(No Model.)

2 Sheets—Sheet 1.

F. H. FOOTE.

BLAST FURNACE.

No. 587,522. Patented Aug. 3, 1897.

Fig. 1.

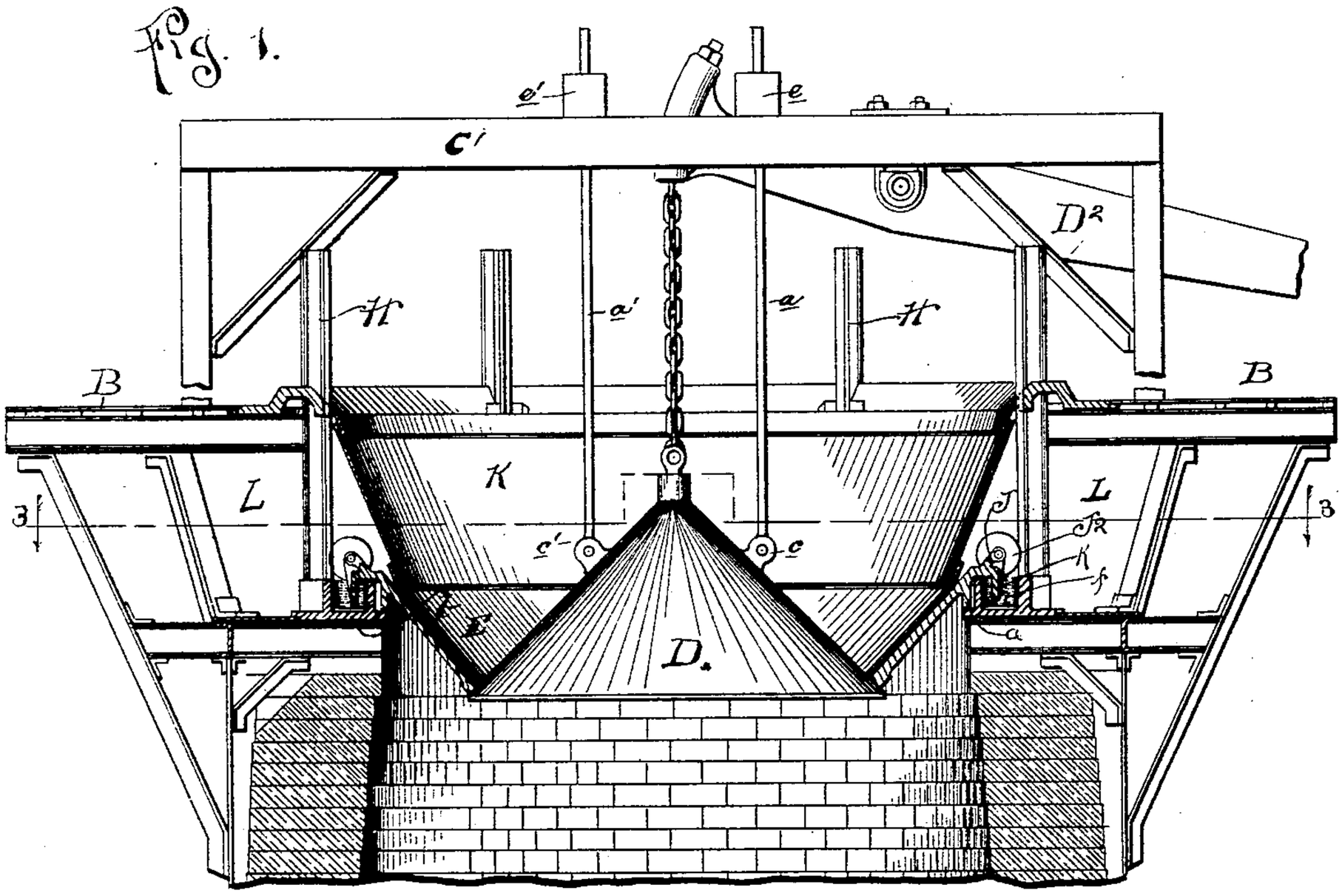
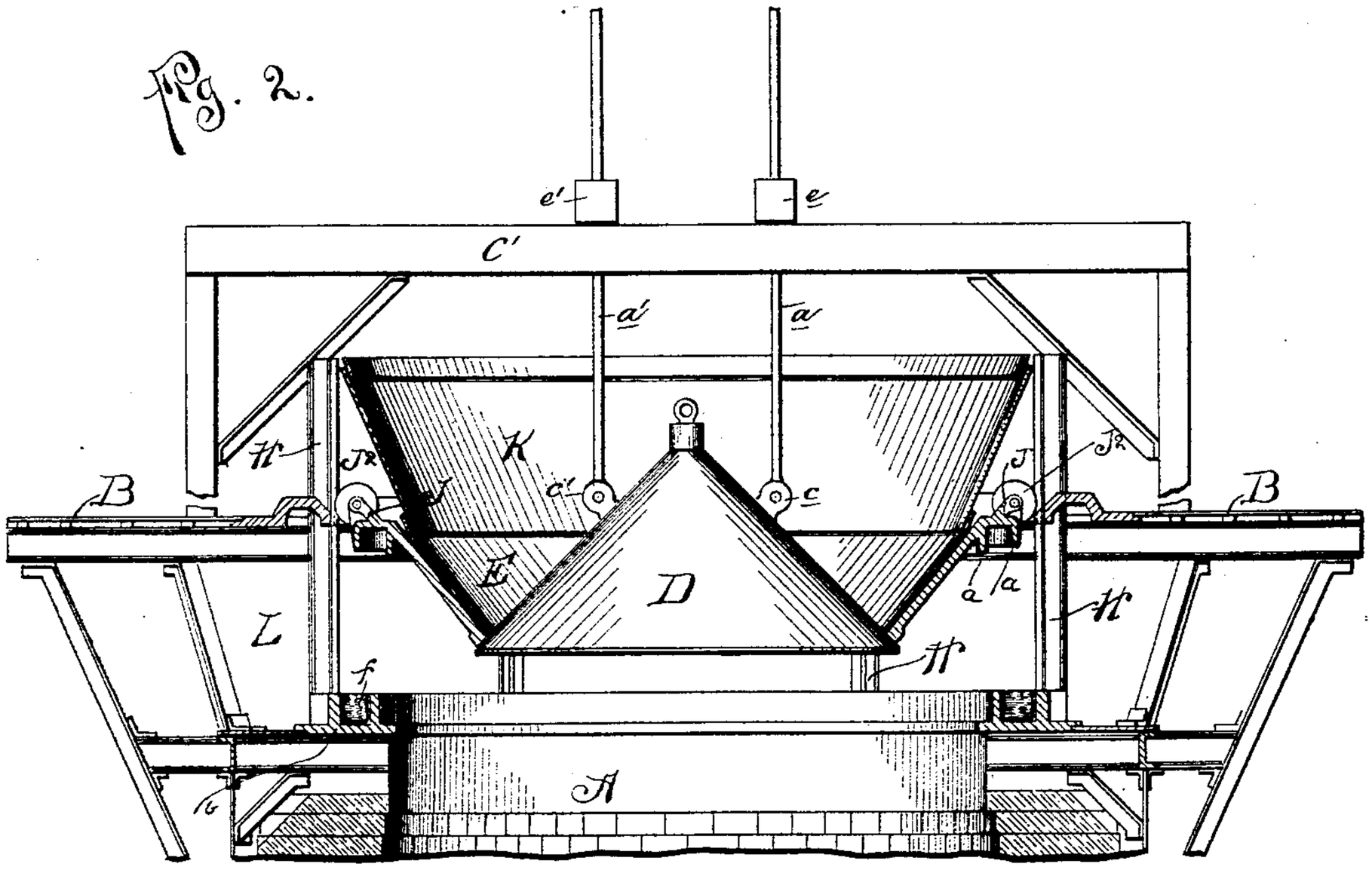


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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BLAST FURNACE.

No. 587,522. Patented Aug. 3, 1897.

Fig. 3.

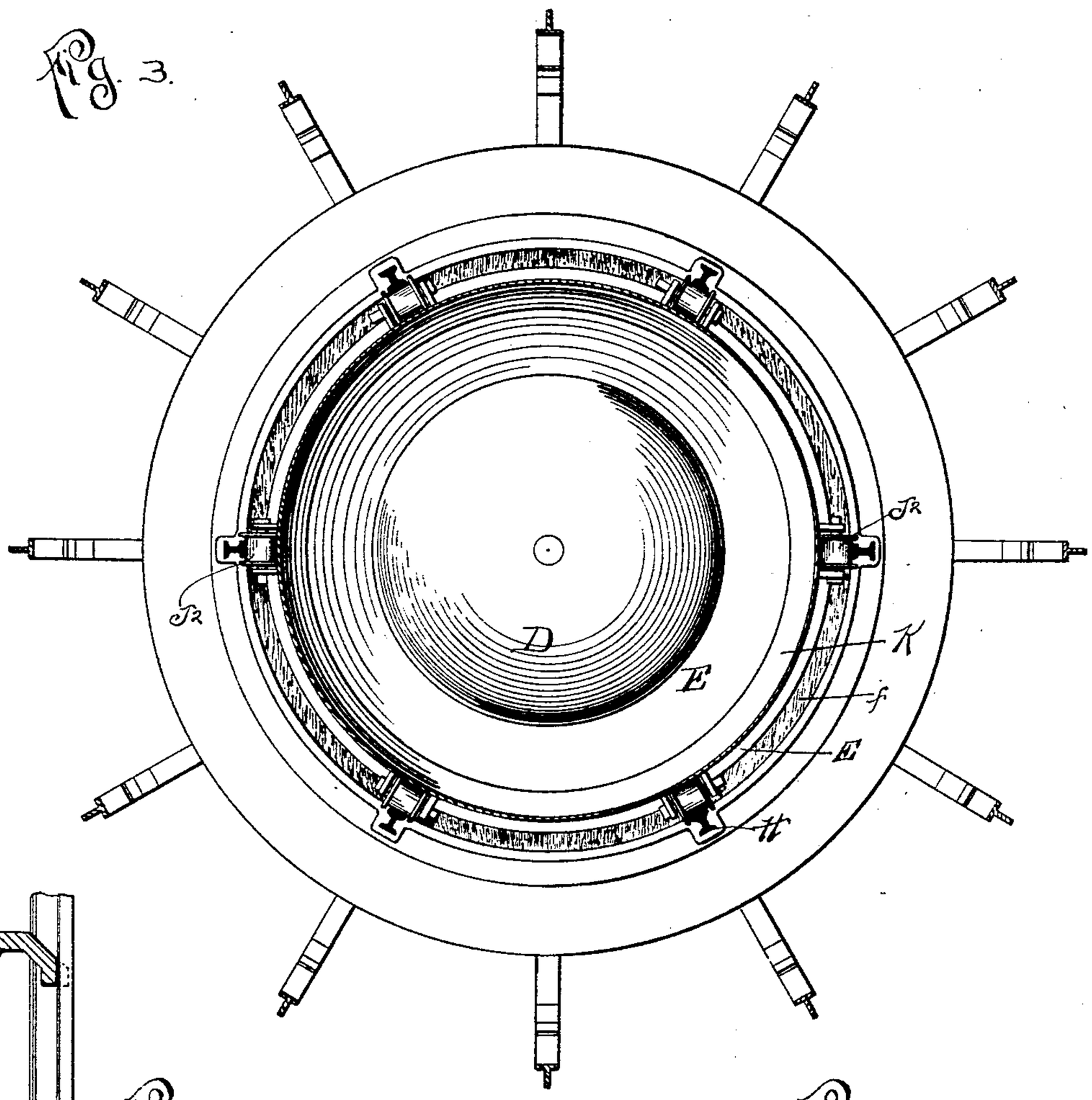


Fig. 5.

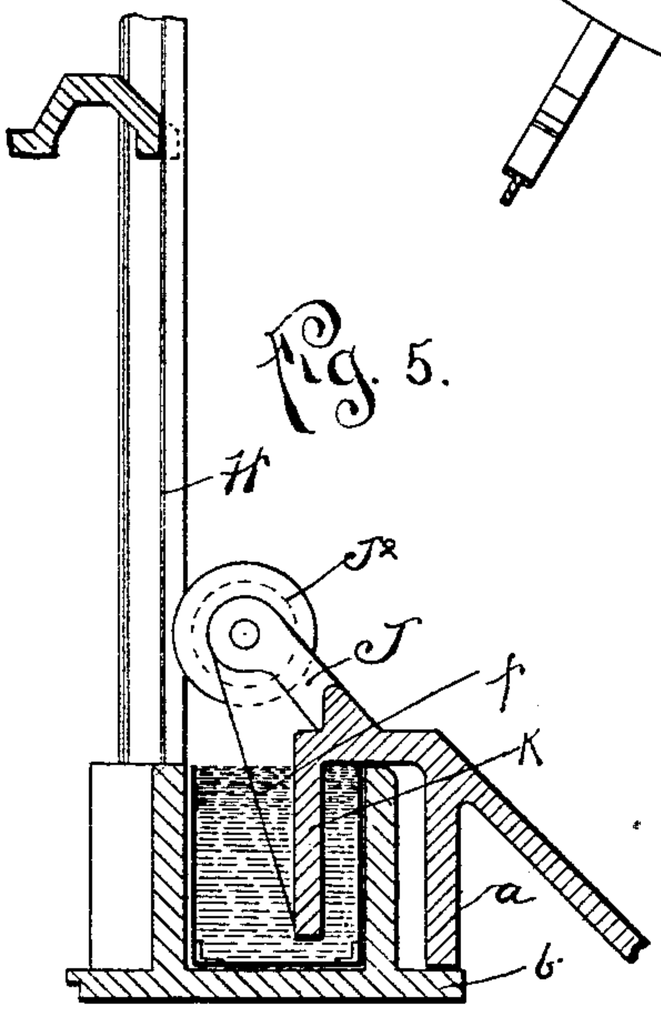
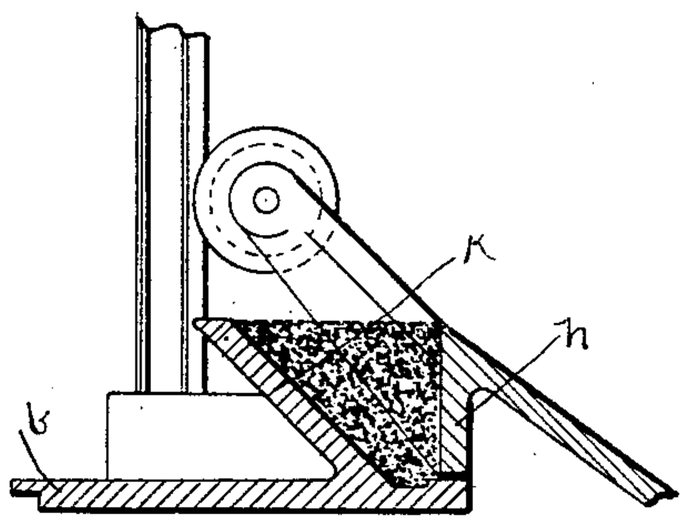


Fig. 4.



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UNITED STATES PATENT OFFICE.

FREDERICK H. FOOTE, OF CHICAGO, ILLINOIS.

BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 587,522, dated August 3, 1897.

Application filed January 4, 1896. Serial No. 574,288. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK H. FOOTE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Blast-Furnaces, of which the following is a specification.

My invention relates to certain improvements in the construction and arrangement of those parts in and about the top of the stack of a blast-furnace at which point the stock is charged into the furnace.

My invention has for its object the provision of means whereby those accidents may be avoided and that damage to property and injury to person overcome which results from explosions of gas caused by slipping of stock in the furnace and from other causes.

To this end my invention consists in such an arrangement as that the bell and connected parts thereof, together with those parts about the bell which receive and guide the dumped stock, are rendered capable of an upward movement under the influence and pressure of an excessive accumulation and explosion of gas, whereby a large, extended, and free opening is provided below the platform on which the operatives are engaged at work which permits the instantaneous, free, and complete release of the accumulated gas, so that the gas can do no harm either to the operatives or the parts of and about the stack.

Heretofore in order to prevent damage and injury from this source resort has been had to circumscribed openings of limited area covered normally by valves; but with these means it has been impossible to preserve tight joints and to prevent the forcible blowing out of the bell, hopper, and other parts of the top of the furnace and the resulting danger and destruction to life and property, whereas my improved device or apparatus is designed to permit the bodily upward movement of the various parts covering the top of the furnace-stack and afford free unobstructed communication with the outer air, in effect accomplishing a substantial uncovering of the top of the furnace-stack automatically, said parts thereon being exposed to the pressure of the gas within the furnace-stack and conditioned to move bodily upward and uncover the top of the furnace-stack upon a definite and abnormal accumulation and explosion of gas in the furnace-stack.

My invention also consists primarily in the provision of a bell and connected apparatus operating or used in conjunction therewith which upon the accumulation of a definite and abnormal pressure of gas will move bodily upward, and thus uncover the top of the furnace-stack and permit the free and unobstructed escape of the gas below the operatives' platform, the bell and connected conjunctively-operating parts being so guided and directed as to automatically reseat and resume their normal position in the proper relation when the excessive pressure of gas has been released.

My invention consists, further, in certain other features to be described, and pointed out in my claims, reference being now had to the accompanying drawings, in which—

Figure 1 is a central vertical section through the top of a furnace, showing the associated parts in position for ordinary use. Fig. 2 is a like view showing the associated parts in a position to release the gas. Fig. 3 is a plan view. Fig. 4 is a detail view of a modified form of seal. Fig. 5 is a like view of still another modified form of seal.

The top portion of the wall of the furnace-stack is designated at A, and supported therefrom by the I-beams and T-beams is the platform upon which the operatives are at work while engaged in dumping the stock into the furnace-stack.

The bell of the furnace-stack is designated at D and is of usual construction and is operated by the rocking lever D^2 in the usual manner, the bell being lowered in order to dump the stock deposited on the bell into the stack.

The bell is supported through the medium of rods *a a'*, suitably connected to the upper surface of the bell or to ears or lugs *c c'*, secured to said bell and projected therefrom, which rods project upward and through and beyond a suitably-supported beam C', the upper end of each rod being provided with a suitable securing device *e e'*, normally resting upon the upper surface of said beam C'.

A hopper E, annular in form, surrounds the bell D, which bears upon the lower edge of the hopper when the bell is in position to

receive its load, the upper end of the hopper being so formed as to engage over and rest upon the top of the wall A of the furnace-stack. Arranged at intervals about the top of the furnace-stack are traveler-posts H, which are secured rigidly in place. Held by arms J, secured to the hopper E, are the antifriction-rollers J^2, which travel upon the vertical posts H. Disposed above and resting upon the hopper E is a hopper-shield K, annular in form, which guides and directs the stock to the hopper E.

From the foregoing description it is manifest that this construction does not interfere in any manner with the lowering of the bell in the usual way nor with the normal usual operation of the apparatus in and about the top of the furnace. When, however, an abnormal pressure of the gas occurs in the top of the furnace from an explosion or through other causes which would cause injury to the operatives and damage to property, it is evident that with my improved construction this is overcome, since the bell and hopper are exposed to the pressure of the gas and are conditioned to move bodily upward and uncover the top of the furnace-stack and permit the free escape of the gas through the wide-open channel or passage formed by the operatives' platform and the top of the furnace-wall A, which channel or passage is designated at L, thus relieving the accumulated confined gas which is discharged out of the top of the furnace below the platform on which the operatives are employed at their work.

In the upward movement of the bell, the hopper, and hopper-shield the antifriction-rollers traveling upon the vertical posts or ways guide, direct, and limit the movements of said parts, and when a normal condition is restored by the release and escape of the gas these parts are guided downward, cushioning on the gas and returned by gravity to their normal position by means of the guiding antifriction-rollers and the traveler posts or ways, which construction causes the bell and associated and conjunctively-operated parts thereof to reseat and resume a proper relative position and permit a further depositing of stock in the furnace-stack in the customary and usual manner without any manual or mechanical intervention to adjust or readjust the parts and a resulting saving of time in the operation of the furnace.

The hopper-shield K serves the purpose of directing all of the dumped stock into the hopper E and prevents any escape through the passage or channel L. This hopper-shield rests within the hopper along its lower edge and bears against and is held in place by the traveler posts or ways at its upper edge, and when the parts are bodily raised this upper edge rides upon and is directed by the said traveler-posts.

As it is necessary to seal the annular joint between the upper portion of the hopper E and the part on which the same rests in a manner which will permit ready separation, I provide depending holding-lugs *a*, extended from the upper portion of the hopper E, which lugs rest upon the plate *b*, the said upper portion of the hopper being extended and arched over the outer wall of an annular liquid-containing receptacle *f*.

In Fig. 4 I have shown a form of construction for a dirt or ore seal, the upper portion of the hopper E having a rim *h*, which rests on the plate B, an annular containing-recess being formed by means of the upper portion of the hopper E and the flange *k*, this annular recess being filled with dirt, ore, or other suitable packing material.

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

1. In a blast-furnace, a bell and hopper, and means for raising and lowering the bell in the usual manner together with guiding apparatus for said bell and associated parts whereby the same are permitted a bodily upward movement upon the accumulation of an abnormal pressure of gas in the furnace to uncover the top of the furnace and also reseat said parts automatically in proper relative position when said pressure is reduced to a normal condition.

2. In a blast-furnace a bell and hopper and an operative's platform located relatively remote from and above the top of the furnace-stack forming an open wide and unobstructed passage below said platform, the bell and hopper being adapted for bodily upward movement upon the accumulation of an abnormal pressure of gas in the furnace to uncover the top of the furnace, together with guiding apparatus for said bell and hopper.

3. In a blast-furnace a bell and hopper and an operative's platform located relatively remote from and above the top of the furnace-stack forming an open, wide and unobstructed passage below said platform, said bell and hopper being adapted for bodily upward movement upon the accumulation of an abnormal pressure of gas in the furnace to uncover the top of the furnace and permit the escape of the gas through said passage and below said platform together with guiding apparatus for the bell and associated parts to reseat the same automatically in a proper relative position upon a reduction of gas-pressure to a normal condition.

4. In a blast-furnace, a bell and means for raising and lowering the same in the usual manner, a hopper associated with the bell and resting loosely upon the top of the furnace-stack, and guiding apparatus for said bell and hopper whereby the same are permitted a bodily upward movement upon the accumulation of an abnormal pressure of gas in the furnace and also reseated automatically in proper relative position when said pressure is reduced to a normal condition.

5. In a blast-furnace, a bell, a hopper, an operative's platform located relatively remote

from and above the top of the hopper forming an open, wide and unobstructed passage below said platform, said hopper being mounted upon said bell and normally resting upon the top of the furnace-stack, guiding apparatus and a hopper-shield mounted upon the hopper and held and directed by the guiding apparatus, which latter directs and guides the upward and downward bodily movement of the bell, hopper and hopper-shield, upon accumulation and release of abnormal gas-pressure.

6. In a blast-furnace, a bell, a hopper mounted thereon, a hopper-shield mounted on the hopper, an operative's platform located relatively remote from and above the top of the hopper, forming an open, wide and unobstructed passage below said platform, and guiding apparatus consisting of traveler-ways and traveler-wheels for guiding and directing the bodily upward and downward movements of the bell, hopper and shield, upon accumulation and release of abnormal gas-pressure.

7. In a blast-furnace the combination of the bell, a hopper separate from the bell but mounted thereon at its lower end and resting at its upper end at the top of the furnace-stack, an operator's platform relatively remote from and above the top of the furnace-stack forming an open, wide and unobstructed passage below said platform, guiding apparatus consisting of traveler-ways and traveler-wheels for guiding and directing the bodily upward and downward movement of the bell and hopper upon accumulation and release of abnormal gas-pressure and an annular containing recess extended about the hopper at its upper portion together with suitable packing material disposed within said annular recess whereby a tight joint is effected between the said upper portion of the hopper and its seat upon the top of the furnace-stack.

In testimony whereof I affix my signature in presence of two witnesses.

FREDERICK H. FOOTE.

Witnesses:

W. J. MELVIN,

P. M. CALDWELL.