Dec. 26, 1922. 1,439,754

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CRUSHER AND PULVERIZER.
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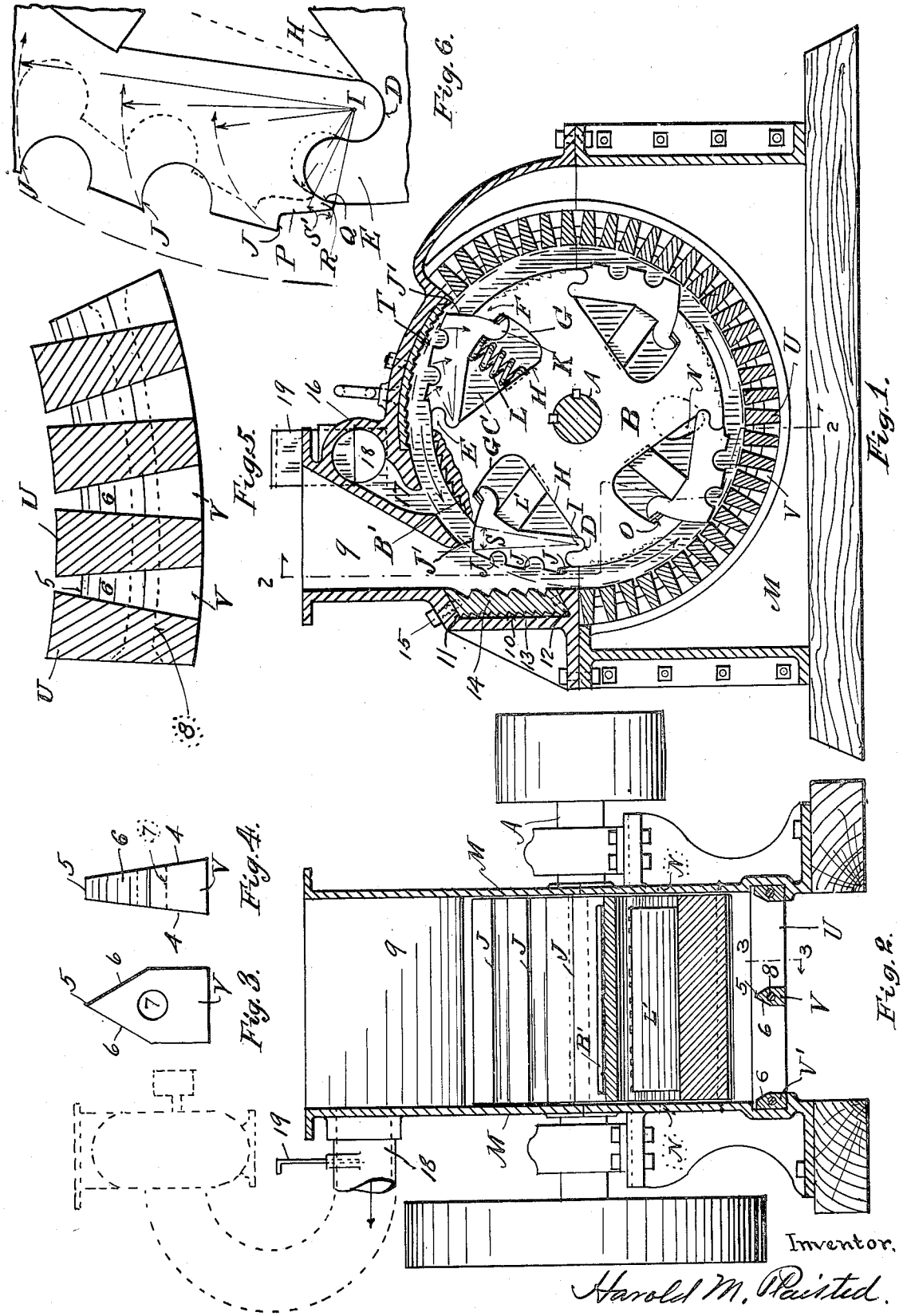

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UNITED STATES PATENT OFFICE.

HAROLD M. PLAISTED, OF ST. LOUIS, MISSOURI, ASSIGNOR TO WILLIAMS PATENT CRUSHER AND PULVERIZER COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

CRUSHER AND PULVERIZER.

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To all whom it may concern:

Be it known that I, HAROLD M. PLAISTED, a citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Crushers and Pulverizers, of which the following is a specification.

This invention relates to certain new and useful improvements in crushers and pulverizers, the peculiarities of which will be hereinafter fully described and claimed.

The main object of my invention is the provision of a rotor having hammers that are pivoted relatively near the hammer circle and extend circumferentially from their pivot (instead of radially from the center of the rotor as usual) and have a normal outward tendency so that they react inward practically radially under the resistance of the material being crushed between said hammers and a breaker plate and cage cooperating therewith; secondly, to provide a spring or other cushion for each of said hammers, so mounted and protected that it is not exposed to the material being crushed and is therefore not liable to become packed solid by the crushed material; thirdly, to provide a rotor grinding face that is practically continuous and having portions that extend beyond the main face of the rotor and are resilient, so that the said projecting portions react inward under extreme crushing resistance: and fourthly, to provide a bar cage having spacing members that allow the full length of the cage bars for grinding, and facilitate the discharge of the crushed material through the openings between the bars.

In the accompanying drawing on which like reference letters indicate corresponding parts, Fig. 1, represents a vertical sectional view across the shaft, cage and casing, and a rotor in side elevation, in a machine exemplifying my invention;

Fig. 2, a sectional elevation of the same on a plane 2—2 of Fig. 1:

Fig. 3, a face view of an enlarged detail of my spacing member for cage bars:

Fig. 4, an edge view of the same:

Fig. 5, a partial section of the cage on the plane 3—3 of Fig. 2; and Fig. 6, an enlarged side view of a portion of my pivoted hammer and its bearing.

The letter A designates the shaft of a rotor, and B the rotor head provided with multiple pockets C in the circumferential face, said pockets being separated by the interposed portions of the outer face of the head and preferably provided with corrugations B′ as shown in Fig. 1. Each pocket has a pivot bearing D at one side thereof and relatively near the outer face of the head, and separated from said face by a retaining lip E, Fig. 6. The opposite side of each pocket has a shoulder F, Fig. 1, projecting from the side wall G, which wall curves radially inward toward the shaft A and is connected by a wall H to the pivot bearing first named.

A corresponding number of pivoted hammers are mounted in said pockets, each hammer having a semi-cylindrical pivot end I adapted to fit the similar bearing D, and having a grinding surface preferably provided with fluted corrugations J, which project successively further outward from the circumferential face of the rotor head as the grinding face of each hammer extends circumferentially from the pivot towards the opposite side of the pocket. The hammer thus closes the pocket in which it is mounted, the opposite end of the hammer being formed on an arc J′ struck from the center of the pivot. The shoulder F is curved on its face to match the end J′ of the hammer, so as to slidingly engage the curved face J′ and retain the pivot in its bearing. The face J′ ends in a lip K at the inner end, which opposes the shoulder F as the hammer swings outward under the centrifugal force of rotation. It is preferred however, to increase the outward tendency and reaction on the material being crushed, by mounting a spring L, or other resilient cushion, in the interior chamber between the wall H and the underside of the hammer next to the lip K. A recess in the wall H receives the end of the spring or cushion to hold it in position. When a rubber cushion L′ is used for the resilient means, the

length of the cushion is shorter than the space between the sides of the casing as shown in Fig. 2, to allow for expansion of the rubber under compression. The rotor head fits closely between the sides M of the casing and the pockets C are thus closed at the sides and with the hammers closing the space between the pivot bearing and the shoulder F, very little finely crushed material can enter the chamber. To discharge this material I provide an aperture N, in each side of the casing below the shaft and in the path of the pockets, through which aperture any such material readily finds exit.

Between the shoulder F and the hammer lip K, I provide strips O, or other means for adjusting the outward projection of the hammer, and these strips or other means can be manipulated through the same apertures N, as the strips lie at the same radial distance from the shaft A as the aperture N and being carried by the rotor, the strips rotatably pass said apertures in the casing and are thus accessible for adjustment and variation.

The pivot end of the hammer is preferably provided with a guarding flange P adjacent the retaining lip E, and said lip has a portion of its outer face Q, formed in an arc about the center of the pivot I, and said flange has a matching curved face R. The length of this arc corresponds to the same angle S Fig. 1, as the angle S′ Fig. 6, where the inward movement of the hammer, indicated by dotted lines, shows that the guarding flange does not leave an opening at the retaining lip in operation. The material is kept out of the pivot bearing by this guard flange.

A continuous grinding face with portions projecting and forming hammers that react radially, is thus formed, and the hammer circle T passes through the outer end of each hammer. When the hammer wears down, it can be adjusted further outward by removing one or more of the strips O between the hammer lip and limit shoulder of each pocket.

A bar cage preferably used with this rotor head, comprises bars U the inner face of which are wider than the outer face, and the opening between the bars is narrower at the inner than the outer face of the bars. To separate these bars, spacing members V are used consisting of pieces having slanting faces 4, matching opposing faces of the bars and having at the upper end 5, a point or transverse ridge with deflecting surfaces 6 extending transversely across the opening between the bars and forming a sharp intersection or transverse ridge at the top of the pieces substantially at right angles to the bars. The point 5 is mounted further outward radially than the inner faces of the bars, so that the full effective length of the bars between the casing sides is available for grinding. The deflecting surfaces 6 direct the crushed material from the spacing members and prevents its lodging thereon. The point 5 located below the inner face of the bar, will allow of the cage bars wearing without affecting the point 5. In each spacer preferably, is a hole 7 matching with a similar hole in each bar U when mounted as shown, and through this opening a supporting member, such as a rivet bolt 8, Fig. 5, passes, and connects a series of bars, and supports intervening spacing members. The bar ends have spacers V′ beveled on one side only, and supported and connected by similar rivet bolts.

A hopper inlet 9 for the casing of this machine is provided, and just below the discharge end of said hopper is a recess 10, having sides formed by the walls M, and top and bottom walls 11 and 12 inclined to a back wall 13, so as to receive a breaker plate 14 having similar inclined top and bottom faces to match those of the recess, and having an opening in each inclined face to be engaged by a cap screw 15, or other means to hold the plate in place at the top while the inclined face 12 holds the bottom of the breaker plate, whichever operative face is exposed; one operative face of the plate is corrugated larger than the opposite face, or in a different manner, so that when mounted in the recess 10 a corresponding grinding effect may be obtained by using either face in connection with the rotor.

The casing of the machine also has a curved wall 16 Fig. 1, adjacent to the hopper 9, that forms a chamber provided with a passage 17, tapering downward in front of the hopper and communicating with the rotor chamber near the inner end of the hopper and the hammer circle. This chamber has an outlet pipe 18, having a regulating valve 19 for varying the size of the outlet opening, and communicating with an exhaust fan or other means for suction as indicated, by which the finely crushed material is taken out through said pipe 18, when carried over by the hammers.

This form of hammer, under the crushing action, will react inward practically radially to the shaft, and thus quickly pass a lump of the material too large to be crushed in one operation. This quick radially inward movement, is due to the location of the pivot of the hammer as far outward on the head as is practicable, and to the circumferential location of the hammers grinding face with regard to said pivot.

While it is preferred to arrange the hammers as shown with regard to the direction of rotation shown by the arrow, thereby effecting a crushing and gradual pulverizing of the material operated on, I may obtain a coarser action of crushing by reversing the shaft and

head in the rotor chamber and rotating so that the crushing action is exerted by the face J′ of the hammers opposite the pivot points. Since the face J′ is an arc about the center L, the crushing resistance would then be exerted directly on the pivot bearing D, and if the size is too great to allow of crushing the lump in one engagement, the hammer would be forced inward radially toward the shaft and allow the lump to pass by for engagement by the next succeeding hammers, or interposed portion of the outer face of the head. Thus a coarse crushing effect is obtained, as compared to the crushing and pulverizing effect obtained by rotating the head and hammers in the direction indicated by the arrows.

I claim;

1. A crusher and pulverizer comprising a rotor head having pockets with a semi-circular recess at one side, and pivoted hammers each having a semi-circular end pivotally mounted in said recess, the pivot end of said hammers being located relatively near the hammer circle and the hammer face extending circumferentially from the pivot to the other side of the recess.

2. A crusher and pulverizer comprising a rotor having a shaft and a head provided with multiple pockets in the circumferential face,—each pocket having a pivot bearing near the face at one side of the pocket,—and pivoted hammers mounted in said pockets and each extending circumferentially from the pivot to engage the opposite side of the pocket and closing the pocket outwardly.

3. A crusher and pulverizer comprising a rotor having a shaft and a head provided with multiple pockets in the circumferential face,—each pocket having a pivot bearing near the face at one side of the pocket, and a limit shoulder at the opposite side,—and pivoted hammers mounted respectively in said pockets and each having a pivot at one end for said bearing and lip at the opposite end for engaging said shoulder.

4. A crusher and pulverizer comprising a rotor having a shaft and a head provided with mutiple pockets in the face,—each pocket having a pivot bearing at one side near the face and a limit shoulder at the opposite side,—pivoted hammers mounted in said pockets and each extending circumferentially from its pivot and provided with a lip opposite the pivot and adjacent said shoulder, and means interposed between each lip and shoulder to vary the outward adjustment of the hammer.

5. A crusher and pulverizer comprising a casing having a side aperture, a rotor head having pockets provided with pivot bearings and limit shoulders at opposite sides of the pockets, pivoted hammers mounted in said bearings and having lips opposing said shoulders, and adjustable strips interposed between said shoulders and lips, and adapted to be carried by the rotor past said aperture and accessible for adjustment through said side aperture.

6. A crusher and pulverizer comprising a rotor having a shaft and a head provided with multiple pockets in its circumferential face,—each pocket having a pivot bearing near the face at one side of the pocket,— and pivoted hammers mounted in said pockets and each extending circumferentially from the respective pivot to the opposite side of the pocket and forming a chamber behind the hammer, resilient means mounted in each pocket chamber and acting radially from the shaft, and means to limit the outward movement of said hammers.

7. A crusher and pulverizer comprising a rotor having a shaft and a head provided with pockets in the outer face,—each pocket having a pivot bearing near the face at one side of the pocket and a limit shoulder at the opposite side of the pocket,—pivot hammers mounted in said pockets and extending circumferentially and projecting beyond the face of the head and each having a lip limiting the outward swing of the hammer by said shoulder, and springs mounted in said pockets and acting against said hammers and protected from the crushed material by the hammers closing said pockets.

8. A crusher and pulverizer comprising a casing having side apertures, a rotor fitting closely between the sides of said casing and provided with pockets in the outer face, pivoted hammers closing said pockets and forming interior chambers, springs mounted in said closed pockets and acting outward on said hammers,—said interior chambers being open at the sides of the head and at substantially the same radial distance from the axis of the rotor as the side aperture so as to rotate past said apertures in the sides of the casing, thereby effecting lateral discharge of any pulverized material working into said chambers.

9. A crusher and pulverizer comprising a rotor head provided with pockets in its outer face, pivoted hammers mounted in said pockets and closing said pockets forming interior chambers, and springs mounted in said chambers acting outward on said hammers,—the outer faces of said hammers and the intermediate portions of the outer face of the head being corrugated and forming a substantially continuous grinding face on said rotor.

10. A crusher and pulverizer comprising a shaft and a rotor head provided with pockets in its outer face, pivoted hammers mounted in said pockets and projecting beyond said face of the head and circumferentially closing said pockets,—the rotor face

of the head between said hammers being corrugated,—and springs mounted in said pockets and acting radially from the shaft upon said hammers, forming radially compressible projecting hammer faces alternating with grinding faces of lesser radius on the interposed portions of the said head.

11. A crusher and pulverizer comprising a shaft and a rotor head provided with pockets,—each pocket having a pivot bearing at one side near the face of the head and curved inward from the face on the opposite side of the pocket in a cylindrical plane about the pivot bearing as a center axis, and having a recess in said opposite side forming a limit shoulder,—pivot hammers mounted in said pivot bearings and circumferentially closing said pockets,—each hammer having a pivot on one end engaging said bearing and curved on the other end in a cylindrical plane about the pivot as a center so as to engage slidingly with the curved wall of the pocket and form an interior chamber, and having a lip entering said recess and opposing said limit shoulder,—the outer face of each hammer having corrugations projecting successively further from the rotor face, —resilient means mounted in said pockets and acting radially from the shaft on the ends of said hammers opposite the pivots, and an arcuate cage located closely adjacent to the hammer circle of the outer ends of said hammers.

12. A machine of the character described comprising a shaft, a rotor head having pockets in its circumferential face,—each pocket having a pivot bearing near said face at one side of the pocket and the other side of the pocket formed in a cylindrical plane from the axis of the pivot,—pivoted hammers having pivot ends mounted in said bearings and extending circumferentially to the other side of said pockets and having the end of each hammer opposite the pivot formed in a cylindrical plane from the axis of the pivot and matching the corresponding plane of the pocket and normally projecting from the face of said head and oscillatable substantially radially as to said shaft, and resilient means mounted in said pockets and acting outwardly on said hammers, and means to limit the outward projection of said hammers from the face of said head.

13. A crusher and pulverizer comprising a rotor head having pockets in its outer face, —each pocket having a semi-cylindrical bearing near said face at one side of the pocket and a retaining lip between the bearing and said outer face having a curved outer portion on an arc from the pivot center, a pivoted hammer for each semi-cylindrical pivot bearing having a guarding flange oscillatable on the said curved portion of the retaining lip and obstructing the entrance of crushed material to said bearing.

14. A machine of the character described comprising a bar cage, and spacing members having beveled deflecting surfaces at their inner ends extending transversely across the opening from bar to bar and meeting to constitute a ridge on the inner end of each spacing member,—said ridge extending transversely to the bars, substantially as described.

15. A machine of the character described comprising an arcuate bar cage and spacing members mounted in the openings between the bars of said cage,—the inner end of each spacing member having two deflecting surfaces formed by the inner end being beveled to a sharp edge extending across the opening between the bars and presenting no opposing surface for lodgment of material on the spacing member, substantially as described.

16. A machine of the character described comprising an arcuate bar cage provided with spacing members having their inner ends beveled to a sharp edge extending across the space between the bars and set away from the inner face of the bars, and fastening and supporting means for said spacing members as disposed between said bars.

17. A machine of the character described comprising an arcuate bar cage having openings wider at the outer face than the inner face of the bars, and having registering openings transversely through the bars at the ends and intermediately spacing members having openings registering with the bar openings and mounted between said bars and beveled on opposite side faces to match said bars and beveled at the top to a sharp edge extending across the space between the bars to deflect the crushed material between the bars, and located with the upper end of each spacing member further out than the inner faces of the bars, and fastening means passing through said registering transverse openings in bars and spacing members.

18. A machine of the character described comprising an arcuate bar cage consisting of a series of independent bars forming openings, spacing means fitting said bar openings and located at the ends and intermediately on said bars, and having deflecting surfaces situated outside the inner face of said bars, and beveled inward in planes extending across the opening transversely to the bars, and connecting means for supporting said spacing means and fastening said bars together in multiple.

19. A machine of the character described comprising a casing having parallel sides and forming a rotor chamber, a rotor head mounted closely between said sides and hav-

ing pockets in the circumferential face,—each pocket having a semi-cylindrical bearing open at one side of the head and a shoulder opposite said bearing,—and pivot hammers mounted in said pockets,—each hammer having a semi-cylindrical pivot end matching the respective pocket bearing, and a lip opposed by said shoulder,—whereby any axial movement of said hammers is prevented by the adjacent casing side while the rotor head is mounted in said casing.

In testimony whereof I have affixed my signature.

HAROLD M. PLAISTED.