

(No Model.)

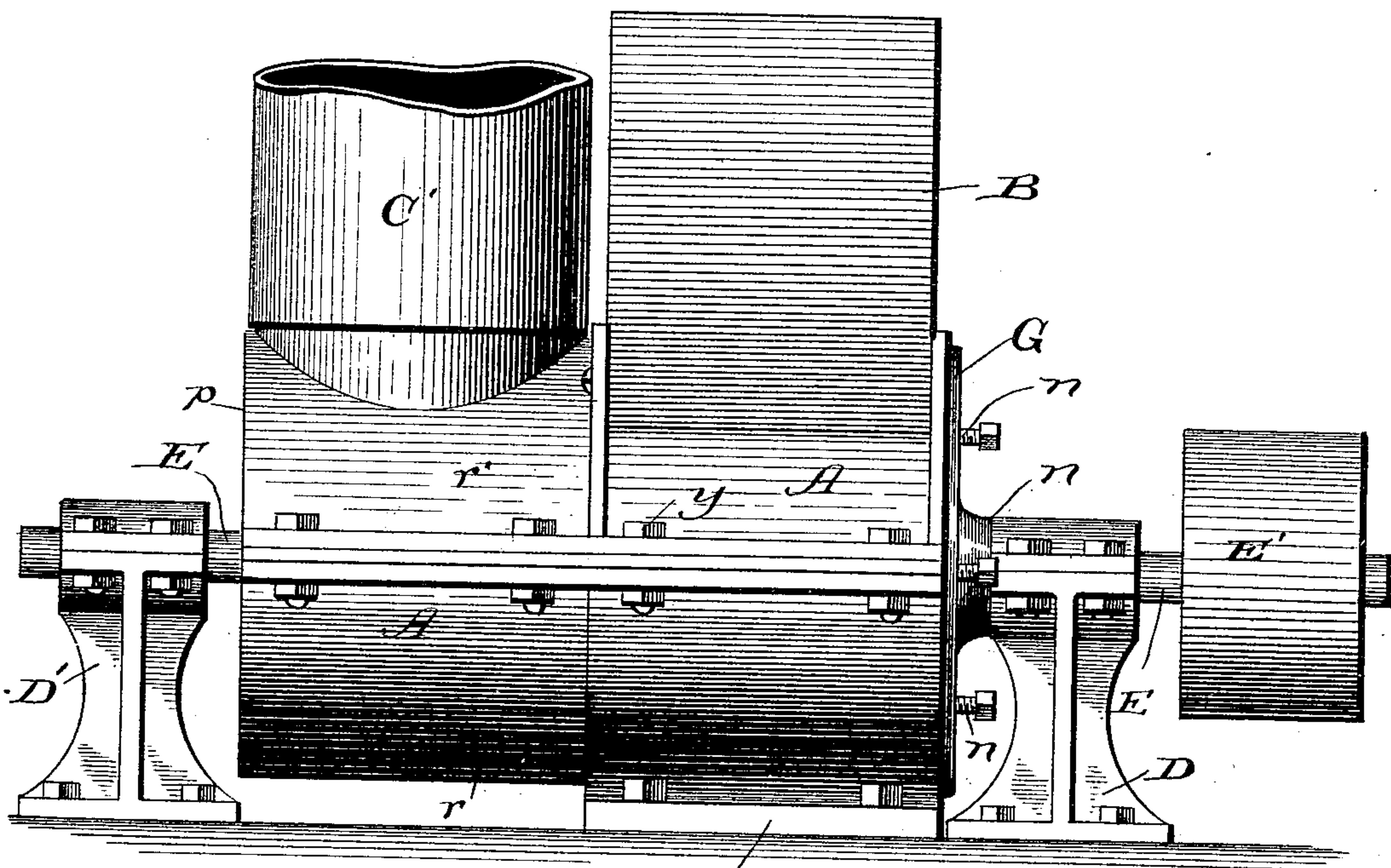
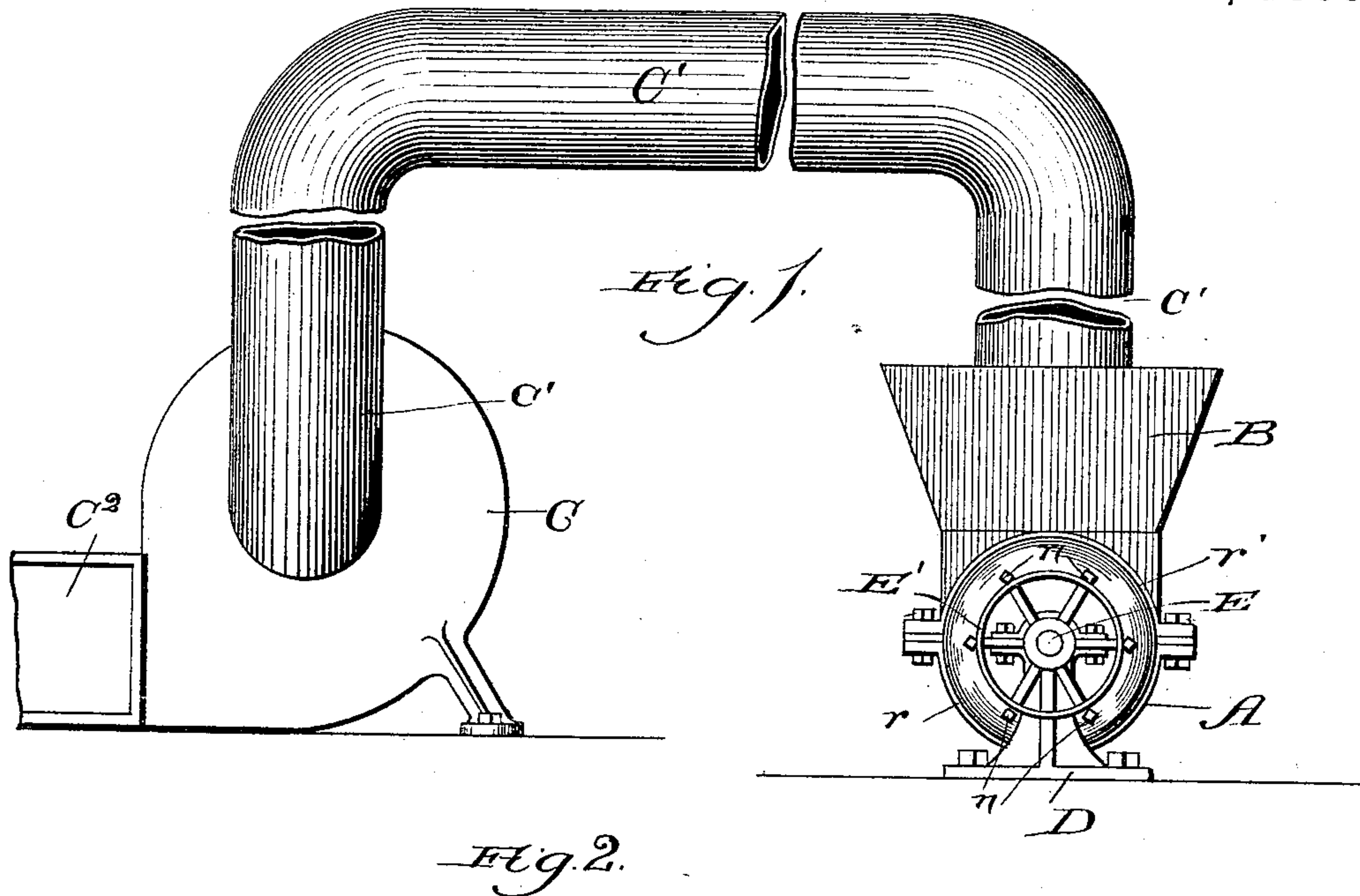
3 Sheets—Sheet 1.

A. H. BLISS.

PULVERIZER.

No. 377,288.

Patented Jan. 31, 1888.



Witnesses:  
Chas. E. Gaylord.  
J. H. Dyneford.

Inventor:  
Abel H. Bliss  
By Dyneford & Dyneford  
Attys.

(No Model.)

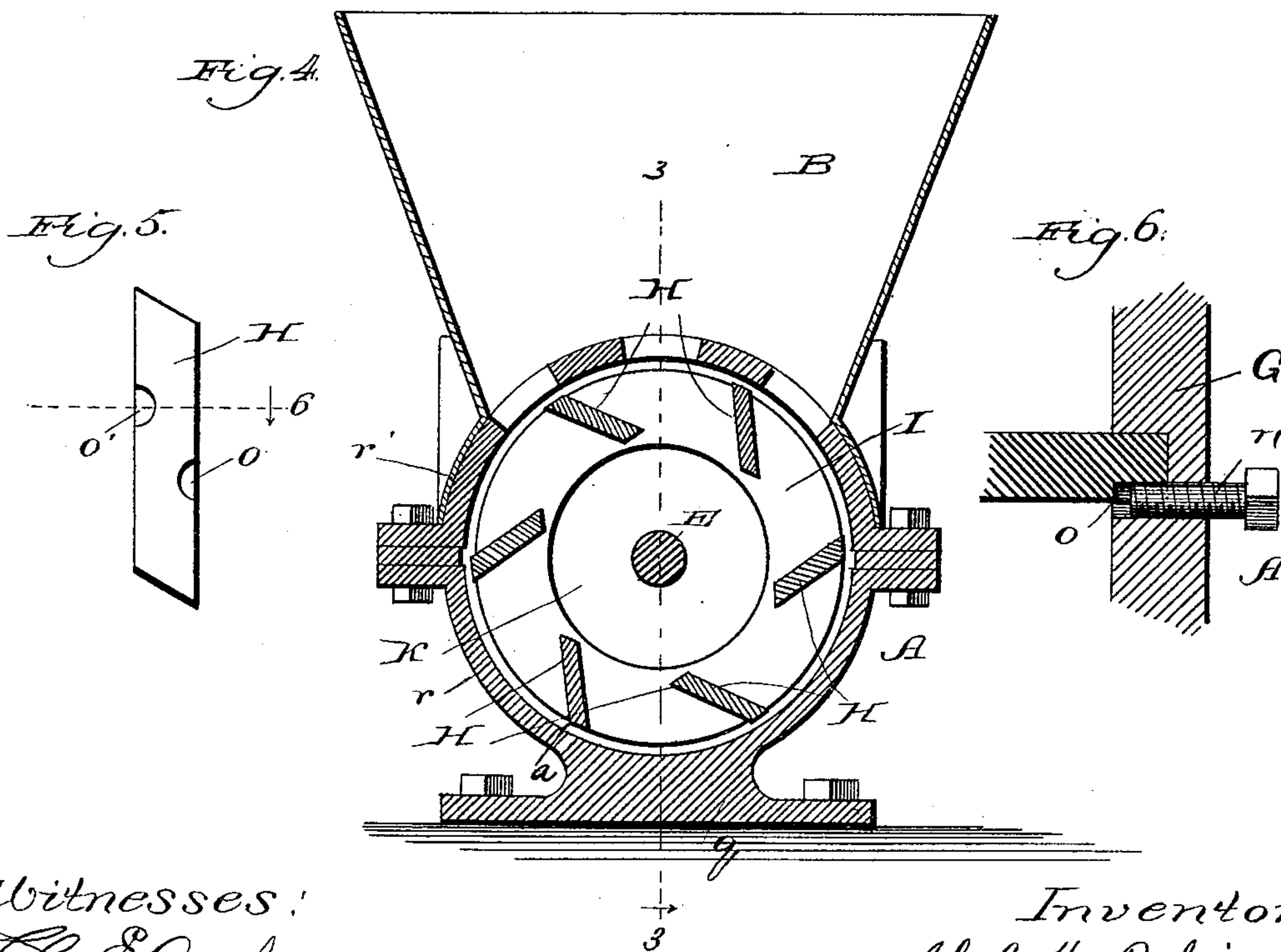
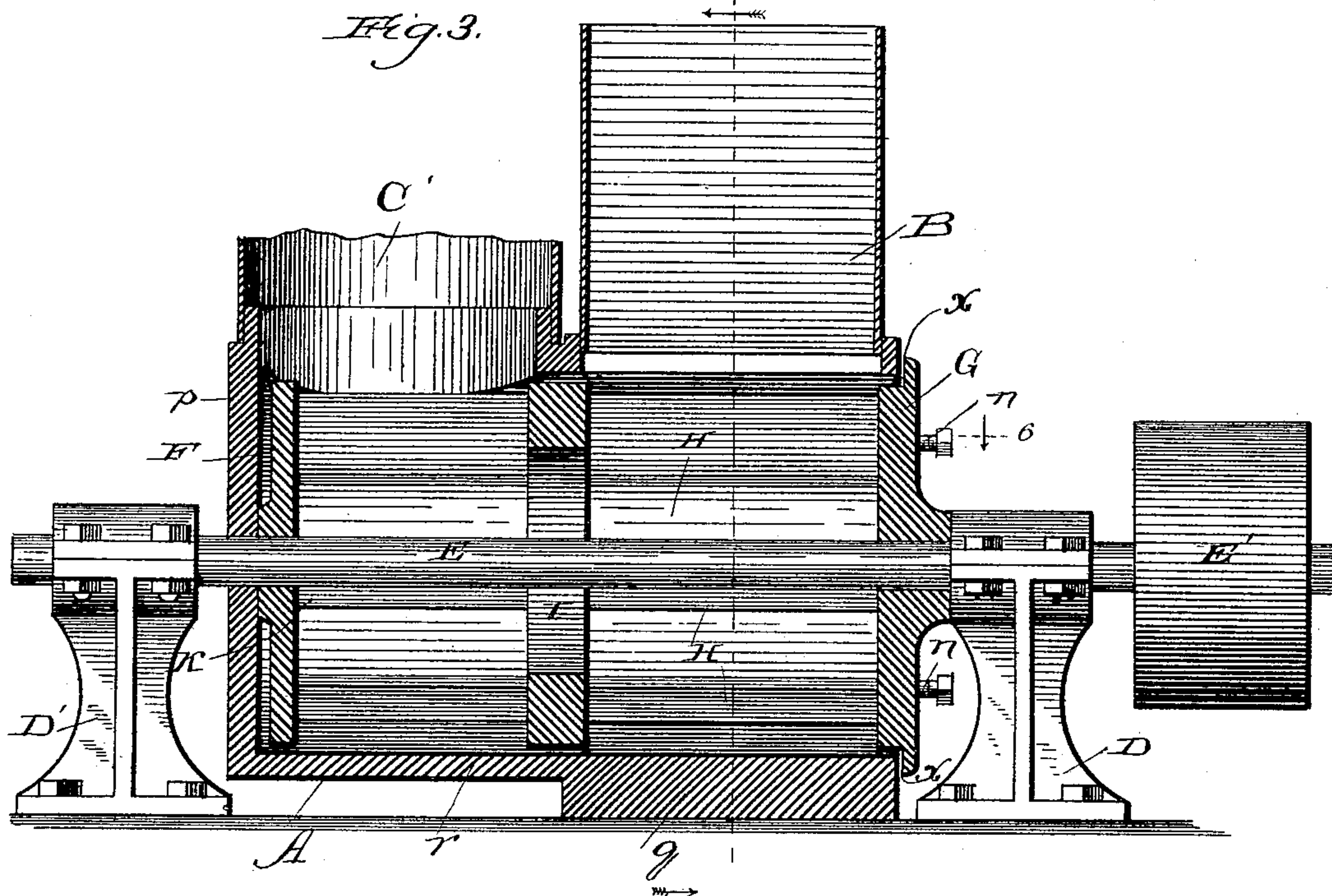
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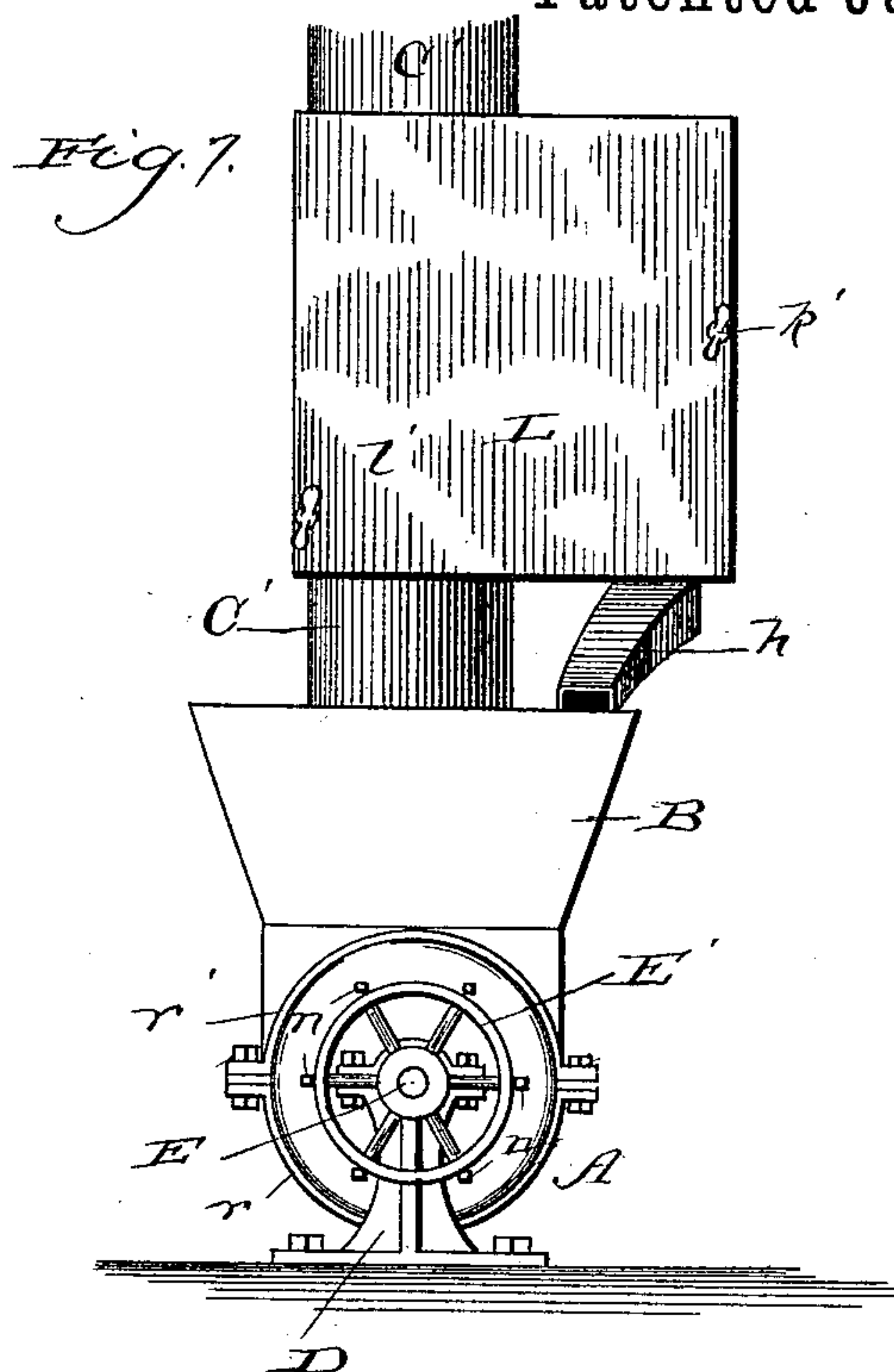
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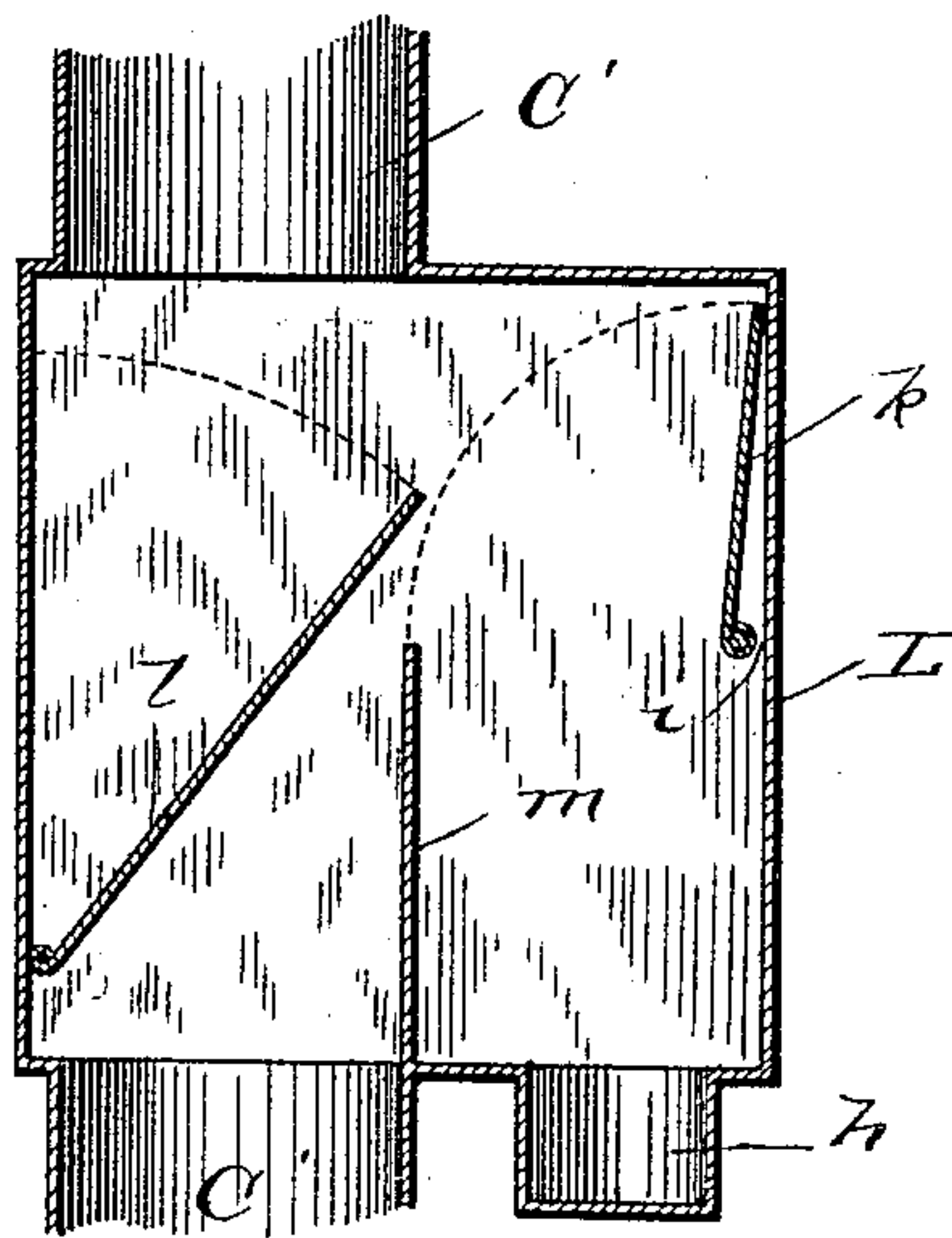
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*Fig. 8.*



witnesses:  
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# UNITED STATES PATENT OFFICE.

ABEL H. BLISS, OF CHICAGO, ILLINOIS.

## PULVERIZER.

SPECIFICATION forming part of Letters Patent No. 377,288, dated January 31, 1888.

Application filed April 12, 1887. Serial No. 234,482. (No model.)

*To all whom it may concern:*

Be it known that I, ABEL H. BLISS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Pulverizers; and I hereby declare the following to be a full, clear, and exact description of the same.

It is my object to provide a pulverizing-machine which shall be of simple construction, involving comparatively few parts, and durable to an extent that it will resist in an unusual degree the wearing effect of even very hard substances, such as highly-refractory ores.

In the drawings, Figure 1 shows my improved pulverizer in end elevation connected with the air-current-producing device in the form of a suction-fan, the connecting medium being shown broken away; Fig. 2, a broken side elevation of the machine without the suction-fan; Fig. 3, a longitudinal section of the device as shown in Fig. 2, taken on the line 3 3 of Fig. 4, and viewed in the direction of the arrows; Fig. 4, a section taken on the line 4 of Fig. 3, and viewed in the direction of the arrow; Fig. 5, a view in end elevation of a detail; Fig. 6, a section on the lines 6 of Figs. 3 and 5, and viewed in the direction of the arrows; Fig. 7, a view similar to that illustrated in Fig. 1, minus the suction-fan connection, but showing a valve-chamber detail removed from Fig. 1 by breaking away the connection between the suction-fan and pulverizer proper; and Fig. 8, a broken sectional elevation of the valve-chamber detail.

A is a metallic shell of general cylindrical shape, comprising a semi-cylindrical lower part, *r*, flanged at its edges and provided with a base, *q*, at which it is secured to the floor or other support, and a semi-cylindrical upper part, *r'*, also flanged at its edges, the two parts being secured together by bolts, as shown, at the flanges. The upper part has openings on its upper side, one between the center and one end to receive the hopper B, and which opening may be slatted over, as shown, to produce interstices at the base of the hopper, and the other between the center and the opposite end, from which communication is afforded with the fan C; and at one end of the shell A is a head, *p*, the opposite end being unprovided with an integral head.

D and D' are bearings, respectively at opposite ends of the shell A, for a shaft, E, extending lengthwise and centrally through the shell, and carrying near one end a belt-pulley, E'. Against the inner face of the head *p* is a disk, F, Fig. 3, secured centrally upon the shaft E to revolve with it, and near the journal-bearing D is a flanged disk, G, secured centrally upon the shaft to revolve with it, and forming the opposite head of the shell A, without affording a close fit, to produce the space *x*. (Shown in Fig. 3.)

Each disk F and G is provided on its inner face with recesses corresponding in the opposite disks and extending from the periphery of each at various angles to receive the ends of metallic bars or slats H, which, when adjusted in the disks, form with the latter a hollow cylinder, K, having heads at opposite ends and longitudinal openings along its body between the slats or bars H, which are preferably continuous, as shown. These latter are provided at their ends which fit into the recesses on the head or disk G, each on opposite sides, with grooves or recesses *o* and *o'*. (See Figs. 5 and 6.) When first adjusted, bolts *n* are inserted through the disk G into the recesses or grooves *o* in the bars H, thereby firmly securing them in position, and the recesses *o'* permit the bars or slats H to be adjusted in inverted position and clamped by the bolts *n*.

Centrally between the disks F and G, and within the shell A, is an annular disk, I, having recesses *g* extending into it from its periphery at the angles of the bars H in the recesses in the disks F and G to receive the bars, as shown in Figs. 3 and 4, and cause its rotation with the open hollow cylinder K, formed by the disks F and G and slats H, and the annular disk I, which divides such cylinder practically into two intercommunicating compartments, and serves especially as a strengthening-band against the disorganizing tendency of the high degree of centrifugal force produced by the rapid rotation of the cylinder. If the cylinder K is quite short, however, the band I may be dispensed with.

From an opening in the upper portion of the shell A leads the conduit C', affording communication between the open cylinder K and the fan C, and in the conduit C' is a box



or chamber, L, Figs. 7 and 8, divided by a central partition, *m*, extending about half-way toward the top of the box. To one side of the partition *m* in the passage formed by it in line with the conduit *C'* is a hinged lid or valve, *l*, which may be perforated, if desired, to afford a screen, hinged to the inner sides of the box, as shown, and provided with a handle, *l'*, outside of the box, whereby it may be turned to open and close and regulate the extent of communication between the pulverizer proper and fan. On the inner sides of the chamber L, at the opposite side of the partition, is a lid or valve, *k*, hinged to leave a space, *i*, behind it and control communication with the hopper B of the chamber L, with which the hopper is connected by means of a chute or spout, *h*.

To operate the machine, the shaft, and with it the open cylinder K, is revolved at a high speed and the fan C is set in motion. The material to be pulverized—ore, for example—is fed from the hopper by falling between the cylinder K and inner surface of the shell A, where the pulverization or reduction to an impalpable powder takes place, owing to the construction and manner of operation of the machine upon the following theory: As the material is fed, the rapid rotation of the hollow cylinder K produces centrifugal force, which tends to hold it toward the periphery and between the upper edges of the slats or bars H and the inner side of the shell, while air-currents of great velocity are generated continually in the machine. The rapid rotation and centrifugal force generated produce energetic vibration of the material, alternate rarefaction and densification of the air in and about the material, and attrition of the latter, each one of which functions of the machine tends to produce disintegration of the particles, and by their combined effect upon the material rapidly reduce it to an impalpable powder. Thus the material is pulverized, first, by the rapid revolution; second, by the current created by the machine itself between the hollow open cylinder K and the slats over the opening at the base of the hopper, and by the attrition of the ore upon itself, being thrown upward and outward by the centrifugal and air forces, and also by the force created by the motion of the machine between the bars H and inner wall of the shell A.

The fan or blower C, which is of ordinary construction, hence not described nor shown in detail in the present connection, sucks the pulverized material through the spaces between the bars H to and through the conduit *C'*, thus necessitating its passage between the bars H on one side of the annular disk I and up between them on the opposite side of the annular disk, and delivers it to a box or receptacle, *C''*, adjacent to and communicating with the blower. The force of the air-currents which draws the pulverized material to the point of discharge is regulated by the rotation of the fan and the valve *l* by adjusting

the latter at the handle *l'* to reduce or enlarge the passage through the chamber L, and coarse particles which may have been carried by the force of the air-currents are intercepted in the chamber or box L by being precipitated into the compartment at the right-hand side of the partition *m*, whence they are reintroduced at desired intervals into the hopper through the spout *h*, to be again acted upon by the pulverizer. Owing to the force of the air-currents, when the spout or chute *h* is opened, to prevent the coarser particles, with the draft that would be produced by opening the chute, from being sucked into the conduit *C'*, the lid or valve *k* is closed by means of the handle *k'*. Any coarse particles which may have accumulated on the upper surface of the lid *k* while closed may be swept into the compartment through the space *i* behind the lid.

While I show a fan or blower for producing the air-currents required to act upon the impalpable material to carry it away, I do not confine myself to such mechanism for the purpose, as other means may be employed for producing the same result.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a pulverizing-machine, the combination of a stationary shell, a rotary hollow cylinder within the shell having longitudinal circumferential openings, a feed-opening in the shell leading directly to the exterior surface of the inclosed hollow cylinder, and means for producing air-currents through the machine, substantially as described.

2. In a pulverizing-machine, the combination of a stationary shell, A, a rotary shaft, E, disks F and G, supported on the shaft to rotate with it, bars H, secured at opposite ends to and supported by the said disks, and forming with the latter a hollow cylinder having longitudinal circumferential openings, a feed-opening in the shell leading directly to the exterior surface of the said cylinder, and means for producing air-currents through the machine, substantially as described.

3. In a pulverizing-machine, the combination of a stationary shell, A, a rotary hollow cylinder, K, within the shell and having longitudinal circumferential openings, an annular disk, I, affording a strengthening-band and partition on the said cylinder, a feed-opening in the shell leading directly to the exterior surface of the said cylinder, and means for producing air-currents through the machine, substantially as described.

4. In a pulverizing-machine, the combination of a shell, A, provided with a feed-opening, a rotary shaft, E, disks F and G, supported on the shaft to rotate with it, bars H, inserted at opposite ends into recesses in the opposing faces of the said disks, an annular disk, I, between the disks F and G, having peripheral recesses at which the bars H are let into it, and means for producing air-currents through the machine, substantially as and for the purpose set forth.



5. In a pulverizing-machine, the combination of a shell, A, provided with a feed-opening, a rotary shaft, E, disks F and G, supported on the shaft to rotate with it, bars H, inserted at opposite ends into recesses in the opposing faces of the said disks and grooved or recessed at one end, and secured in position by bolts inserted into the recesses through the disk G, an annular disk, I, between the disks F and G, having peripheral recesses at which the bars H are let into it, and means for producing air-currents through the machine, substantially as and for the purpose set forth.

6. The combination of a shell, A, having a feed-opening provided with a hopper, B, at one side of the center and a discharge-opening at the opposite side of the same, a rotary shaft, E, disks F and G, supported on the shaft to rotate with it, bars H, inserted at opposite ends into recesses in the opposing faces of the said disks, an annular disk, I, between the said feed and discharge openings in the shell A, and having peripheral recesses at which the bars H are let into it, an air-current-producing device, C, a conduit, C', affording communication between the device C and the discharge-opening in the shell A, and a chamber, L, in the conduit C', provided with an internal partition, m, valves k and l, and a chute,

h, leading into the hopper B, substantially as and for the purpose set forth.

7. A pulverizing-machine comprising, in combination, the following elements, viz: a shell, A, having a feed-opening provided with a hopper, B, at one side of the center and a discharge-opening at the opposite side of the same, a rotary shaft, E, disks F and G, supported on the shaft to rotate with it, bars H, inserted at opposite ends into recesses in the opposing faces of the said disks and grooved or recessed at one end, and secured in position by bolts inserted into the recesses through the disk G, an annular disk, I, between the said feed and discharge openings in the shell A, and having peripheral recesses at which the bars H are let into it, an air-current-producing device, C, a conduit, C', affording communication between the device C and the discharge-opening in the shell A, and a chamber, L, in the conduit C', provided with an internal partition, m, valves k and l, and a chute, h, leading into the hopper B, the whole being constructed and arranged to operate substantially as and for the purpose set forth.

ABEL H. BLISS.

In presence of—

J. W. DYRENFORTH,  
GEORGE C. COOK.