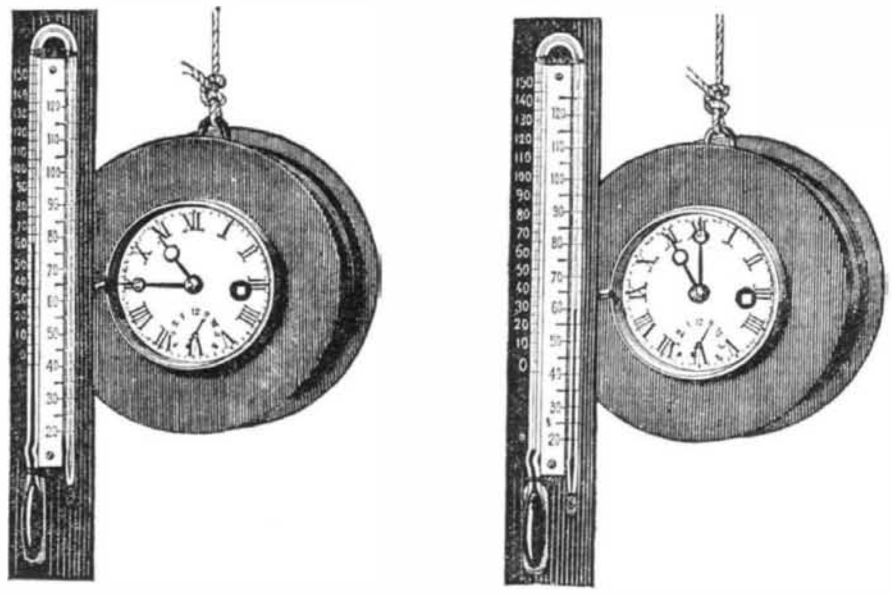
A NEW REGISTERING THERMOMETER.

This new apparatus, represented in our engraving, is designed to measure and register the temperature of ocean depths, of deep borings, or other inaccessible places, or of any locality at any desired time. It is composed of a mercurial thermometer, curved in inverted V shape, and fixed on a scale graduated to Fahrenheit degrees. The cylindrical tube which contains the mercury is slightly bent at the zero point. The instrument is connected with a clock, on the lower portion of the dial of which is a supplementary hand pointing to the numbers 1 to 12. By placing this pointer at any determined number, when that hour is reached the clockwork causes the thermometer to revolve one revolution. The effect of this is to break the mercurial column at the bent portion at 0°, and turn it into the other leg of the tube, where it remains, its hight indicating the temperature at the time for which the dial was previously set.

This will be more clearly understood from the illustration. The figure on the left shows the apparatus set to indicate the temperature at 11 o'clock, the time of setting being 10:45. On the arrival of the hour, the thermometer turns as shown by the arrows in the second figure; and the mercury, passing out into the other leg, remains at the point it then marked on the scale.



REGISTERING THERMOMETER.

THE BASTIE TOUGHENED GLASS.

We recently witnessed a number of interesting experiments upon the Bastie toughened or tempered glass, exhibited by Professor Thomas Egleston, of the School of Mines of Columbia College, in the presence of an audience composed mainly of the glass merchants of this city. Professor Egleston has been investigating the properties of the new material for two months past; but his experiments, though tending to show the remarkable strength of the glass, have given him no information as to the correctness of the process by which the article is prepared. The mechanical apparatus alleged to be used in the process is given in the annexed engraving from the patent drawings.

We summarize Professor Egleston's experiments briefly as follows:

(1). Impact of elongated rounded end steel balls entirely inelastic, with plates secured horizontally: (*a*) Weight of ball, 2 oz. Best English plate glass, $\frac{1}{18}$ inch thick, broke at fall from hight of 15 inches. Bastie glass of equal thickness broke at fall from 4 feet 6 inches. (*b*) Four oz. ball. Ordinary glass broke at fall from hight of 1 foot. Bastie glass broke at fall from hight of 3 feet 6 inches. (*c*) One lb. ball. Ordinary glass broke at fall from hight of 13 inches. Bastie glass broke at fall from hight of 3 feet. The thicknesses of the glass varied in these several experiments, but in each one the Bastie and the common glass were identical. (*d*) Plate glass inclined at about 45°; a low quality glass, such as used in conservatories, was employed. Two oz. ball. Unprepared glass broke at fall of 4 feet. Bastie glass, after withstanding 36 shocks at one point, ruptured with a 9 feet fall. (*e*) Eight oz. ball. Common glass, ½ inch thick, broke with a fall of 3 feet 9 inches. Bastie glass, ¼ inch thick, broke with a fall of 7 feet.

(2). Weight applied at end of a strip, 3 inches wide and $\frac{3}{16}$ inch thick, secured in a vise. Common glass broke at 16½ lbs. Bastie glass broke at 46 lbs. Power was applied at a distance of 6 inches from vise.

(3). Weight applied at middle. This experiment failed owing to lack of necessary weights. A strip of Bastie glass, same size as the foregoing, however, withstood 180 lbs. and gave no signs of rupture.

(4) Heat. Lamp chimneys prepared were heated over Bunsen burners to very high temperatures without rupture. Plates and saucers were similarly treated. A plate of prepared glass, about 1 foot square, was subjected to a blowpipe flame of 1,500° Fah. for about 8 minutes. Ordinary glass broke in 7 seconds. The outer edges of the Bastie plate, for a distance of an inch or more, were cool. The spot touched by the flame became barely red hot. On cooling, the plate cracked just at the heated point, and five minutes later it disaggregated throughout its entire area.

Water suddenly thrown on a heated prepared plate caused the latter to break. It appears that, when the glass is cooled quickly at the rate of 300° or 400° Fah. at a time, it breaks; but when the operation is conducted slowly, at intervals of 50°, rupture does not occur.

Referring to experiment 1: The force required to break the glass is best expressed in foot lbs. In better tests than those quoted, Professor Egleston found that ordinary glass broke at 1·6 foot lbs. Bastie glass bore 3 foot lbs., nearly double. Using a 1 lb. knife-edge weight, ¼ inch Bastie glass broke at 17 foot lbs. From experiment *d*, it will be noted that constant hammering on one spot is without effect. With reference to experiment 2, according to Professor Egleston, the glass has supported as high as 60 lbs. Experiment 3 has been conducted with a knife-edge bearing on the glass, when as high as 200 lbs. has been applied. A remarkable feature of the glass is its rupture, which is a general disaggregation of the entire piece. As the weight falls, a metallic resonance is heard; but on breaking, there is a dull crush, utterly unlike the sound caused by fracturing common glass. The rupture takes place everywhere apparently, in perpendicular and horizontal planes, a cleavage, in fact, very much resembling that of trap rock. The fragments, moreover, are destitute of sharp edges. The hand may be plunged in a vessel full of them, or they may be rubbed between the palms, with impunity.

It is claimed that there is no difficulty in polishing the prepared glass, a fact evidenced by a number of watch crystals and other articles exhibited. It may be etched with hydrofluoric acid or engraved with the sand blast, without becoming impaired in point of strength. It cannot be cut with the diamond, as the removal of a part of a piece determines the immediate rupture of the whole; so that window panes and like articles will have to be prepared in the first instance of the proper size. It may be used for photographic negatives; and finally it has, it is said, withstood for several days the action of a cupel furnace at white heat. Window panes of this glass, it is alleged, will be almost as much protection to buildings as iron shutters; since they would shut off the oxygen until the window frames became entirely consumed. The cost of the process is stated to be about 5 per cent additional to that of ordinary glass, so the holders of the patent affirm.

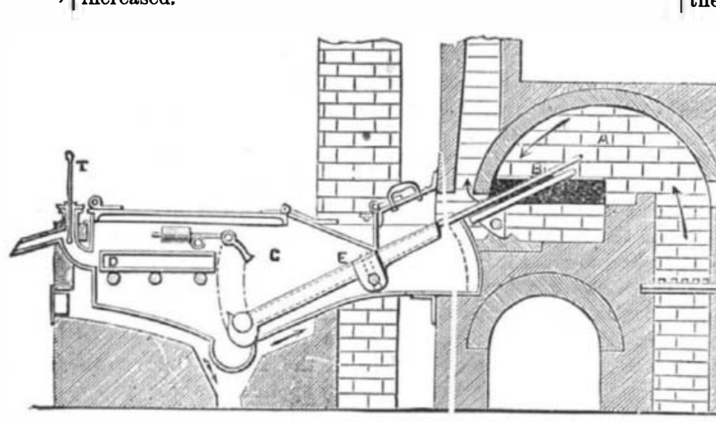
The following is from the specification of the patent as granted in this country December 15, 1874.

"To all whom it may concern:

Be it known that I, François Barthelemy Alfred Boyer de la Bastie, of Paris, France, have invented a new process of tempering flat and shaped glass, and furnaces and machinery to be employed therefor, of which the following is a specification:

This invention relates to a process of tempering glass and glass articles so as to render them less fragile, and to the construction and arrangement of furnaces for effecting the said process.

As the fragility of glass results from the weakness of the cohesion of its molecules, it may be expected that, by forcing the molecules closer together, and rendering the mass more compact, the strength and solidity of the material should be increased.



BASTIE'S APPARATUS FOR TOUGHENING GLASS.

I have found that this cannot be effected by compression, even when applied to the material in a fluid or soft condition. I have, therefore, applied to glass a system of tempering, such as is usually applied to steel, and I will now describe the process and apparatus for this purpose.

Fused glass dropped into water becomes greatly contracted, but, being shapeless, only objects of curiosity can be produced in this way. The sudden cooling in the water puts the glass into a state of unstable equilibrium in its constitution, so that the least shock causes it to break, as in the case of Prince Rupert's drops.

My object is to invert the result, to diminish, or even to remove, the extreme fragility of glass, by tempering it by immersion in a liquid. In attaining this object two essential conditions have to be determined: First, the point at which glass can be tempered without being put out of shape. I have found this to be when it is just at the heat where softness or malleability begins, the molecules being then capable of closing suddenly together, condensing the material, when it is plunged in a liquid at a considerably lower temperature.

Also, glass, when it is thin, may be tempered at red heat, even before becoming soft. Secondly the liquid to be employed for the immersion of the glass is to be such as can be heated much higher than water without boiling. For this purpose I find oils and grease, wax, resin, and tar or pitch suitable. Having settled these conditions, I have devised the process or practical method of operating, and suitable furnaces, which will hereafter be described.

In carrying out the process, it is necessary that the glass to be tempered should be raised to a very high temperature. The hotter it is, the less is the risk of breaking the glass, and the greater is the shrinkage or condensation. Hence the advantage, and often the necessity, of heating the glass to the point of softening, which is attended by the difficulties that glass in the soft condition gets readily out of shape, so that it must be plunged almost without touching it, and that, in plunging the hot glass into a heated combustible liquid, the latter is apt to take fire and cannot easily be extinguished, so that time and material are lost. These difficulties I have overcome by placing the tempering bath in immediate communication with the heating oven, and covering it, so as to prevent access of air. The oven being charged with the articles to be tempered, these are pushed or caused to slide into the adjoining bath without handling them, and the liquid of the bath, having no supply of external air, is not liable to inflame. In order that the shape of the tempered articles may not be affected, particularly for flat glass, the floor of the oven is made to cant, so that, when the glass is heated on it, it is turned to a sloping position, and the glass slides into the bath along a surface therein arranged at the same slope as that of the oven floor. Small articles may be heated on the edge of the bath and immersed by a slight push. The clearness of the glass may be affected by the dust of the furnace flame, which is apt to settle on glass and chill its surface. I avoid this by heating the glass in a muffle, to which the flame has no access, being applied externally. Moreover, the shock of the fall of glass into the bath is prevented by fixing therein a sheet of wire gauze or asbestos fabric, or providing a bed of sand or other like material for the glass to fall on."

The patent drawings contain three figures, one of which we give, and explain briefly as follows:

The sheets of glass are placed in a preparatory oven, and thence, one by one, pushed into the oven, A, by an opening, shown in black. On reaching the requisite temperature, the glass is carried upon table, B, which is normally horizontal though shown in a position for sliding the sheet off. C is the bath of oil, heated by a separate furnace, and so covered as not to be affected by heated gases proceeding from the furnace. A rocking table, E, is supported on a frame moved by a lever and shaft. This is placed in the position shown, and the table, B, is tilted by means of a lever, when the plate of glass slides off on to table, E, and so into the bath. Table, B, is then returned to its horizontal position, and another plate pushed upon it. The sheet in the bath is removed as follows: The table, E, and rocking frame are raised; and by suitable mechanism, the table is separated from the rocking frame to such an extent that the buffer of wire gauze on the frame and end of the latter are brought below the level of the table, which is held up by a latch. The plate is then withdrawn by a rake into the chamber, D, whence it is removed with others, when the chamber, being full, is lifted out of the bath.

The claims made by the patentee are as follows:

1. "The process herein described for tempering glass consisting in the immersion of the hot glass in a bath of oils, grease, wax, or resinous or bituminous substances, the boiling temperature of which is above the boiling point of water.

2. In combination with the oven for heating and the bath for plunging, communicating with each other, the rocking table, *e*, substantially as and for the purpose specified.

3. In combination with the heating oven and plunging bath, the tables, *e* and 19, substantially as and for the purpose specified.

4. In combination with the heating oven and plunging-bath, the rocking table, *e*, and the receiver, *g*, substantially as and for the purpose specified.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

F. B. A. ROYER DE LA BASTIE."

A Life-Preserving Pillow.

A new life-preserving device, which seems to be both simple and practical, has recently been introduced in the Glasgow and Montreal line of emigration steamers. It consists of two pillows of prepared cork wood, with an upper padding of hair covered with mattress tick. The pillows are attached to each other in such a manner that, when about to be used, they can be placed one on the back and the other on the chest and tied, the head and shoulders thus being kept above water. The device has been tested and has been found capable of supporting the heaviest men breast high. The pillows are utilized as articles of bedding, so that they are always at hand in case of danger.

SWEET OIL rubbed on the skin is said to be a sure antidote for ivy poison.