

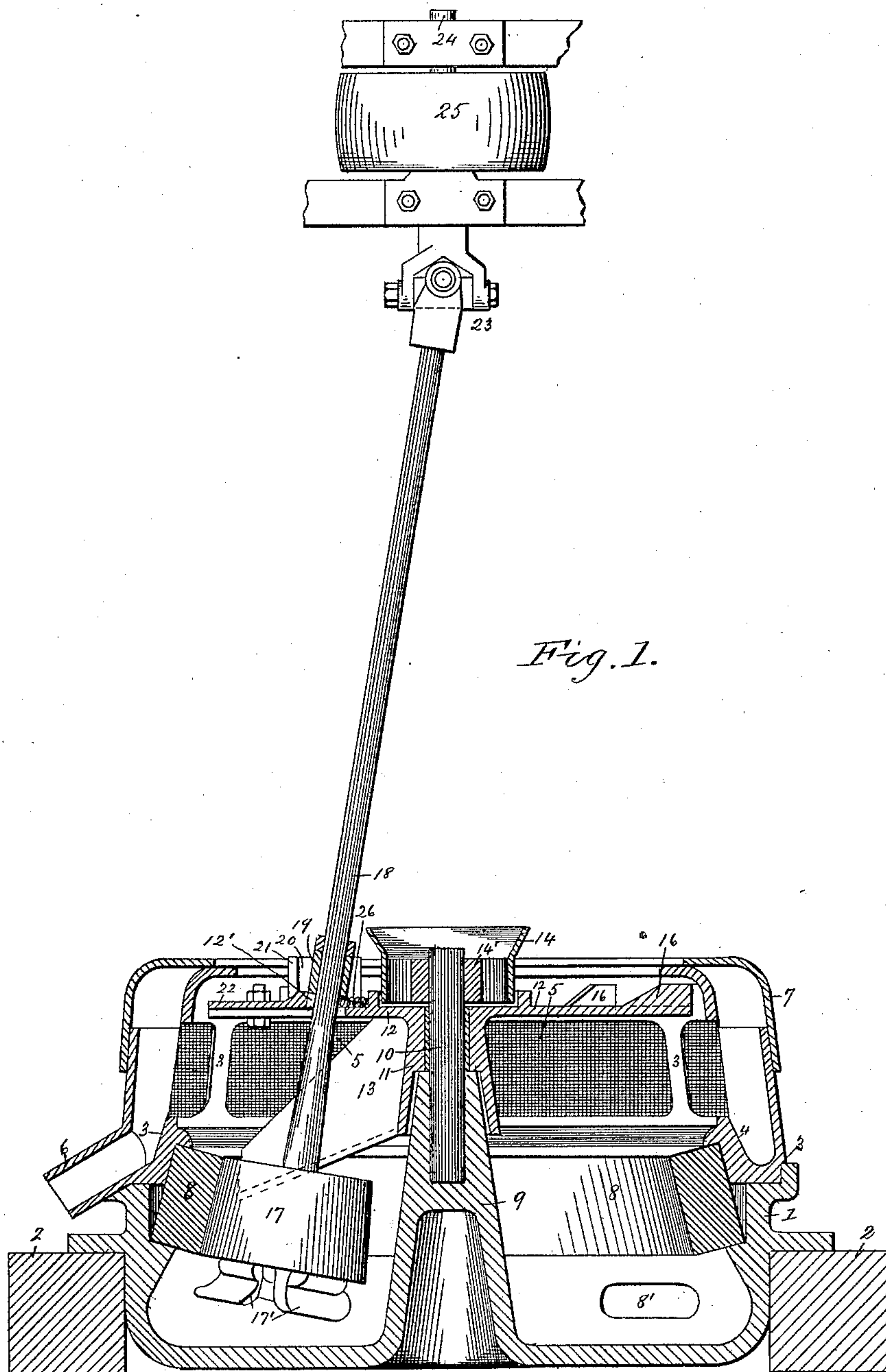
(No Model.)

2 Sheets—Sheet 1.

J. K. GRIFFIN.
PULVERIZING MILL.

No. 409,579.

Patented Aug. 20, 1889.



Witnesses:
T. R. Stuart,
Joseph H. Hunter

Inventor:
James K. Griffin.
By Marble & Mason,
Attys.

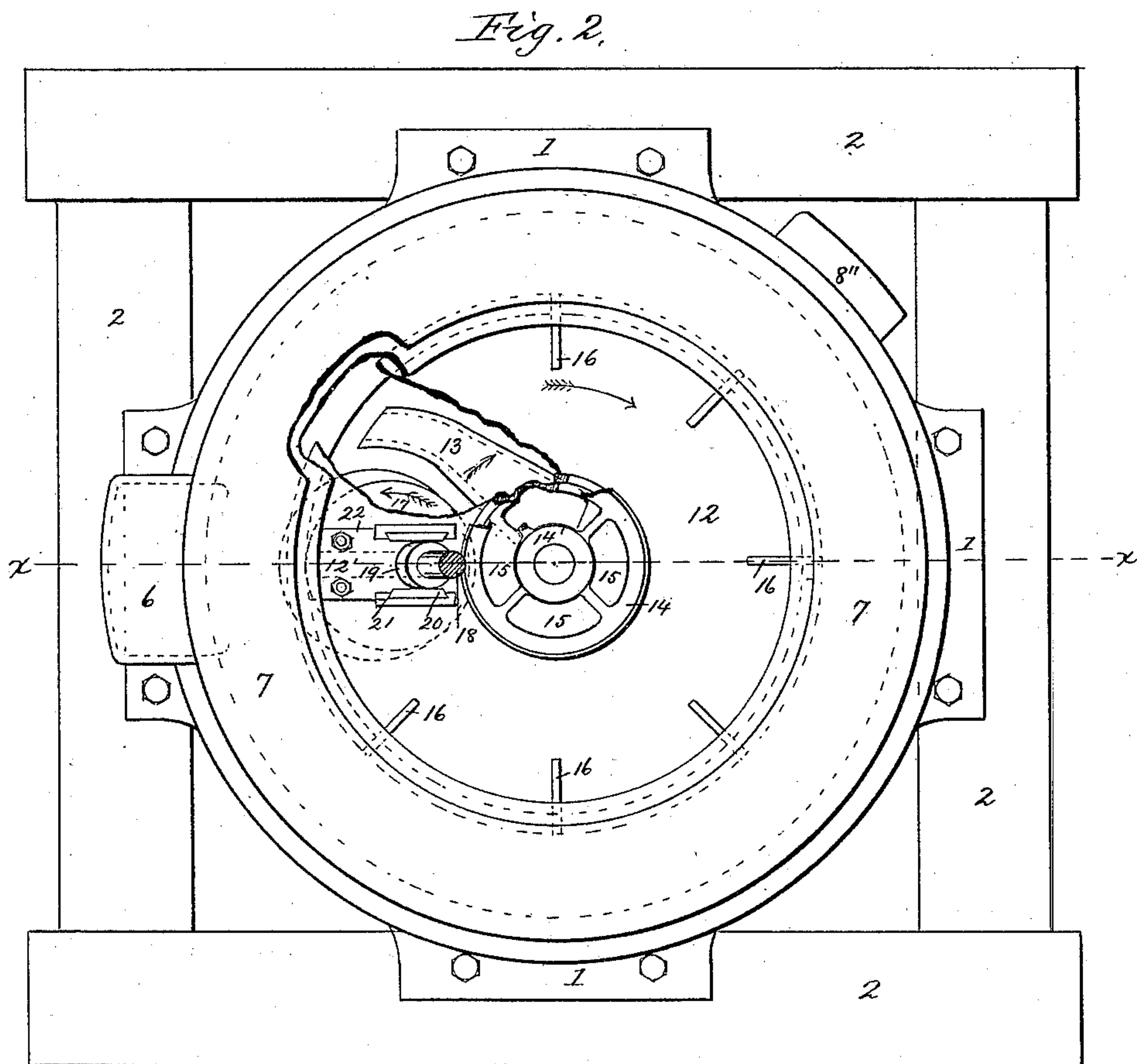
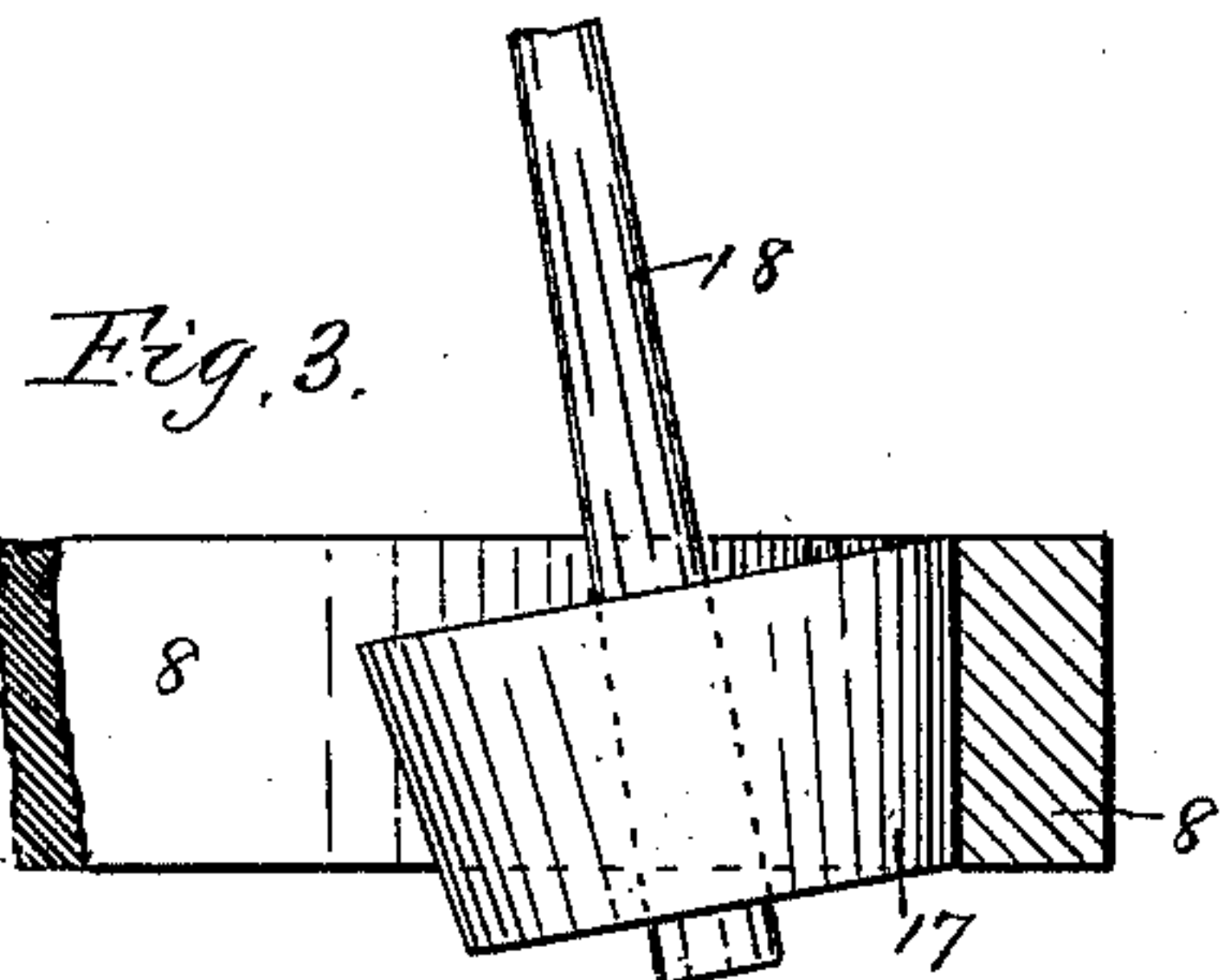
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UNITED STATES PATENT OFFICE.

JAMES KENT GRIFFIN, OF BROOKLYN, NEW YORK.

PULVERIZING-MILL.

SPECIFICATION forming part of Letters Patent No. 409,579, dated August 20, 1889.

Application filed February 18, 1889. Serial No. 300,304. (No model.)

To all whom it may concern:

Be it known that I, JAMES KENT 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, generally, to pulverizing-mills, and particularly to that class thereof in which the reduction or pulverization of ores and other substances is accomplished by the revolution of one or more rolls within and against the inner surfaces of rings or annular dies, and in which said rolls are held in contact with said rings or annular dies by centrifugal force when the mills are in operation; and it consists in the improvements in the construction and arrangement or combination of parts hereinafter disclosed in the description and claims.

The objects of my invention are, first, the production of a mill in which ores or other substances, however hard and refractory, may be cheaply and rapidly crushed and pulverized or reduced to an almost impalpable powder; second, to effect the application of the power employed direct to the roll-shaft, whereby the roll will be caused to positively rotate against the annular die, gyrate around the inner surface of the same, and by its rotary momentum and centrifugal force crush and pulverize the material between the same and said die; third, to provide a yielding or universal connection between the driving-power and the roll-shaft, whereby the roll will be positively revolved with its shaft on the same axis and gyrated within and against the inner surface of the annular die; fourth, to provide the pan or pulverizing-chamber with a top or cover which is provided with a hopper and delivery-spout and carried around or revolved by the revolution of the roll-shaft and roll, the material from said spout being delivered immediately in front of said roll; fifth, to effect the movement or agitation of the material falling upon the bottom of the pan or chamber below the annular die by means of stirrers on the lower end of the positively-re-

volved and gyrated roll, and, sixth, to so construct and arrange the pan or chamber, the screens, the pulverizing devices, and the connections for removing the crushed or pulverized material that it may be discharged from the mill screened or unscreened and wet or dry.

These objects are accomplished by the mechanism illustrated in the accompanying drawings, forming part of this specification, in which the same reference-numerals indicate the same parts, and in which—

Figure 1 represents a vertical section of my improved mill on the line $x x$ of Fig. 2; Fig. 2, a plan view of the same, the roll-shaft being in section, the driving mechanism omitted, and part of the revolving top or cover broken away; and Fig. 3, a view of a portion of an annular die, and also of a roll reversely shaped or arranged from that shown in Fig. 1 and having the purpose hereinafter specified.

In the drawings, the numeral 1 indicates the integrally-formed base and pan or chamber of the mill, within which the operation of pulverizing is carried on, and which is secured to a suitable support 2. On the top of said pan or chamber is secured the screen-frame 3, which is provided with an encircling trough 4 for receiving and discharging the pulverized material passing through the screens 5. This combined screen-frame and trough is formed with a discharge-spout 6, an inner wall having an inwardly-curved top, and an outer wall which is nearly vertical, and over the upper portions of said walls is secured an inwardly-curved plate or cover 7. The ring or annular die 8, against which the roll is revolved for pulverizing the material, is inclined inwardly and secured between flanges projecting inwardly from the pan or chamber and the screen-frame, as shown in Fig. 1. As thus arranged there is an annular space intermediate of said ring or die, the lower end of the pulverizing-roll, and the bottom of said pan or chamber, and into said space the partially and wholly pulverized material descends during the operation of the mill. An opening 8' is formed near the bottom of the pan or chamber 1 and communicates with a spout 8'', through which the pulverized material may be discharged beneath

the ring or annular die. Projecting upwardly from the bottom of the pan or chamber is a central socketed hub or boss 9, in which is rigidly fixed a stud or shaft 10. Surrounding this shaft and the upper end of said hub or boss is a loosely-fitted sleeve 11, which projects downwardly from an annular plate or disk 12, which is arranged within the upper portion of the screen-frame and constitutes a revolving top or cover for the pulverizing pan or chamber. On the under surface of this top or cover is secured or formed a feed-spout 13, which delivers the material against the annular die immediately in front of the roll by which it is pulverized. This feed-spout is in communication with the receiving-hopper 14, which is secured by a hub 14' upon the upper end of the stationary stud or shaft 10, and provided with a number of open-bottomed compartments 15, as shown in Fig. 2, which successively register with the upper open end of the spout 13 during the revolution of the top or cover 12. This revolving cover is also provided upon its upper surface, at suitable intervals around its periphery, with small wings or vanes 16, for causing a light current of air to flow into the mill and effectually prevent the escape of dust through the space between the stationary and revolving covers.

The crushing or pulverizing roll 17 is rigidly secured to the lower end of the roll-shaft 18, and is positively rotated thereby against the annular die, which is arranged a suitable distance above the bottom of the pan or pulverizing-chamber. To the bottom of the roll are attached the stirrers 17', which may be made of steel, chilled iron, or other hard material. They are driven into and secured in suitable dovetailed grooves or flanges formed in or upon the bottom of said roll before the tapered lower end of the roll-shaft 18 is secured to the latter. This roll-shaft passes up through a slot 12', formed in the top or cover 12, as shown in Figs. 1 and 2, and is provided with a sleeve 19, which rests and revolves against suitable anti-friction blocks 20, which are secured in flanges 21, projecting upwardly from the edges of a plate 22, which covers a portion of the slot 12' in the top or cover 12, through which passes said roll-shaft. This slot permits radial movement of said shaft and the roll at its lower end when they are in operation and under the influence of centrifugal force. The upper end of this shaft is connected to and suspended from a flexible or universal joint 23, which is secured to a suitably-supported drive-shaft 24, having a pulley 25 or other suitable gearing for imparting motion thereto. A spring of any suitable form, as the spiral spring 26, may be secured upon the revolving top or cover 12, and arranged to press against the roll-shaft 18 or the sleeve 19 thereon, as shown in Fig. 1, when the roll 17, on being positively or axially revolved, and also pressed radially against the ring or die 8 by said spring or

centrifugal force, will be rotated upon its own axis against the inner surface of said die, held thereto, and gyrated around the central axis of the mill or said die, and thus effectually pulverize the material introduced between the same and said die.

The roll 17 and the ring or die 8, as shown in Figs. 1 and 2, are of such shape and arrangement as to cause said roll to move truly within said die without slipping or sliding vertically; but under the shape and arrangement of the same parts as shown in Fig. 3 there will be some vertical slipping or sliding motion of the roll, since the line of contact between the same and the die, if extended, would fall outside of the universal joint or center of motion, and of necessity permit some upward movement of the roll over the inner surface of the die, which, in grinding or pulverizing some materials, is found to be more effective than when the roll is confined to a true or unvarying rolling motion against the die. It is evident that the shape of the roll and die may be varied, as may be found most effective in view of the nature of the material operated upon or the work to be done.

The operation of my improved mill is as follows: Material being introduced into the stationary receiving-hopper 14 and power applied to the pulley 25, the shaft 18 and the roll 17 will be rotated on their own axis, gyrated around the center of the mill, and carry with them the top or cover 12 and the feed-spout 13, which rotate upon the stud or shaft 10. The material fed into the stationary receiving-hopper 14 is discharged from its compartments 15 into the feed-spout 13, from which it is thrown against the die 8, immediately in front of the roll 17, and is thereby crushed or pulverized. It then falls upon the bottom of the pan or chamber, where it is kept constantly stirred or agitated by the stirrers 17' on the bottom of the roll. These stirrers also act in discharging the material both through the screens 5 and into the trough 4 and through the opening 8' and into the spout 8'', according to whether wet or dry grinding is being effected. If water be introduced, the material that is sufficiently fine will be passed out through the screens 5 into the trough 4, from which it will be discharged through the spout 6. On the other hand, if it be desired to grind material in a dry state, the opening 8' will be unclosed, when the stirrers 17' will force the pulverized material out through said opening. If this product be not sufficiently fine, it may be screened and the tailings returned to the mill. The vanes or wings 16, as stated, cause a light current of air to be forced into the mill, so as to effectually prevent the escape of dust through the space between the stationary and revolving covers.

In this mill the positive rotary motion of the roll against the inner surface of the die and its gyration around the central axis of the mill are accomplished by giving a posi-

tive rotary motion to said roll and also radial movement by centrifugal force, and not by drawing or shoving it around on a spindle carried and driven by a revolving center or driver. This peculiarity in the manner of driving my roll against the inner surface of the die causes far less strain on the driving connections than any construction heretofore devised for a similar purpose, so far as I am aware, and it also accomplishes the pulverization of refractory substances in a most satisfactory manner.

I am aware that it is old to positively revolve rolls and disks or mullers and grind with their peripheral surfaces and lower faces against the bottom, of stationary and revolving beds or dies and pans or chambers; that it is old to place a disk or muller in a stationary pan and move the same over the bottom of said pan by a lever having a ball-and-socket joint for a fulcrum and which is operated from above by an eccentric or crank, and that it is old to revolve a disk beneath a roll that remains in one place and is connected with a universal joint; but these combinations are altogether different from mine, and consequently I do not claim the same.

I make no claim herein to some of the elements and features disclosed, as the same form parts of an analogous invention, for which I have filed an application for Letters Patent simultaneously herewith.

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

1. In a pulverizing-mill, the combination, with an annular die, of a radially-movable roll-shaft and roll and mechanism for positively revolving the same upon their own axis and for gyrating them around the central axis of the mill, substantially as described.

2. In a pulverizing-mill, the combination, with a pan or pulverizing-chamber and an annular die arranged above the bottom thereof, of a suspended radially-movable roll-shaft and roll, which are also arranged above the bottom of said pan or chamber, and mechanism for positively revolving said shaft and roll upon their own axis and for gyrating them around the central axis of the mill, substantially as described.

3. In a pulverizing-mill, the combination, with the pan or chamber and the annular die or ring, of the radially-movable shaft having a fixed roll at its lower end, rotating against the inner surface of said die, mechanism for positively revolving said shaft and roll upon their own axis, and a universal joint for permitting of their gyration and connecting them to said revolving mechanism, substantially as described.

4. In a pulverizing-mill, the combination, with the pan or chamber and the annular die or ring, of the radially-movable shaft having a fixed roll at its lower end rotating against

the inner surface of said die, and mechanism for positively revolving and gyrating said shaft and roll upon their own axis and around the central axis of the mill, said mechanism consisting of the drive-shaft, the pulley, and the universal joint, substantially as described.

5. In a pulverizing-mill, the combination, with a pan or chamber provided with an annular die and a revoluble top or cover, of a radially-movable roll-shaft passing through said cover and having a roll at its lower end, and mechanism for positively revolving said shaft and roll upon their own axis and for gyrating them around the central axis of the mill and revolving said top or cover, substantially as described.

6. In a pulverizing-mill, the combination, with the pan or chamber 1, provided with the annular die 8, and the revoluble top or cover 12, formed with the radial slot 12', and provided with the plate 22, having anti-friction-lined flanges 21, of the radially-movable shaft passing through the slot in said cover and provided with the sleeve 19 and the roll 17, and mechanism for positively revolving said shaft and roll upon their own axis and for gyrating them around the central axis of the mill and revolving said top or cover, substantially as described.

7. In a pulverizing-mill, the combination, with a pan or chamber provided with an annular die, and a revoluble top or cover having a feed-spout, of a stationary receiving-hopper communicating with said feed-spout, a radially-movable roll-shaft passing through said cover and having a roll at its lower end, and mechanism for positively revolving said shaft and roll upon their own axis and for gyrating them around the central axis of the mill and revolving said top or cover, substantially as described.

8. In a pulverizing-mill, the combination, with a pan or pulverizing-chamber and an annular die arranged above the bottom thereof, of a suspended radially-movable roll-shaft, a roll secured to the lower end thereof and provided with stirrers on its lower end, which are also arranged above the bottom of said pan or chamber, and mechanism for positively revolving said shaft and roll upon their own axis and for gyrating them around the central axis of the mill, substantially as described.

9. In a pulverizing-mill, the combination, with the pan or pulverizing-chamber 1, formed with the opening 8' and provided with the annular die 8, the screens 5, and the screen-frame 3, of the suspended radially-movable roll-shaft 18, the roll 17, secured to the lower end thereof and provided with the stirrers 17', and mechanism for positively revolving said shaft and roll upon their own axis and for gyrating them around the central axis of the mill, substantially as described.

10. In a pulverizing-mill, the combination, with the pan or pulverizing-chamber 1, formed with the opening 8' and provided with the annular die 8, the screens 5, and the screen-

frame 3, formed with the trough 4 and spout
6, of the suspended radially-movable roll-
shaft 18, the roll 17, secured to the lower end
thereof and provided with the stirrers 17',
5 and mechanism for positively revolving said
shaft and roll upon their own axis and for
gyrating them around the central axis of the
mill, said mechanism consisting of the drive-

shaft 24, the pulley 25, and the universal
joint 23, substantially as described. 10

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

JAMES KENT GRIFFIN.

Witnesses:

GUSTAVE MAGNITZKY,
WM. A. MUNROE.