

and rewiring that section, when either alternative might be avoided by the simple method of "drawing in." The advantage of this system is exemplified in the case of a new building where the wiring has to be concealed. The free ends of the wires at all outlet points are subject to the tender mercies of the plasterer who is, oft times, not too gentle, resulting in damaged insulation at the edge of the conduit. Again, there is the action of moisture on the insulation, which cannot be avoided, also the serious effect due to the action of lime on rubber.

A good practice, and one well worth specifying, is for short lengths of conduit, say six inches, to be screwed in at all outlet points, and not to be removed until plastering is completed. This will materially assist in keeping the conduits clean. Many "breakdowns" behind switch blocks may be traced to rough handling of the wires during the process of plastering. For ordinary installation work the conductors are rubber insulated, covered with tape and braiding. The Underwriters' Rules specify that the insulating material must be of vulcanised rubber of the best quality, impervious to moisture, and only needing mechanical protection. The radial thickness of the vulcanised rubber is specified, according to the size of the wire, and certain tests are also given which the conductor must be able to stand. Now these tests cannot be made on the installation, but must be carried out in a properly equipped laboratory, or test room in connection with a supply station if the necessary instruments and measuring meters are available. The ordinary testing instruments carried on to a job by the Inspector is of no use whatever to indicate the class of material used for insulation, and will only record the amount of leakage between any two conductors or between a conductor and the earth. This test is, of course, a useful and very necessary one, but the point we wish to make is that it gives no indication of what effect age will have on the rubber, or, technically speaking the dielectric.

Not long ago, a sample coil of wire was taken by the writer for testing purposes. On appearances it was of good quality, and stood up well under a stretching and burning test, but under a voltage test we could only obtain an insulation resistance of 5.39 megohms per mile instead of 2000 megohms, and under the "breakdown" test it failed miserably.

One of the advantages claimed for the use of electricity is its flexibility and this becomes apparent when switches are used in a judicious manner. The initial cost of installing additional switches is repaid in a short time due to saving of current in lamps not immediately required, with a consequent reduction in the monthly account. Where several lamps are installed in a workroom or factory, the switches should be so arranged that any section or group may be cut off if no work is going on in that particular part. Even in a sitting room, with a three-light pendant, two switches are economical because there are many hours in the course of the year that one light will give sufficient illumination. The location of the switches should also be carefully considered, especially where a number of lights are in use. There is a tendency on the part of the contractor

to group all switches in a given spot because the wiring is simplified, but this often leads to inconvenience and loss of time. In the case of a factory, switches for general illumination, should be located in the Foreman's office, and any special lights for machines controlled locally. There should be one switch at the door and if there be a door at each end of the room in general use, two-way switches will probably be an advantage. At present two-way switches do not appear to be used much outside of halls and bedrooms in private dwellings but there are many situations where they would prove very convenient.

In regard to the fire hazard, we are of the opinion that, properly installed, electricity is the safest illuminant. Under other conditions it may be a most serious fire hazard and one of a very subtle nature. In the case of gas, a leak is often discovered through the sense of smell; but as we have no sense which will locate a leakage of current, our first indication of the danger may be a serious outbreak of fire. Certainly every conduit is, or at least should be, protected with a pair of fuses which are designed to "blow" when the current passing exceeds a predetermined amount, but it must be remembered that it is quite possible for a fire to be started without blowing the fuses, although they be of the regulation size. Generally speaking, the most common causes of trouble are faulty materials, bad workmanship, and moisture. Faulty material would include badly designed apparatus such as motors and their starters, generators, resistances, fuses, switches, lamp-holders, fittings of all descriptions, conduits and shoddy wires. Bad workmanship may be caused by carelessness, incompetence or deliberate neglect.

Dealing first with materials we would say that, generally speaking those at present on the market are good in quality, design, and finish, but in these days of keen competition, in the case of any commercial product, there is always the danger of unscrupulous manufacturers trying to swell their profits or to undersell their rivals by producing goods of inferior quality and finish. The defects, however, are usually apparent on inspection, and we have a chance of rejecting it before trouble can ensue. Our greatest source of worry perhaps, among materials, is the shoddy wire, and that at times is difficult to detect.

Under the heading of bad workmanship we have included the worker who is careless, incompetent, or negligent. The careless worker is slovenly and untidy in his work, tries to solder a joint with a half cold iron or forgets to use rubber tape when insulating a joint, and, as a rule, finishes a job with the expression "That's good enough." Among the incompetent we find bell-hangers, school boys, and the man who wants to add another light to his installation after the contractors have finished. Of the negligent, we can only say that as a man who deliberately sets fire to a building is charged with arson when caught, so should the negligent in electrical work be dealt with as a criminal. Moisture or dampness must always be avoided in electrical work and special precautions taken where such situations occur.