winter is solved these ports are destined to have a monopoly of the foreign trades. When on tracing on the map the continuous artery of communication formed by the Inter-Colonial, Grand Trunk and Pacific Railways, stretching from those shores to the Pacific coast, by which the products of the forests and farms of the great West may be expeditiously transported many thousands of miles on their way to Eastern markets, one is impressed by the favorable position of these cities by the sea.

THE measurement of water in pipes is a practical operation, more easily performed than many mechanics are aware of, and often of the utmost use, especially to millwrights. A pipe 1 inch in diameter and 1 yard long will contain 28.26 cubic inches of water, or about one pound in weight. The capacity of a pipe increases in the ratio of the square of its diameter—that is to say, a pipe 2 inches in diameter contains four times as much, and one 3 inches in diameter nine times as much, as a pipe 1 inch in diameter. The practical rule, therefore, for finding the quantity of water in a pipe of any given diameter is as follows, and is sufficiently exact for all ordinary requirements in mill work: Square the diameter of the pipe in inches, and the product is the number of pounds weight of water in one yard of the pipe. As a gallon of water weighs about 10 pounds, divide the number of pounds by 10 (which is done by shifting the decimal point one place to the left) and the result is the number of gallons of water in one yard of the pipe. For example, a pipe 8 inches in diameter will contain 64 pounds, or 6.4 gallons of water, for every yard of its length. For the total capacity of the pipe, it is only necessary, of course, to multiply the contents of one yard by the whole number of yards of the pipe's length. A cubic foot of water weighs 62½ pounds, and contains 6¼ gallons. These figures have slight but unimportant variations, and the rule given here will produce a result sufficiently accurate for all ordinary purposes of measurement in mill work.

PROGRESS IN INDUSTRIAL EDUCATION.

It is pleasing to note the rapidity with which the idea of a practical industrial education for the youth of both sexes on this continent is gaining favor. The experiment is being tried in many places, new schools are being opened, and the whole subject is being investigated by committees appointed for the purpose. It is only a question of time when all large towns will have schools for the practical education of the rising generation, and we trust that the day is near at hand when this system will be incorporated with the present public school system. In the progress of this new system of education, note is made of the fact that the Industrial Education Society of Boston, in 1877–8, made the experiment "to give boys that intimacy with tools and that encouragement to the inborn inclination of handicraft, and that guidance in its use, for want of which so many young men now drift into overcrowded and uncongenial occupations or lapse into idleness or vice." The city generously gave the use of one of its ward rooms for this new and novel school, and three gentlemen, a photographer and two practical wood carvers, gave their services gratuitously, Tuesday and Friday evenings of each week, as superintendents and directors of the work. The experiment was successful, and there were more applicants than the school could receive.

The outfit of the Boston school was: Thirty-two firm work benches for thirty-two boys, giving to each a space four by two and a half feet. Each bench had a vise with wooden jams and an iron screw, a drawer with lock and key, in which the tools were kept, and a gas-burner, with a movable arm. Each boy was provided with a work-apron of cotton drilling. Benches, tools and aprons were numbered, and each boy held accountable for their care and keeping. The following were the bench regulations: "Be at the bench at seven o'clock, according to your number. Do not leave the bench without permission. Make no unnecessary noise. Keep your bench neat, and do not deface it. After work place all the tools in their drawers, and return the key to the teacher. Every boy will be held accountable for the tools placed for his use."

Instruction, not construction, was the purpose of the school, its object being to make boys familiar with certain manipulations equally useful in many different trades.

This experiment has satisfied those interested, that manual education may be made an efficient part of public instruction. The student may be taught in classes, rendering it unnecessary, except in rare cases, to give individual instruction. A series of primary lessons in the use of wood-working hand-tools has been prepared by specialists in Boston which contain exactly the information required, in order that these arts may be brought as completely within reach of the ordinary educational methods as reading and writing. Eleven lessons, of two hours each, embrace the following topics: Use of the cross-cut saw; hammer-striking—square blows; splitting saw—sawing to line; jack-plane—smoothing rough surfaces; hammer—driving nails vertically; splitting saw—sawing at exact angles to upper surface; jack-plane—setting the plane iron; hammer—driving nail horizontally; bit and brace—boring in exact positions; mallet and chisel—mortising; jack-plane—producing surfaces which intersect at exact angles. Auxiliary exercises in laying out the work by measuring and lining, are incidental to all the lessons.

Since the opening of this Boston school an investigation of the whole subject has been made by a committee appointed at the instance of the associated charities of that city. This committee reports that it believes industrial training, or the training of the hand and eye and thereby the mind as well, is an invaluable element of education which deserves recognition and support such as has been given to so-called literary education; that it will interest many who do not come for purely literary studies, and that it develops faculties which other studies do not. They recommend that it should be adopted as a part of the public school system.

To show how far America is behind the other great nations in the execution of this reform, the committee obtained statistics showing that Austria has 1,037 schools for technical instruction, 4,296 teachers and 97,713 pupils, besides schools of forestry, mining and agriculture. Bavaria has 1,671 industrial schools for girls, 1,837 teachers and 71,635 pupils, a polytechnic school at Munich, 36 technological schools and 4 of agriculture. In Germany there are 34 schools of architecture, 25 of mining, 17 of forestry, 108 of commerce, 146 of agriculture, 10 veterinary and 86 other technical schools. Denmark has 49 "farmers high schools, with 3,135 students, of whom 1,003 are females. In Holland there are 11 navigation schools and 32 industrial and drawing schools. In Switzerland 4,373 females are employed in schools teaching needlework. In France a commission was for a long time engaged in the collection of evidence upon the success of industrial education elsewhere and reported strongly in favor of it. It was also declared by the directors of large industrial establishments that generally the deplorable absence of elementary instruction, even among the most intelligent of the workmen, was one of the greatest obstacles to the improvement of the artisan and the progress of industrial art. In view of these facts it appears clear that unless more attention is given to industrial education in this country, we may, in time, be obliged to depend upon foreign artisans. It is not necessary to carry this training to the extent of teaching the actual trades, since this would bring the public into competition with private enterprise. The object of the schools should be to give a general skill which may readily be turned to account in different kinds of work.

As to when the industrial branch should begin in the school coure, the Boston committee say that examples are given by the kindergarten recently started in Philadelphia for teaching the minor arts, the industrial schools in Cambridge, Gloucester and Boston, and elsewhere, wherein it is proved that courses in industrial training may be devised so suited for different ages, as that such training might be made to begin in the primary schools and be continued in the grammar schools, possibly even further, to correspond with the literary training given in the high schools. The committee add that sewing has already been successfully introduced into the girls' public schools of Boston. As to whether the proposed industrial training would interfere with the other studies they quote an authority on the "half time" system in education, who says: "There is a special mutual influence between the school and the factory which improves the quality of the work done in each."—*Industrial News.*