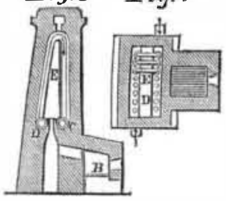
HOT-AIR OVENS FOR IRON FURNACES.

[Continued from page 188.]

In the Staffordshire district, a strong prejudice existed against pig-iron manufactured with hot-blast; and it was not until the hot-blast had been in use some years in Scotland that it wastaken up in Staffordshire. In 1834, Messrs. Lloyds, Fosters & Co., of Wednesbury, erected an apparatus at their works for heating the blast; and, singularly enough, at that early period, proposed to apply the waste gases from the tunnel-head for this purpose. This is believed to be the first attempt at utilizing the waste heat in that portion of the furnace; and, as such, is deserving of special notice. The apparatus constructed at these works consisted of a circular wrought-iron heating-chamber, placed within the brick-work of the tunnel-head, the flame from the furnace rising up through the center of the chamber; the blast was supplied into it from the cold main through several small apertures, which distributed the air against the plates of the chamber on the side exposed to the action of the flame, and the hot-blast was conveyed in a pipe down to the tuyeres. This apparatus was very expensive in its first construction, and constantly required repairs; and it produced a heat of only about 360° Fah., so that a small supplementary oven was required near the tuyere to raise the temperature of the blast still further previous to its entrance into the furnace. This plan has long since been abandoned for more perfect arrangements.

About the same period Mr. Neilson's plan of hot-blast was introduced by Messrs. Firmstone, at the Lays Works, near Dudley. The first experimental oven erected at these works was on the plan as that last described as erected by Mr. Neilson, "by which apparatus," Mr. Firmstone states, "a supply of hot-blast at 600° was with difficulty maintained, and never long without great damage to the semi-circular arch pipes; the pressure on the blast was seriously reduced by its friction in passing through the small arch pipes; but the effect in the reduction of the ores used was astonishing." To remedy these difficulties, both Mr. Neilson, at Calder and elsewhere, and Mr. Firmstone, at the Lays, proceeded

Fig. 6 *Fig. 7*



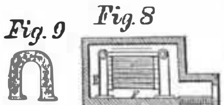
to construct ovens on a plan similar to that shown in Figs. 6 and 7, which show the permanent oven erected, in 1833, at the Lays Works. In order to overcome the difficulty that had occurred previously from the arch tubes, E, being burned down, they were elongated into the form of a siphon, in some instances carried to a hight of 10 feet above the main; and, as an additional safeguard, the grate, B, was placed in a separate compartment, and the oven heated by the gases passing from the burning fuel through small apertures, as shown in Fig. 7. At this stage, also, the previous plan of having a separate oven to each tuyere was abandoned, and the general heating capacity was so much increased, that one oven like that shown in Figs. 6 and 7 was found to be capable of heating the blast for three tuyeres to a temperament of 600° Fah. The dimensions of the oven are as follows:—

Length of longitudinal mains............	7 ft. 6. in.
Number of siphon pipes	9
Area of direct heating surface, total...	240 sq. ft.
Do. per tuyere..............................	80 "
Area of fire-grate, total	9 "
Do. per tuyere..............................	3 "

Fracture of pipes, however, and leakage of joints still took place, but to a much more limited extent than formerly; and these were found good ovens for the requirements of the furnaces of that period.

Another oven worthy of notice is shown in Figs. 8 and 9, erected at the Monkland Works, near Airdrie, Scotland.

Fig. 9 *Fig. 8*



It consisted of two main vertical pipes, E E, of a horse-shoe pattern, with numerous sockets, cast on one face, erected opposite to each other, at a distance of about six feet apart; small, straight cast-iron tubes, F, 15 in number, were then inserted into the sockets, and the horse-shoe mains having been drawn together to close the sockets on the pipes, the joints were well rammed in with iron cement. This arrangement is interesting principally as giving the first example of the curved main; but, as erected, it was a comparative failure. It was subject, also, to the serious objection that, in the event of one pipe becoming burnt or damaged, either the sockets must be stopped up at each end, or the whole apparatus taken down to insert a single new pipe.

In addition to the above, a great number of other modifications of these principles were constructed at various works, involving different arrangements of the tubes, and different modes of setting, too numerous to admit of notice in the present paper. It may be well to add, however, that, with a view of obviating the repeated fracture of pipes and joints, Mr. G. Firmstone made a further trial of wrought-iron in the construction of ovens at the Lays Works, having the connecting arch pipes made of that material; but, although this oven, while in operation, raised the temperature of the blast to 800° Fah., and on this ground was declared by Mr. Neilson to be the most perfect apparatus he had then seen, the old defects of wrought-iron in this position arising from oxydation and want of durability, as previously pointed out, soon became apparent, and the apparatus had to be abandoned.

[To be continued.]

GOULD'S IMPROVED WINDOW FOR SUBMARINE HELMETS.

Walking about on the bottom of the ocean is not a very agreeable pastime, but when it results in the recovery of large amounts of treasure, men are found willing to practice it. Encased in suits of water-tight armor, with which a pipe communicates leading above the surface for the supply of air, the hardy explorers conduct their labors at the bottom of the sea. The helmet of the armor is of course furnished with a window in front of the eyes, to furnish light to the encased operator. But it seems that this window is liable to be obscured by moisture being condensed upon it, and Mr. Gould, of Worcester, Mass., has invented a device to obviate the difficulty. His plan is simply to form the window of two plates of glass with an air space between them.

Fig. 2

Fig. 1

In the annexed engraving, Fig. 1 represents a perspective view of the whole, and Eig. 2 the several parts. B B, is the common bezel, *a a*, the plates, *e*, the space that separates them, and *c c*, the screws by which they are pressed firmly to their beds. They are packed water-tight by rings of india-rubber cloth, and a ring of india-rubber cloth is interposed between them at the edge.

The patent was granted to Charles M. Gould, of Worcester, Mass., and is dated July 26, 1859.

JAMES' RIFLED CANNON AND PROJECTILE.

A new projectile, invented by Hon. Charles T. James, of Rhode Island, and which is intended to be used in connection with a rifled cannon, is a cast-iron cylinder surmounted by a solid conical (canoid) head. The diameter of the cylinder is .02 of an inch less than the bore of the gun; its length is nearly equal to the calibre of the gun; while the length of its conical head is about one inch greater than that of the cylinder. The cylinder retains its full diameter for a quarter of an inch of its length at each end; then, for its intermediate length, its diameter is shortened one-half an inch, forming a recess in its body, which loss of diameter and external surface of the cylinder is replaced by a compound filling of canvas, sheet-tin and lead.

The rings at the end of the cylinder, formed by shortening its diameter, constitute the bearings of the projectile, when introduced into the gun for loading. The solidity of the canoid is continued into and thereby forms the solid portion of the head of the cylinder. The base of the cylinder has a central cavity or opening of 1.95 inches in diameter, which extends into the body 1.5 inches, and from which (like mortises in the hub of a wheel for spokes) there are eight rectangular openings, enlarging as they approach the circumference, in the recess of the body of the cylinder.

When the charge is fired, the gas evolved by the burning the powder, in its effort to expel the projectile and to escape from the gun, is forced into the cavity and through the rectangular openings against the compound filling, which is thereby pressed into the grooves of the bore, and by its firm hold in them, the rifle motion is imparted to the projectile. The canvas and tin, in the order named, constitute the exterior of the filling, and are molded in the recess to the body of the cylinder. This is done by enveloping with canvas the strip of tin, which must be equal in length to the greater circumference of the cylinder, and in width equal to the length of its recess. The strip of tin, when covered with canvas, is formed around the cylinder opposite the recess, and firmly secured there by an iron collar clamp, after which the space between its inner surface and the body of the cylinder is filled with melted lead, which, readily adhering to the tin and iron, forms a compact mass in the recess around the cylinder body.

The following are some of the results of practice with an ordinary six-pound gun (rifled, 15 grooves, and carrying the new projectile), recently made at Chicopee, Mass., under the direction of a Board of officers attached to the Ordnance Department of the United States army, Major W. A. Thornton, chairman.

The gun was first placed at a distance of 674 yards from the target. The quantity of powder used at each firing was one and one-fourth pounds, the service charge for a six-pound round ball, while the weight of the new projectile was over 12½ pounds. Eighteen shots were fired at a cloth target four feet square, fastened on a board frame eight feet square. The shots varied from the center, from three and a half inches to four feet, 14 of them entering the boards. The gun was carried back to 867 yards, or nearly half a mile from the target, elevated at such an angle as should carry a six-pound round ball to the center of the target, and fired. The shot passed over the top of the board frame at an elevation of about 20 feet, cut off four pine trees (one six inches in diameter) without deviating apparently from a direct line, and was lost. This shows the greater range of shot from rifled guns. This charge of one and a fourth pound of powder would carry, by calculations in engineering, a round shot of six pounds weight to the target, and no more; but in this case a shot of more than double weight goes over the target at such a hight and force as to probably double the distance to the target. The gun was then lowered, and five shots fired, two of which entered the board within about two feet of the center. A 12-pound rifled gun was then placed in the same position (867 yards distant), and 19 shots fired. Five of these entered the board at from three and a half to four feet of the center. Great difficulties were encountered in arriving at exactness, inasmuch as the guns had no sights perfectly adapted to them.

At a subsequent trial, with the same weight of powder, projectile, and gun as in the first-described experiments, a range of at least 3½ miles was attained; beyond this point the course of the ball was lost, but the entire range was supposed to be as great as 4½ to 5 miles. A like result with the same conditions of powder and weight of projectile, has probably never been equaled.

In a report on the above experiment, officially submitted to the Secretary of War, the Board say:

"The depth of the grooving in Mr. James' gun is so shallow, as in no case to materially impair the strength of the gun; while it is sufficient to firmly hold the projectile and compel it to take the rifle flight. The perforation of the largest in all instances, and the obtaining of the projectiles after firing, freely indicate that they invariably impinged point foremost; and further, in having one imbedded in damp earth, its spiral motion was plainly indicated in the sand to the close of the flight. The grasp of the rifling is further shown by the increased range obtained while using the same charge of powder and elevation, in projecting masses of double the weight of the usual spherical balls. The merits of the projectiles consist in their answering fully the expectations desired of them—their ready fabrication and adaptation to guns, their ease of loading, as it required but little more force to send the projectile to the bottom of the bore, than is needed to move a body of like weight, on a smooth surface; the certainty of the expansion of the filling, and its firm true hold in the grooves of the gun; the greased canvas wipes the rifling clean and leaves the bore in a condition to receive readily the next charge, and which is also a sure protection to the bore from injury in loading and when the gun is discharged. These conditions commend the guns and projectiles to the favorable considerations of the government."

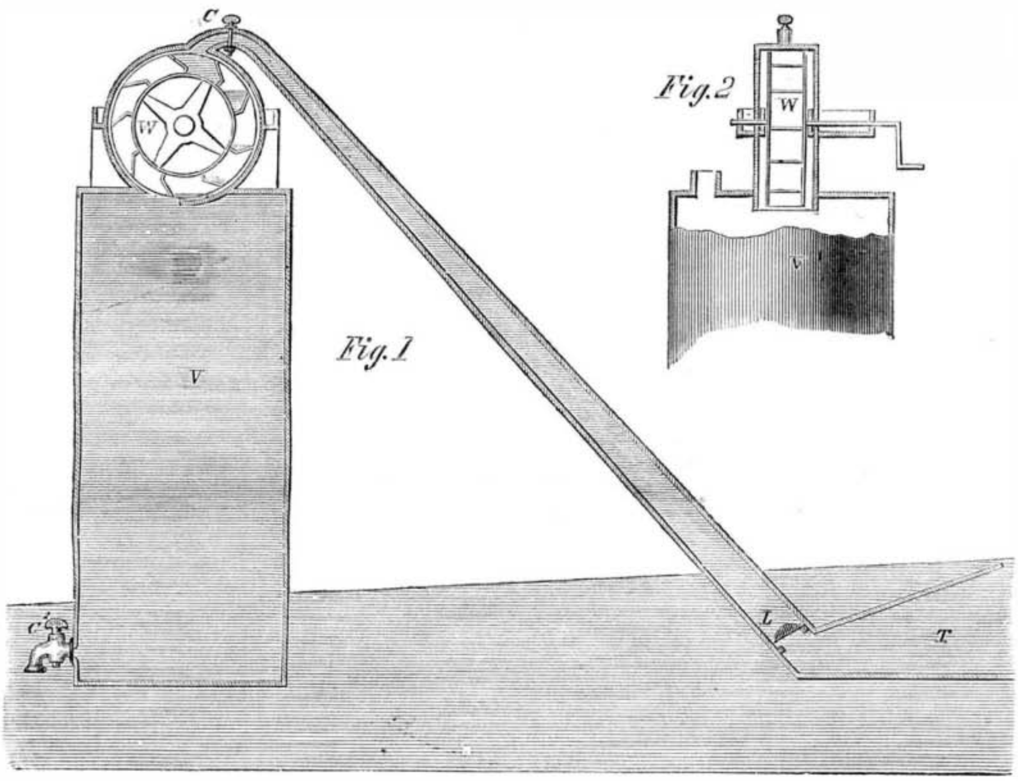
IMPROVED HYDRAULIC MOTOR.

The use of hydraulic power has been a broad field for inventors, and the ideas on the subject do not seem yet to be exhausted. The accompanying engravings represent a plan for using the momentum of water in swiftly-running streams, for which Letters Patent were granted to Morrill A. Shepard, of Orio, Illinois, July 19, 1859.

T represents a tapering tube placed in the water, with its largest part up stream. As the water rushes into this tube, it is carried by its momentum, on to the wheel, W, to which it imparts motion by filling the buckets on one side of the wheel. The vacuum cylinder, V, is to be made air-tight, and the ends of the axle of the wheel should be enclosed in water jackets, so as to encompass the wheel in an air-tight case. The wheel is to be started and stopped by opening and closing the cocks, C and C2. The valve, L, prevents the water from reflowing out of the tube back into the stream, when the wheel is stopped.

The object of this invention is to use the power of rapid streams in a way that will save the expense of damming.

The inventor, Morrill A. Shepard, will be happy to furnish any information in regard to his novel improvement. His address is Parkersburgh, Richland county, Illinois.



SHEPARD'S HYDRAULIC MOTOR.

THE HEAT-CONDUCTING POWER OF METALS.

As there are many erroneous ideas afloat regarding the qualities of different metals for conducting heat, Messrs. F. Grace Calvert and R. Johnson—distinguished English chemists—have lately reported to the Royal Society the results of a series of experiments performed by them to exterminate all the perplexities connected with this subject. These experiments were conducted by placing bars of a certain size of the pure metals, also alloys, in a box so constructed as to prevent radiation, and then applying the heat to them through hot water in such a manner as to secure very accurate results. From these the conductibility of the pure metals have been arranged as follows:—Silver (standard), 1,000; pure gold, 981; rolled copper, 845; cast, 811; mercury, 677; aluminum, 665; rolled zinc, 641; cast, 608; cadmium, 577; malleable iron, 436; tin, 422; steel, 397; platinum, 380; sodium, 365; cast-iron, 359; lead, 287; cast antimony, 215; bismuth, 61. These results are entirely different from those which are usually appended to works on the conducting power of metals. Gold is set down in common tables at 1,000 and silver at 973; here the case is nearly reversed. Platinum is usually set down at 981 (the same as the gold above), while, by the experiments of Calvert and Johnson, it is placed as low as 380—far beneath that of malleable iron. The latter metal is placed in common tables at 347, while above it is ranged at 436. These are very important differences, and should not be overlooked by mechanics and chemists in choosing metals for their conducting powers in any of their operations.

It was also found in these experiments that the molecular condition of the metals greatly affected their conducting powers. Thus, rolled copper, compared with silver at 1,000, was 845, while that of cast was but 811; and while cast-iron was but 359, malleable iron was 436. It is probable that, as the particles of rolled metal are in closer contact, they may thus conduct the heat more rapidly, according to Joule's theory of heat traveling by the vibrations of matter. It was also found that there was a difference in the conducting powers of bars cast vertically and horizontally. Zinc cast vertically was as 628 to 608 of a bar cast horizontally. There is a very great difference in the crystallization of bars cast in different positions, a fact which deserves the attention of all machinists who use cast metal for any purpose. Those bars cast vertically had their crystals more closely arranged, and better disposed for strength and conduction. The higher conducting power of wrought iron over steel and cast-iron shows how much superior it is for boilers and all articles for transmitting heat.

A very remarkable result, developed by these experiments, was the inferior conducting power of alloys—the pure metal always giving the best results. Thus, an alloy of gold, with one per cent of silver, is inferior to pure gold in the proportions of 840 to 981. In making brass, composed of copper and zinc, for boiler tubes, it has always been considered the conducting power of the alloy was in proportion to the copper it contained. This is not so, according to the experiments referred to. Instead of the superior metal (copper) elevating the conducting power of the inferior, the latter brings down the former nearly to its lower standard. Thus, in a brass alloy, containing 49.32 copper and 50.68 zinc, the calculated power is 718; but its actual power, obtained from experiment, was only 688. Again, by increasing the quantity of copper to 66.06, the zinc being 33.94, the calculated power of which brass is 748, it was found by experiment to be about 621. Common yellow brass is composed of 64 parts of copper, zinc, 56, and has a a conducting power of 558, which is higher than that of iron for the tubing of boilers; all other alloys, however, of copper and zinc in other proportions; also, the bronze alloys, containing copper, tin and zinc, possess no higher conducting powers than wrought and cast-iron.

A brass composed of equal parts of copper and zinc is of a beautiful gold color, and crystallizes in prisms. Experiments were made to discover, if possible, whether alloys are simple mixtures of metals or definite chemical compounds; but they were not able to determine this question. When suffered to cool slowly, several alloys have a tendency to form crystallizable compounds, differing in composition in various parts of the cast bars. The less fusible are found on the exterior, the most fusible in the interior of the mass. This will afford an explanation of phenomena sometimes witnessed in rolled iron bars and tubes, namely, that one part will be quite fibrous, while another, not over 18 inches from it, will be highly crystalline.

SEA-WATER AND MARINE AIR.

The density of sea-water is greater than that of ordinary soft water; it varies between the extreme limits of 1.02 in the case of the waters of the Dead Sea, and of 1.00057 in that of the waters of the Frozen Ocean; and M. Aime has ascertained the density of the water of the Mediterranean to be precisely the same at the depth 1750 yards, which it is at the surface. As to the temperature of the ocean, the surface is exposed to the action of local disturbing causes, but there is a zone, of course at a depth varying with the latitudes in which the temperature is constant; below this zone, the temperature decreases, and at the bottom of the ocean the temperature is notably less than it is upon the line of the average. Much has been written upon the subject of the source of the mineralization of sea-water, but, the whole of this question is involved in such mystery that no solution hitherto presented can be considered satisfactory. The presence of the chloride of sodium in such large proportions, and with such strange permanence over the face of the globe, must be considered to be one of the original conditions of matter; and all the attempts hitherto made to account for its presence upon secondary causes only substitute effects for cause. It has been ascertained that the mineralization of sea-water increases with the depth from the surface, but the distance from the equator has little influence upon its composition: in its normal state, sea-water appears to contain 35 parts of solid residue in every 1,000, of which the chloride of sodium constitutes 81 per cent. It is singular that, with the exception of Bouis, no chemist has yet been able to detect iodine in sea-water, although it is notorious that sea-weeds derive their supply of this metalloid entirely from this source. Is analytical chemistry, then, so incompetent to discover the real constitution of a body so universally diffused as sea-water?

It has been ascertained that sea air contains not only the chloride of sodium in a highly comminuted state, but also the hydro-sulphuric acid, the hydro-iodic, and the hydro-bromic acids, combined with ammonia and lime; and in addition to these substances, it also contains at times organic substances. The influence of these agents upon the human frame is great; but their mode of action has hitherto escaped analysis. It is hardly so with their influence upon building materials; for the decay of the latter in so many instances when exposed to the sea air has been traced in its chemical and mechanical bearings with considerable success.

Grape Jelly.—Put the grapes into a jar and place the jar in an oven, or on the top of a stove, to draw out the juice; then squeeze them through a cloth, and to every pint of juice add one pound of loaf sugar, and boil nearly an hour; after which, pour it into the pots, and let it stand till next day; then cover with paper and tie up tight.

Prevention of Pitting from Smallpox.—A new remedy against this result has been recently communicated to the Glasgow Medical Society, by Mr. Branton, clerk to the Infirmary, as having been used repeatedly with success. It consists of glycerine, nitrate of silver and collodion.