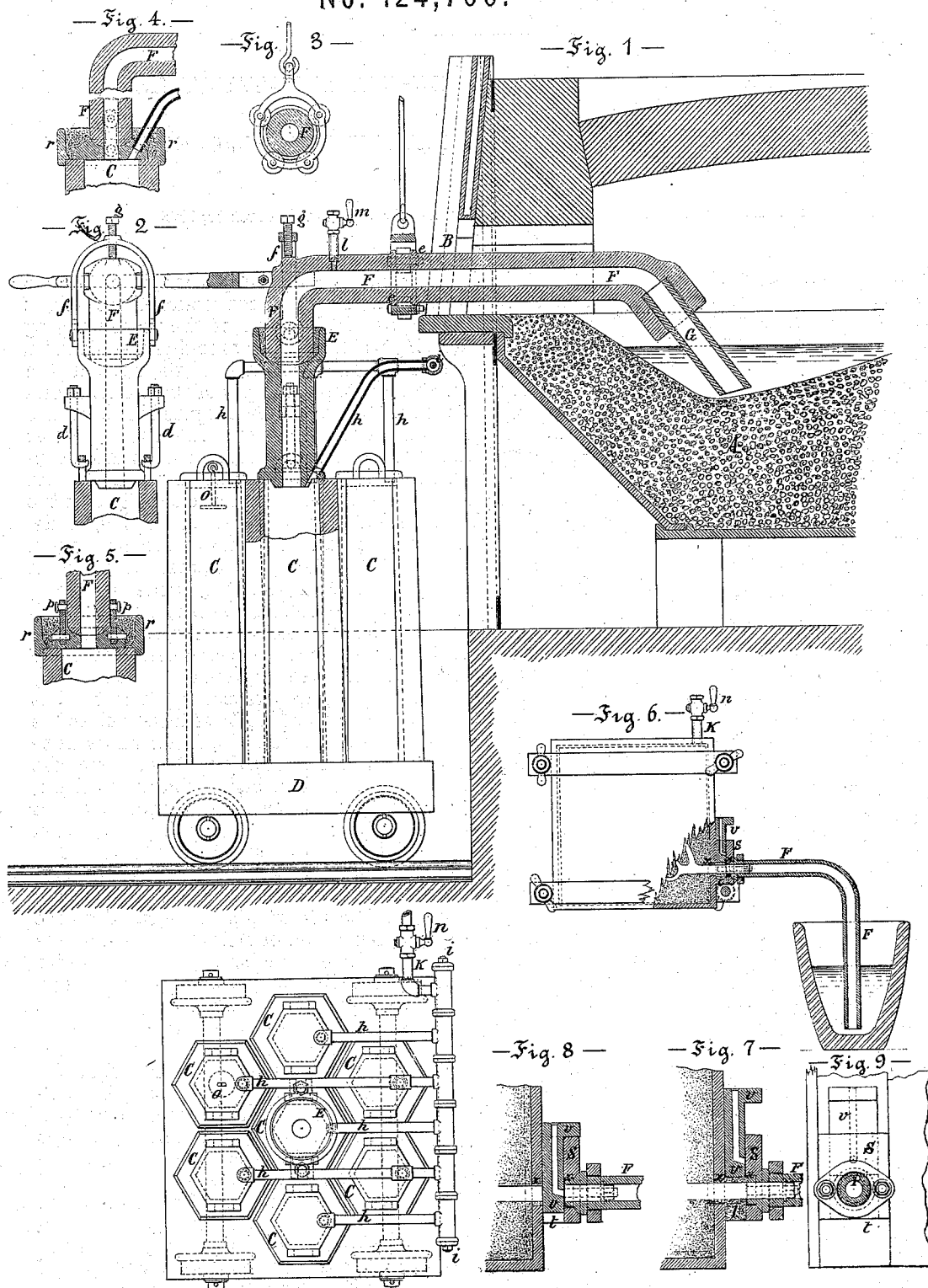


WILLIAM SELLERS.
Improvement in the Manufacture of Cast Steel
and Refined Metals.

No. 124,700.

Patented March 19, 1872.



Witnesses:

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IMPROVEMENT IN THE MANUFACTURE OF CAST-STEEL AND REFINED METALS.

Specification forming part of Letters Patent No. 124,700, dated March 19, 1872.

To all whom it may concern:

Be it known that I, WILLIAM SELLERS, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in the Art of Transferring and Casting Metals, of which improvements the following is a specification:

My invention comprises a novel method of drawing off or discharging the molten metal from the furnace or crucible in which it has been melted without piercing any part of the hearth or bed of the furnace or removing the crucible from the furnace in which it has been treated; and my invention further comprises a novel method of transferring molten metal from furnaces or crucibles to molds, or from one furnace or crucible to another, without the intervention of any ladle or other similar apparatus; and my invention further comprises a novel method of transferring molten metal from furnaces or crucibles to molds, or from one furnace to another, without exposing it to the air in passing from the one to the other, so that it shall have no opportunity to become oxidized by such exposure, no opportunity to carry air with it into the molds or second furnace, and less opportunity to part with its heat than in any of the methods heretofore practiced; and my invention further comprises a novel method of arresting the discharge of molten metal from furnaces or crucibles after said discharge has been established, and of re-establishing said discharge after it has been arrested, without the use of tapping-irons or clay-stoppers, or without moving the crucibles, should the molten metal be contained in such a vessel; and my invention further comprises a novel method of preventing waste of molten metal in discharging it from a furnace or crucible into a secondary furnace or crucible, or from either of these furnaces, into a mold by returning the metal which cannot be delivered when the discharge is arrested back into the furnace or crucible from which it was discharged; and my invention further comprises a novel method of delivering the metal into the molds and retaining it therein after the cast has been made; and my invention further comprises a novel method of venting the molds, so that the metal shall not be exposed to the air while the cast is being made.

A vertical section of my discharging or tap-

ping apparatus, with a portion of a furnace which I have used in connection therewith, is represented in Figure 1 of the accompanying drawing which forms part of this specification.

A is the bed or hearth of the furnace, the lines indicating the depth of the molten metal thereon. The door for charging the metal into the furnace is not shown. A door, B, smaller than the one used for charging, is placed convenient to the deepest part of the hearth for the purpose of examining the condition of the metal and also for the purpose hereinafter described. *c c c* are ingot-molds, arranged upon a single bed-plate, D, and connected with each other by semicircular gates in the bed-plate, as now and heretofore practiced. This bed-plate is mounted upon wheels, which rest upon rail-tracks, so as to be conveniently run into and out of an oven in which the molds may be heated previously to making a cast. The top of each of these molds is faced off, and is provided with a cover, also faced off so as to fit with reasonable accuracy. The cover of the central mold is much higher than the others; in fact in this instance it is a pipe having a bowl-shaped top, E. The inside of this bowl is cylindrical with a spherically-formed bottom, and in the center of this is an opening leading to the interior of the central mold. This central cover or pipe is secured to the top of the central ingot-mold by the hook-bolts *d d*, Fig. 2. From the bowl E to the interior of the furnace a bent cast-iron pipe, F, extends, having one end fitted to the bottom of the bowl E and the other end enlarged to receive the tube G, which may extend to the hearth of the furnace where the pipe F rests upon the sill of the door B. The tube G may be composed of the material used for crucibles in steel furnaces, and is luted into the end of the pipe F with daubing similar to that used for repairing crucibles, and the portion of the pipe F within the furnace is covered with the same material to protect it from the heat of the furnace. Outside the door B the pipe F is slung so as to be raised and lowered, the details of this suspension being shown in Fig. 3, in which a band carrying four wheels is exhibited, and upon the lower wheel the pipe is supported so as to turn freely about its axis, the upper wheels serving only to retain the wheels and band in position upon the pipe by the collars

cc, cast with the pipe. To the bent end of the pipe *F*, outside the furnace, I attach a handle for the purpose of guiding it when placing it in position. This handle can be readily removed when the pipe is not in use, or when it is placed in a furnace to dry the daubing before mentioned and to heat the pipe before making a cast. To the bowl *E* is attached a hinged U-shaped strap, *ff*, having a screw, *g*, in its center for the purpose of holding the pipe *F* securely against the bottom of the bowl *E*. To the cover of each of the ingot-molds wrought pipes *h h h h* are attached, and these pipes are of such shape and length as to bring their ends in line, so that a cross or T-pipe can be received upon each of them in such a manner that a single bolt, *ii*, will serve to secure them together. To one of these T-pipes I attach a pipe, *K*, which leads to a closed vessel, not shown upon the drawing, or it may lead to any apparatus capable of producing a rapid exhaustion of the air contained within the pipes and the ingot-molds. Upon the upper side of the pipe *F*, and outside the furnace, I attach a small pipe, *l*, communicating with the interior of the pipe *F*, and having its upper and outer end closed by a valve or cock, *m*. When the apparatus is in the position described, I fill the bowl *E* with sand lightly rammed in; I likewise sand the joints of the covers upon the top of the ingot-molds and the joints of the molds upon the bed-plate. In the apparatus as used by me the pipe *K* is connected at its outer end to a cylindrical closed vessel made air-tight, which I exhaust of air by means of a steam-jet ejector, and which, in my practice, I have exhausted until the gauge showed a vacuum of twenty-two inches. Between the reservoir and the T-pipes I place a valve or cock, *n*, which must be kept closed until the cast is to be made. In one of the covers I bore a small hole to receive a wire, upon the lower end of which a float, *O*, is attached. This wire must play freely through the cover; and the joint is made sufficiently tight by sand; the object of this float being to determine when a sufficient quantity of metal has been run into the molds. The apparatus being in position, and the metal at the proper temperature, the cock *m* may be opened, when the pressure of the atmosphere upon the molten metal in the furnace will cause this metal to be discharged into the molds, and when a sufficient quantity has entered, as will be shown by the float *O*, the cock should be opened, admitting air to the interior of the pipe *F*; the metal in this pipe will then be partly-discharged into the molds and partly returned into the furnace, leaving a thin film of metal only around the interior of the pipe. As soon as this takes place the cock *m* should be closed. To re-establish the discharge the cock *n* should be closed, and the cock *m*, in the pipe communicating with the exhausted closed vessel before mentioned, opened, thus relieving the interior of the pipe *F* from atmospheric pressure, when the molten

metal will immediately commence to flow through it as before. *cc*

A modification of the central cover and the discharging-end of the pipe *F* is shown at Figs. 4 and 5. In this case the cover has a socket-shaped top to receive the spherically-formed end of the pipe *F*, to which it is attached by links *pp*, so that the pipe can vibrate freely in the socket in the cover. A ring, *rr*, surrounds the top of the mold and rests upon it, this ring being of sufficient height above the mold to retain the sand packing above the socket in the cover, and also sufficiently larger than the cover to permit the sand to close the joint between the cover and the top of the mold. In other particulars it is similar to the pipe *F* first described. This modification is more simple and more easily adjusted than the one first described, and is equally efficacious, but, when the tops of the molds are far below the furnace, it is not so convenient, owing to the length of the vertical part of the pipe *F* required to reach the molds.

Figs. 6, 7, 8, and 9 represent a modification of the arrangement, such as I have used for casting from a crucible into sand molds. The metal employed for casting in this case was the ordinary bronze, and also common brass. The flasks are of iron and of the ordinary construction, with the exception of the lug *S*, which is cast upon the side of one of the flasks, near to one corner. This lug is cast with a rectangular opening, *t*, through it, and this opening is dressed out to receive the plug or slide *v* and allow it to play freely therein. This slide has a small hole extending downward from the top a certain distance until it meets with another similar hole extending inward from the outer surface of the slide, the use of which will be hereinafter mentioned. It is also provided at its upper end with an outward-projecting lug to limit the downward motion of the slide. The pipe *F*, leading from the mold to the crucible, is, in this instance, wrought-iron, and bent to a convenient form, and is provided at the end next the flask with a collar spherically formed upon its outer side, by means of which the pipe is secured to a socket, conformably shaped, in the lug *S*.

When the mold is rammed, a pattern-plug is inserted through holes *xx* in the lug *S* and the side of the flask. The rectangular opening in the lug *S* is rammed with sand the same as the interior of the flask, and the plug is withdrawn when the mold is completed and the patterns removed, and the opening left by the plug is made to communicate with the openings from which the patterns have been removed in the usual manner.

The pipe *K*, Fig. 6, leads to the exhausted closed vessel before mentioned, and is provided with a cock, *n*, as in the apparatus before described. Its interior is in communication with the mold left by the pattern through ducts formed in the sand, as ordinarily practiced for the rising gate, and the slide *v* is

placed in position, as shown in Figs. 6 and 7. To prevent the air from drawing through the sand I cover the top and bottom of the mold with a thin sheet of India rubber or vulcanized gum, over which the usual wooden coverings are placed and secured by clamp-screws, as ordinarily practiced. The openings or joints between the flasks are luted with stiff clay.

The mold is now placed, with reference to the crucible and molten metal, as shown in Fig. 6. The pipe F is heated to prevent chilling the metal and immediately secured to the flask. The cock *n* is opened, and the metal is forced from the crucible into the mold by the pressure of the atmosphere upon the surface of that in the crucible. As soon as the mold is filled the slide *v* is driven downward as far as the lug upon its upper end will permit, forcing out the sand below it in the lug S, and preventing the return of the metal in the flasks. At the same time the hole in the slide *v* will be brought into the position shown in Fig. 8, which will allow the air to enter the upper end of the pipe F, and permit the metal contained therein to flow back into the crucible.

In transferring molten metal from the furnace or crucible in which it is melted to a second furnace or crucible for subsequent treatment, the cover which is used for the central mold must be applied to the end of the pipe F in the second furnace or crucible, which, in this instance, must be placed lower than the first. Communication with the exhausted receiver or exhausting apparatus may be made through the aforesaid cover or into the pipe F at a point below its end in the melting-furnace or crucible. After the air has been exhausted from the pipe F, as hereinbefore described, and this pipe is filled with molten metal, the cover must be removed, and the discharge will continue until the molten metal is exhausted, or until its flow is arrested, as hereinbefore described.

To re-establish the discharge after it has been arrested in the manner described, or from any accidental accumulation of air or gas in the pipe F, the cover must be replaced on the end of the pipe and the air exhausted, as before.

The method of casting hereinbefore described is especially applicable to alloys of zinc, copper, iron, and tin, which rapidly oxidize by being exposed to the air in a molten state, and in consequence thereof the castings are liable to blow-holes, which the process described will obviate.

The details required for convenient working must be arranged to suit the various locations of the apparatus in which the process is to be conducted and the materials with which it is intended to operate. I have stated herein that I used a vacuum of twenty-two inches; but it is evident that the amount of vacuum required will depend upon the specific gravity of the molten metal and the height to which it must be lifted.

It might be supposed that the rapid expansion of the air contained between the particles of sand in a sand mold would destroy the mold when suddenly connected with an exhausted receiver; but I have discovered that the mold is not affected by such connection when made as suddenly as a cock can be turned, and that the metal flows into it without the disturbance which frequently occurs when poured from above, as usually practiced in this class of work.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The door B or its equivalent for discharging or drawing off the molten metal from a furnace or crucible at a point above the surface of the metal on the hearth or in the crucible, substantially as described.

2. The combination of a furnace or crucible in which the metal is melted, a mold in which the metal is cast, and a conduit through which the metal is transferred directly from the furnace or crucible to the mold, substantially as described.

3. The combination of a furnace or crucible in which the metal is melted, a secondary furnace or crucible in which the metal is treated, and a conduit through which the metal is transferred directly from the one furnace or crucible to the other, substantially as described.

4. The combination of the melting-furnace, the pipe F, through which the metal flows, a secondary furnace, and the pipe K, through which the air is exhausted from the pipe F, substantially as and for the purposes described.

5. The combination, with the mold, of the pipe F, through which the metal flows from the furnace or crucible to the mold, and the pipe K, through which the air is exhausted from the mold, substantially as and for the purposes described.

6. The combination, with the conduit F and the air-exhaust K, of the air-cock *m*, or its equivalent, substantially as described.

7. The combination of the melting-furnace, a secondary furnace or a mold, a pipe, F, or its equivalent, and a cut-off air-cock, *m*, or its equivalent, substantially as described, whereby, when the discharge of the metal is arrested, all that cannot be delivered to the secondary furnace or mold will be returned back to the melting-furnace.

8. The combination, with the mold, of a gate, substantially as and for the purposes described.

9. The combination, with the mold and the reflux-gate, of an air-valve, substantially as and for the purposes described.

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