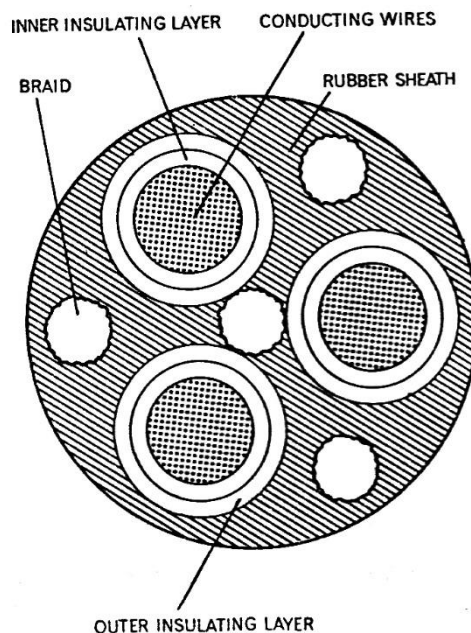


CONDUCTORS AND CONDUCTIVITY

It is usual to consider electric current as a flow of electrons from one point to another through a medium, or even through a vacuum. If the electron flow takes place in a vacuum, as in the case of electronic valves, the electrons will travel at considerable speeds, since little resistance is offered by the medium, and fewer impacts will occur between the electrons. If the medium is a solid - in which case the electrons are more tightly packed - the electron flow will be slower.

All substances may be classified electrically as conductors or insulators, according to the degree of resistance which the medium offers to the flow of current. Most liquids, particularly solutions in liquids, are good conductors. Most gases at normal temperature and pressure are good insulators, but gases maintained at low pressure in a sealed tube allow a flow of current to take place as a result of ionisation of the gas molecules. Solids vary greatly in resistance, some being very good conductors, while others are so resistant that they are referred to as insulators. Electric current is normally transmitted along annealed copper wire.

The resistance of any material to the flow of current is affected by a number of factors, such as the length and cross-section of the conductor, and by its resistivity, which is a specific property of the material at a specific temperature. The temperature therefore also has some effect on the resistance of a material: in most cases, an increase in temperature causes an increase in resistance. With certain metals, such as copper or iron, the change in resistance which attends on changes in temperature is relatively large - a fact which is utilised in the resistance thermometer, in which it is possible to measure temperature changes, as in the windings of an electric motor, for instance, by the change in resistance.



Cross-section of electric cable

Some materials have a very high resistance, and as such they can be used as insulators to prevent the leakage of current. Among these materials are asbestos, celluloid, porcelain, cotton and rubber, and recently a number of new materials have been developed, including synthetic textiles such as nylon, and synthetic resins such as vinyl resins. The resistivity of most insulators decreases with an increase in temperature, for which reason the temperatures in insulated conductors must be kept reasonably low. A breakdown of insulation may occur under the application of very high voltages, and it is necessary to know the dielectric strength

of any insulating material. Some materials, such as cotton, which is often used as insulation, are liable to absorb moisture, and this will adversely affect their insulating properties. Rubber, which is a standard insulating material, is liable to deteriorate under sunlight, and it is therefore advisable to protect it with some weather proof material.