Mainly about Construction

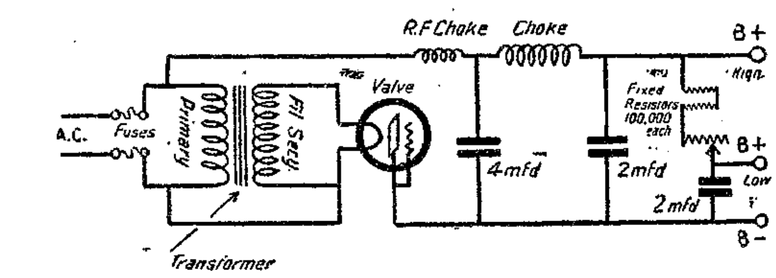
BY "MEGOHM"

"B" Battery Eliminators for Small Sets

SECOND INSTALMENT OF SIMPLIFIED CONSTRUCTION

THIS is a further simplified B eliminator to work from alternating current, the main point of simplification being the cutting-out of the necessity for constructing a double-wound transformer. This eliminator is only intended for use on small sets with two or three valves, the fixed condenser capacity having been cut down to the irreducible minimum, chiefly to keep down cost. By the addition of one, two, or more extra condensers of two microfarads each, a larger set could probably be supplied. The writer has made up, and actually used, this eliminator on a two-valve set, and knows that it can be made to function satisfactorily.

In order to save making a transformer with double windings, it is necessary to purchase a toy of bell-ringing step-down transformer with a primary winding, suited to the voltage of the mains, and a low-tension winding, giving a voltage suited to heating the filament of the rectifying valve. Alternating current, in most places 230 volts, is then passed through the valve to be rectified, and afterwards smoothed by a low-frequency choke and condensers of large capacity.



Circuit Diagram of Half-Wave B Eliminator Employing Bell-ringing Transformer

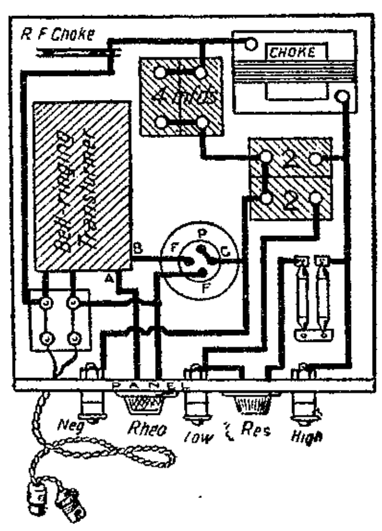
The lay-out and general construction of the panel, baseboard, and cover will be exactly the same as described last week for the double-wound transformer type. The bell-ringing transformer will occupy the position of the transformer, and its primary winding will connect to the fuses as before. The suitable secondary voltage will connect to the rheostat on one side and direct to the valve filament on the other. A connection also has to be made to the filament wiring, in order to draw off the rectified current, which always travels from plate to filament. In case of using an ordinary power valve as rectifier, the plate and grid are both connected together, so that the grid forms an addition to the emission surface of the plate.

THE WIRING DIAGRAM.

A PLAN of the baseboard lay-out is given, showing the wiring connections clearly. The inner ends of the fuses connect to the primary winding of the bell transformer, and also branch off, one to the R.F. choke and the other to one of the filament connections. The output of the transformer should be 4 or 6 volts to suit the filament of the rectifying valve, the voltage being regulated by the rheostat, which once set correctly is best left alone. The plate and grid are now connected to the negative output lead. Other connections are as already described last week. The two fixed resistances of 100,000 ohms each as shown will probably be required to cut voltage down for the detector, as there will only be the drop in the valve and two chokes, which will leave a voltage of perhaps 170, and 45 or 50 volts is ample for a detector. In the case of a two-valve amplifier one resistance would probably give a suitable voltage for the first valve, and the full voltage put on the second, though rather than put too much on the second it might be a better plan in some cases to run both valves at the same plate voltage through the resistances with the means of regulating and finding the best amount. If a resistance has to be placed in the "high" output circuit, it can easily be done, but an extra 2 mfd. condenser must be connected to the "high" terminal and to the negative output, or common wire connecting one side of all the condensers. It will be for each constructor to suit the eliminator to the exact needs of his set. Extra voltages are provided by utilising an extra terminal for each, with fixed or variable resistance, and a 2 mfd condenser connected, as already mentioned.

THE TRANSFORMER.

SMALL transformers can be purchased at an electrician's all ready for connecting to the mains for about 12s. 6d. Some of these have tapped



secondaries giving perhaps three voltages. Three volts would suit the Philips 373 or Mullard DV10, or for a UX171, PM256, or PM6, a six-volt tap would be suitable. For ordinary valves, the PM4 or PM254 are suitable, requiring 3.7 volts on the filament.

AN IMPORTANT POINT.

IT is important to note that when using an eliminator of this type without a double-wound transformer, no direct earth connection can be used on the set. The way to get over this if an earth connection must be used is to insert a good-quality fixed condenser of at least 1 m.f.d. capacity in the earth lead. This makes no diminution in volume. The best condenser for this purpose is one tested at 800 volts and guaranteed for operation at 500 volts. The condensers above mentioned cost about 11s. 6d. each in 1 mfd. and 13s. 6d. for 2 mfds. On no account must constructors omit to provide the tinfoil fuses as shown in the plan.

AERIALS — INTENTIONAL & OTHERWISE

The observant experimenter will often notice quite remarkable effects due to the proximity of an aerial not actually connected to the receiver. At one time it was usual to boast that one's set would receive certain stations without an aerial, and possibly without even an earth.

Such a test carried out under home conditions probably involved disconnecting the aerial wire from the set and leaving it lying on the table near by, or at the most disconnecting the wire from the inside end of the lead-in terminal. In both these cases more careful experiments will show that the aerial is still influencing reception, and it has even been noticed that an aerial is not quite inert if connected to an earth separate from that used by the set.

Receivers are frequently tested nowadays to ensure that they will not receive even a powerful local station without an aerial. This serves as a test of the efficiency of screening boxes. To be quite fair to the set, however, it is important that there should be no aerial, either of the frame or open type, near by.

Other sources of unwanted reception are to be found in long H.T. and loud-speaker leads, particularly the former if a mains unit situated at some distance from the set is being used. The blocking condenser within the set between each H.T. tapping and earth should not be omitted even though there is a full set of condensers in the eliminator; and again, if long loud-speaker leads are to be used, it is desirable that an output transformer, the core and secondary of which are earthed, should be employed in the plate circuit of the last stage in the set.

The use of a frame aerial will endow most receivers with a marked degree of selectivity, which is in no small degree due to the directional property of the frame; but here, again, care should be taken to ensure that there is not a lead-in from an open aerial close by, or persistent jamming by the local station may be experienced.

It is a good plan to mount coils with their axes vertical wherever possible, as, if otherwise placed, they may be acting as miniature frame aerials within the set. Certain special arrangements of windings, such as the toroids and the binocular coils, tend to prevent trouble from this source.

TWO-VOLT VALVES

When using two-volt valves throughout in a multi-stage receiver (with four or more valves) it is often advisable to omit all filament rheostats unless the design which is being followed specially calls for them—possibly as a volume control by dimming the H.F. amplifier. The reason for this is that a certain voltage is dropped in battery leads, both external and internal, and with the small surplus at our disposal it is quite possible that the residual resistance in a rheostat at minimum setting, in conjunction with the extra lengths of wire used in connecting it, may be sufficient to prevent the application of the full rated filament voltage.

This advice applies with greatest force when one or more of the valves consume a comparatively high current. It will be realised that, to obtain a wattage approximating to that consumed by six-volt valves, the tendency is to increase the heating current of those with two-volt filaments.

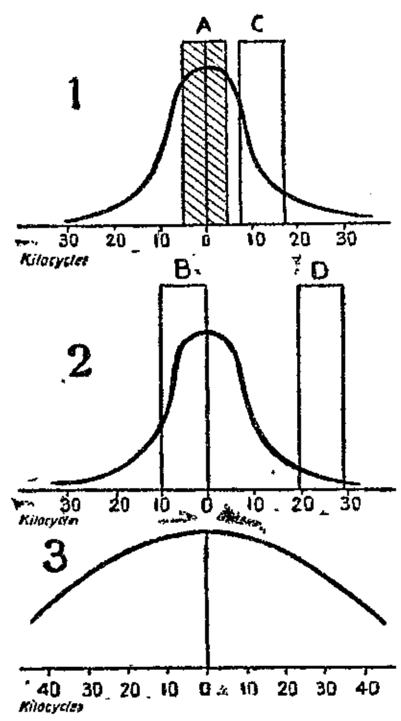
Why Detuning is Bad Control

ON different occasions the practice of detuning has been condemned in this column as being very liable to produce distortion. It is impossible to lay down any exact rule in this matter that may be applied to all receivers, but listeners who are troubled with distortion are recommended to give the matter careful attention, and when distortion occurs in reception, a very careful attempt should be made to reduce it by fine tuning on the dials.

The dial position giving maximum signals is called the "resonant point," but when the signals are strong and spread out slightly, it is sometimes difficult to determine very exactly when the resonant point has been reached, and yet the slightest deviation on either side may tend to introduce distortion, as we shall see.

The wave sent out by the transmitter is several kilocycles wide, the centre portion carrying the low notes and the two outer fringes the high notes and harmonics.

Figure 1 shows the diagram of the resonance peak of a selective receiver. If we tune in to the resonant point correctly, the receiver bands will fall as the shaded portion A, which is substantially all on the resonance peak, so that the exact centre and the sides of the band are both correctly tuned in, so that both the high and low notes will receive equal treatment.



Slightest Detuning May Cause Distortion.

On slight detuning, the peak of the curve is moved with reference to the transmitter, so that the frequency band falls on the curve in some such way as suggested at B in Fig. 2. Here it will be seen that one-half of the band is received at full strength, while the other half is cut down very considerably by being situated on the steeply falling side of the peak, so that while half of the high notes, and practically all of the low notes, are heard well, the remaining half of the high notes is cut out more or less completely.

On further detuning, the centre of the band falls at the beginning of the lower part or "skirt" or the curve, as show at C in Fig 1. In this case one-half of the high notes is accentuated, while the low notes and the remainder of the high notes are badly heard.

In either of thees two cases, in which the tuned circuit picks out part of the total wave at the expense of the rest, there is discrimination between low and high notes, which inevitably results in distortion.

On still further detuning the circuit, so that the peak of the curve is so completely removed from the frequency-band of the transmitter that the whole of the band falls on the skirt of the curve, as at D in Fig. 2, the distortion disappears again, for once again all parts of the band receive equal treatment from the tuned circuit.

DAMPED CIRCUITS.

IT follows, then, that if it is desired to detune a receiver, and at the same time to avoid distortion, each tuned circuit must be adjusted either exactly in resonance with the station being received, or well away from the resonant point. The only exception that may safely be made is where one of the circuits, owing to damping either by the aerial, or by a grid detector, tunes flatly, so that it has a resonant curve of the type shown in Fig. 3. It will at once be seen from the figure that in such circumstances, no matter what position the frequency band may have with respect to the curve, no appreciable distortion can be introduced.

It must not be imagined that the distortion described here is purely theoretical and academic; it can be heard only too plainly in the loud-speaker whenever a really low-resistance circuit is tuned slowly through the wave-length of the local station, the distortion corresponding to B being particularly well marked. This type of distortion is heard at its worst when receiving on a frame aerial with a nearly oscillating detector, when the most minutely accurate tuning is necessary to centre the transmission on the very sharp peak of the resonance curve.

USE OF H.F. VALVE RHEOSTAT.

COMPLETE detuning is particularly useful as a volume control when receiving the local station on a modern neutralised receiver, in which the chief volume control is by the filament rheostat of the high-frequency valve. It often happens with such a set that the local station continues steadily to overload the output valve until the filament is turned right out, when dead silence supervenes. If the aerial circuit is now detuned at least far enough to ensure freedom from distortion, and the filament of the H.F. valve relighted, a position of the rheostat will be found at which the local station is received at convenient volume.

Detuning, then, cannot be used for fine control of volume, except when one circuit of the receiver is of high resistance, but when there is already a volume control of insufficient range, it can be made to provide a very valuable auxiliary control.

If the aerial tuning of the set is accomplished by a loose coupling, and there is no earth connection to any other part of the circuit, then the condenser in the earth lead may be dispensed with, as there will then be no direct path to earth for the B current.

In the case of the two-valve amplifier recently described in this column, if constructed with circuit as shown, no condenser would be required in the earth lead, but the precaution would have to be taken if not plugging in for crystal reception only before turning off the B supply, otherwise a heavy B current would be drawn through the last valve. To obviate any chance of this the connection between crystal socket (1) and centre phone terminal or clip (4) could be dispensed with.

In every case care should be taken not to come into direct contact with the aerial-earth circuit whilst making adjustments.

It is on account of these limitations of the direct method that, after all, the double-wound transformer type appears to be worth the extra trouble involved.

(Continued on Page 13.)