

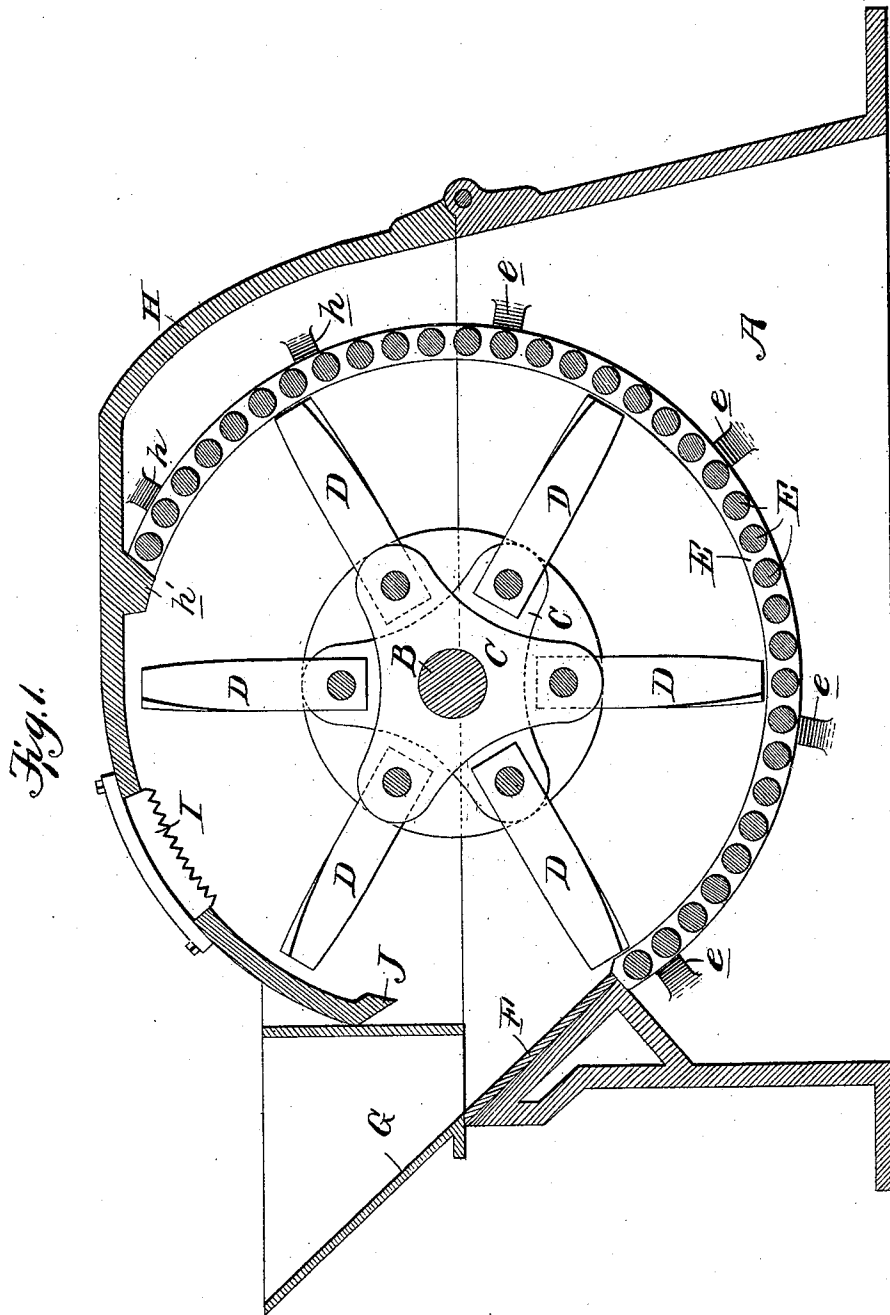
(No Model.)

2 Sheets—Sheet 1.

M. F. WILLIAMS.
CRUSHER AND PULVERIZER.

No. 589,236.

Patented Aug. 31, 1897.



Witnesses:

G. A. Pennington

F. R. Cornwall

Inventor:

Milton F. Williams,

By Paul Bakewell
his atty.

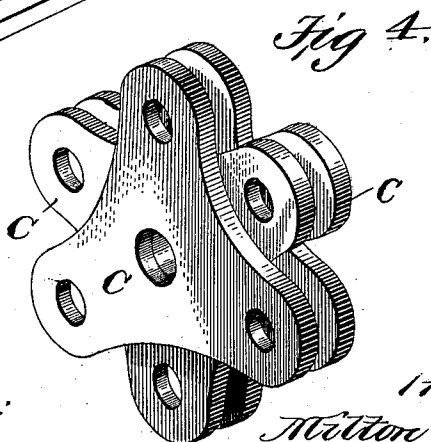
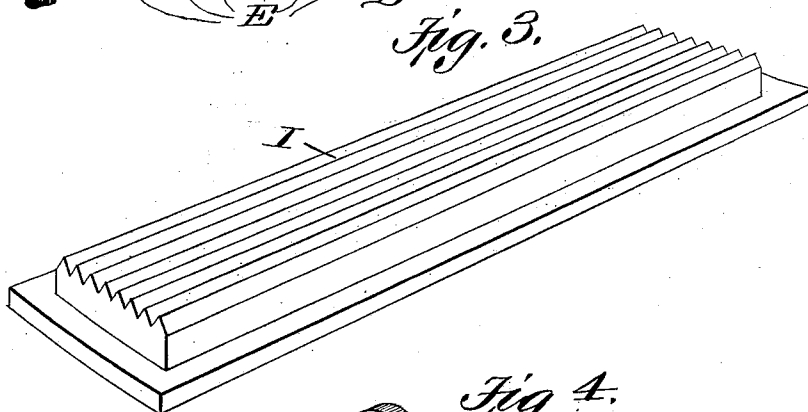
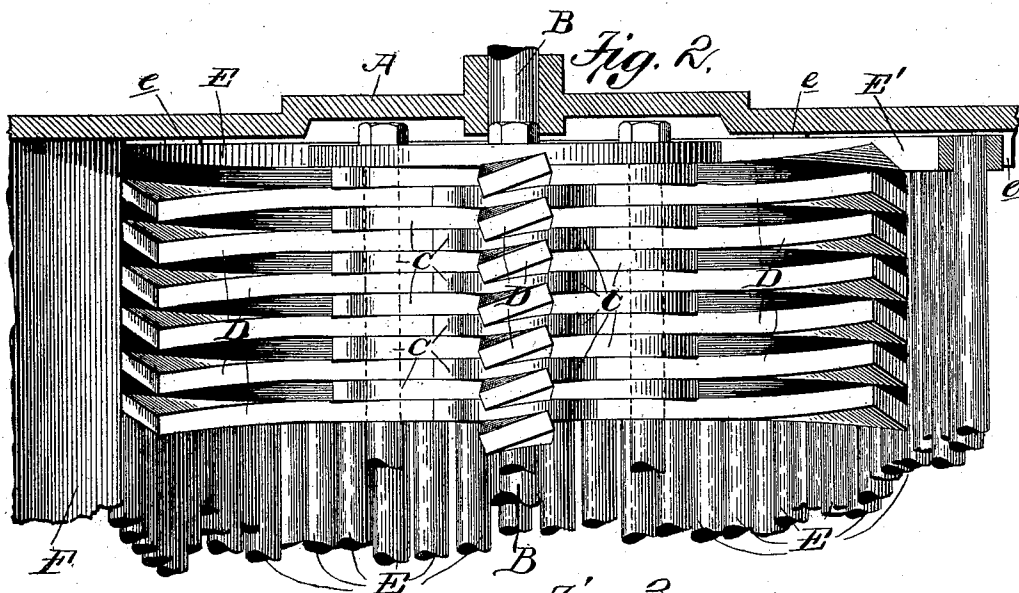
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UNITED STATES PATENT OFFICE.

MILTON F. WILLIAMS, OF ST. LOUIS, MISSOURI.

CRUSHER AND PULVERIZER.

SPECIFICATION forming part of Letters Patent No. 589,236, dated August 31, 1897.

Application filed September 3, 1896. Serial No. 604,722. (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, reference being had to the accompanying drawings, forming a part of this specification, wherein—

Figure 1 is a longitudinal vertical sectional view through my improved machine. Fig. 2 is a horizontal sectional view through the cover, showing the hammer-cylinder in plan. Fig. 3 is a detail view of the removable wear-plate. Fig. 4 is a detail view of several of the hammer-supports.

This invention relates to a new and useful improvement in crushers and pulverizers; and it consists, generally stated, in the peculiar construction of the hammers and their supports; in the provision of a removable wear-plate mounted in the cover to save the cover from wear; in the provision of an intumed lip at the front end of the cover, which deflects the circulating material inwardly and prevents its escape through the inlet, opening, and finally the invention consists in the 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 suitable frame, which is preferably open at the bottom and top, upon which frame or in which frame is journaled a suitable shaft B, which is adapted to be rotated from any suitable source of power. (Not shown.) Arranged on this shaft and within the frame is a nest of hammer-supports C, which, as shown in the drawings, are triangularly shaped, the points of the triangle in alternate supports being staggered or arranged at sixty degrees relation to one another. I have shown these hammer-supports as being triangularly shaped, but it will be understood that they could as well have four or more corners and arranged in the same way to support the hammers, in which event there would be eight or more rows of hammers disposed around the supports, or, if desired, these supports could be arranged as crossed arms at an angle of ninety

degrees relation to each other, in which event there would be four rows of hammers. By the peculiar arrangement of the hammer-supports—that is, by staggering the points—I am enabled to mount the hammers between the points or projections of alternate supports, said hammers being in line with a support which spaces the two before mentioned, such spacing-support also having mounted in its projecting corners hammers which are in line with one of the supports before mentioned.

From the above it will be seen that the hammers of one row are staggered with relation to the hammers of the adjacent row, whereby the hammers of each row have a striking area covering the entire length of the row which is equal to the length of shaft occupied by the supports. So far as I am aware this arrangement of hammers is new, as well as the peculiar manner in which the hammers are mounted to accomplish this result.

In order that the several rows of hammers will cover the entire striking area by themselves, as above described, I twist the ends as shown, when it will be seen that the angle of the twisted end is sufficient to cause it to travel in a path equal to or greater than twice the width of the hammer. In this manner said hammers cover the entire area, whereas if they were straight the combined width would cover but one-half the area.

When the twisted ends of the hammers strike the loose material in the cage, they will deflect it to one side, and if the hammers were all turned in one direction one side of the machine would be practically clear, while the other side would be banked up and would perhaps choke. To obviate this, the alternate rows of hammers are twisted in opposite directions, so that the material is caused to travel in a zigzag path along the cage. This not only prevents choking, but increases the capacity of the machine, as the more the material is subjected to friction the quicker it will be reduced to a size to pass between the bars of the cage, and as each row of hammers covers practically a continuous area across the machine the mass of material in the machine will be kept constantly in motion.

E indicates a cage arranged within the machine concentric to the path of the hammers. This cage is in such relation to the hammers

that the material is crushed between the outer ends of the hammers and the cage, the small pieces of material passing through the spaces between the bars of the cage to a suitable spout or receptacle beneath. The material which resists crushing or is of such size as to prevent its passage between the bars is carried around by the hammers, centrifugal force keeping it against the cage until it is either worn out or broken into pieces small enough to permit their passage between the cage-bars. Should the pieces be of such size as to pass between the hammers, they will be thrown from side to side until they are reduced, which will be accomplished quickly, for as soon as a piece of material passes between the hammers of one row it will remain practically stationary against the bars, and the next row of hammers being staggered relative to that between which said piece of material passes will strike said material full, and, by reason of the twist, with its advance corner. Thus it will be seen that material to be crushed and pulverized, when introduced into the machine, regardless of its high refractory properties, will be quickly reduced, the peculiar construction of the hammers and the manner in which they are mounted all contributing to this end.

The cage E comprises two side pieces E', in which the ends of the bars are supported, said side pieces being supported by lugs *e* extending from the frame of the machine.

The forward end of the cage rests under an inclined removable dead-plate F, arranged at the feed or front end of the machine, said dead-plate being located under a hopper G, into which the material to be crushed is placed when feeding it to the machine. The pivoted hammers D first break the larger pieces of material on this dead-plate and before it enters the machine, the smaller pieces being acted upon by the hammers and cage, as above described.

The machine shown in the drawings is adapted to be run at eight to sixteen hundred revolutions per minute for shale and other highly-refractory material, so it will be seen that the number of times the hammers pass the opening prohibits the entrance of very large pieces of material into the machine, said hammers tending rather to chip or disintegrate.

H indicates a cover which is hinged to the rear end of the frame, said cover extending forwardly to the hopper, so as to inclose practically the entire upper half of the machine.

This cover is provided with lugs *h*, which engage the case and strengthen the same to resist the centrifugal force of the material which acts against the cage in an outward direction.

h' indicates a rib on the cover against which the rear end of the cage abuts, said rib preventing the cage from creeping around.

I indicates a wear-plate inserted through an opening in the cover at a point where the material leaving the cage and flying in a tan-

gential line is most likely to strike. The inner face of this plate is roughened, so as to present a grinding-surface to the material, and said plate is removable, so that it may be readily and quickly replaced. By the presence of this plate the cover is saved from wear at this point, for it has been found in practice where such a plate was absent that a hole would be worn through the cover, due to the friction of the material striking thereagainst.

J indicates a lip formed or arranged in the front end of the cover and extending inwardly. The object of this lip is to deflect the air and material inwardly and cause a suction at the feed end of the machine to draw in the material from the dead-plate.

I am aware that many minor changes in the construction, arrangement, and combination of the several parts of my device 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 of the United States, is—

1. The combination with a shaft, of hammer-supports strung thereon, said supports being formed with projections, the projections of one support being staggered relative to the next adjacent support, so that the projections of every other support aline, through-bolts which pass through said projections, and hammers on said through-bolts and between the projections, said hammers being in line with the body portion of the support for the next adjacent hammer; substantially as described.

2. The combination with a shaft, of hammer-supports strung thereon, said supports being formed with radially-extending projections, the projections of every other support alining, whereby, the supports act as spacers for each other, pivot-bolts which pass through said projections and hammers mounted on said pivot-bolts between said projections; substantially as described.

3. The combination with a shaft, of hammer-supports strung thereon, said supports being formed with radially-extending projections, every other support being so arranged on the shaft that their projections aline, pivot-bolts through said alining projections, hammers strung on said pivot-bolts, said hammers being arranged in rows disposed longitudinally of the shaft, the hammers of each row being staggered relatively to the adjacent rows; substantially as described.

4. The combination with a shaft, of hammer-supports strung thereon, said supports being formed with radially-extending projections, every other support being so arranged on the shaft that their projections aline, pivot-bolts through said alining projections, hammers strung on said pivot-bolts, said hammers being arranged in rows disposed longitudinally of the shaft, the hammers of each row being staggered relatively to the adja-

cent rows; the ends of said hammers of each row being twisted, every other row being twisted in opposite directions; substantially as described.

5 5. In a crusher and pulverizer, the combination with a suitable frame, of a shaft mounted therein, a cover hinged to one side of the frame, a concentric cage comprising curved side bars, mounted in the frame, hammer-
10 supports mounted on the shaft, hammers pivotally mounted in said supports, and a removable wear-plate mounted in the hinged cover, substantially as described.

15 6. The combination with a frame, of a shaft journaled therein, hammers carried by said shaft, a concentric cage partially surrounding said hammers, a dead-plate arranged at the feed end of the machine, a hopper above said dead-plate, a cover, a wear-plate in said
20 cover in front of the upper edge of the cage, and an inturnd lip arranged on the cover above the dead-plate for deflecting the air and circulating material inwardly, whereby,

a suction is formed to draw in the material from the dead-plate; substantially as described. 25

7. In a crusher and pulverizer, the combination with a suitable frame, of a hopper arranged thereon at its front end, a dead-plate arranged beneath the hopper, a shaft jour-
30 naled in the frame, rows of pivoted hammers carried by the shaft which coöperate with the dead-plate to primarily crush the refractory material as it enters the machine, a concentric cage mounted beneath the hammers and
35 having its front end abutting against the dead-plate, and a hinged shell or cover against which the other end of the cage abuts; substantially as described.

In testimony whereof I hereunto affix my
signature, in presence of two witnesses, this
40 18th day of August, 1896.

MILTON F. WILLIAMS.

Witnesses:

F. R. CORNWALL,
HUGH K. WAGNER.