

A Direct Current Eliminator

Third Instalment

By "MEGOHM"



THIS scheme for full plate and filament supply allows of any number of valves being supplied with "A" and "B" current from d.c. mains, together with grid-bias for the audio stages. An anode bend detector is recommended, grid-bias being applied, and the usual leak and condenser dispensed with. A valve of very high impedance may have a high plate voltage and require only $1\frac{1}{2}$ volts bias, whereas the 201A type will require a higher bias, obtainable from a 9-volt tapped bias battery.

One-quarter ampere of current will be drawn from the 230-volt mains, which is economical running—16 hours on one unit of electricity, or where current costs as much as 3d. a heating unit, the set may be used for 3 hours every day at a cost of 17/- per annum for current, or nearly three hours' running for one penny. Compare this with the continual expense of buying new "B" batteries and the cost of recharging accumulators.

Running a Dynamic.

SOME constructors will be making inquiries as to the practicability of using the current to excite the field winding of a dynamic speaker, so it may be stated that a suitable field winding is not likely to be encountered. A winding to pass .25 amp. would only require about 50 volts, and consume 13.5 watts. A field winding to consume 60 watts would be considered extravagant. A 230-volt winding consumes about 6 watts. A specially-wound field would be required, using 26 wire, of which 1050 yards would have a resistance of 98 ohms, giving 4900 turns on the average "pot," which is more than would be necessary with .25 amp. passing. The d.c. resistance must be not more than 500 ohms to include in the filament circuit.

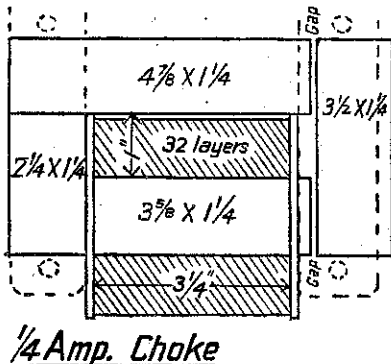
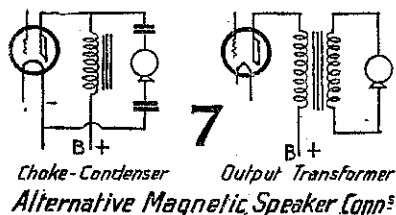
The field winding takes the place of all or part of the extra resistance in the filament circuit, and would render the use of the large smoothing-choke unnecessary.

Valves to Use.

ALL valves used in the receiver must take .25 amp. on the filament, but the voltages may be all the same or different. All filaments are wired in series, including the two push-pull 171's. As the filament in each 171 is at a different potential by the amount of drop across one filament, 5 volts, the bias applied to the grid of each must differ by that amount. That is to say, the grid of the valve (B) nearest to the negative end of the filament circuit requires 5 volts more bias than the other push-pull valve (A). This constitutes the little difficulty that was mentioned earlier.

If a push-pull input transformer is used with a centre-tapped secondary, grid-bias is applied to this tap, and will therefore be equal on each grid. We can increase the potential on the grid of B by placing in the circuit a $\frac{1}{4}$ -volt bias battery as a means of increasing the bias on one valve. Although the bias is actually half a volt short of the required deficiency, this is a very small error in 40 volts—one-eightieth—and clears the difficulty.

It may at first appear to be a poor expedient, including dry batteries, but this small battery saves running the push-pull filaments in parallel, which would double the current consumption of the receiver without any other benefit, and the extra current would cost far more than the $\frac{1}{4}$ -volt battery, of which good makes in the writer's pos-



session have kept full voltage up to 18 months.

When there are fluctuations in the filament supply, either a.c. or d.c., a heavy filament should be used, as it holds the heat better than a light one, making the fluctuations less noticeable, and this quality is particularly needed in the detector. The valve that best fulfils this condition is the 112A, which should be used for the detector and first audio. The 201A type will suit the r.f. stages. If valve voltages are mixed, all that is necessary is to adjust the extra resistance 4 ohms more or less for each volt difference from 5 volts in the filaments. If 201A's give noisy working, try 112A's for r.f. stages.

The Resistances.

TOTALLING up the various resistances in the filament circuit gives 361 ohms, and this deducted from 920 ohms, the full resistance required, gives 559 ohms, which is the minimum extra resistance required in the circuit. In the table of resistances 580 ohms appears as the extra resistance, which allows 40 ohms over, covering a difference of 10 volts. For fine adjustment a rheostat of 10 to 20 ohms to carry $\frac{1}{4}$ amp. may be added to this, but failing a rheostat, the end of the nichrome wire might be made variable by securing to a terminal.

The resistance of a filament is found by dividing the working voltage by the current passed, so the quarter-amp filaments have a resistance of 20 ohms.

The total resistance required across the mains is found by dividing the supply voltage, 230, by .25, the current to be used, which gives 920 ohms. This is to be the total combined resistance of filaments, choke or field windings, bias resistors, etc., included in the filament circuit, to which a small amount of variable resistance should be added.

The total resistance will be made up as follows:—

	Resistance ohms	Volt. drop
Choke	1 0 5	2 7
Extra Res.	5 8 0	1 4 5
5 Valves	1 0 0	2 5
Bias 2 res.	1 7 4	4 5
	9 5 9	2 4 2

Totalling up the various resistances and deducting the sum from 920 gives the amount of extra resistance required in the circuit, but 50 ohms extra at least should be included and made variable so that fine adjustment may be effected to suit mains variation etc. Note that in this circuit every 4 ohms gives a drop of one volt.

Actually 39 ohms extra resistance is shown, but this may be increased slightly to allow for variation. The variable portion is shown at the plate supply end, because this will probably be the most convenient point, especially if a lamp is used for the 400 ohms.

Obtaining suitable resistances is rather a difficulty owing to the comparatively heavy current to be carried.

The best way to make up the 580 ohms is by utilising an electric lamp for 400 ohms, making up the balance of 180 ohms with 28 B. and S. nichrome wire (bare). Only two electric lamps work out to a suitable value—a 230-volt 32 candle-power carbon filament with a resistance of 413 ohms and a metallic filament lamp of 30 watts for 110 volts, having a resistance of 400 ohms.

Two suitable lamps may be used in

parallel for the 580-ohm resistance, but as they will not be brightly lit, care must be taken to make sure that they have sufficient resistance when testing out. A 50-watt 230-volt m.f. lamp works out to 1059 ohms, and passes .217 amp. Two in parallel would have a resistance of 529 ohms when fully lighted. They would jointly be capable of passing .434 amp, but would only be getting .25 amp, between them, hence the reduced brilliancy. Necessary additional resistance would be made up of 30 B. and S. nichrome wire.

When using lamps as resistances it is necessary to arrange that the voltage drop across them is no greater than that for which they are rated, otherwise the filament will burn out.

The 180-ohm resistor may be constructed upon a strip of fibre so that heat may be easily dissipated. Of 28 B. and S. nichrome, 43 feet must be used, with a foot or two extra for preliminary use. If the fibre is six inches wide, each turn will be one foot, so 43 turns will be required. Good spacing will be 10 or 12 to the inch, with notches made at the edges of the strip with a hack-saw. It is best to measure off the wire, which may then be wound upon any convenient size of strip, say 4 inches wide, passing the ends of the wire through fine holes. At the variable end leave 2 feet over, the object of this being to introduce plenty of extra resistance while making preliminary adjustments of the filament circuit. The wire is gradually reduced until the correct reading, 5 volts, is obtained across any of the filaments, using a voltmeter.

The 134-ohm bias resistor for the negative end of the circuit must be constructed of the same wire upon the same plan, using exactly 33 effective feet of wire. If preferred, the fibre strips may be conveniently stowed under the eliminator or receiver baseboards, but a clear air-space of at least $\frac{1}{2}$ in. must be provided on each side to prevent heating.

Bearing in mind that the nichrome wire has a resistance of 4.155 ohms per foot, small bias resistors may be made up as follows: 6 ohms, 18 in.; 7, 20; 8, 23; 9, 26; 10, 29; 12, 35; 16, 46;

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