condensers it is necessary to use those having a test voltage of 1500 or even 2000. The condensers C6 and C9 are most important in this respect.

The Grid-leak Type Resistors

AS mentioned previously these are very important. It would appear that all the various makes are equally faulty as regards rating as against actual resistance, and the matter of luck seems to be all important. If the resistors are incorrect the results achieved will soon reveal this point. The wire wound resistors are usually up to rating to within a reasonable degree. Care should be taken to see that the lugs of these resistances do not foul the mounting legs, causing a short to earth. A little close scrutiny will soon settle this point.

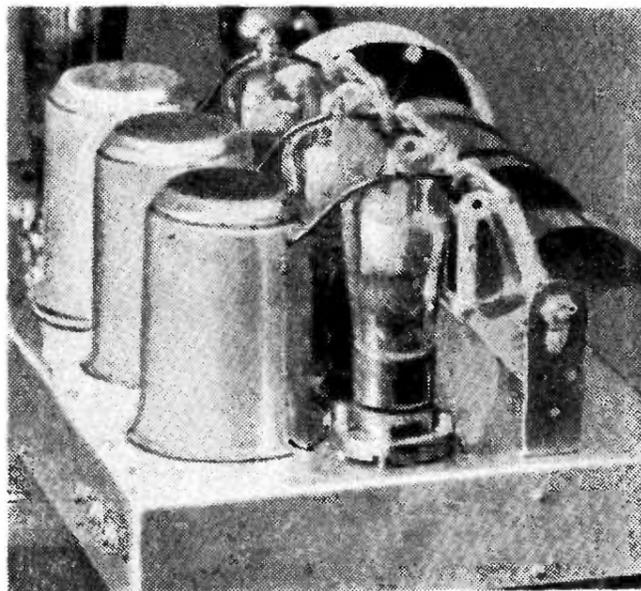
A dynamic speaker is particularly recommended if the full quality of the musical reproduction is to be obtained. Many readers will not worry about buying a cabinet for their set, as the outlay is fairly heavy. It should be remembered, however, that such an outlay is not thrown away. If ever a time comes when it is desired to dispose of the set the cabinet will prove a valuable asset. A good cabinet is now recognised as a piece of high-class furniture. The addition of a gramophone pick-up and motor is also well worth while. The finished product will be equivalent to a set costing about twice the actual outlay necessary for the purchase of the parts. It will represent a splendid investment if carefully and neatly constructed.

Testing the Components

BEFORE a start is made with the actual set it is advisable to test all the components. Condensers such as C4, C5, C6, and C9 can best be tested by charging them from the lighting mains, a lamp being fitted in the lead. Should this lamp light up to full brilliance, it will prove that the condenser is faulty. After the condensers have been charged they should be put aside for a few minutes and then shorted with a wooden handled screw-driver. They should spark sharply if in good condition. The resistances should be tested with an old "3" battery to see if there is any connection between the windings and the mounting lugs. The variable condensers should be tested similarly to prove that the fixed and moving plates are insulated.

Tinning the Lugs

NEXT it is a good plan to run over the lugs of all the components with the soldering iron and tip each one with a little dab of solder. This greatly facilitates the job of wiring the set after the parts have been installed in the sub-panel.



This picture gives an accurate idea of the method employed by Mr. Hull in the mounting of the condensers, valves, and coils to minimise the amount of wiring required.

Coil Winding Data

WHILST we recommend the bought coils, it is quite possible, for these items to be wound by hand. The coils L2, L4, and L6 have 90 turns of 28 gauge wire wound on 1¼ inch formers. The aerial coil L1 can be any number of turns from 30 to 60, and should have a tapping about half way up. If a large number of turns are used the set will not be so selective, but the signal strength will be increased. With the maximum number of turns and an

additional ten turns to L3 and L5 the set will receive all local stations without an aerial or earth, but great care must be exercised to keep the set from oscillating. The bigger coils are suitable for record-breaking attempts, but for ordinary use we recommend the minimum number of turns. The coils L3 and L5 are similar to L1, but comprise from 65 to 80 turns. The connections to the bottom and tops of the various coils are shown clearly in the circuit diagram.

Laying Out the Parts

A DRESS rehearsal is the next item. All the parts that are to be fitted on top of the base should be placed in position, roughly, as shown in the photographs, then lined up and spaced equally with a ruler. All the holes necessary for their mounting should be marked with an ice-pick, or other sharp instrument. The parts can then be removed and the holes drilled. The process is then repeated with the parts which are to be concealed under the sub-panel. Care being taken to see that none of the holes already drilled will be covered, and that the holes being marked will not come out on the top of the pane) underneath any of the components that will be fitted there.

Assembling the Set

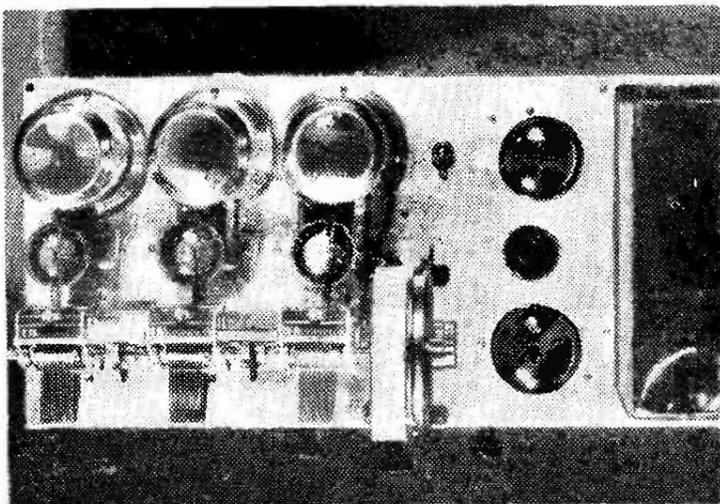
ALL the parts can then be attached to the base by means of the screws and nuts. The jacks for the gramophone pickup and the speaker can be fitted to a piece of bakelite, which covers a hole cut in the back of the base.

They must be carefully insulated from the base. The terminals for the aerial leads can be mounted in a similar manner. The midget condenser can be mounted directly in the aluminium, but the potentiometers must be insulated from the aluminium and mounted in a similar manner to the jacks, on a piece of bakelite. Unless it is purchased ready drilled it will be necessary to cut a hole in the base about three inches square for the wiring from the power pack to be brought through to the underside of the base. As this will be hidden when the set is in operation it can be done with a tin-opener or any other easy method.

Wiring Details

THE wiring should be carried out exactly as shown in the circuit diagram. Care must be taken to see that the filament leads are twisted around one another. All wiring should be as short as possible and straight from point to point. A good way is to cut the spaghetti to the required length, being the bare distance between the terminals to be wired and cutting the glazite about three-eighths of an inch longer.

The ends of the glazite should then be skinned of their insulation for about half an inch and tinned with a little solder. The wire can then be held in place with a pair of narrow-nosed pliers while one end is soldered. The spaghetti is then slipped over the glazite, and the other end soldered in place. In the case of the filament wires which are twisted it will be found that the twisting shortens the wires by about half to three-quarters of an inch. In these cases the spaghetti and glazite must be cut with due allowance for this fact.



A plan view of the 1930 Four giving an idea of the layout.

The First Try-out

IF at all possible, an ammeter should be obtained, on loan, and placed in the plate circuit of the pentode. In one of the leads to the output transformer to the speaker is a convenient position to put it. The set should then be placed up on end so that it rests on the edge of the base and the top edge of the power-pack. In this position it is easy to get a good view of both above and below the sub-panel. Great care must be exercised in handling the set in this position, however, as the voltages are exceedingly dangerous.

The earth, aerial, speaker, and power leads can be connected and the set switched on. A careful lock-out should be kept to see that everything is in order and the set switched off immediately if there are any signs of a flash-over at some point lacking in insulation.

If the rectifier valve gives a blue flash, a short-circuit in the high tension

wires is denoted, and the set should be instantly switched off again. A fairly strong hum should occur in the speaker and the ammeter should rise up to about 50 mills. In the space of about half a minute, the needle should drop to about 30 mills, and the hum dies down considerably. An adjustment of the hum control should then cut out the hum entirely. A movement of the variable condensers should tune in the required stations. The screws holding the couplings to the shafts should be loosened after a far distant station is heard and the condensers each adjusted individually until best results are obtained. The screws can then be tightened again and the adjustment should be satisfactory for all stations. If not it will denote that the coils are not evenly matched and a turn or two may need altering to get the setting of the condensers uniform.

If the hum-bucking arrangement fails to entirely eliminate hum it is an indication that the resistor valves are incorrect.

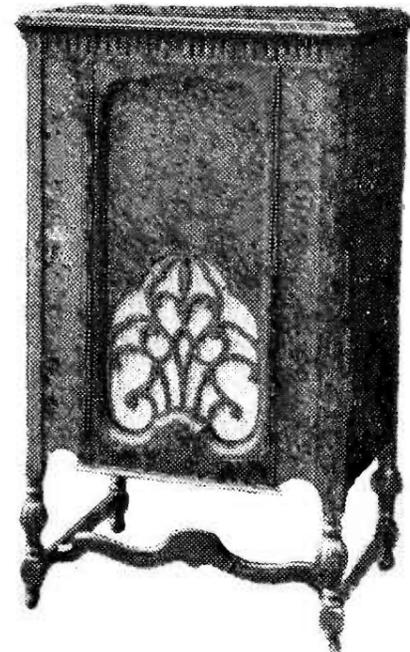
Possible Troubles

GLANCE through the "Queries Answered" columns, since the original article was published, reveals that the following troubles have been most prevalent. Short-circuits in the high-tension supply due to loose pieces of solder rattling about among the wiring and the lugs of the pack, or broken down filter condensers due to using other brands and types to those specified, and faulty valve sockets shorting to the base were often encountered.

A few readers failed to insulate the jacks and the potentiometers from the base, but the rest of the troubles were directly due to incorrect resistor valves. The symptoms being overheating of the output valve, the tapped resistor, and the grid-leak type resistors themselves and distortion. A few also failed to get interstate stations on account of connecting the coils incorrectly. The leads to the tops and bottoms of the coils are shown in the circuit diagram.

Tone Control

HOW to alter the tone of your "1930-FOUR" There are many different tastes as regards musical reproduction. Some people prefer soft, mellow music, whilst others prefer brilliance, which would be called harshness by others. As all, or nearly all, the frequencies are reproduced with the direct-coupled set, it is an easy matter to eliminate any which are not required. To do this small condensers are used. The capacity of C7 has a big influence upon tone, also the by-pass condenser from the auxiliary grid of the pentode.



A suitable cabinet for the completed job. By housing it in a handsome cabinet the set becomes a fine piece of furniture as well as the best of radio receivers.



**HYDRA
CONDENSERS**

**The
Zenith
of
Quality**



*A direct-coupled set which does not employ
grid-leak type resistors.*

AN ALTERNATIVE 1930 - FOUR

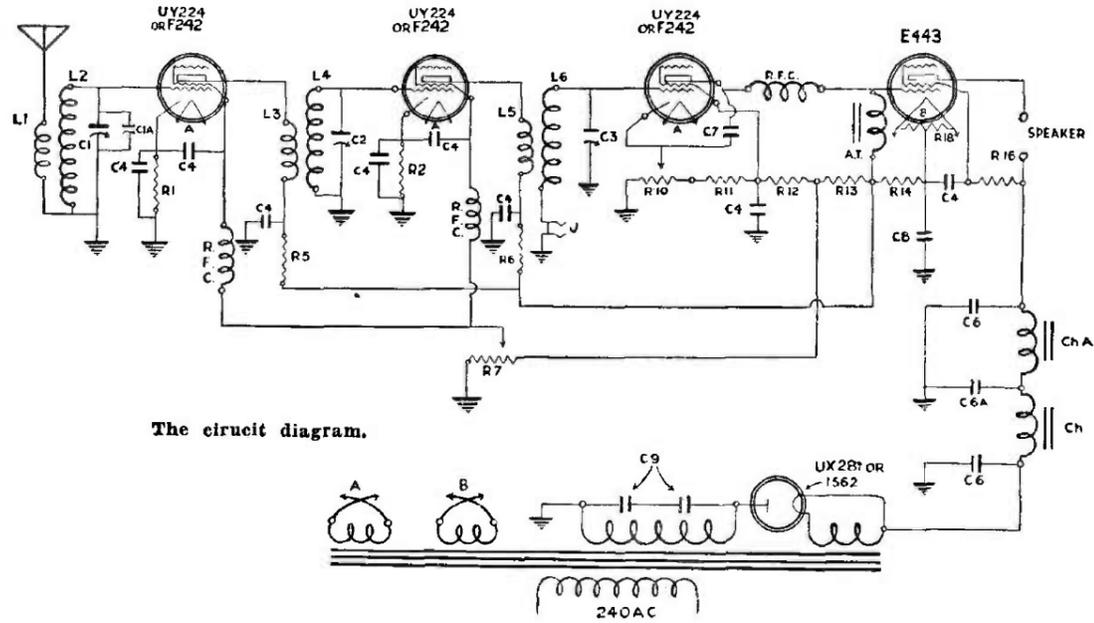
FOR some time past we have promised those in trouble with resistors of incorrect rating that we would redesign the set to eliminate these troublesome components. To those who have asked when the details would be available, the inevitable reply has been, "in about three weeks' time." To those who have had to wait longer than this, we owe an apology, but feel sure that they will find the details well worth waiting for. Anyone who feels confident can convert their original type set, but for those who would prefer to follow some definite instructions we are arranging an article which will cover the work wire by wire. It will probably be ready for publication in next week's issue.

When it became evident that the supply of high-value grid-leak type resistors would soon become exhausted, we started to experiment with a view to eliminating these items from the original circuit. We soon realised that Messrs. Loftin and White, the American engineers who were responsible for the original direct-coupled amplifier, were far more intelligent than some people seem to imagine. However, after several months of research work, usually occupying about sixteen hours per day (!), we have pleasure in presenting the following circuit, which has several features which make it ideal for the home constructor. It is fortunate that we have been successful, for, although resistors are now available, they do not appear to be accurately rated. The resistors used in the new circuit, which are all of wire-wound, low-value type, are not at all critical as regards resistance. There are no inter-connected effects between the detector and the output valve, as found in the original circuit, and on this account the tracing of any troubles which may occur is remarkably simple. With the original set about ten per cent, worked perfectly, eighty per cent, worked fairly well, sufficiently well to make the builder think that nothing better has been or ever shall be produced, and the other ten per cent, are those which are operating with faulty resistors. We expect an entirely different result with the new circuit. Any reasonably intelligent person should be capable of getting exactly the same results that we obtained with this set, without any intricate adjustments or measurements.

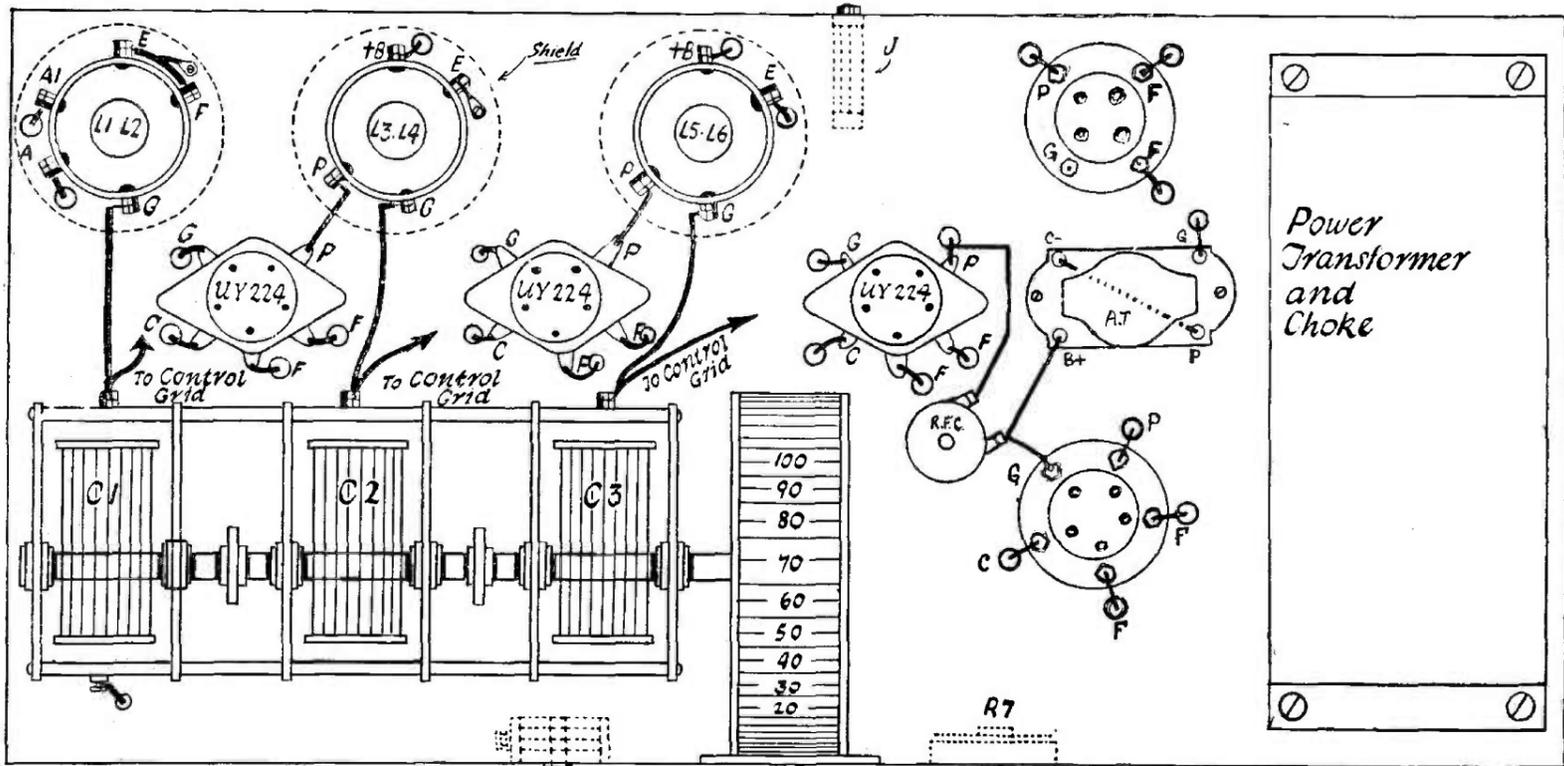
Parts List—Alternative 1930-Four

- 1 Prima Donna or Radiokes Aluminium sub-panel, size 20½ x 9½ x 2½.
- 1 Set of Prima Donna or Radiokes Coils (L1, L2, L3, L4, L5 and L6).
- 3 Coil Shields.
- 1 Prima Donna or Radiokes Power Pack.
- 4 Pilot, "Emmco," or A.W.A. UY-type Valve Sockets.
- 1 Pilot UX-type Valve Socket
- 3 A.W.A. Variable Condenser's of .0005 capacity (C1, C2, C3).
- 2 Sets of A.W.A. or Pilot Couplings for same.
- 1 Pilot Single Drum Dial.
- 2 Brackets for Variable Condensers.
- 1 Pilot or Radiokes Midget Variable Condenser, 5-plate type (C1a).
- 2 Hydra Fixed Condenser of 4mfd. Cap., 1000-volt a.c. test (C6).
- 1 Hydra Fixed Condenser of 2 mfd. Cap., 500-volt a.c. test (C8).
- 7 Hydra Fixed Condenser of .5 mfd. Cap., 500-volt a.c. test (C4).
- 1 Hydra Fixed Condenser of .1 mfd. Cap., 1000-volt a.c. test (C3).
- 1 Renrade Fixed Condenser of .00025 mfd. capacity (C7).
- 1 Federal No. 24 type Potentiometer of 200 ohms, resistance (R10)
- 1 Pilot 200,000 ohms. Potentiometer (R7).
- 1 Mullard, Renrade, or Pilot 10,000 ohms, wire-wound resistance (R16).
- 2 Radiokes, Pilot, or Renrade 2000 ohm. wire-wound resistances (R5, R6).
- 1 Radiokes or Renrade 1166 ohm. resistance (R14).
- 2 Radiokes 450 ohms, resistance or Pilot or Renrade (R1, R2).
- 1 Radiokes or Renrade special-tapped Resistor (R9, R11, R12, R13).
- 1 50 ohms. Pilot, Radiokes, or Renrade centre-tapped Resistor (R18).
- 3 Radiokes. Lewcos, or Renrade Radio Frequency Chokes (R.F.C.)
- 1 Philips Audio Transformer (A.T.).
- VALVES:—
- 3 Philips F242 or Radiotron UY-224 Screen-grid Valves.
- 1 Philips 1562 or Radiotron UX-281 Rectifying Valve.
- 1 Philips E443 Pentode output Valve.
- 2 Speaker Pin Jacks, 1 D.C. Jack, 3yds. 5-amp. Flex Wire, Adaptor,
- 2 Pieces of Bakelite about 2in. square, 9 lengths Spaghetti, 1 coil "Glazite" Wire, 3 clips for valve caps, 3 "Clix" terminals, 7 doz. ⅛ x ⅜ screws and nuts. Solder, lugs, etc.
- 1 Jensen Dynamic Speaker.
- 1 Philips or Blue Spot Gramophone Pick-up.
- 1 Austral-lectric Gramophone Motor.
- 1 Suitable Cabinet.
- Power Switches, etc.

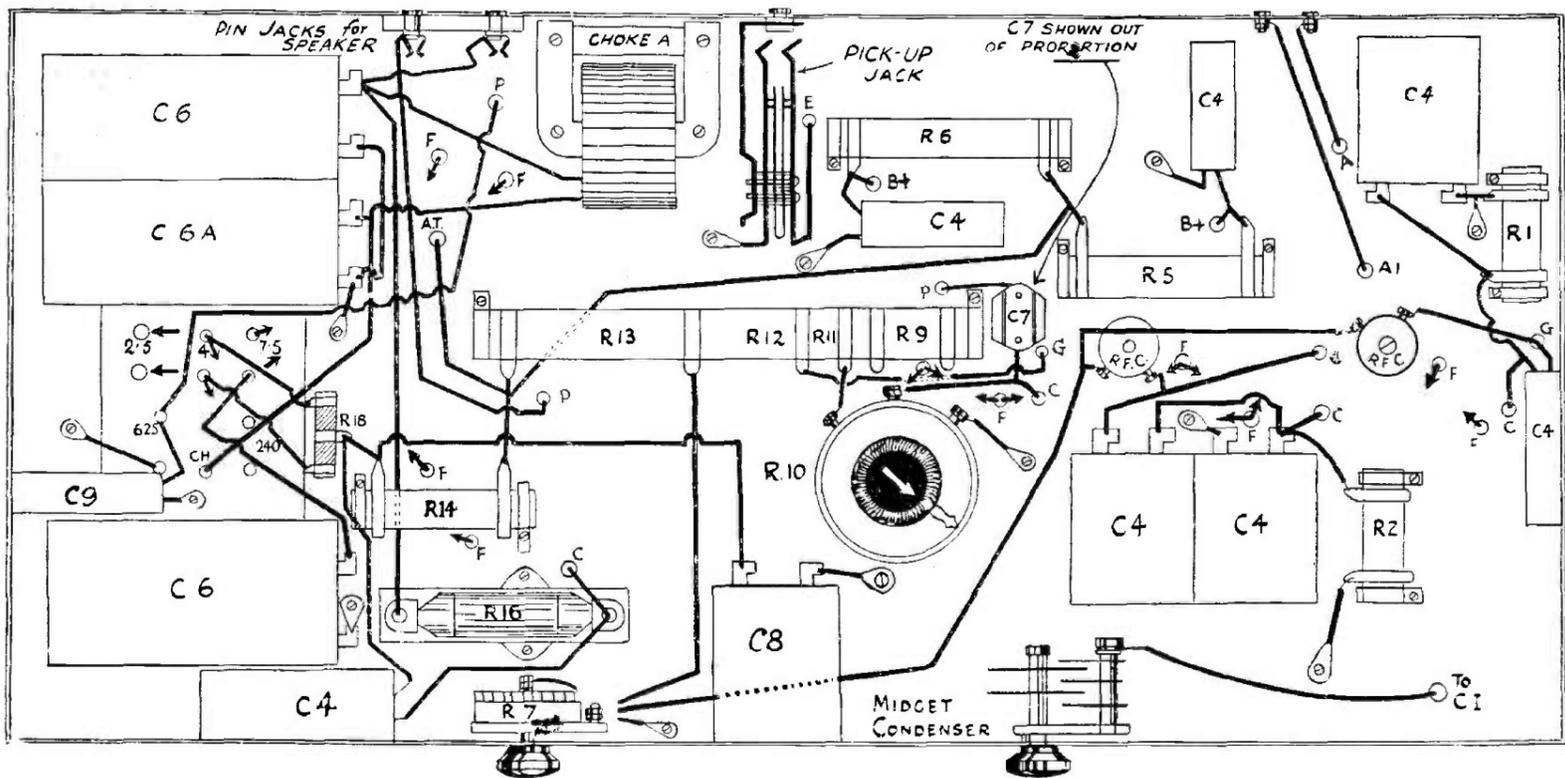
Diagrams for the Alternatives



The circuit diagram.



The layout.



The wiring below the base.

Beware of "Experts"

WHILST admitting that the tone is slightly affected in the new circuit, the difference is almost negligible. Beware of the "expert" who can "prove" to you that the reproduction must be shockingly distorted, harsh, or otherwise most distressing to the ears. Anyone who makes these statements has been misinformed. Placed side by side, it is about an even-money bet that the difference between the two sets cannot be detected. On paper there may be a great difference in the frequency response, but the ears cannot detect this difference very readily. Many people do not understand the fundamental difference between frequency range and frequency response. They may condemn the new circuit, if they have not actually heard it in operation.

The other difficulty is that the hum-bucking arrangements have been found impracticable on this set. In some cases the hum is not at all prevalent, but in case of emergency we have shown on the diagrams how an additional filter choke and filter condenser can be fitted to make the set silent. These are denoted as ChA and C6A. They also appear in the photographs.

Selecting the Components

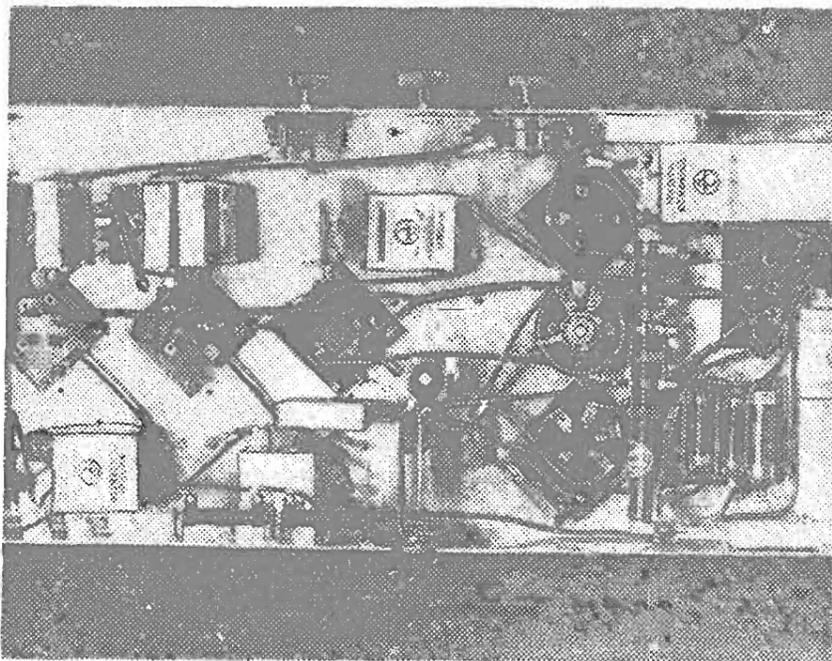
THE selection of components presents the same problems as detailed in the paragraphs dealing with the original set. These paragraphs should be closely studied before the shopping expedition is undertaken. There are several parts, however, which call for special attention. Of course, none of the grid-leak type resistors are required, although two 100,000-ohm resistors of this type can be used in place of the r.f. chokes shown in the leads to the screens of the r.f. valves. Their value is not critical, and they will function satisfactorily, even if several thousand ohms incorrect either way. They have the advantage of being slightly cheaper than the radio frequency chokes. An important part is the 200-ohm potentiometer. It is very advisable that this be the same type and brand specified, as the setting of this potentiometer governs the grid bias of the detector valve, which is an important factor. The method of adjusting the bias will be dealt with later in the article.

The Bias Resistor

ANOTHER important part is the 1166-ohm resistor. This regulates the bias on the output valve, which has a big influence on general performance. The set will operate quite well with a resistor of 1000 ohms, showing that there is no possibility of the set being completely thrown out of adjustment by a slight error in the value of this resistor. With the correct value, however, the tone and distance results are considerably better. The two 450-ohm bias resistors for the r.f. valves can be purchased together as a 900-ohm centre-tapped resistor, but a slight deviation in the layout may be necessary to accommodate the centre-tapped type without having unduly long leads. The centre-tapped resistor for the filament leads of the output valve can be either fifty or twenty ohms, the value having little effect upon results.

The Audio Transformer

ALTHOUGH an audio transformer appears in the list, it is not used for the purpose it was originally intended. However, it is particularly suitable, as it has a fairly high resistance in its windings.



A sub-panel view of the original 1930-Four which is considered more intricate than the revised version.

An ordinary type of cheap transformer is entirely unsuitable, and must on no account be used. The primary and secondary of the transformer are connected, as shown later in the constructional details. Some of the Ferranti transformers are suitable for the purpose, but we particularly recommend the brand shown in the list it is possible to use several transformers in series, in the place of AT, with a slight improvement in volume. It is by no means necessary, however, to use anything more than the single transformer specified.

Testing the Components

AGAIN turn back to the article covering the original set, and study the paragraph headed "Testing the Components." The idea of testing the components is often neglected by some people who evidently think that the manufacturers of components are infallible. In several cases which have come under our notice, enthusiasts have built the set, and then been compelled to dismantle it again, in order to find some minor fault. A rough testing of the components, as outlined, will only take a few minutes to perform, and may save many hours later on in the job. Great care must be exercised when testing fixed condensers on the lighting mains. A lamp must be used in series with the leads to the lugs of the condenser, so that in the case of a faulty condenser the fuses in the lighting supply will not be affected. After the condensers have been tested they should be put aside for a few minutes, and then the terminals should be shorted with a wooden handled screw-driver. The condenser, if in good condition, will retain sufficient "juice" to give a fat spark. In the case of the larger condensers the lamp may glow faintly, but it should not light at all brilliantly.

The Layout

THE arrangements of the components is somewhat similar to the original set, and many different arrangements of the underneath of the sub-panel are equally effective. Several of these are shown in the various photographs of the original and the revised set. The layout of the top of the base, however, has been arranged after a careful consideration of the circuit diagram. A certain amount of latitude is permissible but an important point is that the lead from the top of the outside winding of the coil, which runs to the cap of the valve, and the variable condenser, should not only be kept as short as possible, but should be of exactly the same length as the leads to the other valves. The variable condensers should be spaced the full 13 inches, which is usual with the normal couplings, otherwise shielding must be provided between the condensers to minimise the capacity effect between the stators of the different condensers.

Drilling the Base

UNLESS a base is purchased already drilled, it will be necessary to set up the parts in the positions they are to occupy, and then mark all the holes which will be required for their mounting, and for the leads of wires running through to the underneath of the sub-panel. These can be drilled more satisfactorily if drilled in a bunch than if each component is mounted singly and the holes drilled as required. A considerable amount of time can be saved by attention to this detail.

Mounting the Components

THE work of mounting the components is not difficult, and a study of the diagrams should help considerably. One point to note is that, for clearance sake, we have drawn the fixed condenser C7 out of proportion. The simplest method of mounting this item may be to fit a soldering lug, bent at right angles in the middle, to the terminal of the fixed condenser, and solder it directly to the centre terminal of the potentiometer.

The gramophone jack in the new set can be mounted directly in the aluminium, whereas in the old set it was essential to have it insulated from the base. Care must be exercised to see that the lead to the coil is taken from the terminal, which is not connected to earth, when the plug is in the jack. Of course, the jack must be of the closed circuit type, so that the lead from the coil is earthed when the plug is not in the jack.

Wiring Details

THE wiring arrangements are shown clearly in the diagrams. The filament wiring is not shown. It must be carried out entirely with twisted wires. The filaments of the three screen-grid valves are all off the same wiring, and if a dial light is required it will also be connected to this wiring. Its source of power is derived from the terminals of the power pack marked 2.5 volts. The filament of the rectifier is supplied from the 7.5 volt terminals, and the 4-volt terminals are for the E443 pentode. One side of the 7.5 filament winding is connected to one side of the choke, and also one of the filter condensers.

One of the 625-volt terminals runs to the plate of the rectifier valve, and the other terminal is earthed. There is no connection for the grid terminal of the rectifier valve socket. This terminal is left vacant. These remarks also apply to the original set. The small centre-tapped resistor is connected between the two 4-volt terminals, and can be mounted directly upon the terminal lugs, as shown in the photographs, if desired, or upon the socket of the output valve as shown in the picture diagrams of the original set. It is often a good idea to earth one side of the filament wiring of the r.f. valves. Sometimes it has a slight effect upon any hum which may be evident.

The Audio Transformer

THE audio transformer is used as a choke, and the method of connecting the terminals is shown in the diagram. The secondary and primary are connected together. It is essential, however, that they be connected in one particular manner. In some transformers the connections are different, and the only true method of finding the correct connection will be found by trying different connections after the set is in operation. The set will operate with only the secondary in use, with the connection to either end, but slightly better effect is obtained by employing both secondary and primary, if connected in the correct manner.

The First Try-out

AGAIN the paragraph relating to the try-out of the original set should be carefully studied, as all the points mentioned apply to the new set. However, as there is no hum-bucker, it is necessary only to adjust the potentiometer R10 to give the best results and tone. The setting will be approximately one-third of a turn. Once a station can be picked up there is no difficulty in determining the correct position, and once set, the potentiometer should not require any further adjustment.

Troubles That May Be Encountered

THIS paragraph is going to be the hardest to write, because we cannot see where there is any possibility of trouble being experienced, apart from general items, such as incorrect wiring, faulty insulation, bent condenser plates, or resistors shorting to earth through their mounting lugs. One trouble may be to cut down the volume. This trouble is particularly evident when operating the pick-up for gramophone work. No matter whether the aerial is disconnected or not, the local stations may continue to come in with sufficient strength to spoil the background of the reproduction. It is futile to turn the volume control to the minimum position, as this only makes the set less selective, allowing stations to come in just the same. The best plan is to leave the volume control, which, of course, does not affect the volume from the pick-up, at full strength, and turn the tuning condensers to a spot half way between 5CL and 2FC.

Another point which may give trouble is hum. A wise precaution is to keep the transformer (Choke AT) well away from the power-pack, as in some cases it may pick up stray hums. At the same time it should be kept above the sub-panel so as not to come under the influence of the a.c. in the filament wiring.

Testing the Direct-coupled Set Voltages

MANY home constructors are in the fortunate position of having access to a voltmeter and an ammeter. These instruments can immediately locate practically any trouble which may be encountered with the "1930-Four." The following are the correct voltages for the valves, and apply to both the original and the revised circuits. The plate voltage of the pentode is measured between the filament centre-tap and the plate terminal. It should be about 400 volts. The auxiliary grid, measured in the same way, should read 300 volts. The grid voltage cannot be measured with the ordinary meter, and can only be checked by reading the current flow in the plate lead of the pentode. This should be 30 mills., if the grid bias is correct. If this reading is correct, and the centre-tap is 225 volts above earth, then the plate voltage of the detector is correct. The voltage on the screen of the detector is measured between the screen and cathode terminals of that valve, and should be about 35 volts, but can be as low as 25 volts.

The difference in voltage between the grid and cathode of this valve should be about 2 or 3 volts, but is rather difficult to measure. The voltages of the various elements of the r.f. valves, in each case measured in relation to the cathode, are as follows:—Grid 15 to 20 volts negative, screens 65 volts, plates 180 volts. These figures will give a rough idea of the voltages, but the trouble with the original circuit is to find the cause of these voltages not being as specified.

The most important point to watch is the plate current of the pentode. If this is too high, due to the grid bias being not sufficient, then the voltage drop in the special tapped resistor will be too great, causing the voltages on the detector and r.f. valves to go up, and the plate and auxiliary grid voltages of the pentode to drop. The cause of the grid bias of the pentode being insufficient can be caused by several of the resistors. If the resistor in the cathode lead of the detector has a value too high it will give too much voltage drop, raising the potential of the cathode, thereby increasing the bias, cutting down the plate current, which flows through the bias resistor of the output valve. This current flow affects the voltage drop in that resistor, and, of course, the bias of that valve.

It will be seen that the resistors R8, R14, R15, R16, and R17 can all affect the plate current of the pentode, which governs the voltages along the tapped resistor, from which practically every other point derives its potential. In the new circuit the plate current of the output valve is directly responsible for all the voltages in a similar manner, but in this case the bias of the pentode is caused by the voltage drop in the one resistor, R14.

As this voltage drop is dependent mainly on the current of the pentode, it will automatically correct itself, so long as the resistance is approximately correct.

The plate current of the detector is so small that it has little or no effect upon the voltage drop in resistances of small values, such as those used in this circuit. Consequently the voltages can easily be arranged to be exactly as required for the various valves, and will not vary with slight influences as they do in the original circuit.

The following table gives the recommended working voltages of Hydra condensers:-

Tested at	500 D.C.	500 A.C.	1,000 d.c.	1,000 A.C.	2,000 D.C.	4,000 D.C.
Working Voltage	240 D.C. or 160 A.C.	350 D.C. or 240 A.C.	450 D.C. or 300 A.C.	700 D.C. or 450 A.C.	900 D.C. or 600 A.C.	2,000 D.C.

When you choose your rating make sure that your maximum working voltage does not exceed 60 per cent, of the test voltage as shown above, but always remember that the closer you can keep to the recommended voltages, the longer will be the life of your condensers.

INTERFERENCE

The rapid expansion in the development of the All Electric Receiver and Amplifier is bringing into prominence the problem of interference from electrical apparatus such as commutator type motors, bells, electric signs and clocks, etc., wherein the operating current is broken at various intervals. The resultant spark radiates high frequency electrical disturbances in much the same way as a miniature radio transmitter, and the effect upon radio apparatus is often of a most annoying nature.

However, this annoyance can be overcome by the use of condensers or a combination of condensers and chokes.



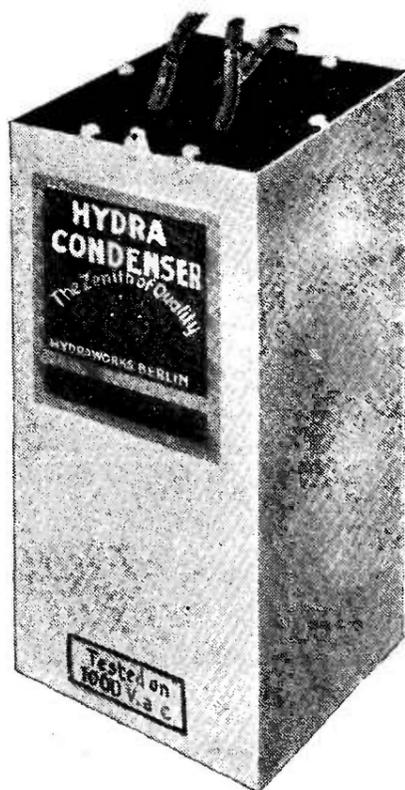
7070

Special HYDRA Condensers are made for this purpose, and the three types in most general use are as follows:—



6017

No. 6017 2 x 0.1 MFD 1000v. A.C. Test
 No. 6046 2 x 2 MFD 1000v. A.C. Test
 No. 7070 2 x 2 MFD 1000v. A.C. Test



6046

Further and more complete information on the subject of interference, together with suitable circuits can be supplied upon application to the Sole Commonwealth Agents for HYDRA Fixed Condensers:—

EASTERN TRADING CO. LTD.

Aberdeen House,
 Clarence St., SYDNEY.

Phone M 2945-6

McEwen House,
 Little Collins St., MELBOURNE

Phone F 2528