No. 646,250. Patented Mar. 27, 1900.

M. F. WILLIAMS.

CRUSHER AND PULVERIZER.

(Application filed Sept. 2, 1898.)

(No Model.)

Fig. 1.

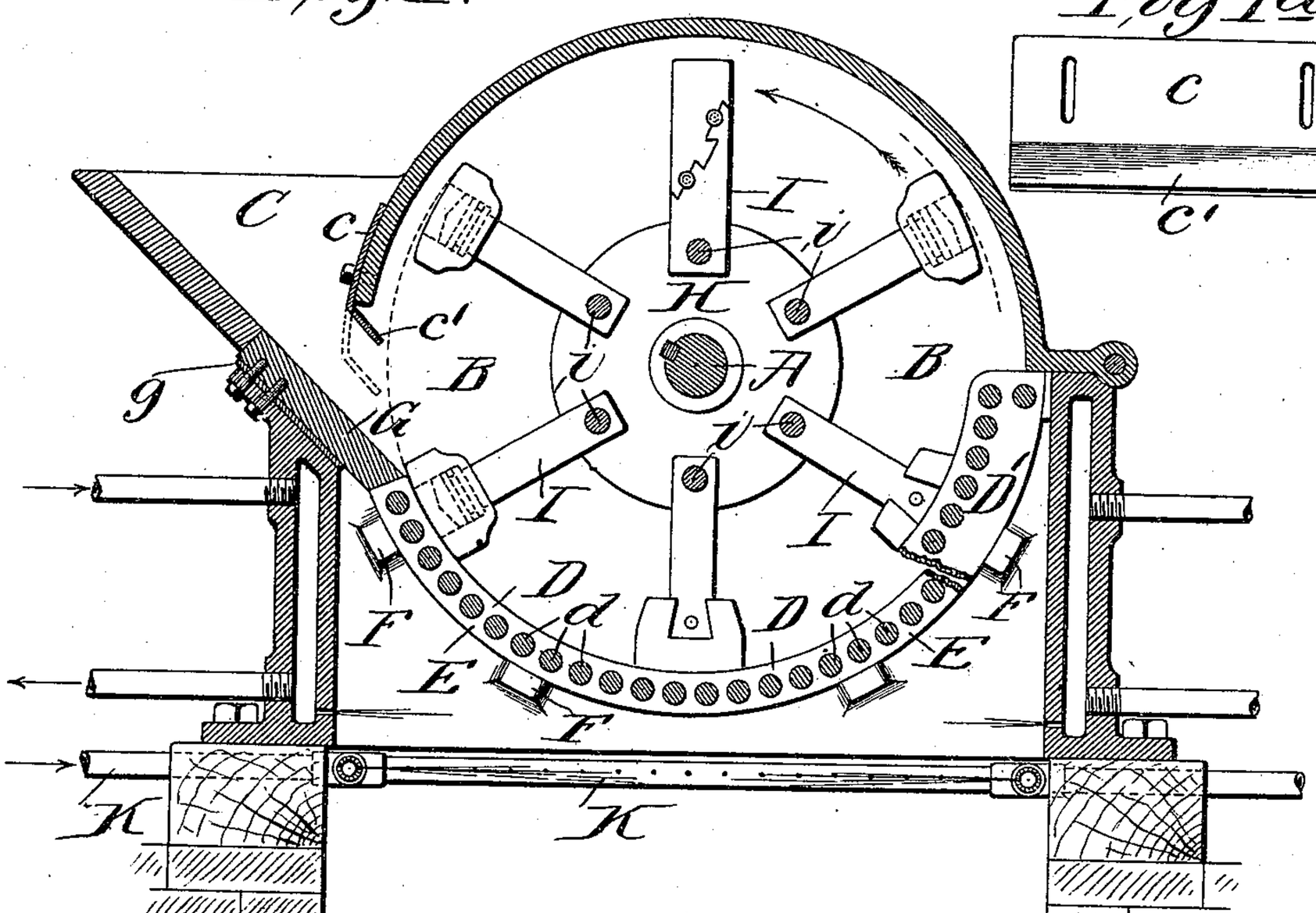


Fig. 1a

Fig. 5.

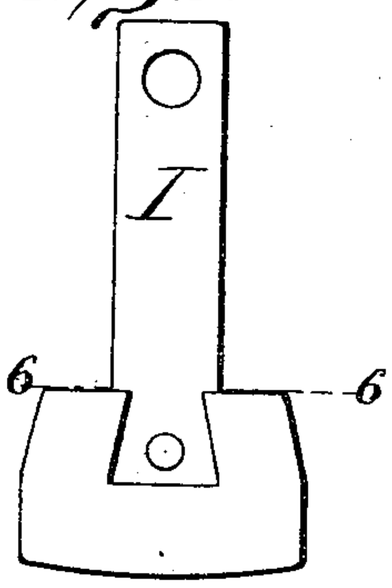


Fig. 2

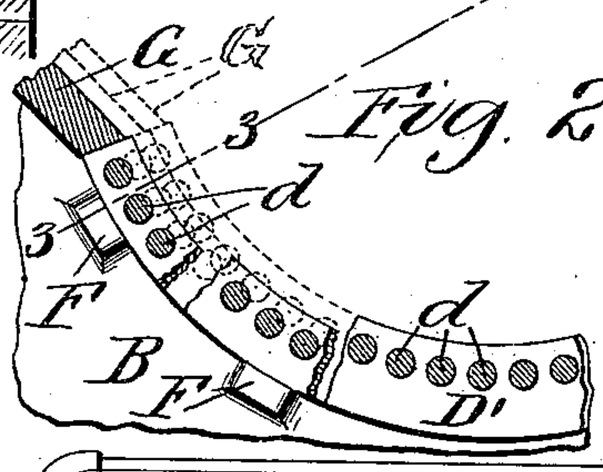


Fig. 3.

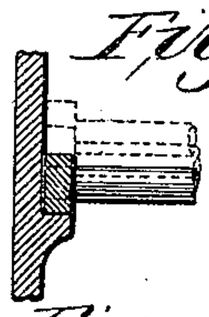


Fig. 7.

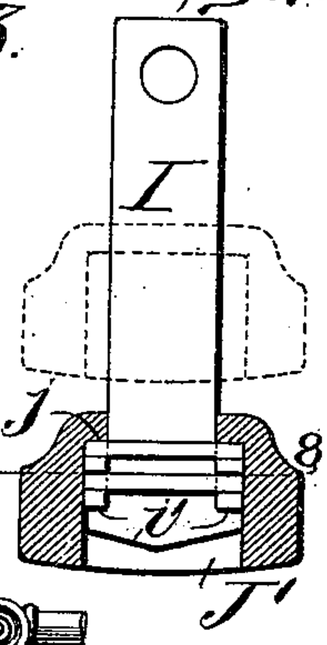


Fig. 4.

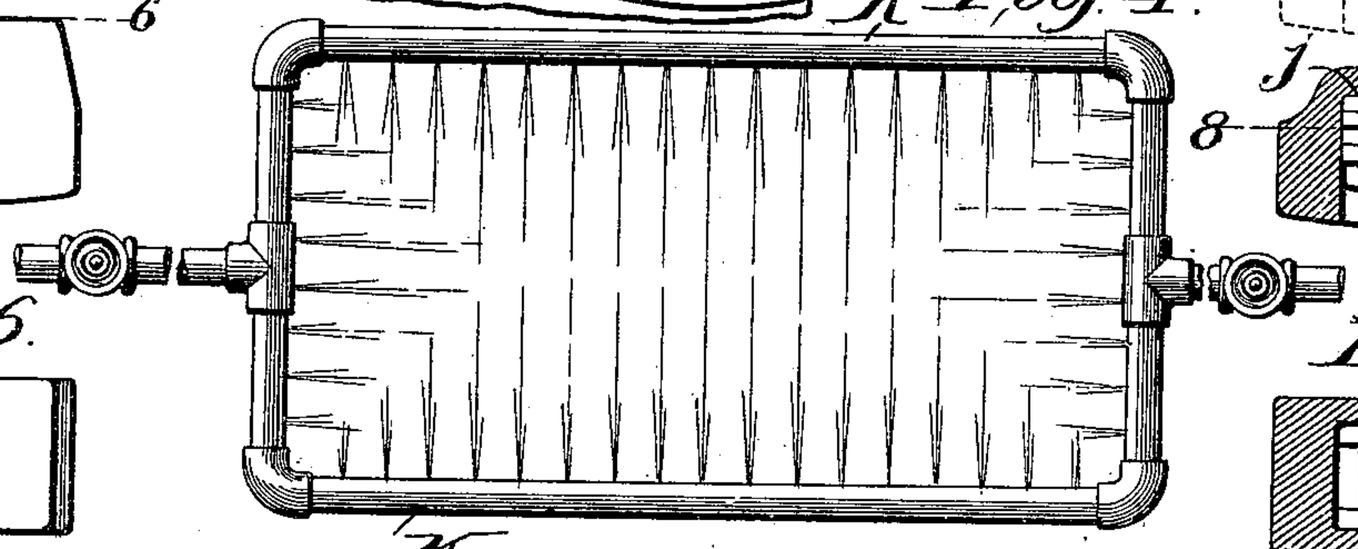


Fig. 6.

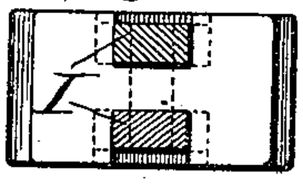


Fig. 8.

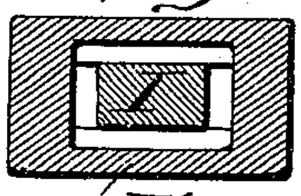
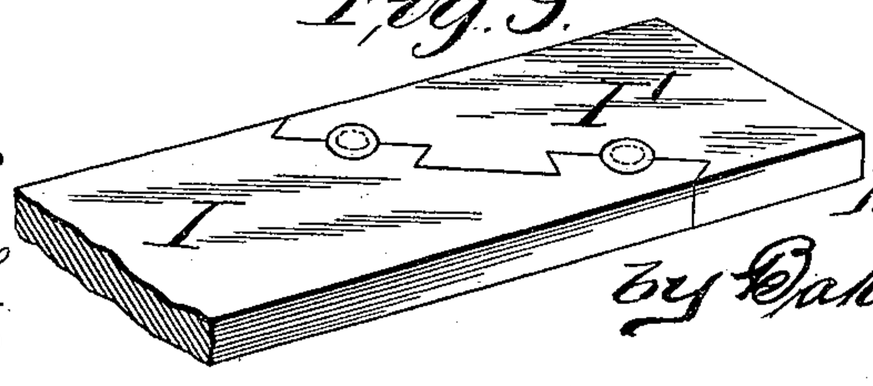


Fig. 9.



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Attys

UNITED STATES PATENT OFFICE.

MILTON F. WILLIAMS, OF ST. LOUIS, MISSOURI, ASSIGNOR TO THE WILLIAMS PATENT CRUSHER AND PULVERIZER COMPANY, OF SAME PLACE.

CRUSHER AND PULVERIZER.

SPECIFICATION forming part of Letters Patent No. 646,250, dated March 27, 1900.

Application filed September 2, 1898. Serial No. 690,072. (No model.)

To all whom it may concern:

Be it known that I, MILTON F. WILLIAMS, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Crushers and Pulverizers, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical sectional view through my machine transversely to the shaft. Fig. 1ª is a regulating-plate with an inturned deflecting-lip. Fig. 2 is a sectional view of a set of cages, illustrating their interchangeability. Fig. 3 is a sectional view of the same on line 3 3, Fig. 2. Fig. 4 is a detailed plan view of the spraying-pipes. Fig. 5 is a side elevational view of a hammer. Fig. 6 is a cross-sectional view on line 6 6, Fig. 5. Fig. 7 is a side elevational view, partly in section, of a modified form of hammer. Fig. 8 is a cross-sectional view on line 8 8, Fig. 7; and Fig. 9 is a detail perspective view showing a bar repointed.

This invention relates to a new and useful improvement in crushers and pulverizers, the object being to construct a machine of the character described in such manner that the wearing parts are adjustable, thus facilitating repointing of the hammers, which results in increasing the efficiency of the machine.

Certain features described and shown in this application are not claimed herein, claims for the same forming part of a copending application, Serial No. 652,566, filed March 22, 1897.

The features of this present invention reside in the peculiar construction of the hammer-head adjustably mounted on the hammer bar or shank, also in the novel construction of the interchangeable concentric cages and the adjustable dead-plate coöperating with the front edges of said cages, and other features reside in the novel construction, arrangement, and combination of the several parts, all as will hereinafter be described and afterward pointed out in the claims.

In the drawings, A indicates a shaft suitably mounted in casing B, which casing has a hopper C at its feed end, giving entrance by a regulated opening for the material to be crushed.

D indicates a cage, which consists of bars *d*, mounted parallel to shaft A in side rims E, concentric with the shaft A and supported on lugs or shoulders F from the sides of the casing B or otherwise. An adjustable dead-plate G coacts with the cage D and the hammers to crush the material delivered to the hopper. This dead-plate G, which is practically a continuation of the bottom of the hopper C, is inclined downwardly toward the hammers, which in their acting position tend to draw the material in, the inner edge of said dead-plate being directly adjacent to the path of the hammers, with which inner edge coöperates the cage D. This dead-plate is adjustably mounted on the front wall of the frame through the medium of liners *g*, which liners may be removed and inserted according to the radial distance of the cage-bars from the shaft or to compensate for the wear of the hammer-heads.

As previously constructed, the hammers in machines of this class have been mounted a fixed distance from the center upon a hammer-support, so that when the points become worn new hammers have to be introduced in order to render the machine efficient.

H indicates disks keyed on shaft A, between which disks are mounted bars or shanks I, a through-bolt *i* being preferably used as a pivot-rod.

The hammer-head J is the part which receives the most wear, and it may be fixed to the bar by a dovetail recess matching the outer end of the bar, which has a dovetail tenon and pin, as shown in Fig. 5. The bar I is double in this case and fits on either side of the disks H. As the head wears off first at the striking-point and tapers backward the hammer may be reversed, and for this reason the outer ends of the shanks or bars are formed symmetrically, so as to match the sockets or recesses in the heads, the longer face of the head being placed in front to serve as the striking-point of the hammer. The hammers may thus be repointed by replacing the heads, and the heads may thus be kept with

their more effective faces presented to the front. In order to facilitate this adjustment, I provide an adjustable head J′, having a socket or recess forming a shoulder *j*, adapted to engage a matching shoulder or projection *i*′ on the end of the hammer-bar, as shown in Fig. 7. A set of washers or filling-in pieces *i*″, preferably of leather or other yielding material, are inserted in the socket between the shoulders *j* and *i*′. When the head is slid inward upon the bar, as indicated by dotted lines in Fig. 7, the number of washers may be varied and the head adjusted. The centrifugal force of the flying machine will keep the heads at their outer limit on their respective bars, and the yielding nature of the leather or other packing washers will take up the shock. Other materials for packing or filling-in pieces may be used, and it is evident that by this means the length of the hammer may be radially adjusted in and out.

Either the fixed or adjustable form of head shown in Figs. 5 and 7, respectively, may be reversed to present a more effective operating face. This simple reversal of the head after it has become worn will result in an improved action of the crusher even without literally changing the reach of the hammers. By means of the adjustability of the head on the bar a fine degree of adjustment is provided. Also the hammers can be maintained at their best operative length. This adjustment and reversal of the hammer-heads proceeds as said bars are worn.

The hammer-head is preferably made of a harder and more durable material than the hammer-bar, such as cast-steel or other material suitable for being hardened. I also provide for the repointing of the bar, as indicated in Fig. 9, in which an interlocking dovetail-and-rivet connection between the bar I and its point I′ is shown. The interlocking portions are stamped or otherwise formed in the slant faces, and the rivets prevent lateral displacement of the point as mounted on the bar.

After the head is adjusted to its outermost limit a new cage D′ is inserted, which has its bars supported in a wider rim, but concentric with the center of the shaft and resting upon the same lugs in the casing, so as to replace readily the cage D and coöperate with the shorter hammers now mounted on the disks. The new cage is readily inserted by throwing back a cap or cover B′ of the casing and pulling out a cage D from the rear. The cage with the wider rim can then easily be slipped into place, as shown to the right of Fig. 1.

In Fig. 2 I have shown the concaves as concentric and prefer them located substantially concentric with the shaft. The concave cages may be arranged otherwise than concentric with the shaft if so desired, as I do not limit my invention to the form or location shown.

The bars *d* of the cage are brought successively nearer to the center by a set of cages with successively-wider rims formed in shorter radii to support the bars nearer to the center of rotation, as indicated in Fig. 2. Instead of a wider rim to support the cage having a shorter radius other supporting means may be employed. The dead-plate G is adjusted accordingly, as indicated by the dotted lines. The lower edge of the dead-plate abuts against the top of the cage, which assists in supporting the dead-plate in its new adjustment. The screws shown in Fig. 1 are slacked off to allow the inward movement of the plate as its inner end follows and preferably rests upon the end of the concave cage D′, as shown in Fig. 2. Liners *g* are then inserted to suit the adjustment of the cage and afford a firm support; but any other adjusting means may be employed.

In operating upon shale or like material in which a fine dust is produced during the crushing process I provide means for settling the dust as it comes from the cage by a spray of steam or a liquid issuing horizontally through perforations in a pipe K, forming a rectangle around the edge of the casing, as shown in Figs. 1 and 4. Inlet and outlet cocks are provided by which entrance and exit may be regulated.

In the crushing of quartz it is desirable to use liquid; but in operating upon some other materials it is desirable that dry steam be used. It will be seen that the spray is directed horizontally on all sides into the falling dust or powder from the cage, as indicated in the drawings.

At the inlet-opening in the casing surrounded by the hopper I provide an adjustable plate *c*, having an inturned lip *c*′ at its lower edge directed inward and downward, as shown in Fig. 1. The plate is adjustable by slots and bolts or otherwise, so that the opening in the casing may be varied in size according to the material operated upon, as indicated by dotted lines in Fig. 1. The inturned lip upon the edge of the regulating-plate is thus likewise carried up and down, according to the size of the opening, and is always located at the edge of the opening, whatever the size of the same may be, to prevent the exit of dust from the material being crushed within the casing.

Referring again to Fig. 1 the dead-plate G is mounted in the bottom of the hopper, preferably at the edge adjacent to the path of the hammers. The primary crushing is here produced, and the main work is performed upon this dead-plate, which also protects the bars or other devices located below the plate. The bars of the concave extend transversely to the circular motion or path of the hammers and are more or less adjacent thereto, so as thus to oppose and still further reduce the fragments of material that have passed the dead-plate. The bars are preferably round in cross-section, and the spaces between them are made according to the material to be crushed and which cannot escape until it be reduced sufficiently to pass between them.

The cage is secured in place by abutment, as shown, or otherwise. Other means than the concave of bars may be used with such dead-plate, if required; but the construction herein shown and described is preferred.

In United States Letters Patent No. 589,236, dated August 31, 1897, are shown a dead-plate, a concave cage, and pivoted hammers, which are claimed in connection with and limited by other elements not shown in this application. I desire to make the present application the parent case. A fixed lip upon the cover is also shown and claimed in said patent and also the abutment of the cage against the cover of the casing. Such fixed lip and special form of cover-abutment for the cage are therefore not claimed in the present application.

I am aware that many minor changes in the construction, arrangement, and combination of the several parts of my machine can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

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

1. In a rotary crusher, an improved hammer consisting of a shank-bar having lateral projections, a slidable head having a hole for the shank-bar, and shoulders for engaging said projections, and yielding pieces separating the opposing shoulders and projections, substantially as described.

2. A rotary crusher comprising pivoted hammers, including shank-bars adapted to be pivoted at their inner ends, and provided with lateral projections at their outer ends together with heads having sockets or recesses matching with said lateral projections, rotary hammer-supports for said hammers, and adjunctive devices adapted to operate therewith, substantially as described.

3. A crusher comprising a casing, a rotary shaft, a hammer-support secured on said shaft, hammers pivoted to said hammer-support, and consisting individually of a bar having a projection at its outer end, a head having a shoulder and slidingly mounted on said bar, and one or more interposed pieces between said shoulder and projection for adjustably limiting the outward movement of the head on the bar under centrifugal action, and opposing devices coöperating with said hammers, substantially as described.

4. In a crusher, the combination with a rotary shaft, a series of hammer-supports carried thereby, a series of hammers pivotally mounted in said supports, and adjustable to vary the distance of their outer ends from the center of said shaft, a casing, a removable concave, and supports therefor, whereby concaves of different radii may be used with said hammers, substantially as described.

5. In a crusher, a rotary hammer comprising a bar provided with a projection near its outer end, a socketed head slidingly mounted on said bar having a shoulder at the socket's inner end, and one or more interposed pieces within said socket between the opposing parts of the bar and head, allowing an adjustment of the limit of outward movement on the head of the bar, substantially as described.

6. In a rotary crusher, the combination with a rotary shaft and hammer-supports thereon, of hammers including shank-bars adapted to be pivoted at one end to said supports and provided with projections on the outer ends, and heads having sockets or recesses matching said projections in either reversed position of one with respect to the other, a casing and means in the casing coacting with the hammers for effecting the pulverization of the material, substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 27th day of August, 1898.

MILTON F. WILLIAMS.

Witnesses:

F. R. CORNWALL,

HUGH K. WAGNER