[illegible] 2 mfd. output condensers may be of 400 or 500 volts test, of which the audio output is the only one approaching the nominal working voltage.

It may interest constructors to know something of the actual function of the main smoothing condensers marked C1, C2, C3 in the circuit diagram.

The function of C1 is that of reducing "ripple" or hum. Its capacity should not be too low, because a reasonably high capacity improves regulation.

The condenser between the two chokes, C2, is merely to reduce ripple, and has no effect upon regulation. If this condenser is not of suitable value it can cause trouble by resonating with the previous choke at 100 cycles on a 50-cycle supply. The extra demand is all made upon C3.

Some circuits employ only 2 mfds. in this position, but it pays to be liberal with the smoothing capacity.

The last capacity, C3, controls audioquality in a perhaps somewhat indirect way. There are large audio-frequency variations in the plate current of the last valve or valves, and it is the duty of C3 to supply the extra current required when a heavy signal arrives on the grid of the power-valve. This condenser is, then, acting as a storage capacity, and when an extra demand is made its voltage drops, but is rapidly raised again. The output through the last choke is steady, direct current, and as fluctuating demand cannot be met.

If the capacity of C3 is too low, the extra demand will not be met, and so distortion results.

Laboratory experiments have shown that increasing the capacity of C3 up to 6 mfds. gives constant improvement with each microfarad added. From 6 to 8 mfds. there is still improvement, but less marked, and after 10 mfds. no difference is noticeable. This shows 8 mfds. to be adequate for ordinary purposes, and the writer's own experience shows this to be the case.

An important point to note is that the common or negative sides of all the 4 mfds. are connected together, but this must be done with insulated wire, which connects to centre-tap of the B supply and the high grid-bias output. If this lead is earthed the bias resistors are cut out of the circuit.

As C1 has to withstand the full a.c. voltage of half the combined secondaries, it may well be of 1000-volt test rating.

Any condenser following a choke is liable to receive heavy surges from that choke at the moment the mains current is switched off, and as that surge voltage is added to that already held by the condenser, the total voltage may be very much higher than the working voltage. This is one reason for having a high test rating for the condensers.

The Diagrams.

NO. 6 shows the transformer complete, as viewed from the back of the eliminator. Note the convenient position of necessary filament and heater leads, which are cut short and soldered to the flex, each joint to be insulated with tape. The rectifier filament leads will also go down through holes in the base. The fuse panel is clearly shown. Keep fuses near edge of panel so that solder tags bolted on back will project. Use 1-8in. brass bolts and washers to suit. Each pair of bolt holes drilled with centres 1in. apart.

No. 7 shows the strip of tin already mentioned, and No. 8 the method of tapping and connecting up two separate high-tension secondaries. The plate leads are both connected to either the taps for the lower voltage, or to out 1 and in 2 for the high voltage.

No. 9 gives the approximate position of leads through spool ends. Mark these out with the 1 3-8in. running in the direction shown.

The Voltage Divider.

THE type of voltage divider for tapped resistance to be employed consists of a continuous high resistance of wire, connected across the positive and negative, and provided with taps at certain points to give a selection of plate voltages. Connected to the negative end of this resistance is a further resistance made up of two 400-ohm wire-wound potentiometers in series. These connect through to the high-voltage secondary centre-tap, and will provide two variable grid-bias voltages.

There are a number of voltage dividers on the market, most of them arranged to reduce 200 volts to the necessary voltages for the average receiver. In this case we have 400 volts available for the plate of the power valve, and this voltage must be reduced to suit other stages of the receiver. We can utilise a 200-volt potential or voltage-divider if we precede it by extra resistance of the value that will effect the necessary reduction. The "pilot" voltage divider is one that would be suitable, and by placing an additional one in series for extra resistance, the 400 volts will be suitably cut down. In case of utilising a make of divider capable of carrying less than 60 mills, it is a better plan to use de Jur or Ward-Leonard fixed resistances totalling about 12,000 ohms as the extra resistance. These are connected in series and placed between the power-valve lead-off from the second choke and the high-voltage end of the voltage divider. The "pilot" divider is made up of resistances of 4000, 3650, 2250, 2800 ohms, totalling 12,700 ohms. The 4000-ohm end is B — and the tappings available will be 180, 135, 90, and 45 volts. For a low detector voltage it will be necessary to include on the panel a variable high resistance of 500,000 ohms and include it in series with the 45-volt tap connection to the panel socket. The voltage divider may be made up in any way, provided that the total resistance of about 22,000 to 24,000 ohms is included, also adding in the grid-bias value. Many constructors will have to use the type of voltage divider that they are able to procure. Few dividers will dissipate sufficient heat to allow of their being used as extra resistance, so it will be safer to use de Jur or Ward-Leonards if the divider available is of very low dissipation, as considerable heat is generated in the extra resistance.

Make the total resistance work out as follows:—Divider 12,000 ohms, extra resistance 12,000 ohms, grid-bias resistors, 800 to 2000 ohms, giving a total of about 25,000 ohms. A thousand ohms difference either way is not very important.

Testing Headphones

THE best method of ascertaining if a pair of headphones is in good condition is to disconnect them, put the 'phones on, and place the end of one of the leads between the teeth. Rub a key or nail upon the other lead and the weak currents set up in them will cause a scraping sound in the earpieces which will correspond with the rubbing of the key. If the sound is very weak in one earpiece and not in the other, you will have ascertained which is wrong, and if both give distinct and clear scraping noises you will know that the 'phones are very sensitive, for no ordinary battery is being used for the test, and only a sensitive instrument will give results.

A.C. Detectors

Avoiding Hum

ONE of the difficulties encountered when an alternating current power-pack is employed (and also valves having heaters supplied with alternating current) is of eliminating the last traces of hum.

It is a comparatively easy matter so to arrange the circuit and the parts used that there is very little hum, and it is only when efforts are being made to reduce or cut out this last trace of hum that every part of the circuit must be carefully examined.

Particular care is necessary with the detector, and the question as to whether leaky-grid or anode-bend is to be used is sure to crop up, for the reason that when a leaky-grid detector is employed there is almost bound to be a certain difficulty in cutting out the hum. This is beca se the wire joining the grid condenser and leak with the grid of the valve is extraordinarily sensitive to stray fields, and the valve itself may collect hum or noise.

It is easy to prove this by placing the fingers near the detector valves. I have found that no effect is produced by placing the fingers on the top of the bulb of a certain type of mains valve, but that a loud hum is set up as the fingers are moved along the bulb towards the base of the valve.

The reason for the leaky-grid type of detector being so liable to pick up hum is because between the grid wire (and the grid of the valve itself) and the filament is a relatively high impedance, in the form of the grid condenser. When this condenser is removed the grid is in direct connection with the filament through the tuning coil and low-frequency voltages, therefore, cannot be set up on the grid.

It follows, then, that the anode-bend type of detector is much less sensitive to hum than the leaky grid type. It may not be convenient to employ anode-bend detection, however; then one has very carefully to arrange the position of the detector valve itself, and also of its grid condenser and leak.

The grid leak should be joined directly between the grid terminal of the valve holder and the filament circuit, and the grid condenser be connected with as short a wire as possible. Different valves of grid leak resistance should always be tried, of course.

Using a Milliammeter

TO use the milliammeter to the best advantage one should know the normal current passed by each individual valve as well as the total for the whole set. It then gives to the operator the same sort of guidance about the condition of his set as a patient's temperature gives to a doctor. There are two other extremely useful purposes served by the milliammeter when used in the way mentioned. It provides an infallible indication of the presence of oscillation in the detector circuit when condenser and grid leak rectification is used.