

PROF. A. B. KENNEDY, F.R.S., recently delivered a lecture in which he said that nothing was impossible except perpetual motion and the transmutation of metals; and about the latter it is hardly safe to be sure, for Prof. Dewar might shortly tell them that at a temperature of about -273 deg. everything was the same, the difference between gold and lead being only a matter of thermo-dynamic function. All the impossibilities were perpetual motions—attempts to get more out of something than was in it. He gave, as instances, the attempt to utilize the steam in an engine over and over again, and to make out of coal a fuel which had twice the value of the coal itself.

ONE of the greatest engineering feats of the century has been the construction of the Manchester ship canal. It was several years before Parliament would pass the bill giving power to the company to commence work, so great was the opposition of Liverpool, who feared she would lose her pre-eminence in the carrying trade, should Manchester become practically a seaport town. Work, however, commenced in 1887, and after the expenditure of an immense amount of money, the canal is at length complete, having been opened on the 7th inst. The public opening will take place on New Year's Day, with a great procession of vessels. What will prove of special interest to Canadians is the fact that the procession will be headed by the "Sophie Wilhelmine," from Parrsboro', N. S. The directors of the canal will pay her £100 for the delay incurred by her in waiting for the public opening, and for lowering her masts to pass under the bridge. The captain will receive a gold watch as a memento of the occasion.

WHAT is possibly the oldest marine engine in the world—certainly the oldest in America—was taken out of the steamer "Sadie" at Oakville this winter by Doty Bros. & Co., to make room for a new engine. This steamer was formerly known as the "St. Jean Baptiste," and the engine in question was built at Birkenhead, Eng., in 1804. Parts of this engine were replaced from time to time, but other portions have been in use every year since the engine was built, and the longevity of this piece of machinery is one of the most remarkable on record. The publishers of THE CANADIAN ENGINEER being anxious that such an interesting relic should be preserved, suggested the advisability of its purchase by the Ontario Government, to be deposited in the School of Science or some museum, but so far we believe no action has been taken. We understand that Doty Bros. are willing to give the engine for such a purpose at its value as old iron, say \$240, and it would be a great pity if such a valuable historical relic should be lost for the sake of this small amount. Who will step in to save it?

SUCTION, AS APPLIED TO FIRE ENGINES AND PUMPS.

BY WM. PERRY, MONTREAL.

Just two hundred and fifty years ago, namely, in the year 1641, a mechanic in Florence received an order to make for the Grand Duke a pump, with a suction pipe extending between fifty and sixty feet between the valve and the level of the water. The pump was made and fixed, but, of course, when it was worked it raised no water. In the belief that the fact was due to some defect in the construction, the maker was told to take it to pieces. This was done repeatedly, and new attempts were made to get the pump to perform its

duty. When nothing more could be done in this way, the superintendent of the Grand Duke's waterworks consulted Galileo, then eighty years old, blind and within a few weeks of death. The philosopher had never seen reason to doubt the truth of the opinion universally prevalent at the time, that nature "abhors a vacuum"; it was universally thought that the power which raises water in pumps is some occult force, which, resisting all attempts to form a void, instantly presses water up the pipes when the air previously in them has been exhausted by the piston. When the whole circumstances of the difficulty at Florence were placed before Galileo, he could only reply that nature's abhorrence to a vacuum is limited, and ceases to operate above the height of thirty-three feet. This opinion, given without opportunity for due examination, was probably not quite satisfactory to Galileo at the time. Within two years Torricelli, who lived in his family, and assisted Galileo during the last three months of his life, was able to announce that this "occult force" was the pressure caused by the weight of the atmosphere.

This important fact he first established by an experiment as simple as it was ingenious and conclusive. He had made a model of the Grand Duke's pump, which had a suction tube sixty feet long placed perpendicularly, with its lower end in water; when the air at the top was exhausted, Torricelli found that he could by no means make the water rise more than 32 or 33 feet. The length of the pipe was next reduced to forty feet, but without better success. It then occurred to the experimenter that if it were indeed the weight of the atmosphere which sustained the water in the pipe, a substance other than water would rise to a height in the tube exactly in proportion to the relative specific gravity of water and of the other substance employed. But a short time elapsed before this thought was submitted to the test of an experiment. The medium employed was quicksilver, which is about fourteen times heavier than water; and when a vacuum was produced in the top of a tube, the lower part of which was filled with quicksilver open to the pressure of the atmosphere, it was at once seen that the column was supported at a height of only one-fourteenth that of the column of water.

The new doctrine put forward by Torricelli was attacked with a virulence almost equal to that which, a few years before, had been shown on the announcement of his master's discovery that the earth revolved round the sun. It is difficult enough now to see who or what was injured by Torricelli's discovery, but the Jesuits opposed it furiously, and perhaps, had a less liberal-minded prince than Pope Innocent X. been on the throne of the Papal States, the young philosopher might have been seriously impeded in his work, if not subjected to personal inconvenience. In the midst of the discussion to which his pronouncement gave rise, Torricelli died at the age of 39; this event took place in the year 1647.

The question was then taken up by Pascal, a French mathematician and divine. He verified the experiments which had been previously made, and varied them, using wine and other liquids, always arriving at the same result. Pascal also was the target for much sarcasm and small wit, and encountered hostility in various ways, but he persevered, and at length his upon an experiment which he at once saw, if successful, must be universally accepted as conclusive. This was to repeat the experiment of Torricelli several