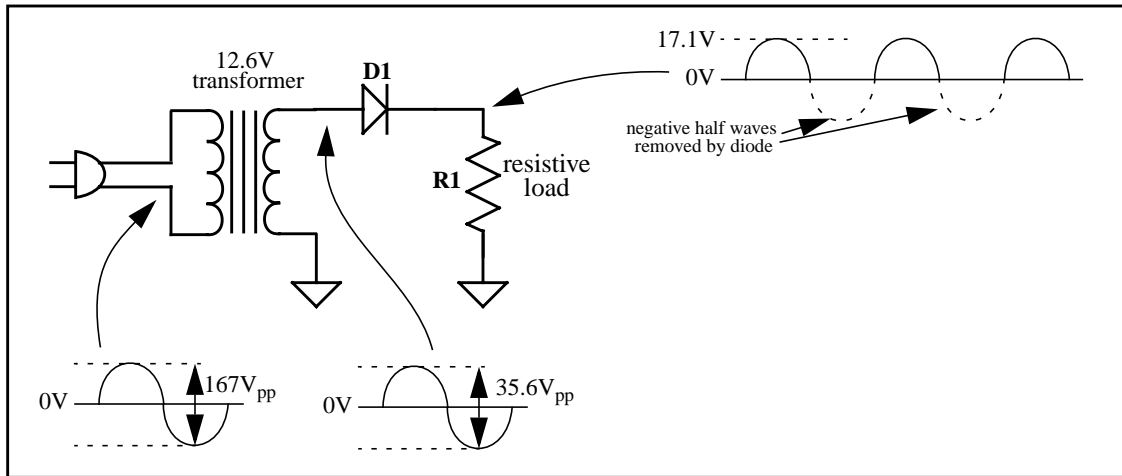


Diodes as Rectifiers

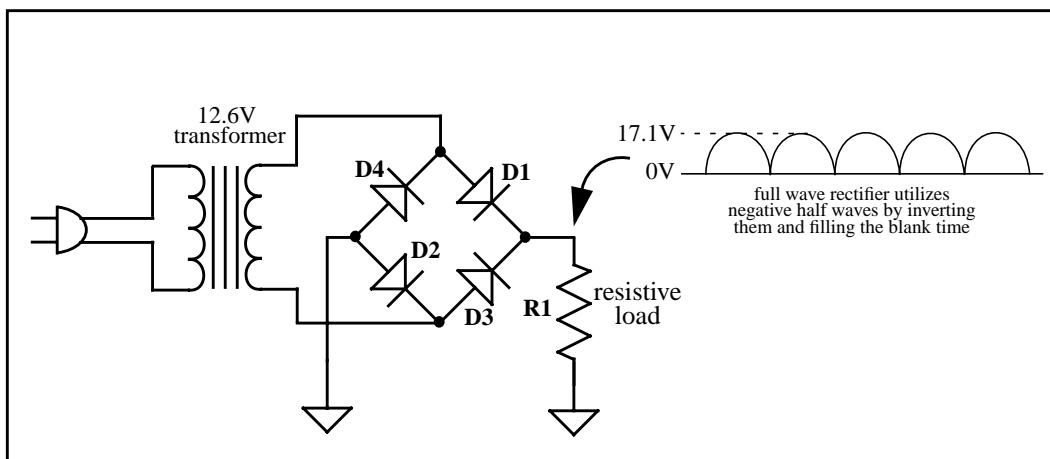
As previously mentioned, diodes can be used to convert AC to DC. This is done for us in the wall warts we use to recharge our robot batteries. Shown below is a representative schematic of a primitive DC power supply similar to a car battery charger. This rectifier circuit is called a half wave rectifier.



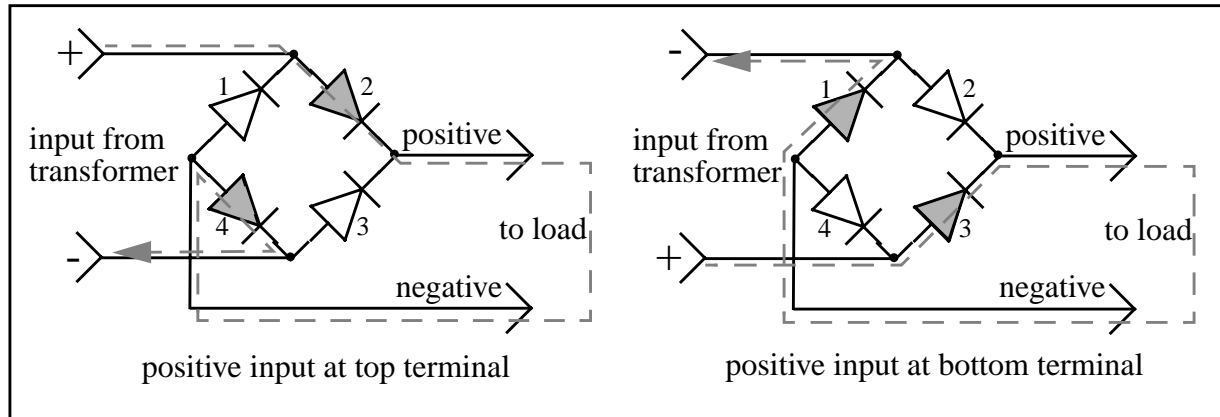
The input transformer steps the input voltage down from 110VAC to 28VAC. The diode converts the AC to DC by removing the negative going part of the sine wave. We are left with a pulsating DC waveform which is not very useful except for charging lead acid batteries as the voltage goes to zero for one half of every cycle. What we would like is a DC output that is steady with no variations over time like that of a battery.

If we could find a way to use the negative going part of the sine wave and use it to fill in between the pulses created by the half wave rectifier the output would be much smoother. It would be like the difference between running over 2x4 lumber spaced at 1ft intervals with your car versus 2x4s' spaced at 6in intervals.

Below we see a circuit that does what we want. Its called a full wave rectifier.



The full wave rectifier uses the one-way action of the diodes to alternatively supply the positive output of the rectifier from the positive and negative half waves of the AC input signal. The different paths through the rectifier are shown below.



When the positive terminal is at the top terminal, only diodes 2 and 4 can conduct. Diodes 1 and 3 are oriented backwards to the applied current and cannot pass current. As the current passes through each diode the voltage drops by 0.7 volts. This prevents diode 1 from passing current back to the input terminal. It cannot because the anode side (pointy end) is at least 0.7 volts below its cathode.

When the positive terminal is the bottom terminal, only diodes 1 and 3 can conduct. In either case the positive terminal remains the positive regardless of the polarity of the input voltage. In the case of an AC wall wart, the input current switches from the first case to the second at a rate of 60 times a second. Thus at the output of the bridge circuit, a pulsating DC voltage is produced.

Now we have an output that is uni-polar but still has "ripple". We can remove most of the ripple with the addition of a capacitor shown below. The capacitor acts as a temporary storage device that supply current to the load between the input pulses. The capacitor is charged on the rising edge of the pulses and supplies current to the load on the falling edge. This circuit is able to provide a fairly clean output that is suitable for most electronic devices.

