(No Model.) 3 Sheets—Sheet 1.

E. C. GRIFFIN.

PULVERIZING MILL.

No. 410,757. Patented Sept. 10, 1889.

Fig. 2.

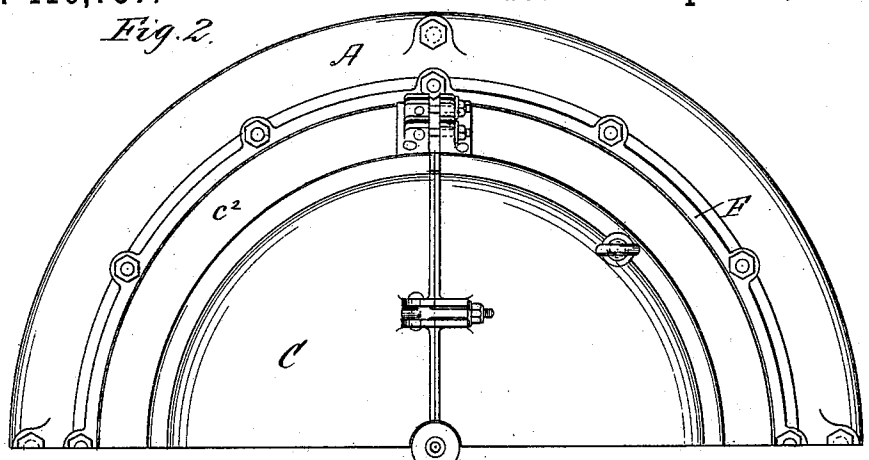
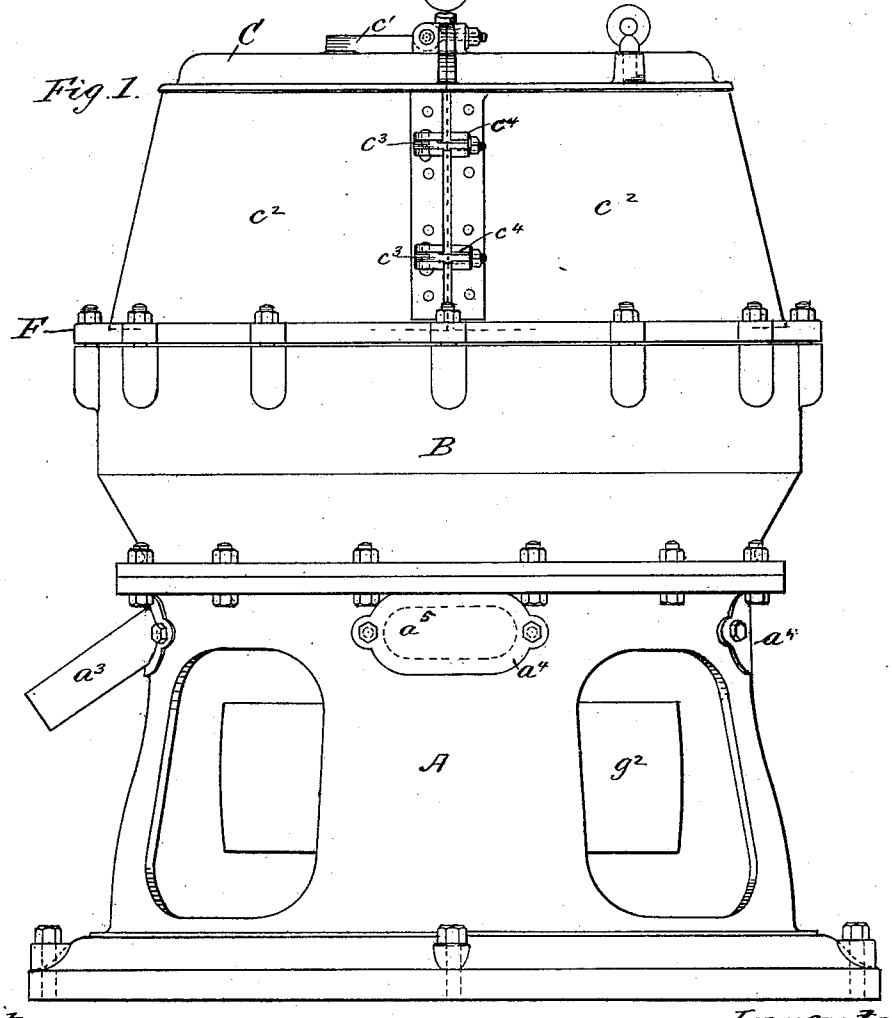


Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig 4

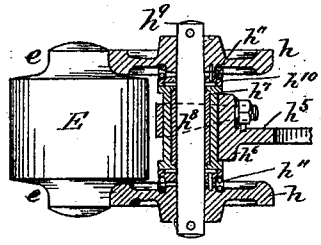

Fig. 5.

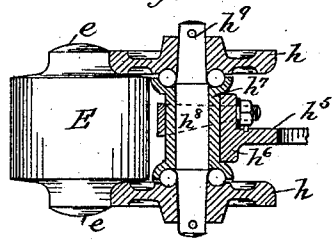

Fig. 3.

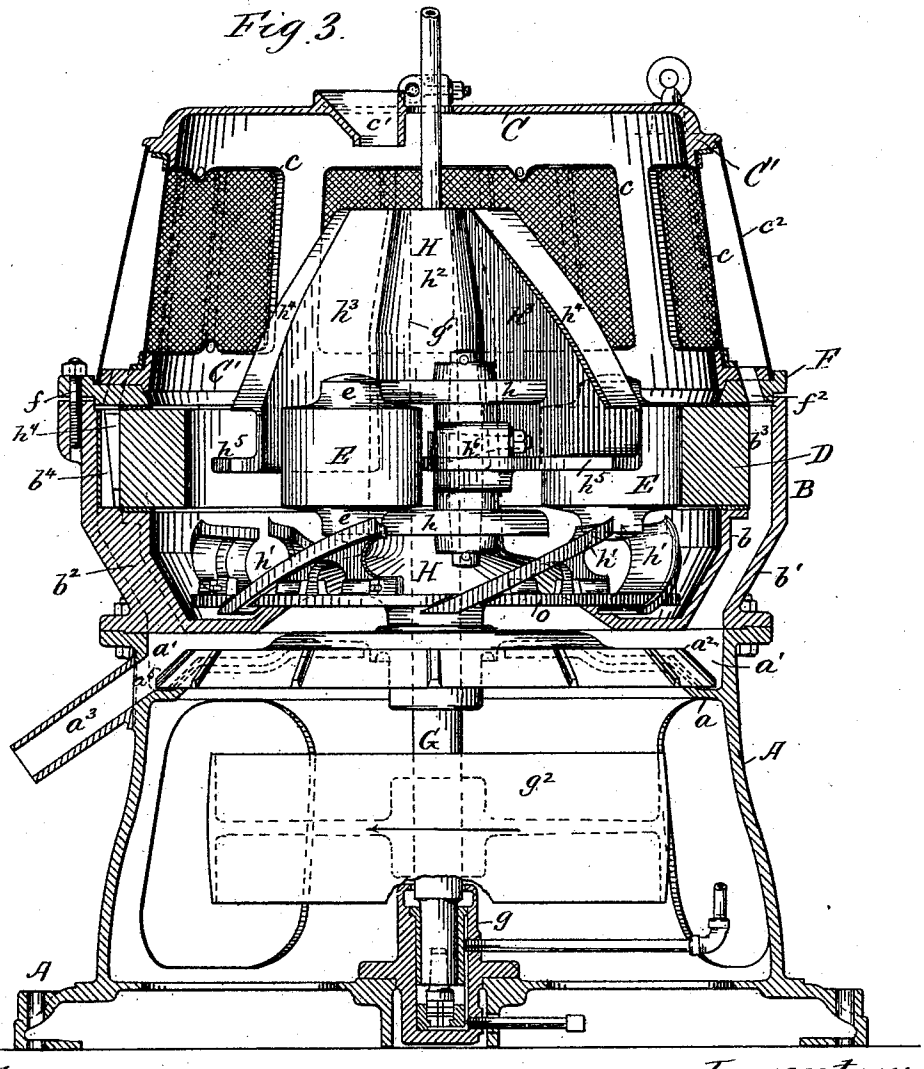

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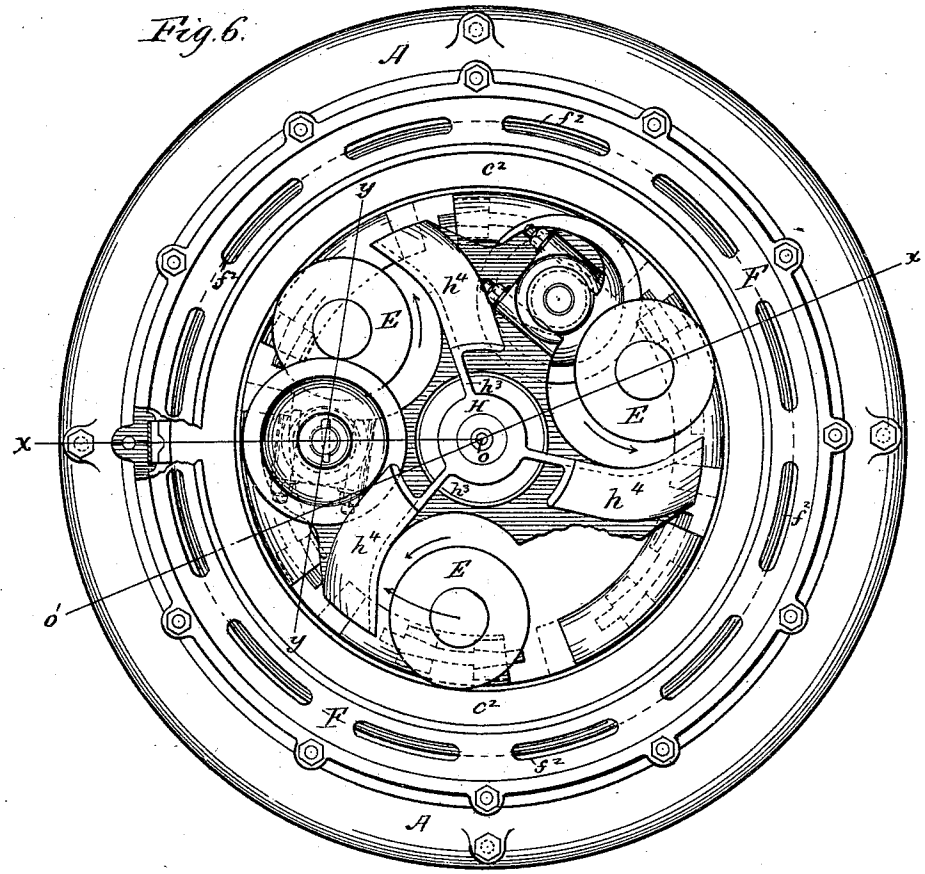
Fig. 6.



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UNITED STATES PATENT OFFICE.

EDWIN COLVER GRIFFIN, OF BROOKLYN, ASSIGNOR TO THE GRIFFIN MANUFACTURING COMPANY, OF NEW YORK, N. Y.

PULVERIZING-MILL.

SPECIFICATION forming part of Letters Patent No. 410,757, dated September 10, 1889.

Application filed June 1, 1888. Serial No. 275,719. (No model.)

To all whom it may concern:

Be it known that I, EDWIN COLVER GRIFFIN, a citizen of the Dominion of Canada, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Pulverizing-Mills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of pulverizing-mills in which the reduction or pulverization of ores and other substances is accomplished by the revolution of one or more rollers within and against the inner wall of an annular die or ring, and in which said rollers are held in contact with the annular dies or rings by centrifugal force when the mills are in operation; and it consists in certain improvements on the construction and arrangement or combination of the parts of my former ore-pulverizing mill, patented October 19, 1886, No. 351,321, as hereinafter disclosed in the description and claims.

The object of my invention has been the production of a mill in which ores and other substances, however refractory and of whatever degree of hardness, may be rapidly, cheaply, and thoroughly crushed and pulverized or reduced to an almost impalpable powder. I am aware that other mills have been devised with a view of accomplishing the same results; but, so far as I am aware, they have been only partially successful.

Some of the essential features of my present improvements on the pulverizing-mill disclosed in my above-named patent are, first, a change in the construction and operation of the driving devices for the grinding or pulverizing rollers; second, a modification or change of construction in the casing or pan inclosing the grinding or pulverizing mechanism; third, the means for securing the ring or annular die within said casing or pan; fourth, the construction and combination or arrangement of the parts for grinding or pulverizing, screening, and discharging the material; fifth, the differences in construction and operation of the revolving casting or driver, whereby a perfect distribution or feed of the material is effected, and, after being ground or pulverized, is raised and thrown against and through the screens, and, sixth, the differences in the construction and arrangement of the cover of the mill, the screen-frame, and the casing surrounding the same, whereby ready access may be had to the interior of the mill for examination and removal or renewal of the screens or other parts.

In the accompanying drawings, wherein the same reference-letters indicate the same or corresponding parts, Figure 1 represents an elevation of my improved pulverizing-mill; Fig. 2, a top plan view of one-half of the same; Fig. 3, a vertical section of the frame and casing or pan, constituting the stationary parts of the mill, taken on the angular line $x\ o\ x$ of Fig. 6, the revolving parts being shown in side elevation at right angles to the line $y\ y$, or on the line $x\ o\ o'$ of said Fig. 6; Fig. 4, a vertical section of a pair of the driving-disks, taken on the line $y\ y$ of Fig. 6, the pulverizing-roller being shown in side elevation; Fig. 5, a similar view to Fig. 4, but showing a modification of the journal-bearing of the driving-disks for permitting the use of anti-friction balls; and Fig. 6, a top plan view of the mill, the cover and screen-frame being removed.

In the drawings, A designates the base or frame of the mill, which, near its upper end, is provided with a web a, forming the bottom of a trough a', for receiving the pulverized material from above; also, said base is formed with openings a^5, for cleaning out said trough or for attaching the discharge-spout a^3 in different positions when desired. Removable covers a^4 are applied to said openings. This base or frame may be made in sections, if desired.

B represents the casing or pan which contains the pulverizing mechanism of the mill. It is made double or is composed of an inner shell b and an outer shell b', which are connected together by a suitable number of webs or ribs b^2, so as to leave an intermediate discharge passage or openings b^3 between them. This casing or pan or its shells may be cast integrally with the connecting webs or ribs; or they may be made in several parts or

sections, so as to secure lightness in handling or convenience in repairing individual parts.

C indicates the top or cover of the mill. It is made in two parts and cast or formed integrally with the main screen-frames C′, which support the smaller screen-frames *c* and to which they are suitably bolted. One half of the combined top or cover and main screen-frame is made removable for obtaining access to the interior of the mill, while the other or stationary half is formed with the feed-opening *c′*, and is adapted to support whatever construction of feeding device may be employed. The sheet-metal casing c^2, surrounding or arranged outside of the smaller screen-frames *c*, is also made in two parts and joined by swinging bolts c^3, which fit in slotted or open-topped lugs c^4, whereby either or both of said parts may be readily removed for examination or renewal of the screens.

D indicates the steel ring or annular die against which the grinding or pulverizing rollers E operate in treating the material. This die may be a solid ring, as shown in Fig. 3, or sectional, as shown in another application of mine filed simultaneously herewith. In my present mill said die rests upon the upper part of the inner shell *b*, and is peripherally secured within the outer shell *b′* by wedges b^4. A ring F is secured by stud-bolts *f* to the outer shell *b′*, and presses upon and secures said die against vertical movement. Between the die and the touching parts of the inner shell *b* and the ring F, and also between the wedges b^4 and the outer shell *b′*, are interposed packings, of rubber, paper, or other elastic material, for deadening the sound and for lessening the jar caused by the operation of the machine. Through the ring F are formed holes f^2, corresponding in position to the openings b^3 between the inner and outer shells.

The moving or revolving parts of my improved mill are the following: G represents the driving-shaft, which is mounted and revolved in the step-bearing *g*, and supported above in a bearing secured in the central elevated portion of the inner shell *b*, as shown by dotted lines *g′* in Fig. 3. To this shaft is secured the driving-pulley g^2; or, if preferred, it may be revolved by gearing. Along the upper portion of said shaft is secured a casting or driver H, which acts as a feed director and distributer and, also, as a support for the driving-disks *h* and for the elevating inclines or shoes *h′*. The lower portion of this revolving casting or driver is formed conically and provided at the base of the cone with a horizontal flange *o*. The elevating inclines or shoes *h′* pass through inclined slots formed in said flange and are attached to the latter by wedges fitted into lugs having wedge-shaped recesses; or said inclines or shoes may be bolted or otherwise removably secured to said flange. At the upper part of said casting or driver H is formed a hub h^2, from which radiate the feed-directing webs h^3 h^3, which are provided with the deflecting-flanges h^4 h^4. At the lower ends of, and attached to said webs and to the central hub, is a horizontal flange h^5, which is provided with pockets or openings in which the grinding or pulverizing rolls work. On this flange are cast bosses h^6, which have open faces merging into the openings or pockets containing the rollers. In these open faces are placed bushings or journal-bearings h^7, which are firmly held in place by clamps or straps h^8, passed around the bosses h^6 and their open faces. Within these bearings revolve the shafts h^9, to the upper and lower ends of which are secured the roller-driving disks *h*, which bear against the journals of and revolve the rollers, which are held in contact with said driving-disks by being forced against the annular die by centrifugal force and by said disks being forced against their journals as the driver is revolved. At the upper and lower ends of each bearing, and between the same and the driving-disks, as shown in Fig. 4, is placed a washer h^{10}, which is made of suitable anti-friction material and backed by an elastic packing-washer *h″*, for effectually reducing wear and keeping out all grit, dust, or water from said bearing; or, in lieu of this construction and arrangement of parts, I may flare and groove the opposite ends of the bearings, correspondingly groove the adjacent faces of the driving-disks, and place within said grooves anti-friction balls, as shown in Fig. 5, and attain the same results.

The grinding or pulverizing rollers E are made with journals *e* on their ends, which bear against the driving-disks *h*; hence, as the rollers are held between said disks and against the annular die by centrifugal force, said driving-disks act as journal-bearings for the journals of said rollers; also, as the driving-disks are several times greater in diameter than the journals of the rollers, they revolve very much slower than said rollers, and consequently the wear on the journals of the driving-disks is proportionally smaller than when the rollers are supported in bearings surrounding their journals, as in former constructions; also, by making the upper driving-disk a little less in diameter than the lower one and the upper roller-journal smaller than the lower one, as shown in Fig. 4, the axes of the grinding-roller will vary somewhat from the perpendicular, and when in operation the roller will have a tendency to rise by centrifugal force and adhesion to the inner surface of the die, and thus counteract the weight or gravity of said roller and allow it to revolve freely and without undue pressure upward or downward against the driving-disks.

The grinding-rollers and their driving-disks may be made of chilled iron or steel, and varied in form from that herein disclosed without departing from the gist of this part of my invention.

The operation of my improved mill is as follows: The crushed rock or other material

to be reduced or pulverized, being introduced into the mill through the feed-opening *c*, is caught as it falls by the feed-directing webs h^3 h^3 and their deflecting-flanges h^4 h^4, is thrown out thereby against the annular die immediately in front of the advancing grinding-rollers, and is acted upon thereby. It then falls downward toward or upon the elevating inclines or shoes *h'*, and by them or by other lifting means is driven upwardly and outwardly against the screens in the screen-frames *c*. Such portions of the material as have been crushed sufficiently fine pass out through the screen and fall through the openings b^3, between the inner and outer shells *b b'*, and into the receiving-trough *a'*, from which they are discharged by the ribbed conveyer or sweep a^2, which is attached to the shaft G through the spout a^3. The material which does not pass through the screens falls back upon and across the face of the die D, and is again acted upon by the rollers until it is reduced to the requisite fineness.

By the perfect distribution of the material, the free and complete working of the grinding-rollers, and the action of the elevating inclines or shoes in repeatedly throwing the material against the screens through which the product is discharged rapidly, I find in practice that my improved mill will do double the amount of work for the same power of any other mill of which I am aware.

For wet grinding it is only necessary to introduce the required amount of water, as the operation otherwise is the same as for dry grinding. As the journals are protected by dust and water-proof packing, it is not possible for the dust or water to interfere with the proper working of the bearings.

Having thus fully described the construction, arrangement, and operation of the parts of my invention, what I claim as new is—

1. In a horizontal pulverizing-mill, the combination of an annular die, vertical pulverizing-rollers having journals on their ends, and a revolving casting or driver having driving-disks mounted thereon and engaging the journals of said rollers, substantially as described.

2. In a horizontal pulverizing-mill, the combination of an annular die, vertical pulverizing-rollers, a revolving casting or driver, revolving shafts mounted thereon, and driving-disks mounted on the ends of said shafts and engaging the journals of said rollers, substantially as described.

3. In a horizontal pulverizing-mill, the combination of the casing or pan, the annular die, the grinding or pulverizing rollers, the central revolving casting or driver, the vertical shafts and their bearings, and driving-disks upon said vertical shafts engaging said rollers at their upper and lower ends and operating to drive the same, substantially as described.

4. In a pulverizing-mill, the combination of the casing or pan, the annular die, the rollers having journals at their upper and lower ends, the revolving casting or driver formed with roller-pockets, the vertical shafts, and the driving-disks at each end thereof for operating upon the journals of said rollers, substantially as described.

5. In a pulverizing-mill, the combination of an annular die, pulverizing-rollers having journals on their ends, a revolving casting or driver, and driving-disks mounted thereon and engaging said journals, the upper disks and journals being of smaller diameter than the lower ones, substantially as described.

6. In a pulverizing-mill, the combination of the casing or pan, the annular die, the rollers having journals at their upper and lower ends, the revolving casting or driver formed with roller-pockets, the vertical shafts, and the driving-disks at each end thereof, the upper driving-disks and upper journals of the rollers being of smaller diameter than the lower ones, substantially as described.

7. In a pulverizing-mill, the combination of the casing or pan formed of an inner and outer shell having an intermediate discharge passage or openings, the rollers, the annular die mounted upon the upper part of said inner shell, the perforated ring over said die, and the wedges around its periphery, substantially as described.

8. A pulverizing-mill provided with a casing or pan formed of an inner and outer shell having an intermediate discharge passage or openings, the rollers, the annular die mounted upon the upper part of said inner shell, the screen-frames and screens, and the perforated ring over said die, substantially as described.

9. In a pulverizing-mill, the combination of the casing or pan, the annular die, the rollers, and the revolving casting or driver provided with feed-directing webs having deflecting-flanges, substantially as described.

10. In a pulverizing-mill, the combination of a casing or pan, an annular die, pulverizing-rollers, and a vertical revolving casting or driver serving to propel said rollers and provided with feed-directing webs having deflecting-flanges above said die, substantially as described.

11. In a pulverizing-mill, the combination of a casing or pan, an annular die, pulverizing-rollers, and a revolving casting or driver serving to propel said rollers and provided with feed-directing webs above said die and feed-elevating devices below the same, substantially as described.

12. In a pulverizing-mill, the combination of a casing or pan having a feed-discharge passage or openings, an annular die, pulverizing-rollers, and a revolving casting or driver provided with feed-directing webs having deflecting-flanges, which are adapted to project the material against said die, substantially as described.

13. In a pulverizing-mill, the combination of a stationary two-part casing or pan having

an annular passage or openings for discharging material from its lower portion, an annular die, pulverizing-rollers, and a cover having screened openings above said die and feed-elevating devices below said die, which are adapted to project the pulverized material toward said openings, substantially as described.

14. In a pulverizing-mill, the combination of an annular die, pulverizing-rollers, a stationary two-part casing or pan having an annular passage or openings between its parts for discharging material from its lower portion, and feed-elevating devices below said die, which are adapted to project the pulverized material toward said passage or openings, substantially as described.

15. In a pulverizing-mill, the combination of an annular die, pulverizing-rollers, a stationary two-part casing or pan having an annular passage or openings between its parts for discharging material from its lower portion, the outer casing, the screen-frames above said die, and feed-elevating devices below said die, substantially as described.

16. In a pulverizing-mill, the combination of the casing or pan, the annular die, the rollers, the revolving casting or driver provided with a slotted flange at its lower end, and removable inclines or shoes fitting in said slots at their lower ends, substantially as described.

17. In a pulverizing-mill, the combination of the casing or pan and the grinding or pulverizing mechanism with the integrally-formed two-part cover and screen-frame, one of said parts being removable and the other stationary, the two-part removable casing surrounding said screen-frame, and the swinging bolts and open-topped lugs for removably securing said two-part casing, substantially as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN COLVER GRIFFIN.

Witnesses:
LAMBERT S. QUACKENBUSH,
LAMBERT SUYDAM.