No. 829,544. PATENTED AUG. 28, 1906.

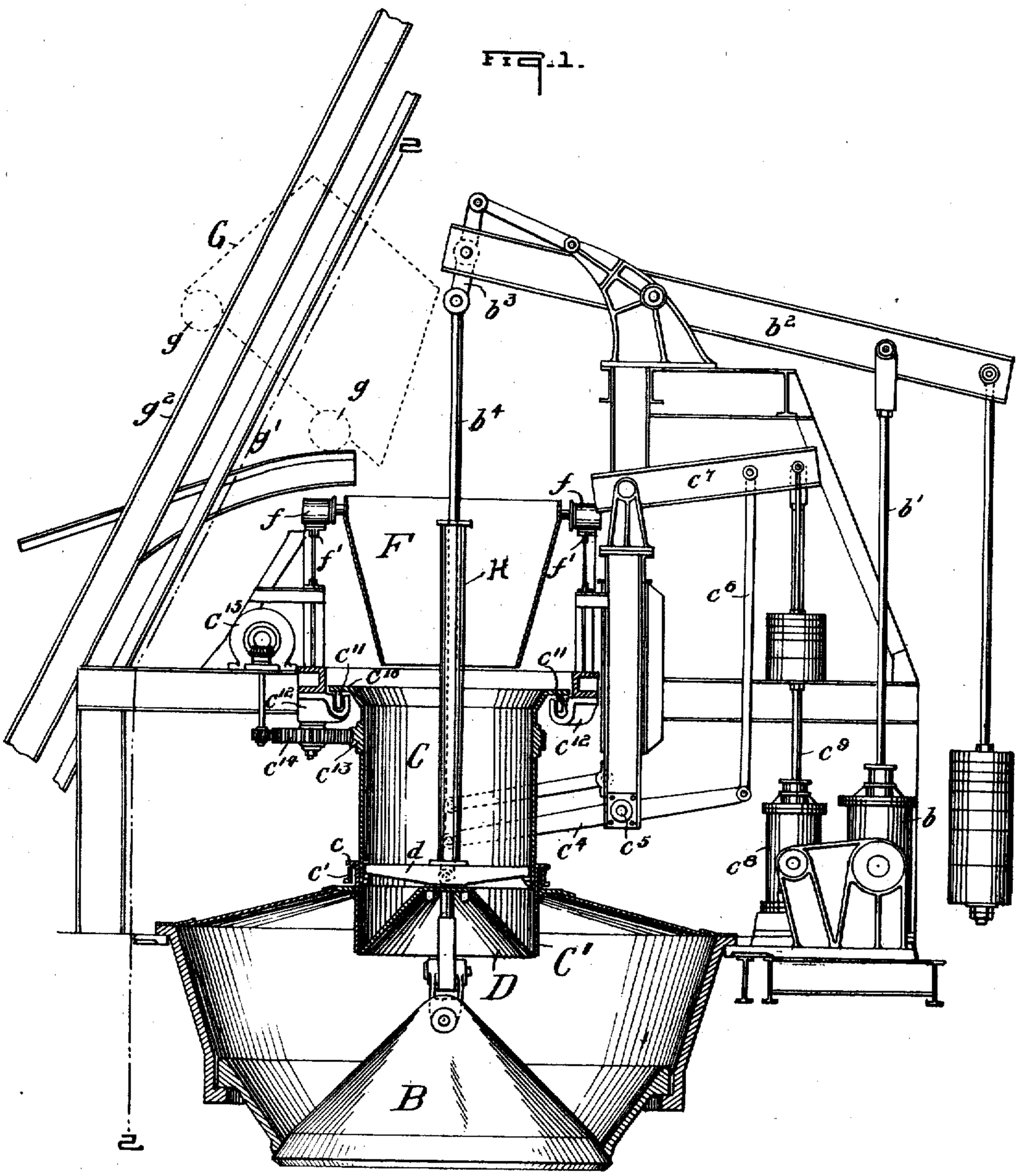
F. C. ROBERTS.

FURNACE CHARGING APPARATUS.

APPLICATION FILED NOV. 10, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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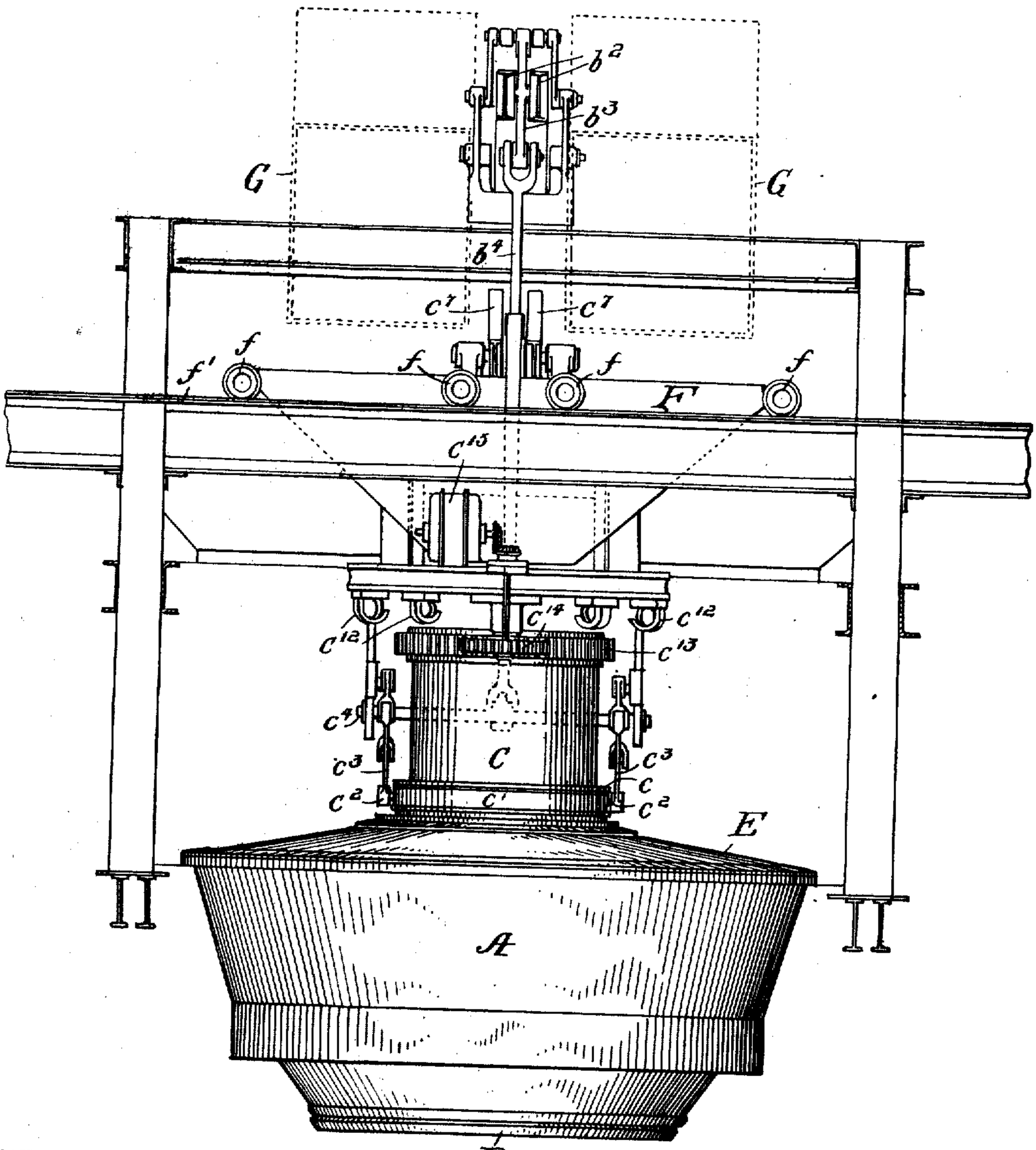
3 SHEETS—SHEET 2.

FIG. 2.



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3 SHEETS—SHEET 3.

FIG. 3.

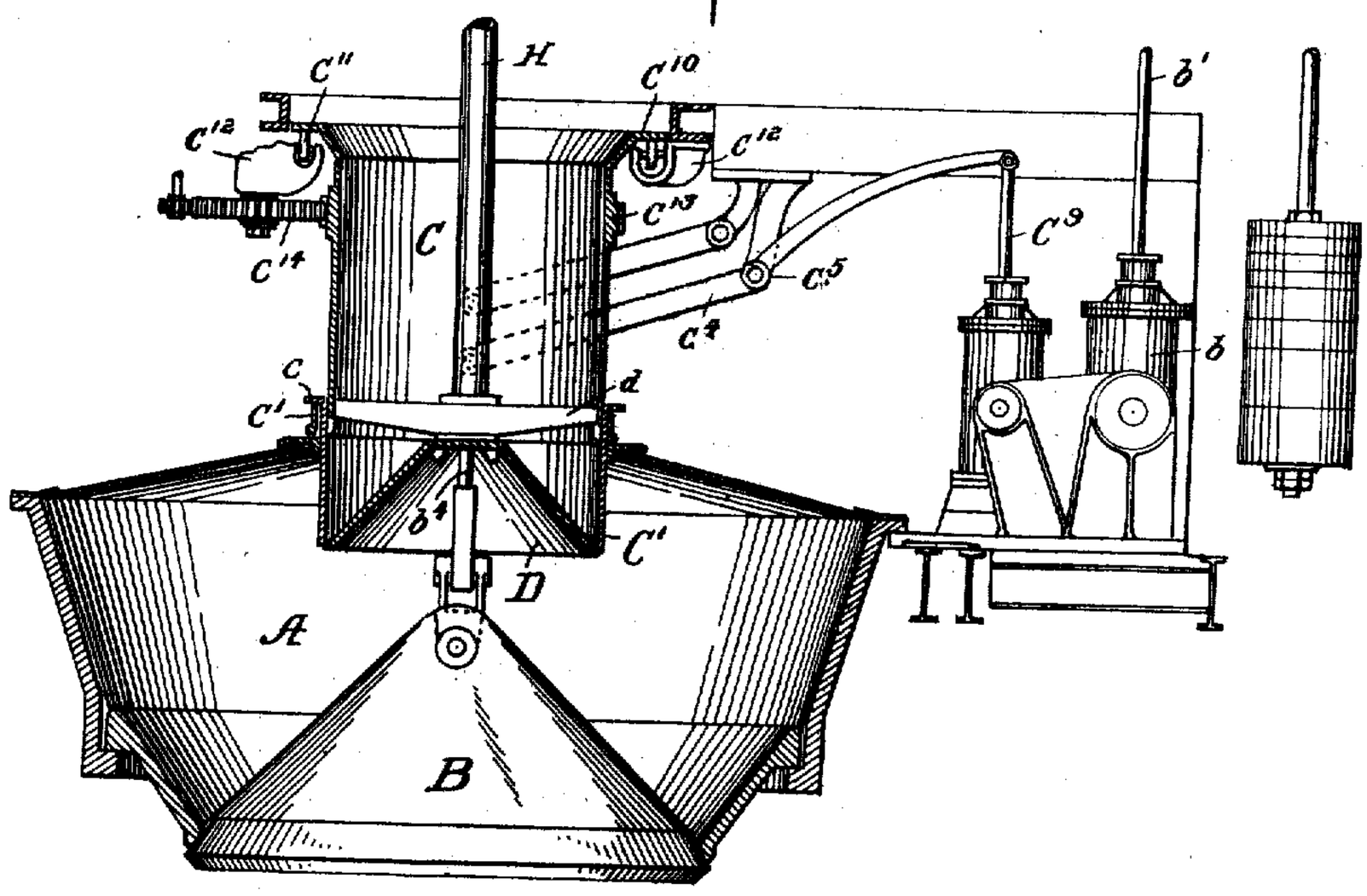


FIG. 4.

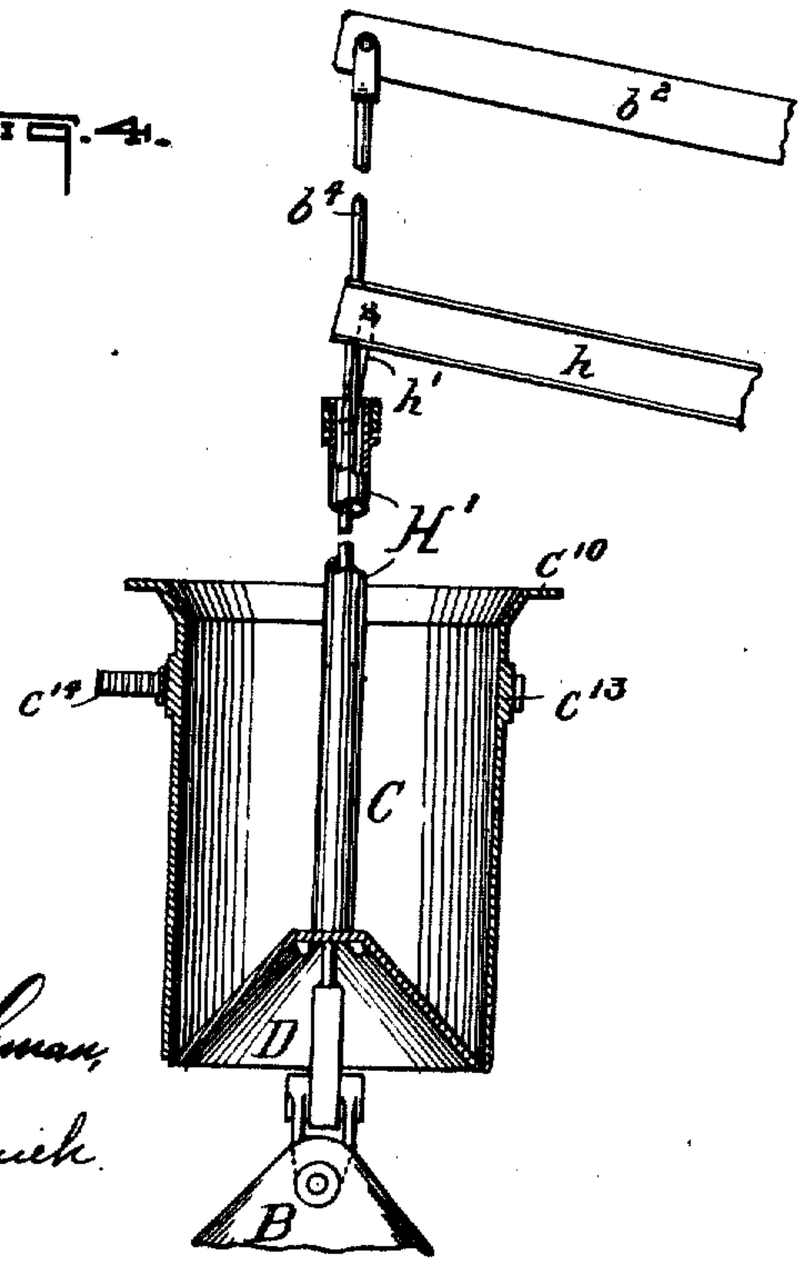
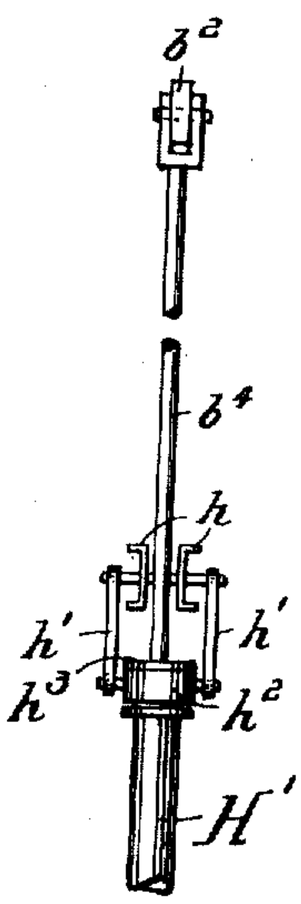


FIG. 5.



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UNITED STATES PATENT OFFICE.

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FURNACE-CHARGING APPARATUS.

No. 829,544. Specification of Letters Patent. Patented Aug. 28, 1906.

Application filed November 10, 1905. Serial No. 286,703.

To all whom it may concern:

Be it known that I, FRANK C. ROBERTS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented or discovered new and useful Improvements in Furnace-Charging Apparatus, of which the following is a specification.

The object of the improvement is to secure a more uniform distribution of the materials charged into the furnace. It is found under certain conditions as to the physical characteristics of the materials to be delivered into the furnace that in the case of furnace-charging apparatus commonly in use the very fine material is apt to separate from the coarser materials and lie in a certain portion of the supplementary hopper. This condition naturally leads to the finer materials being delivered to one portion of the furnace, making it more difficult for the blast supplied to the furnace to penetrate the materials uniformly throughout the cross-section of the furnace. The location of the finer materials in the ordinary supplementary hopper is practically identical each time said hopper is filled, and the object I have in view—namely, the more uniform distribution of the materials within the furnace—will be secured if provision is made to revolve the supplementary hopper before discharging the contents into the main hopper, so that the normal distribution is made at two or more points. The manner in which I prefer to secure the said distribution will be clearly understood by reference to the drawings which accompany this specification, and in which—

Figure 1 represents an elevation, partly in vertical section, showing one embodiment of my invention; Fig. 2, a section on the line 2 2 of Fig. 1; Fig. 3, a sectional view showing a second form of my invention; Fig. 4, a similar section of a third form thereof, and Fig. 5 a detail of the upper portion of Fig. 4.

Referring to Figs. 1 and 2, A designates the furnace-hopper, and B the bell for closing its mouth. The bell is raised and lowered by the steam-cylinder b, the piston-rod b', the lever b^2, the link b^3, and the rod b^4, the latter being secured to the bell.

C is the supplementary hopper located centrally over the hopper A and having its mouth closed by the bell D, secured to the cross-piece d, supported by the upper section of the supplementary hopper C. The lower section C′ of the latter hopper encircles the upper section and normally extends below the same into contact normally with the bell D, upon which it rests. The section C′ is provided with the flange c, under which sits the ring c', having at opposite sides the pins or trunnions c^2 for the reception of the lower ends of the links c^3, secured to the forked ends of the lever c^4, pivoted at c^5. The other end of the lever c^4 is operated by the rod c^6, which is connected to the lever c^7, operated by the steam-cylinder c^8, and the weighted rod c^9. The end of the supplementary hopper C is provided with the circular flange c^{10}, which rests on the antifriction-wheels c^{11}, carried by the brackets c^{12}. The hopper C is provided with the circular rack c^{13}, with which engages the spur-gear c^{14}, driven by the motor c^{15}.

E is the top of the hopper A, and F is the distributing-chute carried by the attached wheels f, running on the tracks f', two of these chutes being provided and designed to discharge into the supplementary hopper C.

G is a skip-car (shown in dotted lines) of any preferred construction having the wheels g running on the track g' and g^2.

H is a tube secured to the cross-piece d and surrounding the rod b^4 to protect the latter from engagement with the ore.

The operation is as follows: The ore is carried up by one of the skip-cars and dumped into the chute F, from which it falls into the supplementary hopper C. The section C′ of the hopper C is raised by means of the steam-cylinder c^8 in an obvious manner, whereupon the ore slides down on the bell D into the hopper A and upon the bell B. The section C′ is then lowered upon the bell D, and more ore is dumped into the hopper C. The motor c^{15} is then actuated to cause the supplementary hopper to turn a quarter-revolution, more or less, when the section C′ is again raised and the ore deposited in the hopper A. This process is repeated, the hopper C being turned a greater or less distance each time after the ore has been deposited therein. Of course the bell B is operated from time to time by means of the cylinder b to deposit the ore in the furnace. Assuming that the supplementary hopper is not moved or is stationary, the finer portions of the materials discharged by the skip-car will by passing down the chute F and the hopper C concen-

trate largely in a definite position of the hopper C, which position may be called X. The materials are then discharged from the supplementary hopper C, as described, the finer materials falling into the hopper A directly under their position in the former hopper. When the bell B is lowered, they will drop into the furnace under their position X in the hopper A. When another car-load of materials is dumped into the hopper C, the finer portions will occupy the position X, as before; but before the discharge of the hopper the latter is rotated so that the said finer materials occupy a new position, which may be called Y. The hopper is now discharged, and the finer materials will be finally dropped into a corresponding position in the furnace. Another car-load is deposited in the furnace in a similar manner, the hopper being rotated to take a third position, which may be called Z, and then discharged. The number of positions into which an entire revolution of the hopper C is divided may be varied, or the hopper C may be continuously rotated and the materials discharged at any point where they might be when the section C′ is raised.

It will be seen that I get a more uniform distribution of the materials in the furnace than with the ordinary furnaces having stationary hoppers. I obtain this desirable distribution preferably by revolving the supplementary hopper so that the distribution shall be made at two or more points and so that the distribution may be made symmetrical.

The motor c^{15} can be controlled by hand or automatically, as may be desired. The ring c' will normally be out of contact with the flange c, as shown on Fig. 1, so as not to prevent the section C′ turning with the remainder of the hopper C.

Referring to Fig. 3, the construction is the same as in Figs. 1 and 2, except the lever c^4 is connected directly with the piston-rod of the cylinder c^8, rendering the link c^6 and lever c^7 unnecessary.

Referring to Figs. 4 and 5, the supplementary hopper C is not telescopic, as in Figs. 1 to 3, the side wall being in one piece and the bell D being raised and lowered by the tube H′, which is connected at its lower end to said bell and at its upper end to the lever h, operated in any manner. The tube is raised and lowered by means of the links h', suspended from the lever h and connected to the ring h^2, surrounding the pipe H′ between the collars or flanges h^3 thereon. The operation of the invention is as in Figs. 1 to 3, except that the bell D will be lowered after each partial rotation of the hopper, corresponding to the times when the section C′ of Figs. 1 to 3 will be raised. The ring h^2 permits the turning of the bell D and tube H′, while holding the bell against the supplementary hopper C.

The most striking feature of my invention consists in the manner in which I secure a symmetrical arrangement of the furnace charges within the furnace. In the operation of my furnace I charge the supplemental hopper so that the materials therein shall be uniformly distributed therein. The distribution can be modified more or less by moving the supplemental chutes backward or forward or laterally upon their tracks, and as the supplemental hopper is at each charge substantially filled or has the materials therein of substantially the same depth in all portions thereof the discharge of its contents will have a symmetrical arrangement in the lower hopper. This charge being symmetrically arranged in the lower hopper will when the bell is lowered be symmetrically arranged within the furnace. This operation is repeated, with the modification that the supplemental hopper is rotated about ninety degrees before the charge is deposited in the lower hopper. At the next operation the supplemental hopper is rotated about one hundred and eighty degrees and at the next operation about two hundred and seventy degrees. Where the material is deposited in the lower hopper by a rotating chute having a door at its lower end and adapted to be rotated to deposit the charge at a limited portion of the lower hopper, the materials in the lower hopper will not be arranged symmetrically at each charge of the upper hopper. In my furnace the symmetrical charge in the supplemental hopper is symmetrically arranged after discharge in the lower hopper, and the charge in the lower hopper is when deposited in the furnace arranged therein symmetrically not only as to the quantity of the material in all parts of the annular deposit in its furnace, but also as to the distribution of the finer and coarser materials.

Having described my invention, I claim—

1. In a furnace, a lower main hopper, means for discharging the same, an upper supplemental hopper, having a fixed bell and a lateral portion movable to discharge a load in the supplemental hopper into the main hopper, means for rotating the supplemental hopper, means for moving the lateral portion away from the bell to discharge the load in the supplemental hopper into the main hopper and a connection between the said lateral portion and said moving means therefor, permitting the rotation of the supplemental hopper.

2. In a furnace, a lower main hopper, means for discharging the same, an upper supplemental hopper, having a fixed bell and a vertical annular lateral portion resting on the bell, means for raising said lateral portion above said bell, a connection between said lateral portion and said raising means, permitting the rotation of the supplemental hopper and means for rotating said supplemental hopper.

3. In a furnace, a lower main hopper,

means for discharging the same, an upper supplemental hopper, having a fixed bottom and a vertical annular lateral portion resting on the bottom, a ring swiveled about said lateral portion, means coöperating with said ring to raise said lateral portion, and means for rotating the supplemental hopper.

Signed at Philadelphia, Pennsylvania, this 9th day of November, 1905.

FRANK C. ROBERTS.

Witnesses:
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