

(No Model.)

2 Sheets—Sheet 1.

E. B. HASTINGS.
ORE CONCENTRATOR.

No. 412,180.

Patented Oct. 1, 1889.

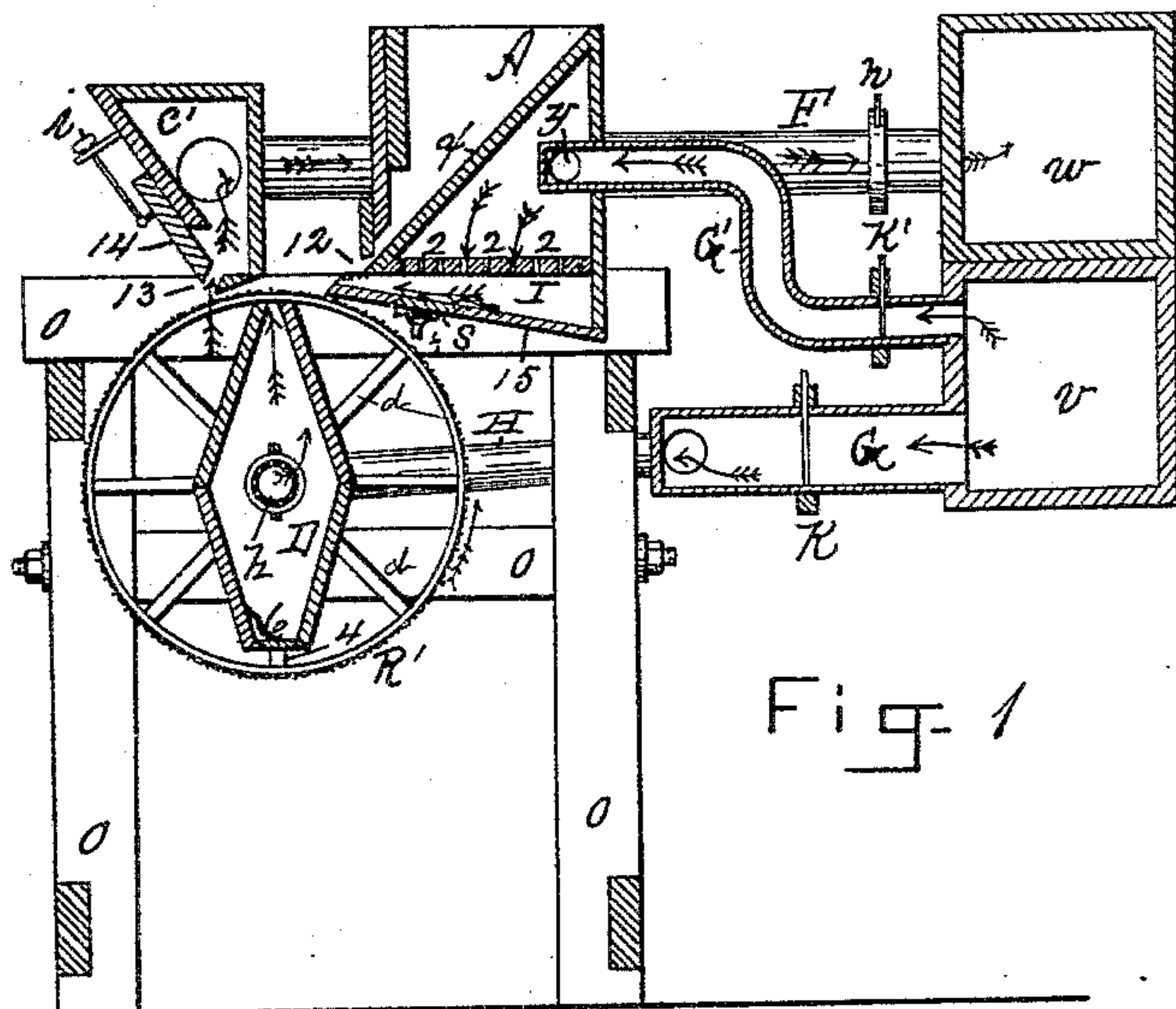


Fig. 1

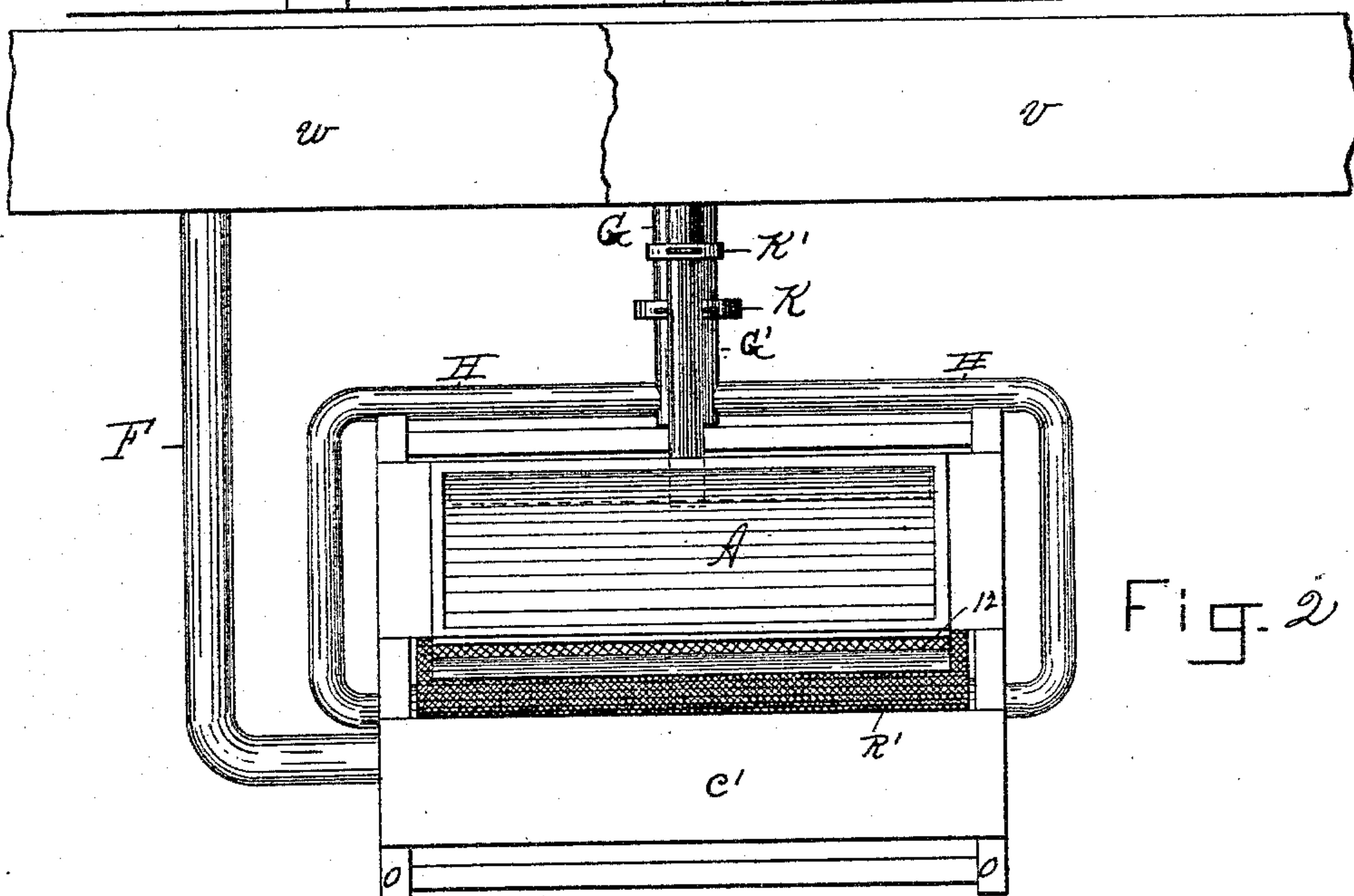


Fig. 2

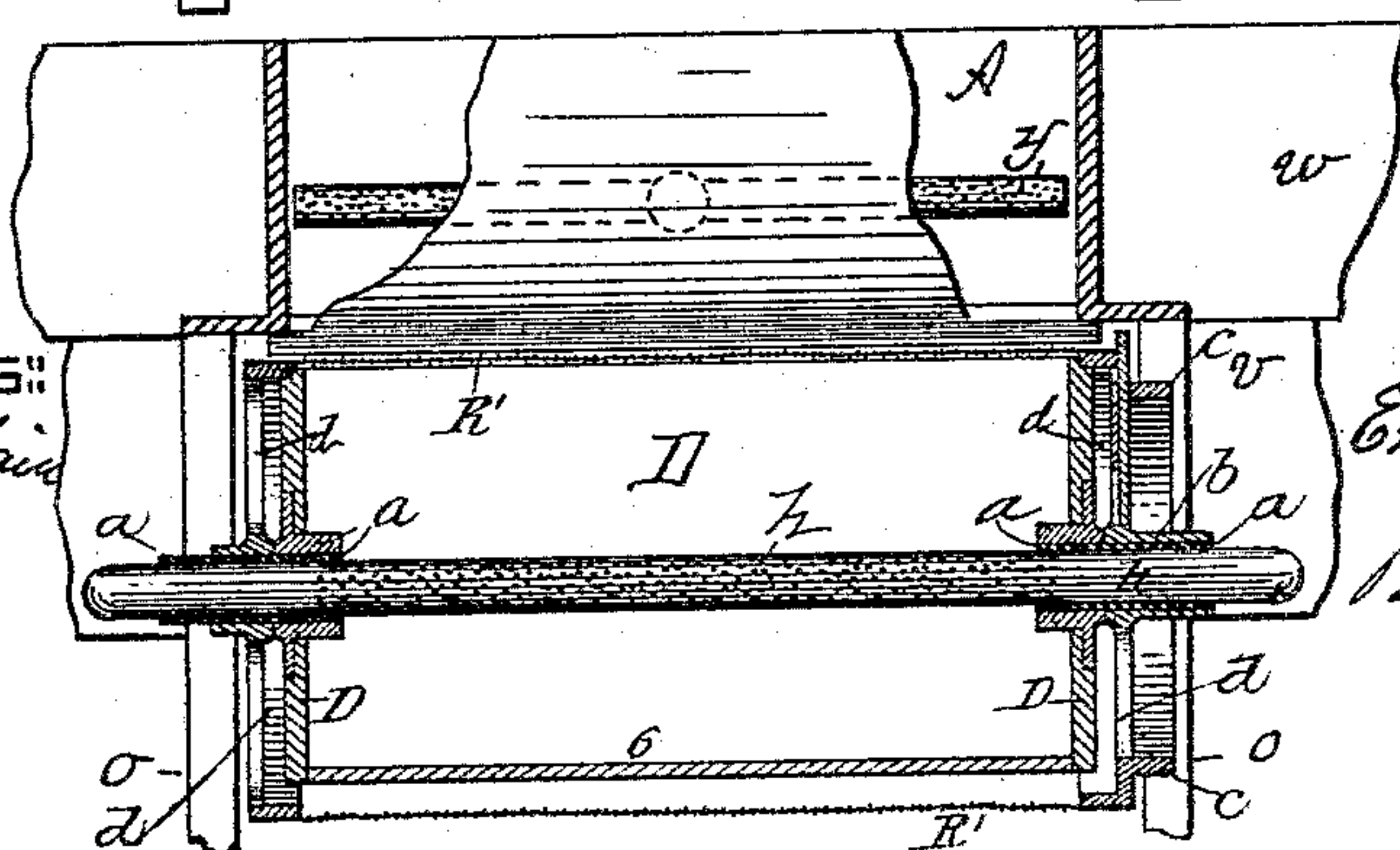


Fig. 3

WITNESSES:

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Wm. H. Chapin

INVENTOR:

Emory B. Hastings

By Chappin & Co.
Attys

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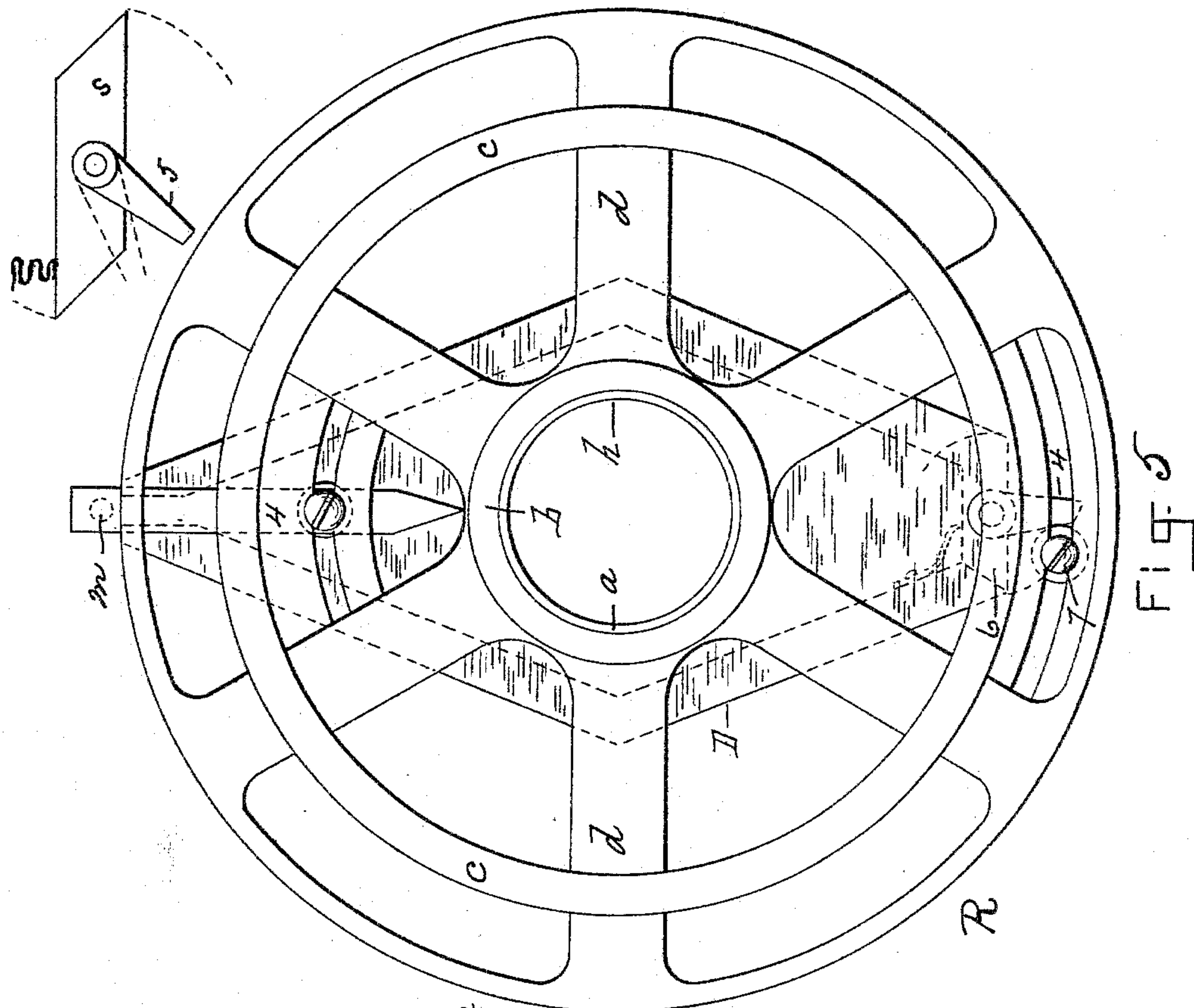


Fig. 5

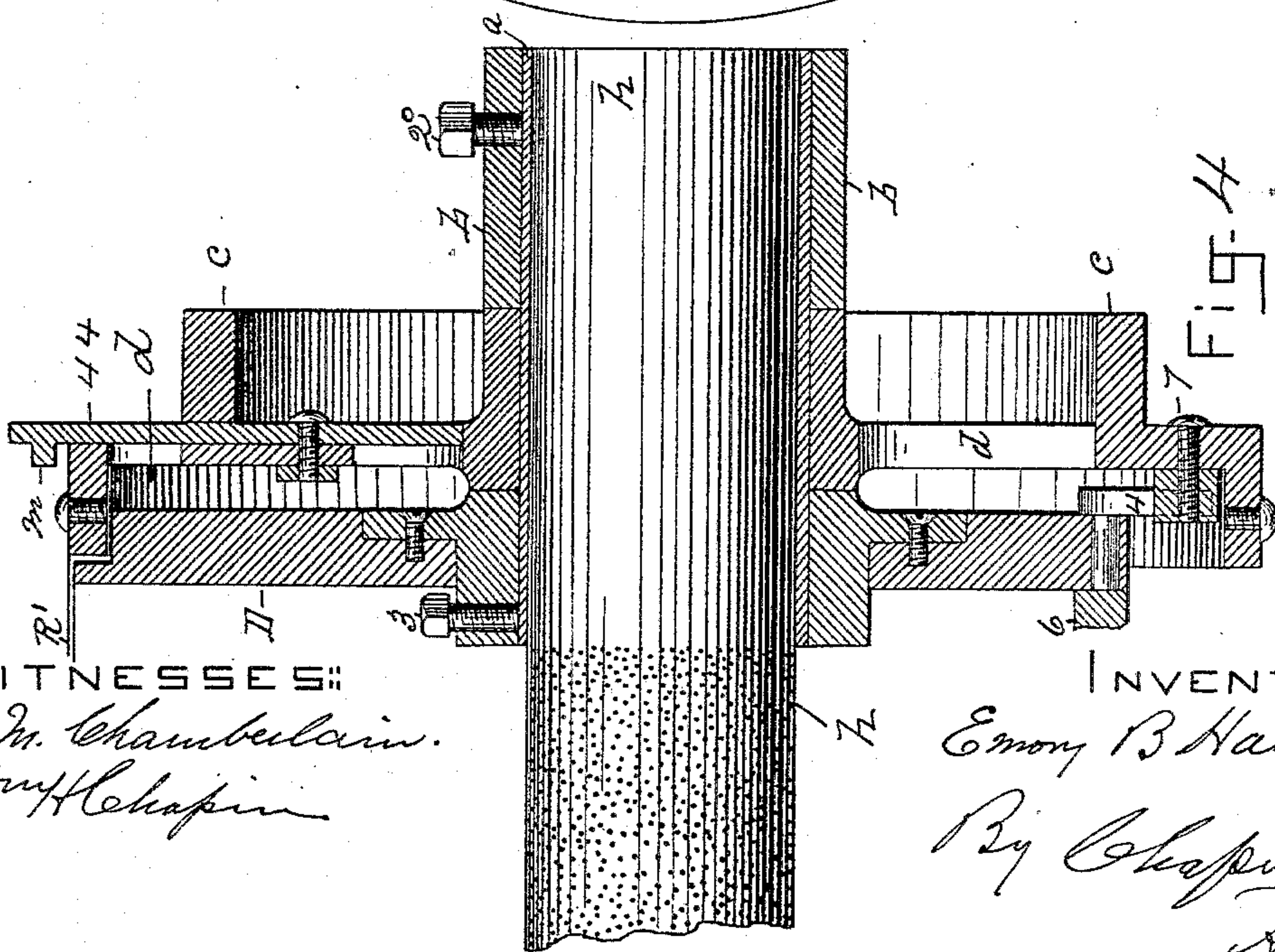


Fig. 4

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UNITED STATES PATENT OFFICE.

EMORY B. HASTINGS, OF GEORGETOWN, ASSIGNOR OF ONE-FOURTH TO
CHARLES P. O'REILLY AND WILLIAM K. URE, BOTH OF DENVER,
COLORADO.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 412,180, dated October 1, 1889.

Application filed September 14, 1886. Serial No. 213,494. (No model.)

To all whom it may concern:

Be it known that I, EMORY B. HASTINGS, a citizen of the United States, residing at Georgetown, in the county of Clear Creek and State of Colorado, have invented new and useful Improvements in Ore-Concentrators, of which the following is a specification.

This invention relates to ore-concentrators, and to that class of said machines which embody in their construction a moving porous bed upon which the crushed ore is deposited, and pneumatic devices for forcing air through said bed and for removing the light earthy or worthless matters which are separated from the crushed ore, thereby leaving the valuable or metallic portion of the latter free and causing its proper concentration and separation; and the invention consists in the peculiar construction and combination of parts of the machine, as hereinafter fully described, and set forth in the claims.

In the drawings forming part of this specification, Figure 1 is a side elevation, partly in section; and Fig. 2 is a plan view of an ore-concentrating machine embodying my improvements. Fig. 3 is a front elevation, partly in section, showing portions of the revolving ore-bed, the ore-hopper, (the front of the latter being shown broken away,) together with portions of the air-exhaust and pressure-boxes. Fig. 4 is a transverse sectional view of one end of the blast-box, one head of the cylinder which constitutes said ore-bed, and other detail parts hereinafter fully described. Fig. 5 is an end elevation of the ore-bed cylinder and blast-box, together with a detailed illustration of a valve in the bottom of one of the air-blast chambers of the machine hereinafter described.

In the drawings, *o* indicates a suitable frame upon which the operative parts of the machine are mounted, *R* being the ore-bed cylinder thereof. Said cylinder consists of two metallic heads *d*, having lateral projections on the inner side thereof, to which is secured in any suitable manner a wire-cloth or a bolting-cloth covering *R'*. A suitable box *b* (see Fig. 4) is suitably arranged at each end of the frame *o*, and within each of said boxes is secured in a fixed position a tubular bear-

ing *a* by the set-screw 2°, on which tubular bearings the two heads of said cylinder rotate by means of a suitable belt running upon a driving-pulley *c* on one of said heads. The said wire-cloth covering of the cylinder *R* is so secured by each edge to the heads thereof as to maintain the surface of the cylinder parallel with the axis thereof, said wire-cloth covering as aforesaid constituting what is termed the "movable ore-bed" of the machine. Within said cylinder is fixed an air-blast box *D*, having the form which is indicated in Figs. 1 and 5. Said blast-box is constructed with two heads, each one of which is secured by the set-screw 3 to the inner end of the said tubular bearing *a*, and the upper edge of said blast-box is made narrower than its lower edge, as shown, and between its sides is formed an air-passage through which air is forced, as below described, against the inner side of said cylindrical ore-bed, the latter being adapted to be rotated over said air-passage. In the lower edge of said blast-box *D* is pivoted a valve 6, having an arm 4 thereon, and a pin 7 is adjustably connected, by screw or otherwise, to one of the heads of said cylinder, as shown in Fig. 5, which pin, at each revolution of said cylinder, is carried against the end of said arm 4, thereby causing the valve 6 to be opened. A suitable spring is attached to said valve to close it after said pin 7 shall have moved away from said arm 4. A perforated metallic air-pipe *h*, extending from the outer end of each of said tubular bearings from end to end of said blast-box, is connected by each end by the air-pipes *H* with the supply-pipe *G*, which is connected with an air-pressure box *v* at the rear of the machine. A sliding gate *K* is placed in said pipe *G* to regulate the air-pressure in the blast-box *D*.

The air-pressure box *v* and the exhaust-box *w*, located above the latter, are practically air-conductors, of wood or other suitable material, with which are connected blowing and exhaust fans of the ordinary description, (not shown in the drawings,) whereby air-pressure is created in box *v* and more or less of a vacuum in the box *w*, and in practice the concentrating-machines are set in front of

two such boxes, the latter being adapted to serve for several machines.

On the frame *o*, a little above and to one side of the axis of the cylinder *R*, is located the hopper *A*, in which is placed the gangue or ore-bearing material to be operated upon. Said hopper has an inclined bottom *x*, upon which said material rests, at the lower edge of which is an opening through the side of the hopper for the delivery of said material, and a suitable gate is arranged above said opening to regulate the width of the latter. The bottom of the hopper-box, which is at right angles to the side thereof, is provided with a series of perforations 2 through it, which communicate with an air-chamber *I* under said bottom. The front edge of the bottom of said air-chamber extends beyond the side of the hopper *A* through which said material is discharged, leaving an air-passage the whole length of the hopper directly under the opening in the side of the latter, which air-passage is covered with either a wire-netting of suitable fineness 12, or with a coarse wire-cloth overlaid with a finer bolting-cloth.

Within the chamber formed by the aforesaid two bottoms of the hopper *A*, and at one side of the latter, is placed a perforated air-pipe *y* and extending nearly from end to end thereof, as shown in Fig. 3. Said perforated air-pipe *y* is connected with the air-pressure box *v* by the pipe *G'*, in which is a sliding gate *K'* for regulating the air-current which enters the pipe *y*, the latter serving to distribute the air equally over the bottom of the hopper, through which it is forced into said chamber *I*. In the bottom 15 of the said chamber *I* is pivoted a valve *s* upon suitable trunnion-bearings, and to one of said trunnions is attached a vibratory arm 5. (See Fig. 5.) Said valve extends the whole length of said bottom, and is closed by a suitable spring attached thereto, and is made to swing open, when desired, by the engagement with said lever 5 of a pin *m*, which projects from the side of a bar 44, which is attached to one of the heads of the ore-bed cylinder, as shown in Fig. 5, where the relative positions of the valve *s* and its arm and said cylinder-head are illustrated. An exhaust-box *c'* is supported on the frame *o* opposite the hopper *A* and to the outside of the axial line of the ore-bed cylinder *R*, having at its lower side an air-passage 13, whose area is regulated by a sliding gate 14 on the side of said box by a screw *i* or other suitable means. Said exhaust-box extends over the whole length of the cylinder *R*, and is connected with the main exhaust-box *w* by the pipe *F*. The aforesaid porous covering of the ore-bed cylinder may consist simply of wire-cloth of suitable fineness, or of a coarser wire-cloth upon which is superposed a finer bolting-cloth, the latter arrangement being preferable when working gangue of fine quality. In practice it is oftentimes difficult to so unite the edges of the aforesaid porous covering in the cyl-

inder as to avoid making such a seam therein as will more or less hinder the air from passing through the bed as freely at that point as elsewhere, and to regulate the feed of the material to the bed during the rotation of the latter, having in view the effect of said seam therein; and to govern the air-blast when said seam passes over the aforesaid air-passage from the blast-box *D*, the said valve *s* under chamber *I* and the valve 6 at the lower edge of the blast-box *D* are arranged and operate as below described.

The operation of my improvements is as follows: The gangue is placed in the hopper on the inclined bottom thereof and flows therefrom onto the porous covering 12 over the air-passage leading from the chamber *I*. It will be understood that the air-currents from the box *v* move in the directions indicated by the arrows in pipes *G* and *H*, in the blast-box *D*, and from the ore-bed cylinder into the suction-box *c'*, and through the pipes *G'* and *y* into the hopper-box, and thence into the chamber *I* beneath the latter, as also indicated by the arrows in those parts, and that the air movement from the suction-box *c'* into the exhaust-box *w* is as there indicated by the arrows. As the ore-bearing matter to be operated upon flows onto the wire-bed 12, the air from chamber *I* is forced against it, thereby carrying the ore onto the cylinder *R*, while it revolves as above described, where it encounters the current of air which is forced from the blast-box *D*, within said cylinder, said air-current rushing forcibly through the porous covering of the cylinder and through the material deposited thereon from the hopper, agitating the ore on said porous covering, thereby forming layers of the material, which pass under the suction-box *c'*. I find also in practice that the air which rushes into the box *c'* to fill the vacuum therein is drawn to a considerable extent from the interior of the cylinder, as indicated by the direction of the arrow shown with its point in the air-space in the bottom edge of said suction-box in Fig. 1, and consequently the air drawn from the cylinder passes through said layers of material and its force is so regulated by the gate *n* in the pipe *F* as to have only sufficient force to lift the top layer, which is the lighter, the valuable part of the matter lying nearest the cylinder and most removed from the full strength of the suction, and thus the action of the latter is to take off the worthless matter and leave the valuable part on the cylinder.

The above-described peculiar suction action on the gangue is owing to the fact that the opening in the lower side of the suction-box is practically on the bottom of the latter; hence the air comes up from the cylinder substantially in a straight line. After the material which is deposited on the porous cylinder *R* from the hopper *A* has been carried over the open end of the blast-box *D* and under the suction-box *c'*, as above described,

it is practically freed from worthless earthy substances and is dropped from the side of the cylinder as it revolves. The action of the said valve *s*, in the bottom of the chamber I, relative to the aforesaid effect of the seam in the porous covering of the ore-bed cylinder is as follows: The action of said valve is so timed as to be open when the said seam in the cylinder-cover passes the point at which it receives matter from the hopper, and consequently, since the blast-effect of chamber I is destroyed by opening valve *s*, no ore can fall upon said seam. The valve is closed with a spring, as aforesaid, when the said pin *m* on the lever 4 on the head of the cylinder moves away from said lever and the feed is resumed. When said seam reaches a point where it would receive thereupon and each side thereof matter from said hopper were it not for the action of the valve *S*, none is found thereon, and hence the surface of the bed *R'* is clear at that point. As said seam approaches the opening over the blast-box *D*, the ore matter which was deposited on said bed in advance of the seam, not being followed by any of said matter to "back it up," as it were, is made to dance by the action of the air from the blast-box; but when the seam commences to move over said air-current it picks up and carries the said dancing gangue along, and as the seam is a "dead-point," through which no air can pass as it goes under the suction-box, the gangue is carried by the seam past the said box and deposited with the "headings" just where it does not belong. The action of the valve 6 is to stop the upward rush of air from the box *D* just before the seam reaches the opening in the latter, and the "dancing" gangue passes over the opening in advance of the seam and is caught by the suction and carried away with the tailings. Immediately that the seam passes the opening over box *D* the valve 6 closes and the air-current rushes up through the material lying behind the seam. If any ore falls through the meshes of the cylinder-cover into the blast-box it is discharged therefrom when the valve 6 is opened into the interior of the cylinder, and from thence finds its way out as the latter rotates.

What I claim as my invention is—

1. An ore-concentrator consisting of a rotating porous-covered cylinder, a compressed

air-chamber I, located contiguous to said cylinder, having an air-exit passage above the surface of the latter covered with a porous cloth, a hopper located over said chamber having an aperture through which the gangue is delivered onto said porous cloth, a suction-box near said cylinder having an air-inlet near the latter, an air-blast box fixed within said cylinder having an air-exit passage therein from which air flows from the cover of the latter, and means, substantially as described, for forcing air into said blast-box and chamber, and for exhausting the air from said suction-box, combined and operating substantially as set forth.

2. In an ore-concentrator, the rotating ore-bed cylinder *R'*, the blast-box *D*, fixed within the latter and having the perforated air-pipe *h* therein, the air-box *v*, the pipe *G*, connecting the latter and said pipe *h*, the hopper *A*, having an inclined bottom and a discharge-opening at one side thereof, the suction-box *c'*, located over said cylinder, the exhaust-box *w*, the pipe *F*, connecting the latter with said suction-box, and means, substantially as described, for forcing air into said box *v* and for exhausting the air from said box *w*, substantially as set forth.

3. The hopper *A*, having an outlet at one side, the air-chamber I, having a pipe-connection, substantially as described, with the air-pressure box *v*, and having an air-outlet contiguous to said hopper-outlet having a porous covering, the valve *s* in the bottom of said chamber, having an arm connected therewith, and the ore-bed cylinder *R*, having a projection in position for intermittent engagement with said arm, and a suitable spring to close said valve, combined and operating substantially as set forth.

4. The rotating ore-bed cylinder *R'*, the blast-box *D*, fixed within the latter, the valve 6, pivoted at the lower edge of said box, having an arm 4 thereon, which intermittently engages with a projection on the head of said cylinder, whereby said valve is opened, and a suitable spring to close the latter, combined and operating substantially as set forth.

EMORY B. HASTINGS.

Witnesses:

CHAS. N. TIBBITTS,
R. B. TEACHENOR.