

V, connected to the terminals of the resistor; and the resistance R, in ohms, would be deduced from the relation— $CR=E$. The above considerations are only exact in the case of an electric current flowing steadily in one direction; in the case of alternating currents a sort of electrical inertia is observed which modifies these results.

In the **arc** furnace, the electric current encounters not only an inert resistance, but also, an opposing electrical force. Both the resistance and the opposing electrical force cause the energy of the current to be turned into heat, and to contribute to the heating of the furnace. A similar opposing electrical force is present in an electrolytic furnace, such as is used for the production of aluminium. In the latter case, however, the work done in overcoming this force, is turned into chemical energy (the isolating of aluminium from alumina) instead of into heat. In most furnace operations, chemical and physical changes are produced, and these increase or diminish the amount of heat liberated in the furnace.

An electric furnace consists of the following essential parts and accessories:—

(1) **Some conducting material heated by the passage of the current.** This may be a vapor, as in the electric arc; or a solid, such as coke; or a liquid, such as molten slag or molten steel.

(2) **An envelope of refractory material.** The walls, floor and roof of a furnace are needed to conserve the heat, to retain the charge, to exclude the air and to support the electrodes and the charging and discharging apparatus.

(3) **Electrodes, or conductors for bringing the current into the furnace,** carbon rods are usually employed for this purpose. They are subjected to the heat of the furnace at one end, and at the other end must be sufficiently cool to permit of making electrical contact by means of special holders with the cables bringing the current to the furnace. In some furnaces electrodes are not needed, the current being generated by induction in the furnace itself.

(4) **Electrode holders.**—These are usually metal clamps for holding and making electrical contact with the carbon electrodes; provision being made for preventing the excessive heating of the holder.

(5) **Charging and discharging facilities.**—Some furnaces are intermittent in action, the charge being added, heated in the furnace and then removed, before the fresh charge can be introduced. Other furnaces are continuous in action, involving the