2 Sheets--Sheet 1.

E. P. HUDSON.

Apparatus for Introducing Refining Materials in Molton Metals.

No. 165,929. Patented July 27, 1875.

Fig. 1.

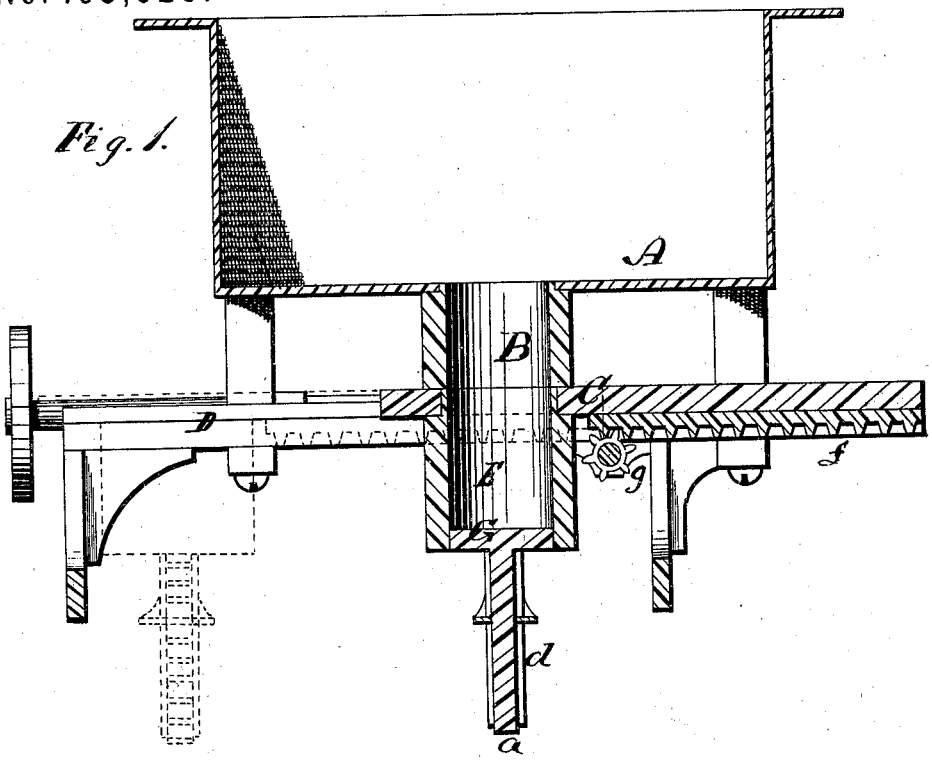
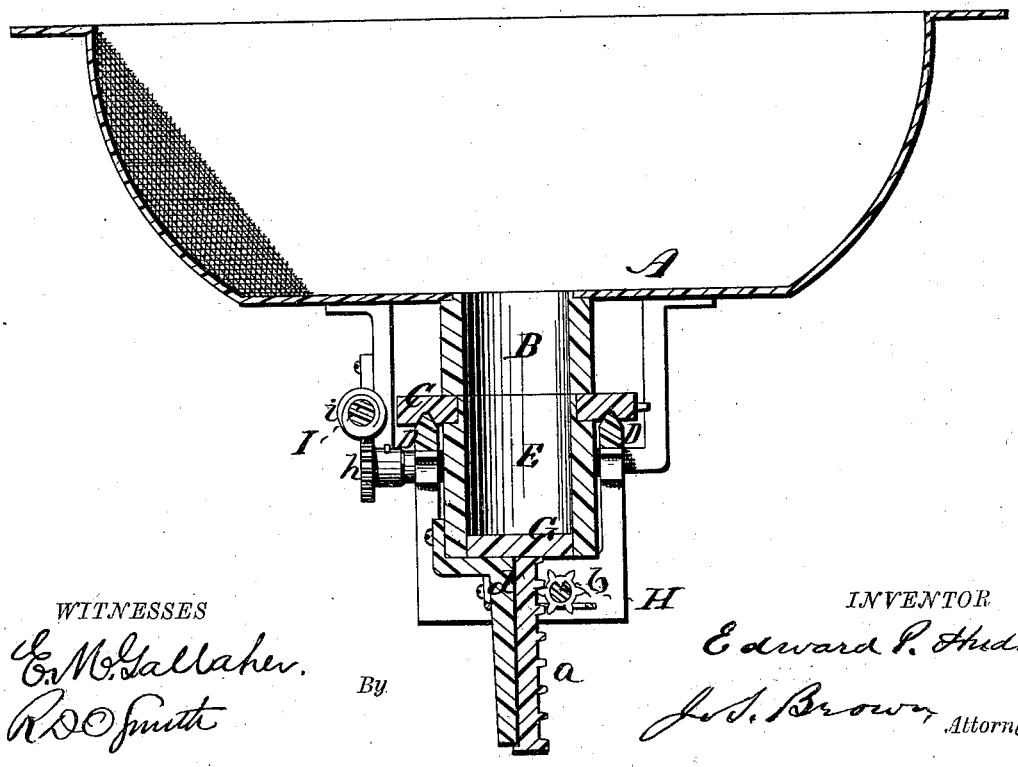


Fig. 2.



WITNESSES

E. McCallaher.

R. D. Smith

By

INVENTOR

Edward P. Hudson,

Jos. S. Brown, Attorney

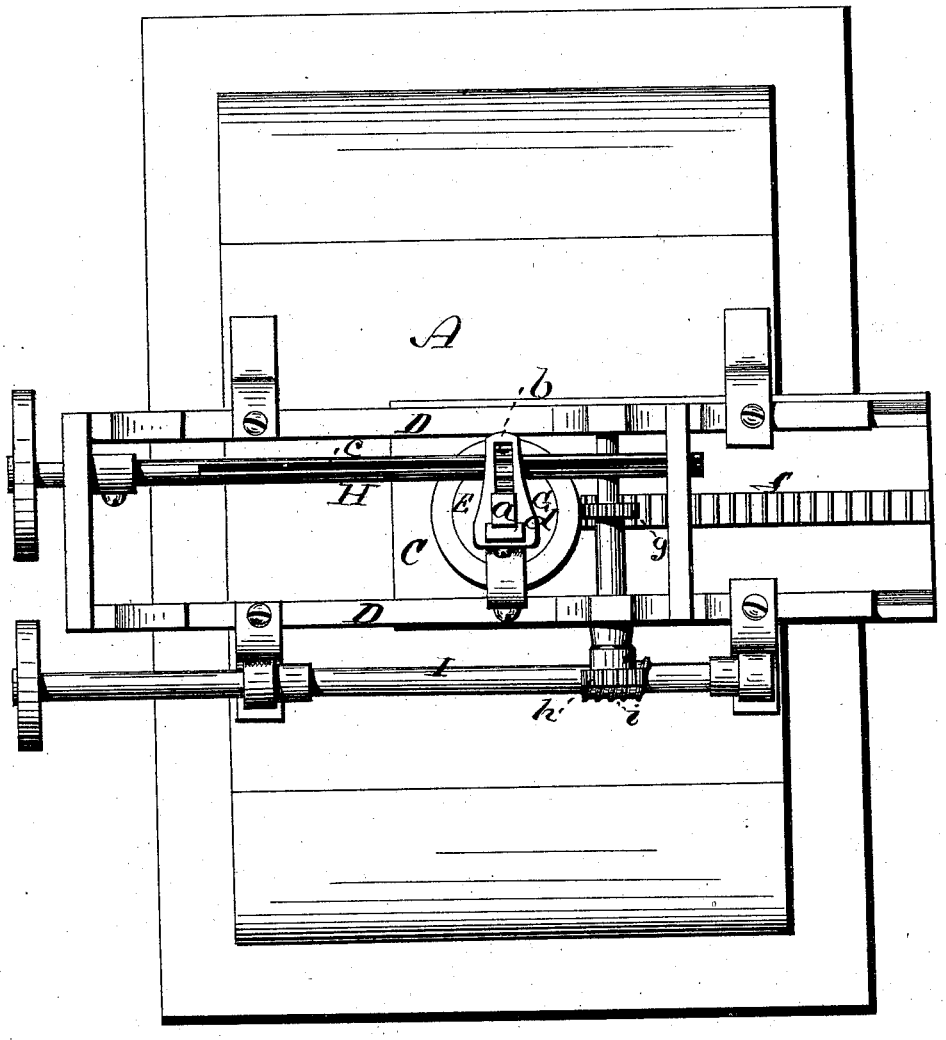
2 Sheets--Sheet 2.

E. P. HUDSON.

Apparatus for Introducing Refining Materials in Molton Metals.

No. 165,929. Patented July 27, 1875.

Fig. 3.



WITNESSES

E. McGallaher.

R. D. C. Smith

By

INVENTOR

Edward P. Hudson,

A. S. Brown, *Attorney*

UNITED STATES PATENT OFFICE.

EDWARD P. HUDSON, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF HIS RIGHT TO NATHANIEL HUGGINS, OF SAME PLACE.

IMPROVEMENT IN APPARATUS FOR INTRODUCING REFINING MATERIALS INTO MOLTEN METALS.

Specification forming part of Letters Patent No. **165,929**, dated July 27, 1875; application filed December 12, 1874.

To all whom it may concern:

Be it known that I, EDWARD P. HUDSON, of New York, in the county of New York and State of New York, have invented a new and Improved Apparatus for Introducing Materials into Molten Metals for Refining and Treating the Same; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings making part of this specification—

Figure 1 being a central longitudinal vertical section of the hearth of a reverberatory furnace, and of my improved apparatus applied thereto; Fig. 2, a central transverse vertical section thereof; Fig. 3, a view of the same from below.

Like letters designate corresponding parts in all of the figures.

The nature of my invention consists in an apparatus, suitably constructed, for introducing into molten metals materials for refining and treating the same from below, or into the liquid metal upward under the surface thereof, whereby the difficulty of introducing such materials into and commingling them with the metals is obviated, and the process of refining and treating the metals is rendered practical, sure, and successful.

My improved apparatus is substantially represented in the accompanying drawings, and is described as follows:

In the drawings, A represents the hearth of a reverberatory furnace, preferably made deeper than usual, for bringing the molten metal thereon into a more compact mass, in order to facilitate the treatment thereof with the materials introduced. At or near the middle of the hearth A a tube, B, is applied, projecting downward therefrom and forming a close continuation thereof. The capacity of this tube is sufficient to contain the amount of refining materials desired or convenient to introduce at one time. The tube is open at top and bottom, and the lower end thereof terminates in a plane or even surface. Immediately under this tube, and tightly fitting beneath it, is situated a sliding plate, C, of a width sufficient to fully close the lower end of the tube, and to mount it on ways D D, or in suitable guides, to direct and support it in its sliding movements, and keep it close to the lower end of the said tube. In this sliding plate or carrier is located another tube or shell, E, of the same diameter or transverse dimensions as the tube B, and of equal capacity thereto, it being so located that it can be brought centrally beneath the said tube B by the sliding plate in which it is mounted, and when so located its axis being in line with that of the said tube B, and its inner surfaces accurately conformed to those of the same tube, and forming a downward continuation thereof. The sliding plate C has a sliding movement forward and backward under the tube B, to convey the lower tube or shell E, mounted therein, beneath the said tube B, as above set forth, and outward again from beneath the hearth of the furnace to a position wherein the tube E can be conveniently filled with the material to be used, or the tube or shell itself be removed from the sliding plate or carrier and again inserted or replaced by another tube or shell of corresponding dimensions. In the tube or shell E is located a piston or follower, G, which can be depressed to the lower end of the tube for the purpose of filling the said tube with the material employed, and again be raised flush with the upper end of the tube for discharging the contents upward into the tube B.

This piston is operated by means of a stem or rod, *a*, having rack-teeth on one side, which gear into a pinion, *b*, on a shaft, H, which is turned by hand or otherwise for the purpose; or any equivalent means may be employed. In order that the shaft-pinion and piston-rack may remain in gear undisturbed while the tube E is moved backward and forward in the sliding plate or carrier C, the said pinion is made to slide on its shaft H, being held from turning thereon by an inward projection in the eye of the pinion running in a groove, *c*, in one side of the shaft, and the pinion is held in proper relation to the rack by a stay-guide, *d*, attached to the tube E, and acting also to keep the rack in a central position, or other equivalent means may be used.

The sliding plate or carrier C receives its reciprocating movement under the furnace-tube B by means of a rack, *f*, thereon of a

pinion, *g*, gearing into the same, and of another pinion, *h*, on the shaft of the pinion *g*, into which pinion *h* an endless screw, *i*, on a shaft, I, works. On turning the shaft I the requisite reciprocating movement of the carrier in its ways is produced. This or an equivalent device for moving the tube E into position beneath the stationary tube B also holds it securely in that position while operating the piston therein.

With this apparatus any material previously reduced to the proper degree of fineness or consistency may be introduced into liquid metal in a furnace below the surface of the metal, and there effectually be employed for refining the same.

The operation of the apparatus is as follows: The tube B, before the charge of metal is placed in the furnace, is packed full and close with the material to be introduced into the molten metal for refining or treating the same, the sliding plate C, at the time, being drawn outward, in order to form a close bottom to the tube, and allow a charge of the material to be introduced into the tube E, the material in a fine state being tightly packed therein by pressure, if necessary; then, when the charge of metal is melted in the furnace, and is ready to be treated, the charged tube E is moved backward centrally beneath the filled stationary tube B of the furnace, and the piston G is driven upward, thereby forcing the charge of refining material from the tube E into the tube B, and the charge previously contained in the latter tube upward into the molten metal in the lower part or beneath the surface thereof, to be there manipulated or employed for the purpose intended. The sliding plate C is then drawn forward for recharging its tube E, or for replacing it by another tube already charged, a sufficient number of such tubes or shells being provided for the purpose, the previously delivered charge of the said tube E remaining in and filling the tube B. The sliding plate C is again driven in, as before, and the process is repeated as many times as required, the same or different refining materials being introduced into the metal, as desired. The charge in the tube B, after the first filling through the furnace, may afterward be continually replaced from the tube E, and always furnish a support for the metal in the furnace.

This apparatus is applicable to a wide range of uses in refining and treating molten metals, particularly iron and steel, it being in general impracticable or extremely difficult to introduce the materials employed by mixing or stirring into the surface of the molten metal. Thus, with this apparatus, for instance, if the purpose is to carbonize cheap, white, and mottled iron to a No. 1 grade of iron, and, at the same time, to refine it so as to make it equal in quality to cold-blast charcoal iron, pure carbonaceous material is introduced by sufficient charges, the hydrocarbons and gases thereof assisting in the refining process, while suitable fluxes may be introduced therewith, and, being distributed through the molten metal, they will remove the earthy matter, as well as sulphur and phosphorus. If the treatment is to be reversed, and decarbonization is required, as for making steel, metallic oxides are introduced in the same way. The apparatus is applicable to reverberatory and other furnaces, and, particularly for simple carbonization, it may be attached to a simple melting pot or receptacle.

What I claim as my invention, and desire to secure by Letters Patent, is—

An apparatus substantially as herein described, consisting essentially of a stationary charging-tube, B, attached to a furnace or melting-pot, a closing plate, C, moving beneath the same in suitable ways D D, a movable charging tube or shell, E, and a piston or follower, G, arranged and operating substantially as set forth, for introducing materials into molten metals below the surface thereof, for refining and treating the same, substantially as herein specified.

EDWARD P. HUDSON.

Witnesses:
S. J. HUGGINS,
D. C. CONEY.