vapor in the air. The mean result is an exact check of the correction factor previously found at the Bureau.

To facilitate the reduction of observations to normal candle-power, a chart is given from which the departure of a lamp from normal value can be read directly when the barometric pressure and the readings of the wet and dry bulb thermometers of a ventilated hygrometer are known. The chart is plotted for a pentane lamp, but it may be applied to other flames without introducing serious errors.

TECHNOLOGIC PAPER NO. 15.

SURFACE INSULATION OF PIPES AS A MEANS OF PREVENTING DAMAGE BY ELECTROLYSIS.

By Burton McCollum and O. S. Peters.

AN investigation of the subject of surface insulation of pipes as a means of preventing damage to underground metallic structures by stray currents from electric railways has recently been completed at the Bureau of Standards. Tests were made of the various substances available for the purpose of insulation of underground structures, including paints, pitch and asphalt dips, pitch and paper and asphalt and felt wrappings, and so forth. Test specimens were made by lining shallow sheet-iron cones with the material to be tested. Before being subjected to the final test each cone was filled nearly full of ten per cent. salt (NaCl) solution and an alternating difference of potential of 80 volts (effective) applied across the coating for 30 seconds, in order to be sure that it was continuous and without flaws. A milliammeter in series with the specimen indicated a defective coating by a kick of the needle. The electrical resistances of the perfect specimens were then approximately determined with a Wheatstone bridge. In the case of the paints these resistances were found to be of the orders of from 10^5 to 10^{11} ohms per square centimetre, while for the wrappings they were much higher.

The final test of the specimens which survived the preliminary test consisted in allowing water and air alternately to come in contact with the coating while a direct potential difference of either four or fifteen volts was applied across the coating. The

value of the voltage applied depended on the thickness and other characteristics of the coating. In some of the specimens made up from each material the iron of the cone was made negative and in others positive, while in the case of the paints some of the specimens were subjected to the alternate action of air and water with no potential difference applied, in order to check up the effect of the electric stress.

The alternating contact with the coating of air and water was obtained by filling the cone and allowing the water to evaporate, which took about a week. Readings of the current flow were made at suitable intervals. The first appearance of current flow was taken as indicating the end of the useful life of the specimen as an insulating coating.

The average life of the paints was about 116 days, the maximum life obtained from any specimen being but little more than a year. No conclusive evidence was obtained that the low potential differences applied had any effect in hastening the initial failure of the coatings. The wrappings lasted longer than the paints and dips, but none of them much more than 400 days. It seems from the results that the failure of the coatings must be caused by absorption by them of water, which in time penetrates to the iron, allowing current to flow and destroy the coating by electrolysis. After the first appearance of current flow the destruction of the coating was observed to proceed very rapidly.

The conclusion drawn from the results of the laboratory tests,—*i.e.*, that the protection against electrolysis which is obtained by wrapping or painting pipes or other metallic bodies for use underground is only temporary,—is borne out by tests on insulated pipes buried in the ground under practical conditions, and also by correspondence with gas and water companies whose experiences lead to the same conclusion.

Protective Rubber Coating for the Hulls of Ships. R. DITMAR. (*Z. Angew. Chem.*, xxvi, 565.)—It is stated that coatings composed of rubber mixings, raw or semi-vulcanized, prepared from low-grade rubbers rich in resin, and preferably containing large proportions of factis (a rubber substitute) and inorganic fillers, when pierced by a projectile will close over the hole and so prevent the inrush of water. The coating may be made more resistant to water by adding tar. It is laid on or cemented to the hull of a ship and painted to protect it from attack by marine animals.