(No Model.)

P. W. GATES.

Stone or Rock Breaker.

No. 243,545. **Patented June 28, 1881.**

Fig 1.

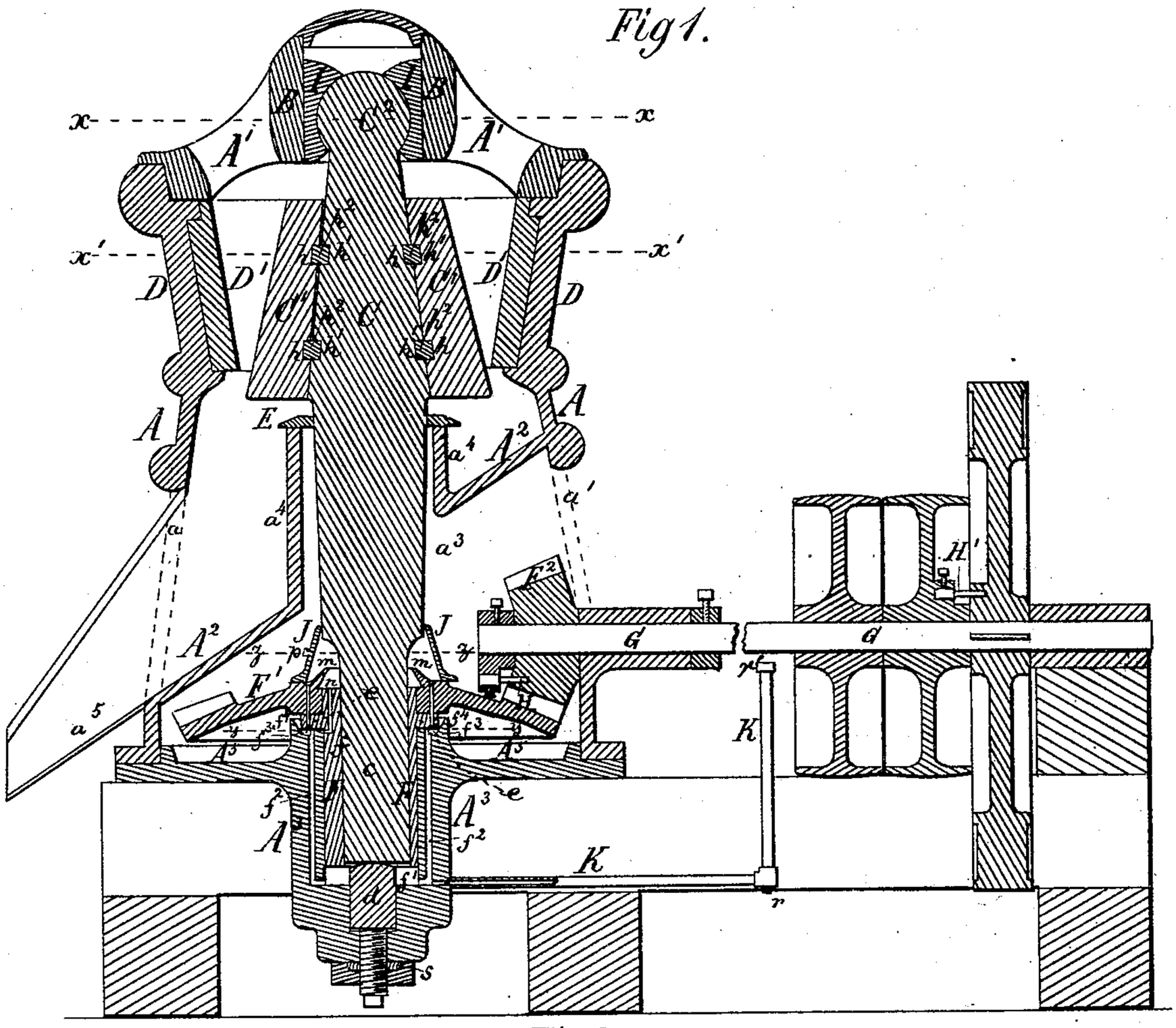


Fig 3.

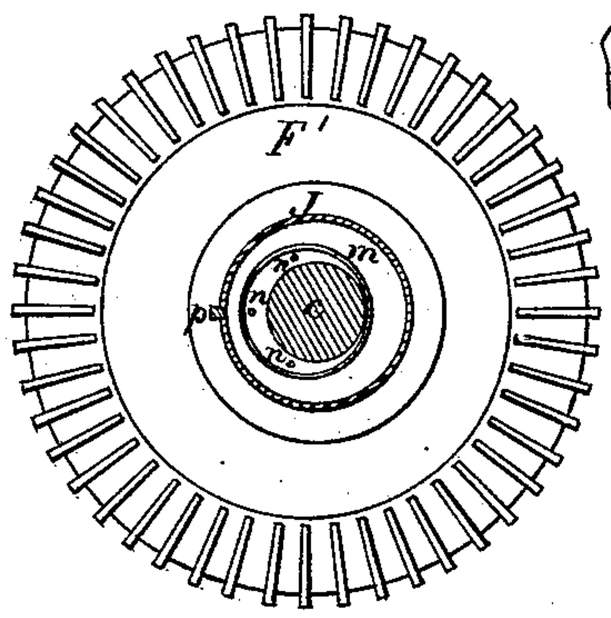


Fig 2.

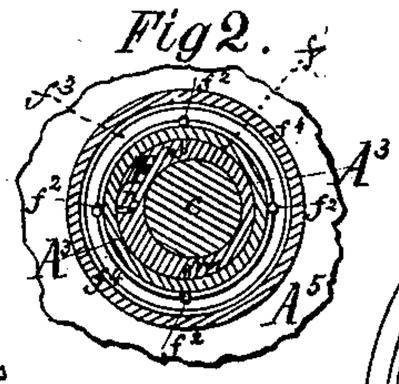


Fig 4.

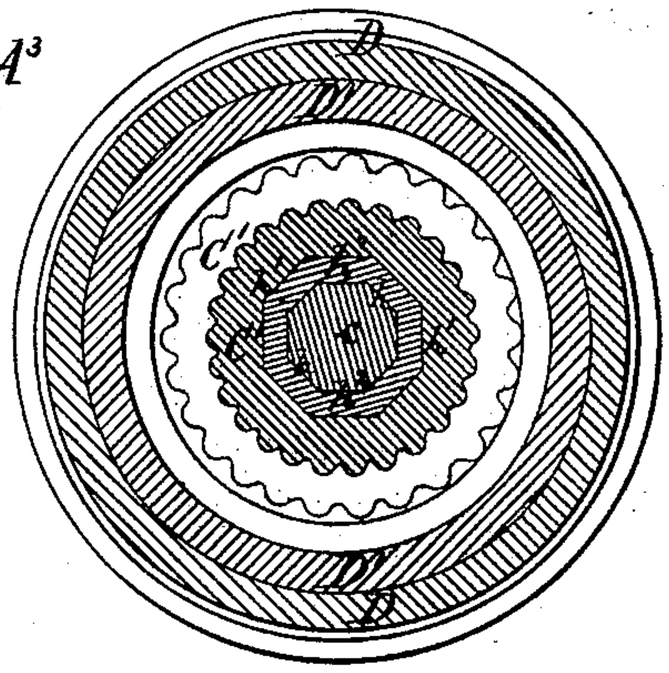
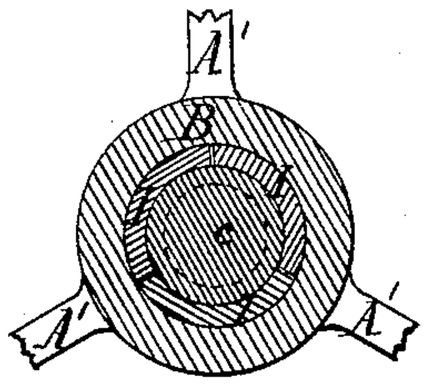


Fig 5.



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UNITED STATES PATENT OFFICE.

PHILETUS W. GATES, OF CHICAGO, ILLINOIS.

STONE OR ROCK BREAKER.

SPECIFICATION forming part of Letters Patent No. 243,545, dated June 28, 1881.

Application filed October 25, 1880. (No model.)

To all whom it may concern:

Be it known that I, PHILETUS W. GATES, 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 Machines for Breaking or Crushing Stone, Rock, and other similar substances, of which the following is a specification.

My improvements relate to that description of stone and rock breaker which employs in its construction an eccentrically-gyrating crusher-head and shaft and a flaring crushing-chamber or concave in which the said crusher-head gyrates, and also in which the stone or rock to be broken is placed and gradually broken or crushed as it descends, a machine of this description being shown in Letters Patent No. 201,646, dated March 26, 1878, issued to Charles M. Brown and assigned to me and others of the "Gates and Scoville Iron Works" of Chicago, Illinois.

My improvements consist—

First, in the novel construction, hereinafter described, of the bearing for the ball-fulcrum of the eccentrically-gyrating crusher-head and shaft.

Second, in the novel construction, hereinafter described, of the crusher-head and shaft thereof and the union of the head and shaft.

Third, in a novel application of a loose collar around the eccentrically-gyrating shaft, to prevent dirt or dust getting into the journal-bearing and into the oil-chamber, in the event of any fine particles passing by the first loose collar heretofore provided in this class of machines for preventing the broken stone or rock descending upon the gearing and other lower portions of the machine.

Fourth, in a novel combination of the outer shell of the machine, having an inclined diaphragm with a tubular guard-flange around its central opening, two loose collars—one for preventing the passage of broken stone down upon the gearing, and the other for excluding stone-dust and fine particles of dirt from the oil-chamber—the eccentrically-gyrating shaft, and its journal-bearing, the supporting and oil chamber having oil passages and channel.

Fifth, in a novel combination of means whereby the lower bearing and the journal of the gyrating shaft are lubricated, these means being such that the oil, after descending along the shaft to the step of the shaft, rises again outside of the bearing of the shaft to the flange of said bearing, and is then, by the centrifugal force of said flange, caused to pass out into a channel which is in communication with passages connecting with the oil-chamber, and from said channel it is allowed to flow downward into the oil-chamber to the step of the shaft, and thus a perfect and continuous circulation of the oil beneath the flange of the journal-bearing, as well as over other parts of the machine requiring lubrication, is kept up so long as oil is properly supplied to the oil-chamber.

Sixth, in a novel combination of an oil-pipe provided with a plug at its elbow and a cap or plug at its top, with means for effecting the lubrication of the journal-bearing and the journal of the shaft, whereby the oil in the chamber can be, when it becomes too thick from long use, drawn off through the aperture at the elbow of the pipe, or whereby the chamber can be cleaned by pouring hot water into it and setting the crusher-shaft in motion. The water, by flowing through the machine and passing out at the top of the pipe, will force the dirty oil and particles of matter out of the chamber and pipe, and then, if desired, new oil can be supplied to the chamber through the capped end of the pipe. The pipe also will serve as an indicator of the condition of the oil in the machine, for by taking off the cap the fact whether the oil fed in at the top of the journal-bearing is freely circulating will be made known, for as the oil is supplied a portion of it will rise in the tube. The proper oiling of a machine which is designed to run at a speed of one hundred and sixty revolutions per minute and to break or crush eight tons of stone or rock per hour is a matter of vital importance, and this result, it is believed, has been effected by the means described.

Seventh, in a novel flange formed on the gear-wheel and around the eccentrically-gyrating shaft, so as to overhang the open end of the supporting and oil chamber and the open end of the journal-bearing.

Eighth, in the combination of the revolving journal-bearing of the shaft, provided with a

flange and oil-passages, and the supporting and oil chamber of the said journal-bearing, and the shaft provided with a guard-flange on its upper edge. By means of the flange on the gear-wheel the lubricating material is kept from being thrown out by centrifugal force and wasted before it had time to pass down to its proper place, and by means of the flange on the supporting-chamber the oil is, when thrown out by centrifugal force beneath the flange of the journal-bearing, arrested and turned back into the channel at the base of said flange, and compelled to flow back into the oil-chamber at the bottom of the supporting-chamber of the journal-bearing and journal of the shaft.

In the accompanying drawings, Figure 1 is a vertical central section of a stone or rock breaker with my improvements embodied therein. Fig. 2 is a horizontal section of the same in the line *y y* of Fig. 1. Fig. 3 is a horizontal section in the line *z z* of Fig. 1. Fig. 4 is a horizontal section in the line *x' x'* of Fig. 1, and Fig. 5 is a section in the line *x x* of Fig. 1.

Similar letters of reference in the several figures refer to like parts.

A represents an upright circular shell, with an opening, *a*, at one side for the discharge of the broken stone or rock, and another opening, *a'*, on the opposite side to allow ready access to the mechanism within the lower part of the shell. The upper part of this shell is provided with an open arched-shaped cap, A', which serves as a strong support for the ball-fulcrum bearing-box B of the shaft C and crusher-head C'. Just below the bearing-box B the shell is made with a downwardly inwardly tapering form, and this tapering portion D serves for supporting the crushing-surfaces D' of the crushing-chamber or concave in which the crusher-head C' operates. Below the crusher-head C' the shell A is provided with an inclined diaphragm, A^2, having a central passage, a^3, through it, around which passage a tubular flange, a^4, is formed, and this flange extends upward a proper distance, as shown. The diaphragm forms an internal chute for conducting the broken stone or rock out of the machine upon the outside chute, a^5, and the flange a^4 of this diaphragm acts as a guard all around the passage a^3, to prevent the fragments of stone passing down through the passage upon the gearing of the machine as they fall from between the crushing-surfaces of the machine. A lower portion of the shaft C extends down through the central passage of the annular inclined diaphragm A^2, and the journal *c* on said portion of the shaft enters the journal-bearing F, which is within the supporting-chamber A^3. The supporting-chamber A^3 is a portion of the bed-plate A^5, and it is provided with a step, *d*, at its bottom, upon which the journal *c* of the shaft C rests, as shown.

Around the shaft C and resting upon the flange a^4 is a loose collar, E, which serves for preventing small particles of broken stone descending between the shaft C and tubular flange a^4. The bearing F has an eccentric bore, *f*, through it for the journal *c* of the shaft C to fit into. This bearing is provided with a broad horizontal flange, *e*, which rests upon the upper edge of the supporting-chamber A^3 of the bed-plate A^5, and by this flange the said bearing is firmly riveted to the bevel or other toothed gear wheel F', as shown.

G is a shaft carrying a toothed wheel, F^2, which gears with the wheel F' and thereby revolves the eccentric bearing F and causes it to gyrate the shaft C and crusher-head C'.

The crushing-machine thus far described by letters of reference is, in general arrangement and operation, substantially the same as the patented machine of Charles M. Brown, hereinbefore referred to, excepting that an improved form and construction are given to the outer shell, A, and a flange, a^4, and loose collar E are provided for more effectually preventing the broken stone from passing down upon the gearing of the machine, which improved form and construction of shell A, together with the flange a^4 and loose collar E, and also the safety break-pin devices shown at H and H', are substantially the same as shown in an application for a patent filed by me on February 17, 1879. Therefore none of these things are intended to be claimed here otherwise than as they may be combined with other parts not shown in aforesaid patent of Brown and my aforesaid application for a patent.

My present improvements I will now describe as follows:

The ball fulcrum-bearing I, which is fitted in bearing-box B, is formed of three segmental pieces with chords of equal length. These pieces are cylindrical on their outer bearing-surfaces, and are of a partly-spherical form on their inner bearing-surfaces. They are cast on a metal ball and thereby chilled as well as finished in the casting process. The chilling of the pieces prevents rapid wearing away. Heretofore this bearing has been made of a great number of parts and of soft metal, in order to be easily turned to fit the fulcrum-ball C^2 of the shaft C, and in connection with the numerous parts set-screws were provided for keeping them in position and adjusting them. This old mode of construction with a ball, C^2, on its upper end did not give a durable and strong bearing. The parts being too light were liable to breakage, and it was very expensive to manufacture the bearing of so many pieces and to turn them true with respect to the ball-fulcrum. My improvement in the fulcrum ball-bearing I has been found to be substantially right for practical use, and it effects a great saving in the getting up and use of stone-breakers.

The crushing-surface D' of the concave or crushing-chamber is cast in a chill, and the crusher-head C' is also cast in a chill and made of white metal. In the eye of this head grooves

h are formed, and around the shaft at points opposite the grooves *h* corresponding grooves *h'* are provided. Suitable holes for flowing melted iron or other metal and for the escape of air are to be provided in connection with the grooves *h h'*. By this construction provision is made for flowing melted metal into the grooves *h h'* for uniting the parts C and C' together after the head C' has been properly placed around the shaft C, and thus the head and shaft can be held firmly together, and the head cannot slip up or down when subjected to great strain, it being held by the metal ring-fastenings h^2 formed of the metal flowed into the grooves *h h'*, as shown. This is a very essential improvement, as the practical working of the machine depends upon the durability and rigidity of its crushing-surfaces, and it being important to have a forged wrought metal shaft without making the crusher-head and shaft of homogeneous metal, the great utility of the cast chilled white-metal head, and the effective mode of uniting the head and shaft will be readily seen.

The supporting-chamber A^3 for the journal-bearing F and journal *c* of the shaft C is made to form an oil-chamber, *f'*, below the journal *c* and journal-bearing F. From the chamber *f'* vertical oil-passages f^2 extend upward through the wall of chamber A^3, and at the upper terminus of these passages a circular channel, f^3, is formed in the wall of the chamber A^3, and this channel intersects and communicates with the passages f^2. Outside and all around this channel a deep flange, f^4, is provided on the upper wall of chamber A^3, and it prevents oil being discharged by centrifugal force outside the chamber A^3.

Through the upper part of the journal bearing F angular oil-passages *n* are provided, said passages receiving oil at the top of said box and discharging it beneath the flange *e*, as shown in the drawings.

Overhanging the passages *n*, and attached to the gear-wheel F', is a flange, *m*, which forms an oil-receiving well just above the journal-bearing F. The flange *m* acts as a guard to prevent oil being thrown outward by centrifugal force before it has passed between the parts and into the oil-chamber *f'*. At the point where the flange is applied the shaft C is reduced in diameter in order to give sufficient room for the passage of the oil into the chamber; and just above this reduced part of the shaft C a loose collar, J, is fitted around a hollowed portion of the shaft, and it is made to cover the flange *m*. This collar rests loosely upon the gear-wheel F', and it is provided with an oil-supply hole, *p*, which may be covered by a slide or cap to exclude dust. By means of the collar J all light particles of dirt and dust which may incidentally escape past the collar E are arrested and prevented from passing down into the supporting-chamber A^3 of the bearing F and shaft C.

At the bottom of the supporting-chamber A^3 an elbow-pipe, K, is applied, so as to be in communication with the oil-chamber *f'*. This pipe is provided with a screw-plug, *r*, at its elbow, and with a cap, *r'*, at its upper end.

In practice the step of the shaft C requires to be raised or lowered in order to adjust the breaker for fine or coarse breaking, as occasion requires, and in order to avoid leakage at the step packing and white lead are applied, as at *s*, and screwed tight and retained by a jam-nut.

The bearing F is preferably made of carbon bronze or steel, in order that it may work smooth and be sufficiently durable.

The safety break-pin devices at H and H' may be of metal which will break easily, and the pin may be applied upon the driving-shaft so as to either allow the pulley of the belt to turn or the gear F^2 to turn when the pin becomes broken, such result occurring whenever a crowbar or other obstruction gets between the crusher-surfaces and clogs the machine.

The lubricating-oil is supplied to the machine through the hole *p* of the loose collar J, and it flows down into the chamber *f'* by passing between the journal-bearing and journal *c* of shaft C, and also between the wall of the supporting-chamber A^3 and the outside of the journal-bearing F; and when the chamber *f'*, passages f^2, and channel f^3, and pipe K have become supplied with oil and the machine is running the revolution of the bearing F and its flange *e* will cause the oil to rise and pass up between said bearing F and the wall of the supporting-chamber A^3, and then outward beneath the flange *e* into the channel f^3, and therefrom down into the passages f^2 and oil-chamber *f'*, and in this manner the oil is caused to continuously circulate between the surfaces of the said parts, and the machine is thereby saved from too rapid wear and from undue friction, and at the same time waste of oil is prevented by the flanges f^4 and *m*; and when the cap of the oil-pipe K is opened, the fact that the oil is circulated and that a sufficient quantity is in the chamber *f'* will be made known, as the movement of the oil can be seen in the pipe K; and, also, if the oil is too thick or cloggy it can be drawn off through the passage at the elbow of the pipe, or the oil-chamber *f'* and other parts can be cleaned by removing the cap of pipe K and flowing hot water through the supporting-chamber A^3 and discharging it at the upper end of the elbow-pipe K while the machine is in motion.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a stone-breaking machine having a gyrating shaft carrying a crushing-head between its ends, and having a ball-fulcrum on its upper end, the combination of the fulcrum-ball C^2 and a chilled surface on the partly-spherical surface of the fulcrum-bearing I, the said surfaces bearing directly against each other, while the ball and bearing are sustained directly by the box of the arched cap-piece A'

of the frame of the machine, whereby the use of an adjustable intermediate wear-compensating contrivance is dispensed with, and great durability and strength are secured, substantially as described.

2. The combination of the chilled metal crusher-head C′, provided with grooves *h* of polygonal shape horizontally, the shaft C, also provided with grooves *h′*, of polygonal shape horizontally, and the fastening-rings h^2, formed of metal flowed into the grooves of the crusher-head and its shaft, substantially as and for the purpose described.

3. The combination of the shaft C, bearing F, chamber A^3, wheels F′ F^2, and loose collar J, substantially as and for the purpose described.

4. The combination of the shell A, loose collar E, supporting-chamber A^3, loose collar J, eccentric journal-bearing F, and shaft C, having a crusher on its upper portion, substantially as and for the purpose described.

5. The supporting-chamber A^3, forming an oil-chamber, *f′*, and provided with passages f^2 and a channel, f^3, at top of chamber A^3, in combination with the revolving journal-bearing F, provided with a flange, *e*, and passages *n* at its upper end, which passages lead under the flange *e*, substantially as and for the purpose described.

6. The combination of pipe K, chamber A^3, having passages f^2, and chamber *f′*, bearing F, having flange *e*, and passages *n*, shaft C, and wheels F′ F^2, substantially as and for the purpose described.

7. The combination of the gear-wheel F′, provided with flange *m*, and the journal-bearing F, shaft C, chamber A^3, and wheel F^2, substantially as and for the purpose described.

8. The supporting-chamber A^3, provided with flange f^4 on its upper end, in combination with a rotating journal-bearing, F, having flange *e* and passages *n*, substantially as and for the purpose described.

PHILETUS W. GATES.

Witnesses:

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