"thorough" on first testing a new material, as there will be probably many evidences visible on mere inspection which would lead one to expect changes in the material. Subsequently a far less pretentious test will be all that is required to ensure repeat orders of material being satisfactory. As the best means for obtaining high pressures, and also of varying the pressure, is by means of alternating current; this, of course, should be used. It must be noted that varying periodicity would give varying results; also, that the shape of E.M.F. curve affects the results in the same way, a peaky curve being more apt to break down the insulation than a flat curve, though both may have the same R.M.S. value. An alternator giving fifty periods and approximately a sine curve of E.M.F. would be suitable, and would correspond somewhat to prevailing practice in alternating-current work in England. A variable-ratio transformer is practically indispensable for obtaining the varied voltages required to test the different classes of insulators. Though it may be possible at times to use one of two machines for testing purposes, it is preferable to stick to one (unless the machines are identical), as the more constant the conditions of testing the more reliable is the information obtained. The larger the works and the more elaborate might be the testing, but however simple the apparatus, it is desirable to pressure test all insulating papers, etc., at varying temperatures on first testing unknown materials; afterwards it would probably only be necessary to test at one temperature, supervision being kept over the appearance of all materials, as variations from the standard article are thus detected. Supervision is most essential in connection with varnishes and paints, and attention to appearance should, if possible, be supplemented by testing with the hydrometer to see that the specific gravity does not change. This is partly a check on its chemical constituents, any alteration in chemical composition generally affecting its specific gravity.

Taking tests for the specific points mentioned for insulating materials in the foregoing in the order named, we have for paints and varnishes:

1. Quick Drying.—This is merely a matter for trial, and can be done either in the open air or in a drying-stove, as desired.

2. Elastic Strength.—This may be tested by coating a piece of presspahn, tin or copper (metal for preference), and when dry bending backwards and forwards. An electrical test can also be made after the bending to see if this has affected the insulating material.

3. High Melting Point.—First dry off the liquid components and then heat the residue, and see at what temperature it melts. If the drying was done in a thin layer, it would also be possible to note when it commenced to char.

4. Affecting Copper.—Copper strips may be coated and examined after an interval (which is practically working conditions), but a quicker way is to put copper filings into a quantity of the varnish. They will readily show if the varnish will in any way affect the copper.

5. Waterproof, etc.—The varnish or paint could be tested on some plant about the works, where there is generally some motor or other running under adverse circumstances as regards oil, etc. A test might be made of a piece of metal left exposed to the elements for some considerable time.

6. This we will deal with later, along with 4 and 5 for fibres, etc.

Taking now fibres, papers, etc., we find—

1. Pliability.—This is, of course, purely a matter of trial.

2. Creasing.—A good test to subject the material to is to make two creases crossing each other. This is likely to be as severe as anything short of an actual tear.

3. Non-Hygroscopic.—This might be tested by immersing all samples systematically for a short time in water and then testing for breakdown after drying the surface.

The tests for 4 and 5 for fibres, papers, etc., and for 6 in varnishes and paints, can conveniently be made in a felt-lined box, heated by either lamps or a resistance frame, the latter for preference if the higher temperatures are desired. If a thermometer be fixed projecting into the box, the desired temperature is easily noted, and can be regulated by varying the current through the resistance. The box should be fitted with two terminals about 1½ in. in diameter, the flat surfaces having the sharp edge rounded off to prevent excess of pressure at these points. If one of the terminals be fitted with a flat spring, a fairly uniform pressure will be secured, as the thickness of the samples tested does not vary within very wide limits. Ordinary instruments would be necessary for reading current and voltage, the ammeter indicating at once the breakdown of any specimen under test. It is the systematic recording and making of these electrical tests that enable the designer to make the most of the materials at his disposal. They also, as previously noted, keep the materials used up to sample, and, therefore, more reliance can be placed on the work of the various departments. One point remains to be emphasized in pressure tests, and that is that the breakdown strength is not proportional to thickness, especially in the case of fibres and such like materials which are built up in layers. It would appear very difficult to get rid of moisture in the thicker sheets, and this brings down the insulating strength.

A very important test which should not be overlooked is the galvanometer test for leakage, as some materials may be good against piercing and yet be bad from a leakage point of view. Take mica-paper for instance. This, if the mica is well laid—that is, with all joints well lapped—will show well under a disruptive test, but for leakage would depend entirely on the mucilage or varnish with which the mica flakes are built up. Failing a standard galvanometer testing set, a rough test may be made by testing against a known good insulator, and noting the discharge and the length of surface over which it takes place. This can, of course, only be done when the thickness of the piece tested is secure against breakdown from the pressure applied to obtain this discharge. Every care should, of course, be taken to accurately gauge the thickness of material under test, especially at the point of breakdown.

In conclusion, it may be said that attention to this question of insulation is amply repaid, and it is well to bear in mind that it is not well "to spoil the ship for a ha'porth of tar."—Electrical Engineer, London.

CEMENT SPECIFICATIONS.

The Canadian Engineer for March, 1902, gave details of standard Portland cement tests as prepared by a committee of the Canadian Society of Civil Engineers.

We here give the specifications for Portland and natural cements adopted by the American Railway Engineering and Maintenance-of-Way Association. There is also appended the specifications for concrete as submitted by the committee of the Association. Though the convention did not pass upon the concrete specifications, they were considered of such importance as to justify publication in this form.

Portland Cement.

Portland cement is a product of the mixture of clay and lime-carbonate in definite proportions, calcinated at a high temperature and reduced to a fine powder. Cement shall be packed in well-made wooden barrels lined with paper, or in strong cotton or paper sacks. Each package shall be plainly marked with the brand and name of the manufacturer, and the net weights shall be exact and uniform. One barrel shall contain not less than 376 pounds of cement, and four sacks shall be equivalent in weight to one barrel. All cement shall be delivered in sound packages, undamaged by moisture or other causes. Cement must be stored, until used, in a perfectly dry place in such manner as will ensure it from all damage. All cement failing to meet the requirements of the specifications may be rejected, and all rejected cement, whether damaged or rejected for other causes, shall be removed at once from the company's property.

All cement shall be subjected to the following tests: (1) The selection of the sample for testing, the number of packages sampled, and the quantity taken from each package, must be left to the discretion of the engineer, but each sample