D.C. POWER SUPPLY UNITS

Power is normally distributed as 240V a.c. If d.c. supplies are required they are obtained by transforming the a.c. to the required value, rectifying and then smoothing the output voltage.

HALF WAVE RECTIFICATION

A simple way of making an a.c. voltage unidirectional is to insert a single diode between the supply and the load (Figure 1).

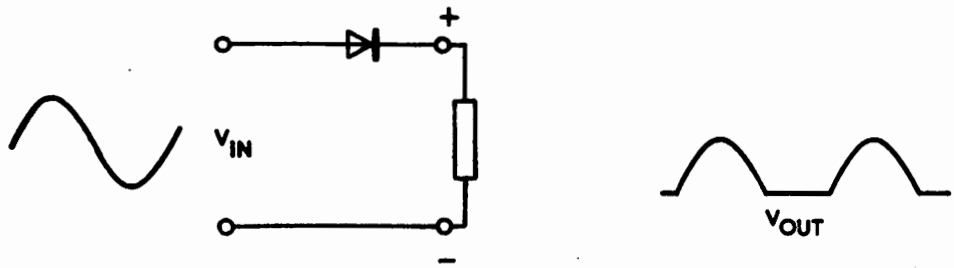


Fig. 1 : Half wave rectification

The output, although unidirectional, is pulsating and only half of the input cycle contributes to its output.

FULL WAVE RECTIFICATION

An arrangement of diodes whereby both halves of the input cycle contribute to the output is called full wave rectification. If a transformer is available with a centre tapped secondary only two diodes are required, as shown in Figure 2.

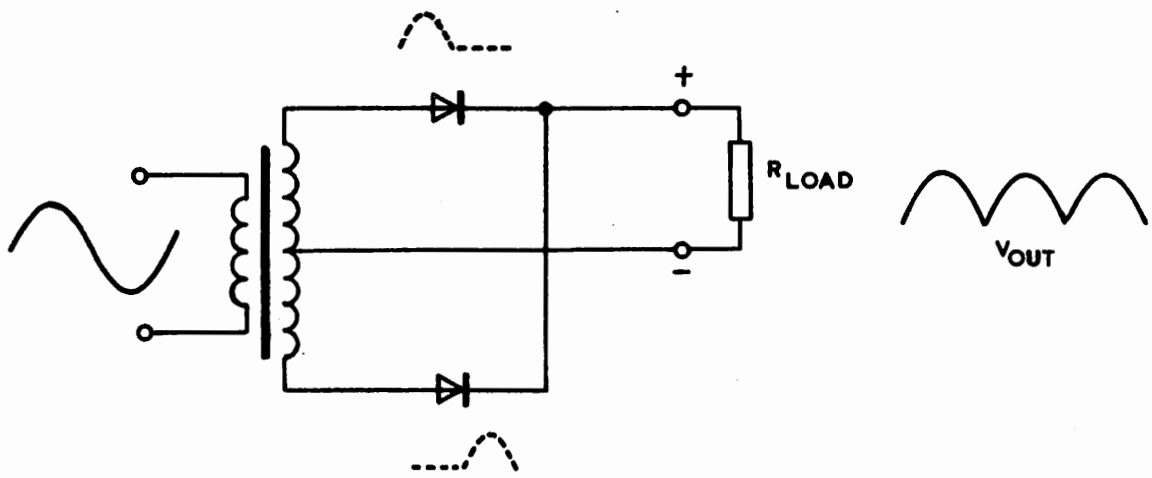


Fig. 2 : Full wave rectification (2 diodes)

D.C. POWER SUPPLY UNITS

If there is no centre tap four diodes are required, as in Figure 3. This diode arrangement is called a "bridge rectifier".

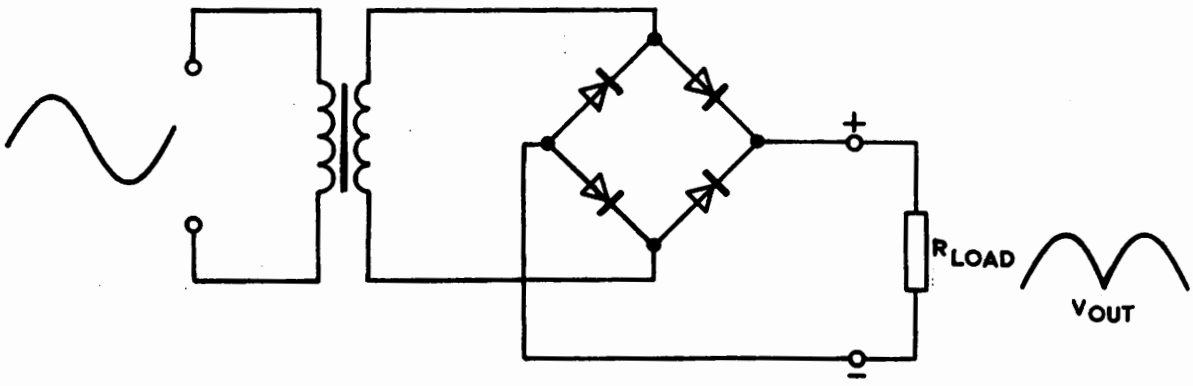


Fig. 3 : Full wave 'Bridge' rectification

SMOOTHING

In the simple circuits shown in Figures 1, 2 and 3 the output voltage is pulsating at input frequency (50 Hz) for the half wave rectifier and twice input frequency (100 Hz) for the full wave rectifier. This output can be smoothed by connecting a large capacitor across the output from the rectifier (Figure 4).

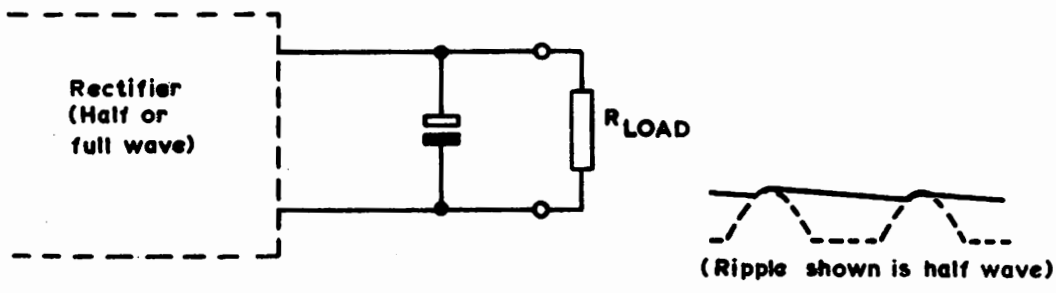


Fig. 4 : Simple smoothing

Similar circuits are used for both half and full wave rectification - obviously the degree of smoothing required is greater for half wave rectification.

This simple smoothing circuit can be improved by adding an extra RC filter (Figure 5).

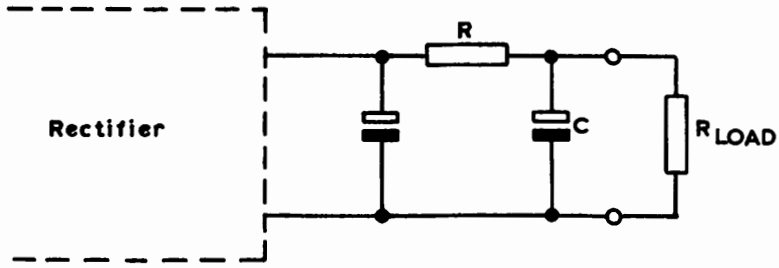


Fig. 5 : Simple R-C smoothing

This arrangement, while removing most of the ripple, also drops wanted d.c. voltage across the R. If a choke is used instead of a resistor, then it will attenuate the ripple and if the choke winding resistance is low there will be little d.c. voltage drop. The smoothing circuit with choke shown in Figure 6 is known as a 'capacitor' input filter.

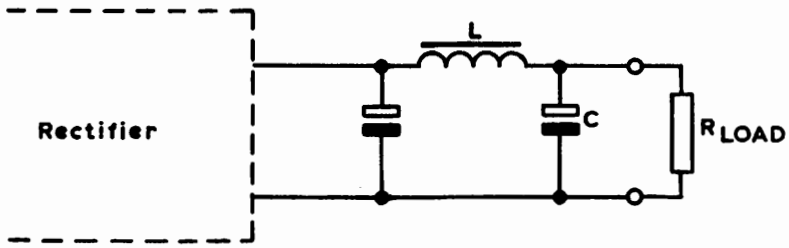


Fig. 6 : 'Capacitor input' filter

An alternative smoothing circuit using a choke is shown in Figure 7, and is known as a 'choke input filter'.

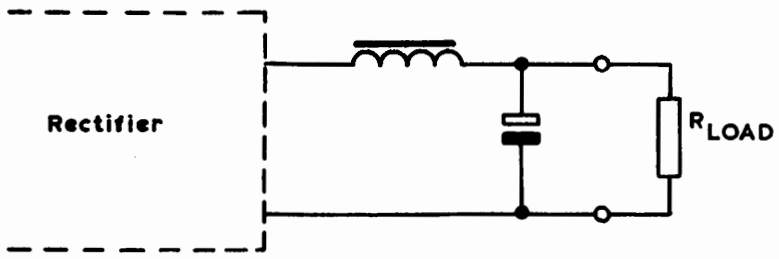


Fig. 7 : 'Choke input' filter

This circuit provides a lower output voltage than the 'capacitor input filter', but the output voltage does not change nearly so much as the load current changes.

D.C. POWER SUPPLY UNITS

REGULATION

Regulation of a d.c. power supply circuit is its ability to maintain a constant output voltage when the load current changes. The regulation for different smoothing circuits is shown below (Figure 8) as a graph of output current against output voltage.

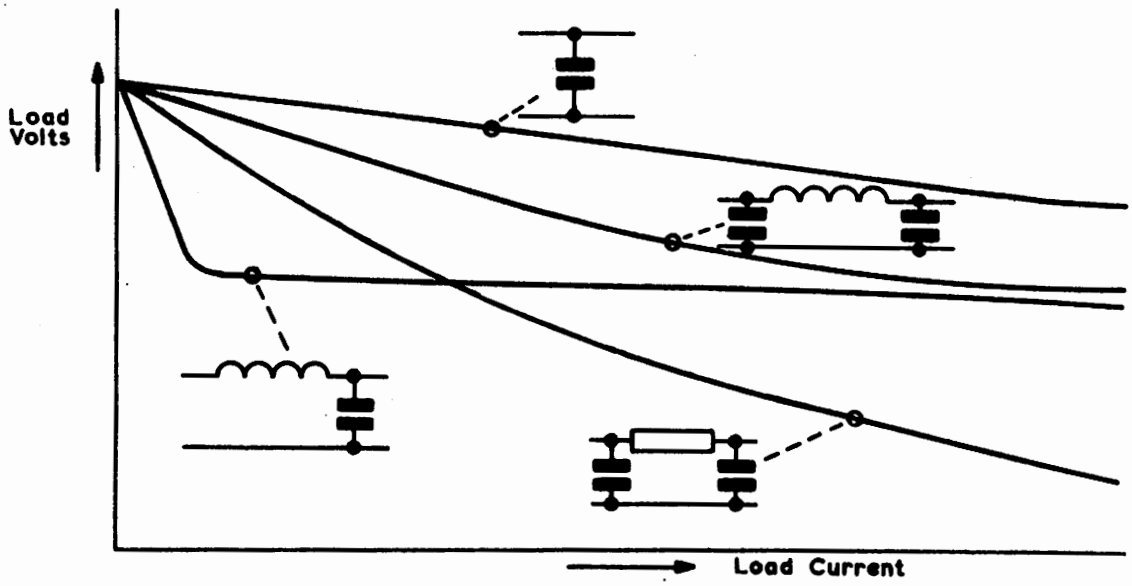
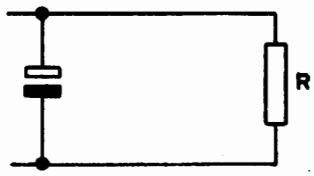
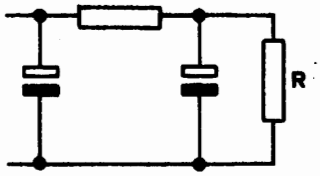
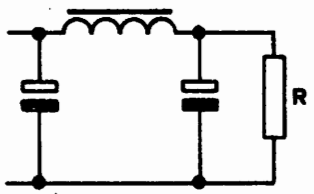
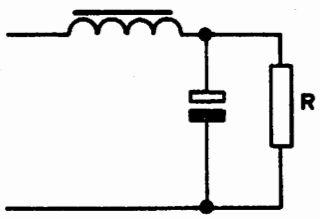


Fig. 8 : Regulation

The regulation and smoothing of the circuits are listed on the next page.

STABILISED POWER SUPPLIES

It is possible to build power supply circuits with extremely good regulation and very low ripple, but transistor circuitry and reference (Zener) diodes are required. These circuits are not covered in this information sheet as they are rather complicated.

Smoothing circuit and load (R)	Regulation	Smoothing
	Fair	Good for small load currents, poor for high load currents. This circuit is suitable for class B audio amplifiers
	Poor, because as load current increases, more d.c. volts are wasted across smoothing resistor.	Good. This circuit is suitable where load current is constant (e.g. for class A amplifier).
	Fair, provided winding resistance of choke is low.	Very good.
	Very good, apart from initial rapid fall in load volts.	Good if L and C have high values.
	<u>N.B.</u> It is usual in this circuit to connect an extra resistor (called a 'bleeder') across the load so that the circuit operates over the linear characteristic shown in Figure 8	

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