This resistance also acts as a voltage divider for tapping off the lower plate voltage for the first stage. Negative grid bias for this stage is also supplied by tapping the mid-point of the filament supply at a certain point on this resistance as shown.

Two condensers are used to shunt all resistances to offer a lower resistance path to the audio-frequency component. The bias resister for the last stage valve is shown. The valve for which depends entirely upon the current taken by the last valve. All these important points show the reader the extreme care that has to be taken to correctly design the whole piece of apparatus. Not only does it have to be worked out mathametically, but also the arrangement of the components needs careful consideration. The audio-frequency transformers have to be arranged so that they do not come in the field of the power transformer. This is to rectify. A valve of the 280 type has two plates and filaments, and rectifies up to 350 volts.

In this diagram an arrangement known as the series filament current is shown. The bypass resistance described previously is designed to carry sufficient current to make up the total for the speaker winding. Providing at least 60 mills can be passed through this resistance a convenient form of filament current is available for a 199 type of valve. By including the filament of this valve in series with the main resistance a voltage drop corresponding to the voltage rating of the filament, takes places across the two filament leads, and this extra resistance will have to be calculated to work in with the main resistance bank.

A precaution necessary with this type of filament supply is to shunt the filament leads with a high valve resistance, so that in the case of the filament burning out the voltage divider will not be completely disconnected. The value of this resistance can be such that a current of two or three mills is only passing as long as the 199 valve filament is intact. Although this article is not intended to give constructional details, it at least shows that a great deal of time and careful study has to be given to the design and the characteristics of most of the components depend entirely upon a collection of the characteristics of the remaining parts. It is certainly not a job for the absolute novice to attempt.

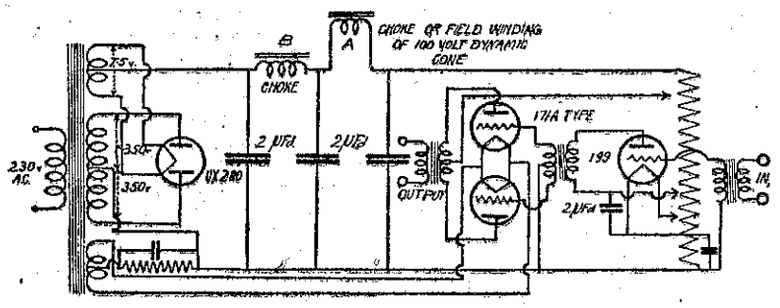

Diagram 2.—Power amplifier using push-pull.

done by careful screening in aluminium boxes.

Diagram 2 shows an amplifier using push pull in the last stage, and for a given power output much lower plate voltages are necessary. This not only makes the receiver safer to construct, but also provides a great saving on condensers.

The condensers in the previous arrangement will of necessity have to have a high working voltage rating. By using lower plate voltages the price of suitable condensers is greatly reduced. Also a single valve can be used

A "Tinning" Trouble

SOME amateurs are more or less perpetually worried by the "tinning" burning off their soldering irons, and, as it is generally a hopeless task to attempt any efficient soldering work without a properly tinned iron, much valuable time is expended in repeated tinnings of the iron.

Of course, the preservation of the "tin" on a heated soldering iron is, in many respects, a matter of experience only. One of the best ways of preventing the trouble is always remove a soldering iron from the fire or gas flame as soon as the characteristic green colouration is seen.

Again, an iron should always be placed in the fire or flame with the tinned surface upwards. This simple precaution will do much to prevent the solder on the iron from running or dropping off when it has reached a molten state, and, in fact, if the two points described above are carefully attended to in practice, the amateur will find that he will be able to reduce the number of repeated re-tinnings of his soldering-iron very considerably.

Testing Dry Batteries

IT is frequently stated that a battery should not be allowed to drop more than one quarter of its rate of voltage —that is to say, a battery registering 45 volts should be discarded at 38 volts. At this voltage artificial static appears. A voltmeter should be kept by every radio enthusiast who requires the best from his set, and the batteries to be constantly tested, but they must be tested under working conditions.

Dry batteries are composed of a large number of Leclanche cells, which have the power of recuperating to a great extent when not working. This means that if a battery which has been working is left for several hours, the voltage will rise, but during the next ten minutes or so of operation, it will rapidly drop, so that the only true test of battery voltage can be made after the set has been working some time.

The battery may be tested either by placing the tester directly across the battery or by testing the voltages on each valve. Place the positive of the voltmeter on the B terminal of the transformer adjacent to the valve to be tested, and the negative on B minus. The reading should be approximately that required by the valve, slightly higher, if anything, to allow for the drop across the transformer. This should be compared with the reading directly across the battery, as it will reveal any defects in battery-winding.

Brief Pointers

THE object of the adjusting screw on a horn loudspeaker is to vary the distance between the permanent magnet and the diaphragm in order that the maximum sensitivity can be obtained.

THROTTLE-CONTROL reaction has of late become very popular for shortwave work.

FOR sensitivity's sake it is often an advantage to reduce the value of the shortwave condenser to .0001 and increase the grid leak up to about 6 megohms.

THRESHOLD howl, the bugbear of the shortwave enthusiast, is not due to only one particular circumstance, but can arise from a large number of different factors.

RADIO DIRECTORY

What to Buy and Where

CITIES

AERIAL MASTS	Domestic Radio Co., Ltd., Strand Arcde, Auckland.
ALTONA & HAMMARLUND-ROBERTS SETS.	Johns, Ltd. Chancery Street, Auckland.
ATWATER-KENT RADIO	Frank Wiseman, Ltd. 170-172 Queen Street, Auckland.
BREMER-TULLY RADIO	Superadio, Ltd., 147 Queen Street, Auckland.
BURGESS RADIO BATTERIES,	All Radio Dealers.
CROSLEY RADIO	Abel, Smeeton, Ltd., 27-29 Customs St. E., Auckland.
FERRANTI RADIO COMPONENTS	A. D. Riley & Co., Ltd., Anzac Avenue, Auckland, and all leading Dealers
CROSLEY SETS	Lewis Eady, Ltd., Queen Street. Auckland.
LOUDSPEAKER AND TRANSFORMER REPAIRS	A. E. Strange, 404 Worcester Street, Christchurch.
MULLARD VALVES	All Radio Dealers.
RADIOLA RECEIVERS	Chas. Bennett, Ltd., 619 Colombo Street, Christchurch.
RADIOLA RECEIVERS and Expert Radiola Service.	Farmers' Trading Co., Ltd., Hobson Street. Auckland.
RADIO REPAIRS AND SERVICE	E. G. Shipley, 185 Manchester Street, Christchurch.
DIAMOND DRY BATTERIES	Royds-Howard Co., 553 Colombo Street, Christchurch.
T.C.C. CONDENSERS	A. D. Riley and Co., Ltd. Anzac Ave., Auckland, and all leading dealers

COUNTRY TOWNS

CROSLEY RADIO	J. C. Davidson, Main Street. Pahiatua.
CROSLEY SETS	F. H. Jellyman, Ltd., Devon Street. New Plymouth.
CROSLEY RADIO	D. A. Morrison & Co., Victoria Avenue, Wanganui.
MAJESTIC, ATWATER-KENT AND APEX ELECTRICAL SETS. Also Bremer-Tully, Radiola and Browning-Drake	Radio House, Hamilton. G. S. Anchor, Manager.
PHILIPS VALVES AND APPARATUS	All Good Radio Dealers.