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THE NEW YORK CABLE RAILWAY.

For several months a cable railway has been running steadily and without interruption of any kind on 10th Avenue, this city, from 125th Street north for a distance of about 3¼ miles. The massiveness of the machinery, the admirably planned and handsome building in which it is placed, and the smoothness with which everything works, justify us in presenting a somewhat detailed description.

This system differs in many essential points from those in use elsewhere, and is so designed, by means of duplicate cables and independent engines and driving gear, as to insure the continuous operation of the road under all probable conditions arising from accidents of any nature. In a city like New York, a great many street car lines are operated continuously during the day of twenty-four hours; and as it is impossible to get machinery and wire ropes that will run forever, without stoppage for repairs, it becomes almost absolutely necessary that some plan of duplication should be adopted. We therefore find that the principal characteristic of this system is of course the double line of cables that run side by side through the trenches; while one of these cables is working the other is held as an auxiliary, or reserve, only to be called into operation should anything disable the first. The machinery is so arranged that the load can be easily and quickly transferred from one rope to the other, and the grips on the cars are made double, so as to take hold of either rope as occasion requires. This method not only insures the uninterrupted operation of the road, but also provides for a careful inspection of either rope and the repairing of either whenever necessary. It allows the cables to be operated alternately for twenty-four hours, thereby providing time to make repairs to machinery or ropes; the change of ropes causes no interruption to travel.

The engine room, of which we present two views, one looking toward the street and the other toward the rear, is occupied in the portion next to the street with two Wright automatic cut-off engines, which may be used either together or independently. Each engine is of 300 horse power, the cylinders being 28 inches in diameter by 48 inches stroke; each flywheel is 18 feet in diameter and weighs 40,000 pounds. Upon each engine shaft is a gear 6 feet in diameter and 18 inches face, meshing with a gear 13 feet in diameter on the line shaft. (For convenience of description, we will consider the machinery driving the drums over which the cables pass as being divided into two sections, one at each side of the engines.) This shaft is 12 inches in diameter and 100 feet long, and at the center is provided with a coupling, in order that either side or section can be operated independently of the other and by either engine.

The shaft revolves in ten bearings, and drives at each section a system of gearing carrying two sets of cable drums. As will be seen from the engravings, particularly the enlarged view of one of the sections, Fig. 3, the gearing is placed in the center of a rectangular space, upon each long side of which are two drums working together. Thus there are four sets or pairs of drums, each pair with its own cable, and either of which can be operated independently of the others, or all may be worked at the same time. The two cables of the same section constitute the double ropes that pass over the same route and with-

(*Continued on page* 70.)

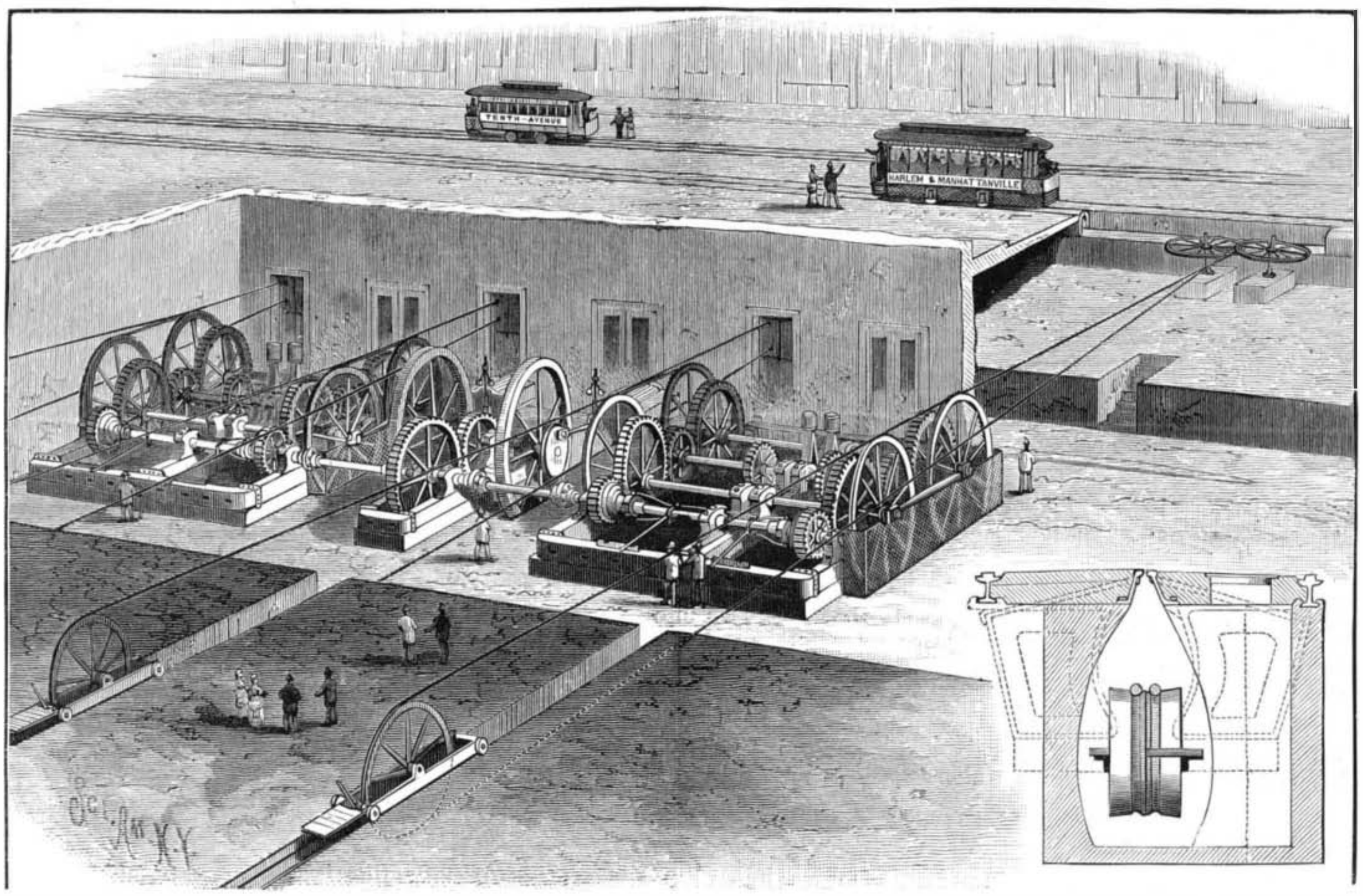


FIG. 2.—VIEW OF OPERATING MACHINERY.—LOOKING TOWARD THE STREET.

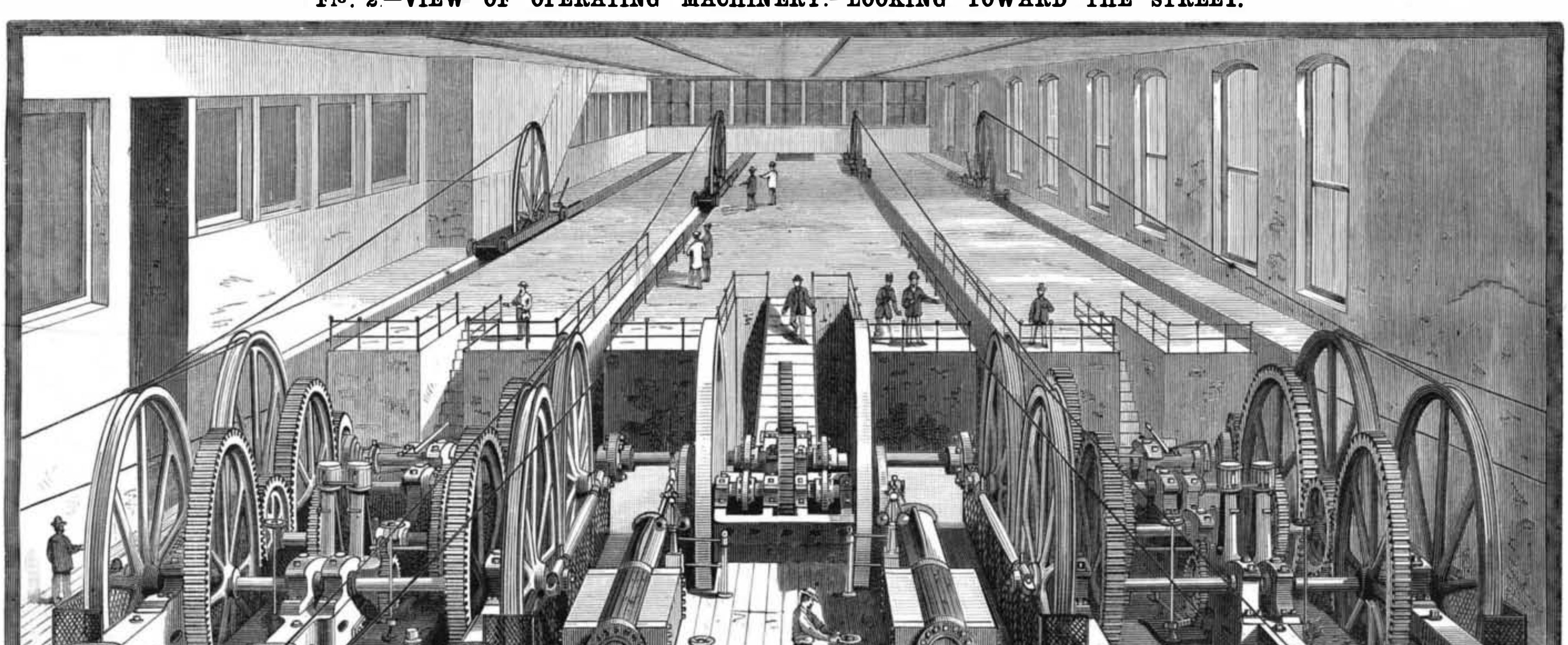


Fig 1.—OPERATING MACHINERY OF TENTH AVENUE CABLE RAILWAY, NEW YORK CITY.—LOOKING TOWARD THE REAR.

THE NEW YORK CABLE RAILWAY.

(*Continued from first page.*)

in a few inches of each other. One of these sections now operates the line along 10th Avenue, and the other will in the near future operate cables passing through 125th Street, from river to river. On the main shaft are four loosely mounted pinions, two at each section. Each pinion drives a train of gearing carrying a pair of drums, and as they are precisely alike in construction, a description of one will answer for all. Meshing with the pinion is a gear on a shaft, so mounted that it carries one of the driving drums upon its outer end. The second driving drum is carried by a shaft having a large gear wheel, similar to the one on the first shaft. Between and meshing with these gears is a smaller one. Around each pair of drums a cable is wound.

An important variation from the construction usually found in machinery of this kind is here introduced. Generally the bearings of the drum shaft are placed one at each side of the drum. The advantage of placing both bearings at the same side of the drum, as in this case, is apparent. When the tension car, owing to the stretching of the rope, has reached the upper or farther end of the pit, the surplus length of rope can be easily taken up by winding it once more around the driving drums, thereby saving the time, trouble, and expense of splicing. The outer ends of each pair of drum shafts are connected by a strut, adjustable in length by a key, and which serves to take the strain created by the cable passing around the drums, and relieves the bearings.

Each pinion on the line shaft is provided with a friction clutch operated by a handle lever, the bearing points of which are so arranged that there is no strain brought upon the shaft, to throw it either way in the direction of its axis, when the clutch is closed. The clutch consists of two sets of steel plates, one set secured to the pinion and the other to a sleeve sliding longitudinally upon, but revolving with, the shaft. The plates of one set alternate between those of the other, so that when pressed together by the lever, operating through a compound toggle, the friction between them is sufficient to revolve the pinion with the shaft.

The incoming portion of the cable passes around the drums, then around a sheave on a car running on tracks laid on the edges of the pit, shown in Fig. 1, and then to a sheave located so as to guide the rope into the trench along the middle of the street, as shown in Fig. 2. The slack in the cable is taken up by weights on a differential lever at the upper or rear end of the tension pit. The two cables operated by the same section run through the trench upon independent pulleys at a distance of about 3 inches apart. The grip is formed with clutching jaws at each side of the lower end, so that either cable may be grasped to propel the car. By means of the double grip, the cable in use is bound to drop into the grooves of its own pulleys as the car passes on. A cross section of the trench is shown in Fig. 2.

The care of the ropes in the cable system is a very important item, and experience has proved that they should be examined at least once in twenty-four hours, to discover, if possible, any breaks which might otherwise cause the rope to "strand:" For this purpose the pair of small vertical engines shown in the center of each section are provided to move the idle rope slowly. It is also very convenient often in repairing a rope to move it a very little, without starting the main engines. Steam is supplied by four return tubular boilers of 150 horse power each, located in the rear of the engine room. The operating machinery was built by Messrs. Poole & Hunt, of Baltimore, Md. Its smooth and almost noiseless working shows the accuracy and skill displayed in executing the designs, while the great size of many of the parts shows the facilities at their command, and conveys some idea of the extent of their works. The duplicate system for cable railways is the invention of Mr. D. J. Miller, of this city.

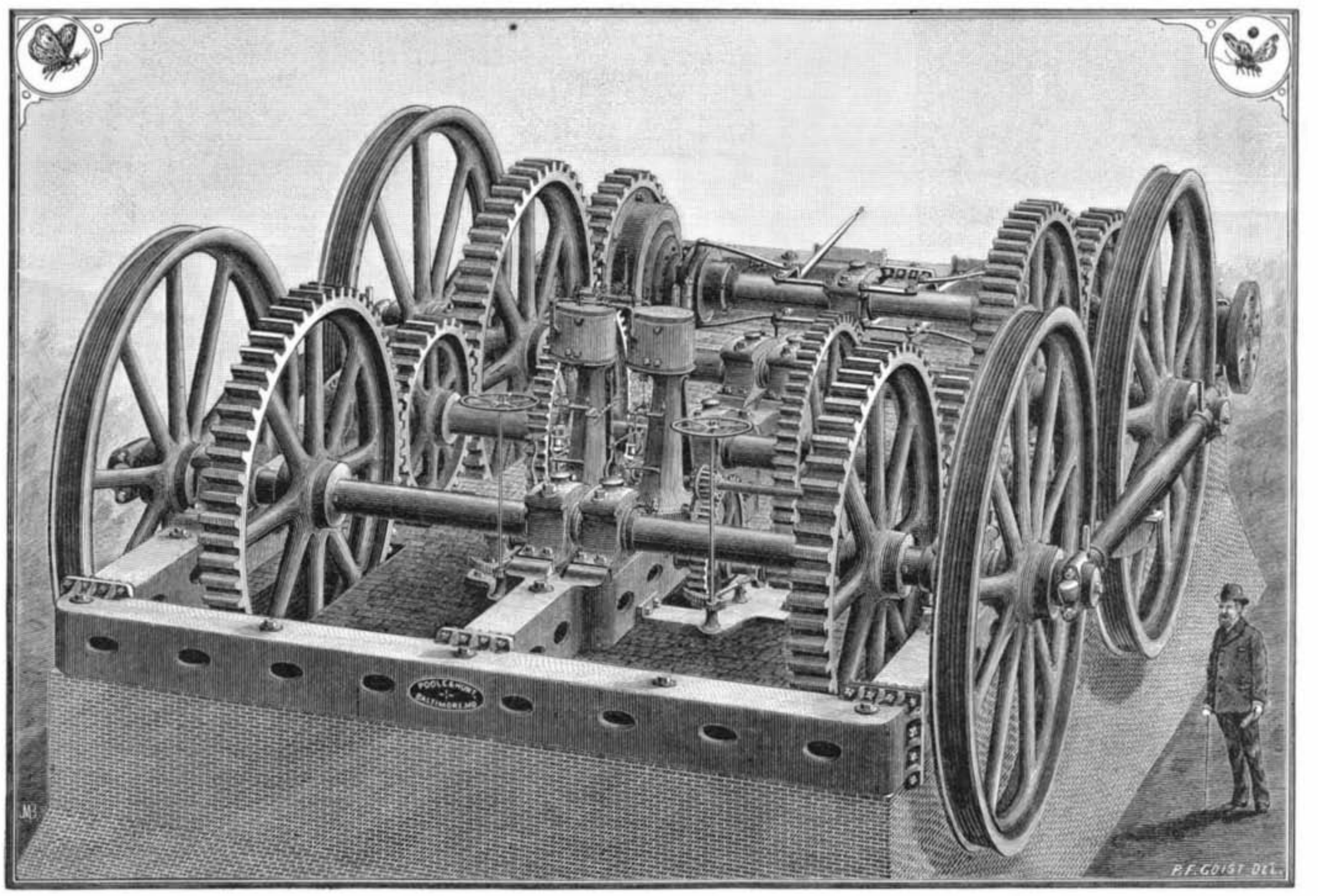


Fig. 3.—NEW YORK CITY CABLE RAILWAY.—ENLARGED VIEW OF ONE SECTION.

MAKING STEAM BY FRICTION.

The friction still illustrated by the accompanying engravings has been devised, says the *Engineer*, by Mr. Lional Pearse, of Coalbournbrook, near Stourbridge, for the production in an open boat, or in any boat at sea, of small quantities of fresh water from sea water without any heat supply except that of muscular energy. The still and the small machine for illustrating the frictional generation of heat are very ingenious applications of well known phenomena and of the experiments of Count Rumford. Mr. Pearse has succeeded in solving a problem which has occupied many minds; and although no vessel expects to be wrecked, there is little doubt every well-appointed passenger ship will carry several of these little machines for their boats.

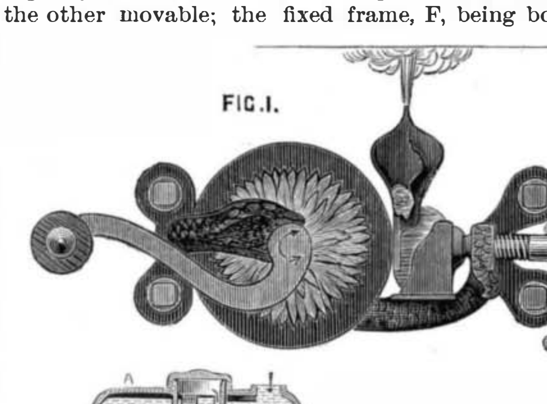
Fig. 2 shows a friction still fixed to and let through the seat or after thwart of a ship's boat; above that seat is the condensing or domed part, and below is the malleable iron framing. The machine may, of course, be fixed to any, or the most convenient, place in a boat. Our engraving is about one-fourth full size. The framing may be said to consist of two parts, one fixed and the other movable; the fixed frame, F, being bolted through the seat, fixes the part above the seat to that below. The metal supporting the boiler must be understood to be part of this fixed frame, though the section does not clearly show it. The movable frame, M, is capable of a sliding motion in three bearings, one above the pressure screw, S, and another to each side of friction wheel, W. It is single where shown in section, and branches off to each side of the wheel to form bearings for the spindle, P. This frame brings the friction wheel, W, in contact with the boiler, B, at B^1 with any desired pressure, regulated by the pressure screw, S. The inequalities which may occur in the periphery of the friction wheel are compensated for in the elasticity of the packing at E. Either side of the spindle may be fitted with a handle, and the same still can be worked effectively within the range of power from that of a lad of fourteen years of age to a man power. The boiler, B, is held in a hard wood block to prevent heat being readily conducted to the metal frame supporting it. The upper part of the machine is hinged at H, and may be thrown open, leaving boiler and friction wheel exposed; the inner domes, D^1 D^{11}, also hinge open or take out for any attention that may be required.

The overflow tank, T, is pivoted so as to be easily released from the boiler. The manner in which it is fed and the action are as follows: It will be seen that the upper tank, A, is full of sea water; from this tank the water is made to pass at intervals in the directions indicated by the arrows. It then passes down small pipes shown in the center, and feeds or saturates the flannel with which the two domes are covered. The arrows still indicate the course of the sea water after it has left the coverings, and it will be seen that that from the inner dome, D^{11}, as it is collected by its trough, runs through a pipe into the overflow tank, T, which tank is openly connected with boiler, B, keeping that fed with sea water to the height allowed by overflow tank; the overflow from the middle dome, D^1, is allowed so run away as cooling water, because that from the inner dome is sufficient feed for the boiler, and, being hotter than that from D^1, is preferred. The water enters the boiler at the bottom, as shown by the arrow. The heat result of the friction of the wooden wheel, W, against the steel on the boiler at B^1 causes the sea water to boil in about half a minute. The steam then rising is wrapped in the dome, D^{11}, and, condensing upon its inner surface, drains away into its trough, then from that to outlet pipe, P. The condensed steam or distilled water may be traced throughout the engraving indicated as drops.

The heat given up by the steam condensed upon the inner surface of dome, D^{11}, will be imparted to the sea water held in the saturated flannel covering the dome, D^{11}; this water is freely vaporized at a lower temperature than that required for the boiler, its vapor being condensed upon the inner surface of dome, D^1, inclosing it. The action of vaporizing and condensing goes on in the next compartment as just described, but at a lower temperature; the product from the three condensing surfaces can be traced as drops all flowing into and out of outlet pipe, P. The feed water, W, in the tank, A, will, when the machine is in full work, reach a temperature that a delicate hand cannot bear by heat imparted to it from the vapor which condenses upon the domed bottom of the tank.

If the machine is worked by the power of a boy of fourteen years, the product from the two flannel-covered domes will be nearly double that of the boiler; if worked by a man, the product from the boiler will be equal that of the two domes, making the profit through the domes upon the man's work much less in proportion to that of the boy's work. Cov-

FIG. 1.



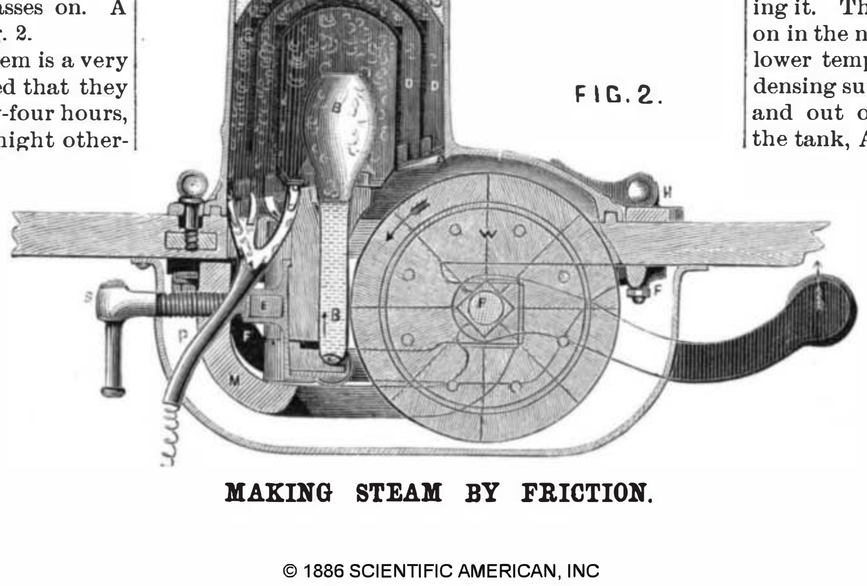


FIG. 2.

MAKING STEAM BY FRICTION.