

### A STUDIOUS INVENTOR.

Ransom Cook, who died in Saratoga last week, was master of twenty-six trades and owner of seventeen patents. Among the latter was one for an improvement in the manufacture of wrought iron and steel cannon. This idea was appropriated by Sir William Armstrong, who made both fame and fortune out of it. Among the other patents were one for a lunch-case, one for a fan-blower, for a hydraulic apparatus for producing a blast, for an improved electro-magnetic ore separator (made by Mr. Cook when 80 years old), an improvement in blast pipes for carrying heated air and gases to furnaces, an improvement in scissors, an improved boring instrument known as the "Cook auger," an improved machine for turning the lips of augers, an improved bit for boring wood, an improvement in ventilating and excluding dust from railway cars, an improved exhaust fan, and an improvement in the mode of straining saws for saw-mills. There were several others of more or less importance. Some of his inventions, particularly the patent auger, were very profitable. He was making a machine and wanted an auger that would bore at an angle with the grain without starting with a gouge. He hit upon the idea of examining the lips of the worm commonly known as the wood-borer with a microscope, and from this model, furnished by nature, he made his auger, which was very successful. His workshop was a curiosity. He made all his own models, and had engines and machinery well adapted to the purpose. He had also accumulated one of the most complete and valuable collections of scientific and mechanical books in the country. His library contains more than 3,000 volumes, some of them very rare. The books are arranged in small cases, piled one on top of the other, from floor to ceiling. The purpose of this arrangement was to have them ready for rapid removal in case of fire.—*Buffalo Express.*

### THE SAND BLAST.

Among the wonderful and useful inventions of the times is the common sand blast. Suppose you desire a piece of marble for a grave stone; you cover the stone with a sheet of wax no thicker than a wafer; then you cut in the wax the name, date, etc., leaving the marble exposed. Now pass it under the blast and the sand will cut it away. Remove the wax and you have the cut letters. Taking a piece of French plate glass, say two by six feet, cover it with fine lace and pass it under the blast, and not a thread of the lace will be injured, but the sand will cut deep into the glass wherever it is not covered by the lace. Now remove the lace and you have a delicate and beautiful figure raised upon the glass. In this way beautiful figures of all kinds are cut in glass and at a small expense. The workmen can hold their hands under the blast without harm, even when it is rapidly cutting away the hardest glass, iron, or stone, but they must look out for finger nails, for they will be whittled off right hastily. If they put on steel thimbles to protect the nails, it will do little good, for the sand will soon whittle them away; but if they wrap a piece of soft cotton around them they are safe. You will at once see the philosophy of it. The sand whittles away and destroys any hard substance—even glass—but does not effect substances that are soft and yielding, like wax, cotton, or fine lace, or even the human hand.

**STAMP CANCELLING MACHINE.**—It is announced that an American inventor, employed by the Post Office Department, Washington, has produced a machine which, worked by hand, will easily cancel 400 stamps a minute, but if worked by power can cancel 1,000 a minute. The mechanism is so managed that the various pieces of mail matter are surely separated from each other, and the postal card as well as the letter is certain to come under the eraser. The rapid increase of mail matter, and the fact that in our largest cities, where important mails close in day time, there are thousands of pieces deposited in the Post Office just before the hour of closing, renders such a machine a very important one. The most experienced man cancelling by hand has a difficult task in such an emergency, and the physical results of the severe strain oftentimes prove injurious.

The International Geographical Institute of Berne has put forward a project for the establishment of an international school for training travelers. The programme of study is a formidable one, and is divided into two distinct divisions. The first includes instruction in numerous branches of knowledge more or less necessary for a traveler, and the second practical training in the field.

## Engineering, Civil & Mechanical.

### EXPLOSION OF A PLAIN CYLINDER BOILER IN PHILADELPHIA.

BY S. N. HARTWELL.

The next page cut illustrates the explosion of boiler No. 3 in the dye works of Gafney & Co., in Kensington, Philadelphia, which occurred during the noon hour, on the 1st day of June, 1881, killing three persons and injuring a number of others. The coroner's sensible and pertinent inquiries into the cause of death brought out the usual variety of opinions of the cause of the primary rupture from which the explosion arose.

#### THE CONSTRUCTION OF THE BOILER

was not new or uncommon, nor was the material or work unusually bad. The shell plates, which did not break, were marked at a fair tensile strength, and the head that did break was a fair quality of cast iron where the rupture began. The type and principal dimensions are as follows: A plain cylinder, 30 feet feet long by 36 inches diameter, composed of No. 3 iron plates in nine courses, single riveted; the least observed thickness at the edge of plate was 0.255". The end plates or heads were flat cast iron disks having suitable flanges turned inward, with cored radial holes for the rivets that secured them to the shell plates. Thickness of disks, 1½ inches; flanges, 1½ inches. The pitch or spacing of the rivets was according to accepted American practice. A man-hole was cut in the centre of the front head, 12½ by 12½ inches, the form of which appeared to be not an ellipse, but of somewhat larger area. The gasket seat had been planed, but the corresponding seat on the man-hole plate was not planed, though it appeared quite as true as such castings usually are.

The arrangement of the boilers is shown in the engravings, by which it will be seen that two, namely, Nos. 1 and 2, were set over by the same furnace, and No. 3 by itself over an adjoining one. The former, called the old boilers, had been in use two years, and the latter, the new boiler, had been working but two months prior to the explosion. Two pair of safety valves, one pair to each system, were fitted as shown, their connecting pipes coming through the wall of the steam dry house under which the boilers were set. The pair of boilers had a pair of 2½ inch, and the single boiler, No. 3, had a pair of similar 2 inch safety valves. The main steam stop valves, by which communication between the boiler and with the heating and drying systems of pipes was regulated, were also in front of the wall, as shown. The steam and water pipes were so arranged that the single boiler could be used alone.

These boilers were insured by the Hartford Steam Boiler Inspection and Insurance Company, and allowed to carry 70 pounds of steam. The usual working pressure appears to have been from 60 to 65 pounds by the gauge, the pressure increasing when the demand for steam was less than the supply, indicating that the safety valves did not fully relieve the boiler. The increase of pressure that might have occurred with all the distributing valves closed is therefore unknown.

The new boiler was inspected on or about the 7th of March, and no doubt the hydrostatic test (about 100 pounds) was applied according to law. The builder swears before the coroner that he applied a cold water test of 115 pounds, and found it all tight, etc.

This boiler, No. 3, was fitted with the usual gauges and other attachments, and fed by an injector, either separately or in common with the other two boilers. The steam was used for boiling dye-stuff and for drying.

The observed phenomena indicate unmistakably that

#### THE EXPLOSION

was due to a pressure a little in excess of the strength of the weakest point of the boiler. The course of the initial ruptures is clearly indicated in the engravings, radiating from the man-hole. The cast-iron head was not compensated for the loss of continuity. There was simply a slight chipping spot just raised above the general inner surface, for convenience in finishing a gasket seat upon the planing machine. The removal of the firm and tenacious skin of the iron by the planer reduced its strength. The slight sustaining power of the pinch on the gasket is an indefinite and variable factor, and a great strain falls upon the margin of the man-hole.

So far as the writer knows, there is no well defined and simple rules for determining the strength of the flat disks with man-holes