Welding by Electricity.

Recently, at the Institute of Technology, Boston, Professor Thomson, of the Thomson-Houston Company, of Lynn, made known to the public his new and remarkable method of welding, by which a broken bar of metal can be easily reunited, or bars of different metals welded together; and those materials which previously resisted welding most strenuously are now joined with ease, while those previously easily welded remain the same by the new process. Differences in specific electrical and heat conductivity are the properties which are most troublesome. The method consists in simply forcing the ends to be welded together tightly and passing a sufficiently powerful current of electricity through the joint. The resistance raises the metal to a welding heat, and the pressure makes the joint. The speaker enumerated some of the practical results obtained personally within a recent period. Iron and copper wires of varying dimensions have been joined end to end. Steel or iron bars nearly an inch in diameter have been solidly welded together, and steel has also been joined to brass. A copper rod nearly one-half an inch in diameter has been welded, requiring a current of 20,000 amperes. Steel pointed tools may be cheaply made of inferior metal, and new points welded on as desired.

The cost of the new process is uudoubtedly less than by the old method of forge and hammer, while the time required is very short and no heat is wasted. Mr. Thomson stated that in welding a steel bar 1½ inches in diameter, a current of 6,000 amperes in volume and having an electromotive force of one-half a volt was necessary. The use of 35 horse power for one minute is another way to state it.

SCIENCE IN TOYS.

II.

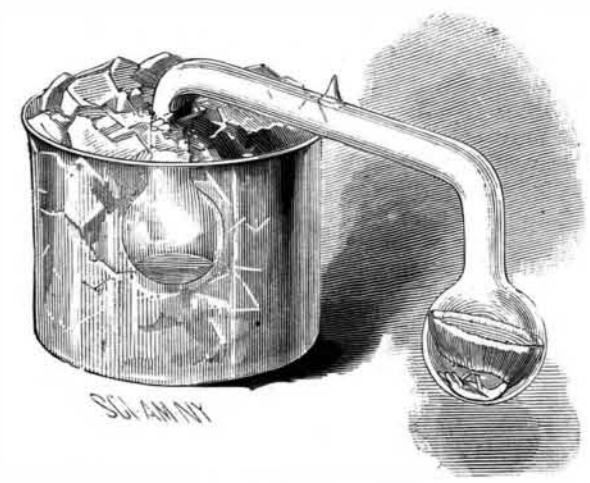
The pulse glass, shown in the annexed engraving, is due to Franklin. It consists of two glass bulbs, formed on opposite ends of a tube bent twice at right angles, the system being partly filled alcohol or ether, the air having been expelled by boiling the inclosed fluid before sealing the tube. When the bulb containing the liquid is held in the hand, and the tube is placed in a horizontal position, the rapid evaporation of the liquid by the warmth of the hand creates a pressure which causes the transfer of the liquid to the cooler bulb. The quick evaporation of the liquid adhering to the sides of the now empty bulb increases the pressure, and causes a rapid ebullition of the liquid in the full bulb, and at the same time carries off the heat to such an extent as to produce a very decided sensation of cold.

PULSE GLASS.

When the bulb is held at an inclination of about 40°, the liquid pulsates from one bulb to the other. The expulsion of the liquid from the bulb in the hand produces cold, which is quickly dissipated; and when equilibrium is restored, the liquid contained by the tube condenses the vapor in the empty bulb, and enters that bulb, to be again expelled as before.

The instrument operates continuously and very regularly when placed in a horizontal position upon a table, with one of the bulbs in the vicinity of a lamp, that is, within eight or ten inches of the flame, the other bulb being placed as far as possible away from the flame and shaded.

Wollaston's cryophorus is similar to the pulse glass,



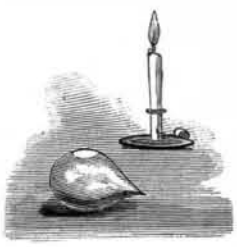
WOLLASTON'S CRYOPHORUS.

the only difference being that the tube connecting the two bulbs is made much larger, to avoid choking by ice, a thing sure to occur when the tube is of small diameter—the water vapor which is drawn toward the empty bulb (in a manner presently to be described) being condensed and frozen on the walls of the tube to such an extent as to entirely close it.

The cryophorus in process of construction is partly filled with water, which is boiled in the bulbs before sealing, to drive out the air. When the empty bulb of the apparatus is placed in a freezing mixture of ice and salt, for example, the evaporation of the water in the filled bulb, due to the cooling and condensation of vapor in the empty bulb, is so rapid as to carry off the heat to such an extent as to cause the water to freeze. Instead of employing the freezing mixture, a spray of ether or bisulphide of carbon may be projected upon the empty bulb with the same results.

This is a very interesting experiment, illustrating the principle of freezing by evaporation. It is the opposite of the popgun experiment illustrated and described in the last article on this subject. That was heat by compression. This is cold by rarefaction.

The candle bomb, shown in the annexed engraving, exhibits in a forcible way the explosive power of steam. It consists of a small bulb of glass filled with water and sealed. When held in a candle or lamp flame by means of a wire loop, it soon explodes violently.*

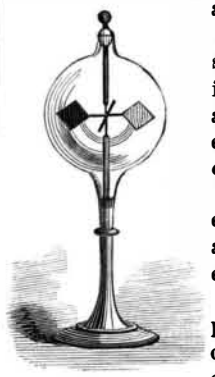


CANDLE BOMB.

The least expensive machine for applying to mechanical work the force exhibited by the candle bomb is the fifty cent engine, shown in the engraving below. It is a small and simple machine, but it is far more perfect than the steam engines of our forefathers. It will readily make 800 to 1,000 revolutions per minute. It is a wonderfully inexpensive example of the world's greatest motive power. Its construction is so well known as to require no description.

FIFTY CENT ENGINE.

The radiometer is one of those instruments which should perhaps be classed with scientific apparatus, but it may, nevertheless, be properly called a toy. It is a heat engine remarkable for its delicacy as well as its great simplicity. It illustrates a class of phenomena discovered by Crookes, which are complicated and difficult to explain in a brief and popular way.



RADIOMETER.

The instrument consists of a very slight spider of aluminum, supporting on the end of each of its four arms a very thin mica plate blackened on one side and silvered on the other side.

The aluminum spider is provided with a jewel, which rests upon a delicate needle point supported at the center of the glass globe.

The spider is retained on its pivot by a small tube extending downward from the top of the globe. When placed in sunlight or near a gas or lamp flame, the vanes revolve rapidly. Crookes' explanation of the radiometer is as follows: "The interior of the glass vessel being highly vacuous, the light or the total bundle of rays included in the term light, falling upon the blackened side of the vanes, becomes absorbed, and thereby raises the temperature of the black side. This causes extra excitement of the air molecules which come in contact with it, and pressure is produced, causing the fly of the radiometer to turn round." G. M. H.

Encouraging Inventors.

Until very recently the propriety of rewarding inventive genius, by securing to the originator of a public benefit certain rights, by which he might obtain remuneration for the labor and time expended by him in perfecting his invention, has not been questioned. A uniformly healthy sentiment has prevailed on this subject, which has materially assisted in increasing novelties of a useful character. The incentive of a pecuniary reward has stimulated the efforts of men of ability in every walk of life, and as a consequence there has been a marked improvement in the domestic economy of all civilized peoples.

The advantages of the patent right system are probably more apparent in the United States than in any other country. No nation has produced so many useful inventions as this, and to the efforts of American genius may be ascribed the complete revolution in several fields of labor which has rendered it possible for men who were once slaves of toil to work and at the same time enjoy life. This has a forcible illustration in the changed system of farming brought about by the patent agricultural implements now in general use. Before the introduction of these useful articles every grain of wheat was paid for, literally, by a drop of sweat; but now, although the farmer is still compelled to labor, he does it under such improved circumstances that it scarcely seems burdensome, and agriculture, as a consequence, has become a favorite pursuit, instead of being avoided, as it was at one period.

It would be idle to attribute the great strides made in mechanics to any other cause than the protection afforded to inventors by the patent laws. It is unfortunately true that the deserving originator is often deprived of his just rights by his inability to comply with the requirements of the law governing the granting of patents, or, as sometimes happens, through ignorance; but this does not affect the general result. It has been asserted, also, that irregularities occur in the issuance of patents by the commissioner, by which inventions are rejected as valueless on the ground that they do not possess sufficient novelty to entitle them to the protection of a patent, and subsequently another applicant is awarded letters for substantially the same thing originally declined. Such mistakes should not militate against the system.

The truth of the matter is, that the law in its present shape is a very good one, and it has the indorsement of all who are interested in the prosperity of the nation. That it may sometimes be abused is no argument against its advisability, for very few acts are absolutely perfect. So long as a reasonable protection is accorded to inventors, no one will have cause for fault-finding. Public opinion is strong enough, as was evinced recently in the sewing machine case, to restrain those having the power to give extensions from using their privilege when it is liable to work injury to the country at large. Those who have commenced a senseless opposition to the entire system because a few grasping men, following the natural instincts of human kind, have attempted to derive more benefit from it than they deserve, will see their error, and unite with us in expressing the belief that the encouragement of genius is the product of an advanced state of civilization, and for that reason merits the friendship of sensible men.—*The Manufacturers' Gazette.*

Snow Melting Apparatus.

A system of snow melting has been devised by Mr. F. Lyon, of 94 Harleyford Road, London. When it is considered that a fall of snow 6 inches deep, over one mile of road 60 feet wide, amounts to 5,866 cubic yards, the impossibility of removing it promptly by means of horses and carts is at once apparent—the more so when it is remembered that some metropolitan vestries have from 50 to 100 miles of road, and thus would have to deal with from 300,000 to 600,000 cubic yards of snow, assuming a 6 inch fall to occur. The principle of Mr. Lyon's invention is that the snow can be dealt with in the roads on which it falls when it is in a light and fleecy condition, and therefore easily melted. The apparatus consists of a wrought iron tube about 35 feet long, having a furnace at one end and a short length of vertical pipe for a chimney at the other. The tube is made in lengths of 6 feet, and each length is tapered so that they all fit into each other and are closely packed for transport on wheels. When a fall of snow occurs, the apparatus is to be laid along the gutters of the roads to be cleared, the width occupied being about 4 feet. A fire is then to be lighted in the furnace, the heat from which will pass along the horizontal tube, which has a flatly arched top. The snow is then to be shoveled on to the heated tube, which will melt it, the resulting water flowing away to the nearest gully. A trial of this apparatus took place in the St. Marylebone district in February, 1885, on some snow which had fallen long previously and had been twice carted. Notwithstanding the solidified condition of the snow and the imperfect condition of the experimental apparatus, it is stated that 21 yards of the consolidated snow, weighing 10 tons 8 cwt. 3 qrs., and equal to 198 yards of freshly fallen snow, were melted in 10 hours with a consumption of coke of the value of 1s. 7d., or under 1¾d. per ton.

Talcum Filter.

Talcum as a filtering medium, recommended by Dr. Fr. Hoffmann, is reported by the Committee on the National Formulary to be better, cheaper, and affording quicker filtration and clearer filtrates than other media previously used. Finely powdered white talcum should be well washed with hot water, slightly acidulated with hydrochloric acid, and again washed with pure hot water until no trace of acid can be detected. It is then dried, and may be used by adding the dry powder to the cloudy mixture, and filtering through paper; or the talcum filter may be constructed in the following manner:

Make a double filter out of white filtering paper, and insert it in a quart glass funnel; mix about half an ounce of talcum with one pint of hot water in a bottle and shake well, then pour it immediately upon the paper filter, taking care so to distribute the mixture that the entire filter from bottom to top is evenly covered with the fine powder. The water will be found to pass off rapidly and perfectly clear, after which the filter is ready for filtering any cloudy mixtures. The same filter may be used frequently for the same substances; but after it has been used the funnel should be covered with a glass plate, to exclude the dust and preserve the filter clean for the next operation.

* When experimenting with candle bombs, a guard of some sort should be provided, to prevent injury to the experimenter.

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