No. 702,897. Patented June 17, 1902.

F. R. WILLSON, JR.

MACHINE FOR WASHING COAL, &c.

(Application filed Nov. 7, 1899.)

(No Model.) 4 Sheets—Sheet 1.

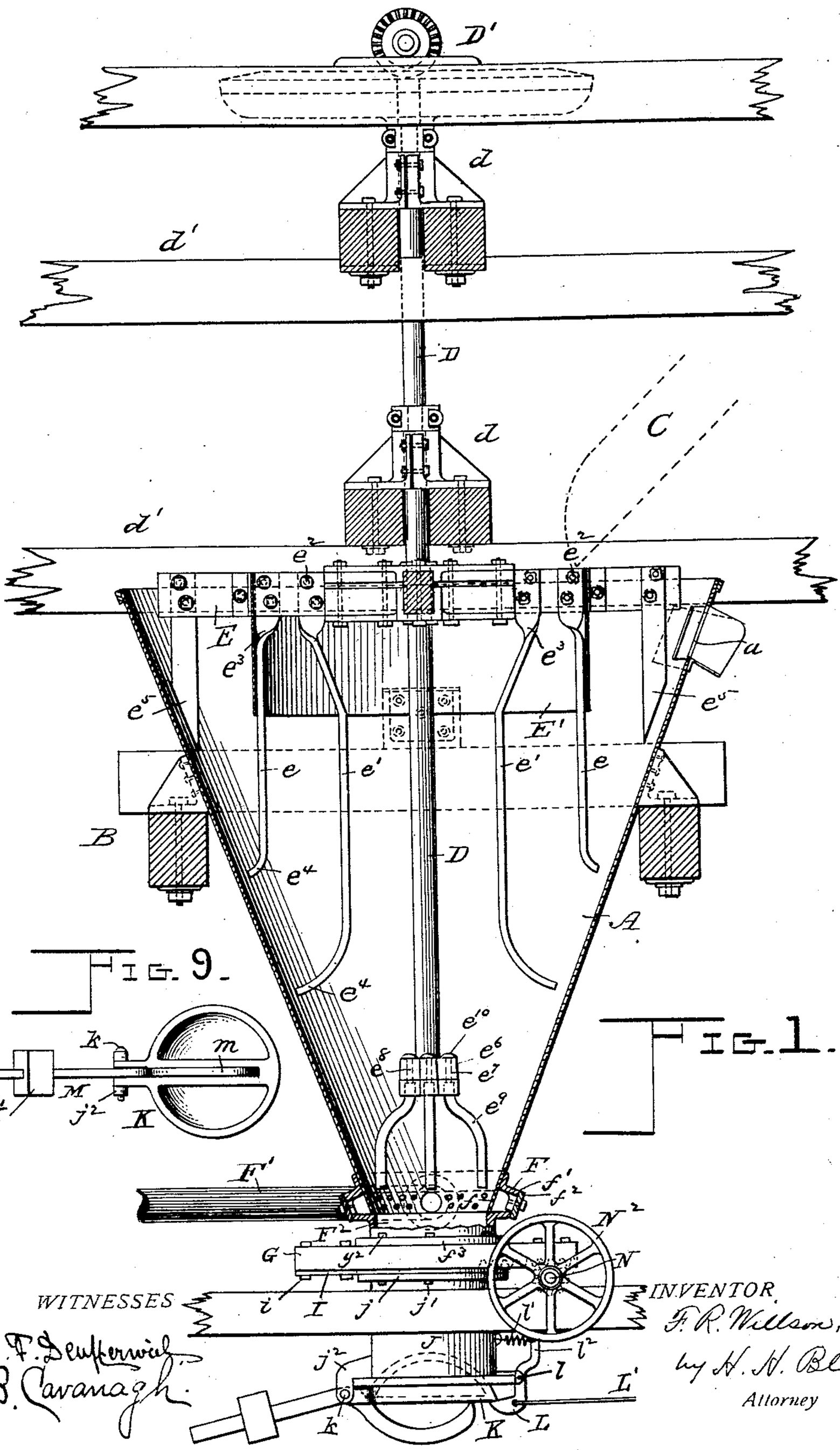

FIG. 9.

FIG. 1.

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(No Model.) 4 Sheets—Sheet 2.

FIG. 2.

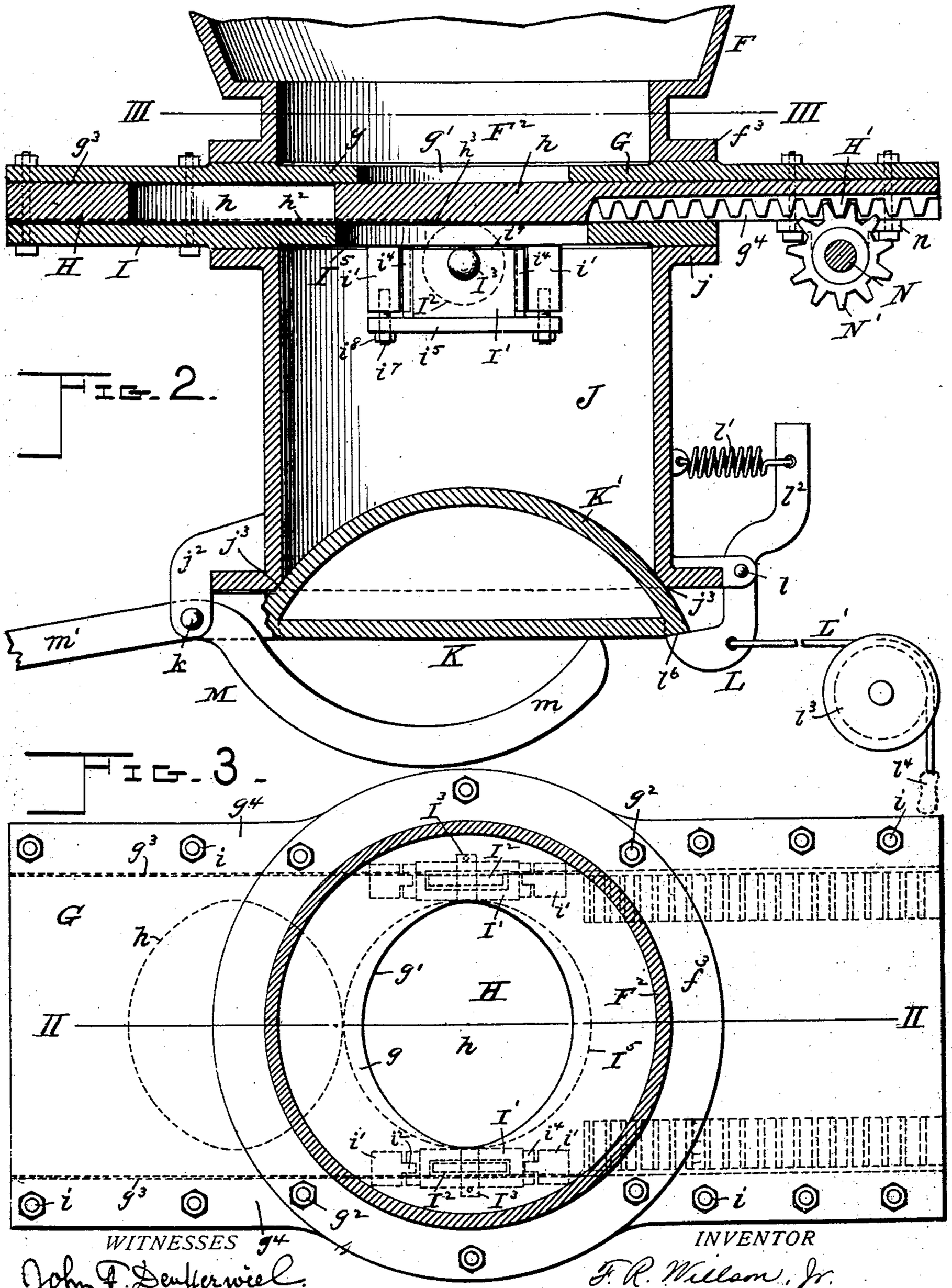

FIG. 3.

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(No Model.) 4 Sheets—Sheet 3.

FIG. 4.

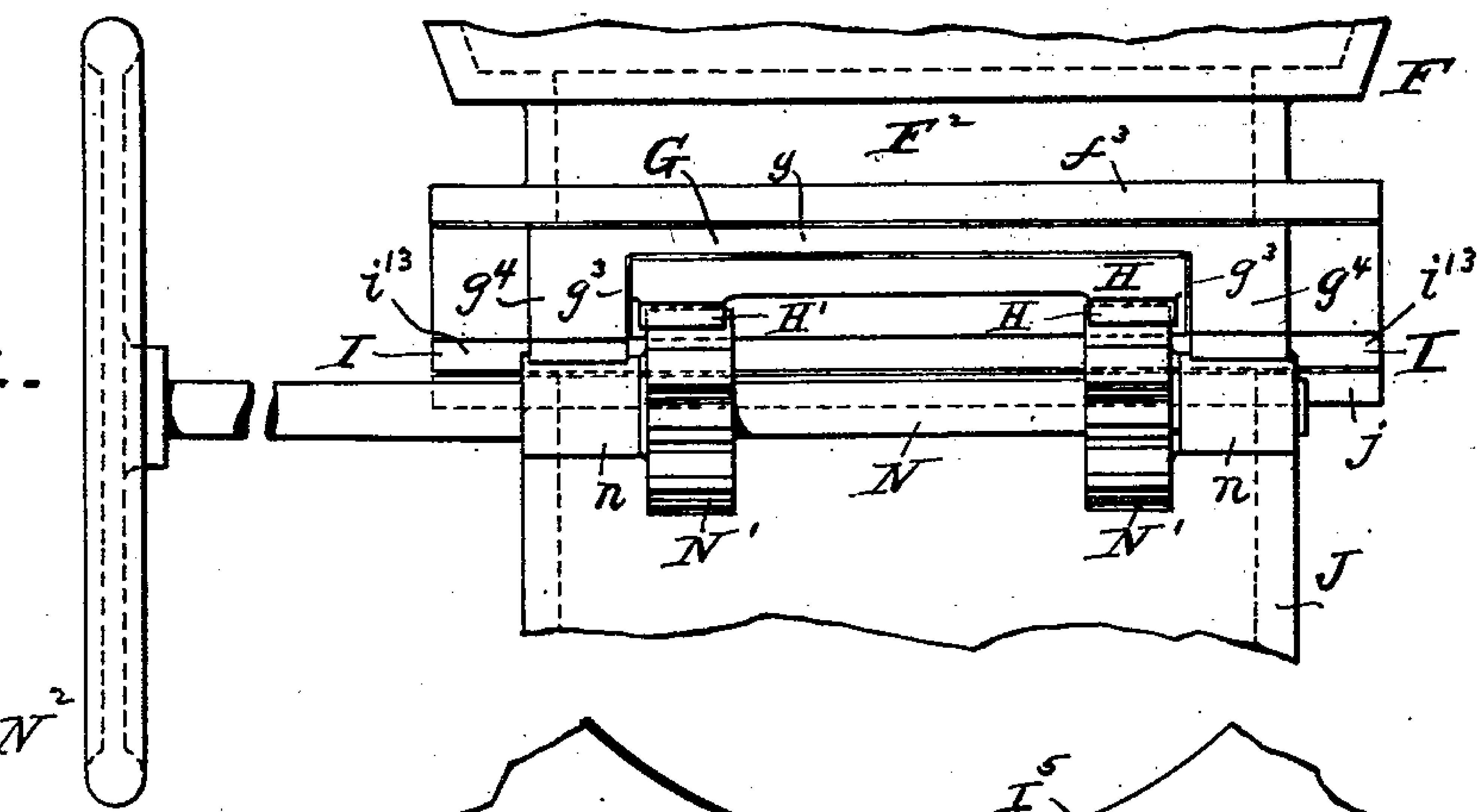


FIG. 5.

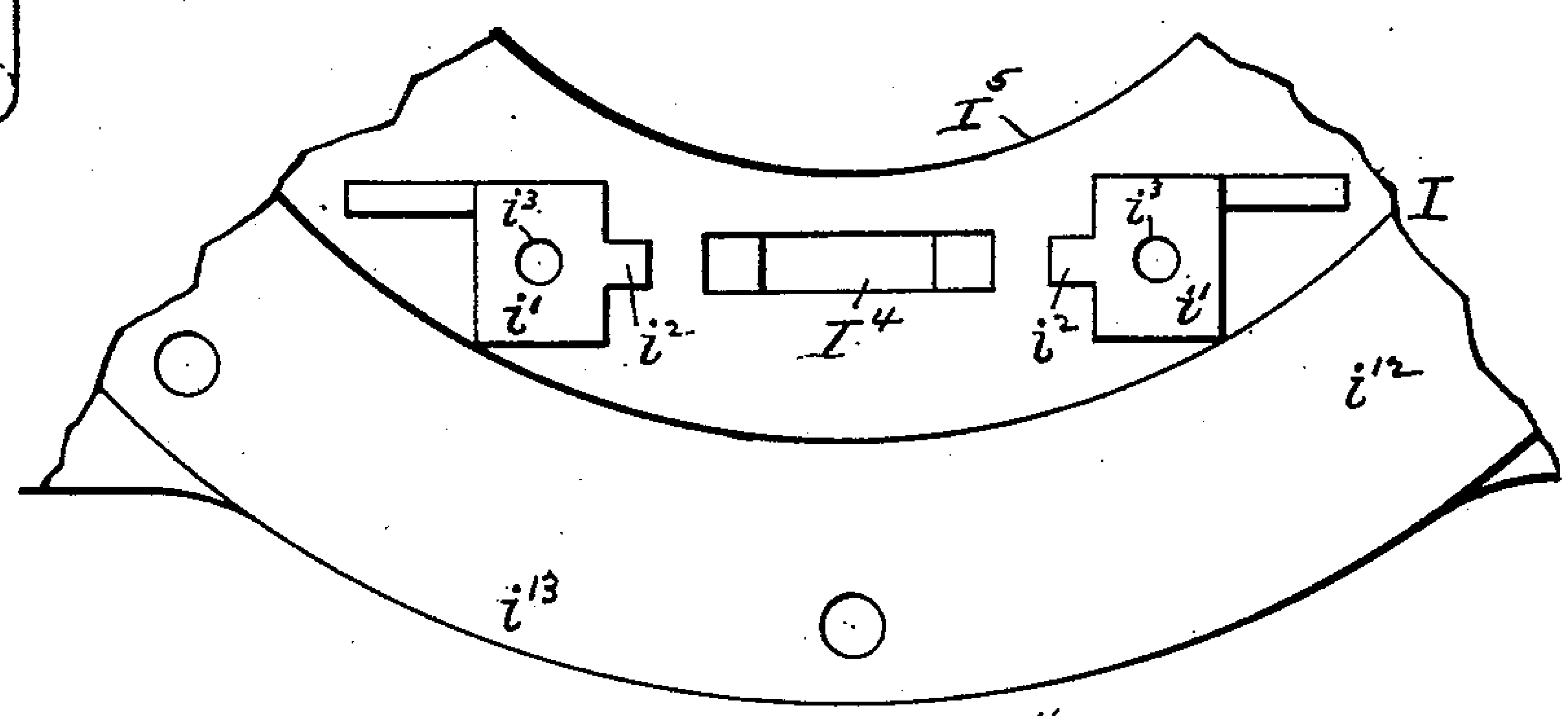


FIG. 6.

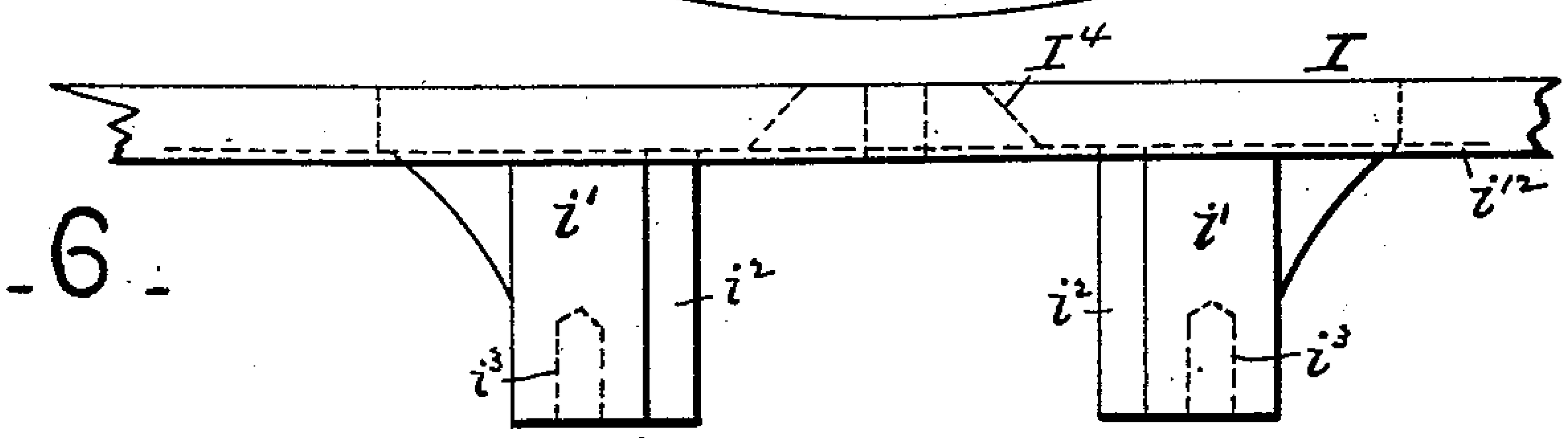


FIG. 6A.

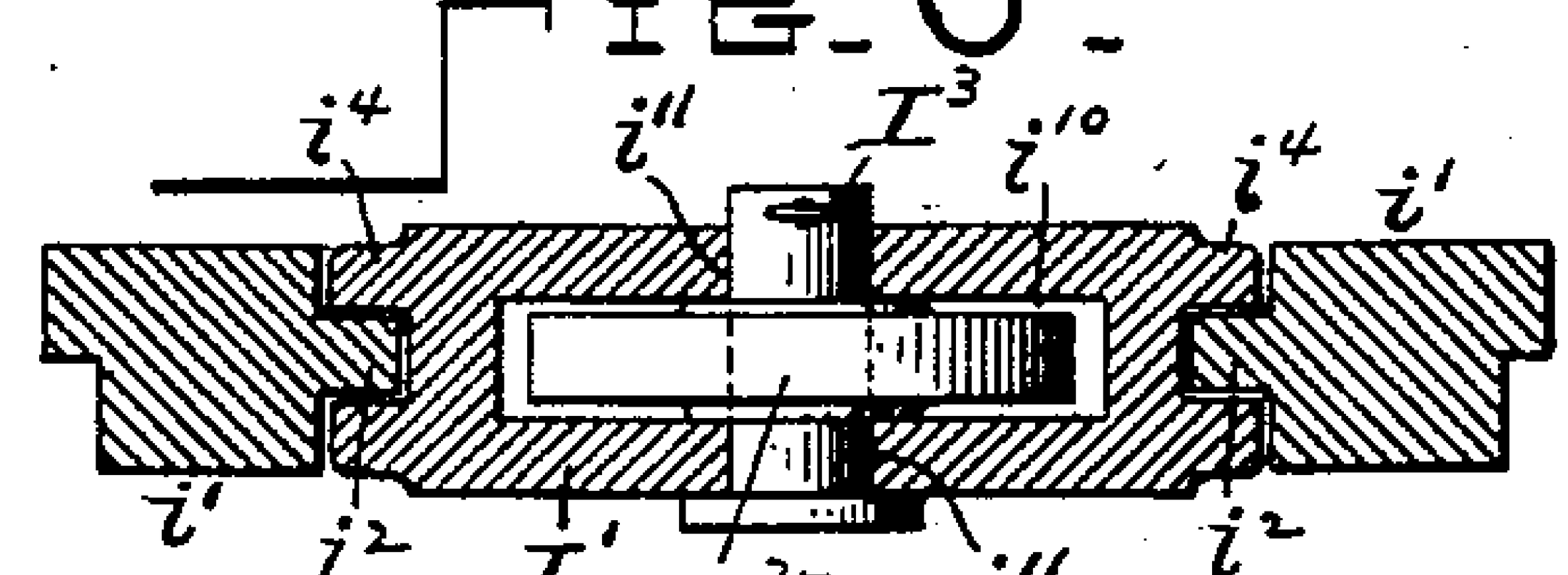
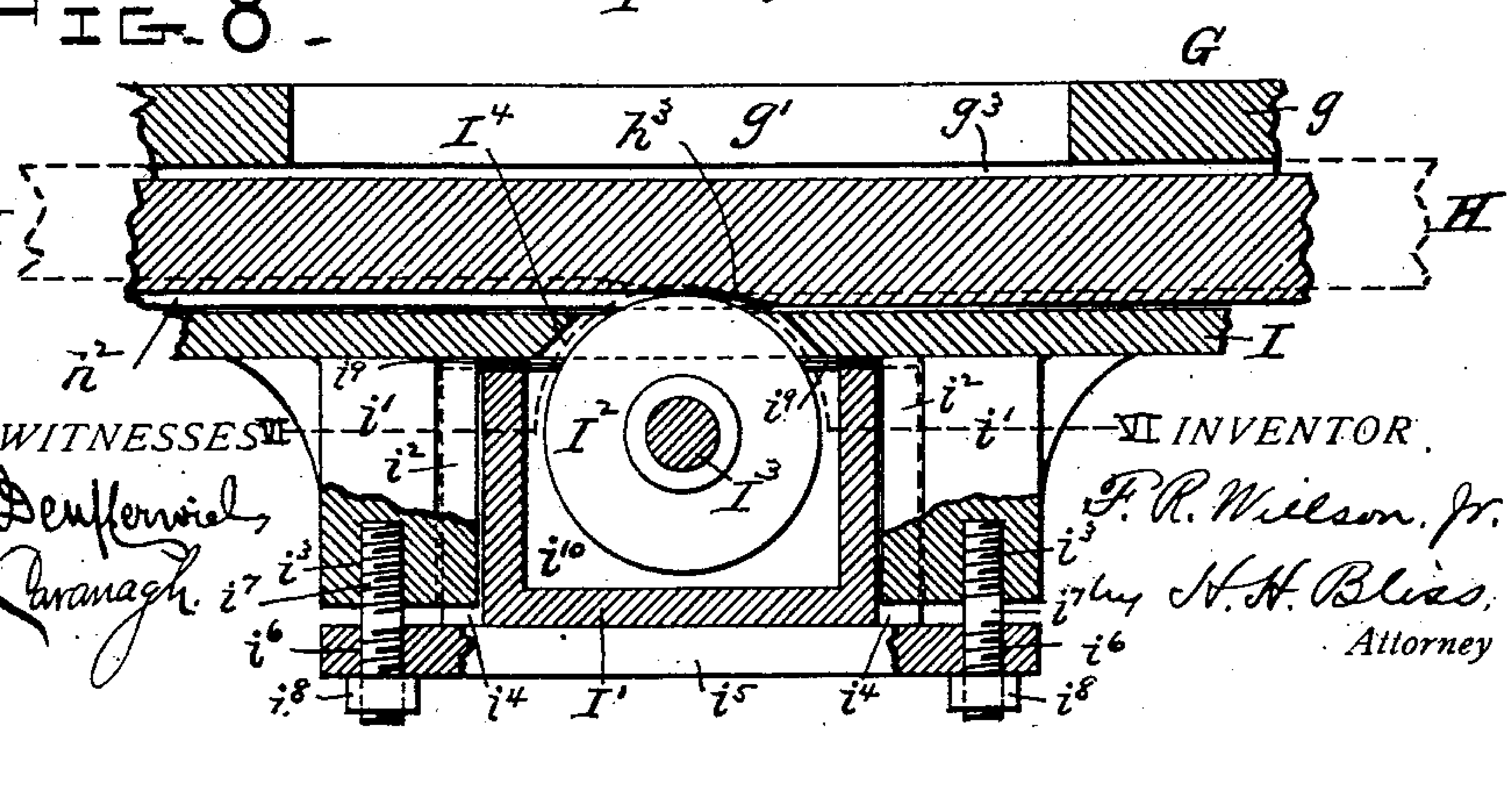


FIG. 8.



WITNESSES

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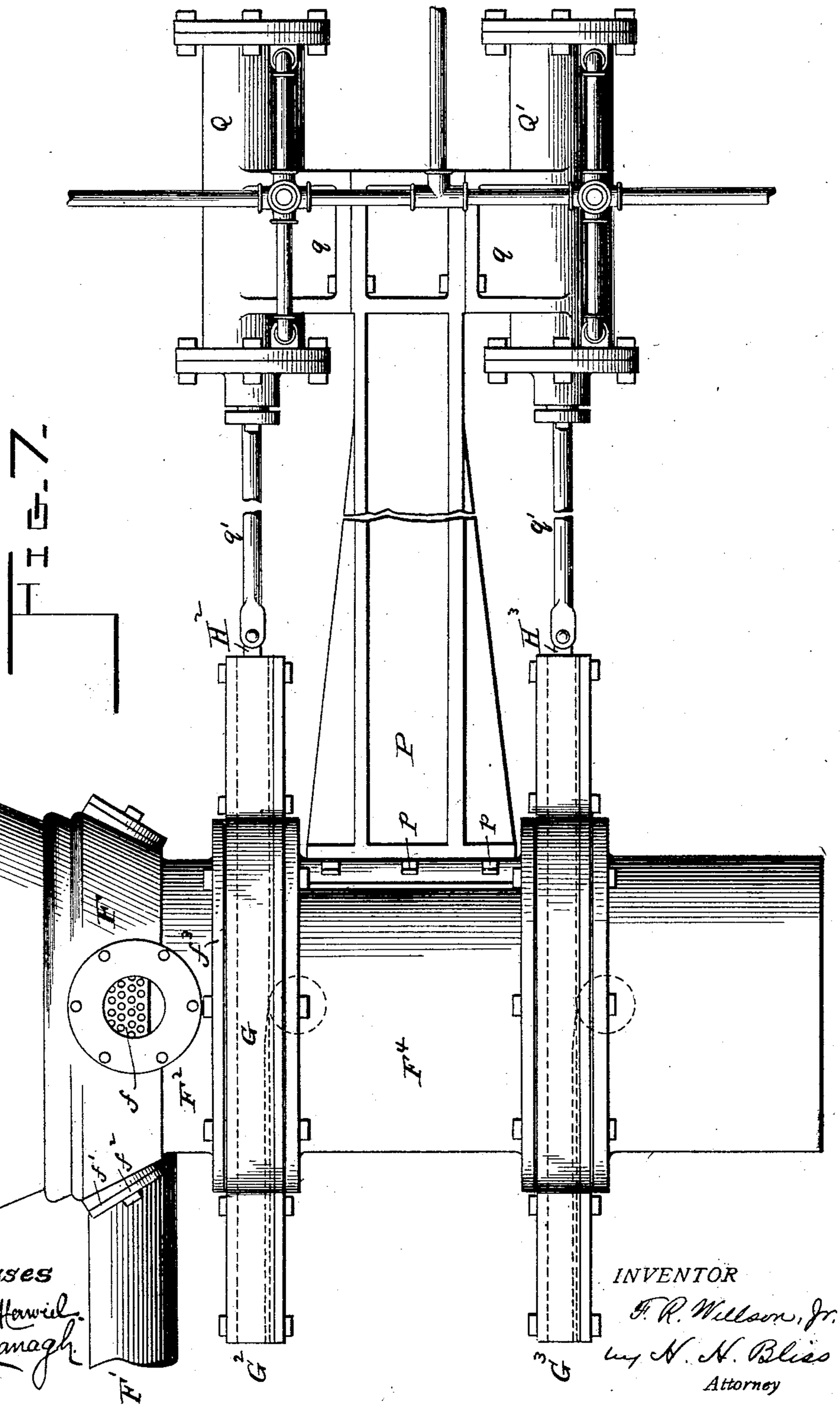
(No Model.) 4 Sheets—Sheet 4.

FIG. 7.



UNITED STATES PATENT OFFICE.

FREEMAN R. WILLSON, JR., OF COLUMBUS, OHIO, ASSIGNOR TO JOSEPH A. JEFFREY, OF COLUMBUS, OHIO.

MACHINE FOR WASHING COAL, &c.

SPECIFICATION forming part of Letters Patent No. 702,897, dated June 17, 1902.

Application filed November 7, 1899. Serial No. 736,147. (No model.)

To all whom it may concern:

Be it known that I, FREEMAN R. WILLSON, Jr., a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Machines for Washing Coal and Similar Material, of which the following is a specification, reference being had therein to the accompanying drawings.

In order to make the invention more clearly understood, there are shown in the accompanying drawings means for carrying the same into practical effect, without limiting the improvements in their useful applications to the particular constructions which, for the sake of illustration, have been delineated.

In said drawings, Figure 1 is a vertical sectional view, partly in elevation, of a washing-machine for coal and other purposes embodying the improvements. Fig. 2 is a vertical sectional view of a portion of the same on line II II, Fig. 3. Fig. 3 is a horizontal sectional view on line III III, Fig. 2. Fig. 4 is an end view of a portion of the same looking from the right hand of Fig. 2. Fig. 5 is a bottom plan view of a portion of the bottom plate of the valve-frame. Fig. 6 is a side view of the same. Fig. 6^A is a horizontal section on line VI VI, Fig. 6, showing also the housing in section and the roller in plan. Fig. 7 is an elevation of the lower portion of a washer also embodying the invention, showing the use of the slide-valve for closing both the upper and the lower ends of the slate or lock chamber. Fig. 8 is a side view, partly in section, illustrating the construction of the slide-valve and its movement. Fig. 9 is a bottom plan view of the drop-valve.

Referring to the drawings and especially to Figs. 1 to 6^A, A is a washing vessel or tank of suitable form having a contracted lower end. Preferably it is of the frusto-conical form shown and supported in an upright position by a frame B. At its upper end the washer A is open and adapted to receive the coal or other material to be washed or separated through a chute C, by which the material may be fed at intervals or to suit the requirements of the washer in its speed of operation and the withdrawal of washed or separated material therefrom.

D is a vertical shaft within the washer, supported by a bearing or bearings d on a frame d' and rotated by a gear or other power means D'. On the shaft D is fixed a head, frame, or bar E in or near the top of the washer and carrying depending and rigidly-fixed stirrers or agitators e e', which ordinarily consist of flat iron blades bolted to the head E at e^2 and twisted, as at e^3, so that their sides lie tangential to their circular paths in the washer. At their lower ends each pair or series of stirrers is bent outwardly at e^4, so that at their terminations they lie substantially perpendicular to and near the inner conical wall of the washer. Carried by the head E is a cylindrical flange or casing E', open at top and bottom and surrounding the upper ends of the stirrers e e'. This serves to limit the horizontal distribution of the material as it is initially fed and holds it substantially within the radius of action of the stirrers e e'.

e^5 indicates a pair or series of shorter stirrers mounted on the head E outside of the casing E', extending close to the upper part of the conical wall of the washer and adapted to act on any material which may lie in the top of the washer without said casing.

e^6 is a collar fixed on the lower end of the shaft D. It is formed with vertical seats e^7, into which extend the stems e^8 of a series of bottom stirrers e^9, which are fixed in place by heads or nuts e^{10}, resting on the top of the collar. These stirrers act on the material in the extreme narrow part of the washer A.

F is a water chamber or ring surrounding and attached to the lower end of the washer, communicating therewith through a perforated wall or plate f, having cleaning-apertures f', closed by removable plates f^2, and a water-supply pipe F'. The water thus supplied to the washer is after the washing operation conducted away, with the lifted or suspended lighter or finer impurities or separated materials, by an opening a near the top of the washer and suitable conduits. The chamber F has a short downward cylindrical extension F^2, terminating at a horizontal flange f^3. Bolted to the latter is a horizontal frame G, which I term the "valve-frame." It is cast and finished in the form best seen in Figs. 2, 3, and 4. It comprises a horizon-

tal web or plate g, having a central aperture g' in line with the chamber of the extension F^2, which web is secured to the flange of the latter by the bolts g^2 at or near two of its opposite sides. Between the holes for said bolts the frame is formed on its under side with a longitudinal recess g^3, extending from end to end of the frame and adapted to receive between its side walls g^4 a closely-fitting valve H, formed with an aperture h corresponding with that at g' in the valve-frame. The valve may be moved longitudinally by means hereinafter described, so that its aperture h may coincide with the aperture g' to permit the escape of material from the washer, or so as to lie beneath the imperforate plate g and bring the imperforate portion h' of the valve across the aperture g' to tightly close this exit from the washer.

I is a plate coöperating with frame G to closely hold the valve H except as to its longitudinal movement above described. It lies beneath the valve and valve-frame and is secured to the latter by bolts i along its sides.

i indicates lugs or brackets attached to or preferably cast with the plate I on its under side and formed with vertical guides or flanges i^2 and threaded-bolt seats i^3.

I′ I′ are combined bearings and housings, having at their ends means for engaging the guides i^2, such as flanges i^4. On these guides housings may be adjusted vertically relative to the plate I and valve H. A convenient means for this purpose consists in a strap i^5, one for each housing, lying beneath and supporting the latter and having perforations i^6 in their ends in line with the seats i^3. Bolts i^7, firmly fixed in said seats, pass through the perforations of the strap, and nuts i^8 on the bolts serve to support the strap and housing and adjust said parts vertically. One or more gaskets i^9 are interposed between the housing and the plate I, against which the housings are tightly clamped. By removing a gasket and again screwing up the nuts i^8, with or without the interposition of a thinner gasket, the housing, with its roller, will be adjusted upward and still firmly clamped in place. The housings are formed with a chamber i^{10} open at the upper side, and lateral bearings or apertures i^{11}.

I^2 is a roller mounted in the housing on a journal-pin I^3, passing through the roller and fitting in the apertures i^{11}. The periphery of the roller projects beyond the upper edge of the housing sufficiently to pass through a slot I^4 in the plate to a point slightly above the upper face of said plate, so as to be in contact with and support the valve H. The rollers are arranged upon the diametrical or median line of the aperture g', whereby the valve is directly sustained and may be said to be balanced just at the place of greatest pressure, due to the superimposed contents of the washer. The operation of the valve is thus materially eased.

In the washers of the class described much difficulty is experienced from leakage through the valve at the bottom of the machine, through which the heavy separated material must necessarily be withdrawn. By the present invention, however, this difficulty is obviated and a washer is provided, the main slate-discharge valve of which may be operated with all the necessary convenience and ease and which when closed will form a water-tight joint. This object is attained by giving to the valve at or near the end of its longitudinal closing movement a vertical movement toward and against its seat or frame-plate. This is effected in the construction illustrated by a peculiar conformation of the valve in conjunction with the rollers I^2. At each side of the valve H, along its under surface and for approximately that portion of the length of the valve which travels upon said rollers, there are formed grooves, depressions, or rabbets h^2 of a vertical depth nearly equal to the distance for which the rollers project above the plate I. This allows the valve to travel with its weight on said rollers and slightly above the upper surface of the plate I. At the inner ends of said rabbets are formed downwardly-inclined planes h^3. From this construction it will be observed that just as or immediately after the valve H has moved inward sufficiently far to close the aperture g' the said inclined planes will encounter and travel up upon the rollers, thereby raising the valve bodily into close contact with the under side of the plate g to form a water-tight joint. On the other hand, as soon as the opening of the valve is begun the inclined planes will run downward on the rollers, taking the plate of the valve out of contact with the plate g and allowing of the further outward movement of the valve in a relatively loose condition with the minimum of friction possible.

J is a lock-chamber or slate-chamber, preferably cylindrical in form, formed with a horizontal flange j at its upper end, by which it is secured below and to the plate I in line with the aperture g' or chamber F^2 with bolts j'. To give the said plate sufficient width for this purpose, it is formed with a shallow circular boss i^{12}, which, together with the body of the plate, is extended laterally at i^{13} beyond the sides of the main portion of the same. The chamber J incloses the housings I′, as shown, and is designed by the operation of the valve H, above described, to receive the slate or other heavy material separated in the washer and collected in the bottom thereof. The said housings serve to isolate and protect the rollers from the material so discharged.

K is a drop-valve hinged at k to a lug j^2 at or near the bottom of the slate-chamber J and serving to close the lower end of the latter while material is being discharged from the washer thereinto. The drop-valve is of hollow parti-spherical form, and when closed partly enters the lower end of the chamber J

with its rounded portion K, as shown, thereby throwing the material accumulated immediately above it to the edges of the discharge-opening j^3 of said chamber. The valve is held closed by a sustaining dog or catch L, pivoted at l on a convenient portion of the slate-chamber and pressed into its engaging position by a spring l', acting on the upper arm l^2 of the catch.

L' is a detaching device, such as a cord, connected with the lower arm of the catch and passing over a pulley l^3 to a handle l^4, whereby when the space under the slate-chamber is occupied by a car or other receptacle for the material to be discharged said catch may be released from a distance. The automatic closing of the drop-valve when the chamber is emptied and the load on the valve removed is provided for by a lever M, pivoted conveniently on the hinge-pin k of the valve, engaging by its inner arm m the under side of the valve and carrying on its outer arm m' an adjustable weight M', adapted to overcome the weight of the valve.

Various means may be employed for actuating the slide-valve H. When practicable, I prefer the construction illustrated in Figs. 1 to 4, in which N is a rotary shaft mounted in bearings n, secured to the valve-frame G at or near the sides of the same. Pinions N', fixed on said shaft, engage correspondingly-toothed racks H', attached to or preferably formed on the valve H. N^2 is a hand-wheel secured to the shaft N for the operation of the same by hand. Obviously this wheel may be a pulley operated by a belt adapted to be run in either direction, or other power devices may be employed for the purpose. By turning the shaft N by the means described in the desired direction the valve H may be opened to permit the discharge of the slate or other settled material from the bottom of the washer into the slate-chamber, and by turning the shaft in the other direction the valve may be closed to cut off the slate-chamber from the washer and seat the valve up against the plate g by the action of the rollers and inclined planes or cams h^3 already described.

While for certain purposes preferring to employ the drop-valve already described as a means of closing the lower end of the slate-chamber, a slide-valve may be used for the purpose. Such a construction I have shown in Fig. 7, in which the lower valve is constructed and mounted in a manner similar to the valve H, already fully described. In this construction, however, a different valve-operating mechanism is illustrated.

F^4 is a receiving or slate chamber having at both its upper and lower ends valve-guiding means G^2 G^3 and valves H^2 H^3, the latter in this construction taking the place of the drop-valve hereinbefore described for closing the bottom of said chamber. Attached to the exterior of the chamber is a rigid bracket or frame P, which is held in place on the cylinder by bolts p.

Q Q' are cylinders for steam or other fluid, each cast with a bracket q. By means of the latter the cylinders are mounted on the bracket P at the upper and lower sides of the same and substantially in line with the valves. The pistons of said cylinders are connected by rods q' or other means with the valves H^2 H^3. By suitably operating fluid admission and exhaust ports of the cylinders in a well-known manner the upper or the lower valve may be operated as desired.

Referring to the drop-valve, it will be observed that the lock L engages the valve through a cam-face l^6, inclined to the normal plane of the valve when closed, whereby the lock under the action of the spring l' will not only pass beneath the valve, but will have an upward movement and pressure, keeping the valve closely to its seat, even in a heavily-loaded condition.

It will be seen that in numerous respects the construction herein presented differs materially from those that have been heretofore used or proposed which were of the same class of washers. Heretofore the plan followed or suggested as concerns the valve between the washing-chamber and the receiving-chamber below it has been to make it a relatively short or imperforate plate, which was drawn out from or away from the passage-way between the two chambers far enough to bring the inner end of the valve to the outer edge of the passage-way to permit the heavier refuse material to drop from the upper chamber to the lower, past the said inner end of the valve. Numerous disadvantages are incident to a construction of that sort, and particularly this: that the valve-guideways thus opened become clogged with refuse material, so that it is frequently impossible to return the valve fully to its closed position, the impediment to such movement often being such as to leave the valve partly open, with a loss of water and material from above. Again, if a sufficiently large amount of the slate or other hard refuse descends to more than fill the receiving-chamber below the end of the valve impinges upon the mass when it returns and has no way of clearing itself and is frequently stopped entirely in its inward movement. These difficulties I have overcome by constructing the valve in the way shown and providing for it a guideway and chamber of the character set forth. When so made and arranged, the inner edge of the valve never comes out to the passage-way between the chambers and the guideways proper are never exposed in such manner as to permit them to become filled with refuse, and by having an aperture in the valve-plate at points remote from both of its ends it can clear itself much more readily when being moved to its inner or closed position. This

is particularly the case when plates or diaphragm-like partitions are provided above or below the valve, or both, as shown, projecting inward somewhat from the walls of the chambers, as such a diaphragm or partition insures that there shall be clearance-spaces into which the pieces of slate or other material can be carried under the pressure of the valve as it moves along the guides. I prefer to have the diaphragms or partitions provided by the top plate of the valve-frame and the bottom plate I, as the apertures g' I^5 through these can be made of such relatively small size that while the refuse materials can pass sufficiently freely down to the receiving-chamber, yet the plates will tend to hold the refuse pieces in such way as not to interfere with the valve.

I have above described in detail the construction and mode of operation of the rollers I^2 and the counterpart portions of the valve; but it will be seen that these may be regarded as elements of the guiding devices for the valve and that the invention in this respect is not necessarily restricted to such details. The purposes aimed at can be accomplished if the valve and its guide be so constructed and correlated that the described movements of the valve shall be accomplished—that is to say, if the valve shall not only have a principal movement on lines transverse to those of the passage-way, but also a movement on lines parallel thereto, so that the valve shall be bound or pressed against its seat when it is closed and shall be released from such pressure when it is being taken from or brought to the position of closing—and another important improvement in the present construction lies in this: that the means for actuating the valve between the washing-chamber and the receiving-chamber are so supported on, connected with, or related to the walls of these chambers that the latter serve as the abutments for the application of the valve-moving forces. Heretofore it has been customary to support the chambers by one means and to support the valve-actuating devices upon other means. Sometimes great power is necessary to move the valves, and when the actuating mechanism is mounted on and reacts against a remote device independent of said chambers there is a distorting strain exerted upon the washer-chamber and the valves and their actuating-rods or equivalents are forced out of line and made more difficult to operate. This I have obviated by supporting the actuating devices directly upon the walls of the chambers.

I believe myself to be the first to have combined with a washing apparatus of this sort and with the valve between the washing-chamber and the receiving-chamber a vertically-moving lower valve at the lower end of the receiving-chamber. A valve of this character enables me to obviate entirely the difficulties above described incident to the horizontally-sliding valves heretofore used—namely, the impeding and clogging of the valve-path—and also to very quickly release the contents of the receiving-chamber and to cause their discharge by their own gravity, thus economizing both time and power. The automatic closing of such a valve will also be quickly accomplished, as the weight or equivalent will exert a force only slightly less than that of the contents of the chamber, so that immediately after they have escaped the valve will be brought again to its seat and automatically caught by the lock or catch. By making the drop-valve partispherical or cone-shaped on its upper side not only do I, as aforesaid, guard against leaking at the valve-seat when the full pressure of the contents of the washer is upon this lower valve, but I also insure a very quick escape of the refuse contents of the lower chamber, for the instant this valve has dropped a short distance from its seat the pieces of slate or other material rapidly slide off and it is not necessary that the valve should move through an arc of forty-five degrees, as would be required if it were flat.

What I claim is—

1. The combination of the chambers F and J, terminating in opposing flanges, the valve-box formed separately from and secured to the said opposing flanges, and having a plate g which extends to points inside of the walls of the chambers F and J, the rectilinearly-sliding valve in the said valve-box, and antifriction supporting devices for the valve situated in the interior of the chamber J, substantially as set forth.

2. The combination of the upper chamber F formed with the flange f^3 at the bottom, the lower chamber J with the flange j at its upper end, the intermediate valve-box formed separately from and interposed between the said chambers F and J, and having the upper plate and the lower plate extended to points inside of the walls of the chambers F and J, the valve-plate in said box between the upper and lower plates thereof and having an aperture of less horizontal area than the interior area of the chambers F and J, substantially as set forth.

3. The combination of the chambers F and J terminating in opposing flanges, the valve-box formed separately from and secured to the said flanges, and having an upper plate and a lower plate which extend to points inside of the outer walls of the chambers F and J, a rectilinearly-sliding valve in the said box, and antifriction supporting devices for the valve within the chamber J and supported from the lower plate of the valve-box, substantially as set forth.

4. The combination of the chambers F and J terminating in opposing flanges, the valve-box formed separately from and secured to the said flanges, and having an upper plate and a lower plate extending to points inside of the wall of the chamber J, the rectilin-

early-sliding valve in the said box, the vertically-adjustable rollers in the chamber J and the roller-carriers supported by the lower plate of the valve-box, substantially as set forth.

5. The combination of the chambers F and J, the valve-box between them and detachable therefrom, the rectilinearly-sliding valve having two roller-bearing surfaces along its side edges, each of which is formed with an inclined portion, and two rollers supported by the valve-box and situated on opposite sides of and on the median line of the communication between said chambers, and each adapted to engage with one of the said surfaces of the valve; substantially as set forth.

6. The combination with the chamber F and the chamber J, of the intermediate valve-box having the supports i' situated within the chamber J, the roll-carrier held and guided by said supports, the roll in said carrier and the rectilinearly-sliding valve resting upon the said roll, substantially as set forth.

7. The combination with the chambers F and J, of the detachable valve-box between them formed of the upper longitudinally-recessed relatively longer plate G, the lower relatively shorter plate I, the valve in said box between said plates, formed with the relatively large aperture remote from its ends, and with the two parallel rows of rack-teeth, means for guiding said valve through the greater part of its travel on horizontal straight lines and through the final portion of its travel on an inclined line, said means comprising supporting-rolls within the section J and directly under the inner part of the valve-plate, and the pinions and pinion-shaft, substantially as set forth.

8. In a coal-washer, the combination of upper and lower chambers, a sliding valve between said chambers, and means above the valve forming a shoulder or flange extending inward beyond the walls of said upper and lower chambers.

9. In a coal-washer, the combination of upper and lower chambers, a sliding valve between said chambers having cam-surfaces h^3 and rollers mounted below the valve and on each side of and on the median line of the communication between the chambers, and adapted to engage said surfaces.

10. In a coal-washer, the combination of upper and lower chambers, a sliding valve between said chambers, housings, I', separate from the walls of and within the lower chamber, and rollers journaled in said housings and supporting the valve.

11. In a coal-washer, the combination of upper and lower chambers, a sliding valve between said chambers, housings separate from the walls of and within the lower chamber and adjustable in directions transverse to the valve, and rollers journaled in said housings and supporting the valve.

12. In a coal-washer, the combination of upper and lower chambers, a sliding valve between said chambers, rollers in said lower chamber and supporting the valve, and adjusting means for said rollers, whereby the rollers may be set toward or from the plane of operation of the valve.

13. In an ore and coal washer, the sliding-valve plate, having the aperture h, the imperforate portion, the supporting-surfaces h^2, at the sides of the plate, and the inclines or cams, h^3, at the ends of the supporting-surfaces and substantially in line with and at opposite sides of the middle of said imperforate portion.

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

FREEMAN R. WILLSON, JR.

Witnesses:

E. B. MERRILL,

C. A. DODDS.