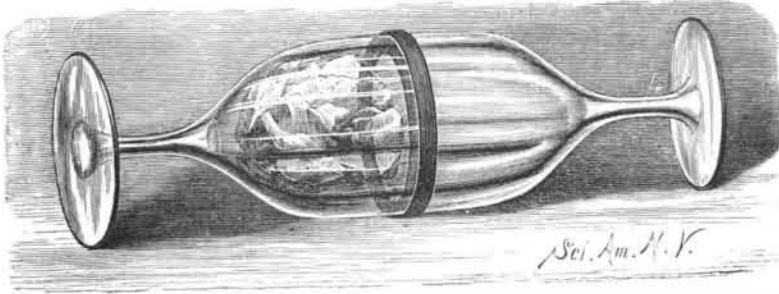


EXPERIMENTS ON THE INEXPANSIBILITY OF WATER AND CONTRACTION OF ICE.

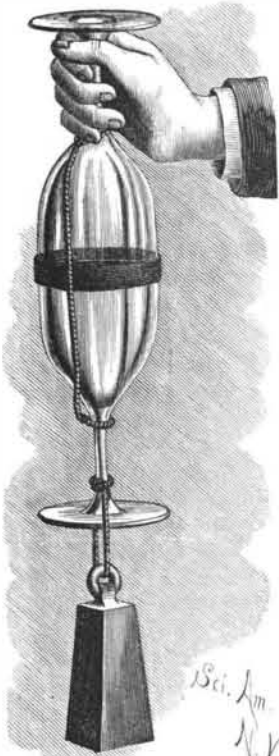
T. O'CONOR SLOANE, F.R.S.

When ice melts, the water produced is of considerably less volume than was the original ice. This is obvious from the fact that ice floats upon water. The reverse is a fact but too well known to housekeepers, who trace many broken vessels and fractured water pipes to the expansion of freezing water. The change in volume is



THE CONTRACTION OF MELTING ICE.

a sudden one for the most part. At 39.2° F. water attains its greatest density. If the temperature is lowered it expands slightly, until 32° F. is reached, when it freezes, if there are no causes to prevent. In freezing it suddenly expands about one-eleventh of its bulk with almost irresistible power. A pressure as high as 28,000 pounds to the square inch has been estimated as having been exerted by it.



THE INEXPANSIBILITY OF WATER.

Many other substances in solidifying experience the same change. Thus solid cast iron floats on melted iron as ice does on water, and for the same reason.

This sudden expansion is the more impressive in the case of water, because it is ordinarily of comparatively constant volume. Its change of bulk by alterations of temperature or pressure is but slight. It resists compressive or expansive strains, yielding but little to very high pressures.

Both of these phenomena—the reduction in volume experienced by melting ice and the slight expansibility of water—are illustrated by the simple experiments shown in the cuts. Nothing in the way of apparatus is required to perform them, unless a couple of wineglasses or

goblets and an India rubber band can be termed such.

The simplest one may be first described, the illustration of the slight expansibility of water. If two empty wineglasses are placed mouth to mouth, and a rather wide India rubber band is sprung around the junction, they will resist separation with some force. The glasses in separating slide, like the members of a telescope, through the band, and in doing so cause the air within to be slightly rarefied. A partial vacuum is produced, and some exertion is required to separate them. When they part, a slight report is produced by the inrush of the outer air. It is evident that if the glasses were filled with a non-expansible substance, they would adhere much more strongly. For air, therefore, water may be substituted.

The glasses are immersed in a vessel of water large

enough to hold them mouth to mouth. The band is sprung over them and is worked up as near the lip of one of them as possible. It is important that it should be wet, to facilitate its sliding. The glasses, immersed so as to be filled with water, are next brought mouth to mouth beneath the surface. The band is adjusted by sliding so as to cover the junction as evenly as possible. Care must be taken to exclude all bubbles of air. The glasses are then removed from the water, when they will be found to adhere loosely yet strongly. They can be worked from side to side, but will resist a direct pull with great force. A very heavy weight can be sustained before they come apart. The water contained within them is practically incompressible, and permits no telescoping of the band and glasses.

The second experiment may now be tried. The glasses are separated and emptied, and the band is sprung around one of the glasses and is brought down below the edge, so that only half of its width surrounds the body. The other half will now spring inward and form a horizontal diaphragm through which a large aperture extends. It represents a flat perforated washer. The glasses are again immersed in water and filled. A lump of ice as free from air bubbles as possible is introduced into one of them, and they are as before brought together under the surface of the water. The ice is, of course, rapidly melting. The instant they touch, they adhere strongly. The shrinkage of the water as it changes from the solid into the liquid state produces a vacuum, and the atmospheric pressure forces the glasses strongly together. They are now removed from the vessel. It will be found that they can be laid on their sides and rolled about; that they can be held by the base of one in a horizontal position, and that they will sustain a very heavy weight before pulling apart. They will adhere thus for a number of days, until gradually enough air has leaked in to destroy the vacuum. The other arrangement of band could be used, and is to be advised when the edges of the glasses are not true; but the flat surface of connection makes it much more impressive, and by doing away with any chance of telescoping, restricts the experiment to an illustration of the shrinkage of frozen water on melting.

The glasses should be selected of equal diameter at the mouths, and if ground and polished, they are much better. There is no trouble in finding such glasses at any dealer's. Even if the mouths fit poorly, the experiments can be performed by having a wide enough band and by not attempting to use the flat washer arrangement.

Electrical Currents.

We have in the case of electrical waves along a wire a disturbance outside the wire and a current within it, and the equations of Maxwell allow us to calculate these with perfect accuracy and give all the laws with respect to them.

We thus find that the velocity of propagation of the waves along a wire, hung far away from other bodies and made of good conducting material, is that of light, or 185,000 miles per second; but when it is hung near any conducting matter, like the earth, or inclosed in a cable and sunk into the sea, the velocity becomes much less. When hung in space, away from other bodies, it forms, as it were, the core of a system of waves in the ether, the amplitude of the disturbance becoming less and less as we move away from the wire. But the most curious fact is that the electric current penetrates only a short distance into the wire, being mostly confined to the surface, especially where the number of oscillations per second is very great.—H. A. Rowland.

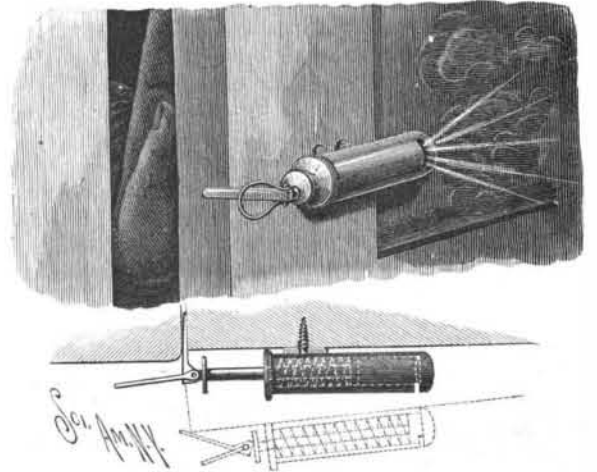
AN IMPROVED CLINICAL THERMOMETER.

The accompanying illustration represents an improvement in clinical thermometers which has been patented by Messrs. Robert H. Hunstock, of San Antonio, Texas, and Emigdio Chavez, of Guanajuato, Mexico. It is an improved article of manufacture, in which the zero mark of the scale is placed at the normal temperature of the body. Each degree is divided into five or ten parts, according to the size of the instrument, those above zero reading supranormal, and those below that mark being subnormal. If desired, one or two scales may be made to appear upon the same instrument.

At a recent meeting of the Manchester Section of Chemical Industry, Mr. William Thompson read a paper on the heat-producing powers of twelve samples of coal, determined by burning in oxygen (in the apparatus devised by him), compared with their theoretical values as calculated from their chemical composition. The coal which he found to give the highest results as regards heat producing was anthracite, which gave 8,340 Centigrade units of heat.

AN IMPROVED BURGLAR ALARM.

A device which may be readily attached to a door or window, and is adapted to explode a cap as the door or window is opened, has been patented by Mr. Neil McIntyre, and is illustrated herewith. It consists of a tubular cylindrical body with closed ends in which slides a piston surrounded by a spiral spring, which has a bearing on a plunger at one end of the piston and against the inner side of the cylinder at its other end. One end of the piston rod projects out of the cylinder and is provided with a handle, while upon the extremity of the rod is hinged or pivoted a thin wedge-shaped arm. The end of the cylinder opposite the handle has a transverse slot, and the cylinder itself is adapted to be attached to a door or window by means of a screw

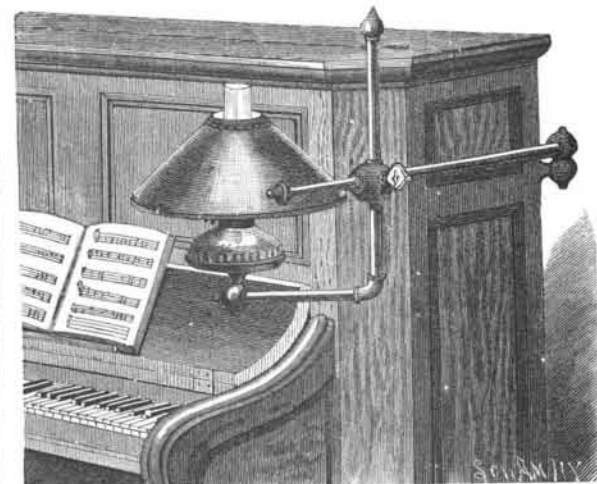


MCINTYRE'S BURGLAR ALARM.

which forms an integral portion of the body at the back. The cylinder is screwed on the inner face of a door or window, an inch or so from the outer edge, and the piston rod is then drawn outward, by means of the handle, against the tension of the spiral spring, until the wedge-shaped arm can be carried inward between the door and casing, as the door is closed. A cap is then inserted in the transverse slot in the rear end of the cylinder, where it is violently struck by the plunger on one end of the piston rod when the door is opened, the wedge-shaped arm being thus released and allowing the spring to exert its tension on the piston rod. For further information relative to this invention address the Travelers' Pocket Burglar Alarm Co., No. 200 East Eighty-second Street, New York City.

AN IMPROVED PIANO LAMP BRACKET.

The accompanying illustration represents a piano lamp bracket designed for attachment to an upright piano, and conveniently and readily adjustable to any position desired. It has been patented by Mr. William A. Smith, of Butte City, Montana Ter. A T-shaped plate is attached by screws to the back of the piano, and projecting from this plate beyond the end of the piano is a short arm with a socket, in which is mounted a pivot pin projecting from a horizontal rod, the latter being of sufficient length to extend past the end and in front of the piano. This horizontal rod has a vertical sleeve, through which extends a vertical arm, adjustably held by a set screw. To the lower end of the vertical rod is secured, by an elbow joint, a horizontal rod having at its outer end a socket, in which is secured



SMITH'S PIANO LAMP BRACKET.

the shank of a stand upon which may be placed a lamp. By means of such a bracket the lamp stand may be swung back out of the way when not required for use, or moved to one end of the keyboard, or raised or lowered in its position with regard to the music resting above the keys.

Arrow Poison.

According to Mr. Stanley, the arrow poison used by the natives of the Lower Congo district is made from a species of red ants found in that locality. The ants are dried, crushed into powder and cooked in palm oil. The exceedingly irritating properties of the poison are supposed to be due to formic acid.



HUNSTOCK & CHAVEZ'S CLINICAL THERMOMETER.