R. S., R. B. & A. B. WATT.

ORE CRUSHER.

APPLICATION FILED NOV. 27, 1908.

929,177.

Patented July 27, 1909.

2 SHEETS—SHEET 1.

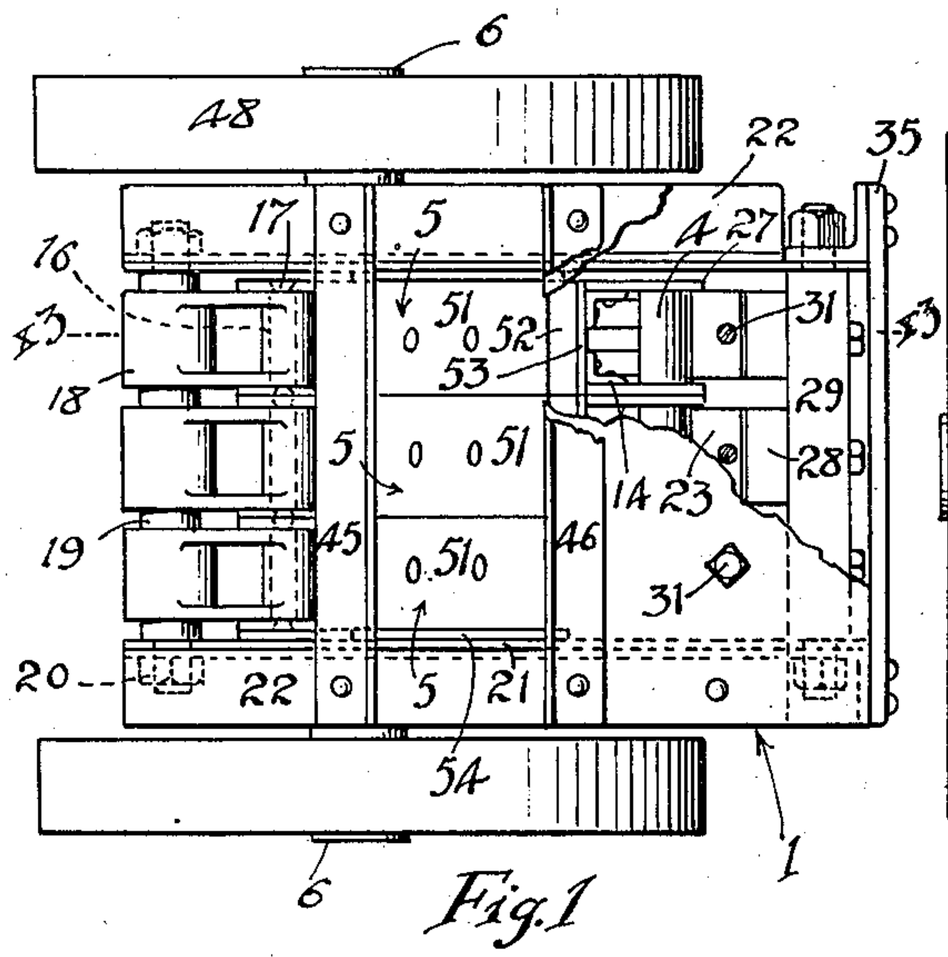

Fig. 1

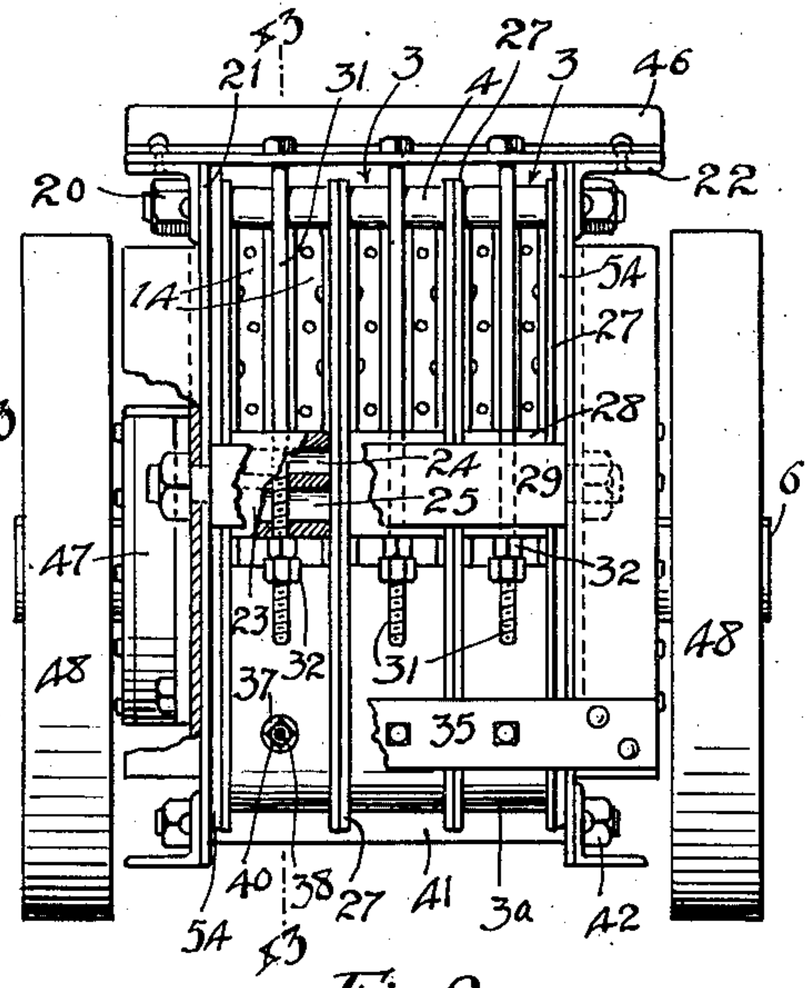

Fig. 2

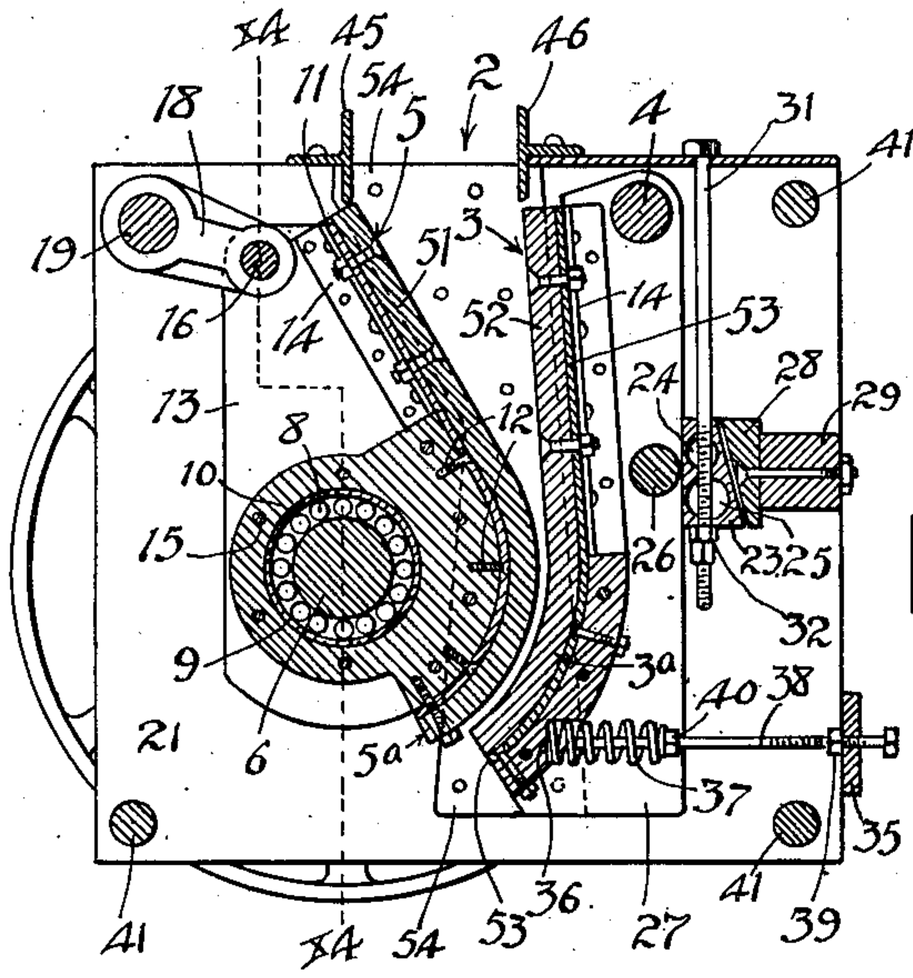

Fig. 3

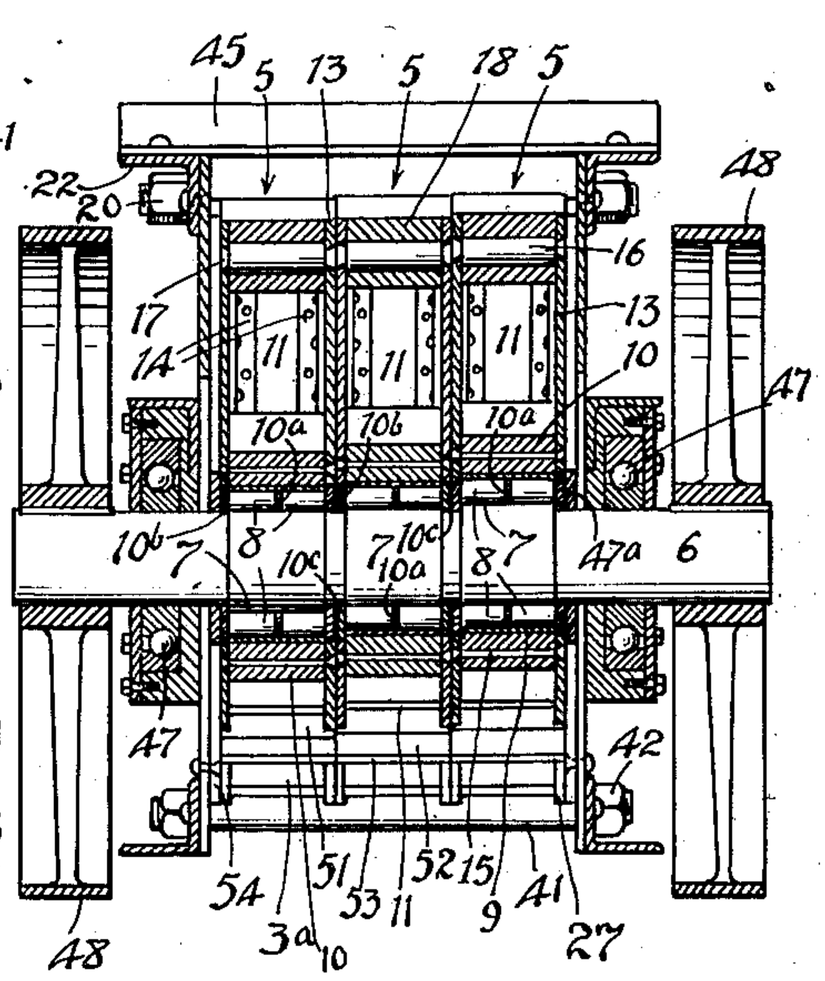

Fig. 4

Witnesses

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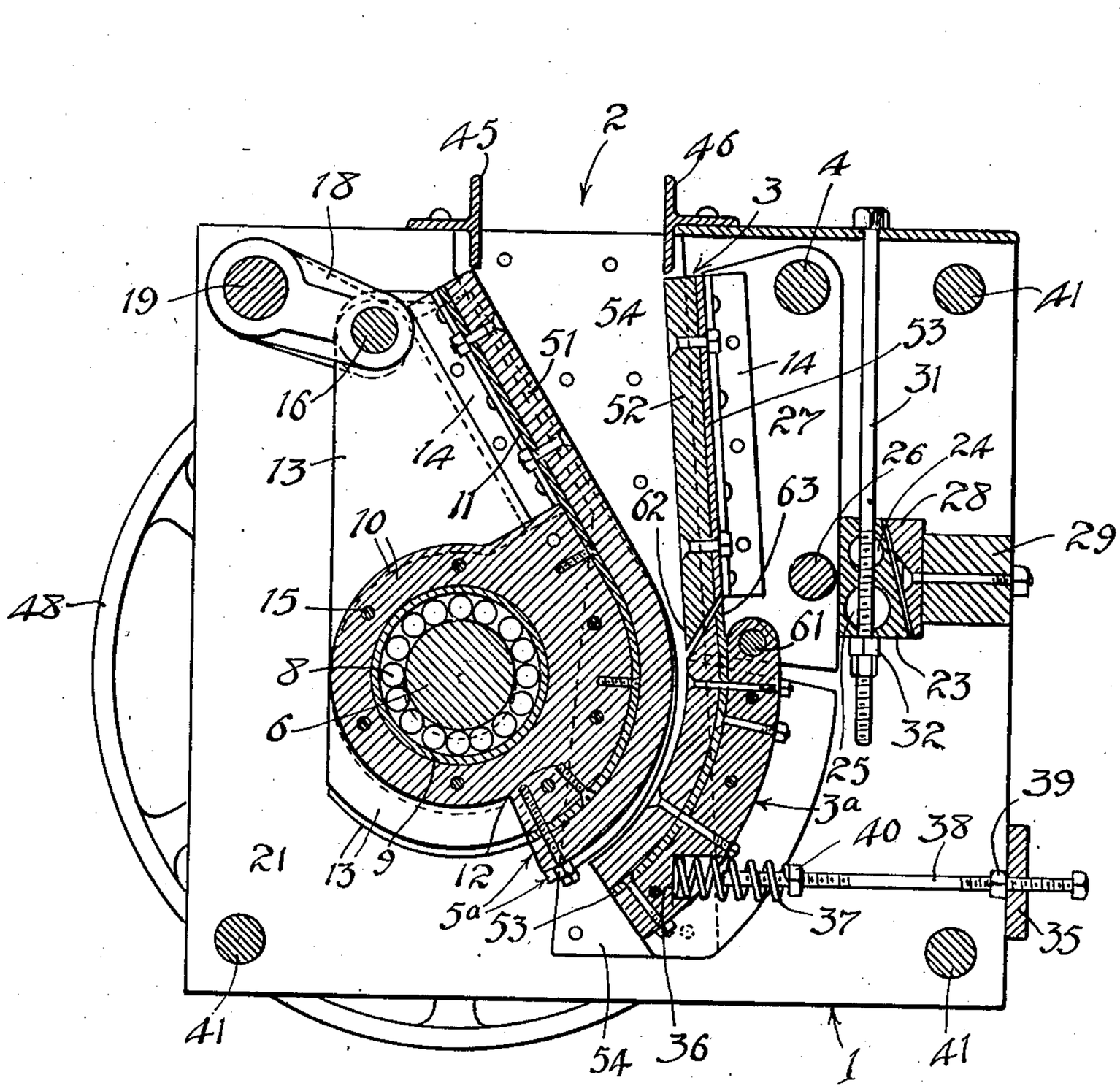

Fig. 5

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UNITED STATES PATENT OFFICE.

ROBERT S. WATT, ROBERT B. WATT, AND ARTHUR B. WATT, OF LOS ANGELES, CALIFORNIA.

ORE-CRUSHER.

No. 929,177. Specification of Letters Patent. Patented July 27, 1909.

Application filed November 27, 1908. Serial No. 464,513.

To all whom it may concern:

Be it known that we, ROBERT S. WATT, ROBERT B. WATT, and ARTHUR B. WATT, all citizens of the United States, residing at the city of Los Angeles, State of California, have invented a new and useful Ore-Crusher, of which the following is a specification.

An object of this invention is to provide an ore crusher adapted to receive ore directly from the mine in pieces of relatively large dimensions and to reduce all such ore to particles within a predetermined, relatively small size, and at the same time to reduce a large per cent. of the ore to a fine powder at the first operation.

In the application of the above-named Robert S. Watt and Robert B. Watt filed October 10, 1908, Serial Number 457,109, for patent on ore crushing and sizing apparatus, is described and claimed an ore crushing mill designed to receive ore which has first been passed through a primary crusher, and adapted to reduce the entire body of such ore to a predetermined fineness; said mill being adapted to grind to an extreme fineness, if desired.

It is more particularly the object of the present invention to provide a primary crusher adapted to reduce ore from a large size to fragments suitable for feeding to above-mentioned mill.

Another object of this invention is to provide improved means for preventing the driving shaft, or other parts expensive to replace, from being broken on account of any unbreakable substance, such as a piece of metal, being fed to the crusher.

A further object is to provide for the crusher improved construction adapted to be so operated as to prevent the machine from being choked in case an excessive amount of ore is fed thereto.

Referring to the accompanying drawings, which illustrate the invention,—Figure 1 is a plan view of the crusher. Fig. 2 is a rear elevation, partly broken. Fig. 3 is a vertical section on line x^3 of Figs. 1 and 2. Fig. 4 is a transverse section on irregular line x^4 of Fig. 3. Fig. 5 is a vertical longitudinal section of a modification.

Referring in detail to the drawings,—Upon a frame or casing 1 provided with an elongated feeding opening 2 in the top, are mounted a series of relatively stationary jaws 3. Each of said jaws 3 is pivotally supported near its upper end by a transverse shaft 4 which runs from side to side of the crusher. Each of said jaws 3 coöperates with a driven jaw 5 mounted opposite thereto. Said jaws 3 and 5 are thus mounted in pairs in position to allow the ore or rock to be fed downwardly therebetween.

In the embodiment of the invention illustrated in the drawings, the discharge ends of all of the jaws 3 and 5 are provided with a portion or section which is deflected toward the side occupied by the driven jaws.

3^a designates the deflected section of each jaw 3, and 5^a the deflected section of each of the jaws 5. Said deflected sections are preferably curved, as shown, so as to form an arc concentric with the driving shaft 6. The grinding faces throughout said deflected sections are normally in close proximity to each other when the mill is adjusted for fine grinding.

The driving shaft 6 has formed upon it an eccentric or cam 7 opposite to each driven jaw, said eccentrics being spaced around the shaft a distance apart equal to one-third of the circumference thereof in the embodiment of the invention illustrated in the drawings, but when a greater number of pairs of jaws are provided the spacing will be such as to divide the circumference of the shaft into a number of segments equal to the number of the pairs of jaws. Around each eccentric 7 are placed anti-friction rollers 8 in a series which is incased by a sleeve 9 to form a bearing within casting 10 which forms a part of each driven jaw. As described in the prior application for Letters Patent, already referred to, the anti-friction rollers 8 of each jaw are desirably separated into two sets by steel washers 10^a, and between the roller bearings of each jaw are two metal washers 10^b separated by an intervening felt washer 10^c.

To each casting 10 is fastened a backing-plate 11 by any suitable fastening means such as counter-sunk screws 12. Each of said backing plates 11 projects above the member 10 as shown in Fig. 3, thus extending to the top of the jaw.

Side-plates 13 extend from the rear side of each backing plate adjacent the side edges thereof as best shown in the broken portion of Fig. 1. 14 are angle-iron strips fitted into the angles thus formed at the rear of the backing-plates. Said strips 14 are bolted in place to fasten together the backing plates and side plates. The side plates have down-

wardly extending, widened portions which surround sleeves 9 and are riveted to the sides of the casting 10 by means of rivets 15 which extend through casting 10 and have counter-sunk heads at each side thereof.

In order to permit the driven jaws to oscillate, each of the side plates 13 thereof is, near its upper end, movably fastened to the frame. For this purpose, a shaft 16 is mounted on each of the driven jaws, said shaft being shouldered at the ends and having heads 17 riveted into counter-sunk holes in the side plates. For each driven jaw a link 18 is also provided, said link connecting each shaft 16 with a stationary shaft 19 which extends transversely across the frame. Said shaft 19 is desirably provided with reduced threaded ends which project through the side-plates 21 of the frame and also through the depending flanges of angle-irons 22 which extend across the top of the frame and are riveted thereto as shown in Figs. 1, 2 and 4.

20 are nuts screwed onto the ends of shaft 19.

Means are provided for allowing the lower portion of the jaws 3 to yield away from the driven jaws in case an unbreakable substance enters the mill, so that such an occurrence will not break the driving shaft or other important parts of the mill. Such means consists of a wedge-shaped safety block 23 cored out in any preferred manner, being shown in Fig. 3 as having an upper bore 24 and a lower bore 25 extending therethrough. Each of said safety blocks is interposed between a stay shaft 26 extending between the side plates 27 of the jaws 3, and a wedge-shaped block 28 bolted to a bar 29 which extends across the rear of the frame.

Each safety block 23 is vertically adjustable being suspended by a rod 31 from the top of the frame. Upon the lower end of said rod is a nut 32 to regulate the height of the safety block, to determine the fineness with which each pair of jaws will crush the ore.

35 is a stay-bar extending across the lower portion of the rear of the frame. The lower section 3ª of each jaw 3 is provided with a socket 36 extending into the rear side of the jaw. Into said socket is inserted one end of a heavy compression spring 37, a pilot rod 38 entering the other end of said spring. Said pilot rod is supported by stay-bar 35 through which it extends.

39 is an adjusting nut to regulate the position of rod 38 and thereby determine the compression of follower-nut 40 upon the spring 37.

41 designates stay-bars extending transversely of the frame and having threaded ends whereon nuts 42 are screwed to hold said bars to the main side plates 21 of the frame.

45 and 46 are T-bars extending across the top of the frame at each side of the feeding opening and riveted in place through angle irons 22 to strengthen the upper portion of the main frame.

The driving shaft 6 passes through ball bearings 47 at each side of the crusher.

48 are driving wheels, desirably of considerable weight to also perform the function of fly-wheels.

47ª are washers, desirably of brass, to take up the space between the side plates 21 of the frame and outer side plates 13 of the end jaws.

To each of the jaws 5 is fastened a grinding shoe 51, said shoe being secured to the plate 11 by means of bolts with counter-sunk heads.

52 designates the shoe of each jaw 3, said shoe being secured to a backing-plate 53 with which each of the jaws 3 is provided. To the inner side of each of the main side plates 21 of the crusher is fastened a cheek-plate 54 which forms an end of the hopper or feeding opening 2 and protects said side plates from wear.

In Fig. 5 is shown a modified form of the crusher in which means are provided for pivoting the deflected section of one of the jaws of a pair with relation to the upper portion of such jaw in order to provide for reducing the ore to as fine a size as desired without diminishing the extent of the feeding-opening throughout the straight portion of the jaws. Most of the parts, however, are of the same construction in Fig. 5 as in the preceding views and are therefore designated by the same reference characters except where there is a difference of construction.

In Fig. 5, 61 is a pivot-bar or bolt which pivotally suspends the deflected section 3ª of the jaw 3. The lower end of the straight portion of the shoe is provided with a ledge or lip 62 which overhangs a beveled rise 63 with which the lower section 3ª is provided at its upper end.

It will be seen that in both forms of the invention a series of crushing jaws are mounted in pairs, thus forming the front and rear sides of a hopper, and that the jaws at one side of the hopper are simultaneously operated by driving shaft 6 the eccentric portions of which are spaced circumferentially around the shaft to cause the side of the hopper formed by the driven jaws to present an uneven reciprocating surface which effectively loosens the material in the hopper, particularly if the driving shaft is rotated in a direction to move the driven jaws upwardly during the crushing movement, thus preventing clogging.

There is, during the operation of the machine, a constant pulverizing of the material into fine particles throughout the length of

the curved portion of the jaws, thorough pulverizing being effected largely by reason of the combination, with the jaws having the smooth curved grinding faces, of the powerful compression spring 37 which keeps the jaws so close together and causes so heavy a grinding pressure upon the ore as to effect the most thorough pulverizing thereof. Moreover the grinding faces being curved substantially concentric to the driving shaft causes each rotation of the driving shaft to result in a long sweep of the convexed grinding face of the driven jaw across the concave grinding face of the relatively stationary jaw. We are aware that the elements of a crusher which are being enumerated are not, separately considered, new in the art, but are not aware of any like combination thereof capable of producing the superior pulverizing effect set forth. When the driving shaft is rotated in a direction to lift the driven jaw when it approaches the other jaw, the effect is to delay the descent of the material being pulverized until it is reduced to a still finer powder.

The invention is not limited, however, to a series of crushing jaws, but includes a single pair of such jaws having the novel features set forth.

We claim:

1. In a device of the character described, a frame, a pair of crushing jaws mounted on said frame in position for ore to pass downwardly between said jaws, said jaws having a correspondingly deflected lower section, said deflected section of one of said jaws being pivotally connected with the upper portion thereof, supporting and driving means for the other jaw, and means for yieldingly holding said pivoted section toward the other jaw.

2. In a device of the character described, a frame, a pair of crushing and pulverizing jaws mounted on said frame in position for ore to pass downwardly between said jaws, one of said jaws being a driven jaw, and the other relatively stationary with relation to said driven jaw, means movably connecting the upper end of said driven jaw to said frame, a driving shaft eccentrically connected with the lower portion of said driven jaw, the lower portion of said driven jaw having a pulverizing surface curved away from said shaft, the aforesaid relatively stationary jaw having a curved lower pulverizing surface which is throughout its length normally in proximity to and substantially parallel with the curved surface of the driven jaw, means at the upper end of said relatively stationary jaw to pivotally support the same, and resilient means at the lower end of said relatively stationary jaw to yieldingly hold said curved surfaces in proximity to each other during the pulverizing operation, said curved portions having relatively smooth coöperating pulverizing faces.

3. In a device of the character described, a frame, a pair of crushing and pulverizing jaws mounted on said frame in position for ore to pass downwardly between said jaws, one of said jaws being a driven jaw and the other relatively stationary with relation to said driven jaw, a link pivotally connecting the upper end of said driven jaw to said frame, a driving shaft eccentrically connected with the lower portion of said driven jaw, the lower portion of said driven jaw having a pulverizing surface curved away from said shaft, the aforesaid relatively stationary jaw having a curved lower pulverizing surface which is throughout its length normally in proximity to and substantially parallel with the curved surface of the driven jaw, means at the upper end of said relatively stationary jaw to pivotally support the same, and resilient means at the lower end of said relatively stationary jaw to yieldingly hold said curved surfaces in proximity to each other during the pulverizing operation, said curved portions having relatively smooth coöperating pulverizing faces.

In testimony whereof we have hereunto signed our names in the presence of two subscribing witnesses at Los Angeles, California, this 21st day of November, 1908.

ROBERT S. WATT.
ROBERT B. WATT.
ARTHUR B. WATT.

Witnesses:
ALBERT H. MERRILL,
FRANK W. HOVEY.