

No. 646,249.

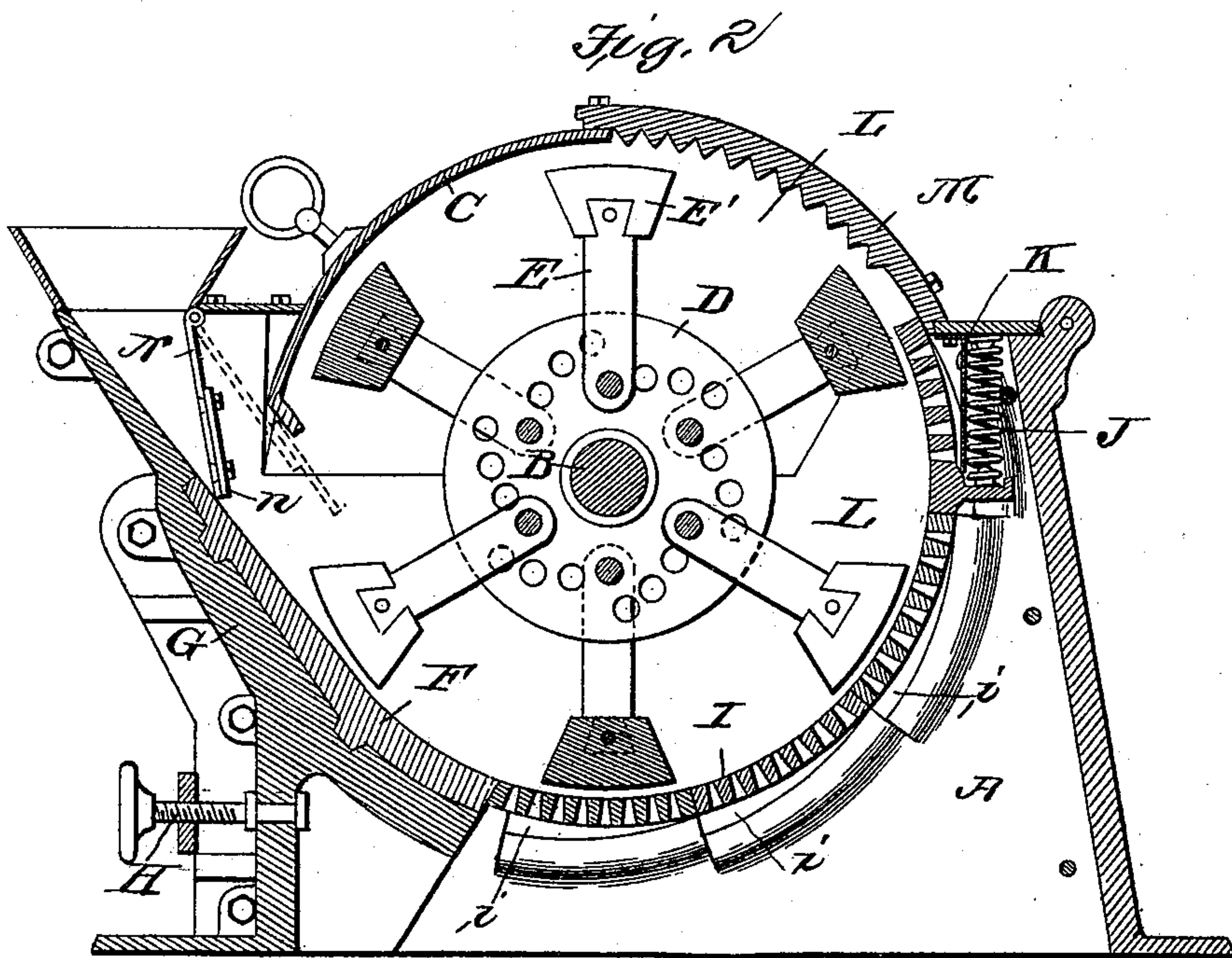
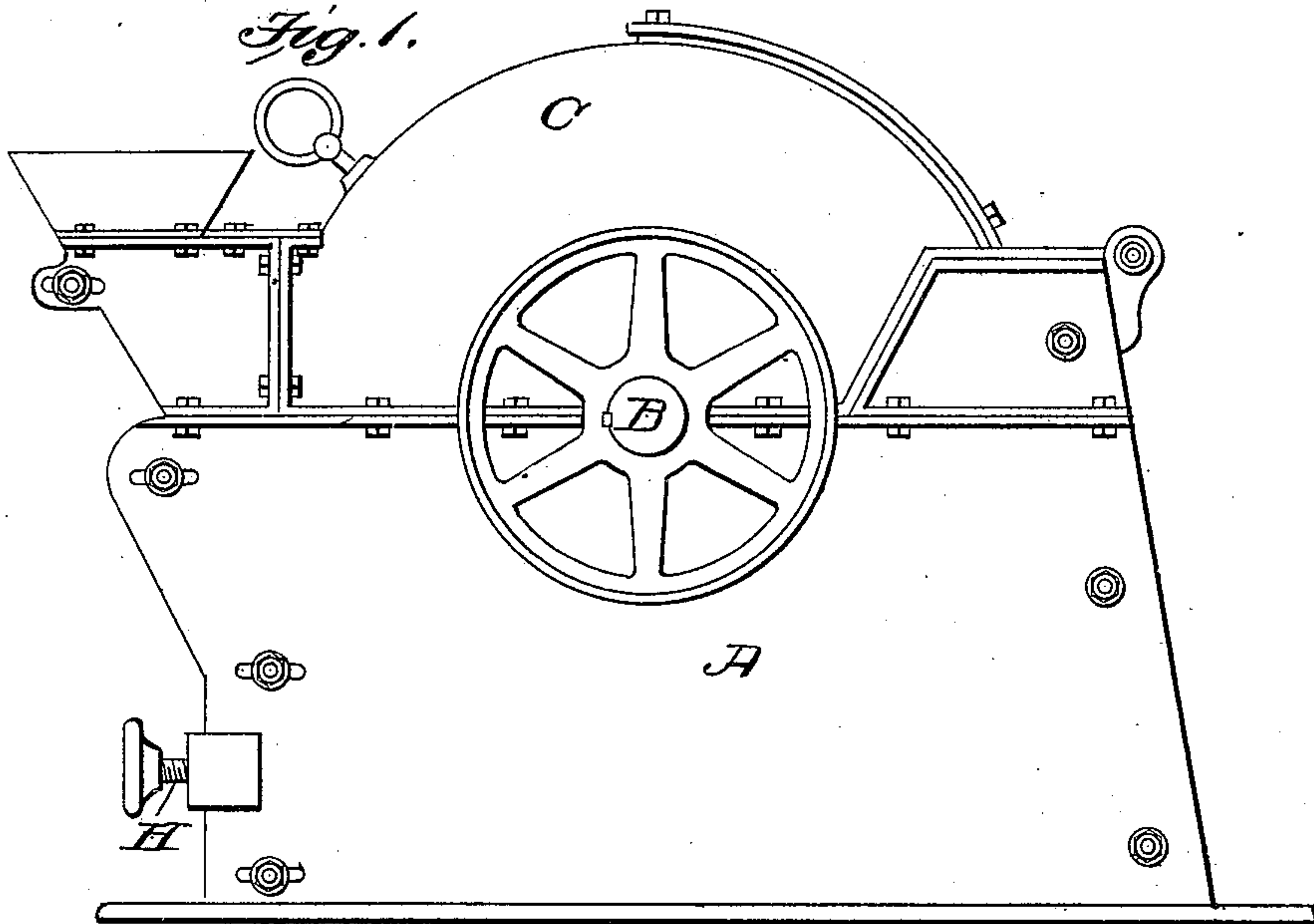
Patented Mar. 27, 1900.

M. F. WILLIAMS.
CRUSHER AND PULVERIZER.

(Application filed Mar. 22, 1897.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:
J. R. Cornwall
G. A. Pennington

Inventor
M. F. Williams
by Paul Bakewell
his atty

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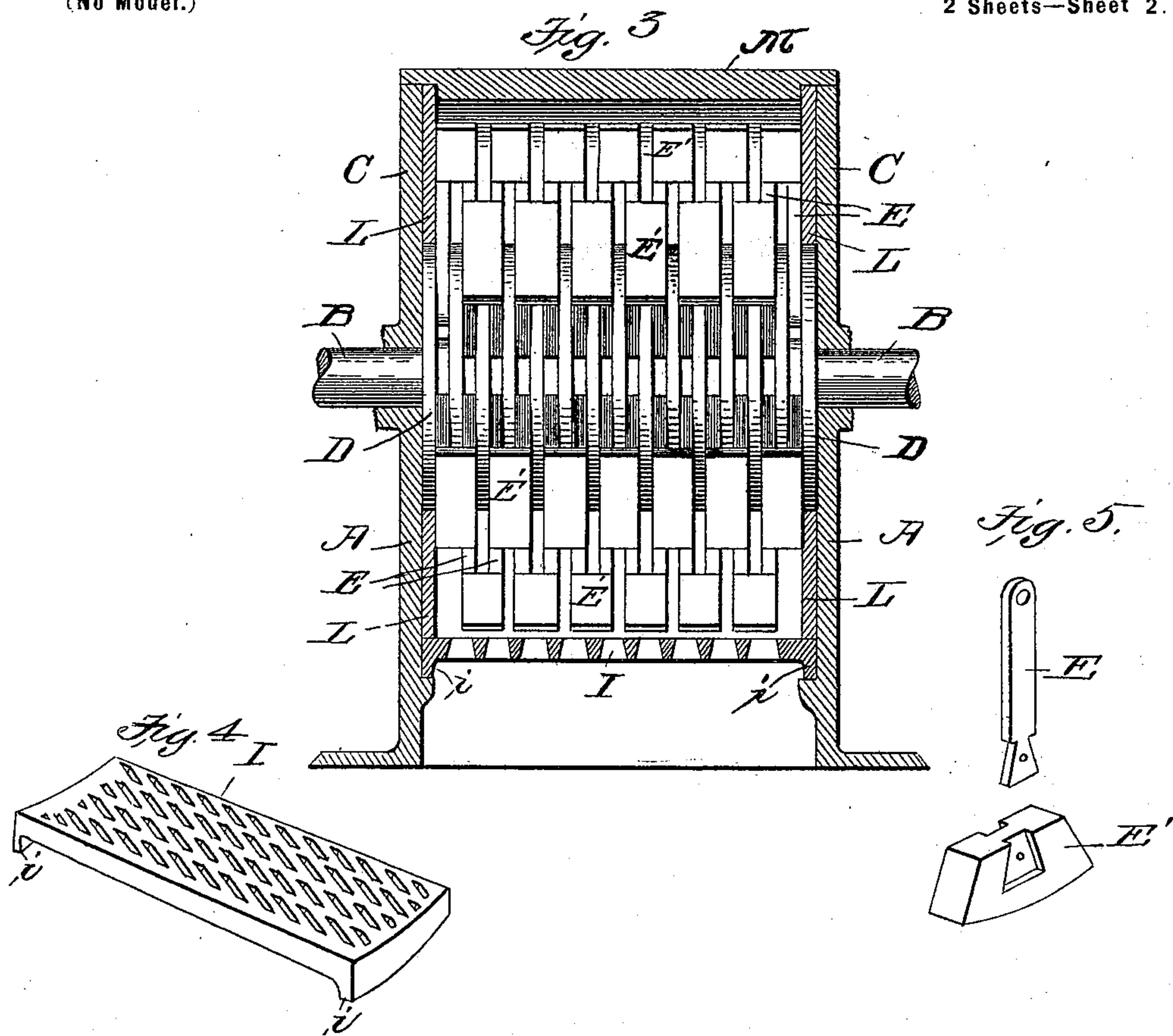
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UNITED STATES PATENT OFFICE.

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. 646,249, dated March 27, 1900.

Application filed March 22, 1897. Serial No. 628,566. (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 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, in which—

Figure 1 is a side elevational view of my improved machine. Fig. 2 is a vertical longitudinal sectional view through my improved machine. Fig. 3 is a vertical cross-sectional view through my improved machine. Fig. 4 is a detailed view of one of the sections of the grinding-surface. Fig. 5 is a detailed view of one of the hammer-heads and one of its supporting-shanks.

This invention relates to a new and useful improvement in machines for crushing and pulverizing ores, shale, bones, &c., the object being to construct a machine of the character described in such manner that it will efficiently perform the work for which it is intended, and which machine is simple and cheap in construction and requires but comparatively small power for operating same.

The essential features of my present invention reside in the grinding-surface, the dead-plate, the hammers, the valve at feed end of the machine, and, finally, 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, in which is mounted a shaft B.

C indicates the cover, which is preferably hinged to the rear end of the frame A; but it is obvious that this cover can as well be bolted in position.

D indicates the hammer-supports, in the form of disks strung on shaft B within the frame A. These supports are each preferably provided with eccentric series of openings, through which through-bolts may be passed for pivotally supporting the hammer-shanks in radially-adjusted positions.

E indicates the hammer-shanks, which are pivotally supported on through-bolts, said

hammer-shanks carrying at their outer ends the hammer-heads or striking-points E'. These shanks and heads are so arranged relative to each other that two shanks are employed to support a single head, the method of mounting the heads on the shanks being preferably that shown in Fig. 5, where it will be seen that recesses, grooves, or pockets are formed in the side faces of the heads to receive the outer ends of the shanks. This method of mounting the heads on the shanks practically supports the shanks, so that in mounting the shanks on the through-bolts the shank of every other hammer-head straddles the same disk, the remaining shanks straddling adjacent disks. This staggers the longitudinally-disposed rows of hammer-heads relative to each other, so that in operation the hammer-heads will cover the entire area of the dead-plate and grinding-surface. I preferably arrange the supporting-disks equidistantly apart, the thickness of each disk being equal to the distance between two disks, so that when the shanks are arranged between the disks they will be supported against lateral strain by the disks.

F indicates the dead-plate, which is preferably so shaped that its lower or inner portion is concentric, while its upper portion is tangentially disposed to the path of the hammers. The dead-plate is mounted in a suitable carriage G, said carriage and dead-plate being adjustable relative to the striking-points of the hammers. This adjustment, as shown in Figs. 1 and 2, is accomplished through the medium of lugs on the carriage, through which lugs pass suitable bolts, said bolts also passing through horizontally-disposed slots in the side framing of the machine. By loosening the nuts on the bolts the carriage and dead-plate may be adjusted inwardly and outward, where it will be held in its adjustable position by tightening the nuts on the bolts. Threaded rods H, having hand-wheels at their outer ends, may be employed for adjusting the carriage and dead-plate. This bodily adjustment of the dead-plate relative to the hammers I consider an important feature in my machine in that wear of the dead-plate can be compensated for

without necessitating the renewal of the dead-plate. Again, by forming a dead-plate with a curved portion and a tangentially-disposed portion the hammers will first crush the material or break it into fine particles, after which the hammers will act upon the material on the dead-plate, effecting a grinding action until the material is carried beyond the dead-plate onto the grinding-surface, which forms practically a continuation of the curved portion of the dead-plate.

The inclination of the dead-plate downwardly toward the hammers in their acting position to draw the material in and with the inner edge directly adjacent to the path of the hammers and a concaved cage coacting with the hammers to crush the material is important in that this arrangement insures a proper feed to the machine and counteracts the tendency of the rapidly-revolving hammers to throw the material outwardly.

I indicates the grinding-surface, which may either be in the form of a concentric cage, as shown in Fig. 6, or said grinding-surface may be composed of perforated sections abutting against each other, as shown in Fig. 2. The openings or perforations in these sections are preferably diagonally arranged, as shown in Fig. 4. The ends of these sections are provided with eccentrically disposed or inclined runners *i*, which coöperate with correspondingly-inclined supports on the framing of the machine. By the above construction it will be noted that as the carriage and dead-plate are adjusted inwardly to compensate for wear the first section of the grinding-surface abutting against the dead-plate will be moved to the rear, as will also all of the sections of the grinding-surface, and this rear movement of the sections will cause the eccentrically-disposed runners to ride up on their supports or toward the axis of rotation of the hammers. The adjustment of the dead-plate, therefore, also accomplishes the radial adjustment of the grinding-surface to compensate for its wear, as well as the wear of the dead-plate. The grinding-surface in order to be adjusted coincidentally with the adjustment of the dead-plate must be held yieldingly against said dead-plate, and in order to effect this I provide a spring or springs J, coöperating between a fixed abutment at one end and against the grinding-surface at its other end, the tension of said spring being exerted in a direction toward the dead-plate. This spring also holds the grinding-surface against the action of the hammers, so that if any material is caught in the openings of the grinding-surface and struck by the hammers the grinding-surface will yield slightly under the blow. I preferably arrange this spring to engage the last section of the grinding-surface, so that it will affect the sections in front of it. Other springs might be employed on the other sections in the same manner as the springs on the last section, if desired, or the ends of the grinding-sections might project through the

side framing and the springs to be located out of path of falling material.

A curtain K is preferably arranged between the spring J and the grinding-surface to shield the spring from flying particles passing through the openings in the grinding-surface.

Practical experience has demonstrated that the side framing of the machine is liable to wear or be ground out at a point close to the grinding-surface, and in order to save the framing of the machine I prefer to introduce linings L, as shown in Figs. 2 and 3, to save the wear of the framing of the machine. I have also found that any material carried beyond the grinding-surface will wear the cover, and in order to save the cover I prefer to arrange a wear-plate M therein, which forms practically a continuation of the grinding-surface, but at a greater radial distance from the hammers.

N indicates a valve, preferably gravitating, arranged at the feed end of the machine, so as to close the opening in said feed end or so much thereof as the material being fed to the machine will permit. This valve, in addition to performing the above function, which prevents the exit of dust, will also act as a deflecting-lip, as shown by dotted lines in Fig. 2, to direct the air circulating in the direction of the revolving hammers inwardly. This valve is provided with an adjustable portion *n*, which forms practically an extension of the valve and carries the deflecting-lip inwardly a sufficient distance to compensate for the wear of the hammers, thus locating the end of said deflecting-lip in close proximity to the path of the hammers. The adjustable plate *n* of this valve N is only adjusted to lengthen the valve whenever the hammers are worn, and any such adjustment when made must necessarily not extend inwardly to such a distance as to place the adjustable plate in the path of the hammers. The reason for this is obvious, as the hammers would strike said plate and soon destroy the same. When the material is being fed into the machine, it only raises valve N to such an extent as to permit said material to pass freely into the machine. Thus no free opening is made for the exit of dust; but, on the contrary, the circulating air in the machine strikes the valve and is deflected inwardly, creating a suction at the feed end of the machine which tends to draw the material and dust inwardly.

It will be noted that when the hammers are worn they may be readily adjusted by withdrawing the through-bolt and placing the through-bolt in another opening in the eccentrically-disposed series of openings for the through-bolts. This feature, however, forms the subject-matter of a pending application.

The operation of the machine is obvious. By adjusting the radial position of the striking-points of the hammers, adjusting the position of the dead-plate, adjusting the radial position of the grinding-surface, and adjusting the length of the valve and lip enables the

machine to be operated for a long period of time before it is necessary to replace the parts by reason of wear.

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. In a crusher and pulverizer, the combination with a suitable casing, of pivoted revolving hammers, a concentrically-arranged grinding-surface cooperating therewith, eccentrically-arranged runners or supports at the sides of said grinding-surface, and correspondingly-arranged supports on the casing for cooperating with said eccentrically-arranged runners, substantially as described.

2. In a crusher and pulverizer, the combination with a suitable casing, of pivoted revolving hammers, a concentrically-arranged grinding-surface composed of independently-movable sections, eccentrically-disposed runners at the sides of each section, and supports extending from the sides of the casing with which said runners cooperate, substantially as described.

3. In a crusher and pulverizer, the combination with pivoted, revolving hammers, of a grinding-surface for cooperating with said hammers, and means cooperating with the rear end of the grinding-surface for yieldingly holding the same against the action of the hammers; said means permitting a limited concentric movement of the grinding-surface, substantially as described.

4. In a crusher and pulverizer, the combination with pivoted, revolving hammers, of a grinding-surface for cooperating with said hammers, said grinding-surface being composed of sections arranged end to end, each of said sections having eccentrically-disposed runners, eccentrically-disposed guides or supports for said runners, and means for yieldingly holding said sections to their seats and against the action of the hammers; substantially as described.

5. In a crusher and pulverizer, the combination with pivoted, revolving hammers and means for adjusting the striking-points of said hammers, a dead-plate upon which the material is primarily crushed by the hammers, a concentrically-disposed grinding-surface forming a continuation of said dead-plate, and means for adjusting the dead-plate toward or from the hammers, which adjustment of the dead-plate moves the grinding-surface concentrically and adjusts said grinding-surface radially, substantially as described.

6. In a crusher and pulverizer the combination with pivoted revolving hammers, of an adjustable dead-plate, a concentrically-mov-

able grinding-surface having its front end abutting against the dead-plate, and means for adjusting the dead-plate, which adjustment of the dead-plate effects a similar adjustment of the grinding-surface, relative to the hammers, substantially as described.

7. In a crusher and pulverizer, the combination with pivoted, revolving hammers, of an adjustable dead-plate, and a grinding-surface composed of sections, each of said sections being provided with eccentrically-disposed runners which cooperate with corresponding supports on the frame of the machine, all of said sections abutting against each other, and the front section abutting against the dead-plate, whereby, when the dead-plate is adjusted inwardly, it moves said grinding-sections along their eccentrically-disposed supports, and in toward the axis of rotation of the hammers; substantially as described.

8. In a crusher and pulverizer, the combination with pivoted, revolving hammers, of an adjustable dead-plate, a grinding-surface composed of sections, each of said sections being provided with eccentrically-disposed runners which cooperate with corresponding supports on the frame of the machine, all of said sections abutting against each other, and the front section abutting against the dead-plate, whereby, when the dead-plate is adjusted inwardly, it moves said grinding-sections along their eccentrically-disposed supports, and in toward the axis of rotation of the hammers, and means for holding said sections together and against the dead-plate; substantially as described.

9. In a crusher and pulverizer, the combination with pivoted, revolving hammers, of an adjustable dead-plate, a grinding-surface composed of sections, each of said sections being provided with eccentrically-disposed runners which cooperate with corresponding supports on the frame of the machine, all of said sections abutting against each other, and the front section abutting against the dead-plate, whereby, when the dead-plate is adjusted inwardly, it moves said grinding-sections along their eccentrically-disposed supports, and in toward the axis of rotation of the hammers, and a spring on the last section whose tension is exerted to hold all of said sections together and against the dead-plate; substantially as described.

10. In a crusher and pulverizer, the combination with pivoted revolving hammers, of means for adjusting the radial position of the striking-points of said hammers, an adjustable dead-plate, a concentrically-movable grinding-surface having its front end abutting against the dead-plate, and means for adjusting the dead-plate, which adjustment of the dead-plate effects a similar adjustment of the grinding-surface relative to the hammers, substantially as described.

11. In a crusher and pulverizer, the combi-

nation with a suitable casing comprising a frame and a cover, of a hopper arranged at the feed end of the machine, a valve hinged to the lower inner edge of said hopper, and adapted to cooperate with, and be limited in its rearwardly-opening movement by, the front edge of the cover, a shaft mounted in said casing, pivoted hammers carried by said shaft, a dead-plate tangentially arranged under the hopper, and a concentrically-arranged grinding-surface having its front end touching against said dead-plate, substantially as described.

12. In a crusher and pulverizer, the combination with pivoted, revolving hammers, of a dead-plate arranged at the feed end of the machine, a valve pivoted above said dead-plate for closing the feed end of the machine, said valve, when raised, acting as a deflecting-lip for the circulating air and material within the casing of the machine, and an adjustable extension on said valve; substantially as described.

13. In a crusher and pulverizer, the combination with pivoted, revolving hammers, of means for adjusting the radial position of said hammers, an adjustable dead-plate arranged at the feed end of the machine, and an adjustable swinging valve, which, in a raised position, extends into the casing of the machine adjacent to the path of the hammers where it acts as a deflecting-lip; substantially as described.

14. In a crusher and pulverizer, the combination with pivoted, revolving hammers, and the casing in which said hammers are mounted, of a grinding-surface for cooperating with hammers, and a removable wear-plate ar-

ranged in said casing and forming a continuation of the grinding-surface to receive the material carried beyond the grinding-surface, said wear-plate permitting the concentric movement of the grinding-surface by being at a greater radial distance from the axis of rotation of the hammers than the grinding-surface, and means for moving said grinding-surface concentrically; substantially as described.

15. 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 downwardly 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 which, with said dead-plate, coacts with the hammers to crush said material.

16. In a crusher and pulverizer, the combination with a casing, pivoted revolving hammers and means for driving the same, of means for adjusting the radial position of the striking-points of said hammers, and a dead-plate cooperating with the adjustable striking-points of said hammers, and means for adjusting the dead-plate to vary its position relative to the path of the hammers, substantially as described.

In testimony whereof I hereunto affix my signature, in presence of two witnesses, this 15th day of March, 1897.

MILTON F. WILLIAMS.

Witnesses:

F. R. CORNWALL,
HUGH K. WAGNER.