BEGINNERS start here... 16

An Instructional Series for the Newcomer to Electronics

As an example of our new knowledge, consider the smoothing network found in most power packs. It generally consists of two capacitors and an inductance arranged as in Fig. 16.1.

The alternating current from the mains supply is converted into "pulsating d.c." by the action of a rectifier (not shown here). This current, really a.c. mixed with d.c., is too rough to use in electronic equipment. It is therefore passed through a smoothing or filter circuit.

Referring to Fig. 16.1, the first capacitor C1 offers an easy path for the a.c. variations, but the inductor L1 opposes them. To d.c., however, L1 offers very low resistance, while capacitors C1 and C2 offer an infinite barrier. The small amount of a.c. that manages to pass through L1 is provided with an easy return path via C2.

COMPONENTS . . .

HIGH VOLTAGE FILTER

C1	16μF electrolytic 500V	Dual unit, both capacitors in same can
C2	16μF electrolytic 500V	
L1	10 henry choke, 65mA	Standard h.t. smoothing choke, approximate size 1¾in × 2⅛in × 1⅞in. Osmabet or similar

LOW VOLTAGE FILTER

C1	5,000μF electrolytic 15 to 25V	
C2	5,000μF electrolytic 15 to 25V	
L1	0·1 henry choke 2A	Not generally available, but easily made up as described in the text. Material required: old loudspeaker transformer; small reel of 24 s.w.g. enamelled copper wire

Miscellaneous Items for Both Units

Wooden baseboard, approximately 5in × 3in × ½in. Brass wood screws. Black and red plastic covered wire. Perforated zinc for the cover.

The first capacitor C1 charges up on the positive going "peaks", but returns some of this charge to the supply line when the a.c. component is moving negative-wise. This capacitor is often referred to as a *reservoir* capacitor, and it contributes largely to the smoothing or filtering action of this circuit.

In this manner smooth, steady d.c., like that from a battery, is obtained to work the "load" which is some electronic device connected across points *c* and *d*.

Transformation of the pulsating d.c. into "pure" d.c. is indicated graphically in Fig. 16.2.

We will now proceed to the construction of two filter units—both based on the circuit given in Fig. 16.1. This work will enable you to gain a little more soldering experience, and afford the opportunity to handle further types of components in a practical sense. The filters themselves will be very useful in later work. In fact they will be essential for producing smooth d.c. from the a.c. mains, via suitable transformers and rectifiers, which will be put to work operating the future practical projects we have lined up for this series.

HIGH VOLTAGE FILTER

This unit will smooth rectified a.c. (that is, pulsating d.c.) of about 250 volts pressure, supplying currents up to about 60mA. (Don't forget m stands for "milli", meaning a thousandth, and A is the abbreviation for "ampere", which is a measure of current flow.) This filter can therefore be used to supply valve equipment drawing not more than the above mentioned amount of current.

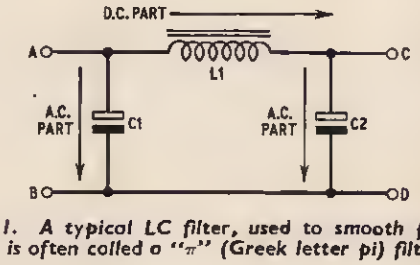

Fig. 16.1. A typical LC filter, used to smooth pulsating d.c. It is often called a "π" (Greek letter pi) filter, from its shape

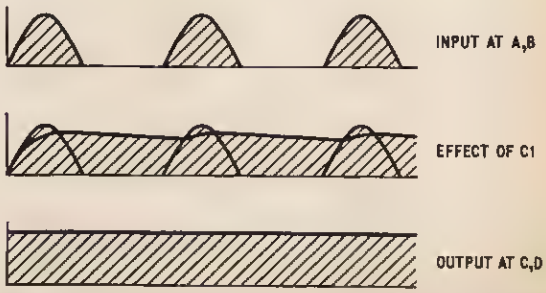

Fig. 16.2. These waveforms illustrate the smoothing action of the filter

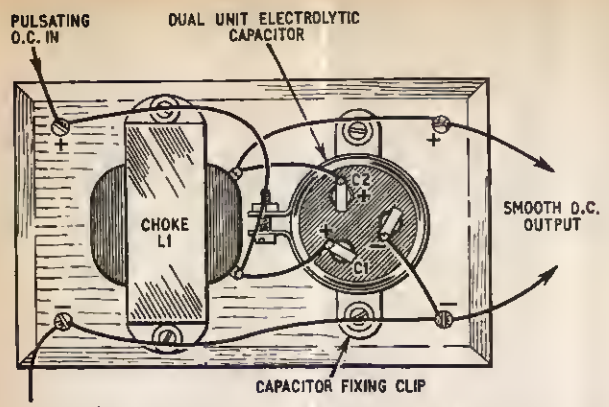

Fig. 16.3. A top view of the high voltage filter unit. The low voltage filter is identical except that C1 and C2 will be two separate components

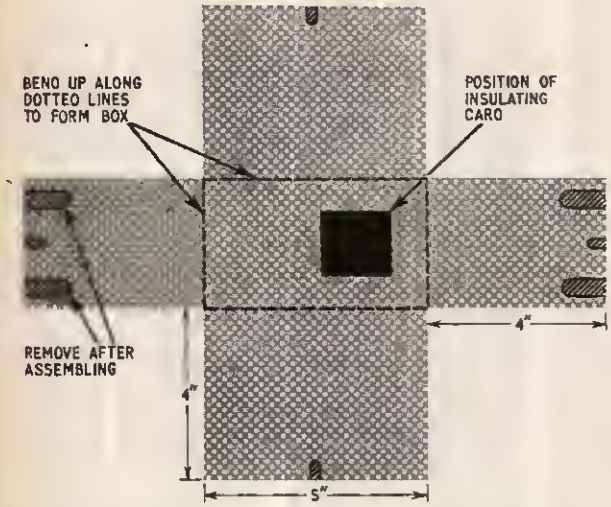

Fig. 16.4. Preparation of the perforated zinc sheet to make a cover. The sides can be bent up, and card corners stuck on. This is strong and easier to carry out than soldering the perforated zinc

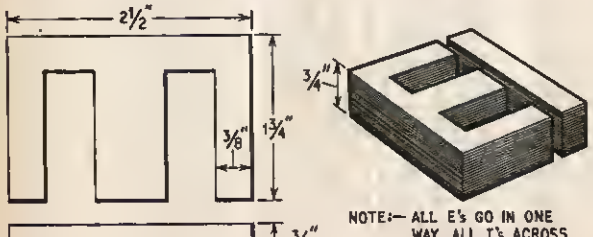

Fig. 16.5. Size of standard laminations suitable for the O·1H 2-amp choke for second filter. The stack of laminations should be about ¾in for best results. A thin piece of paper should be inserted between the E and I stock. This just keeps the laminations apart, thus introducing a small air gap in the magnetic path

Construction is carred out on one of our standard wooden baseboards, and a perforated zinc cover is added to shield the high voltage points from the possibility of being touched. The diagrams and photographs show just where everything goes. It is useful to remember that this unit added to the output of an existing power pack will give a vast improvement in the smoothing, probably eliminating any residual hum still present in the original circuit.

IMPORTANT POINTS

Remember to connect up the electrolytic capacitors correct way round and to connect the supply positive to positive and negative to negative. Note carefully any information printed on the electrolytic capacitors. Make sure that the voltage ratings indicated on the capacitors agree with the details given in the components list.

Sometimes the aluminium can is connected internally to the negative side of the capacitors; when this is so, a separate negative solder tag may not be provided and external connection is then made by attaching a lead under one of the screws on the metal fixing clip. This brings us to another important point: always ensure that you obtain the appropriate fixing clips when you purchase electrolytic capacitors.

Small wooden panels, nearly the size used in our designs, are on sale in Woolworth's Stores. These are meant to take electrical fittings, (plugs points etc.) mounted on walls. As they say—just the job!

LOW VOLTAGE FILTER

The second filter unit supplies around 12 volts at one to two amps, and is suitable for supplying circuits employing transistors. There is no need to cover up with a shield this time, unless you would like to make one for matching the other unit, but be careful not to mistake which unit is which, or trouble will arise indeed! (Perhaps different coloured paint would overcome this hazard.)

SMOOTHING CHOKE

The components list mentions everything except the smoothing choke (L1) for the low voltage, high current unit. This particular component cannot be readily obtained in the shops, but can be made from an old loudspeaker transformer or choke similar in size to the one used in the high voltage filter. Such components can be salvaged from an old radio or television set, or a dealer will supply them. Secondhand components are quite suitable for this purpose.

Strip the transformer or choke right down, keep the laminations and bobbin, but dispose of the fine wire that formerly filled it. Now wind on about 400 turns of 24 s.w.g. enamelled copper wire. When you have covered the coil you have produced with a protecting layer of tape, replace the laminations. Notice that all the "E" laminations go in one way, and all the "I" strips go on the other end, with a piece of paper between. See Fig. 16.5. The lamination shroud now goes on, and the component is ready to be screwed down.

It is unlikely that you will be able to obtain a dual unit capacitor for the values required in this second filter unit. Two separate capacitors (as detailed in the components list) can be mounted side by side on the board. Note the remarks concerning electrolytic capacitors in general given in the section dealing with the high voltage filter.

Next time we shall discuss changing a.c. into d.c. and d.c. into a.c.