(No Model.)

3 Sheets—Sheet 1.

J. & J. H. HENDY.

ORE FEEDER.

No. 365,518. Patented June 28, 1887.

Fig. 2.

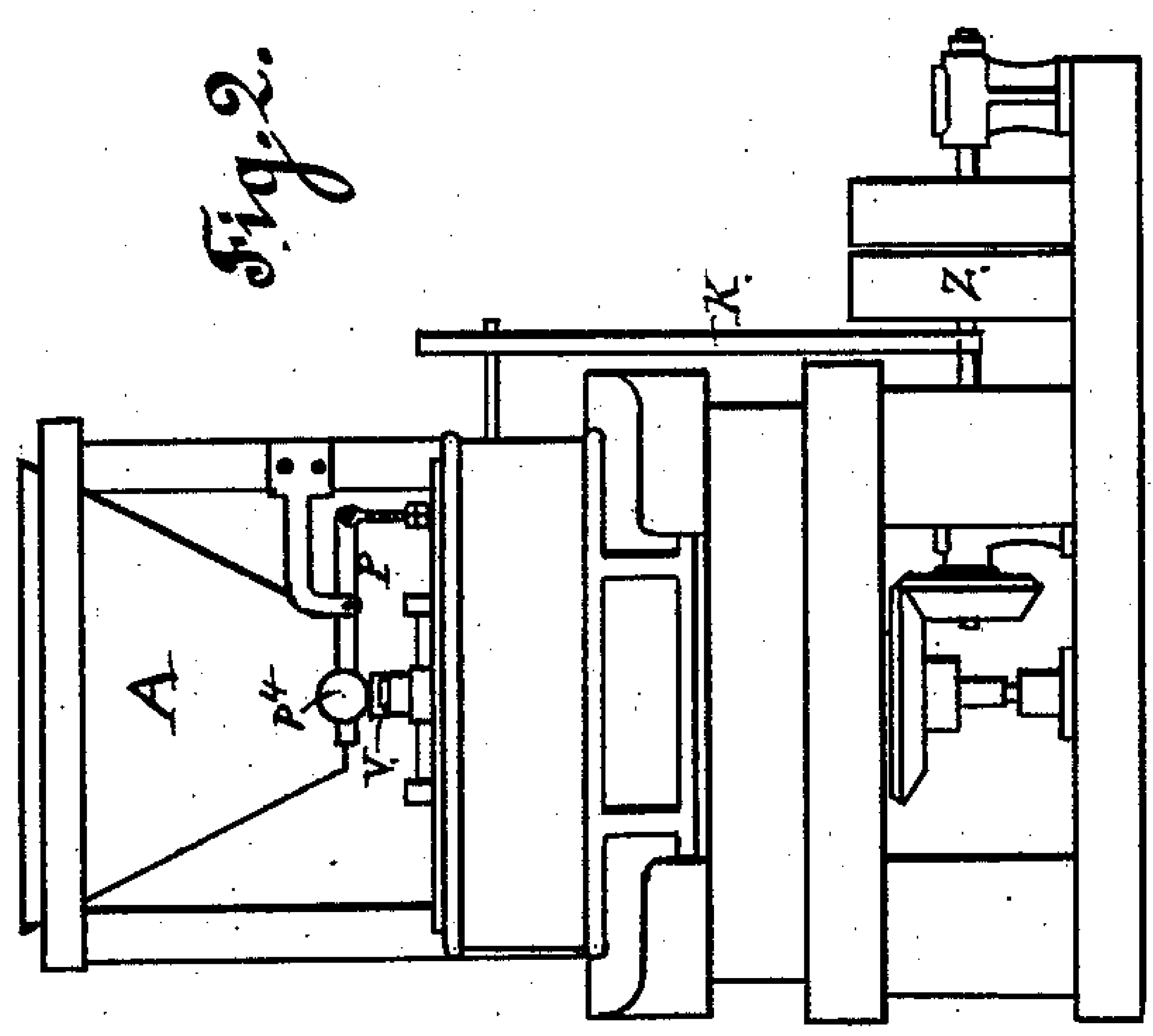


Fig. 1.

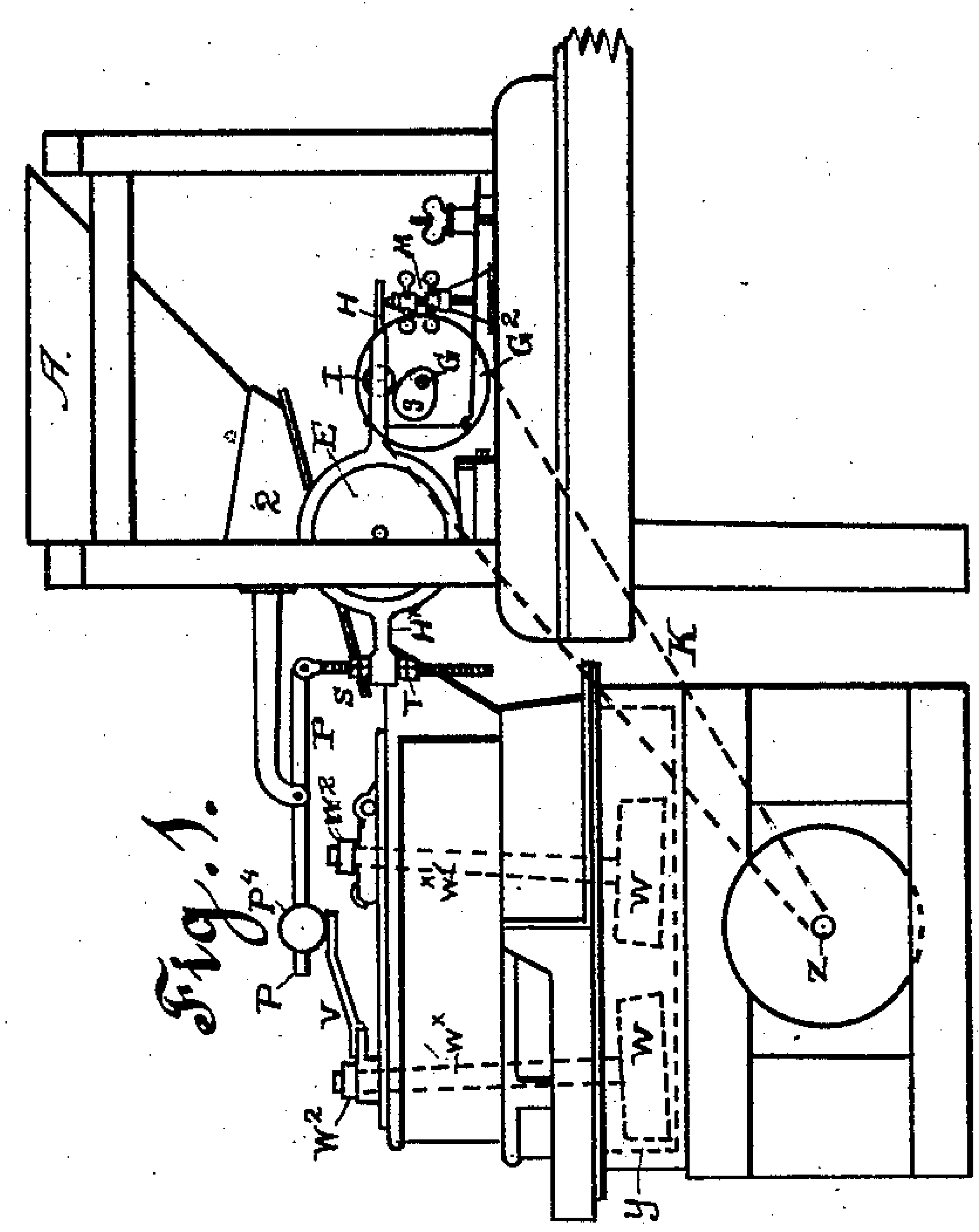
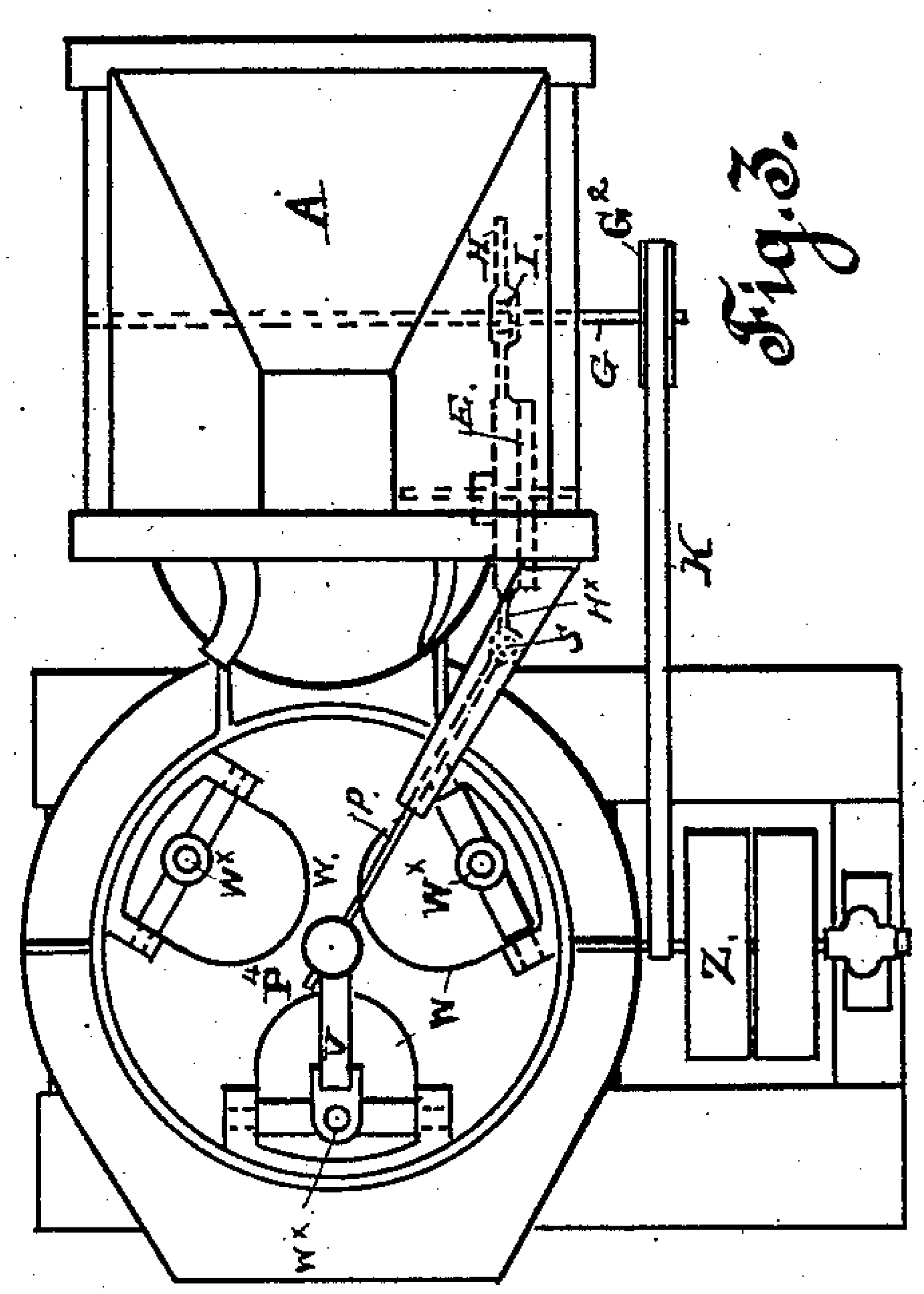


Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

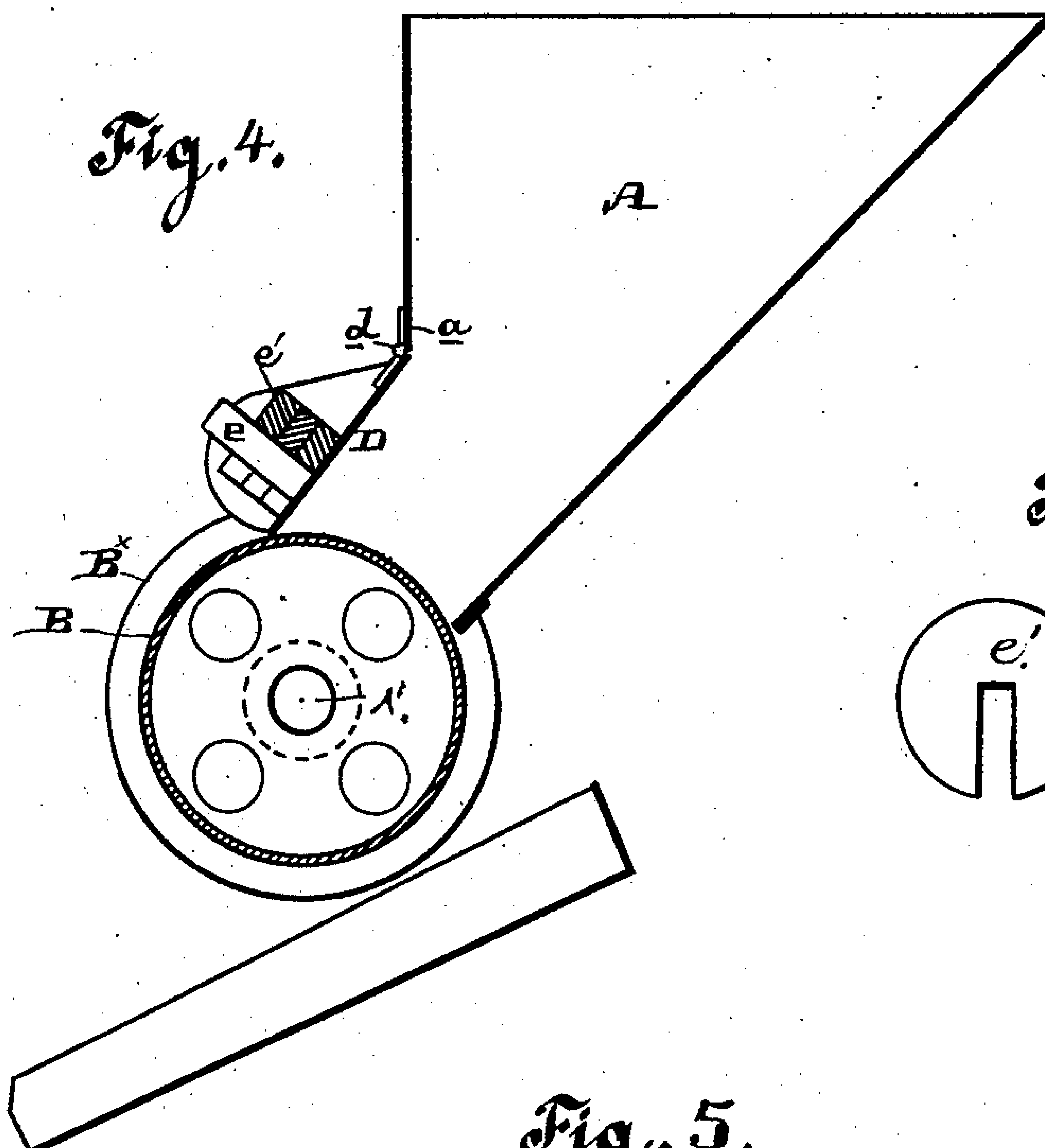

Fig. 6.

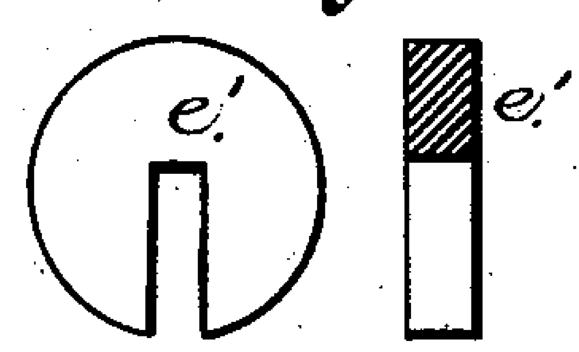

Fig. 5.

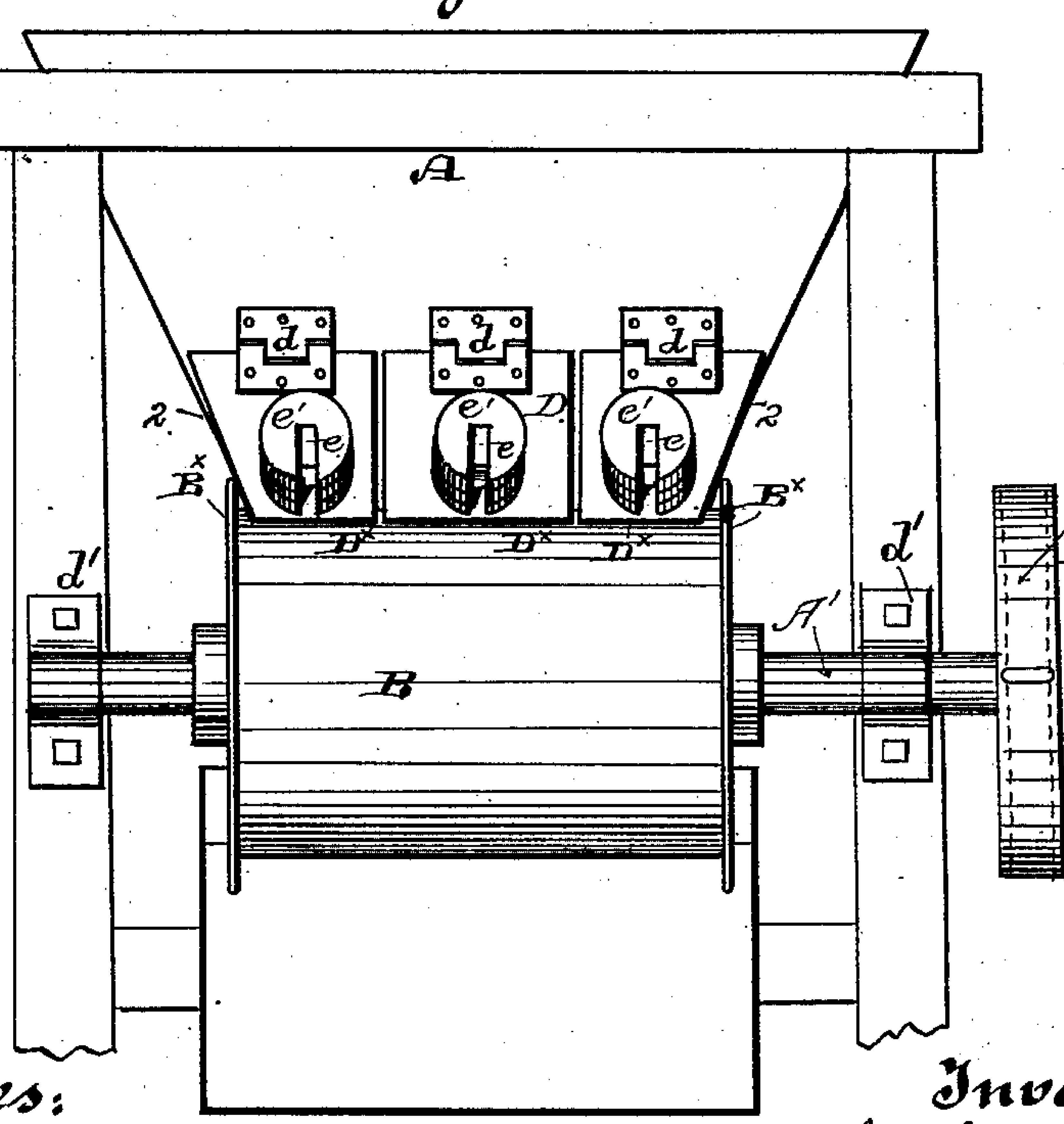

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FIG. 7.

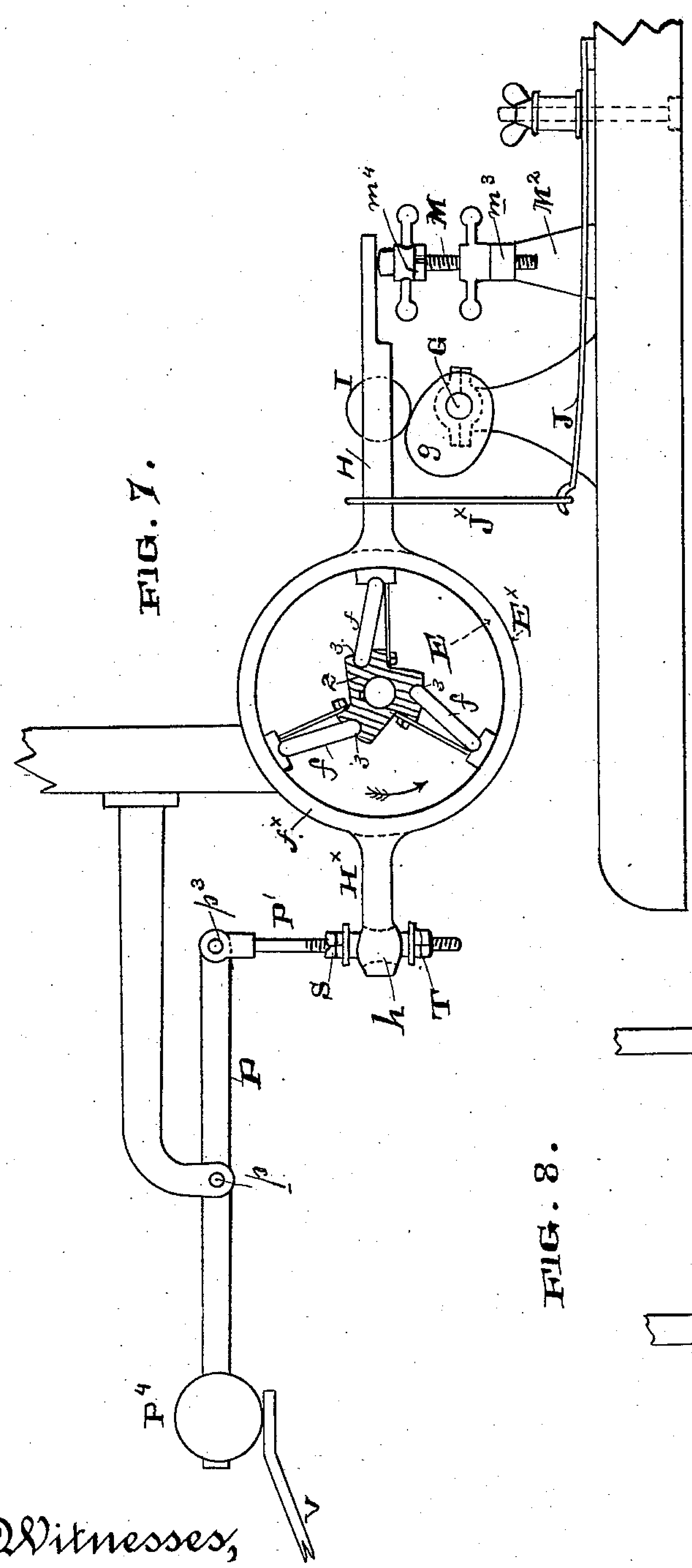
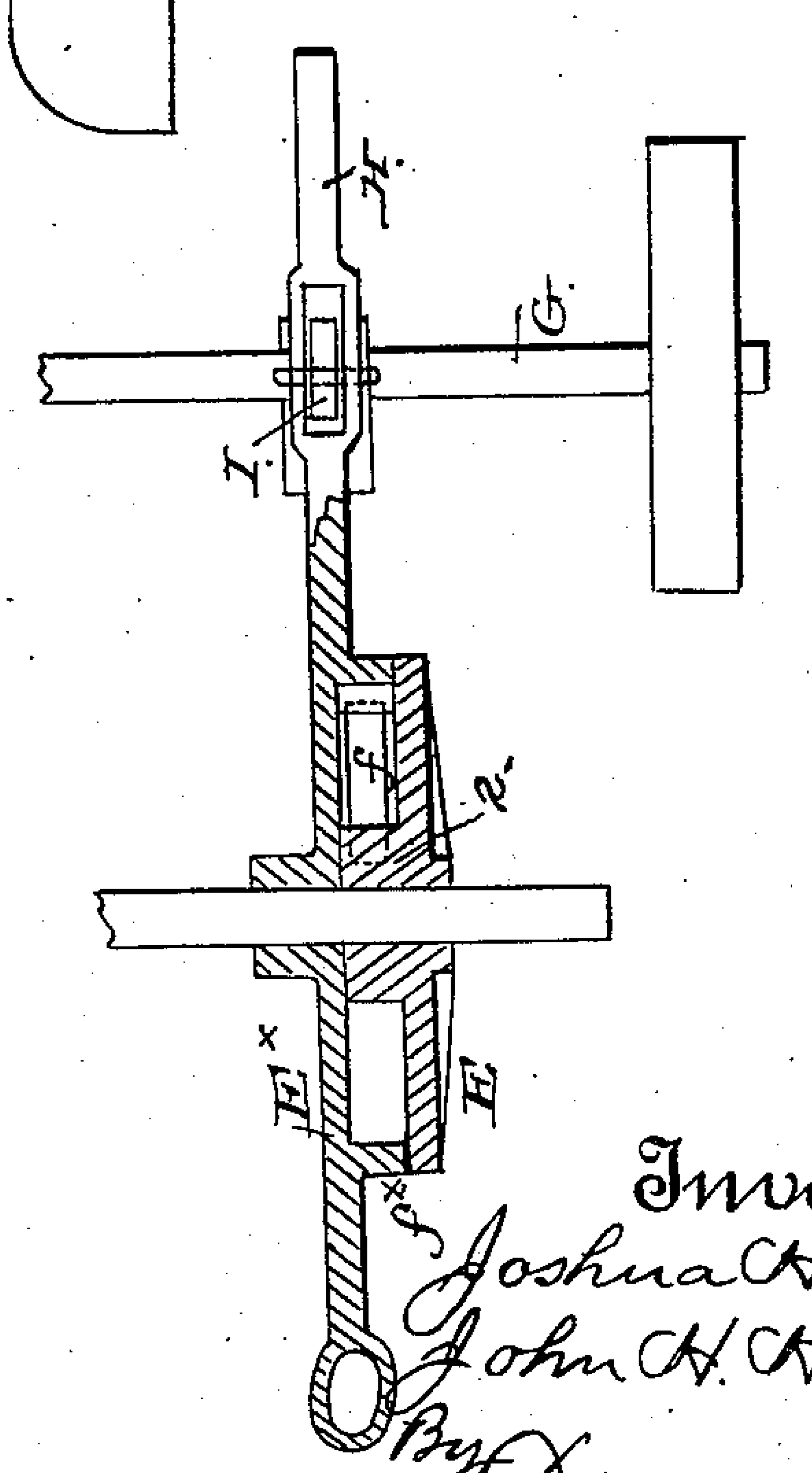


FIG. 8.



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UNITED STATES PATENT OFFICE.

JOSHUA HENDY AND JOHN H. HENDY, OF SAN FRANCISCO, CALIFORNIA.

ORE-FEEDER.

SPECIFICATION forming part of Letters Patent No. 365,518, dated June 28, 1887.

Application filed August 14, 1886. Serial No. 210,949. (No model.)

To all whom it may concern:

Be it known that we, JOSHUA HENDY and JOHN H. HENDY, citizens of the United States, residing in the city and county of San Francisco, in the State of California, have invented certain new and useful Improvements in Ore-Feeders; and we do hereby declare that the following is a full, clear, and exact description of our invention, reference being had to the accompanying drawings.

Our invention relates to improvements in ore-feeders for quartz-mills.

Machines of this class to which our improvements relate have a supply-hopper, a feeding device by which the material is discharged from the hopper at such times and in such quantities as the grinding or reducing mill calls for, and, in connection with the feeding device, certain mechanism operating to control and regulate the feed by or from the mill itself.

The improvements embraced in our invention relate to the construction and combinations of parts hereinafter described and claimed.

These improvements as constructed and applied for operation according to our invention are fully explained in the following description and drawings, the said drawings being referred to by figures and letters.

Figure 1 is a side elevation of a rotary grinder with our feeder attached. Fig. 2 is an end view of the same. Fig. 3 is a plan view of the same. Fig. 4 is an enlarged vertical section of the feeder. Fig. 5 is a front view of the same. Fig. 6 is a view of one of the weights *e'*. Fig. 7 is an enlarged view of the feed-operating mechanism, with a section of the clutch. Fig. 8 is a top view and part horizontal section of parts of the same.

A is a hopper with straight breast, sloping back, and sides that converge to the front. The back extends forward to a point directly under and in line with the bottom edge, *a*, of the breast or front. The space between this bottom edge and the edge of the sloping back below is the ore-outlet of the hopper.

B is the feeding-cylinder, mounted on the hopper-frame directly against this outlet. It has a smooth cylindrical surface, and it is set closely against the edge of the sloping back and under the edge *a* of the front. In such position the cylinder closes the ore-outlet from the edge of the sloping back upward to a point half-way or more between it and the uppermost edge of the opening, and projects more or less into the hopper and a distance beyond the breast of the same.

The space between the cylinder and edge *a* is closed by the swinging gate or apron D, attached by hinges *d* to the hopper-front in such a manner that the opening above the cylinder is closed and the body of ore is held back by the weight or resistance of the gate. It is attached by hinges or other yielding connections, in order that under the pressure and movement of the ore produced by the rotation of the cylinder it may swing outward or yield sufficiently to let the ore pass under its edge. Flat springs could be used instead of hinges to attach the gate to the hopper-front. We construct this gate in separate and independently-moving sections, as shown more particularly at $D^{\times}$ $D^{\times}$, Fig. 5. Each section is therefore free to yield and fall back again into proper position without disturbing the others. This construction will be found to possess considerable advantage over a gate in one piece, particularly in cases of ores having irregularity to a considerable degree in the size of lumps and in material where large pieces are present, since when one section of the gate is raised by the passage under it of a large piece the other sections are not disturbed. The section of the gate thus raised will immediately fall back into line when a large piece has passed out and the escape of smaller particles will not be materially increased. A gate or apron in one piece would be raised along the entire edge by a large piece of ore in the matter being moved forward by the feed-cylinder, and would therefore increase for the time the discharge of the quantity of matter composed of smaller pieces and fine particles.

The gate-sections are set at an inclination, and each one is held down by weights, that are increased or reduced in number to regulate the quantity of material being discharged over the top of the cylinder. For this purpose the gate-sections have pins *e* to hold removable weights *e'*. By preference, these sections are made of suitable length to bring their lower edges upon the cylinder along a line perpendicularly or nearly perpendicularly over the axis. Such lengths of gate-sections will be required where the material is generally fine or consists principally of small particles; but for feeding coarse material the edge of the gate need not be brought down so closely to the cylinder as to actually touch it when there is no material in the hopper.

The spaces at the sides of the inclined gate are closed by carrying outward the sides of the hopper, as seen at 2, Figs. 1 and 5, and these sides are set inside the projecting heads or flanges on the ends of the cylinder. These heads are seen at $B^{\times}$ $B^{\times}$, Figs. 4 and 5.

The shaft A′ of the cylinder is set in boxes d' d', and on one end thereof, projecting beyond the side of the frame, is fixed the disk E of a friction-grip, such as is shown and described in Patent No. 322,716, granted to Joshua Hendy July 21, 1885, said disk being keyed fast upon its shaft, and is provided with a hub, 2, having sockets 3, adapted to receive the inner ends of arms f, said arms being placed tangential to the shaft and of such a length as to bind against the inside of the rim $f^{\times}$ on the disk $E^{\times}$ when moved in one direction, and thus turn said wheel or disk. The disk $E^{\times}$ is loose upon the shaft and has an arm, H, that extends backward over and in line with a cam, g, on the shaft G. This mechanism gives intermittent or step-by-step movement of greater or less length to the feeding-cylinder, and it is of that character of mechanism which is now employed in many machines, and in some ore-feeders, in place of the well-known pawl and ratchet-wheel, to move the feeding device.

We operate this mechanism by and from the continuous rotation of a shaft, G, on the feeder-frame in the following manner: A friction-roller, I, (see Figs. 1 and 7,) is set in a slot or pocket in the arm to travel on the edge of the cam, and the two are kept in contact by the flat spring J. The end of this spring is connected with the arm by the stirrup $J^{\times}$. By rotation of the cam the arm H is moved up and down once in each revolution of the shaft G. The effect of this is to turn the cylinder-shaft A′ a part of a revolution, and the length of such movement is regulated by a stop mechanism that is controlled by the grinding mechanism of the mill with which the feeding mechanism is connected in operation.

A hand regulating device can be employed, also, in all cases where it may be considered desirable, and such a device is shown at M, Fig. 7.

The screw is held by the stand M^2 directly under the end of the arm H, and a hand-wheel or arms on the head furnish means for turning it up and down in the socket m^3 to raise or lower it. When set to the desired height to stop the lever-arm H, the screw is locked by the jam-nut m^4.

The stop mechanism, (shown more particularly in Figs. 1 and 7,) is automatic. It consists of the lever P, having a fixed fulcrum at p on the frame and extending forward into position to bring its outer end over the center of the ore-mill. The opposite end of the lever is connected to the arm $H^{\times}$, that projects from the rim of the loose disk $E^{\times}$, the connection being made by the rod P′, which is attached at p^3 by a loose joint and passes through the socket h on the end of the arm $H^{\times}$. On this rod are two stops, S T, of which the upper one controls the upward movement of the arm $H^{\times}$, and therefore limits the extent of downward movement of the long arm H on the opposite side of the center. The rod is screw-threaded, and the stops are nuts or threaded collars to give adjustment. By setting up the top nut, S, the long arm H is given longer movement upon the cam, and the length of rotation of the cylinder is increased accordingly. The position of this stop determines the longest feed movement of the cylinder that can be produced when the lever P stands in its normal position or out of action with the part which connects it to the grinding mechanism of the ore-mill. From this point of greatest feed the movement of the long arm H is decreased in proportion as the outer end of the lever P is raised, until as this end is lifted to its highest point the arm H will not be acted on at all by the cam G, and the feed-cylinder will stop. Between these points of greatest movement and no movement the feed-cylinder will be affected by the changes taking place in the position of the lever P, and will be governed in the length of its movements accordingly. Therefore, by connecting the outer end of the lever P with some moving part of the ore-mill that is affected by the variation in the quantity of material under process of reduction between the grinding or reducing surfaces, we cause the inner stop-carrying end of the lever to be depressed as the ore matter accumulates between the grinding-surfaces, and to be raised as such matter is discharged, the result of which being to reduce the feed in the one case and to increase it in the other.

The length of feed movement of the cylinder is regulated each time by the requirements of the mill, and the quantity of material supplied to the grinding-surfaces is controlled by the mill itself in a manner best calculated to secure rapid and effective reduction and discharge of the matter being treated.

For the purpose of illustrating the manner in which we apply our feed actuating and regulating mechanism for operation with ore-mills of the circular or rotary kind, we show in Figs. 1, 2, and 3 of the drawings the kind of ore-mill in which the grinding-wheels or revolving grinders W are mounted on upright spindles $W^{\times}$, and are also suspended from points W^2 above, in order to swing or yield in a direction both toward and away from the surrounding circular track or grinding-surface Y of the pan. As the material accumulates between these grinding-surfaces the revolving grinders are pressed inward away from the sides of the pan, and as the material becomes reduced in bulk and is pulverized sufficiently it is discharged, and the grinders then swing back again into closer relation to the grinding-surface or sides of the pan.

By fixing to the upper end of the spindle of one of the grinding-disks a bar, V, of suitable length to extend to the center of the pan and take under the end of the lever P, we cause this swinging or yielding movement, as produced by the material itself, to act upon the lever, and through it to change the length of feed movement of the cylinder, as before described. The bar V is rigidly fixed to the spindle of the grinding-roller, and the end of the lever P is kept down against it by the weight P^4.

The actuating-shaft G is connected directly to the driving-shafts Z of the mill, from which it receives continuous rotation. For this purpose the shaft G has a pulley, G^2, to take a belt, K, from the mill-shaft. In this manner we operate a feeder directly from a mill of the rotary kind with a degree of certainty and a uniformity of action that will secure the most effective results and the greatest possible rapidity of reduction in such mills.

Having thus fully described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In an ore-feeder, the combination, with the hopper and feeding-cylinder, of the cam-shaft having the cam *g* mounted thereon, a friction-clutch comprising a loose disk having arms H $H^\times$ projecting therefrom, the weighted lever P, a connection between said lever and arm $H^\times$, a spring attached to the arm H, and an arm connected with said lever, the arm V, and the grinding-wheels of a rotary mill, substantially as set forth.

2. In an ore-feeder, the combination, with the hopper and feeding-cylinder, of the cam-shaft having the cam *g* thereon, a friction-clutch having a loose disk with arms H and $H^\times$ extending therefrom, a spring connected with one of said arms, the weighted lever P, a rod connecting one end of said lever with the arm $H^\times$, the stops S and T on said rod, and an arm attached to the grinding wheels or disks of a rotary mill and operated thereby, substantially as described.

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