Engineering, Civil & Mechanical.

A NEW SMELTING FURNACE.

The remarkable increase within the last few years in the production of argentiferous lead in connection with the great commercial success of the operations as exemplified at Leadville, Colorado; Horn Silver Mining Company, Utah; Eureka and Richmond Consolidated, Nevada; and numerous other almost equally great enterprises, has naturally stimulated improvement of methods of reduction. The new smelting furnace, manufactured by the Lane & Bodley Company, Cincinnati, possesses several features that we think of sufficient importance to describe in this article.

Whenever the use of cast iron has heretofore been objectionable on account of liability to breakage from unequal expansion or other cause, wrought iron has been substituted; also in other places where the use of cast iron resulted in great weight, a similar substitution of wrought metal has been resorted to, thus producing a furnace of maximum strength and durability with minimum weight.

The ground plan of the crucible binders is that of a rectangle with the corners chipped off, thus allowing the upright supports of the deck-plate to be entirely independent of the masonry within the binders. The uprights are wrought iron I beams in lieu of the usual cast iron columns, thus avoiding weight, securing more room, and the flanges on the sides forming excellent racks for supporting bars and other implements used about the furnace.

The usual troublesome cast iron deck plate is superseded by I beams, the space between them being utilized as a channel to conduct off the noxious gases and fumes that escape to a greater or less extent from all furnaces, owing to the pressure within, due to the blast pressure; from the channel above mentioned are flues to conduct the gases, etc., to the outside of the stack building.

At the feed door is a ledge a few inches high, thereby requiring the feeder to throw the charges over it into the furnaces, thus preventing the charges being shoved in, and the fine materials all falling in one side of the furnace.

The space between the crucible and deck plate can be filled with brick and water tuyeres or spray jackets, or water jackets of cast iron, wrought iron, or steel, with closed or open tops; the engraving represents open top steel jackets. Jackets of this construction have been thoroughly tested at the large new smelter of the Horn Silver Mining Company near Salt Lake City, Utah, and proved to be the most economical, although of somewhat higher original cost, than other forms of jackets. These jackets are constructed by forming the sheet next to the fire into a box six inches deep, the corners being shaped up without cutting, welding, or riveting (the back is formed by a shallow box fitting into the deep one), resulting in a presentation of no welded or riveted joint to the action of the fire, excepting where the bronze metal tuyere thimble is secured by countersunk rivets to the inside sheet of the jacket, and from which no trouble has resulted, owing to precautions taken in the details of construction.

The end jackets do not run down to the crucible, the spaces so left being closed by small jackets with the tap hole through them; these small jackets can readily be removed without disturbing the main end jackets, in cases of necessity admitting the introduction of a bar without "running down the furnace."

One of the most fruitful sources of annoyance about furnaces is the blast and water pipes; in this furnace the details of these pipes have received great care. The blast pipes do not interfere with putting in or removing jackets, and they are out of the way of water pipes, permitting of readily repairing the same. The blast pipes are not in the way in bricking up from top of jackets to deck plate. All the water pipes are readily accessible for repairs, and the water pipe valves are within easy reach of the furnaceman, yet out of the way in working around the furnace. The water pipes and valves are so arranged as to admit of removal, and repair of any jacket without disturbing the water supply, or connections of other jackets.

There is frequently considerable trouble in keeping jackets properly cool, when first starting, upon account of their not being protected with a layer of chilled slag; this trouble is found to be entirely overcome by the use of an auxiliary supply, obtained through the connection to the block off hole in each jacket, which supply is only used under the circumstances above indicated.

The brace under the slag spout is notched in steps for the purpose of catching the edge of slag pots, thus holding them level without putting a block under the foot of the pot carriage; such blocks being a source of annoyance, as the slag pot wheels frequently strike them, causing the hot slag to be spilt.

Frequent reference has been made to details, as they are an indication as to the convenience in the operating of any device.

In this furnace the maximum strength and durability with minimum weight are secure, and there is no piece but admits of ready transportation. The total weight is very small, consequently cost of transportation small. There are no cast iron parts liable to break, and all parts are readily removable for repairs. The escaping noxious gases and vapors are carried off. The forms of all essential parts have been approved in practical working.—*Sci. Ame.*

IMPROVEMENT IN STEAM BOILERS.

We give an engraving of an improvement in boilers lately patented by Mr. S. L. Hill, of 68 South Fourth St., Brooklyn, N. Y. In this boiler the inventor, by adding external water tubes, utilizes a great amount of heat that usually goes to waste, and thereby increases the capacity of the boiler without increasing the quantity of fuel consumed.

The boiler not only has this economical feature, but it is made safer and more durable by the addition of the water tubes. If the water contains any foreign matter likely to form sediment, it will be deposited in the horizontal pipe below the fire line.

Steam made in the tubes passes directly to the steam room of the boiler, and water is supplied to the water tubes by pipes leading from the water space of the boiler at each end. The curved tubes offer considerable protection to the fire sheets of the boiler, as they come between the fire and the boiler, and prevent the bottom of the boiler being burned. This is especially advantageous where the feed water is very impure.

One of the principal advantages of this boiler is the facility with which it may be put together or taken apart. The ends of the water tubes are expanded into wrought iron flanges, to which cast iron reducers are secured by ordinary bolts, as shown in the sectional view. The joint is formed by two such reducers, connected by a double cone hollow plug, upon which the reducers are clamped by the coupling bolts. The peculiar form of the plug renders the joint similar to a ball and socket joint, and insures a tight joint, while allowing the pipes to expand and contract.

It will be noticed that none of the joints are exposed to the fire; they are consequently never corroded, and may be taken apart and put together whenever necessary without injury and without creating leaks. The great capacity of this boiler, its safety, and economy are points worthy of the notice of steam users.

IMPROVED THREE-CYLINDER ENGINE.

We give engravings of a new pattern of three-cylinder engine constructed by Mr. Jabez James, London, the engine being one designed and patented by Mr. James, in conjunction with Mr. Walter Wardrope. The special features of the engine are the arrangement of the valves and ports, and the manner in which the valves are driven.

Referring to our illustrations, it will be seen that the engine has three single-acting cylinders, each of which is provided at its outer end with a short straight port leading to the corresponding valve casing. The slide valves are piston valves, and the cylindrical casing in which each valve works communicates at its outer end with the exhaust, while the central portion of its length is in communication with the steam supply. In addition to the port just mentioned, the opening and closing of which is controlled by the valve, each cylinder has other exhaust ports, so placed that they are uncovered by the piston when the latter has made about five-eights of its stroke toward the crank shaft; these supplementary exhaust ports are shown dotted in Fig. 1, and in section in Fig. 2, from which their arrangement will be readily understood. These supplementary ports permit of the escape of a large proportion of the steam, as the piston, after having uncovered them, moves but slowly, so that they are left uncovered during a considerable fraction