otherwise the incoming tide would tend to lift it vertically, and slide it along the sills. Should this ever happen, it would mean heavy wreckage and probable loss of life within the berth, due to the sudden inrush of water. The only way to prevent this is to allow an increasing amount of water ballast within the structure as the tide rises and thus insure its stability against the hydrostatic uplift. The thing to guard against was, therefore, the closing of the main flooding valve when the caisson is submerged and acting as a stop gate. This point was felt to be so important that it was decided to make the control of the flooding valve of such a nature that it would be humanly impossible to have it closed when circumstances would demand its being open. It will be remembered that when the caisson is berthed it is designed to act as a crossing between the two sides of the dock, there being a communicating bridge on the top. Consequently, if its roadway were artificially obstructed until the main valves were in the open and safe position, it was agreed that there would be small danger of the valves being left closed through inadvertance. The visual effect of a large notice board blocking the roadway, which could only be put out of the way by leaving open the main flooding valves, was thought to be a surer guarantee of safety than any attempted interlocking device between valve stems.

The erection of the floating caisson was carried on simultaneously with that of the rolling, the arrangement effecting a great economy in the use of the derrick car.

The heavy keel section was placed on a series of wedged keel blocks placed approximately at 3 feet centre to centre. These were carefully lined up and adjusted so that the keel came to an absolutely true bearing. The frames were then assembled up to elevation of deck E. From this point on no particular difficulty was encountered.

Messrs. M. P. and J. T. Davis, with Mr. S. H. Woodard as chief engineer, are the general contractors for the whole dry dock project; and all the work in connection with these two steel caissons was given to the Dominion Bridge Company, Limited, Montreal, as subcontractors. Of this company Mr. G. H. Duggan is general manager; Mr. F. P. Shearwood, assistant chief engineer; Mr. A. E. Johnson, mechanical engineer, Mr. P. L. Pratley, designing engineer and Mr. D. C. Tennant, chief draftsman, while to the writer was entrusted the direct charge of the work from its early stages. Changes in design were only made after consultation with the Department of Public Works, Ottawa, represented by Mr. U. Valiquet, supervising engineer, and Mr. S. J. Fortin, structural engineer. They had also the approval of all detail drawings.

By the beginning of September, 1915, without reckoning roads constructed in the region occupied by the field army, work had already begun on the construction of a network of Russian State railways with a length of 3,530 miles, to cost $315,368,000. The construction has been sanctioned of new lines totalling 300 miles at a cost of $26,478,000, and the building was proposed of new railways totalling 1,812 miles, at an outlay of $196,194,000. In all, these new lines and branches have a length of 5,645 miles, and for their construction is demanded about $538,000,000. The realization, however, of proposals for the building of new lines has been postponed till the end of the war.

At Drammen, Norway, new zinc works are about to be started for the extraction of zinc by an electric wet process, invented by a Belgian engineer, M. Sturbelle. Raw materials for the first year, about 10,000 tons, have been secured, and special attention will be paid to ores containing from 8 to 30 per cent. zinc, which have hitherto been considered as really worthless.

SOME SUGGESTIONS PERTAINING TO THE OPERATION OF WATERWORKS PLANTS.*

By John W. Toyne.

The operation of a waterworks plant is essentially a question of management, and in the present paper I have treated it exclusively from this viewpoint. The management of any utility consists of two distinct features—the management of the physical plant through the utility's operating force and the management of the utility's business relations with its customers. This is equally true whether the utility is privately or municipally owned. Applicable, too, to both, are the several regulations recently adopted by the public service commissions in Indiana as well as other States.

The management of the physical features of a utility is an engineering problem, and I use the term "engineering" in its broader sense, which includes experience, sound judgment and the ability to build and maintain a loyal organization, as well as the essential theories taught us in the technical schools. Any one of these alone is good; all are absolutely essential in order to attain the most desirable results, and as in any line of endeavor really worth while there is no "royal road" to real success.

The questions that continually confront the manager of a utility are: Of what does my plant consist? What is its value? Of what is it capable? Is it rendering the highest possible efficiency? Is it rendering the best service possible? What provisions must be made to meet changing conditions? Is anything being overlooked that is essential? Does it pay?

I am afraid if we were asked these or similar questions a great many of us, at least, would experience some little difficulty in assuring even ourselves that we really knew the answer.

Is it sufficient, from the standpoint of the manager, to sum up one's plant as so many acres of land, so many buildings, certain pumping machinery, so much power generating equipment, so many miles of distribution pipe lines, so many hydrants, valves, meters, etc., enumerating only the physical items? Does not the human element, the operating force, enter as largely into the make-up of a plant as its mere physical properties?

Given the best equipment, the most scientifically designed distribution system and an unfailing supply of water, and still your plant is sadly deficient if this feature has not been properly provided.

A knowledge of the value of the plant, not only in its entirety but by units, is essential in order that provisions may be made for replacements as well as a fair return above maintenance during their useful life. In my own work I have adopted the system of permanent, unit inventory, showing for each unit, wherever possible, date of purchase, manufacture, purchase price, cost of installation, probable life, depreciation annuity and present value. In a great many cases the compilation of an inventory of this character is a really formidable undertaking, owing to the incomplete and inaccurate data of record necessary, but once developed it is of inestimable value to the manager, even though frequent corrections or adjustments must of necessity be made.

Every manager cannot only well afford but cannot afford not to paraphrase Pope into "Know, then, thy plant"; not only its value, either its cost or appraised unit

*Read at annual convention of the Indiana Sanitary and Water Supply Association.