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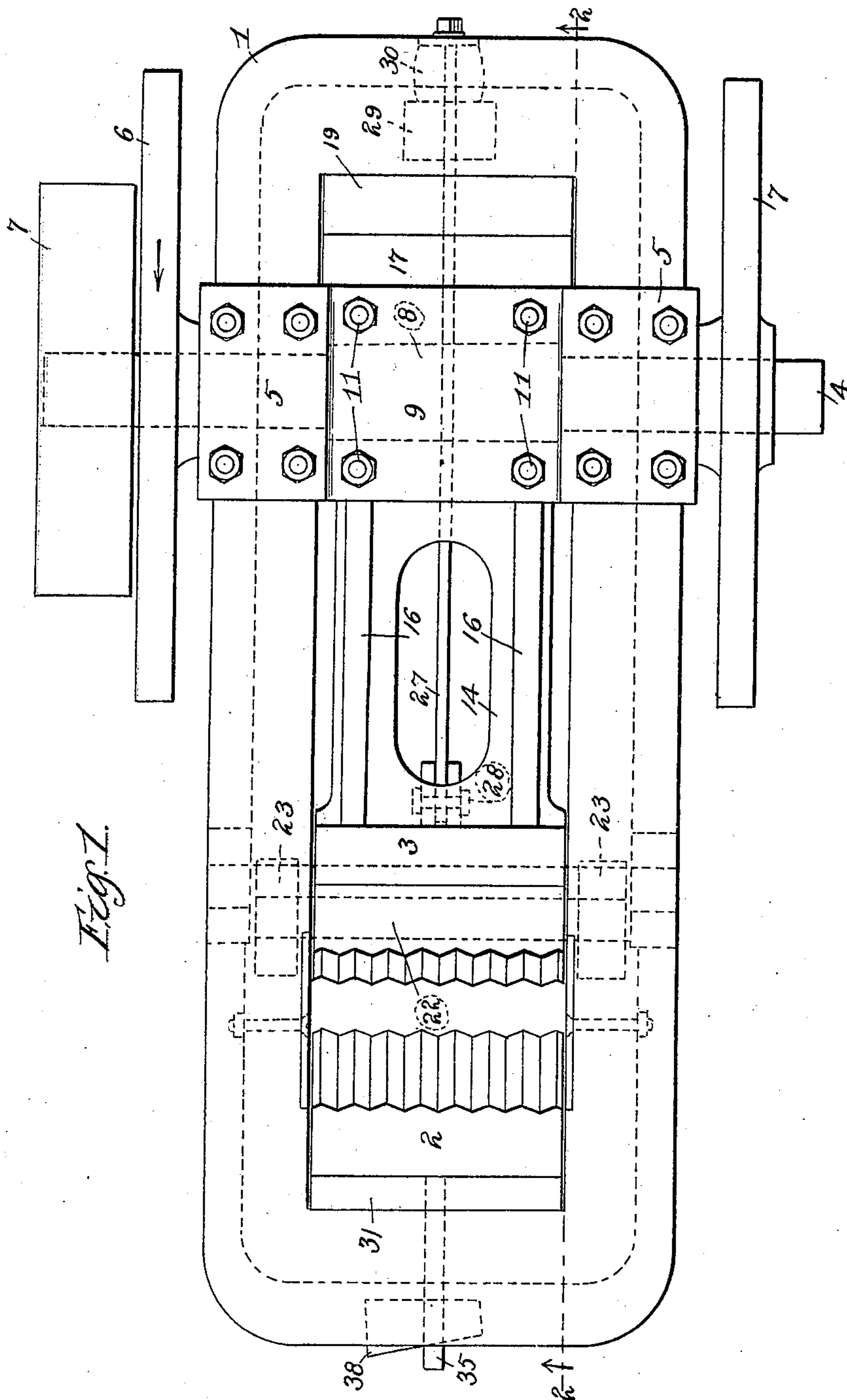
Patented Mar. 21, 1899.

C. F. HINMAN.
CRUSHING MACHINE.

(Application filed Feb. 8, 1897.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses.
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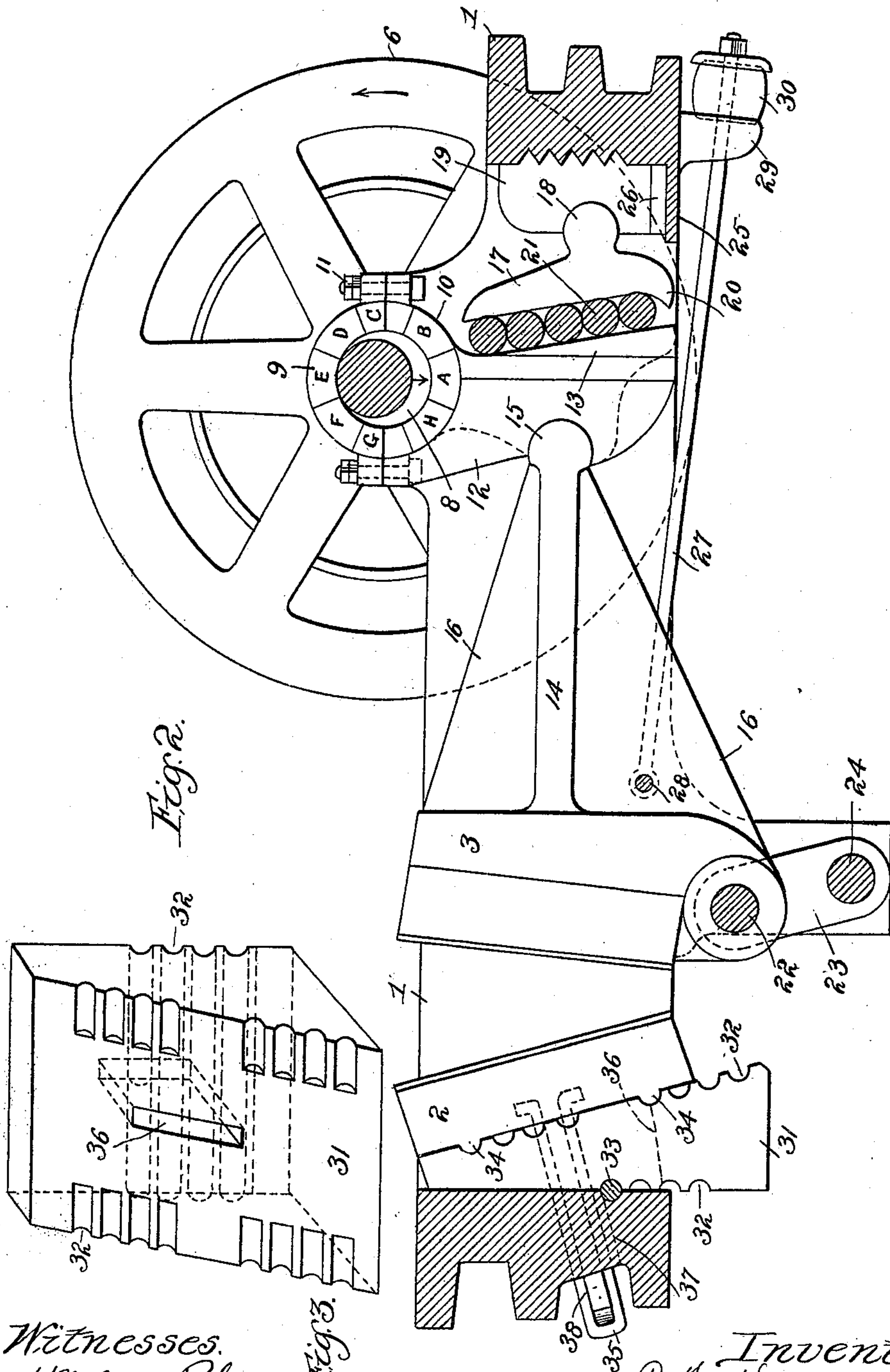
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UNITED STATES PATENT OFFICE.

CLEMENT F. HINMAN, OF CHICAGO, ILLINOIS.

CRUSHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 621,754, dated March 21, 1899.

Application filed February 8, 1897. Serial No. 622,485. (No model.)

To all whom it may concern:

Be it known that I, CLEMENT F. HINMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Crushing-Machines, of which the following is a full, clear, and exact specification.

My invention relates more particularly to that class of rock-crushing machines known as "jaw-crushers," usually employing a pair of jaws one of which is stationary, while the other is movable and is given alternate propulsive and receding movements, so that the material deposited between them, as in a hopper, is crushed or broken by the impact. One of the greatest defects of crushers of this character is the severe shock and strain brought upon the parts, and particularly upon the driving-shaft, resulting from the spasmodic or plunging action of the movable jaw, at times advancing with extreme and swift movement and as suddenly receding, thus rapidly subjecting the shaft, as well as the other parts, to sudden and severe strains.

One of the objects of my invention, therefore, is to avoid this defect and to cause the movable jaw to do some crushing work substantially at all times during a complete rotation of the driving-shaft, whereby the strain upon the shaft and other parts will be equalized or disseminated, as it were, throughout substantially the shaft's entire circumference.

Another object of my invention is to compel substantially all points of the face of the movable jaw to move in straight thrusts and to cause the lower edge or portion of the jaw to take an upward trend; whereby the superposed particles of the rock or material will be struck at substantially right angles to the face of the jaw against which they rest and will be induced to move downwardly, while their downward movement, when they are about to leave the mouth of the hopper, will be arrested by the upward thrust of the lower edge of the moving jaw and instead of being squeezed out through the opening will be further crushed before being allowed to escape.

Another object of my invention is to cause a greater center thrust or waist movement of the movable jaw than heretofore attained,

whereby a greater crushing capacity and a straighter and more effective stroke are produced.

Another object of my invention is to provide a mechanical movement especially adapted for operating the jaw of a crushing-machine which shall offer less resistance and friction, and consequently require less power to operate it, than heretofore and which mechanical movement shall also produce a continual crushing action of the movable jaw substantially throughout the period at which its bodily thrust begins and ends; and my invention has for its object, finally, to provide means whereby the positions of the jaws may be altered with relation to each other without necessarily changing their angularity and without interfering with or affecting the position of the operating mechanism.

With these ends in view my invention consists in certain features of novelty in the construction, combination, and arrangement of parts by which the said objects and certain other objects hereinafter appearing are attained, all as fully described with reference to the accompanying drawings, and more particularly pointed out in the claims.

In the said drawings, Figure 1 is a plan view of my improved crusher. Fig. 2 is a vertical longitudinal section thereof, taken on the line 2 2, Fig. 1; and Fig. 3 is a detail perspective view of the means for holding and adjusting the stationary jaw.

One feature of my invention in its broadest aspect is a mechanical movement capable of application or use generally; but I have shown it in connection with certain parts characteristic of a crushing-machine as an illustration of its greatest field of utility at present known to me, and with such parts, especially when one of the crushing-jaws is capable of both oscillatory and bodily movement, the said mechanical movement performs certain improved results attributable to the peculiar action of this mechanical movement combined with the action of the movable jaw, as will hereinafter appear. Hence my invention as a whole only relates to a crushing-machine and is not restricted thereto.

My invention comprises an oscillatory portion which constitutes a lever and is in the form of or provided with a wedge or incline,

at one side of which it has operative connection or relation to the part to be propelled or vibrated—such, for example, as the movable jaw of a crusher—while at the other side with
 5 a rocking-abutment bearing or fulcrum whose bearing against the incline or wedge is extended and touches the same at points on both sides of a line passing through the point of operative connection with the jaw and the
 10 center of oscillation of the abutment, whose face is preferably relieved from wear and excessive friction by one or more rotatable anti-friction devices, such as rollers, whereby the jaw or other part to be operated will be vi-
 15 brated by the combined lever and wedge action which effects the certain peculiar and desirable functions not heretofore accomplished already alluded to and more fully described hereinafter.

20 Having thus given a general outline of the salient features of my invention, I will now particularly describe the embodiment thereof shown in the drawings and afterward explain more in detail the peculiar functions
 25 and advantages of the parts.

1 represents the bed or main frame, which may be of the usual or any suitable construction and at one end of which is located the crushing-jaws 2 3, having, if desired, the
 30 usual corrugated faces, while at the other end the frame is provided with a pair of pillow-blocks, in which the main driving-shaft 4 is journaled and held in place by the usual box-caps 5 or any other suitable means, the shaft
 35 4 being provided with the usual fly-wheels 6 and band-wheel 7. The driving-shaft has formed thereon or secured thereto an eccentric 8 or is otherwise cranked, and this eccentric is inclosed by a divided eccentric strap
 40 or box comprising two members 9 and 10, secured together by bolts 11, and the lower one, 10, of these members is formed on or secured to a pitman 12, which constitutes the recip-
 45 rocating oscillatory portion or lever, hereinbefore referred to, having upon one side a wedge or incline 13, while at its other side it is provided with operative connection with or arranged in operative relation to the mov-
 50 able jaw 3, and which connection may be conveniently effected by any suitable means, such as the well-known device shown more clearly in Fig. 2, consisting of an arm 14, projecting from the rear side of the movable
 55 jaw 3 and being provided with a journal 15, seated in a suitable cavity in the side of the pitman 12, 16 being strengthening-webs for the arm 14.

Arranged against the inclined face or wedge 13 is an abutment bearing or fulcrum for the
 60 pitman during its action as a lever and cam, and this abutment-bearing consists of a rocker 17, having its face opposed to the face of the incline 13, extending parallel with such incline, while its other side is provided with a
 65 boss constituting a journal 18, seated in a suitable bearing in a block 19. The lower end of the rocker 17 is provided with a nose

or projection 20, which extends toward the incline 13, and located between the opposed faces of the incline and the rocker is one or
 70 more, preferably a series, of rotatable anti-friction devices—such, for instance, as ordinary rollers 21—resting one upon the other in the space between said faces and being held
 75 from dropping out by the nose or projection 20, the inner edge of which latter is struck on a greater arc than the roller, so as to force the latter upward.

The jaw 3 is capable of both an oscillatory and a bodily movement, and as a convenient
 80 means of attaining this result and at the same time supporting it in a proper position its lower side is provided with any suitable shaft or trunnions 22, which are mounted in the
 85 upper ends of a pair of links 23, the latter being in turn journaled or mounted upon a suitable shaft 24, secured in appropriate projections on the main frame 1. By this means it will be seen that the rotation of the driving-
 90 shaft 4 imparts to the pitman 12 both a vertically-reciprocating and oscillatory and forward-and-back movement. The reciprocating movement results in the propulsion of the jaw 3 by virtue of the cam action of the in-
 95 cline or wedge 13 against the abutment or rollers 21, while the oscillatory movement of the pitman causes it to act as a lever taking its abutment or fulcrum against the rollers 21 and propelling the jaw 3 forward by virtue of its connection 14 15 therewith. It will
 100 also be seen that in consequence of this two-fold action of the pitman it is performing its propulsive function upon the jaw 3 substantially at all times during its complete recip-
 105 rocation, as will hereinafter more fully appear.

In order that the pitman while acting as a lever or as a cam may not displace the anti-friction devices 21 and may produce a uniform strain on both sides of the line of strain be-
 110 tween the bearings 15 18, the abutment-bearing, comprising the shoe 17, preferably supplemented by the rollers 21, is extended and touches the incline 13 on both sides of such line of strain. It is also evident that the ex-
 115 tent of thrust of the movable jaw 3 may be varied by raising or lowering the abutment 17 or otherwise altering the relative altitudes of the portions 13 17—that is to say, if the shoe 17 should be raised the action of the lever or pit-
 120 man upon the jaw 3 would be less and if lowered would be greater—and in order that this principle may be available the block 19 is made adjustable vertically. Its rear face and the opposed face of the frame 1 are provided
 125 with engaging teeth and notches, respectively, the notches being in greater number than the teeth, so that the block may be raised or lowered and held from slipping. If de-
 130 sired, the frame 1 below the block may be provided with a ledge 25, between which and the bottom of the block may be interposed one or more shims 26 for affording a firmer foundation for the block.

The parts are held in firm contact and the momentum of the jaw 3, when its propulsive movement ceases, prevented from pulling the jaw and other parts loose from their connections by means of a tie-rod 27, pivoted at 28 to the jaw 3 or to the web 16 and passing through a lug 29, formed on the frame 1, and upon the other side of which lug the rod is provided with a stout cushion or rubber 30 for permitting of the requisite thrust of the jaw 3 and returning the jaw and other parts to their normal position.

In order that the stationary jaw 2 may be adjusted relatively to the jaw 3 without unnecessarily changing the angularity of the jaws, I employ an adjusting-wedge 31, which is interposed between the frame 1 and the rear side of the jaw 2, and its faces are parallel with the face of the jaw 2 and the face of the frame against which it rests, respectively, so that the movement of the wedge will alter the position of the jaw 2 without changing its angle with reference to the jaw 3. Each face of the wedge 31 is provided with a number of notches 32, in one series of which engages a lug or key 33, also seated in a suitable notch in the frame 1, while in the other series engage two lugs 34, formed on the rear side of the jaw 2, the notches 32 in the inner face of the wedge 31 being located at each end thereof, so that the jaw 2 may be taken out and reversed when desired. The rear side of the jaw 2 is provided with a shank or loop 35, which passes through a slot 36 in the wedge 31 and a slot 37 in the frame, and it is pierced by a linchpin 38, which is wedge-shaped and rests against the back of the frame, thus binding the parts together.

For convenience of illustration I have shown in the drawings the strap 9 10 of the eccentric divided into eight sections, lettered, respectively, from A to H, and upon the eccentric 8 I have represented an arrow or index for convenience in following the movement of the eccentric and the jaw 3 through the various stages of the former's rotation. In rotating the shaft and moving the pitman, as before described, and passing through the section A to B it will be seen that the top of the pitman starts with the movement of recession, as well as ascension, the greater amount of recession being at A and the greater amount of ascension being at B. The first movement causes a recession of the entire jaw 3; but as soon as the rising motion becomes effective the rocking motion begins to cause the upper part of the jaw to move forward, while the lower portion of the jaw moves in recession from the rocking motion; but such recession of the lower part of the jaw is neutralized by the counter motion of the pitman bearing upon the incline plane or wedge, which causes a propulsive movement, effecting an increase of propulsion to the entire jaw, excepting as to a small portion at the extreme lower part, where the two movements practically balance or offset each other.

From B to C the movement is almost entirely a rising one, the rocking of the jaw and the propulsion of the incline plane causing a marked motion forward to the upper part of the jaw, while permitting but slight recession at the lower part. From C to D the pitman starts with a rising, but soon turns into a forward, motion. The rising motion gives the forward rocking motion to the top of the movable jaw, while the incline plane causes a slight propulsion to the entire jaw. At D the leverage action of the pitman begins to give propulsion to the entire jaw. From D to E the movement of the pitman is almost wholly a lever action, and it is while passing through this period and the following section that the peculiar action of the rocking abutment or fulcrum gives the desired powerful leverage-stroke which from D to E moves the entire jaw in propulsion. While the pitman is ascending and going forward, the rocking abutment or fulcrum rocks downwardly and carries the bearing-point of the fulcrum lower down on the back of the pitman or incline and farther from the movable jaw, thus increasing the propulsive thrust. From E to F the motion of the pitman being forward and downward, the leverage propulsion soon ceases and the downward motion causes the jaw to recede at top and to advance at the bottom, and the downward motion of the incline or wedge 13 over the rollers of the rocking abutment causes still further recession of the upper part of the jaw, while the slight forward motion at the lower part of the jaw terminates on reaching the section G. Slightly farther toward the first position or A, the motion being downward and backward, the jaw moves in general in recession through about sixty degrees of the circumference, and this is the only rest the eccentric is given. It will thus be seen that the rocking movement of the pitman is so influenced by the action of the incline plane and the pitman leverage over the shifting fulcrum that the forward rocking of the upper part of the jaw is not accompanied by a concurrent recession of the lower part of the jaw, but the entire jaw moves forward, following the upper propulsion, and the lower part of the jaw continues to move forward after the upper part has ceased its propulsive movement and the entire jaw follows in recession and the lower part continues in recession after the upper part has ceased to recede and the propulsive motion has again begun at the upper part. This peculiar action insures a marked full semistroke or waist movement, and yet the backward strain at no time varies ten degrees from the horizontal, and throughout the entire ascension of the pitman the incline plane has the same uniform strain on the crusher-frame and the same propulsive action or stroke, while a toggle-joint giving a similar degree of propulsion would increase or lessen the strain during its movement and at the same time its angle of pressure upward from

the horizontal would be much greater than ten degrees. It will also be seen that in making these movements substantially the upper side of the jaw at every point thereof moves toward the fixed jaw in a straight line, while the extreme lower edge of the movable jaw has a slight upward movement at the conclusion of the stroke, thus causing the jaw to catch the particles as they are induced to descend by the downward movements and insuring their arrest and disintegration before escaping.

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

1. In a crusher, the combination of a reciprocatory and oscillatory wedge or incline, a rocking-abutment bearing having a series of rotatable antifriction devices located on both sides of a line passing through its axis of oscillation, and the jaw to be propelled having operative relation to said wedge or incline, substantially as set forth.

2. In a crusher, the combination of a reciprocatory and oscillatory portion provided with an incline or wedge, the jaw to be propelled having a bearing at one side of said wedge and a rocking-abutment bearing against the opposite side of said wedge and at all times extending to points on both sides of a line passing through said first bearing and the center of oscillation of said abutment, substantially as set forth.

3. In a crusher, the combination of a reciprocatory and oscillatory wedge or incline, a rocking-abutment bearing having a face substantially parallel with the face of said wedge or incline, and a series of rotatable antifriction devices arranged between said parallel faces for receiving the impact of the transverse movement of said wedge, and the part to be propelled arranged in operative relation to said wedge or incline, substantially as set forth.

4. In a crusher, the combination of an eccentric or crank, a pitman having operative connection thereto and being provided with a wedge or incline, a rocking abutment having a series of rollers against which one side of said pitman bears, and the jaw to be propelled bearing against the other side of said pitman, substantially as set forth.

5. A crusher having in combination an oscillatory bodily-movable jaw, a reciprocatory and oscillatory wedge or incline having operative relation to said jaw, and a rocking-abutment bearing having a series of rotatable antifriction devices located on both sides of a line passing through the axis of oscillation of said abutment, substantially as set forth.

6. A crusher having in combination a reciprocatory and oscillatory portion having an incline or wedge, an oscillatory bodily-movable crushing-jaw bearing against said portion at the side opposite said wedge or incline, and a rocking-abutment bearing located against said portion at the other side of said

wedge and having points of contact therewith on both sides of a line passing through said first bearing and the center of oscillation of said abutment, substantially as set forth.

7. A crusher having in combination an oscillatory bodily-movable crushing-jaw, an eccentric or crank, a pitman having operative connection with said eccentric or crank and being provided with a wedge or incline on one side thereof, the opposite side of said pitman having connection with said jaw, a rocking abutment having a face parallel with the face of said incline and a series of rollers arranged between said parallel faces and extending above and below a line passing through the center of oscillation of said abutment and the point of connection between said pitman and jaw, substantially as set forth.

8. A crusher having in combination an oscillatory bodily-movable jaw, a reciprocatory and oscillatory portion constituting a lever against which said jaw has a bearing, a rocking abutment or fulcrum for said lever having at all times an extended engagement therewith, an adjustable block against which said abutment is seated, and a support for said block, said block and support being provided with engaging teeth and notches, whereby the block may be set at various adjustments, substantially as set forth.

9. A crusher having in combination an oscillatory bodily-movable jaw, a reciprocatory and oscillatory portion constituting a lever against which said jaw has a bearing, a rocking abutment or fulcrum for said lever having an extended bearing thereagainst, an adjustable block against which said abutment is seated, a support for said block, said block and support being provided with engaging teeth and notches, and a shim arranged under said block, substantially as set forth.

10. A crusher having in combination a movable jaw, a reciprocatory and oscillatory portion constituting a lever against which said jaw has a bearing, a rocking abutment or fulcrum for said lever having an extended bearing thereagainst an adjustable block against which said abutment is seated, a support for said block, said block and support being provided with teeth and notches, and an elastic connection between said jaw and support for binding the parts together, substantially as set forth.

11. A crusher having in combination an oscillatory bodily-movable jaw, a reciprocatory and oscillatory portion constituting a lever against which said jaw has a bearing at one side, the opposite side of said portion being provided with a wedge or incline, and a rocking abutment or fulcrum for said lever having at all times an extended bearing against said wedge or incline, substantially as set forth.

12. A crusher having in combination a reciprocatory and oscillatory wedge or incline, the part to be propelled having operative relation to one side of said wedge or incline, an

abutment-bearing arranged opposite the other side of said wedge or incline and being provided at its lower end with a portion curved inwardly toward the face of said incline and a series of rollers arranged above said portion and bearing against said wedge or incline, said rollers being of smaller radius than that of the arc of said inwardly-curved portion, whereby said rollers will not stop abruptly against said portion, substantially as set forth.

13. A crusher having in combination a frame, a pair of crushing-jaws, a wedge arranged between one of said jaws and frame, and the last said jaw, frame and wedge being provided with a series of engaging notches and lugs for holding the said jaw and wedge from slipping, and means for binding the frame, wedge and jaw together, substantially as set forth.

14. A crusher having in combination a frame, a pair of crushing-jaws, a wedge arranged between said frame and one of said jaws and having one of its faces parallel with the face of said jaw and the other face parallel with the face of said frame, and a shank secured to said last jaw and passing through said wedge and frame and having means for imparting endwise pull thereto, substantially as set forth.

15. A crusher having in combination a frame, a pair of crushing-jaws, an adjusting-wedge arranged between said frame and one

of said jaws and having one face parallel with the operative face of the last said jaw and its other face parallel with the face of said frame, a shank secured to the last said jaw, and a linchpin passing through said shank and abutting against the rear side of the frame, said jaw and wedge being provided with means for preventing movement in an upright direction, substantially as set forth.

16. A crushing-machine having in combination a reciprocating oscillatory pitman having a wedge or incline on one side, an abutment fixed against movement at one end and its other end being arranged to resist the lateral pressure of and being movable with said pitman, a pair of crushing-jaws one of which is bodily movable and oscillatory and between which latter jaw and said abutment the said pitman and incline is located and has operative relation to said movable jaw for imparting thereto its wedging and lever action, and a series of rollers for resisting the pressure of said jaw against said wedge, located at a point between the fulcrum and the jaw and extending at all times to both sides of the main line of strain between the fulcrum and the movable jaw, substantially as set forth.

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