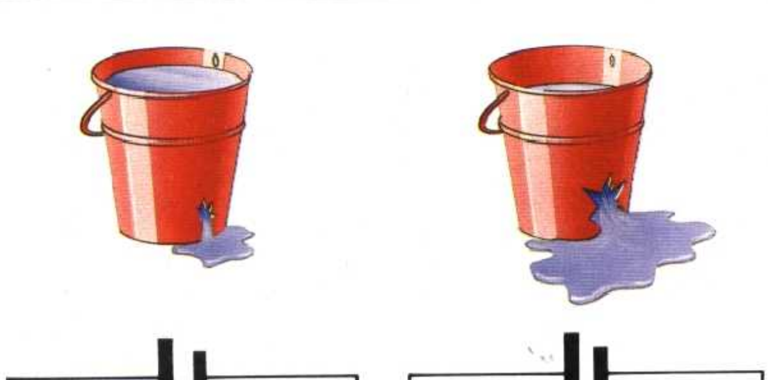
CURRENT AFFAIRS

In the last instalment of the Workshop series we explored some of the phenomena that cause an electrical system to work. Now we look in greater depth at the relationship between the three theoretical components of electricity: potential, current and resistance. To do this we must learn about the way in which they are related, and the very simple piece of arithmetic that predicts that relationship.



Resistance And Current

A component in an electrical circuit offers resistance to the flow of electricity, just as the pipes and tanks in a central heating system resist the flow of water: the greater the resistance offered, the less the flow. If a bucket has a small hole, little water will escape because the edges of the hole resist the flow; if the hole is larger, this resistance is lessened, so more water flows. Similarly, an electrical circuit carrying a high resistance shows a lower current flow than the same circuit carrying a low resistance. A component's electrical resistance depends largely upon its material — wires are made of copper because it offers little resistance; light bulb filaments are made of highly resistive material so that the work done by the current against the resistance is expressed in heat, and hence in light

Georg Ohm, a German physicist living in the 19th century, was the first to deduce the relationship between voltage, current and resistance, and to realise that any one of the three fundamental values can be deduced from the other two. Voltage, he found, was equal to the resistance multiplied by the current. Simple arithmetic allowed him to transpose the equation, so that resistance could be determined by dividing the voltage by the current, and current calculated by dividing the voltage by the resistance.

Using the conventional single-letter symbols V for voltage, I for current and R for resistance, the equations themselves are very simple:

$$V = R \times I$$
$$R = V/I$$
$$I = V/R$$

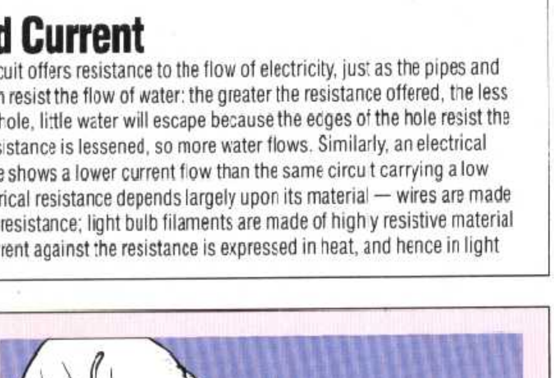
An extension of Ohm's Law is the Power Law:

$$W = V \times I$$

which relates W, the power consumed in a circuit or device, to the voltage across it, and the current running through it. If voltage in this formula is expressed in volts, and the current in amps, then W, the power, is measured in watts.

This equation is very useful around the home — it allows us to determine the value of the fuse we should fit to a domestic appliance. Let us take the case of a three kilowatt fan heater running off 240 volts. Dividing 3,000 (the power, in watts, consumed in the device) by 240 (the mains voltage) tells us that the amount of current consumed will be 12.5 amperes. Thus, any fuse less than 12.5 amps value will blow. As the maximum rating for any one household power socket is 13 amps, we can also deduce that any other device running off an adaptor on the same socket as a three kilowatt fan heater must not consume more than 120 watts, or we are endangering the entire circuit. In the next issue we will conduct some experiments to prove Ohm's Law in practice.

Quality Control



With this simple modification, the Sinclair Spectrum can provide a composite video signal, which enables the use of a high resolution monitor. Open the case and identify the RF modulator — a large silver component at top left. The modulator has two connections. Find the one nearest the back. Solder a short lead from this to the outside of a surface-mounting BNC socket. Solder another lead from the case of the modulator itself to the central connector on the socket. The socket can be mounted on the side of the Spectrum case

WARNING: Your computer's guarantee may be rendered null and void if you open the case!