shaft and one on the solid shaft gearing each into both of the gears of the separate engine shafts, so that one engine must run in the opposite direction from the other engine. There is a slight difference in the diameter of the gear wheels, the wheels on the engine shafts being the largest, having 40 teeth of 3½ inch pitch, and those of the fan wheel and knife wheel 33 teeth; therefore, while the engine shaft makes 175 revolutions, the knife and fan wheels will make 200 revolutions, each in opposite directions.

The arrangement for reversing the knives for the purpose of cutting the snow from either the right or left is somewhat difficult to explain without drawings. There are four knives, consisting of one-half inch steel plate, 40 inches long and 24 inches wide. They swing on the knife arms, which extend from a square wrought iron hub to a bearing fastened to an angle iron at the circumference of the wheel, which is 8 feet 9½ inches diameter. The space between the knives is occupied by plates of steel, five-sixteenths inch thick, forming sectors of a circle. They are fastened to the angle iron on the circumference, and radially to four other spokes of wrought steel between the knife arms. The knives are held in a position forming an angle of about 30° with the sector plates, leaving openings of about 12 inches between the edges of the knives and the edges of the plates. At the end of the knives next to the hub the bearings have attached to them gear segments, which again gear into others, each of the latter having one strong bevel wheel tooth attached, which projects over the end of the square hub next to the end of the fan-wheel shaft, but does not come in contact with the latter. The end of the fan-wheel shaft next to the square hub of the knife wheel forms a hub, and is provided with a deep annular groove to receive a ring, 4 inches wide, with four bevel wheel teeth, corresponding to the teeth of the second segment gear of the square hub. The bevel wheel ring can slide in and out on the central part of the fan-wheel hub a distance of 3 inches, and may thus be engaged with the four segments of the square hub, or may be disengaged after the work of reversing the knives, which is done automatically, has been performed. The first gear segments are each provided with two notches, corresponding to the two positions of the knives, and a four-winged clutch latches into those notches, holding the knives in proper position. The clutch may be disengaged by sliding it parallel with the axis of the shaft, which is done simultaneously with the sliding of the bevel wheel ring, bringing the latter to gear with the second segment gears, and, the knives being free, they will swing over to the other cutting position when the bevel wheel ring is allowed to return. After this work of reversing the knives has been performed, the ring and clutch fly back, the clutch fastening the knives again, and the ring in the same instant disengaging the gears. The clutch has four rods attached, passing through the square hub, and connected to a sleeve back of the hub. Springs in the hub keep it in proper place. The bevel wheel ring also connects by means of rods to a sleeve around the hollow shaft, and springs keep it disengaged from the gears. Two rods behind the fan-wheel hub pass outside the shaft through the pillow block, and are attached to a ring-shaped plate on the shaft, to which a spring latch arrangement is attached, so that when the ring-shaped plate is forced forward by means of a lever combination at a certain position of knife and fan wheel, the clutch and bevel wheel ring are both moved forward. The engines are then slowly reversed, and the latch on the hollow shaft disengages at the proper place, fastens the knives, and disengages the gears, and the shovel is ready to do its work again in the opposite direction.

The opening of the spout can also be changed so as to cast the snow on the proper side corresponding to the motion of the fan wheel. The spout starts from the circumference on the top of the drum with an opening of 6 ft. Part of the sheet on each side forming the circumference of the drum leads off tangentially at an angle of about 50°; so that if such sheet from each side were continued to the vertical center line, the vertex of an angle would be formed there, but the sheets being cut off, they leave an opening of about 42 inches measured horizontally. In order to form an opening on either side of the center line of the drum, a cap or plate is introduced which swings at the vertex, forming there a bearing on each side of the wheels, which incase the opening fore and aft. This plate continues at the same angle as the sheets from the drum, and rests on the latter. The shaft on the top of the cap plate running across from sheet to sheet extends beyond the back sheet to receive a chain wheel, and a chain runs from there below to a pinion, to the shaft of which a hand wheel is attached by which the cap may be changed to either side of the spout. A pawl with ratchet wheel on the pinion shaft keeps the cap in its position. There is also an arrangement attached to the bearings of the cap shaft by which the cap may be raised or lowered in the center for the purpose of changing the angle. At an angle of 50°, and at 200 revolutions of the fan wheel, the horizontal distance thrown (if the snow is well enough packed) would be about 248 ft. and the vertical height about 74 ft. At the trial near Buffalo the number of revolutions was not noted, but the distance thrown was reported to be 295 ft., and from this it is calculated that the fan wheel must have made at least 210 revolutions. To avoid any danger of throwing the whole machine from the track in case of ice having formed inside the rails, an ice breaker is attached in front of the forward wheels of the front truck. This ice breaker consists of two strong pieces of steel inside in the shape of a large planing tool, projecting about 2 in. below the tops of the rails, and placed inside them. They are attached to a frame which swings on the axle, and may be raised, when required, from the inside of the house. There is also a flanger attached in rear of the back wheels of the forward trucks, to remove the snow remaining on and betweeen the rails and not taken away by the shovel. The attachment is made in the same manner as the ice breaker. It may also be raised when necessary. A steam brake is attached to the wheels of the rear truck.

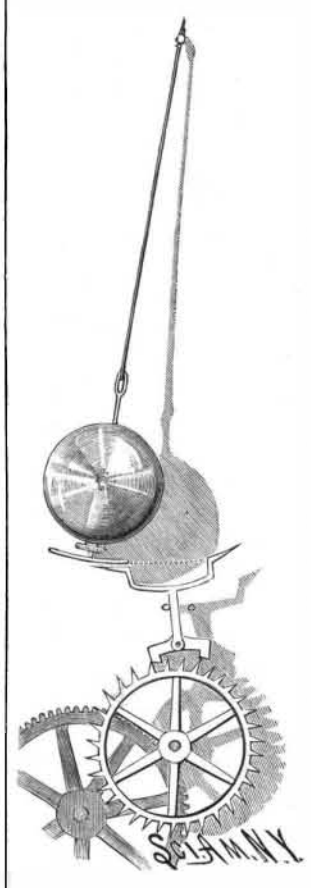
The principal dimensions of the machine are as follows:

Distance apart of centers of trucks	16 ft. 8 in.
Center of front truck to back of drum	3 " 11 "
Extreme length of drum	5 " 1 "
Extreme length of frame from back of drum	29 " 1 "
Extreme length of machine	34 " 2 "
Height of machine to top of spout	12 " 8 "
Width of house	9 " 6 "
Length of body of house	28 " 4 "
Length of roof of house	31 " 6 "
Weight of entire machine, about 45 tons.	

Among those present at the test were several railroad officials, who strongly indorsed the work done by the machine, and expressed their conviction that any railroad subject to snow blockades could be kept open in the most severe storms by the use of these shovels, thereby causing a great saving in rolling stock, and preventing delays.

PENDULUM ESCAPEMENT.

The construction and operation of the pendulum escapement recently patented by Mr. William Hart, of Kirksville, Mo., will be readily understood from the accompanying engraving. The improvement consists simply in applying power through a lever escapement to a pendulum. The pendulum, being detached, meets with less resistance after receiving an impulse, and hence is more accurate for time. The power being applied at or below the ball instead of so far above and so near its place of suspension, much less power is required to keep it in motion, or to run the clock.



Less power being required, there is, naturally, less wear; and a reduction in springs, weights, and material may be made throughout. Weaker or thinner springs being sufficient, there is less liability of their breaking. The dial of the clock is brought down where it can be squarely seen, and no ladder is required in winding. In tower clocks the pendulum may be made of any desired length, and run up into the steeple out of the way. An accurate compensation may be had by extending a rod from the bottom of the ball up, for the support of the pendulum.

Stepping Stones to Success.

Learn your business thoroughly.

Keep at one thing—in nowise change.

Always be in haste, but never in a hurry.

Observe system in all you do and undertake.

Whatever is worth doing at all is worth doing well.

One to-day is worth two to-morrows.

Be self-reliant; do not take too much advice, but rather depend on yourself.

Never fail to keep your appointments, nor to be punctual to the minute.

Never be idle, but keep your hands or mind usefully employed except when sleeping.

Use charity with all; be ever generous in thought and deed—help others along life's thorny path.

Make no haste to be rich; remember that small and steady gains give competency and tranquillity of mind.

He that ascends a ladder must take the lowest round. All who are above were once below.

Think all you speak; but speak not all you think;
Thoughts are your own; your words are so no more—
Where Wisdom steers, wind cannot make you sink;
Lips never err when she does keep the door.

—*Selected.*

New Electric Tramcar.

A public and very successful trial on the lines of the South London Tramway Company of an electrically driven tramcar was lately made, which is thus described by *Engineering:* The propelling power was furnished by secondary batteries manufactured by the Electric Power Storage Company, and the motors and gear were constructed to the designs of Mr. A. Reckenzaun, whose name is intimately associated in England with the utilization of electric accumulators for the purposes of locomotion, both by land and water. The car which figured in the trial trip has already been running at night on Queen's Road, Battersea, for six weeks past, in order to subject its machinery to a prolonged trial, and previously to that it was tested for a very considerable time at Millwall upon a line 400 ft. long, with inclines varying from 1 in 17 to 1 in 40, and with a curve of 35 ft. radius.

The trial trip was made under the command of Mr. Reckenzaun, and was undertaken to give the Local Board of Wandsworth an opportunity of seeing the performance of the car before granting their permission for its use within their district. Thirty passengers were carried, and the full rate of speed allowed, namely, six miles an hour, was easily maintained even uphill, very considerable inclines being easily mounted. The car proved to be under complete control, and could be stopped and started as readily as a horse car. The machinery ran perfectly silent, and an inside passenger had no evidence that there was anything unusual in the vehicle, except from the interest manifested by the people on the footpaths, and occasionally by the behavior of a too intelligent horse, who seemed inclined to resent this invasion of the vested interests his race possess in street traction. The car carries under the seats sixty accumulators weighing 40 lb. each, and capable of propelling it, with a load of 46 passengers, over an average country for two hours. The cells can be run out at the end of the car and replaced by fresh ones in a few moments. The current is utilized in two Reckenzaun motors, each mounted on a four-wheeled bogie frame, and driving one of the axles direct by means of a worm and wormwheel. The worms are very quick pitched, so that the wheels can drive them when the car is running downhill, or traveling by momentum only. The wormwheels dip into oil baths.

All the connections are taken to main switches on the driver's platform. Each switch handle has three positions; in the first the circuit is broken, in the second the current passes through the two motors in series, and in the third the motors are connected up parallel to each other. In the second position a current of 30 amperes flows from the battery, and in the third a current of 100 amperes. This latter position is used when starting the car from rest, or when on inclines, and the second during general working. The total weight of the car and machinery is 4¼ tons, made up as follows: Car, 2½ tons; accumulators, 1¼ tons; motors and gear, ½ ton. The working expenses for traction, including interest and depreciation, are estimated at 3½d. per car mile, or one-half of horse traction.

Electric Motor Trial.

The Daft Electric Light Company are building some motors for testing the merits of their invention in a practical manner on some of our railroads. The *Electric Record* records the fact that two motors are being built for the Baltimore Union Passenger Railway Company, and one for the trial on the Ninth Avenue Elevated, New York city. On both roads work is rapidly being pushed. On the latter the portion chosen for the trial lies between Fourteenth and Fifty-fourth streets, a distance of two miles. As both uptown and downtown tracks will be equipped, there is needed four miles of center rail, This is a 30 foot, 56 pound standard rail. A portion, however, is laid with a smaller rail, 50 pounds to the yard. It has already been hoisted the entire length, and now only the laying is needed for completion. The rail is specially insulated with Mr. Daft's patent umbrella-like insulators, four of which are placed to each rail. Already the laying is finished from Fourteenth to Thirty-fourth street, on the uptown track. The trackmen finding it a little novel at first, slow progress was made. Its completion will be noted within about 10 days or a fortnight. It is proposed to use the two center rails parallel for the outgoing current and the four outer or regular rails for the return current. By this means the calculated resistance of such a system is very slight indeed. The framework of the motor is completed, and now only the work of assembling is need to finish it. Its estimated weight is about seven tons. On Sixteenth street, in an old sugar house—No. 428—one of Mr. Wright's 150 horse power stationary engines and the dynamos will be placed. The foundations are nearly completed, and within a few weeks the primary station will be in readiness.

Thousands of miles, the writer says, have been traveled by these motors, and heavy machinery has been driven for fifteen months or more, thousands of feet from the primal source of energy. The result of the experiments about to be made will go far toward solving the practical and financial problem of utilizing electricity for propelling purposes.