2 Sheets—Sheet 1.

# P. W. GATES.

## Ore-Crusher.

No. 202,941. Patented April 30, 1878.

Fig 1.

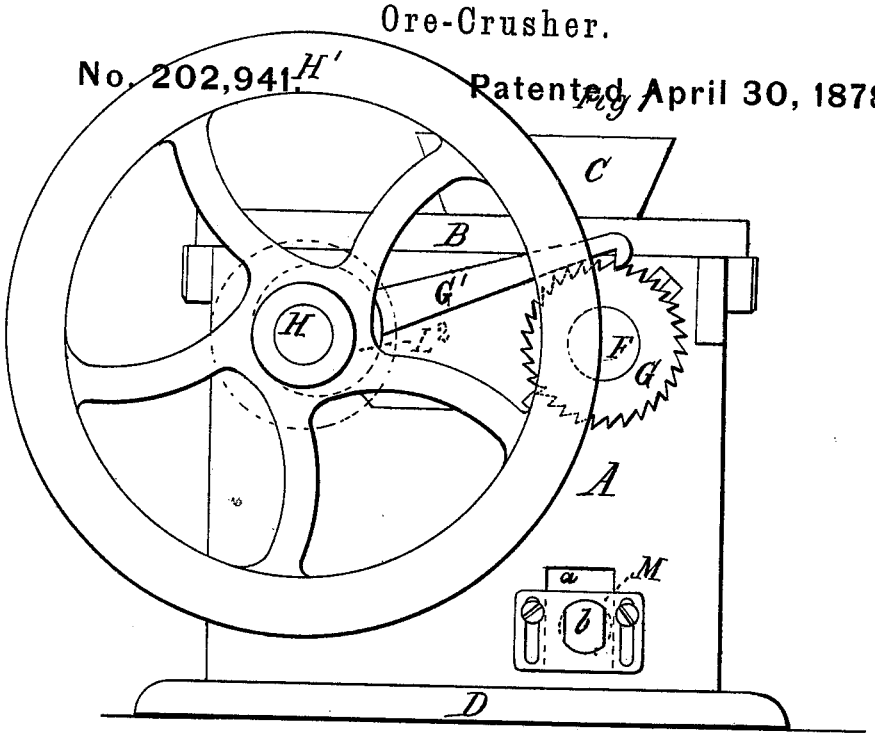
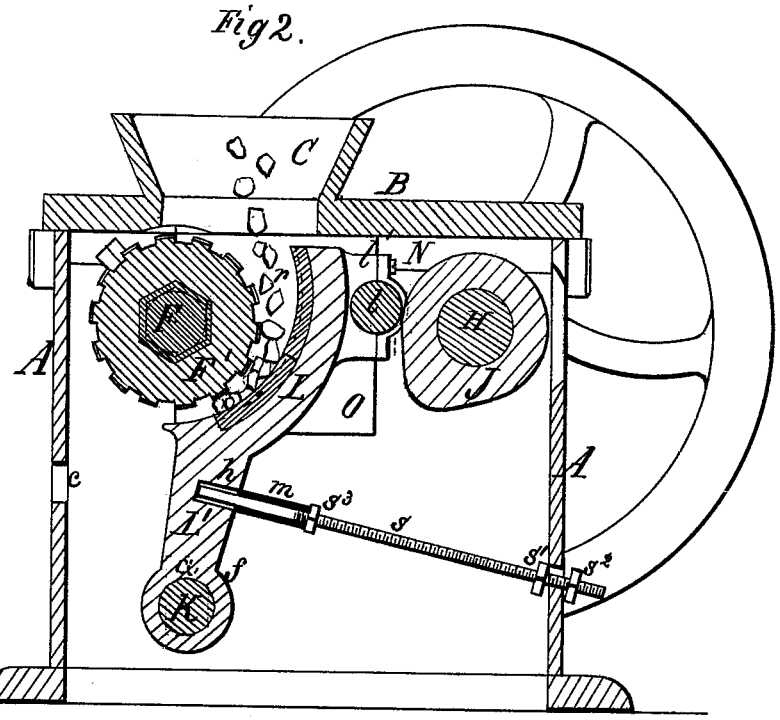



Fig 2.




Witnesses.
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by
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2 Sheets—Sheet 2.

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## Ore-Crusher.

No. 202,941. Patented April 30, 1878.

*Fig. 3.*

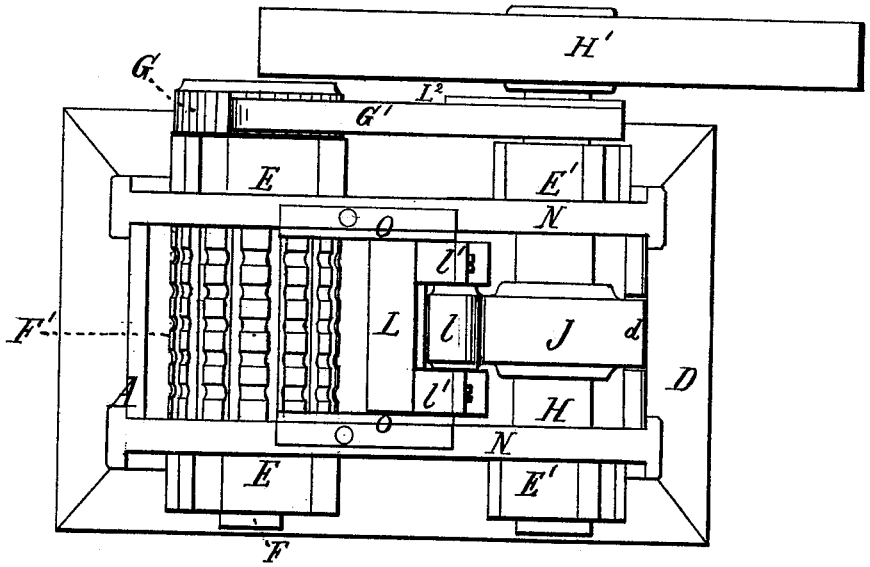



*Fig. 4.*

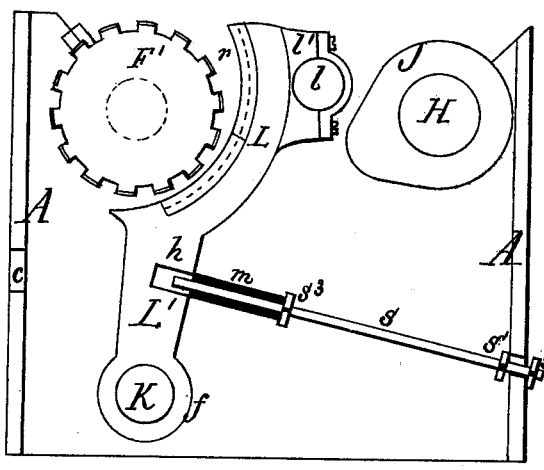
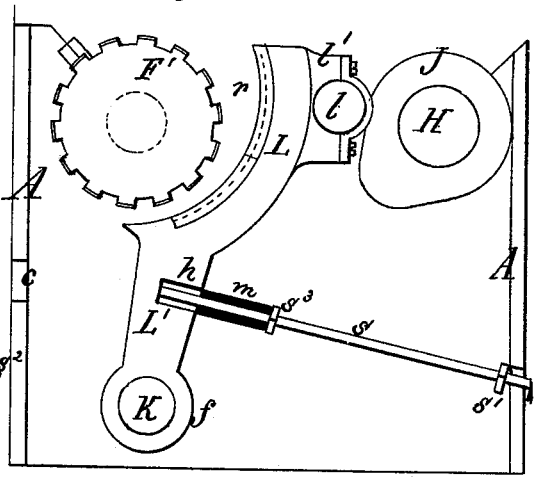



*Fig. 5.*

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# UNITED STATES PATENT OFFICE.

PHILETUS W. GATES, OF CHICAGO, ILLINOIS, ASSIGNOR TO HIMSELF, ABIGAIL E. GATES, RYERSON D. GATES, AND PHILETUS W. GATES, JR., OF SAME PLACE.

## IMPROVEMENT IN ORE-CRUSHERS.

Specification forming part of Letters Patent No. **202,941**, dated April 30, 1878; application filed November 16, 1877.

*To all whom it may concern:*

Be it known that I, PHILETUS W. GATES, of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Stone-Breaking Machines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side view of my improved stone-breaking machine. Fig. 2 is a vertical central section of the same. Fig. 3 is a top view of the same with cap and hopper removed. Fig. 4 is a sectional diagram of the machine as it appears when stone to be broken is not between its crushing-surfaces. Fig. 5 is a like diagram of the machine as it appears when stone to be broken is between its crushing-surfaces.

The nature of my invention consists in the combination of a crushing-cylinder, a vibrating crushing-jaw, a revolving cam on the driving-shaft, a ratchet-wheel on the shaft of the cylinder, and a pawl attached to the strap of an eccentric pulley on the driving-shaft, whereby the jaw has an intermitting swinging motion and the cylinder receives an intermitting revolving motion, its movement taking place when the jaw is receding from the cylinder and ceasing when the jaw is approaching the cylinder, and thus the cylinder operates, by its rotary movement, to aid in discharging the stone which has been crushed just at the proper time, and during the crushing of the stone acts as a stationary crushing device, and also a quickly-pounding action is produced upon the stone during the crushing operation.

My invention also consists in the combination, with the stone crushing or breaking and discharging cylinder, which is turned by a ratchet and pawl, and with a vibrating jaw operated by a revolving cam on the driving-shaft, of a yielding sustaining device, substantially as will be hereinafter described, which allows the vibrating jaw to come in range of and in contact with the cam when stone is between the crushing or breaking surfaces, and throws the jaw toward the crushing or breaking and discharging cylinder when the stone is not between the crushing or breaking surfaces and the machine is still running; and this combination is such that both of the devices which respectively vibrate the jaw and turn the cylinder permit the jaw to move to its normal position out of range of and contact with the cam while the cylinder is standing still.

My invention likewise consists in a vibrating stone crushing or breaking jaw and a pawl with a pitman motion, in combination with a crushing-cylinder having a ratchet-wheel on its shaft for the pawl to take into, and thereby turn the cylinder.

In the accompanying drawings, A represents a strong frame, closed in on all sides as far as practicable, and provided with a suitable removable cap, B, with a hopper, C, attached to it. This frame rests upon a strong open bed-plate, D, and is provided with journal-boxes E E for the support of the shaft F of a metal crushing-cylinder, F′, and a ratchet-wheel, G, and with similar boxes E′ E′ for the support of a driving-shaft, H, on which is a balance-wheel, H′, and a cam, J, as shown. This frame has an elongated slot, *a*, in each of its sides, for the reception of vertically-sliding bearings M, into which the flattened ends *b* of the pivot K of a metal crushing-jaw, L, are fitted, and whereby the position of the jaw in respect to the size to which the stone is to be crushed, and in respect to its operative relations to the cam J and crushing-cylinder F′, is adjusted; and in the discharging end of the frame an aperture, *c*, is formed, for a chute to fit in for conducting away the broken stone. Any other proper construction of frame may be adopted without departing from my invention.

In order to give proper strength to this frame, longitudinal tie or binding bars N are applied to it, as shown, and to these bars side shields may be fastened, for the purpose of keeping the stone from dropping sidewise from between the cylinder and jaw, and thereby clogging the operation of the machine.

In the drawings, the metal crushing-cylinder F′, which revolves, is shown as working in combination with a metal crushing-jaw, L,

which vibrates, and is of a concave form on its crushing or working face; and a cam, J, is represented as the means for forcing the jaw L toward the cylinder F′ and up to its work of breaking stone. The jaw L, as shown in the drawings, is so constructed and arranged with respect to the cylinder F′ that a space, *r*, which flares or gradually increases in size across the whole width of the jaw from the point where the broken stone is delivered to the point of receiving the stone to be broken, is formed between it and the cylinder.

The working-faces of the crushing devices (represented by F′ and L) may be constructed in any of the well-known practical ways; but I prefer to form annular grooves and ribs on the cylinder F′, and to intersect these grooves and ribs by deeper grooves, which run lengthwise of the cylinder, and thus make a breaking or crushing and discharging surface on said cylinder which presents projections or teeth, and on the jaw L to make corrugations or grooves and ribs which run from top to bottom of the concaved side of said jaw, but not across the same; and for some kinds of work or materials to be broken or crushed the concave may be smooth on its working-face, and the cylinder may be simply grooved and ribbed lengthwise. The movable jaw L is fitted loosely by its lower end *f* to the pivot K, and swings back and forth thereon, and the pivot is prevented from turning by its flattened ends *b* being held in the straight-sided bearing-blocks M on the frame A.

The size of the delivery-aperture at the lower end of the space *r*, between the crushing-surfaces represented by F′ and L, may be decreased by reversing the bearings M in the slots *a*, thereby throwing the pivot K upward and frontward, as is necessary for its proper operation. Lesser changes of position of the pivot K, for smaller differences in the sizes of the broken stone, may be quickly effected by inserting a flat bar of proper thickness under the bearings M, and thereby raising them and the jaw. Thus the sizes of the stone crushed may be varied from one-fourth to two inches in a given size machine.

At the upper end of the jaw L a metal friction-roller, *l*, is hung in journal-boxes *l′ l′*, for the cam J to impinge upon, and thereby force the jaw up to its work of crushing or breaking stone.

The friction-roller may be of steel, and it serves to prevent wear of the jaw, and when it is worn too much a new one may be supplied in its place.

On the leg L¹ of the jaw L, between its pivot K and its concave portion, a socket, *h*, is formed, into which the upper end of a bar, *s*, is loosely fitted. The bar *s* is screw-threaded, and connected to the frame A by means of a nut, $s^1$, or two nuts, $s^1$ $s^2$; and by the nut $s^1$ bearing against the frame A, it is enabled to sustain the back thrusts of the jaw, and can, at will, be moved toward or from the jaw L. Between the jaw L and a nut, $s^3$, an india-rubber or metal spring, *m*, is arranged on the bar, the jaw and nut forming abutments for the spring when it is compressed by screwing up the nut, or by the force of the stone to be crushed acting against the concave of the jaw. By means of the spring *m* and the bar *s* the jaw L is kept out of contact with the cam J at all times when the space *r* between the crushing-surfaces represented by F′ and L is not occupied with stone to be crushed or broken, and thus unnecessary wear and noise are prevented. But when said space *r* is occupied in part or wholly with stone to be broken, the elasticity of the spring *m*, in conjunction with the forward movement of the crushing-cylinder, permits the stone which is to be broken by the surfaces represented by F′ and L to force the jaw in contact with the revolving cam J, and thereby enable the cam to forcibly press the jaw up to its work of breaking stone between the said surfaces F′ and L.

On one side of the frame the fly-wheel shaft H is provided with an eccentric, L², and to the strap of the said eccentric a hooked pawl, G′, is attached, which operates the ratchet-wheel G on the cylinder-shaft F.

In manufacturing the parts of the stone-breaker described it will be found most practical to make the cam of white or chilled iron on its wearing-surface, and the cylinder F′ a cast shell of white or chilled iron, and to place this shell on a six-sided shaft, and run Babbitt metal or zinc into the space between the shaft and the shell, so as to make a solid cylinder; and to make the vibrating jaw L with a working-face of white or chilled iron, said face being constructed separate from the jaw proper and set into a recess cast in the jaw, whereby, when the lower portion of the working-face is worn out, said face may be removed and turned upside down, and thus a new wearing portion of the face brought into use, or whereby a new working-face may be substituted for a worn-out one.

Operation: The machine being set in motion, stone to be broken is introduced between the breaking and crushing surfaces through the hopper, and the pawl G′ periodically pulls the cylinder F′ around a distance equal to one of the ratchet-teeth, and causes the cylinder to force the stones against the jaw L and the jaw against the cam J. The jaw L is then forced by the revolving cam J against the now stationary cylinder, and the stones between the jaw and cylinder are crushed. The cylinder F′ now receives another forward movement, whereby it discharges the broken stone from the jaw L and forces the succeeding portion of unbroken stone against the jaw, thereby repeating the above-described operation.

A suitable chute receives the broken stone from the jaw L and conducts it to the aperture *c* outside the frame.

When the machine is running and not fed with stone, the spring *m* forces the jaw L to its normal position, (represented in Fig. 5,)

away from the cam J, and the cam in its revolutions does not strike the friction-roller *l*.

The motions of the jaw L, which are very quick and short, are regulated and assisted, as is well known, by the large balance or fly wheel H′.

One great advantage of my machine is, the cylinder remains stationary during the crushing operation, and moves to aid in discharging the stone after each of the operations of breaking the stone takes place; and, while this latter advantage is secured, the further one of having the jaw move out of contact with the cam when the stone is not between the crushing-surfaces and the machine still running is secured.

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

1. The combination of the crushing-cylinder F′, vibrating jaw L, revolving cam J, ratchet-wheel G, pawl G′, and driving-shaft H, substantially as and for the purpose described.

2. The combination of the vibrating jaw L, the pawl G′, having a pitman motion, and a crushing-cylinder, F′, having a ratchet-wheel, G, on its shaft, for the pawl to take into and turn the cylinder, substantially as described.

Witness my hand in the matter of my application for a patent for a stone-breaking machine this 2d day of June, A. D. 1877.

PHILETUS W. GATES.

Witnesses:
JOHN W. MABBS,
CHARLES ANDERSON.