

boiler. When conditions developed which made it necessary to remove the tubes, they were cleaned and inspected, the corrosion being judged usually by the number of tubes of each set which had to be discarded, and the relative depth of pitting. Table I contains several recent examples of such investigations, typical of tests which have been run on many roads.

#### TUBES FOR CORROSIVE CONDITIONS

When it comes to a choice of tubes to withstand corrosive conditions we usually recommend "National" lap-weld steel tubes, which have the advantage of a patented process of roll-knobbling that the steel receives in being worked down from the bloom to the plate. By this kneading operation the metal receives considerably more mechanical work laterally, is made uniformly dense and other conditions being equal is more resistant to corrosion.

#### ADVANCE IN MODERN STEEL TUBES

The increased use of steel tubes in latter years, is probably due to a recognition of the physical superiority of the material, together with a better understanding of the causes of corrosion. A special grade of open hearth steel has been developed which is now used in the manufacture of both lap-weld and seamless tubes. Particular attention is given to the welding quality of this steel, and its power to withstand manipulation in setting and reworking. There is now practically no loss in installing modern steel tubes, either lap-weld or seamless, and as they will withstand without cracking so much more expansion than the old charcoal-iron, it is not a matter of much consequences if the flue-sheet hole happens to be worn a little large. The sectional expander may be used in setting, without fear of splitting the tube, and a good shoulder obtained behind the sheet and a strong bead in front, thus holding the tube firmly in the flue-sheet. The sectional expander or if preferred the roller expander, may be used until the tube is too thin for further service on this class of steel tubing, without injury to the metal. The steel being stiffer than the iron, requires less attention on account of leaking while in service, which means of course considerably less cost for maintenance. The steel beads are stronger than charcoal-iron and much better able to resist the various stresses incident to modern service. In order to be sure that each lap-weld tube is up to the required standard, a machine was designed to turn a flange on the crop ends cut from each tube. This testing operation as carried out every day in the mills is illustrated in motion pictures at this meeting.