giving with accuracy the perpendicular depth and the set of the submarine currents. It consists of a stout cylinder open below, and filled with a liquid sufficiently lighter than water, to cause the apparatus to float; it is sunk by having two cannon balls attached to it, which are released by a trigger striking against the bottom, when the apparatus returns to the surface. The distance and direction of its point of emergence from that of its sinking, will give the resultant of the submarine currents; and it has, moreover, attached to it a light fan, whose revolutions will measure the space moved over. (This is Saxton's apparatus for measuring the velocity of currents of water.) A little vessel attached and provided with valves to close when the vessel begins to rise, will bring to the top a specimen of the bottom water, and an overflow thermometer, (on Walferdin's principle); a modification of the apparatus itself will measure the temperature. At subsequent sessions of the academy, the proposed apparatus was shewn to be not new, but it remains to be seen whether it may not prove very useful.

On some Properties peculiar to Caoutchouc, and their Applications. By

MR. BROCKEDON.*

Caoutchouc is a vegetable constituent, the produce of several trees. The most prolific in this substance are, *Siphonia caoutchouc* *Urceola elastica*, *Ficus elastica*, &c. Of these, the *Siphonia caoutchouc* extends over a vast district in Central America,—and the caoutchoc obtained from this tree is best adapted for manufactures. Over more than 10,000 square miles in Assam the *Ficus elastica* is abundant. The *Urceola elastica*, (which produces the Gintawan of the Malays) abounds in the islands of the Indian Archipelago. It is described as a creeper of growth so rapid, that in five years it extends 200 feet, and is from 20 to 30 inches in girth. This tree can, without being injured, yield by tapping from 50 to 60 lbs. of caoutchouc in one season. A curious contrast is exhibited in the tardy growth of the tree from which the gutta percha is obtained. This tree does not come to its prime in less than from 80 to 120 years. The produce cannot be obtained but by the sacrifice of the tree. It is found in a concrete state between the bark and the wood after the tree has been cut down; and it is in this condition that, having been scraped out, it is sent to our market. When coagulated by evaporation or agitation, caoutchouc separates from the aqueous portion of the sap of the trees which yield it. This solid and fluid cannot afterwards be re-united, any more than butter is capable of mixing with the milk from which it is separated. Caoutchouc is a hydro-carbon. This chemical character belongs to all varieties of the substance, and many other vegetable constituents, though they differ materially in physical qualities. Some specimens are harder than gutta percha itself, while others never solidify, but remain in the condition of birdlime or treacle. The process termed the *vulcanizing* of caoutchouc was discovered by Mr. Thomas Hancock in 1843. A sheet of caoutchouc immersed in melted sulphur, absorbs a portion of it, and at the same time it undergoes some important changes in many of its characteristic properties. It is no longer affected by climatic temperature:—it is neither hardened by cold,

* London Athenaeum, April, 1851.

nor softened by any heat which would not destroy it. It ceases to be soluble in the solvents of common caoutchouc, while its elasticity becomes greatly augmented and permanent. The same effect may be produced by kneading sulphur into caoutchouc by means of powerful rollers; or the common solvents naphtha and spirit of turpentine may be charged with a sufficient amount of sulphur in solution to become a compound solvent of rubber. In these cases articles may be made in any required forms before heating for the change of condition. It is necessary, however, for this purpose, that the form should be carefully maintained during the exposure to the heat necessary to effect the vulcanization, which leaves it in a normal state. A vulcanized solid sphere of $2\frac{1}{2}$ inches in diameter when forced between two rollers a quarter of an inch apart was found to maintain its form uninjured. In fact, it is the exclusive property of vulcanized caoutchouc to be able to retain any form impressed on it, and to return to that form on the removal of any disturbing force which has been brought to act on it. Caoutchouc slightly expands and contracts in different temperatures: it is also capable of being condensed under pressure. A cube of $2\frac{1}{4}$ inches, impactly secured, was subjected to a force of 200 tons. The result was, a compression amounting to one-tenth; great heat appeared to have been evolved; and the excessive elasticity of the substance caused a fly-wheel weighing 5 tons to recoil with an alarming violence. The evolution of heat from caoutchouc under condensation is a property possessed by it in common with air and the metals. It differs, however, from the latter in being able to exhibit cold by re-action. Mr. Brockedon stated that he had raised the temperature of an ounce of water two degrees in about fifteen minutes by collecting the heat evolved by the extension of caoutchouc thread. He refers this effect to the change in specific gravity. He contends, that this heat thus produced is not due to friction; because the same amount of friction is occasioned in the contraction as in the extension of the substance,—and the result of this contraction is to reduce the caoutchouc thus acted on to its original temperature. Attention was directed to some of the latest applications of the elastic force of caoutchouc.—*Proceed. Roy. Inst. March 21, 1851.*

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Reflexion of Light from the Surface of Liquids.

The following are the conclusions of M. Jamin, from a series of experiments recorded in the *Annals de Chimie et de Physique*, for February, 1851:—

- 1st, Liquids surfaces polarize light incompletely and elliptically.
- 2nd, Liquids having a high index of refraction have a positive anomaly, or difference of phase between the principal components of the reflected motion.
- 3rd, This anomaly becomes negative, when the index is very small.
- 4th, There are substances, whose indices are about 1.4, whose polarization is rectilinear.