

J. W. ARNOLD.

AUTOMATIC CHARGER FOR BUSHELING FURNACES.

APPLICATION FILED APR. 6, 1900.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1

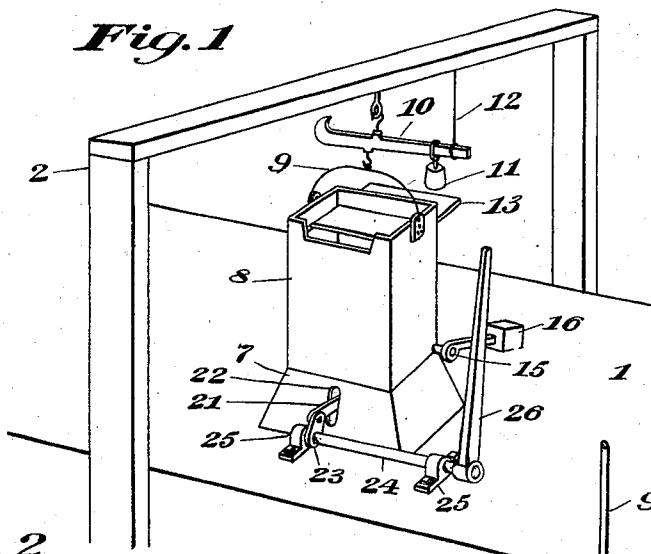


Fig. 2

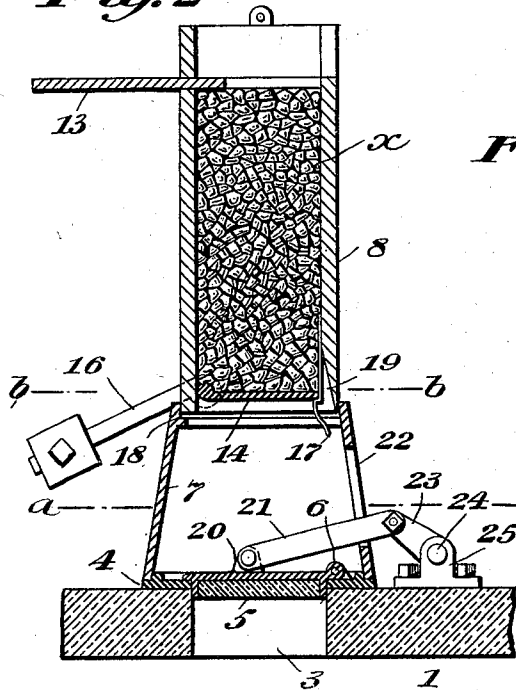
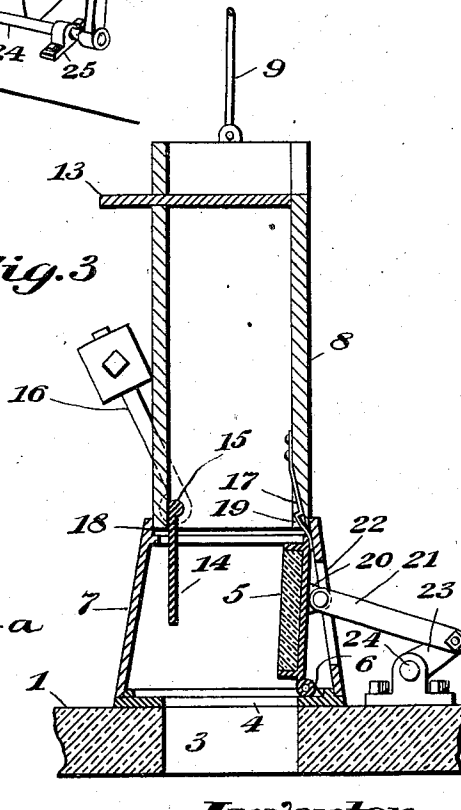


Fig. 3



Witnesses

John Thorne
John Elias Jones

Inventor

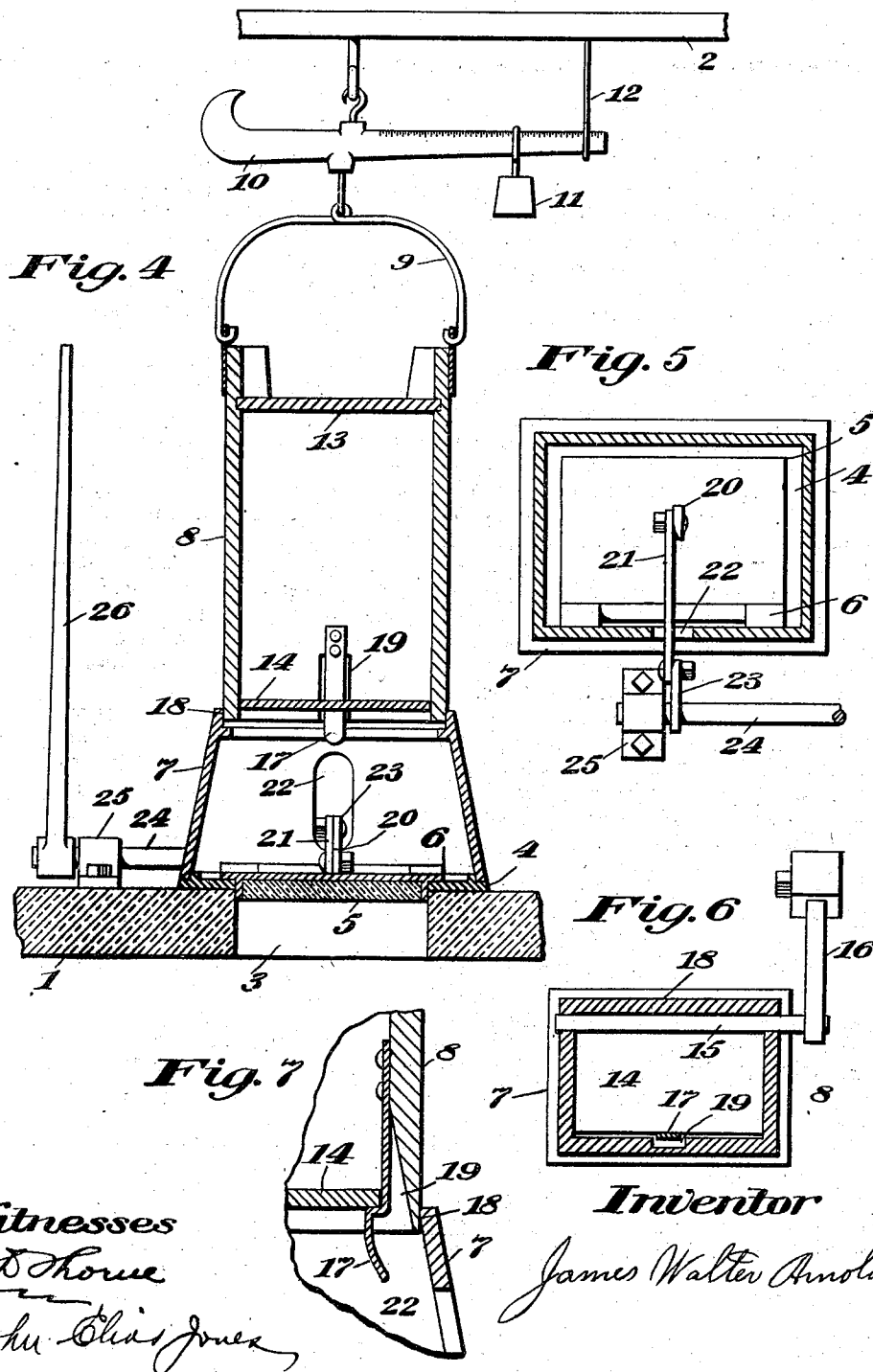
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UNITED STATES PATENT OFFICE.

JAMES WALTER ARNOLD, OF COVINGTON, KENTUCKY.

AUTOMATIC CHARGER FOR BUSHELING-FURNACES.

SPECIFICATION forming part of Letters Patent No. 726,839, dated May 5, 1903.

Application filed April 6, 1900. Serial No. 11,819. (No model.)

To all whom it may concern:

Be it known that I, JAMES WALTER ARNOLD, a citizen of the United States, and a resident of Covington, in the county of Kenton and State of Kentucky, have invented certain new and useful Improvements in Furnace-Charging Devices, of which the following is a specification.

This invention relates to certain improvements in converting iron, and has for its object in part to improve and simplify the converting or puddling process, so as to permit a material economy in the cost of the operation and also to permit of effecting a saving of time and labor, and in part to provide certain improvements relating to the furnace wherein the process is carried out, by means of which improvements the handling of the charge and the carrying out of the improved process in practice are materially facilitated and simplified.

The invention consists in certain novel features of the construction, combination, and arrangement of the several parts of the improved furnace whereby the size of the charge may be conveniently gaged and its introduction into the furnace may be readily and conveniently accomplished without material loss of heat, all as will be hereinafter fully set forth. The novel features of the invention will be carefully defined in the claims.

Heretofore, so far as I am aware, in the puddling or converting process it has been customary when a charge has been heated and finished to operate the dampers so as to cool down the furnace and harden the balls or lumps sufficiently to permit them to be conveniently withdrawn from the furnace, and after the balls or lumps have been withdrawn from the furnace the latter is still further cooled by holding the same open while a cool and fresh charge is being introduced. In this operation, it will be seen, there is a very considerable waste of fuel, caused partly by the cooling of the furnace preliminarily to the removal of the finished charge and partly by the holding of the furnace open during the introduction of a fresh and cool charge, and there is also a material waste of time, owing to the delay in the removal of the finished charge while it is being cooled and hardened and in the introduction of the fresh charge

and also in the time consumed in again bringing the furnace up to the required heat. This waste of fuel and time I avoid by my improvement, which consists in introducing a cool and fresh charge into the furnace as soon as a preceding charge has been heated and finished, so that the necessary heat is absorbed by the fresh charge to so cool and harden the finished balls or lumps as to permit of their being conveniently withdrawn without any further cooling of the furnace or any material delay in the operation. In this way it will also be seen that the waste of fuel caused by the operation of dampers is altogether avoided, since the heat abstracted from the heated and finished charge to cool and harden the same is not lost and dissipated, as in the old process, but is absorbed by the fresh charge, so that the operation so soon as the finished charge shall have been removed from the furnace may immediately be proceeded with.

Figure 1 is a perspective view of a furnace provided with my improvements. Fig. 2 is a vertical section taken through the top of the furnace and through the charging-box supported above the same and showing a charge held in said box ready to be introduced into the furnace; and Fig. 3 is a view similar to Fig. 2, but showing the parts in the positions in which they stand when the charge is being introduced into the furnace. Fig. 4 is a sectional view taken vertically through the charging-box in a plane at right angles to the plane of the section in Figs. 2 and 3. Fig. 5 is a sectional view taken transversely through the lower part of the charging-box in the plane indicated by line *a a* in Fig. 2. Fig. 6 is a sectional view taken transversely through the charging-box in the plane indicated by line *b b* in Fig. 2. Fig. 7 is an enlarged detail view showing the latch for upholding the charge in the charging-box.

As shown in the views, 1 indicates the top or crown of the furnace, in which is formed at a suitable point over the hearth a charging-opening 3, around which is set a metal coping 4, having a central opening communicating with the opening 3 and adapted to be closed by a trap or door 5, hinged, as shown at 6, to the coping and faced with fire-brick or other refractory substance upon its un-

der side to resist the heat to which it is exposed from the furnace when closed.

Above the coping 4 is arranged the charging-box, which is formed in two parts 7 and 8, one above the other, the said box being adapted to receive the charge and being provided with means adapted for operation to permit such charge to be conveniently dropped when the door 5 is raised through the opening 3 and into the furnace. The lower part 7 of the charging-box is in the form of a rectangular metal casing, the walls of which are inclined or sloped outwardly from top to bottom, so that the lower part of the box is thereby made enlarged.

The upper part 8 of the charging-box is also rectangular in cross-section and is arranged to fit movably or loosely in the top of the said lower part 7 of the box, which lower part is recessed, as shown at 18, to receive said upper part, and the said upper part 8 is provided with a hinged bail 9, by which it is supported from one end of a scale-beam or steelyard 10, the other end of which is graduated and carries a pea 11. The beam or steelyard 10 is supported from a framework 2 or other means over the furnace, and a loop or wire 12 is provided for holding the graduated end of said scale-beam or yard.

The upper end of the upper part 8 of the charging-box is provided with a sliding door 13, which when slid back, as shown in Fig. 2, opens the mouth of the said box for the introduction of the charge, (indicated at *x* in said figure,) and at the lower end of said part 8 is a swinging or pivoted door or valve 14, held on a shaft 15, one end of which is extended outside the charging-box, as seen in Fig. 6, and carries a weighted arm 16, so arranged as to hold the door or valve normally in a raised or horizontal position, as shown in Figs. 2 and 4. A spring-catch 17 is arranged at the side of the charging-box opposite to the shaft 15 and is adapted for engagement with the free edge of said swinging door or valve to hold the same in raised position when elevated by the weighted arm 16, so as to support the charge rested on said door or valve. The wall of the box is recessed or cut out, as shown at 19, to permit said catch to be drawn back out of engagement with the door when it is desired to release the same and drop the charge into the furnace, and said catch 17 is formed with a bent lower end, which is extended below the door 14 and into the lower part of the charging-box and is arranged in the path of the trap or door 5, so that when said trap or door 5 is raised, as shown in Fig. 3, its free edge will by engagement with the said extended end of the spring-catch 17 disengage the said catch from the door or valve 14 and permit the same to fall under the weight of the charge rested on it, so that the said charge will be permitted to drop down through the charging-opening 3 and into the furnace.

For actuating the door or trap 5 I provide a hand-lever 26 at one side of the charging-box, the said lever being held on a rock-shaft 24, mounted in bearings 25 and having a crank-arm 23, which has pivotal connection with a link 21, extended into the charging-box through an opening 22 in the lower part 7, the end of the link within said charging-box having pivotal connection with the trap 75 or door 5, as shown at 20.

In operation the charge will be supplied to the charging-box during the heating of the preceding charge within the furnace, so that no time will be lost and a fresh charge will always be ready for introduction into the furnace upon the finishing of a preceding charge. In supplying the charge to the charging-box the lower swinging door or valve 14 will be held closed by the spring-catch 17, and the upper sliding door 13 will be opened, as shown in Fig. 2, to permit the charge to be shoveled in. The pea 11 will be set on the scale-beam 10 at the weight desired for the charge, so that so soon as such weight has been supplied to the movable upper part 8 of the charging-box the beam will balance, after which the door 13 is closed. When the preceding charge in the furnace has been finished or converted, it is formed into balls or lumps, which are pushed to one side out of the way of the fresh charge to be supplied to the hearth, after which the lever 26 is manipulated to raise the trap or door 5 and uncover the charging-opening 3 of the furnace. As the door or trap 5 is raised its free edge coming in contact with the extended end of the spring-catch 17 serves to push the said catch back into its recess 19 and out of engagement with the door or valve 14, so as to permit the said door or valve to fall under the weight of the charge, which is permitted to drop through the opening 3 into the furnace. So soon as the charge has fallen from the charging-box the weighted arm 16 will act to again close the door or valve 14, and the lever 26 being moved back to close the door or trap 5 upon the charging-opening 3 of the furnace serves to release the spring-catch 17, which is thereupon free for engagement to hold the door or valve 14 in closed position for the support of a fresh charge in the charging-box. The charge thus introduced into the furnace serves to abstract heat from the finished balls or lumps, so as to chill and harden the same sufficiently to permit them to be conveniently withdrawn from the furnace, which is thereupon closed in order that the fresh charge may be heated and converted.

From the above description it will be seen that by my improved process a very material economy is effected in the use of fuel and also that a considerable saving in time and labor is effected, so that not only is the output of the furnace increased, but the cost of conducting the operation is very much lessened. The labor heretofore needed in charging

ing the furnace is also much lessened and no particular skill is required in gaging the charge for introduction into the furnace.

Having thus described my invention, I claim—

1. The combination of a furnace having a charging-opening, a pivotally-mounted door to close said opening, means to operate said door, a device to deliver a charge to said opening and means, controlled by the pivoted door, for retaining a charge in said device, substantially as described.

2. The combination of a furnace having a charging-opening, a pivotally-mounted door to close said opening, means for operating the door, a device for delivering a charge to the charging-opening, a valve for retaining a charge in said device and capable of operation to release the charge and permit it to be delivered to the charging-opening and means, controlled by the pivoted door to hold the valve against movement, substantially as described.

3. The combination of a furnace having a charging-opening, a door to close the opening, a device to deliver a charge to the opening, a valve for retaining a charge in the device and capable of operation to release the charge and permit it to be delivered at the charging-opening and a catch controlled by the door when moved to hold the valve in closed position, substantially as described.

4. The combination of a furnace having a charging-opening, a door to close the opening, a device to deliver a charge at the opening, a valve for retaining a charge in the device and capable of operation to release the charge and permit it to be delivered at the charging-opening and a catch for holding the valve in closed position, said catch being arranged in the path of the door and adapted for actuation thereby to release the valve, substantially as described.

5. The combination of a furnace having a charging-opening, a door to close the opening, and adapted to be raised to open the same, a device to deliver a charge to said opening, a valve for retaining a charge in the device and adapted, when lowered to release the charge and permit it to be delivered at the charging-opening and a device for holding the valve in raised position and arranged in position to be engaged by the door when the door is raised, and adapted, when so engaged by the door, to release the valve, substantially as described.

6. The combination of a furnace having a charging-opening, a door to close the opening and adapted to be raised to open the same, a device to deliver a charge to the opening, a valve to retain a charge in the device and adapted, when lowered, to release the charge and permit it to be delivered at the charging-opening, a counterbalancing device for raising the valve after the charge is released and a device to hold the valve raised and arranged in position to be engaged by the door when

the door is raised and adapted, when engaged by the door, to release the valve, substantially as described.

7. The combination of a furnace having a charging-opening, a pivoted door to close the opening, a device to deliver a charge to the opening, a valve to retain a charge in the device and adapted, when lowered, to release the charge and permit it to be delivered at the charging-opening, and means for successively actuating the pivoted door and valve to release the charge and permit it to be delivered at the charging-opening, said means being arranged to actuate first the pivoted door of the charging-opening and when said door is fully opened, being arranged to actuate the valve, substantially as described.

8. The combination of a furnace having a charging-opening, a door to close the opening, a device to deliver a charge at the opening and comprising a movable part the lower end of which is above the opening, a weighing mechanism with which the movable part has connection, a valve to retain a charge in the movable part and capable of operation to release the charge and permit it to be delivered at the charging-opening and means to operate the door of the charging-opening, the valve being controlled by said door when moved, substantially as described.

9. The combination of a furnace having a charging-opening, a door to close the opening, a device to deliver a charge at the opening and comprising a movable part the lower end of which is above the opening, a weighing mechanism with which the movable part is connected, a valve to retain a charge in the movable part and capable of operation to release the charge and permit it to be delivered at the charging-opening, and means, controlled by the door to hold the valve in closed position, substantially as described.

10. The combination of a furnace having a charging-opening, a door to close said opening, a device to deliver a charge at the opening and comprising a movable part the lower end of which is above the opening, a weighing mechanism with which the movable part is connected, a valve to retain a charge in the movable part and capable of operation to release the charge and permit it to be delivered at the charging-opening and a catch to hold the valve in raised position, said catch being arranged in the path of the door and being adapted to be actuated thereby to release the valve, substantially as described.

11. The combination of a furnace having a charging-opening, a charging device comprising a lower part surrounding the opening, an upper part above and movable with relation to the lower part, a valve to retain a charge in the upper part and capable of operation to release the charge, a door for the charging-opening and a weighing mechanism with which the movable upper part of the charging device is connected for weighing a charge therein, substantially as described.

12. The combination of a furnace having a charging-opening, a charging device comprising a lower part surrounding the opening, an upper part above the opening and movable with relation to said lower part, a valve to retain a charge in the upper part and capable of operation to release the charge, a door for the charging-opening, a weighing mechanism with which the movable upper part of the charging device is connected for weighing a charge therein and means, controlled by the door of the charging-opening, for holding the valve of the movable part in closed position, substantially as described.
- 15 13. The combination of a furnace having a charging-opening, a charging device comprising a lower part surrounding the opening, an upper part above the opening and movable

able with relation to the lower part and provided with a bail, a valve to retain a charge 20 in the upper part and capable of operation to release the charge and permit it to be delivered at the charging-opening, a door for the charging-opening, a weighing device with which the bail of the upper part of the charging device is connected for weighing a charge 25 in the movable upper part and a catch to hold the valve in closed position, the said catch being in the path of the door and adapted to be actuated thereby to release the valve, substantially as described. 30

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Witnesses:

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