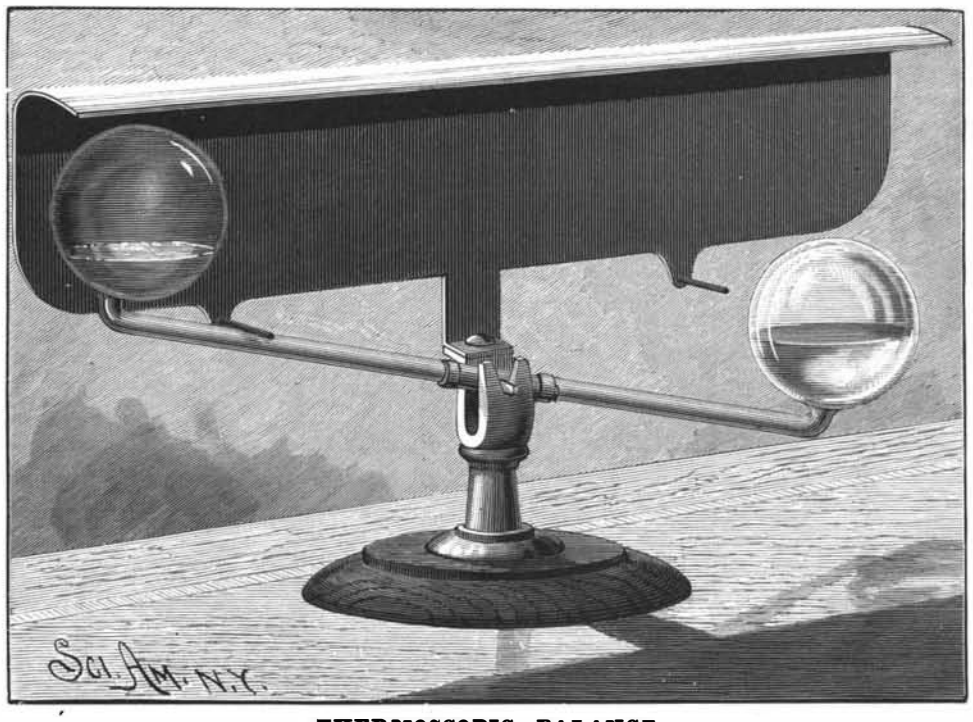
THERMOSCOPIC BALANCE.

BY GEO. M. HOPKINS.

The action of this instrument is due to the facility with which liquids evaporate in a vacuum. A small amount of heat is sufficient to vaporize the liquid to the extent required to secure the desired action. The instrument is provided wih a glass tube bent twice at right angles, and having a bulb blown on each end. The tube and the bulbs are partly filled with water, and a vacuum is secured by boiling the water in the bulbs before sealing them. The center of the tube is furnished with V-pivots, which rest in bearings in the top of the forked column. The column also supports a metal screen, which is bright one side and black on the other. Two pins project from the shield, to limit the movements of the glass tube and bulbs.

When the instrument is in use, the screen is placed toward the source of heat, and when radiant heat strikes the bulb which is unshielded by the screen, the water in that bulb is vaporized, and sufficient pressure is produced to drive the water upward into the bulb behind the screen. When a little more than half of the water has been in this manner forced from the lower to the higher bulb, the upper bulb preponderates. The tube and bulbs are supported on their pivot so as to secure unstable equilibrium, so that, when the upper bulb begins to descend, it completes its excursion at once, and exposes the full bulb to the radiant heat, at the same time carrying its empty bulb behind the screen, where it cools. The transfer of the water from the full bulb to the empty one now occurs as before. This operation is repeated so long as the bulbs are exposed to the action of radiant heat. The oscillations may be quickened by smoking the sides of the bulbs remote from the screen, and still greater rapidity of action may be secured by concentrating the heat on the bulbs by means of condensers or reflectors.



THERMOSCOPIC BALANCE.

The Duration of the Sun.

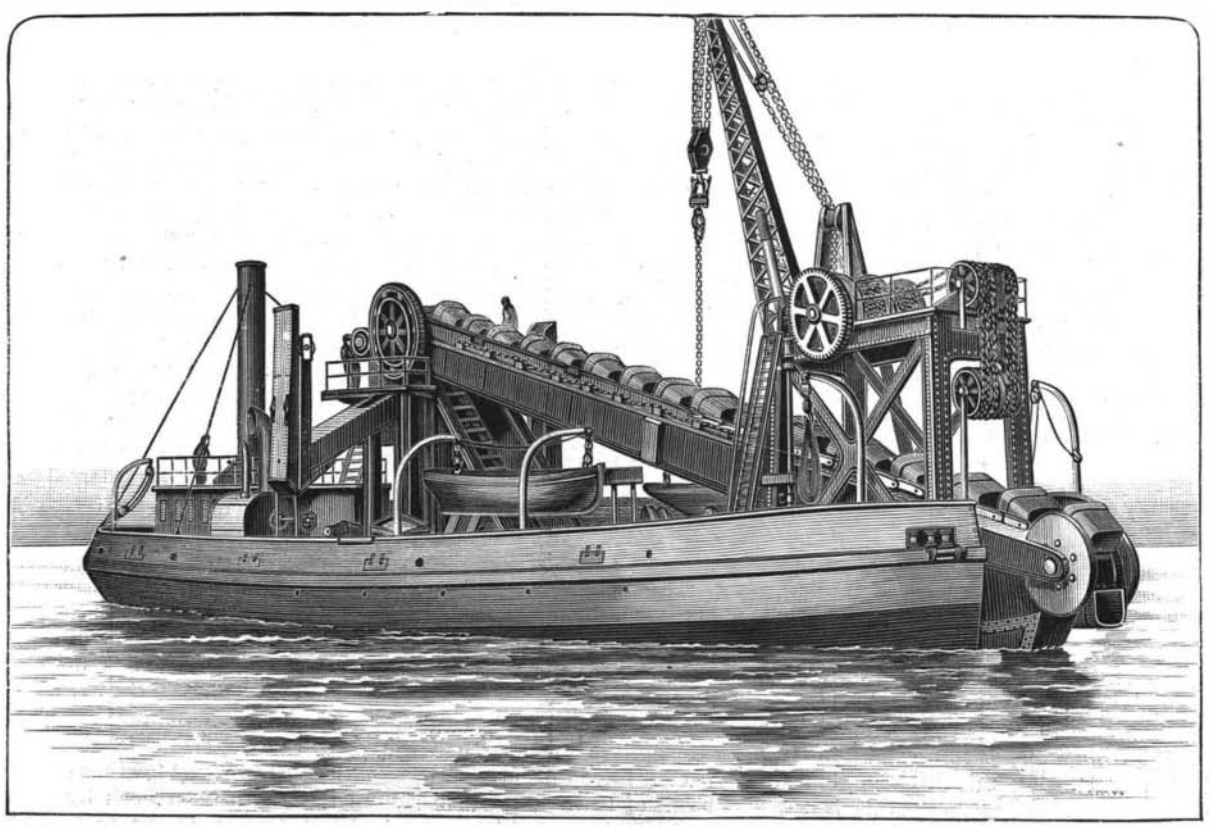
The *Builders' Weekly Reporter* (London) has an interesting account of a lecture at the Royal Institute, given by Professor Sir William Thomson, on the latest dynamical theories regarding the "probable origin, total amount, and possible duration of the sun's heat." During the short 3,000 years or more of which man possesses historic records there was, the learned physicist showed, no trace of variation in solar energy; and there was no distinct evidence of it even, though the earth, as a whole, from being nearer the sun, received in January 6½ per cent more heat than in July. But in the millions of years which geology carried us back, it might safely be said there must have been great changes. How had the solar fires been maintained during those ages? The scientific answer to this question was the theory of Helmholtz that the sun was a vast globe gradually cooling, but as it cooled, shrinking, and that the shrinkage—which was the effect of gravity upon its mass—kept up its temperature. The total of the sun's heat was equal to that which would be required to keep up 476,000 millions of millions of millions horse power, or about 78,000 horse power for every square meter—a little more than a square yard—and yet the modern dynamical theory of heat shows that the sun's mass would require only to fall in or contract thirty-five meters per annum to keep up that tremendous energy. At this rate, the solar radius in 2,000 years' time would be about one hundredth per cent less than at present. A time would come when the temperature would fall, and it was thus inconceivable that the sun would continue to emit heat sufficient to sustain existing life on the globe for more than 10,000,000 years. Applying the same principles retrospectively, they could not suppose that the sun had existed for more than twenty million years, no matter what might have been its origin—whether it came into existence from the clash of worlds pre-existing, or of diffused nebulous matter. There was a great clinging by geologists and biologists to vastly longer periods, but the physicist, treating it as a dynamic question with calculable elements, could come to no other conclusion materially different from what he had stated. Sir William Thomson declined to discuss any chemical source of heat, which, whatever its effect when primeval elements first came into contact, was absolutely insignificant compared with the effects of gravity after globes like the sun and the earth had been formed. In all these speculations they were in the end driven to the ultimate elements of matter, to the question—when they thought what became of all the sun's heat—what is the luminiferous ether that fills space, and to that most wonderful form of force upon which Faraday spent so much of the thought of his later years—gravity. The lecture was heard with deep interest and close attention.

IMPROVED MARINE DREDGER.

The twin screw dredger Dolphin was recently constructed for the Colonies, under the direction of Sir John Coode, assisted by Mr. Wm. Matthews, C.E., and is especially designed, says the *Engineer*, for harbor improvements in the West Indies. The dimensions are:

	Ft.	In.
Length between perpendiculars	130	0
Breadth moulded	30	0
Depth	8	0
ENGINES—Compound surface condensing, I.H.P. 250		
Stroke of pumps		14
Diameter of high pressure cylinder		16½
" low pressure "		33
Length of stroke		24
Diameter of air pump		11½
" circulating pump		6½
" feed pumps		2½
" bilge pumps		2½

The boiler is of steel, for a working pressure of 90 lb. per square inch. The bucket ladder works through a well formed in the center of the vessel, and dredges to a depth of 33 ft. below the water level, and the buckets are made wholly of steel, and are capable of lifting 250 tons of free soil per hour. Triple-geared winches are supplied at bow and stern for working the mooring chains, the barrels of which can be worked independently or conjointly, as required. The cabins for the officers and crew are of the most complete description; those of the former being fitted on starboard side of the well, and consist of rooms for the captain, mate, and engineers, also mess room. All the rooms are large and efficiently lighted and ventilated. A powerful crane is erected at forward end for overhauling the buckets, hoisting gear, etc.



THE DREDGER DOLPHIN.

Hydraulic Dredging at Washington.

At a recent meeting of the Engineers' Club of Philadelphia, a paper by Conway B. Hunt was read on hydraulic dredging machinery.

The paper mentions the early application of the principle of hydraulic dredging, that is, the mixing of dredged material with water and then removing the mixture by suction or otherwise; and after referring briefly to the Roy Stone and Bowers dredges as typical machines, describes in detail the Von Schmidt dredge. Two of these dredges are engaged on the improvement of the Potomac River at Washington, D. C., under the United States Government. Each is 100 feet by 50 feet, with a semicircular bow, around which travels a vertical suction pipe, 22 in. in diameter, and telescopic. At its foot is a conical hood, beneath which works a rotary excavating plow, 8 feet in diameter. The suction is produced by a powerful centrifugal pump, run by a 200 horse power engine.

The discharge pipe is 20 in. in diameter, has rubber hose joint connections, and is carried to the shore on pontoons. The material was mixed with from three to ten times its volume of water, and discharged at distances up to 3,500 feet from the dredge, and at from 6 to 10 feet above water. A year's record shows an average of 175 cubic yards per working hour, and 2,300 yards per day, for each dredge. The work was done, by contract, at prices of 12·37 cts., 15 cts., and 15·45 cts. per cubic yard, which includes the cost of levees to confine the semi fluid material, drains to carry off the water, etc. The final estimates were specified to be taken by cross sections of the completed fill after it had become solidified and compacted. In conclusion, it is noted that the devices and details of hydraulic dredging machines are the subjects of numerous patents, and their most efficient combination may be long deferred. The large number of machines that are still in the experimental stage of development would indicate that the best results attainable from this class of dredges have not yet been accomplished.

A New Sugar Process.

The details of the process vary with quality of beets. To a vat containing the secondary products to be treated are added calculated quantities of diluted hydrochloric acid and milk of lime at 25° B. The mass is heated to the boiling point by a steam coil. In a separate vat the product is diluted with water at 75° C. to 23° B., and subsequently run through Puvrez filtering bags. The filtrate is clear in color, and is received in a measuring tank, from which it is run into the diffusion battery. In the latter but few changes are necessary. It is said that by this method an additional 1 per cent sugar is extracted from the beet, and the white sugar obtained can be at once placed upon the market.

THERE were exported last season from Prince Edward Island 91,000 cases of lobsters.