No. 889,571. PATENTED JUNE 2, 1908.

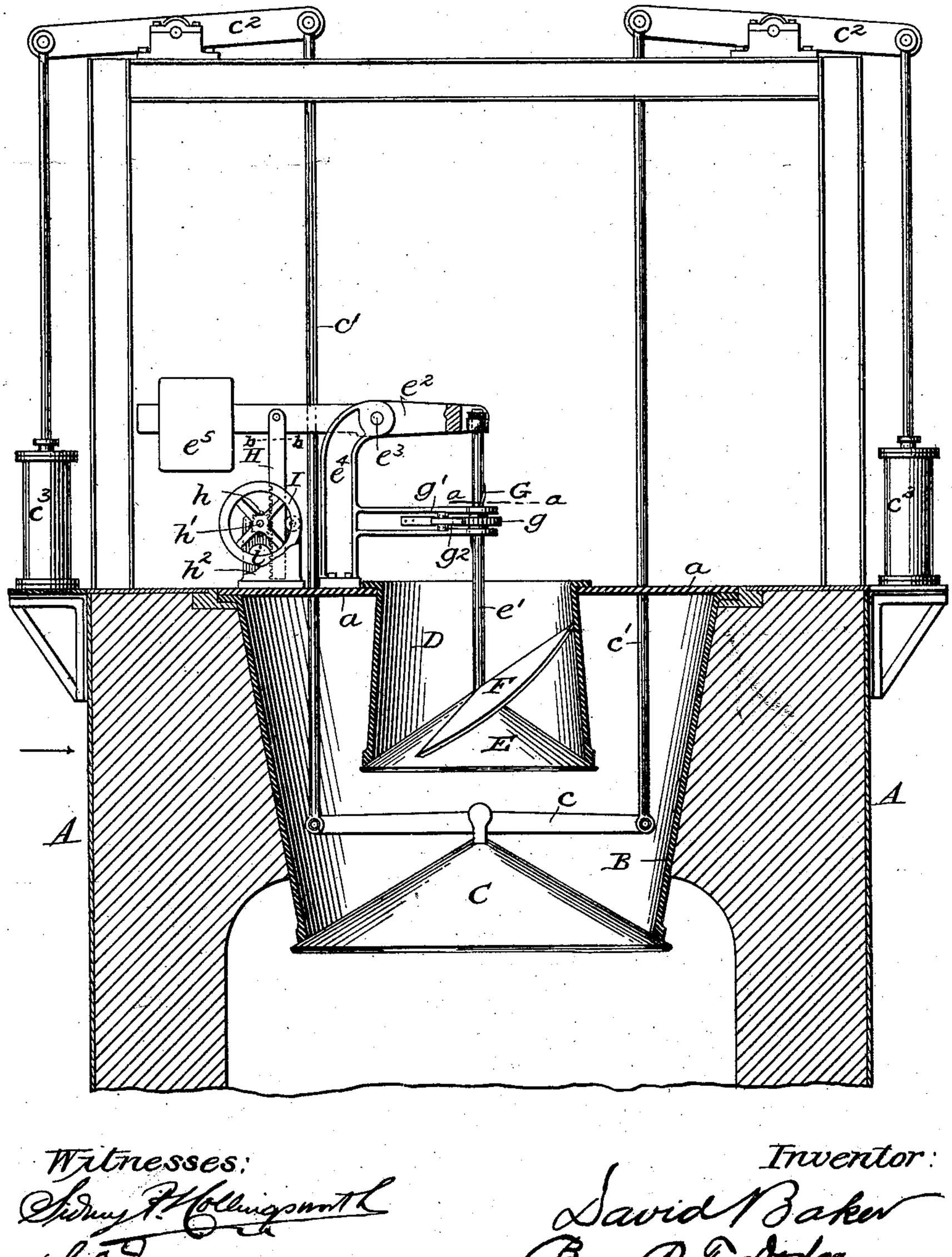
D. BAKER.

FURNACE CHARGING MECHANISM.

APPLICATION FILED MAY 18, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2

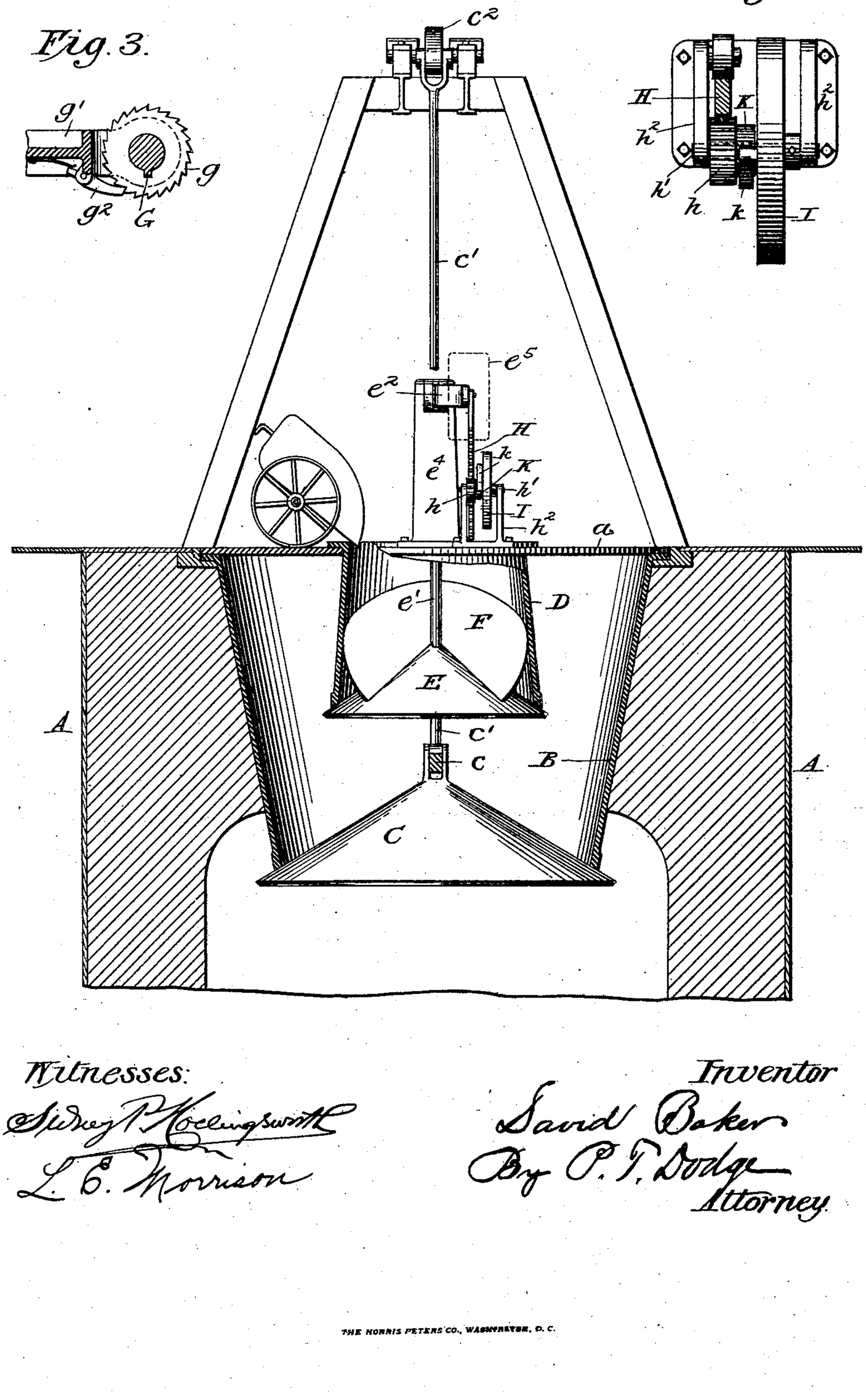

Fig. 3.

Fig. 4.

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3 SHEETS—SHEET 3.

Fig. 5.

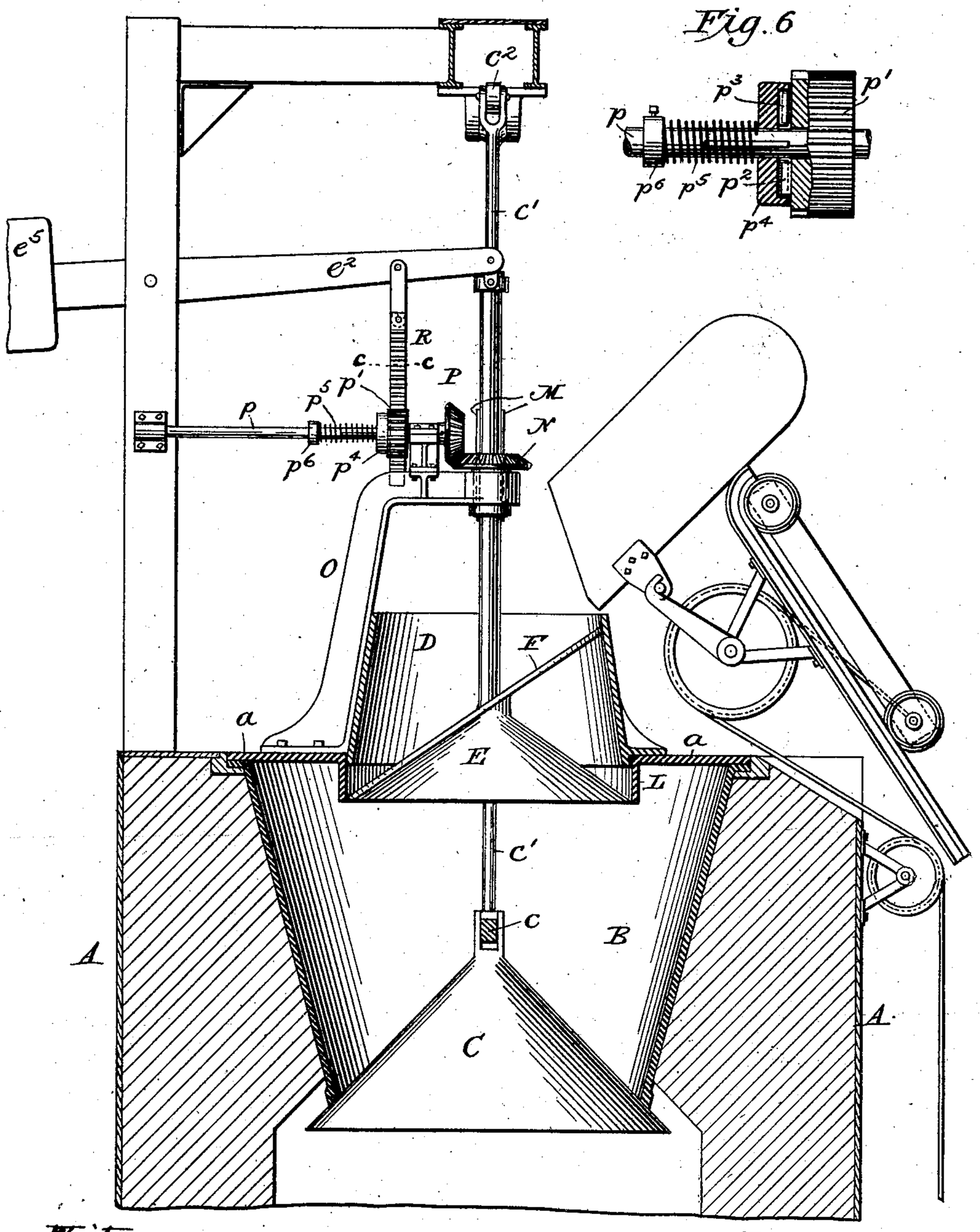

Fig. 6

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UNITED STATES PATENT OFFICE.

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FURNACE-CHARGING MECHANISM.

No. 889,571. Specification of Letters Patent. Patented June 2, 1908.

Application filed May 18, 1906. Serial No. 317,422.

To all whom it may concern:

Be it known that I, DAVID BAKER, of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Furnace-Charging Mechanism, of which the following is a specification.

This invention relates to mechanism for charging furnaces, and is designed more particularly for effecting an even and uniform distribution of the stock in blast furnaces.

The aim of my invention is to provide a mechanism of simple construction, which will act to automatically effect the distribution of the stock at different points around the main hopper, and it consists in combining with a receiving hopper or chute, a deflecting plate and gas seal movable around therein to different positions to vary the direction of the flow of the materials entering the hopper, and movable up and down to close the hopper, improved means being provided for controlling the movements of said parts, as will be fully described hereinafter.

In the accompanying drawings:—Figure 1 is a sectional elevation of the upper end of a blast furnace equipped with my improved charging mechanism. Fig. 2 is a similar view looking in the direction of an arrow in the preceding figure. Fig. 3 is a horizontal sectional plan view on the line *a*—*a* of Fig. 1, showing the mechanism for effecting the shifting of the deflector plate by the closing movement of the gas-seal. Fig. 4 is a sectional plan view on the line *b*—*b* of Fig. 1 showing the mechanism for retarding the closing action of the gas-seal. Fig. 5 is a sectional elevation of the upper end of a blast furnace equipped with my invention in a modified form. Fig. 6 is a sectional elevation on the line *c*—*c* of Fig. 5, showing the mechanism for effecting the automatic rotation of the deflector plate by the closing movement of the gas-seal.

Referring to the drawings:—Referring to Figs. 1 to 4, inclusive, A represents the upper end of the blast furnace formed with a main hopper B closed at its upper end by an annular cover plate *a*, and at its lower end by a main bell C suspended from a horizontal beam *c* jointed to the lower end of suspension rods *c'*. These rods extend upwardly through the cover plate and are connected at their upper ends with the inner ends of two pivotal actuating levers c^2, whose outer ends are operatively connected with pistons in cylinders c^3, the admission of pressure to the cylinders and its exhaust therefrom serving to raise and lower the main bell and thus close and open the main hopper in the usual manner.

D represents a receiving hopper preferably in the form of a truncated cone, situated centrally within the main hopper, with its upper end connected with the central opening in the annular cover plate. This hopper receives the stock which, as usual, is elevated to the top of the furnace and discharged into the hopper in any appropriate manner, either by means of skip cars such as shown in Fig. 5, or hand barrows, such as shown in Fig. 2.

The lower end of the receiving hopper D is adapted to be closed by a conical gas-seal bell E which when in closed position, as shown in Fig. 1, prevents the escape of gases on the opening of the main bell, and which when opened, will permit the contents of the receiving hopper to pass into the main hopper.

F represents a deflector plate, which is preferably carried by the gas-seal bell and extends from its apex outwardly at one side, with its outer edge conforming to the inner curvature of the hopper, and acting to direct the materials entering the hopper to one side, so that they will pass laterally and be accumulated to the side of the main hopper.

The gas-seal bell E is adapted to be opened automatically when the stock is introduced into the receiving hopper, and for this purpose the bell is counterweighted in such manner that it is normally held in closed position by the weight, and is adapted to be lowered to open position when the stock falls thereon. The means for effecting this action is preferably of the form and construction illustrated in Fig. 1, where it will be seen that the bell is carried on the lower end of a vertical stem *e'*, having its upper end swiveled in the inner end of a horizontal lever e^2 pivoted midway between its ends, as at e^3, to an upright e^4, and having applied to its outer end a counterweight e^5, of such weight, and bearing such relation to the lever and bell, that it will act to normally hold the bell upwardly against the lower edge of the hopper D, and effectually seal the same against escape of gases, and will act to permit the bell to move downward when the first portion of the stock falls on the deflector plate, so that as the stock from the skip car or hand barrow enters the

receiving hopper, and falls on the deflector plate, it will act to automatically lower the gas seal bell, and the stock will flow to one side and enter the main hopper in corresponding position, and after it has all passed out of the receiving hopper the weight e^5 will act to automatically raise the bell and close the same against the lower end of the hopper.

In order that the deflector plate may be turned around to different positions, so as to vary the direction of the flow of the stock, to the end that the successive loads may be deposited at different points in the main hopper, I provide means for automatically shifting the bell and its attached deflector plate, around horizontally when the bell rises to close the hopper. I prefer to effect this object by forming on the stem e' a spiral rib G entering a notch in a horizontal ratchet wheel g (see Fig. 3) sustained in an arm g' extending horizontally from the upright e^4. The teeth of the wheel are engaged by a spring pawl g^2 sustained by the arm, and acting to permit the rotation of the ratchet wheel in one direction only. The direction of inclination of the spiral rib, and its relation to the ratchet teeth and pawl are such that when the bell moves downward, the ratchet wheel will be allowed to turn, the pawl clicking over the teeth. But when the bell moves upward, the pawl arresting the motion of the ratchet wheel, the stem will be caused by the spiral rib to be turned around horizontally on a vertical axis, thereby turning the bell and the deflector plate attached to it. As a result of this construction, the position of the deflector plate will be changed on each closing movement of the gas seal bell, with the result that the successive loads charged into the receiving hopper, will be directed by the changing deflector plate to successively different positions in the main hopper.

If the closing action of the gas seal is rapid, there is danger of the bell closing against the lower end of the receiving hopper, before all of the contents of the hopper has passed therefrom. It is desirable therefore that the closing action be slow. Under certain conditions the resistance offered to the rise of the bell by the rotation of the stem, will be sufficient to reduce the speed to a degree which will give the contents of the hopper time to wholly escape. But in order to render this action certain, I propose to combine with the closing mechanism, a retarding device, which will act as a brake on the moving parts, and prevent the bell from closing with a quick action. Various means may be provided for this purpose, but I prefer to adopt the construction shown in Figs. 1 and 4, where it will be seen that the lever e^2, beyond its pivot e^3, has jointed to it, a vertical rack H engaging a pinion h loose on a horizontal shaft h' mounted in bearings h^2 fixed to the cover plate a. This shaft has fixed to it a balance wheel I, provided with a weight i near its periphery, and so related to the pinion h, the rack H and the bell E, that as the bell rises under the influence of the weight e^5, the balance wheel will, through the medium of a clutch mechanism to be described later, be turned and will move its weight i upward, the effect thus being to place additional work on the parts, and render the closing movement of the bell slow. The transmission of motion from the rack h to the weighted wheel, is effected through the medium of the clutch in such manner that the wheel will be turned only when the rack moves upwardly on the closing movement of the bell. This clutch mechanism consists of a ratchet wheel K fixed to the pinion, and engaged by a pawl k carried by the wheel I, the arrangement being such that when the rack moves upward on the lowering of the bell, the pinion will be rotated with the pawl clicking over the teeth of the ratchet wheel, but when the rack moves downward, on the closing movement of the bell, the ratchet wheel will, through the pawl k, impart movement to the weighted wheel.

In Figs. 5 and 6 I have represented a modification of my improved mechanism. In this case, instead of arranging the receiving hopper below the cover plate and in the main hopper, it extends above the cover plate, its lower end projecting within an annular depending neck L on the cover plate, this neck forming in effect the lower end of the hopper. The gas seal bell is adapted to contact with the lower end of the neck in effecting the seal of the main hopper against the escape of gases. The rotation of the deflector plate is, as in the first instance described, effected automatically by the rise of the gas seal bell, but by a mechanism of different form. In this instance, the stem of the bell E is provided on opposite sides with straight ribs M, fitting loosely in grooves in a horizontal bevel wheel N mounted in bearings in the upper end of an arm O rising from the top of the furnace, the upper end of the stem being swiveled as before in the inner end of the weighted lever e^2. The bevel wheel N is engaged by a vertical bevel wheel P on the inner end of a horizontal shaft p, mounted in bearings on the superstructure of the furnace. Alongside the bevel wheel P, the shaft has mounted loosely thereon, a pinion p' provided on its face with inclined teeth p^2 adapted to coöperate with oppositely inclined teeth p^3 on an endwise-sliding collar p^4 splined to the shaft and acted on by a spiral spring p^5 encircling the shaft, and bearing against a fixed collar p^6. The pinion p' is engaged by a vertical rack R jointed to the horizontal lever e^2, and adapted when the lever is moved up and down on the closing and opening movements of the bell, to rotate the loose

pinion p'. The construction and relation of the coöperating teeth p^2 and p^3 and the other parts of the mechanism is such that when the rack moves downwardly on the opening movement of the bell, the coöperating teeth will slip past each other and will have no effect on the shaft; but when the rack moves downward, the turning of the pinion p' will impart a corresponding motion to the collar p^4, which will in turn rotate the shaft p, and through the medium of the bevel wheel P, will turn the horizontal bevel wheel N, and this motion will be imparted to the stem of the bell, with the result that the latter and its inclined deflecting plate will be shifted in position in the receiving hopper.

It will be seen from the construction described that the operation of the distribution of the successive loads to different points in the main hopper is entirely automatic, the gas seal bell opening automatically when the load first enters the receiving hopper, closing automatically when the contents have entirely passed therefrom, and the position of the deflector plate also changing automatically on the closing movement.

The operation is as follows:—As the successive loads of charging materials, either from hand barrows or skip cars, are introduced into the receiving hopper from one unchanging point, they are directed by the deflector plate to one side of the receiving hopper, and upon the opening of the gas seal bell, the contents of the hopper pass into the main hopper in a corresponding position. The gas seal bell now automatically rises and closes the receiving hopper against escape of gases, at the same time changing the position of the deflector plate, so that the next load entering the hopper will be directed to a different point. The main hopper is now lowered and the previously deposited load enters the furnace to one side, the escape of gases during this operation being prevented by the bell E. A second load is now introduced into the receiving hopper, and as it begins to fall on the deflector plate and gas bell, the latter is again lowered, the changed position of the plate causing the second load to pass to the main hopper at a different point from the first, after which the gas seal bell again automatically closes as before, and these operations are repeated with the result that the successive loads charged into the receiving hopper enter the furnace and are deposited at intervals around the same. Instead of operating the main bell to introduce individual loads one after the other into the furnace, it may be held closed until the full charge has been deposited therein and then lowered to introduce the charge into the furnace.

Having thus described my invention, what I claim is:—

1. In a furnace charging mechanism, the combination of a receiving hopper, a vertically movable gas seal, a horizontal lever pivoted between its ends, a stem connecting the lever with the bell, a retarding mechanism, connections between the retarding mechanism and the lever formed to permit the lever to be moved independently of the retarding mechanism on the opening of the bell and constructed to automatically clutch the retarding mechanism to the lever when the bell closes.

2. The combination with a hopper and a bell having a vertical stem, of a counter-balanced lever connected at its inner end to said stem, a rack bar depending from the lever, a fly wheel, a loose pinion engaged by the rack bar, and means for clutching the fly wheel to the pinion on the downward movement of the rack bar and releasing the same on the upward movement of the rack bar.

In testimony whereof I hereunto set my hand this second day of May, 1906, in the presence of two attesting witnesses.

DAVID BAKER.

Witnesses:

CHAS. W. MCCONNELL,

S. HORACE MYERS.