CAPILLARITY AND HYDROSTATICS.

T. O'CONOR SLOANE, PH.D.

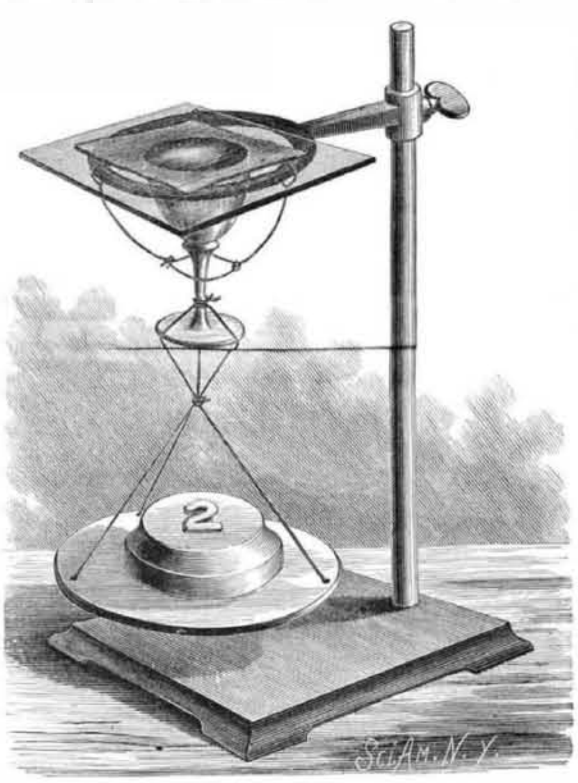
In the last issue a series of experiments in capillarity were described. The suggestion was made that the amount of vacuum determined by blotting paper could be subjected to a rough measurement by weighing. In the cut we show how this can be done. The wineglass is supported by blotting paper and glass plate on a retort stand, the vacuum having been produced in the manner described already. A loop of string hangs loosely below the body and surrounding the stem of the wineglass. A weight pan is suspended from its foot. Weights are placed on the pan until the joint is broken. Their weight, added to the weight of the glass, water, and scale pan, shows the strength which the joint developed. The loose loop is designed to catch the glass, and prevent it from spilling its contents, or falling and breaking.

A simple construction of the well-known Barker's mill is shown in the next illustration. For base, a small tin pan is used. In the center of this a step is secured, which is shown in section in the right hand corner. It consists of a short piece of brass tubing soldered to the bottom of the pan. A piece of glass rod, of corresponding diameter, has its end heated in a Bunsen burner or blow-pipe flame. While hot, a slight indentation is made in it by pressure with a pointed wire. Then the end is cut off, and dropped into the tube.

The rotating portion of the apparatus is made of two pieces of brass tubing, soldered together so as to be open throughout, and carrying a cup soldered on their upper end, communicating with their interior. Water poured into the cup will pour out from the lower ends. To the center of the cross piece a carpet tack is soldered, as a pivot to work in the glass step. Two pieces of bent glass tube, drawn to a point, are attached to the arms of the mill by India rubber tubing. A brace, shaped like an inverted V, soldered to the rim of the pan, with a hole in its apex, supports the moving part in a vertical position. Unless an opening and closing bearing is used, the vertical arm must be passed through the hole before the cup is soldered on. Water is poured into the cup. It issues in a general tangential direction from the glass tubes, and the mill rotates with great speed in the opposite direction.

The brass tubes should be of rather large bore, ¼ to ⅜ inch. The glass jets must be adjusted in size by trial. Filing or grinding square across the ends will enlarge them.

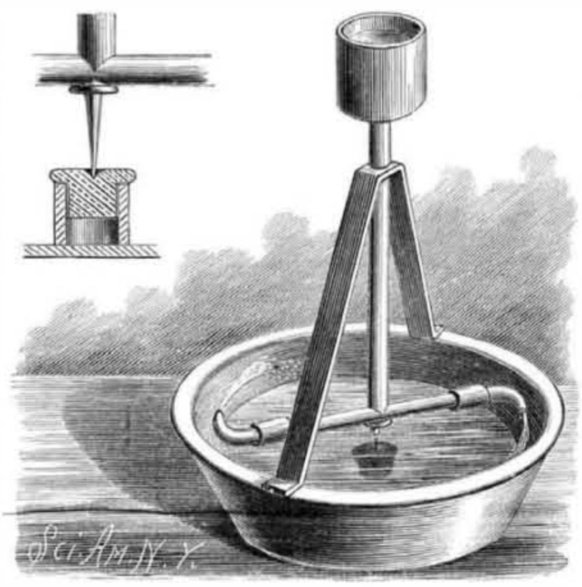
This apparatus works by true reaction. It is not the pressure of the water against the air that is the ultimate cause of its rotation ; it is the mechanical energy in a horizontal direction that is imparted to the water. This acting at right angles to the cross arms generates an opposite reaction, that drives them backward. In a vacuum it will work faster than in the open air.



CAPILLARY VACUUM.

It might, at first sight, seem that such a machine would be of very low efficiency. But some have been constructed that gave very good power, and the turbine is of the same category, working by true reaction, and the best results have been attained with it. Many fireworks act on the same principle, especially wheels and rockets. Hence it is to be supposed that these would work in a vacuum, were such a practical experiment. The apparatus is named from Dr. Barker, who invented it toward the close of the seventeenth century. It may rank among the standard experiments in hydraulics, though its chief value for purposes of demonstration is in its illustration of the Newtonian law of action and reaction. The centrifugal force, it is said, assists in the rotation by increasing the pressure in the ends of the cross arms.

Another of the classic experiments performed with home-made apparatus is illustrated in the cup of Tantalus. The mythological legend of Tantalus, tortured in beholding food and drink spread before him, but withheld, gives it its name. A bottle is cut off so as to have about the proportions shown. This can be done with a hot poker or a piece of lighted "punk." A crack must first be started. This can be



BARKER'S MILL.

done by heating the bottle at the angle between its bottom and sides, and touching the place with a drop of water. A crack thus started can be led in any direction by a hot iron or other heated body. In order to have a guide by which to cut it straight, an India rubber band may be sprung around it, and arranged in a true position. The cut must be kept an even distance from this. As a small protuberance will almost certainly be left where the crack meets around the bottle, this may be broken off with the wards of a key, in small fragments like fine sand. A file will remove the cutting edge, or fifteen minutes' grinding on a plate of glass, with sand and turpentine, will bring it to a pretty true line, if the original cut was a straight one.

A piece of glass tubing is bent as shown, is passed through an aperture in a tightly fitting cork, and the cup is finished. A foot can be improvised from a corresponding portion of another bottle, or may be turned out of wood.

If water is poured into this vessel, nothing special occurs until the bend of the siphon is reached, when it immediately begins to run out through the bottom and empties the cup. Filling it to the point in question charges the siphon, which immediately begins to work, and continues until its lower opening within the cup is exposed to the air. To make the construction complete, a figure of Tantalus should be arranged to cover the siphon, with his mouth a little above its bend. Then, as the water nearly reaches his mouth, it begins to flow away.

The principle of this apparatus is used to explain the phenomena of intermittent springs. It is applied in sanitary engineering where it is desired to produce sudden or large flushes of water from limited supplies. In the Moulde or so-called Waring system of subsoil sewage [illegible] is discharged by a similar apparatus, a flush tank, so as to [illegible] entire length of drainage pipes. A small and continuous stream of water may thus be made to supply a periodical flush of large volume for sewer pipes.

Brotherhood of Locomotive Engineers.

The annual convention of the Brotherhood of Locomotive Engineers began in New York, October 20, with a large attendance.

The opening public exercises were held in the Metropolitan Opera House, which was crowded with delegates, invited guests, and spectators.

Chairman William H. Gurney opened the meeting with a speech of greeting to the guests, and then the Rev. Delos Everett, Grand Chaplain of the Brotherhood, offered prayer. Then Mayor Grace was introduced, and made a short speech welcoming them to the city. This was followed by addresses from Gov. Abbett, of New Jersey, and Rev. T. De Witt Talmage.

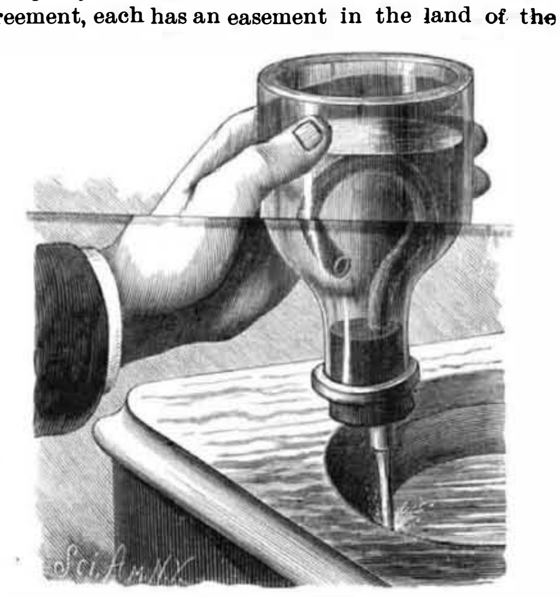
Grand Chief Engineer Arthur then made his annual address, in which he said that now that the intellect, and also the ignorance, of the nation was knitting its brow over the solution of the so-called knotty problem of the nineteenth century, it was fitting that the Brotherhood, representing the unknown quantity of that problem, should meet together. In describing it as the unknown quantity, he would say that some had tried to equivocate their position and that of their executive officer, because of the conservative stand taken and his utter refusal to treat with other labor organizations. They maintained that a good labor organization was a good thing; but that a heterogeneous mass of men engaged in divers occupations could combine interests satisfactorily to form an organization which should serve all, and with equal justice, was very doubtful. Until there was nothing more to be done for the Brotherhood, could they afford to become interested in other things foreign to their order? They had no sympathy and could not co-operate with any class of men who based their claim for it on the principles that might is right and that the rich owe the poor a living. No man had a right to anything which he had not acquired honestly.

There was no antagonism between capital and labor, continued Mr. Arthur, but between work and idleness there had never been any other feeling. Most men of frugal habits were capitalists, capital being invested wealth, no matter how small. He urged upon the Brotherhood the desirability of life insurance, and recommended that its system be modified so as to allow members not so well off to take out policies of $1,500, instead of $3,000, as at present. The Brotherhood's Life Insurance Association now had 4,444 members. Twenty-seven members had died during the year, and two had become disabled. Seventy-eight claims had been paid, amounting to about $230,000. He was sure that the labor agitation of the past six months would result in good. What was necessary to settle the questions at issue was for both sides to give them full and fair consideration, which could only be reached by arbitration.

The public would always condemn the willful destruction of private property and the stopping of public business. During the Missouri Pacific and Texas Pacific troubles of last spring, the Brotherhood conducted itself in a way worthy of praise in resisting the threats and persuasions of the Knights of Labor. This loyalty had shown the railroad companies that a contract entered into by the Brotherhood would not be violated, and the companies would not hesitate to make other contracts with it when the occasion called for it. Moderation, conciliation, and arbitration must rule in dealings between employers and employed. Capital could not afford to be overbearing, and labor could not turn from peaceful channels without injury.

The Law as to Party Walls.

A party wall in law is the wall dividing lands of different proprietors, used in common for the support of structures on both sides. In common law, an owner who erects a wall for his own buildings, which is capable of being used by an adjoining proprietor, cannot compel such proprietor, when he shall build next to it, to pay for any portion of the cost of such wall. On the other hand, the adjoining proprietor has no right to make any use of such wall without consent of the owner, and the consequence may be the erection of two walls side by side, when one would answer all purposes. This convenience is often secured by an agreement to erect a wall for common use, one-half on each other's land, the parties to divide the expense; if only one is to build at the time, he gets a return from the other party of half what it costs him. Under such an agreement, each has an easement in the land of the



CUP OF TANTALUS.

other while the wall stands, and this accompanies the title and descent. But if the wall is destroyed by decay or accident, the easement is gone, unless by a deed such contingency is provided for. Repairs to party walls are to be borne equally; but if one has occasion to strengthen or improve them for a more extensive building than was at first contemplated, he cannot compel the other to divide the expense with him. In some States there are statutes regulating the rights in party walls, and one may undoubtedly acquire rights by prescription on a wall built by another, which he has long been allowed to use for the support of his own structure.—*Building.*