not be off-set by decrease of empty mileage, and by savings affected to general business. Also that if expense can be saved to owners in the receiving or depositing of property, it enables them to pay a better freight rate.

The methods of transacting business connected with the transportation and handling of commodities have changed greatly during the past twenty years. It is worth investigating whether these changes which are beneficial to the country at large, have not conduced to the diminished average movement of cars, and whether this diminished movement has not really added to the facilities for transacting business, and that if these facilities be curtailed, it may be necessary to make corresponding reductions in freight charge.

Mr. Chanute also referred to the figures given by Mr. Shinn, which show that a large percentage of freight cars run empty. It costs nearly as much to travel an empty car as a full one, and by designing and managing cars so that they can be loaded back, and having a sufficient number to enable them to wait for such back loads, empty mileage may probably be reduced.

He also referred to the economy likely to result from the establishment of large warehouses at terminal points.

He also, while agreeing with Mr. Shinn that there are serious defects in the present system of mileage charges, suggested some objections to the per diem charge which Mr. Shinn proposes to substitute.

First, that it may lead to a considerable increase in the mileage of empty cars.

Second, that there would be difficulty in following the per diem charge over the different roads over which the car passes so as to afford a check to the owner.

Third, the probable increased expense in keeping the accounts beyond the present system, with the probable necessity for the establishment of a car clearing house.

Fourth, the opposition which will arise to the proposed change.

Fifth, the confusion and hardship likely to occur from changes of methods.

Mr. Chanute suggested these objections, not as insuperable, but to show that there must be a well matured plan presented, rather than merely the suggestion of a plan.

He also considered the charge of one dollar per day, proposed by Mr. Shinn to be entirely too large because it yields much more than the interest upon the cost, depreciation, and cost of repairs.

He presented figures showing the cost of the cars and of their maintenance upon the Erie, and the Pennsylvania railroads, and from these figures drew the conclusion that a per diem charge of 25 or 30 cents per day would be a fair one.

The paper was also discussed by Messrs. Cooper, Forney, Emery, Hamilton and Shinn.

THE GRANTHAM IRON WORKS.

(Drummondville, P. Q.)

BY B. J. HARRINGTON, PH. D.

Nearly a century and a half ago, the King of France, Louis XV,* displayed a most commendable zeal in stirring up certain of his subjects in the New World to take advantage of the deposits of bog iron ore, which had long before been discovered in the vicinity of Three Rivers, on the St. Lawrence. In 1730 he gave a Royal License to a company to work the ores, and even advanced 10,000 livres to aid in building a furnace, &c. No work having been done, he subsequently withdrew the license, but in 1735 granted it to another company, which received 100,000 livres in aid, and in 1737 erected a blast furnace, the stack of which is still standing. Several other furnaces have since been built in the same region, and also near the St. Francis River, south of the St. Lawrence, where ores similar to those of the St. Maurice, have long been known to exist.

Of the latter, one was erected in 1869, by the "St. Francis River Mining Company," at St Pie, in Yamaska County, and was sold in 1874 to Messrs. John McDougall and Co., of Montreal. Mr. Robert McDougall, of the St. Maurice Forges, was then appointed manager of the St. Pie Works, and under his superintendence, smelting operations were carried on for six years, when the furnace was abandoned, owing to the difficulty of obtaining sufficient supplies of ore within a reasonable distance.

It was, however, found that bog ore of good quality could be obtained in abundance in the vicinity of Drummondville, on the St. Francis; and, accordingly, an excellent site having been acquired near the town, a small blast furnace was erected in 1880. The enterprise proving successful, a second furnace was built, close to the first, in 1881; an office, store, dwellings for the workmen, &c., have also been put up, and now the scene presented is one of busiest activity.

For convenience in charging, the furnaces have been placed near the foot of the sloping bank of the St. Francis, where advantage can also be taken of the water-power afforded by the river. One stack is built of stone, the other of red brick, made of clay obtained on the spot. The internal measurements of the brick furnace are as follows:

	Ft.	In.
Height	32	0
Diameter at boshes	10	0
" of hearth	3	4
" of throat	4	0
Height of hearth	5	0

The stone furnace is thirty-four feet high, but otherwise similar in dimensions to the above. Both furnaces are lined with fire-bricks imported from England. The brick furnace has three tuyères, and is worked with hot blast; the other has the same number of tuyères, but the blast is cold. The blowing machinery is that which was formerly used for the bloomaries at Moisie, and is now driven by a Leffel turbine of forty-five horse-power. Each of the two horizontal blowing cylinders is eight feet long, and four and a half feet in diameter, the length of stroke being seven feet. When set up at Drummondville, this machinery was only intended to supply the blast for one furnace, and now it has to do duty for two, and when the water in the river is low the pressure obtained is insufficient, being at times only from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch of mercury. The hot-blast stove is of the ordinary type with siphon-pipes, but is defective in construction. The temperature of the hot blast on reaching the tuyères is said to be about 300°, and the manager states that with the blast heated to this temperature, the production of iron has been only about 10p.c. greater than with cold blast, and that no very marked difference in the quality of the iron has been observed.

The average charges employed are:

Bog iron ore	400-600 lbs.
Limestone	50 "
Charcoal	20 bu. = about 260 lbs.

The daily production of pig iron (mostly numbers 2 and 3) has not averaged more than five tons.* The

* Not Louis XIV, as stated in Mr. Swank's Census Report on the Iron and Steel Production of the United States, (Washington, 1881.) Louis XIV died in 1715.

* The iron is used entirely for car-wheels, and is worth from $28.00 to $30.00 per ton in Montreal.