

(No Model.)

2 Sheets—Sheet 1.

M. F. WILLIAMS & E. H. FRICKEY.
CRUSHER.

No. 590,748.

Patented Sept. 28, 1897.

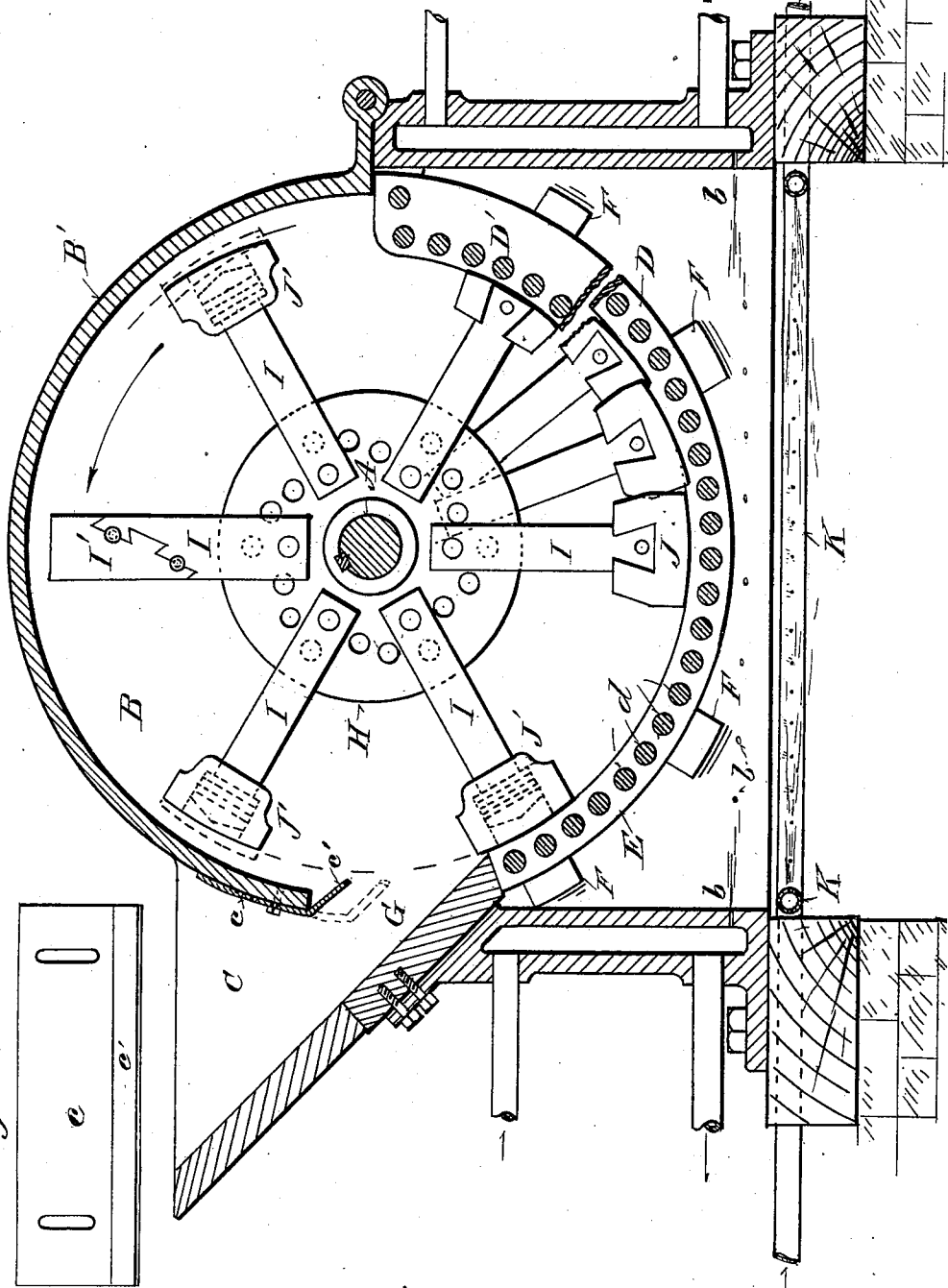


Fig. 1a.

Fig. 1.

Witnesses

B. M. Clifton
F. Forrester

Inventors

Milton F. Williams.
+ Edward H. Frickey.
By H. M. Plaisted,
their Attorney

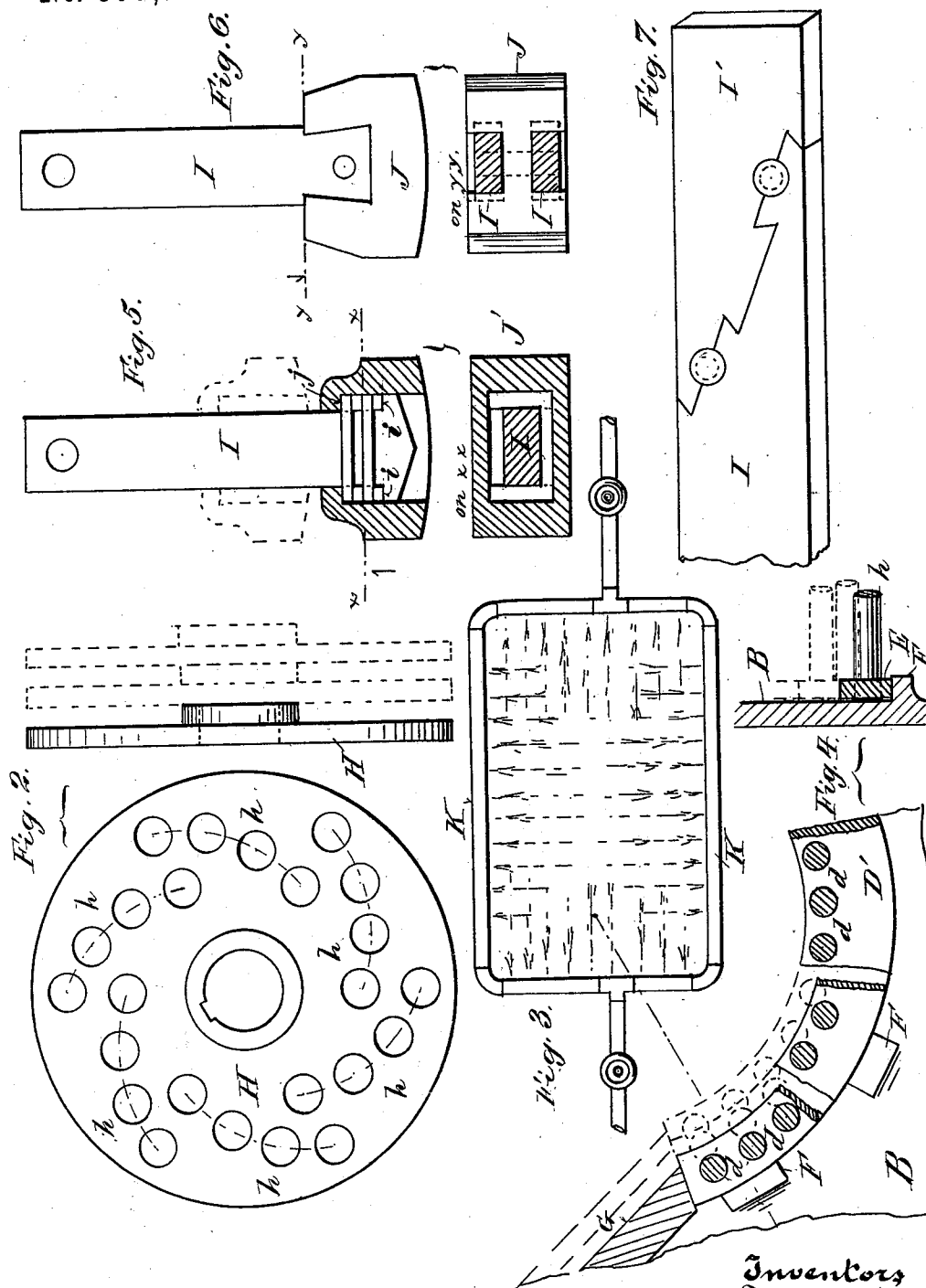
(No Model.)

2 Sheets—Sheet 2.

M. F. WILLIAMS & E. H. FRICKEY.
CRUSHER.

No. 590,748.

Patented Sept. 28, 1897.



Witnesses
B. M. Clifton
F. Forrester

Inventors
Milton F. Williams
& Edward H. Frickey
By H. M. Plaisted
their Attorney

UNITED STATES PATENT OFFICE.

MILTON F. WILLIAMS AND EDWARD H. FRICKEY, OF ST. LOUIS, MISSOURI,
ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO THE WILLIAMS
PATENT CRUSHER AND PULVERIZER COMPANY, OF SAME PLACE.

CRUSHER.

SPECIFICATION forming part of Letters Patent No. 590,748, dated September 28, 1897.

Application filed December 23, 1896. Serial No. 616,721. (No model.)

To all whom it may concern:

Be it known that we, MILTON F. WILLIAMS and EDWARD H. FRICKEY, citizens of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Crushers, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in crushers and pulverizers, and the object is to provide adjustability in the wearing parts, facilitate repointing the hammers, and increase the efficiency of the machine.

Our improvements have reference to the perforated disk or hammer-support by which the pivot-point of the hammers can be adjusted outward from the center of the shaft, have reference to a hammer-head adjusted on the hammer-bar, have reference to a set of interchangeable concentric cages, have reference to repointing the hammers, and the points of detail hereinafter described and claimed.

In the accompanying drawings, on which like reference-letters indicate corresponding parts, Figure 1 represents a vertical sectional view through our machine transversely to the shaft; Fig 1^a, a regulating-plate with an in-turned deflecting-lip; Fig. 2, a detail face and edge view of the hammer-disk; Fig. 3, a detail plan view of a spraying-pipe; Fig. 4, sectional views of a set of cages, illustrating their interchangeability; Fig. 5, a sectional detail view of an adjustable hammer-head in radial and cross section; Fig. 6, a similar view showing a fixed head and double bars; Fig. 7, a detail perspective view showing a bar itself repointed.

Our invention belongs to the class of radial crushers in which a shaft A is suitably mounted in the casing B, having a hopper C, giving entrance by a regulated opening for the material to be crushed. The bottom of the casing is formed by a cage D, 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. A dead-plate G coacts with the cage and the hammers to

crush the shale or other material delivered to the hopper.

As previously constructed, we have mounted the pivot-hammers at a fixed distance from the center upon a hammer-support. We now locate the hammer-pivots adjustably and, as a preferred construction, provide a series of holes arranged in sets *h*, which holes gradually increase in distance from the center of the shaft, as shown in the detail, in circumferentially-diverging lines. This is the preferred arrangement of the holes, as it provides sufficient metal for strength around them, yet increasing the radial distance by small degrees as the pivots are adjusted successively in the holes. Other arrangement of the holes may be employed, however. The disks are keyed or otherwise secured to the shaft side by side. Each hammer includes a bar I and a head or striking-point J, and each disk has a set of hammers adjustably pivoted thereto in the holes nearest the center, as shown in Fig. 1. As the main work is done by the hammer-heads, these points wear off, and we then move the hammers to the nearest hole in each set or series, and so on as the wear on the hammer-head increases, as shown in Fig. 1. The proper distance between the hammer-head and the dead-plate and cage in order to produce the best crushing effect is thus readily maintained.

When the hammer reaches the outer hole of the series, it may be replaced at the inner hole and the new cage D' inserted, having the bars supported in the 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 cooperate with the shorter hammers now mounted in the inner holes. The new cage is readily inserted by throwing back the cap B' of the casing and pulling out the cage D in the direction of the arrow. The cage with a wider rim may then be easily slipped into place, as shown at the right, Fig. 1.

In Fig. 3 we have shown the concaves as concentric, and prefer them located substantially concentric with the shaft. One or more of the concave cages may be arranged other-

wise than concentric with the shaft, if so desired, as we do not limit our invention to the form or location shown.

The hammer-head is the part that receives the most wear, and it may be fixed to the bar by a dovetail recess, matching the outer end of the bar, having a dovetail tenon and pin, as shown in Fig. 6. The bar I is double in this case and fits on either side of the disk plate 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 shank-bar are formed symmetrical, so as to match the sockets or recesses in the heads, whichever radial face of the head is placed in front to serve as the acting face of the hammer. The hammers may thus be repointed by replacing the heads, and the heads thus may be kept with their more effective faces presented to the front. It is in order to facilitate this adjustment of the hammer-head, and for other reasons, that we 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. 5. A set of washers or filling-in pieces, preferably of leather or other yielding material, are inserted in the socket between the shoulders i and j. When the head is slid inward upon the bar, as indicated by dotted lines in Fig. 5, the number of washers may be varied and the head adjusted. The centrifugal force of the flying hammers 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 independently or coöperating with the change of pivot location upon the perforated plate H.

Either the fixed or adjustable form of head shown in Figs. 6 and 5, respectively, may be reversed to present a more effective radial opposing face of the head instead of the shorter face and inclined end caused by the wear of the head upon the material crushed. Thus simply reversing the heads after they have become worn, as indicated, will result in an improved action of the crusher even without literally changing the reach of the hammers.

By means of the head adjustable on the bar a fine degree of adjustment is provided; also, the hammers can be maintained at their best operative length until the heads are worn enough to allow of the adjustment of the pivot-point to the next outer hole in the disk. Thus adjustment proceeds from the fine adjustment of the head upon the bar through the successive adjustment of the hammer-bar in the series of holes in the disk, and the final adjustment of the cage with a wide rim replacing the cage with a narrow

rim. The lateral projections may have a square shoulder, as in Fig. 5, or an inclined face, as in Fig. 6, or other shape and are preferably from the edges of the shank-bar.

The hammer-head is made of a harder and more durable material than the hammer-bar, such as cast-steel or other material suitable for being hardened. Thus we may provide for repointing the bar as indicated in Fig. 7, 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.

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. 4. 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 dotted lines. The lower edge of the dead-plate abuts on the cage which supports it in 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 E, as indicated in the adjustment of the dead-plate to cages of different radii shown in Fig. 4. The screws are then tightened to hold it firmly. Any other adjusting means may be employed. Any desired number of screw-bolts and holes may be used for adjustment, but two are shown in Fig. 1.

In operating upon shale or like material in which a fine dust is produced during the crushing process we provide for settling this dust as it comes from the cage by a spray of steam or other liquid issuing horizontally through perforations in a pipe K, forming a rectangle around the edge of the casing, as shown in Figs. 1 and 3. 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 should 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 we provide an adjustable plate c, having an intumed 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 on, as indicated by dotted lines in Fig. 1. The intumed lip upon the edge of this 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 of the hopper-opening, with its inner 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 the bars. The cage is secured in its place by abutment, as shown, or otherwise. Other means than the concave of bars may be used with said dead-plate, if required, but the construction herein shown and described is preferred.

We do not limit ourselves to the exact construction herein shown.

In another application on crushers by M. F. Williams, Serial No. 604,722, is 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. We have therefore made the present application the parent case and herein claim the dead-plate and cage broadly. A fixed lip upon the cover is also shown and claimed in said Williams application, 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.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A crusher comprising a casing having a hopper-opening, a rotary shaft, and hammer-supports thereon, hammers pivotally mounted in said supports, an adjustable dead-plate inclined downward toward the hammers in their acting position to draw the material in, and with its inner edge directly adjacent to the path of the hammers, and a concave cage coacting with said dead-plate to crush said material.

2. A crusher comprising a casing, a rotary shaft, a hammer-support on said shaft, having separate points of attachment for the hammers and hammers adjustably pivoted separately and independently to said hammer-support to vary the reach of said hammers.

3. A crusher comprising a casing, a rotary shaft, a hammer-support consisting of a perforated plate having sets of holes arranged

in series increasing in radial distance, and hammers adjustably pivoted in said holes.

4. In a crusher, the combination with a rotary shaft, a set of pivoted hammers and a dead-plate, of a hammer-support mounted on the shaft, consisting of a disk plate having sets of holes arranged in circumferentially-diverging lines, increasing in radial distance, for the adjustable pivot location of said hammers.

5. 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 there-with.

6. 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 radial socket forming a shoulder and slidably mounted on said bar, and one or more interposed pieces between said shoulder and projection adjustably limiting the outward movement of the head on the bar under centrifugal action, and opposing devices cooperating with said hammers.

7. 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.

8. 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 matching shoulders for said projections, and yielding pieces separating the opposing projections and shoulders substantially as described.

9. In a crusher, a rotary hammer comprising a bar provided with a projection near its outer end, a head slidably mounted on said bar by a socket-eye having a shoulder at said 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.

10. A crusher comprising a casing, a rotary shaft, a hammer-support, a series of hammers pivoted to said support at variable distances of the pivot-point from the center, and provided with heads radially adjustable, a dead-plate in said casing opposing said hammers, and a cage consisting of parallel bars concentric with the shaft and adjacent to said dead-plate, substantially as described.

11. The combination with a casing, a rotary shaft, perforated disks mounted on said

shaft and provided with holes at increasing radial distances from the center, swinging hammers each consisting of a shank-bar provided with a socket-head adjustably mounted
5 thereon, and pivoted in said holes in the perforated plates by removable pivots, a dead-plate and a barred cage mounted in the casing and coacting with said hammers, substantially as described.

10 12. 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 sup-

ports and provided with projections on the outer ends, and heads having sockets or recesses matching said projections in either re- 15
versed position of one with respect to the other, a casing, and means coacting with said hammers.

In testimony whereof we affix our signatures in presence of two witnesses.

MILTON F. WILLIAMS.
EDWARD H. FRICKEY.

Witnesses:

WILLIAM H. HAUSCHULTE,
M. JUDSON WILLIAMS.