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THE GREAT GAS METER OF THE CONSOLIDATED GAS COMPANY OF NEW YORK.

We have already illustrated in this paper the largest pair of gas holders in the world. Though they belong to England, and though there are no gas holders in this country that can compare with this colossal pair, the great meter shown on this page is to be seen in this city. It stands in the meter house of the 21st Street station of the Consolidated Gas Company. In drum capacity, or actual working power, it is the largest in the world.

The case is cylindrical, and is made of cast iron. The heads are each in four segments, bolted together by radial flanges. This not only obviates the necessity of making castings of such difficult size and shape, and so liable to warp, but it also secures a strong piece of work. The flat heads of large meters spring more or less on account of the water pressure exerted upon them. The flanges in the construction shown stiffen the heads, so that little or no springing takes place. In England, as a rule, square cases are used for meters. These are not favorites here, as when large they require much internal bracing to enable them to resist the pressure. As a cylindrical drum is the object to be inclosed, a case of corresponding shape seems the most logical.

The drum is made of heavy tin plate. It is built on an elaborate frame of angle and T-iron, perforated for rivets where required. This frame was constructed from an exact model made of tin, and of small size. Over the large frame, the duplicate of the small one, the tin was riveted, the rivets soldered, and the edges and joints of the sheets solidly soldered together.

The case was taken through an opening broken through the side of the building for the purpose, and placed upon its foundation piers. The drum was set up and completed on the floor in front of the case, and then was placed in position within it. This was an operation of peculiar difficulty, occupying a number of men several days. Its weight was six tons, and this had to be handled with the utmost care, for fear of deformation. All the prying and lifting had to be done against the iron frame. The tin was not touched, lest it should be bent.

The old way of constructing drums was to provide them with fixed shafts. These rested in journals, and rotated with the drum. In the meter we are describing, a departure was made from this method. A stationary shaft reaches from back to front of the meter case, resting on brackets attached to the heads. The drum is carried by this shaft, and has journals in its center pieces, and revolves around it like an idle pulley. This is considered an advance on the old construction.

The usual disposition of inlet and outlet pipes and of index plate is followed. The gas enters at the center of the back plate. It goes through the drum, turning it on the principle of an Archimedes screw as it does so, and emerges from the drum into the case and leaves it by the outlet pipe. This is also connected to the back head, to one side and above the inlet pipe. These inlet and outlet connections are of 30 inches internal diameter. The index plate occupies the center of the front face. It contains the long row of dials indicating the amount of gas passing, arranged in a circular arc, and within the arc is a clock.

The case is 17 ft. 9 in. in length, and 18 ft. 6 in. in outside diameter. Its drum capacity is 3,000 cubic feet. This means that in each revolution it delivers that quantity. Its capacity per day of twenty four hours is placed at 4,500,000. This is based on a general drum speed of one revolution per minute Unquestionably it could far exceed this amount, and could probably dispose of 6,000,000 cubic feet per day.

It would be hard to find any mechanical construction of such simplicity, yet so hard to describe and understand thoroughly as a wet gas meter. If the reader can picture to himself an Archimedes screw extending through an angle of 180° only, he will have a correct idea of one of the compartments of a meter drum. As a rule, there are four such compartments. In the small drawing we show the construction. A drum is there represented, part of the outside cylinder and cap being cut away to show the interior. A cylinder has its interior divided by four partitions that are slightly helical. At the back and front, quadrant plates are soldered to these and to the edge of the cylinder. These plates are a little inclined outward from the plane of the base of the cylinder. They run in opposite directions to each other, so as to carry out the general helical direction of the partitions, but far more abruptly and about at right angles to the partitions. The free edges of these two partitions lie almost in the same plane, parallel to the axis of the drum, and nearly coincident with two radii.

The plane determined by these two edges is the correct water level. The drum is immersed to that depth in water. The threefold partition described, being repeated four times, gives four helicoidal divisions. As the quadrants or "hoods" dip under the water they close one end of a division. This immersion coincides with the lifting of the other hood from the water. Hence, when a partition is open at one end, it is closed at the other. If gas is entering a division, it cannot

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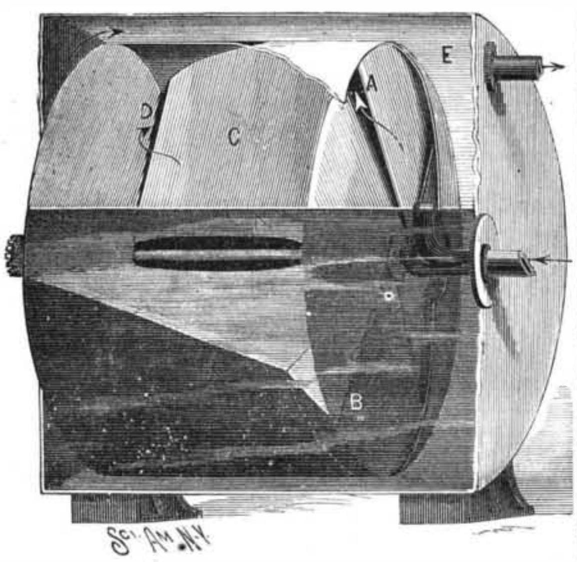
pass through it. As it forces its way in, it causes the meter to rotate. This gradually carries the inlet hood around until it is immersed in water. No more gas can enter the compartment; in other words, it is full of gas. But just as this immersion occurs, the outlet hood comes out of the water, thus giving the gas a way to escape from the drum. As the drum rotates, the gas is forced out, and the next division fills. In each rotation the four divisions are successively filled and emptied. Each one is an Archimedes screw, beginning and

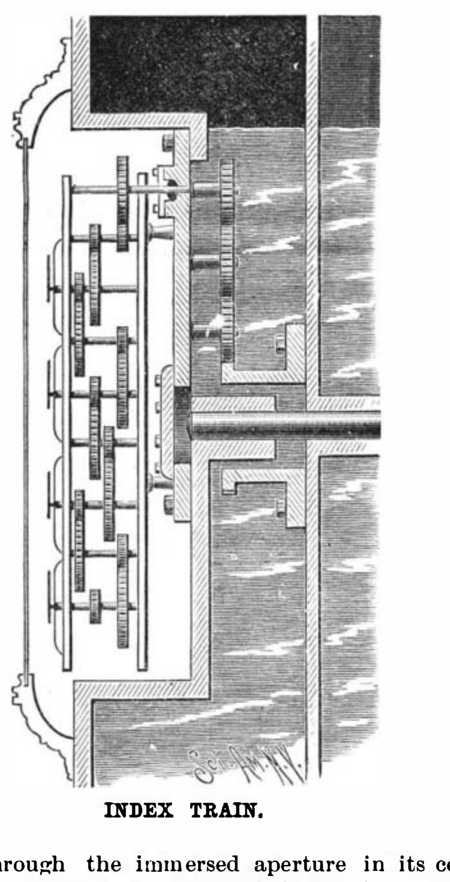


METER DRUM.

ending in about the same plane, but on opposite sides of the axis and opposite ends of the drums.

The water level, it will be seen, determines the capacity of the drum. Hence it must be preserved constant. This constancy in the meter we are describing is secured by an overflow. Water is continually running in and out of the meter through an overflow pipe of proper height.

It is also necessary to force the gas to go through the drum, and not around it. The rear end of the cylinder of the drum is carried out a short distance, and closed with a plate, solid except for a hole in its center. This hole is completely immersed in the water. The inlet pipe runs through this hole under the water and curves up into the space above the water. Thus the gas cannot go around the drum. The cap is shown partly in section in the small drawing, half being broken away. Referring to the drawing, the top of the drum is moving toward the spectator. The gas is entering by the curved pipe in the center of the back of the case. It is carried within the cap, the pipe



INDEX TRAIN.

passing through the immersed aperture in its center. The compartment marked C has just filled with gas. The opening of its inlet hood at B has gone below the water, so that no more gas can enter it, while its contents is escaping through the aperture of the outlet hood at D into the case, E, and thence by the outlet pipe into the main. Meanwhile gas is entering at A into the compartment next to and beyond C, and is turning the drum. The course of the gas is indicated by the arrows.

In the next cut is shown the arrangement of the index train. A gear wheel is carried by the drum. Its motion, by a train of idle wheels, is carried above the water line, where a spindle attached to a working gear wheel passes through a stuffing box in a recess in the front head of the meter. Hence the motion is carried through the long train of wheels, each successive one rotating at one-tenth the rate of its predecessor. Thus if one index rotates once around its dial for 1,000 cubic feet, the next one is reduced to one-tenth that speed, so that one rotation of this next index indicates 10,000 cubic feet. Each dial is divided into tenths of a rotation, so that the first dial mentioned above would be divided into successive hundreds of cubic feet.

The meter was erected by the American Meter Company, of this city, to whom belongs the honor of being the makers of the largest meter in the world. The iron work and casting of the case were executed at the Continental Iron Works of Brooklyn, N. Y.

Important Electrical Patent Decision.

An important decision was not long ago rendered in the Chancery Division of the High Court of Justice, London, before Mr. Justice North, in the suit of Abraham Van Winkle, of Newark, N. J., U. S. A., *vs.* William Alexander Carlyle, of Birmingham, England. This was a suit for infringement of dynamo-electric machines for electro plating, owned by the said Van Winkle, of the firm of Hanson, Van Winkle & Co., Newark, N. J., and has been some time pending in the English courts. An interim decree for injunction having previously been granted, it has now been made absolute—the defendant being restrained during the continuance of the letters patent or any extension thereof from making or selling any magneto-electric machines under or in accordance with or in violation of the letters patent on which the suit was brought.

The firm of Hanson, Van Winkle & Co. were the first introducers of dynamo-electric machines in this country, and the above decision is likely to have considerable influence on the sale of their new machines, both here and abroad, as this is considered a test suit.

The invention relates to the radial construction of the armature and the use of a governor to prevent reversal of the current.

THE CAPILLARY SIPHON—HERO'S ENGINE.

T. O'CONOR SLOANE, PH.D.

In the last article of this series we described some experiments with capillary siphons, emphasizing the fact that capillary force ceases to operate as soon as they become fully charged with water. A simple experiment appears in the cut, showing how a boat could be sunk by a siphon of this description. It is conceivable that a sail hanging over the side of an open boat into the water, its inner end reaching to the bottom of the boat, might fill it. The sail would first become charged with water by capillary action, and then, acting as a siphon, would draw water over the sides and into the interior.

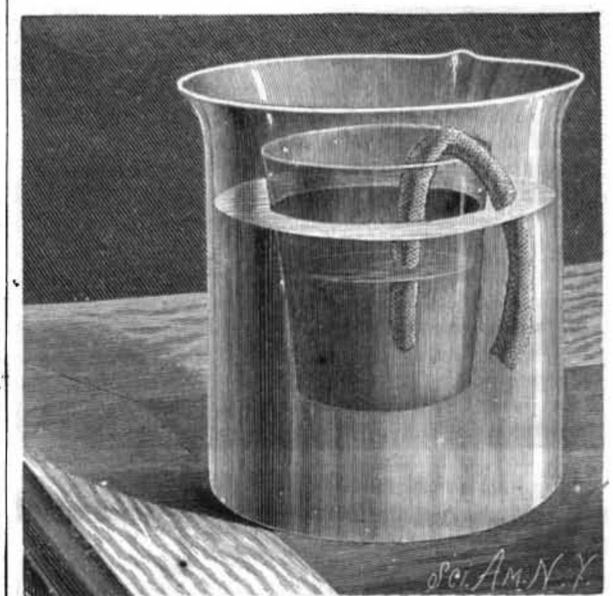
For the experiment, two vessels are needed. They are preferably of glass. One must be large enough to contain the other, with some space to spare. The large vessel is filled with water. The small one is floated in it. If the latter tends to cant to one side, a few bits of lead, or coins, or even sand, may be introduced as ballast. Thus arranged, the bottom of the inner vessel will be one or two inches below the level of the water outside of it. A lamp wick, or strip of muslin, preferably well soaked with water, is next placed in the position shown, care being taken to have the inner end reach well down toward or touching the bottom. The siphon action begins very soon, and water gradually collects in the floating vessel. This does not interfere with the siphonage by raising the level of the contained fluid, because very nearly as fast as it rises the vessel sinks. Thus the difference of level is maintained almost constant, except for the slight floatative effect of the additional portion of the glass submerged. The operation continues until the edge of the glass becomes even with the surface of the water on which it floats. The water suddenly rushes in and the glass sinks.

If a good quantity of muslin is used, the glass will sink in a few minutes. By the use of a lamp wick the operation will be somewhat prolonged.

The point made about the approximate constancy of the difference of internal and external level is an interesting feature of the experiment. It recalls the old problem about the level of water in a vessel in which a lump of ice is floating. The question is, how the level is affected by the melting of the ice. Assuming the temperature of water and ice to be about 32° F., the level will, of course, remain constant while the ice floats in it and after it is melted.

In the other illustration is shown a simple way of constructing a reactionary steam engine. It is on the principle used in the Barker's mill, already described in this paper. Steam is generated and driven out of an aperture. It necessarily pushes backward the tube from which it issues, and the tube is so arranged as by this backward motion to cause a central body to rotate around a fixed axis.

A round bottom flask, of about 150 cubic centimeters capacity, is a convenient one for the boiler of this primitive steam engine. It is fitted with a perforated cork and to the cork a tube is adapted, bent into the form shown in the cut. Its end is slightly drawn out, forming a large jet. The flask is half filled with water. A circular piece of wood, about six inches in diameter and an inch thick, is provided, through whose center a hole is made. This hole must be large enough to admit the neck of the flask freely, so that the board will rest firmly upon its shoulders. The hole may with advantage be chamfered or countersunk on one side to fit. A round bottom flask is recommended, because it will stand direct contact of flame when it contains water.



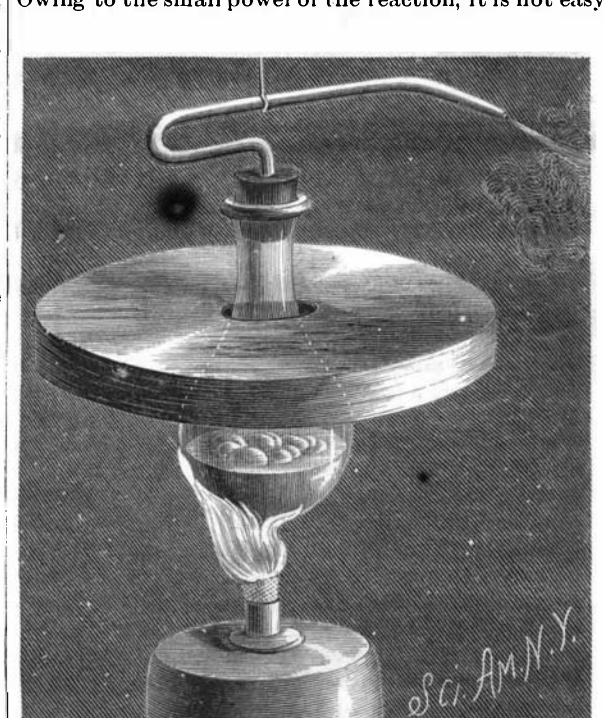
CAPILLARY SIPHON.

The cork, after the flask has been passed through the aperture in the board, is put in position in its neck, and the whole is suspended by a silk thread, which should be as long as possible. An alcohol lamp is placed under the flask and is lighted.

In a short time the water begins to boil. A few drops of water are first projected from the end of the bent tube, after which steam begins to issue. As the jet of steam acquires strength, its reaction becomes perceptible, and the tube is driven backward by it, imparting a movement of rotation to the suspended apparatus. The velocity increases until the bottle and board whirl around at high speed.

The circular board here comes into play in preserving, by its gyroscopic force, the steadiness of rotation of the apparatus. It retains the flask in position over the lamp flame. Without the board, the apparatus oscillates from side to side and cannot be well heated.

For a suspension cord a silk thread a couple of yards long may be used. A thread a foot long answers perfectly, but as the flask rotates, it becomes soon twisted or untwisted, and breaks; but a long thread will admit of several minutes' running before giving away. Owing to the small power of the reaction, it is not easy



HERO'S ENGINE.

to find an available swivel. The friction interferes with the speed.

It might be supposed that the board would be burned. But if the flame is made to impinge directly on the glass, the board will not feel its effects seriously. It will not, of course, be heated except for a few minutes at one time, and this will have little effect upon it. The experiment in connection with the Barker's mill is a good illustration of the identity of some laws affecting liquids and gases. It shows that both alike possess mass, and by their reaction, if caused to move, can generate absolute force due to mass moved.