instance, in the case of four similar railways; two of 300 ft. and two of 600 ft. length, one 300-ft. railway equipped with a 1-ton and the other with a 2-ton car, the 600-ft. systems similarly equipped; all handling material of such weight as to carry their rated capacity on each trip and all so efficiently loaded as to be able to realize about the highest hourly capacity of each installation, the cost of labor chargeable to each ton carried would vary considerably, for but one good operator would be necessary in any case. The cost of operation per ton handled on the longer of the two systems with 1-ton cars would be but 30 per cent. more, as far as labor or attendance is concerned, than on the shorter railway, while similar comparison between the two 2-ton car systems would show a labor burden of 36 per cent. more for the longer than for the shorter system. A comparison of the two 300-ft. systems and the two 600-ft. would show an increased burden for labor per ton for the shorter installations of about 80 per cent. for the 1-ton car railway, and for the longer installations of about 70 per cent. more for the railway with the small car.

Installations of the same length and similar cost of construction would vary somewhat as to first cost, depending upon whether equipped with 1- or 2-ton cars and similar installations, as far as construction cost and size of car, but of different length, would also vary, it is true, but this variation would scarcely effect the economic value of the installation, as the burden imposed by interest on investment, taxes and insurance would be the only items to appreciably affect the net cost of operation. These items would in themselves not vary to any great extent, for initial cost of installation would not differ much between a 1-ton car or a 2-ton car railway, nor would the cost of similar installations of different length vary directly with the length of the railway; rather the cost per foot of railway would vary more nearly inversely as the hourly capacities of the systems. For instance, the cost per foot of a 300-ft. railway would average about 30 per cent. more than the unit cost of a similar railway 600 ft. long. The customarily necessary allowance to make for depreciation, renewals, etc., can almost be neglected in the ordinary automatic railway installation, as there are many instances on record where such systems have been in almost continuous daily operation for over 40 years with practically no depreciation evident, the originally installed car still being used, and no renewals except a very occasional new cable or possibly a new sheave or block.

The variable labor charge may also be greatly discounted, for, in the average installation, some attendance would very probably be required at the loading hopper if the operator of the railway was not present. The cost of elevating the material handled to the loading hopper or to the automatic railway car itself—installations occasionally being made where the car is loaded directly from the apparatus performing the preliminary work of elevating the material to be carried—is rarely more than would be required for similar operation by any other system that could be employed to handle the load to the point where the automatic railway car drops its load to bin or storage, not more than a few additional feet of elevating being required for the material to be discharged to a loading hopper of even the largest size ordinarily employed.

In operations requiring the knowledge of the exact weight of material handled, the automatic railway enables such records to be kept easily and economically, without the necessity of any delicate or complicated automatic weighing devices, etc. A platform car scale with double beam is the only accessory necessary. The operator simply records the weight of the empty car on one beam, then loads the car and balances the weight of the loaded car on the second beam, the reading on the second beam then gives directly the net weight of the load, which may be entered in a "tally book" while the car is traveling from the loading hopper to the discharge point and back. This semi-automatic weighing system accurately measures the exact amount of material that is discharged from the car, any material remaining in the car being accounted for in the next empty car reading and subtracted from the load dropped by the car on its next trip.

Possibly the greatest advantage of the automatic railway, however, is the reliance that may be placed on its continual operation. Once properly installed and adjusted, no attention at all is required other than an occasional inspection of cable, etc.—the car always automatically returns to the loading point after discharge of load, so is always ready for operation. High-grade ball or roller bearings are used for all rotating parts so lubrication is reduced to a minimum and the general high-grade of equipment that the system required for satisfactory operation minimizes the expense for incidental supplies of all kinds.

The disadvantages of the system are exceedingly few, one being its somewhat limited capacity. This, however, is no great detraction, for, requiring no supply of power for its operation, it costs practically nothing to have the system in operation for sufficient time to enable it to carry all the material that a power-consuming conveying system of greater hourly capacity could handle in considerably less time but with a charge for power, increased burden of depreciation, etc., and probably a heavier attendence charge for the shorter operative hours than that entailed in caring for the slower system. Another drawback to the automatic railway is its comparatively short operating range. This is limited to 600 ft. as the maximum, and it is doubtful whether railways shorter than 50 ft. in length would operate entirely satisfactorily owing to the comparatively short distance that the descending car would have in which to store up momentum sufficient for the operation of the system. However, this limitation does not affect many installations where the mechanical handling of materials is advisable if not necessary.

Although the automatic railway is primarily designed and adopted for the handling of material in bulk, which can be automatically dumped from a gable-bottomed car, modifications of this standard have been installed for handling materials in bags, etc. For such service, a special type of flat car is used equipped with a mechanism by which the car is held stationary on completing its forward travel, at the unloading point, the operating weight of the system being held in an elevated position at the same time. On unloading the flat car, the holding attachment is released and the operating weight of the system drops and pushes the unloaded car back to the loading point.

[NOTE—This article is the seventh of a series on "The Mechanical Handling of Materials," written for *The Canadian Engineer* by Mr. Trautschold.—Ed.]

Boston proposes to have a forty-foot channel in its harbor because there is now in commission and in prospect ships requiring that depth of water. Boston now has in its service mammoth liners drawing from 32 to 33½ feet. In July this port handled twice as many ocean passengers as Philadelphia, and four and one-half times as many as Baltimore.