(No Model.) 3 Sheets—Sheet 1.

# F. A. HUNTINGTON.

## CRUSHING MILL.

No. 427,690. Patented May 13, 1890.

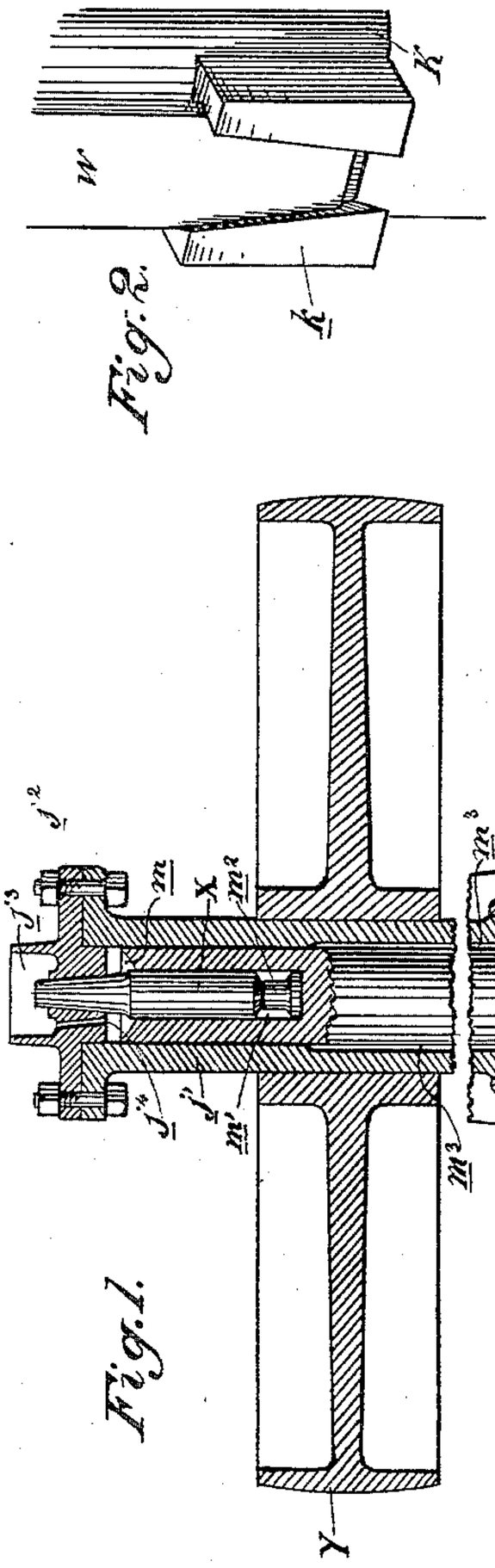

Fig. 2.



Fig. 1.

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## CRUSHING MILL.

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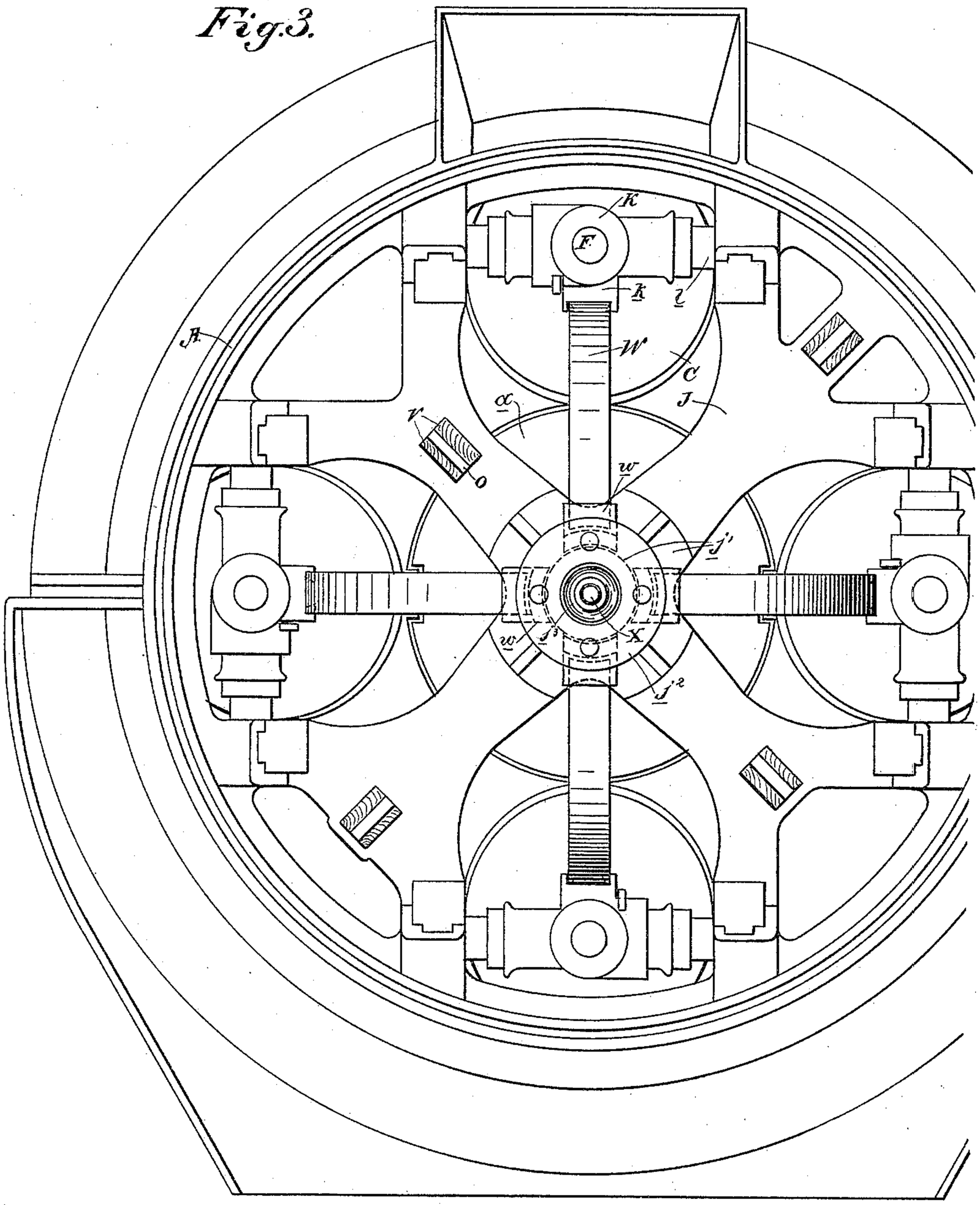
*Fig. 3.*

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## CRUSHING MILL.

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*Fig. 4.*

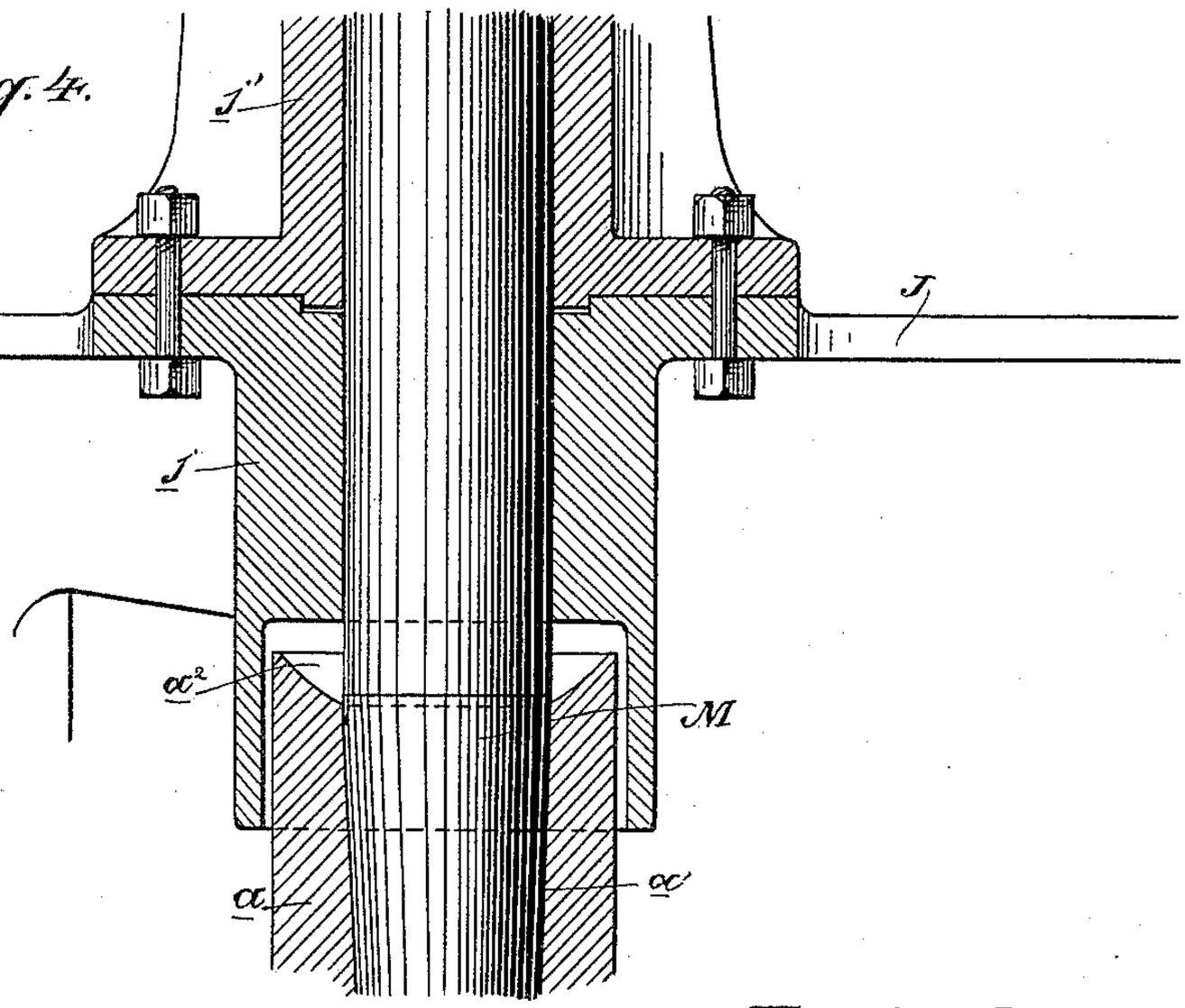



*Fig. 5.*

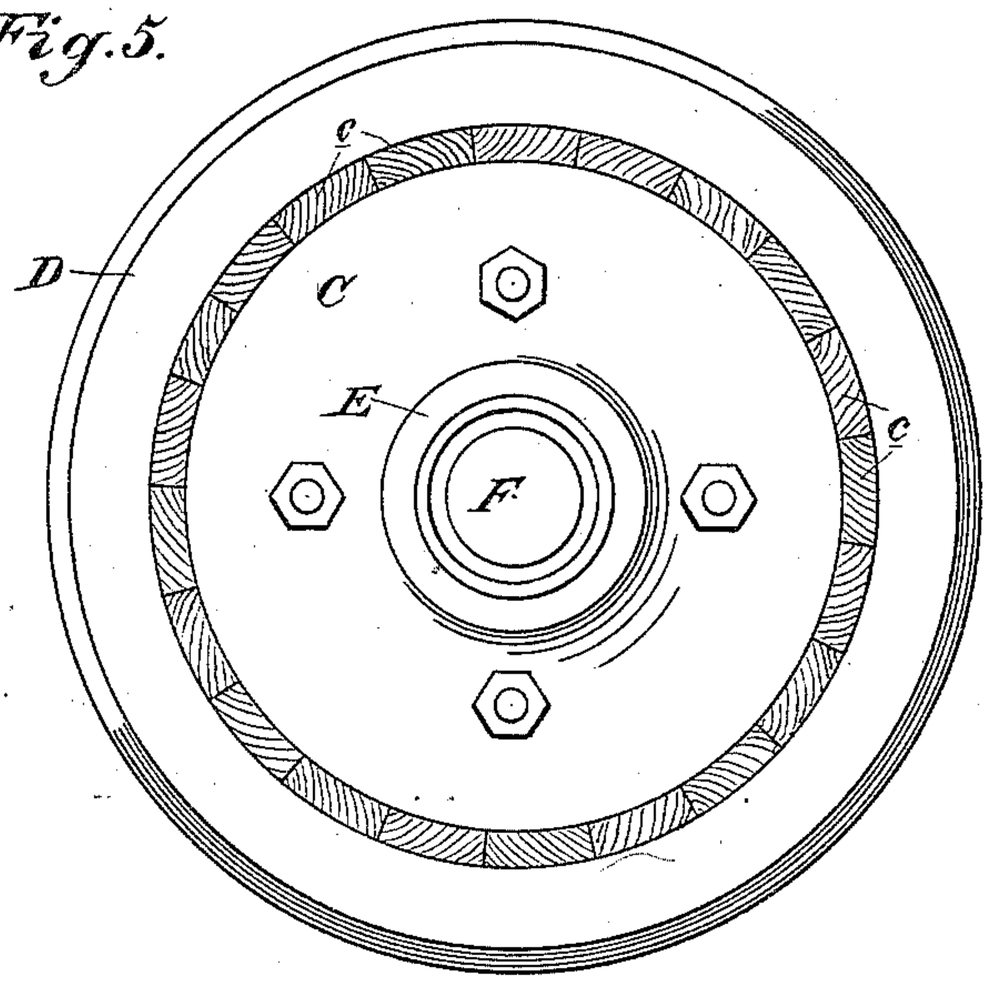
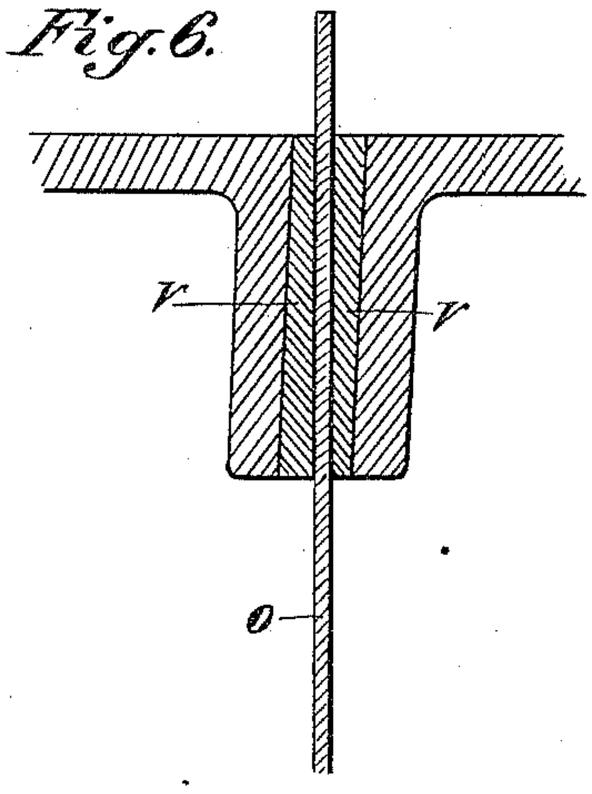



*Fig. 6.*




Witnesses,
H. C. Lee

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# UNITED STATES PATENT OFFICE.

FRANK A. HUNTINGTON, OF SAN FRANCISCO, CALIFORNIA.

## CRUSHING-MILL.

SPECIFICATION forming part of Letters Patent No. 427,690, dated May 13, 1890.

Application filed July 6, 1889. Serial No. 316,711. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK A. HUNTINGTON, of the city and county of San Francisco, State of California, have invented an Improvement in Crushing-Mills; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of mills especially intended for the crushing of quartz and valuable metal-bearing rock, and in which an annular series of pivotally-suspended rollers are revolved within a pan, whereby the material is crushed between said rollers and the rim of the pan, this particular class of mills being more fully exemplified by Letters Patent of the United States, Nos. 277,134 and 325,804, granted to me May 8, 1883, and September 8, 1885.

My invention consists in such novel improvements in this mill as will be hereinafter more fully described, and specifically pointed out in the claims.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a vertical section of my mill. Fig. 2 is a detail perspective of the fitting of the lower end of spring W. Fig. 3 is a plan of my mill. Fig. 4 is a section of a portion of the mill, showing the hub *j* of the disk J bolted to the bearing-sleeve *j'*. Fig. 5 is a plan view of one of the rollers C, showing the shoe D and its connection by binding-pieces *c* with the roller. Fig. 6 is a view showing the reversed wedges V for holding the spring-arms O of the scrapers P in their sockets in the driving-disk.

A is a circular pan having a ring-die B fixed around the interior of its rim, and having suitable discharge-openings and screens. The rollers C, which do the crushing, have exterior circular shoes D secured to them, these shoes rolling against the interior of the die B, so that the material is crushed between them, and the wear comes upon the shoes and the die, which may be easily replaced whenever it is necessary. These rollers have each a sleeve E, which extends upwardly, and through these sleeves pass shafts F for suspending the rollers, as shown.

J is the driving-disk, to which the shafts F are connected by means of the sleeve K, having trunnions *l* projecting from each side, which turn in boxes on the disk, so that the shafts have a pivotal movement, thus adapting the crushing-rollers to be thrown outwardly centrifugally against the die of the pan. These devices are substantially the same as are shown in my previous patents, and need no further or detailed explanation.

The first improvement in my present invention lies in the means for supporting and driving the disk and the rollers which it carries. In the present instance I form the bottom of the pan with a central uprising bearing or cone *a*, in which is made a tapering hole or socket *a'*. Into this hole or socket is fitted tightly the standard-shaft M, the lower end of which is correspondingly tapered, so that it is wholly supported in the bearing *a*, and is stationary therein—that is to say, said standard-shaft does not turn on its axis, but is non-rotary. The driving-disk J has a hub *j*, to which is bolted a bearing-sleeve *j'*, and through this hub and sleeve the standard-shaft M extends, as shown. To the top of the sleeve *j* is bolted a cap-plate $j^2$, having an oil-well $j^3$, from which an oil-hole $j^4$ extends down into an oil-chamber *m* in the top of the standard M. Fitted in the cap-plate is a toe-piece X, which is fixed therein and extends down into a socket *m'* in the standard and rests its lower end upon a small bearing $m^2$ in the base of said socket. A pulley Y is fitted to the sleeve *j'* and is the driving-pulley. Now it will be seen that the standard-shaft M, instead of being, as heretofore, the driving-shaft, is merely a supporting-standard for carrying the entire weight of the driving-disk and connected parts, the weight being carried by the top of the standard through the intervention of the toe-piece. Power is applied to the pulley and rotates the sleeve *j'*, the toe-piece turning in the socket in the standard M, and through the rotation of this sleeve the driving-disk and the suspended crushing-rollers are revolved. The object of this particular construction is to avoid driving the mill from below, where the parts are difficult to reach, but, instead thereof, to drive it from above, which is more convenient and is more advantageous generally than driving from below.

The standard M is sufficiently smaller than the sleeve *j'* to provide a passage $m^3$ for oil

from the upper journal of the sleeve to the lower journal of said sleeve and the hub $j$ of the driving-disk, and in the top of the cone-bearing $a$ of the pan is made an oil-chamber $a^2$, protected by the downwardly-extending flange of the hub $j$, and said chamber, which is a waste-oil chamber, communicates with a channel $m^4$ in the standard, and which extends to the bottom thereof. Now it will be seen that the oil fed to the well $j^3$ of the cap-plate $j^2$ passes down through the hole $j^4$ into the oil-chamber $m$ in the top of the standard, and thereby oils the journal of the toe-piece X, and also the upper journal of the sleeve $j'$. The oil thence passes down through the passage $m^3$ and oils the journals of the base of the sleeve and the hub of the driving-disk, and thence passes down into the waste-chamber $a^2$, and from this, through the channel $m^4$, to a place under the pan, so that none of it gets into the pan itself.

In order to assist the centrifugal action of the rollers by positively forcing them out against the die of the pan, and yet allowing them to yield, when necessary, I have the springs W. These are curved in the shape shown, and are fitted loosely in dovetailed grooves formed in bearing-pieces $k$ on the sides of the sleeves K, which support the shafts F of the rollers. The upper ends of these springs are free, and are borne down upon by adjusting pieces or arms $w$, which are connected with the sleeve $j'$, and are vertically movable by reason of having elongated slots $w'$, through which pass fixed bolts $w^2$ into the sleeve $j'$. By this construction it will be seen that the springs W may be readily inserted, and their tension may be regulated by the adjusting pieces or arms $w$.

Another improvement herein lies in the means for connecting the circular shoes D with the rollers C. These shoes are formed on their bases with inwardly-projecting flanges $d$, which pass under the rollers. The rollers are made with the diameter of their upper surfaces smaller than the diameter of their lower surfaces, so that their peripheral surfaces converge upwardly, and the interior surfaces of the shoes are made parallel with the peripheral surfaces of the rollers. This leaves a space between the shoes and the rollers, the sides of which are parallel. Into these spaces I drive wooden binding-pieces $c$, which, instead of being wedge-shaped, as heretofore, are made with parallel sides to correspond with the spaces in which they fit. Now, on account of the inclination of the various contact-surfaces from the perpendicular, it will be seen that the shoes cannot fall from the rollers, but have a tendency to tighten themselves by their own weight, which would not be the case if the spaces between the shoes and the rollers were wedge-shaped, as heretofore, and had wedge-shaped pieces driven into them.

Another point of improvement lies in the manner of mounting and attaching the scrapers P, which operate over the base of the pan, to the driving-disk. I connect these scrapers to the lower ends of the arms O, which, in the present case, I make of springy material, so that the scrapers can yield sufficiently when required. They are connected to these spring-arms by means of bolts $o$ through an intervening elastic washer $o'$, which makes a cushion for the scrapers.

The upper ends of the spring-arms are fitted in sockets in the driving-disk, and are held therein by means of the reversed wedges V, the object of which is to enable the spring-arms to be readily removed by driving down one of the wedges from the top. This construction enables me to tighten and loosen the devices from the upper side, thereby obviating the necessity incident to the use of a single wedge of working from the under side.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a crushing-mill, the combination of the pan, the non-rotary central standard, the crushing-rollers operating in the pan, the driving-disk carrying the rollers, the bearing-sleeve of the disk journaled on the central standard, a support between said bearing-sleeve and the top of the standard, and the driving-pulley on the bearing-sleeve, substantially as described.

2. In a crushing-mill, the combination of the pan, the non-rotary central standard, the crushing-rollers operating in the pan, the driving-disk carrying the rollers, the bearing-sleeve of said disk journaled on the standard, and the toe-piece connected with the top of the bearing-sleeve and journaled in the top of the standard, substantially as described.

3. In a crushing-mill, the pan having a central bearing $a$, the driving-disk, and the crushing-rollers carried by the disk and operating in the pan, in combination with the non-rotary standard supported in the central bearing of said pan, the bearing-sleeve of the driving-disk journaled on the standard, and the toe-piece secured to the top of the bearing-sleeve and journaled in the top of the standard, substantially as described.

4. In a crushing-mill, the combination of the pan having a central bearing, the non-rotary standard mounted in said bearing, the driving-disk having a hub journaled on said standard, the rollers carried by said disk and operating in the pan, the bearing-sleeve bolted to the hub of the driving-disk and journaled on the standard, the cap-plate bolted to the top of the bearing-sleeve, the toe-piece connected with the said cap-plate and fitting and journaled in the top of the standard, and the driving-pulley on the bearing-sleeve, substantially as described.

5. In a crushing-mill, the combination of the pan, having a central socketed bearing $a$, provided with a waste-oil chamber in its top, the non-rotary standard mounted in said chamber and provided with a waste-oil chan-

nel, the driving-disk journaled on the standard, the crushing-rollers carried by the disk, the bearing-sleeve of the disk fitting about the standard, the cap-plate bolted to the top of the bearing-sleeve and having an oil-well and hole, the toe-piece fitted in the cap-plate and journaled in the top of the standard, and the oil-chamber in the top of said standard, substantially as herein described.

6. In a crushing-mill, the pan, the driving-disk, and the pivotally-suspended crushing-rollers carried by said disk, in combination with the springs, the lower ends of which bear against the roller-connections, and the vertically-adjustable pieces or arms bearing against the upper ends of the springs for regulating their tension, substantially as described.

7. In a crushing-mill, the pan, the non-rotary central standard, the revolving driving-disk, the bearing-sleeve of said disk, and the pivotally-suspended crushing-rollers carried by the disk, in combination with the sleeves K, suspending said rollers and having grooved bearing-pieces on their sides, the springs, the lower ends of which fit freely in said bearing-pieces, the slotted pieces or arms secured to the bearing-sleeve and abutting on the upper ends of the springs for regulating their tension, and the fixed bolts passing through said slots into the bearing-sleeve for adjusting said pieces or arms, substantially as described.

8. In a crushing-mill, the crushing-rollers having bases of greater diameter than their tops, whereby their peripheral surfaces converge upwardly, in combination with the ring-shoes fitted to said rollers and having their interior surfaces parallel with the peripheral surfaces of the rollers, and the parallel-sided binding-pieces driven in between the shoes and the rollers, substantially as described.

9. In a crushing-mill, the crushing-rollers, having their bases of greater diameter than their tops, whereby their peripheral surfaces converge upwardly, in combination with the ring-shoes fitted to said rollers, and having inwardly-extending flanges bearing under the rollers and their interior surfaces parallel with the peripheral surfaces of said rollers, and the parallel-sided binding-pieces driven in between the shoes and rollers, substantially as described.

10. In a crushing-mill, the pan and the driving-disk, in combination with the scrapers operating over the bottom of the pan, the arms carrying the scrapers and fitting in sockets in the driving-disk, and the reversed wedges for holding said arms in the sockets of the disk, substantially as described.

In witness whereof I have hereunto set my hand.

FRANK A. HUNTINGTON.

Witnesses:
S. H. NOURSE,
H. C. LEE.