(No Model.) 2 Sheets—Sheet 1.

H. BRADFORD.

ORE AND ROCK CRUSHING AND PULVERIZING MACHINE.

No. 359,495. Patented Mar. 15, 1887.

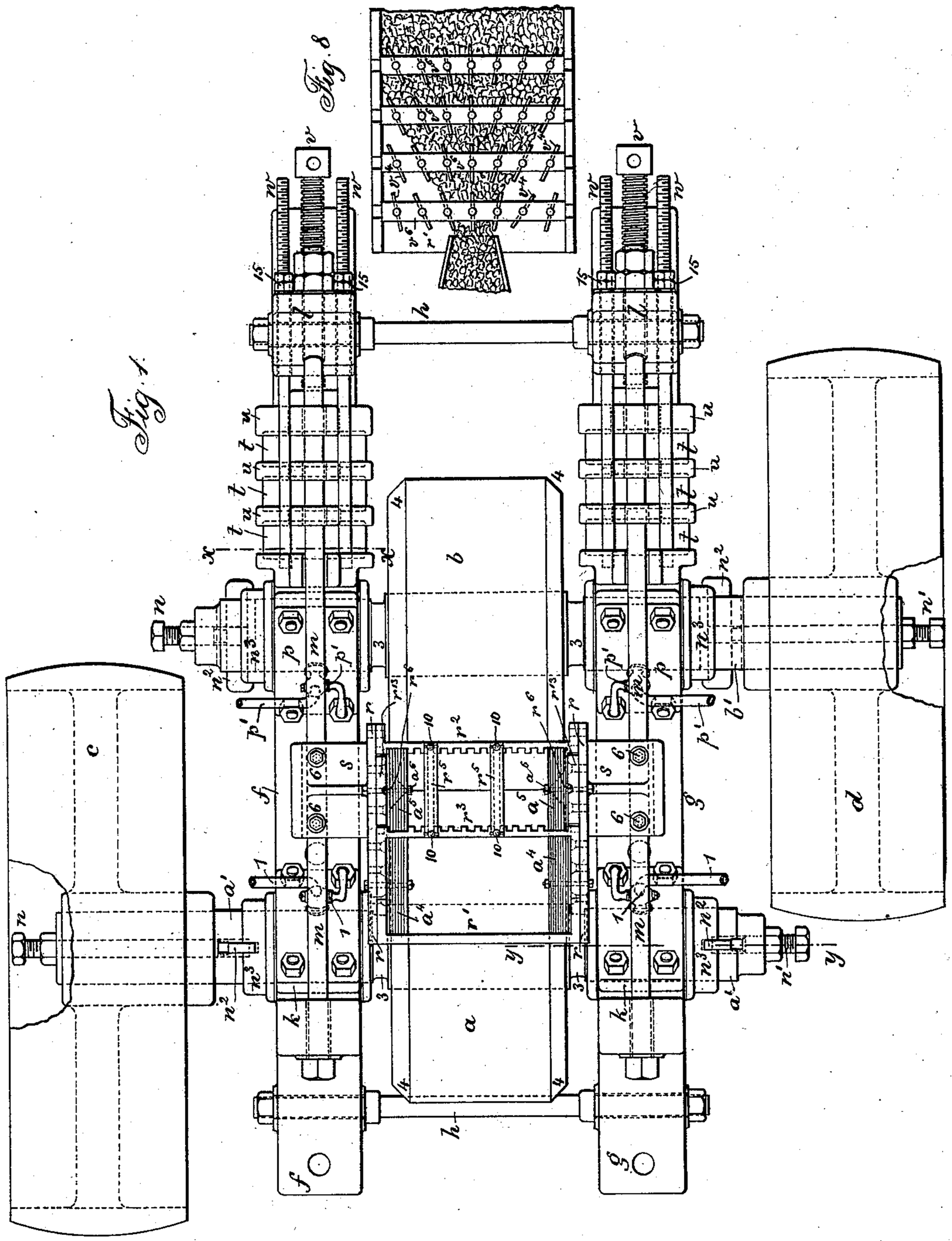

Fig. 1.

Fig. 8.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

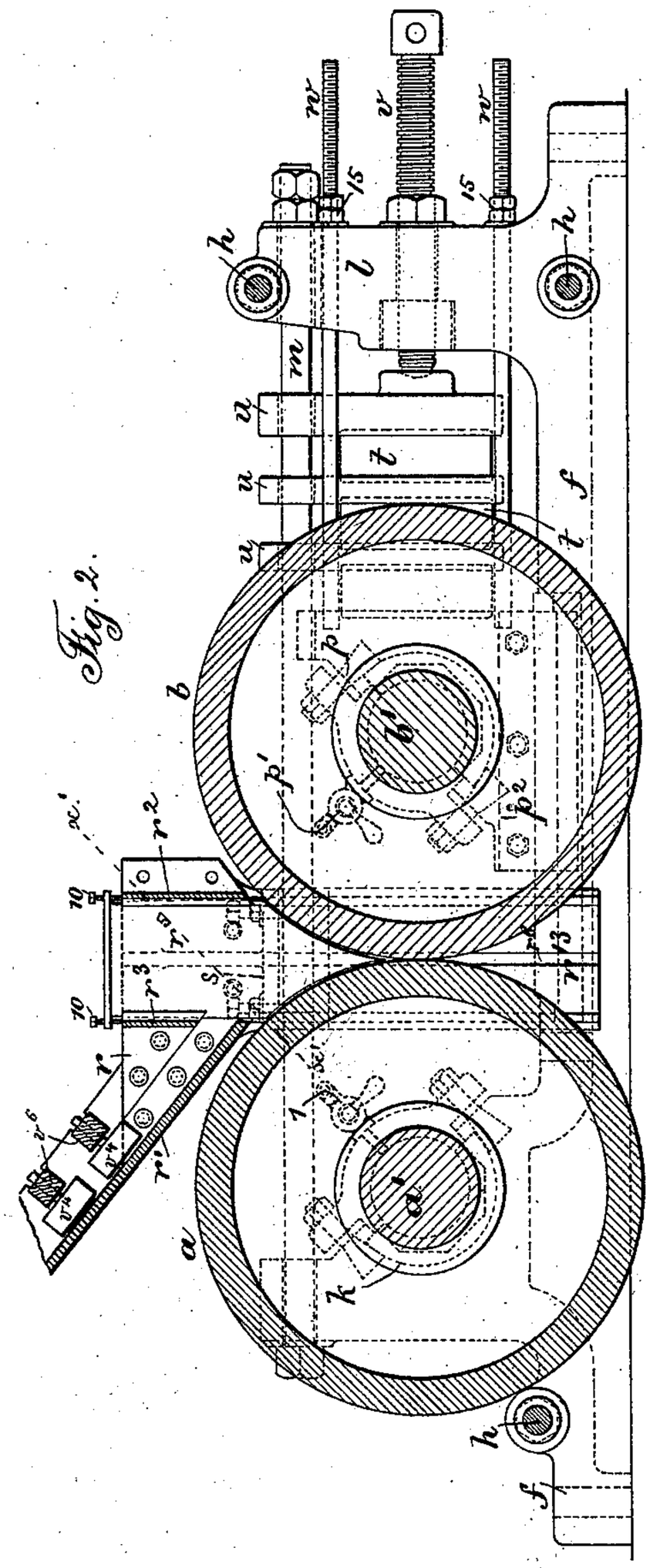


Fig. 7.

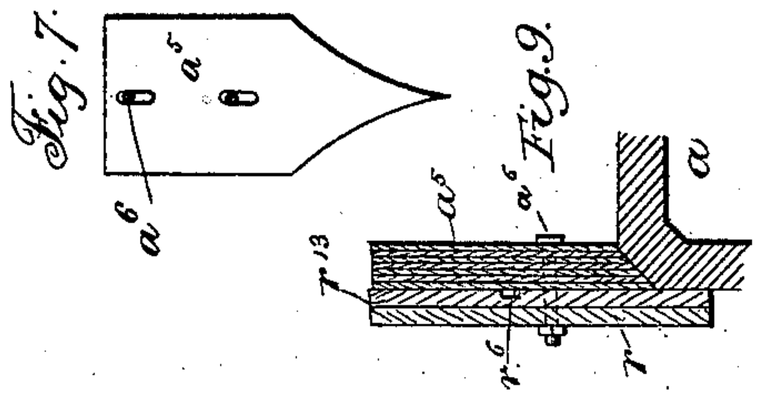


Fig. 6.

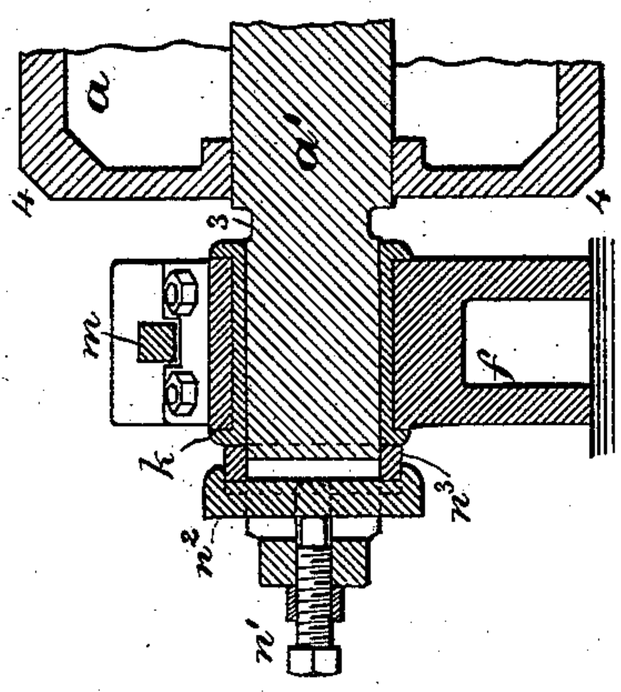


Fig. 3.

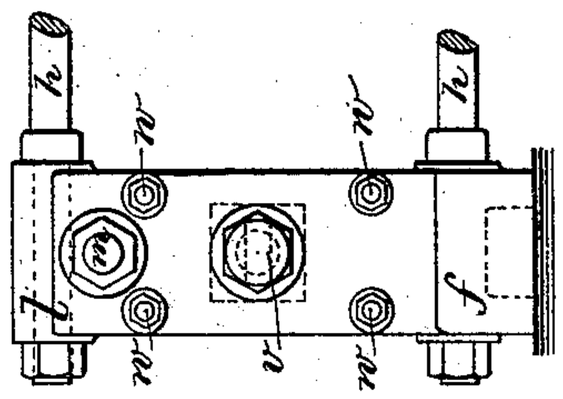


Fig. 5.

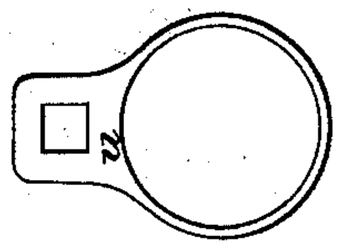
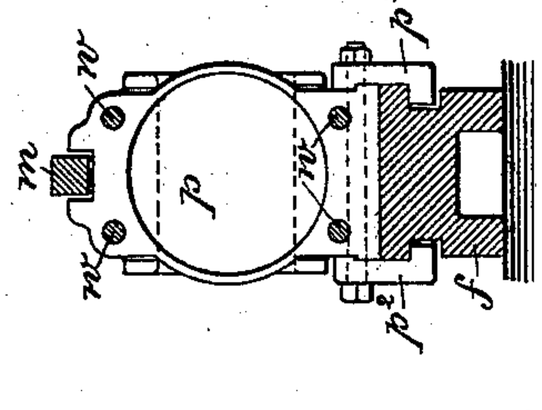


Fig. 4.



Witnesses:
I. Stair
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Inventor:
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per Samuel W. Serrell atty

UNITED STATES PATENT OFFICE.

HEZEKIAH BRADFORD, OF PHILADELPHIA, PENNSYLVANIA.

ORE AND ROCK CRUSHING AND PULVERIZING MACHINE.

SPECIFICATION forming part of Letters Patent No. 359,495, dated March 15, 1887.

Application filed February 16, 1885. Serial No. 156,026. (No model.)

To all whom it may concern:

Be it known that I, HEZEKIAH BRADFORD, of Philadelphia, Pennsylvania, have invented an Improvement in Ore and Rock Crushing and Pulverizing Machines, of which the following is a specification.

In many ore and rock crushing rolls heretofore constructed the edges of the rolls are liable to become broken, and the faces of the rolls wear faster in the middle than near the edges in consequence of the ore or other substance being unequally distributed.

The shafts of the rolls have been supported in journal-boxes, and are usually prevented from moving endwise by the boxes, and the dust and particles of mineral matter cause wear of the journal-boxes and shafts, and the journals or shafts of the rollers, as this wear takes place, are liable to move endwise in their bearings, and uneven ridges often project at the ends of the rolls, the surface not being worn off uniformly.

My present improvements are made for obviating these difficulties, and for causing these rollers to wear with uniformity and retain their cylindrical form; and I support the journals of the rollers in such a manner that endwise movement is prevented, and dust and foreign substances are excluded from the bearings.

In the drawings, Figure 1 is a plan view of the machine complete. Fig. 2 is a vertical longitudinal section transversely of the rolls. Fig. 3 is an end view at one side of the frame. Fig. 4 is a cross-section at the line *x x*, Fig. 1. Fig. 5 is a separate view of one of the followers. Fig. 6 is a cross-section at the line *y y*, Fig. 1. Fig. 7 is a separate view of one of the filling-plates, and Fig. 8 is a plan of the guides for distributing the ore as it passes into the hopper. Fig. 9 is a partial section at the line *x' x'*, Fig. 2.

The rollers *a b* are upon the axles or shafts *a' b'*, and the power to rotate these rollers is applied to the pulleys *c d*, or to gear-wheels which may be used in place of said pulleys. The frames *f* and *g* of the machine are preferably of cast-iron, connected together by the cross-bolts *h h*. Near one end of each frame is a journal-box, *k*, and near the other end of each frame is a vertical standard, *l*, and there are tie-rods *m* passing through the upper portions of these standards *l*, and through projections above the journal-boxes *k*. These tie-rods *m* strengthen the frame and prevent injury from the lateral thrust resulting from the compressing or crushing of the ore or other materials by the rollers *a b*.

The ends of the shaft *a'* are bored out axially to receive the screws *n n'*. Such shaft is also mortised transversely for the reception of the gibs n^2, which pass transversely across such shaft, the ends projecting and terminating as hooks, one of which passes at each side of the movable collar n^3, the slot being longer than the thickness of the gib. Each collar is in contact with the face of the journal-box *k*, and it will now be apparent that by adjusting the screws *n n'* the gib can be moved along in the slot. A limited amount of end motion can be given to the shaft *a'*, so that the roller *a* may be adjusted to the proper transverse position to correspond with the roller *b*. The rollers are of the same length, so as to be in contact all along their surfaces. These collars n^3 also serve to exclude dust and particles of foreign matter from the journal-boxes *k*. I also prefer to make these journal-boxes *k* partially recessed or hollow at one side, and to connect with the recessed portion of each box a pipe, 1, and cock, Fig. 2, by means of which water, oil, or other lubricating material can be supplied to such recesses of the journal-boxes, the same being under sufficient pressure to cause such liquid to ooze out gradually between the rings n^3 and the faces of the journals, and also at the inner surfaces of the journal-boxes adjacent to the rollers. As an additional precaution to prevent the journals of the rollers wearing, I reduce such shafts or journals between the journal-boxes and the rollers themselves, as at 3, in order that any particles of stone or other foreign matter falling upon the shaft may not come into contact with the faces of the journal-boxes, but will adhere to the neck or reduced portion of the shaft and fall from the same as such foreign substances may accumulate, or streams of water may be used to wash off accumulations from the journals.

The shaft *b'* of the roller *b* is provided with adjusting-screws *n n'*, collars n^3, and gibs n^2, the same as described with reference to the shaft *a'*, and these are applied for the object above described.

The journal-boxes or pedestals *p* for the

shaft b' are to be recessed and each provided with a supply of water, oil, or other lubricating material by the pipe and cock p', for the same purpose and in the same manner as to the journal-boxes k.

In ore and stone crushing machines heretofore constructed there is not as much wear upon the surfaces of the rollers, as heretofore made, near the edges as there is in the middle portions of the roller-surfaces; hence the rollers wear hollow, and there is a greater distance between the faces of the rollers in the middle portions of the rollers than at the ends. I avoid these difficulties by beveling the edges of the rollers at the ends, as seen at 4 4. This prevents the chipping of the rollers and enables me to apply the feed-hopper (hereinafter described) in such manner that the wear upon the entire surfaces of the rollers will be uniform and the cylindrical character of such rollers maintained, and grooves and channels be prevented, in order that the distance between the rollers at the point of proximity may be uniform throughout their entire length, and the reduction of the ore or other mineral substances may also be uniform in size.

The hopper into which the material to be crushed is supplied is formed of the end pieces, $r\ r$, the inclined side piece, r', and the vertical side r^2. There is also a cross-bar, r^3, in the hopper, attached at its ends to the end pieces, $r\ r$.

The support-flanges s of the hopper rest upon the longitudinal tie-bars m, and are provided with set-screws 6, resting upon such tie-bars m, by which the flanges of the hopper and the hopper itself may be raised or lowered, as necessity may require. The object of this is to bring the side piece r^2 of the hopper and the inclined side piece r' into the required proximity to the surfaces of the rollers $a\ b$.

The hopper is made as wide as the rolls are long, and upon the two ends there are plates a^5, hanging upon and secured by bolts a^6. These plates are about a quarter of an inch thick, with their lower ends beveled to fit the angle formed on the rolls by the beveled ends. These plates a^5 are to fill up the open spaces formed by the beveling of the ends of the rolls. They should be removed one by one as the corners of the rolls wear away, and there should always be space enough left at these ends of the rolls to cause them to be worn away as fast as the center parts of the rolls, and the feed of the ore into the rolls is to be so directed that the corners or edges of the rolls will have as much ore to crush in proportion to the surface of the rolls as the center or other part of the rolls. Similar plates, a^4, are to be bolted against the inner surfaces of the hopper ends, so that the inclined supply side of the hopper may be of uniform width.

The end plates, r^{13}, of the hopper are provided with vertical channels at r^6 in line with the meeting surfaces of the rolls $a\ b$, so that after the rolls have been worn down cylindrically and the beveled portions 4 worn off the particles of ore will come freely into contact with the extreme edges of the rolls, and thereby they will be worn away as rapidly as any other part of the rolls, and if pieces of ore pass down through these channels r^6 without being crushed sufficiently fine the same will be retained by the screens and returned to the crusher by an elevator. These plates r^{13} can be raised or lowered or moved laterally and clamped in place by the attaching-screws, so that a fresh surface may be brought into position to take the wear from the ore passing between the rolls.

In order that the corners of the rolls may not be prevented from acting on the ore, the hanging pieces a^5 should be removed as the rolls wear away, so that the full proportion of ore shall be crushed by falling directly against the corners, and to insure this it is better that some small portions of stone should drop through the spaces at the ends of the rolls than that the corners should not be worn off as fast as any other part of the faces of the rolls, as any coarser pieces thus falling through will be returned by the screens and elevators to the rolls, as usual.

In order that the operator may be able to direct and distribute the ore equally, rows of guides v^4 are made use of, as seen in Fig. 8, each guide turning on a pin like a window-blind. These guides are placed in the hopper to regulate the distribution equally across the hopper. The ore frequently reaches the hopper from the rock-breaker in a narrow stream; but it is distributed by these guides, being turned into inclined positions, as shown, to spread the ore as it runs down the hopper, and these are positioned so as to equally distribute the ore. These guides are supported by beams v^6, placed over the hopper, the pins of the guides passing at right angles with the face of the hopper through such beams, and forming pivots that allow the guides to be adjusted to the proper angular position, to equally distribute the ore. The hopper with these guides is to be sufficiently long to allow for the introduction of a number of ranges of these guides, so as to direct the material and distribute it equally. By placing these pivoted guides upon beams across the hopper the guides can be applied wherever necessary and to any desired extent, and the pivots are in the cross-bars and not in the bottom of the hopper, and the hopper is not injured by being perforated. By this construction I am enabled to evenly feed the material to be crushed upon the inclined side r' of the hopper, and allow the same to pass gradually beneath the cross-bar r^3, in between the rollers $a\ b$, which crush or reduce the same to the desired extent. The action is uniform across the entire faces of the rollers $a\ b$ because the supply of the material to be crushed is uniform; but in case any hard foreign substance—such as a chisel or a piece of steel drill—should pass in between the rollers $a\ b$ and remain in position, and the rollers grind against the same

until a groove is cut in one or both of the rollers before the obstruction is discovered, then I provide a shield for the injured portion of the roller-surface, the same consisting of a plate, r^5, introduced between the vertical side r^2 of the hopper and the cross-bar r^3 into the grooves and the faces of such bar and hopper sides which are adjacent to the injured portion of the surfaces of the rollers. One or more of these shields or plates may be used as necessity requires, and they are to be provided with adjusting-screws 10, by which they may be raised or lowered, in order that their lower ends may be in the proper position relatively to the surfaces of the rollers *a b*. These shields do not prevent the stone, ore, or other material that is being operated upon passing down upon the rollers, because such shields are comparatively thin. They, however, keep the material to be crushed away from contact with the injured or worn portions of the surfaces of the rollers, in order that said surfaces may not be exposed to wear, and that the wear may come upon the other portions of the surfaces of the rollers until the entire surfaces of such rollers again assume their true cylindrical form.

I provide springs that act between the standards *l* and the journal-boxes *p* to compress the roller *b* toward the roller *a*. Such springs are by preference blocks of india-rubber, as shown at *t t;* but metallic springs may be used. These are introduced between hanging followers *u*, which are in the form of plates suspended from the tie-rods *m*, as seen in Fig. 2. The surfaces of these followers are recessed sufficiently to receive the bases of the blocks of india-rubber *t*, in order that such rubber springs may not become misplaced; and I pass through each of the standards *l* a horizontal screw, *v*, which acts against the end follower, *u*, to compress the springs to whatever extent may be necessary for applying the necessary pressure against the journal-boxes *p* and the roller *b*. These screws *v* are each provided with a set-nut to prevent the same being turned accidentally.

It is often desirable to allow a certain distance between the roller *b* and the roller *a*, so that pieces of ore or other material of a less size may pass through unacted upon. I therefore provide the holding-rods *w*, which are screwed at one end into the journal-boxes *p*. I prefer to employ four of these holding-rods to each journal-box, and to pass the same through holes in the standards *l*. These holding-rods *w* are provided with set-nuts 15, which, when brought into contact with the vertical surfaces of the standards *l* and being revolved upon the screw-holding rods *w*, draw back the roller *b* from contact with the roller *a* the desired distance. These holding-rods, passing loosely through the standards *l*, do not interfere with the roller *b* sliding back and compressing the springs *t* should any substance fall in between the rollers *a b* that cannot be crushed by them, thus allowing such substance to pass through as the roller *b* yields and moves away from the roller *a*. In driving these rollers *a b*, I prefer to use separate belts upon pulleys *c* and *d*, in order that the said rollers may be driven at different speeds, thereby causing a grinding action between the surface of one roller and the surface of the other; and I prefer, also, that the belt to the pulley *d* should pass vertically downward or upward to a driving-pulley below it or above it, in order that the roller *b* and its shaft *b′* may move horizontally and laterally against the action of the springs *t t* without the belt becoming materially slackened or tightened by such movement.

The rollers *a b* are formed of hollow cast-iron shells, as represented in section *m*, Fig. 2. These shells are of the proper thickness for obtaining the necessary strength; and at the ends or heads there are inwardly-projecting hubs, which are bored out and fitted to receive the shaft, the shaft being slightly tapered in order that the roller may be driven thereon firmly, endwise of the shaft. This allows for the removal of the roller when worn out, and the replacing of another roller upon such shaft without injury to the shaft. Keys should be driven into channels in the shafts and hubs, respectively, to prevent the rollers turning on their shafts.

The journal-boxes *p* are provided with sliding clips p^2 at their bases, such clips being applied one at each side of the sliding journal-boxes and bolted to the same. The lower inwardly-projecting ribs upon these clips pass into grooves in the frames *f g*, so that the journal-boxes or pedestals *p p* are allowed to move endwise of the frame; but they are held down in place and cannot rise or become detached from the same.

I prefer to construct the rollers *a b* of cast iron with chilled surfaces, these surfaces being ground off or otherwise rendered true.

In my improved machine I am able to distribute the ore in the hopper uniformly, to crush it uniformly, or nearly so, to render the wear upon the rolls uniform, and to maintain the rolls in their proper relative positions and in good condition until worn out, thus effecting a saving in the machinery and doing better work than heretofore.

I claim as my invention—

1. The combination, with the rollers and their shafts, of the screws *n n′*, gibs n^2, and rings n^3, for adjusting the rollers and roller-shafts endwise, substantially as set forth.

2. The combination, in a stone-crushing machine, of the rollers *a b*, having the edges beveled, and the supply-hopper having an inclined surface down which the materials pass, the end plates, and the thin removable plates a^5, beveled at their lower ends to fit the rolls and attached to the end plates, substantially as specified.

3. The combination, with the crushing-rollers and the feed-hopper, of movable shields adapted to be placed and secured in the hopper,

substantially as specified, so as to protect any portion of the roller-surface which may have become grooved or injured, substantially as set forth.

4. The combination, with the crushing-rollers and feed-hopper, of the grooved cross-bar r^3 and grooved side piece r^2, and one or more movable shields, r^5, substantially as and for the purpose set forth.

5. The combination, with the crushing-rollers, of the sliding journal-boxes or pedestals p, and the clip-pieces p^2, fastened to the lower portions of such pedestals, and having ribs passing into grooves in the frames of the machine, substantially as and for the purpose set forth.

6. The combination, with the rollers, shafts, journal-boxes, and sliding bearings or pedestals p, of the holding-rods w, the standards l, through which the rods pass, the nuts 15, adjusting-screws v, and the springs t between the pedestals and the adjusting-screws, substantially as set forth.

7. The combination, with a pair of crushing-rollers, of the hopper having end plates with vertical channels in line with the meeting surfaces of the rolls, for the purposes and as set forth.

8. The combination, with the feeding-hopper, down which the material passes to the rollers, of the cross-beams v^6 above the hopper, and the guides v^4, pivoted to the cross-beam and hanging below the same, for the purposes and substantially as set forth.

Signed by me this 5th day of February, A. D. 1885.

HEZEKIAH BRADFORD.

Witnesses:
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WILLIAM G. MOTT.