No. 636,121. Patented Oct. 31, 1899.

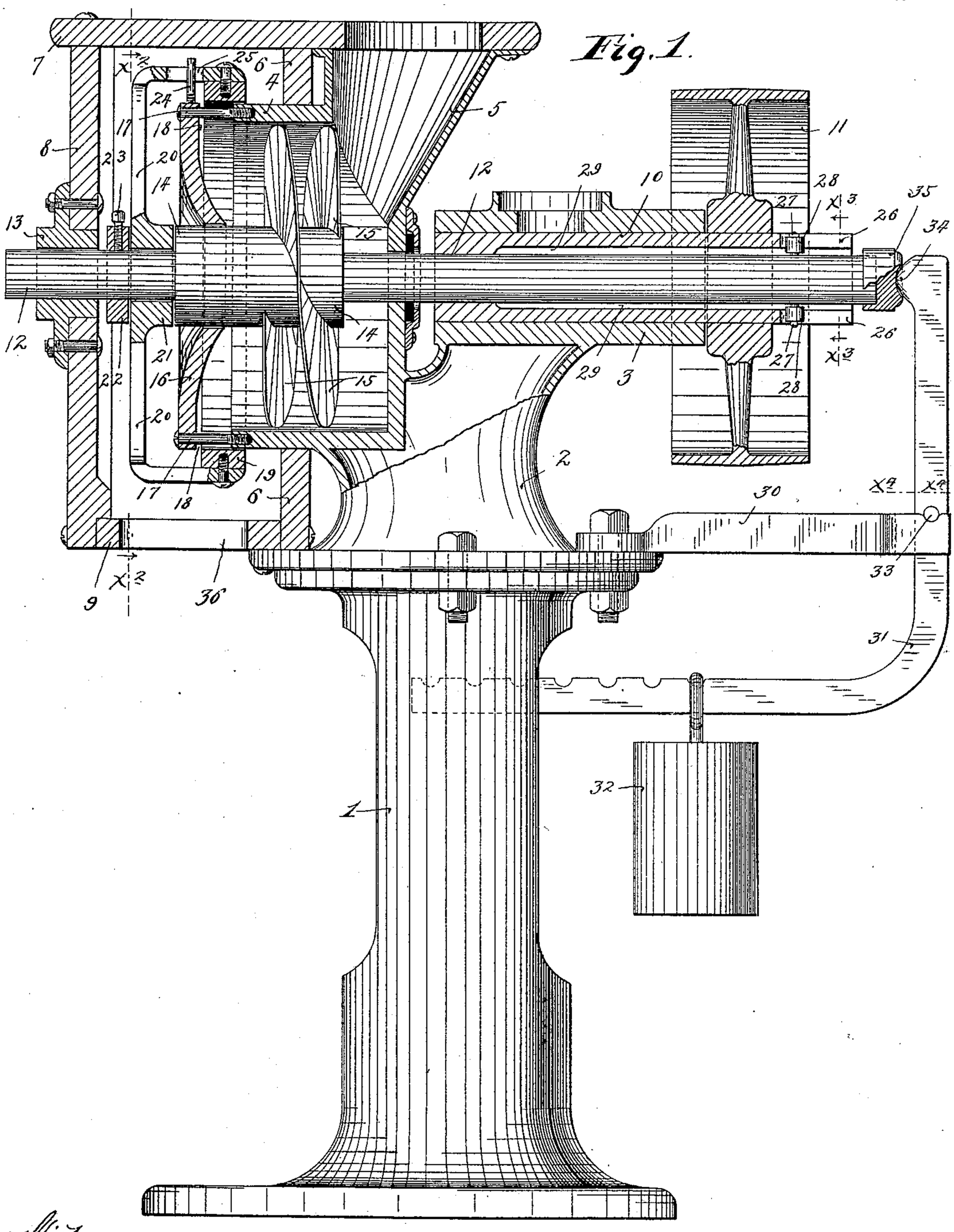
E. R. DRAVER.

GRINDING MILL.

(Application filed Jan. 7, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses.

Harry Kilgore

F. D. Merchant.

Inventor

Emil R. Draver:

By his Attorney.

Jas. F. Williamson

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig. 2.

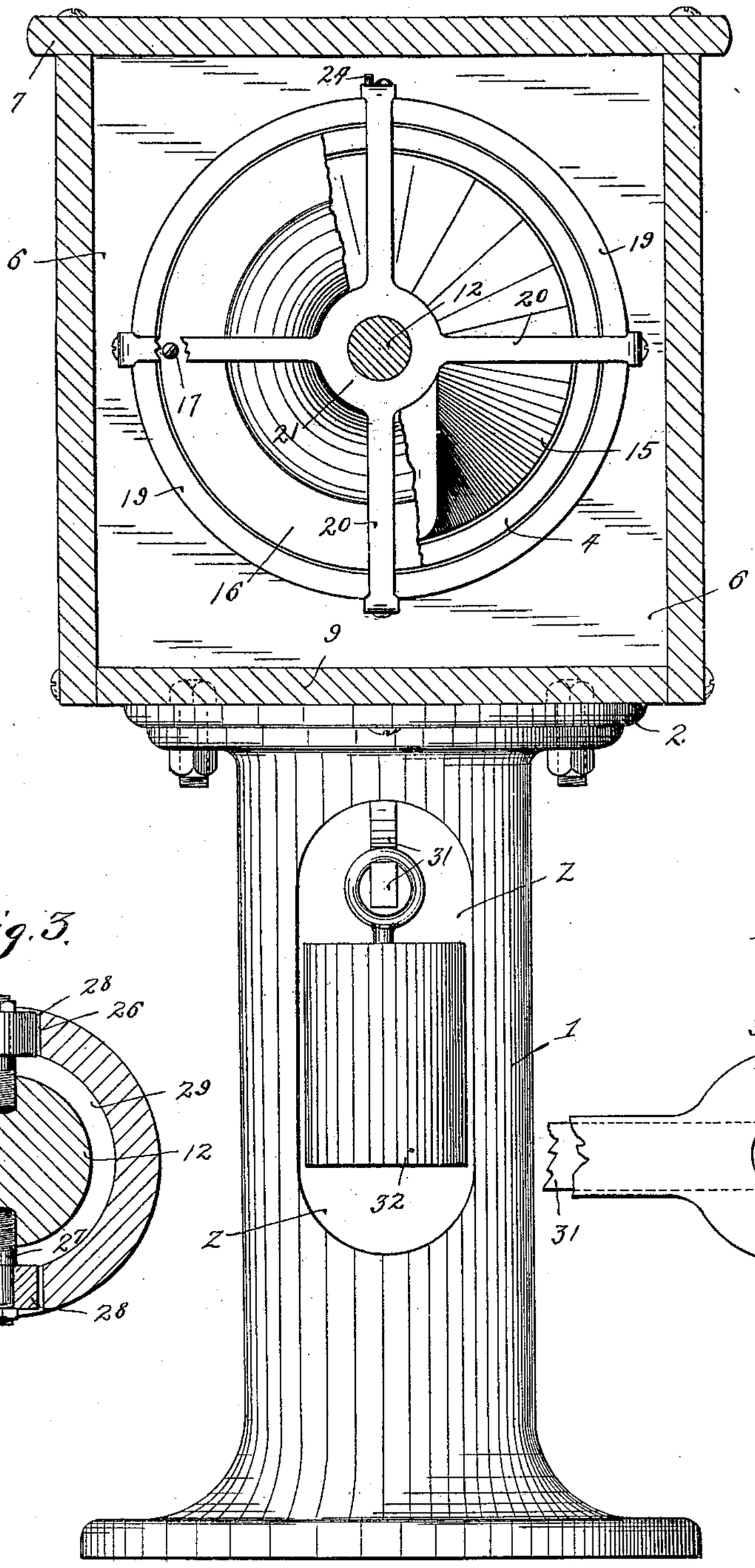
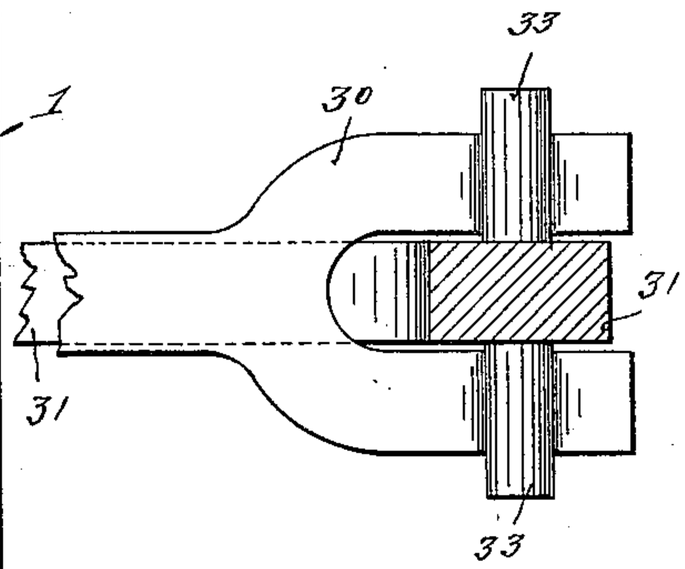


Fig. 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

EMIL R. DRAVER, OF WINCHESTER, INDIANA, ASSIGNOR OF ONE-THIRD TO HENRY C. DRAVER, OF SAME PLACE.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 636,121, dated October 31, 1899.

Application filed January 7, 1899. Serial No. 701,435. (No model.)

To all whom it may concern:

Be it known that I, EMIL R. DRAVER, a citizen of the United States, residing at Winchester, in the county of Randolph and State of Indiana, have invented certain new and useful Improvements in Grinding-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 grinding-mills of that type wherein a screw or propeller coöperates with a resistance plate or block to effect the grinding action, and has for its object to provide an improved machine of this class with a view of securing an increased capacity.

To this end my invention consists of the novel devices and combinations of devices which will be hereinafter described, and defined in the claims.

The invention is illustrated in the accompanying drawings, wherein like notations refer to like parts throughout the several views.

Figure 1 is a view chiefly in front elevation, but partly in vertical section, with some portions broken away, illustrating my improved machine. Fig. 2 is a view, partly in elevation and partly in vertical section, on the line x^2 x^2 of Fig. 1. Fig. 3 is a detail in cross-section on the line x^3 x^3 of Fig. 1 with some parts removed. Fig. 4 is a detail in horizontal section on the line x^4 x^4 of Fig. 1.

The numeral 1 represents a main casting of suitable form to afford a supporting-pedestal for the machine. To the pedestal 1 is bolted or otherwise rigidly secured a casting 2. The casting 2 is of suitable form to afford a long bearing 3 for the pulley-sleeve 10 and has formed integral therewith a cylindrical casting 4, open at its outer end and constituting the feed trough or casing for the grinding screw or propeller, as will later more fully appear. The casting 4 is also provided with an extension 5, which serves as the feed-hopper. The feed trough or casting 4 extends through one member 6 of a set of housing-plates 6, 7, 8, and 9, which are rigidly secured together and to the casting 2 and 5 and are of such size as to afford sufficient space or clearance between the inclosed outer end of the cylinder or feed-trough 4 and the housing formed by said plates.

In the long bearing 3 is mounted the sleeve 10, which has fixed thereto a driving-pulley 11. Within the sleeve 10, as one of its bearings, is mounted a shaft 12, which extends through a feed-trough 4 and has its opposite end mounted in a bearing 13, fixed to the outer-end housing-plate 8. To the shaft 12 is fixed a propeller-hub 14, having blades 15, which work within the feed-trough 4. As shown, the propeller is in the form of a double screw. The hub 14 of the propeller is extended and works through a suitable passage provided therefor in a stationary resistance-plate 16. Said plate 16 is secured to the outer end of the grinding-cylinder 4 by draw-bolt screws 17. This permits the plate 16 to be adjusted and set in respect to the end of the grinding-cylinder 4 to afford an opening 18 between the two of any desired size. The opening 18 is controlled by a ring 19, which is mounted to telescope over the outer end of the cylinder 4. Said ring 19 is carried by the horizontal extensions of spider-arms 20, the vertical or radial members of which project from a common hub 21, which is loosely mounted on the shaft 12 outward of the propeller-hub 14. A stop-collar 22 is located on the shaft 12 outward of the spider-hub 21 and is provided with a suitable set-screw 23 for securing the same to the shaft in any desired set position. The resistance-plate 16 is provided with a projecting radial pin 24, which works through a slot 25 in the horizontal extension of one of the spider-arms 20. This arrangement prevents the spider 20 21 and the ring 19 from rotating.

The pulley-sleeve 10 is provided at its right end with a pair of open-ended slots 26, as best shown in Figs. 1 and 3. The shaft 12 is provided with a pair of shouldered studs 27, fitted with rollers 28, which work in said slots 26 of the pulley-sleeve 10. The slots 26 in the sleeve 10 are of course directly opposite to each other. Likewise the studs 27 and the rollers 28 are located directly opposite to each other on the shaft 12. It is obvious that with this construction the pulley-sleeve 10 and the shaft 12 are connected for rotation together under the driving action from the

pulley 11, while at the same time the shaft 12 is free for sliding or longitudinal motion through the sleeve 10. This roller-and-slot form of clutch for connecting the pulley-sleeve 10 and the shaft 12 is a good one, because thereby friction is minimized. For further reducing the friction under the sliding movement of the shaft 12 the pulley-sleeve 10 is recessed for the greater portion of its length, as shown at 29 in Figs. 1 and 3. Hence the shaft 12 has its bearing on the sleeve 10 only at the inner end of the sleeve.

To a horizontal bracket 30, rigidly secured to the flanges of the castings 1 and 2 and projecting toward the right under the shaft 12, is fulcrumed a bent lever 31, which is provided on its lower or horizontal arm with a suitable adjustable weight 32. The horizontal arm of the lever 31 projects through an opening Z, formed in the pedestal-casting 1, and this passage or opening is sufficiently large to permit the weight 32 to also pass therethrough. As shown, the bracket 30 is bifurcated at its outer end to pass the lever 31, and the lever 31 is provided with trunnions 33, which rest in suitable seats provided therefor in the prongs or arms of said bracket 30, as best shown in Fig. 4. The upper end of the lever 31 has a convex head 34, which bears against a cap 35, fixed to the outer end of the shaft 12. The cap 35 has a concave face for coöperation with the convex head 34. Hence the shaft 12 is under yielding pressure from the weight 32 to move toward the left and force the propeller-blades 15 toward the stationary resistance-plate 16.

With the construction above described the grinding action may be readily understood from the following statement:

Assuming the proper stock to be supplied through the feed-hopper 5 to the feed-trough 4 and the propeller to be under rotary motion at the proper speed, the grinding action will take place under the coöperation of the propeller-blades 15 and the stationary resistance-plate 16. As the shaft 12 is under strain from the weight 32 to move toward the left, the propeller-hub 14 will slide through the resistance-plate 16, and the stock will be fed by the blades 15 and be held under yielding pressure against the inner face or surface of the resistance-plate 16. Hence under the rotary motion of the propeller the stock will be ground by the rubbing action of the propeller-blades and the rubbing action of the particles of the stock on each other. Otherwise stated, the propeller-blades rub against the stock under yielding pressure, and the rotary motion of the stock itself when thus held under pressure between the propeller-blades and the resistance-block makes the particles rub against each other, thereby producing the grinding action. The resistance-plate 16 is bulged inward at its center, so as to flare outward from its joint with the propeller-hub 14 toward the periphery of the resistance-plate 16. This conoidal form of the resistance-plate 16 affords a greater facility of discharge in the outward radial movement of the stock toward the periphery of the plate. Hence the stock is gradually worked toward the periphery of the plate and finds its way out through the discharge-opening 18, whence it falls through a passage 36 in housing-plate 9 into a suitable chute or other receptacle. (Not shown.)

By shifting the weight 32 the propeller-blades may be set to work toward the resistance-plate 16 under any desired yielding pressure. As the ring 19 is carried by the spider-arms 20 and as the spider-hub 21 is located directly between the outer end of the propeller-hub and the stop-collar 22, said ring 19 will shift with the longitudinal movement of the propeller, thus varying the size of the discharge-opening 18. This renders the mill to a large extent self-adjusting for the proper grinding action regardless of whether or not the feed of the stock from the hopper 5 is properly graduated. If a large quantity of stock is supplied to the feed-trough 4, the propeller will simply yield backward or move away from the resistance-plate 16, thereby increasing the size of the opening 18 for adaptation to the increased quantity of stock, while continuing to grind under the same pressure as if a smaller quantity of stock were being acted on. The ring 19 is simply one form of discharge-gate for controlling the discharge-opening from the grinding-chamber.

The discharge-gate might take other forms than that shown, as long as the gate is automatically adjustable with the propeller-shaft, or the discharge-opening itself might be varied by the longitudinal movement of the propeller shaft or hub.

It is of course well known that this class of grinding-mills is intended for operation on comparatively soft stocks, which cannot be handled with equally good effect in a roller-mill. Such soft stocks when subject to the rolls are simply smashed or flattened. Under the treatment peculiar to this type of grinding-mills they may be ground into granular condition, so as to have much the same appearance as hard stock when treated by a roller-mill.

This machine is especially adapted for action on what is known to the trade as "dust middlings." It may, however, be used on other forms of stock after one or more breaks or reductions have been made.

It will be understood, of course, that the invention herein disclosed is capable of modification in construction without departing from the spirit of the invention.

So far as I know, I am the first to provide in a machine of this type a grinding screw or propeller wherein the grinding or propelling blades radiate from a solid hub or solid shaft as distinguished from being formed by a twist in the shaft, auger-like,

and wherein the hub is extended through a suitable resistance block or plate, whether the latter be stationary or movable. I am also the first, so far as I know, to hold the grinding screw or propeller under yielding pressure for movement toward and from the resistance plate or block, which coöperates therewith. I am also the first, so far as I know, to provide in a mill of this type a discharge-opening which is automatically varied in size under the longitudinal movement of the grinding screw or propeller. All these features I desire to claim in the broadest possible way.

By actual experience I have demonstrated the efficiency of the mill herein disclosed for the purposes had in view. As compared with a roller-mill for action on the same kind of stock—dust middlings, for example—I have found that a small mill of this type, costing only a small fraction of the cost of a roller-mill, will do an equal amount of work and give a product of much higher grade.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a grinding-mill, the combination with a feed-trough or propeller-casing and a suitable non-rotary resistance-plate, of a grinding screw or propeller having an extended hub which passes through said resistance-plate, with said parts mounted to afford a yielding action between said plate and said propeller, substantially as described.

2. In a grinding-mill, the combination with a feed-trough or propeller-casing and a suitable non-rotary resistance-plate, of a grinding screw or propeller within said casing, held under yielding pressure to move toward and from said resistance-plate, and a discharge-opening which is automatically varied in size under the longitudinal motion of said propeller, substantially as and for the purposes set forth.

3. In a grinding-mill, the combination with a feed-trough or propeller-casing and a stationary resistance-plate, of a screw or propeller within said feed-trough, having an extended hub or shaft, mounted to slide through said resistance-plate, under yielding pressure to move the propeller toward the resistance-plate, and a discharge-gate controlled by the propeller to automatically vary the size of the discharge-opening from the grinding-chamber, substantially as described.

4. In a grinding-mill, the combination with a feed-trough or propeller-casing and a stationary resistance-plate, of a screw or propeller, within said feed-trough, having an extended hub or shaft mounted to slide through said resistance-plate, under yielding pressure, and a discharge-gate carried by the propeller-shaft and movable therewith to vary the size of the discharge-opening from the grinding-chamber, substantially as described.

5. In a grinding-mill, the combination with a feed-trough or propeller-casing and a stationary resistance-plate of a screw or propeller, within said feed-trough, having an extended hub or shaft, mounted to slide through said resistance-plate, under yielding pressure, a spider carried by said shaft and movable under the sliding motion of the shaft, and a discharge-gate carried by said spider and controlling the discharge-opening provided between the outer end of the feed-trough and said stationary resistance-plate, substantially as described.

6. In a grinding-mill, the combination with a feed-trough or propeller-casing, and a stationary resistance-plate, of a screw or propeller, within said trough or casing, having an extended hub or shaft, mounted to slide through said resistance-plate, under yielding pressure, and a driving-sleeve affording a bearing for said propeller-shaft, and a clutch connecting said sleeve and shaft for common rotation, but permitting the said shaft to slide in said sleeve, substantially as and for the purposes set forth.

7. In a grinding-mill, the combination with a feed-trough or propeller-casing and a stationary resistance-plate of a screw or propeller within said feed-trough or casing, having an extended hub or shaft mounted to slide through said resistance-plate, under yielding pressure, the driving-sleeve 10 having the open-ended slots 26, and the shouldered studs 27, fixed to the shaft 12 and provided with the rollers 28, working in said slots 26 of said sleeve 10, substantially as and for the purposes set forth.

8. In a grinding-mill, the combination with a feed-trough or propeller-casing, and a stationary resistance-plate, of a screw or propeller within said trough or casing, having an extended hub or shaft mounted to slide through said resistance-plate, the pivoted lever 31 having the adjustable weight 32 mounted to bear against the end of the propeller-shaft, for holding the same under yielding pressure, to move the propeller-blades toward the resistance-plate, substantially as described.

9. The combination with the feed-trough 4 of the stationary resistance-plate 16, adjustably secured thereto by the draw-bolts 17, for setting said plate in any desired fixed position, relative to the outer end of the feed-trough, the propeller within said feed-trough having the extended hub, 14, working through said resistance-plate, the spider carried on said shaft between the propeller-hub and a stop-collar 22, and the discharge-gate 19, carried by said spider for controlling the discharge-opening between said trough and said plate, and a connection from said plate to said spider, for preventing the spider and gate from rotating with the shaft, all substantially as described.

10. In a grinding-mill, the combination with a feed-trough or propeller-casing and a suitable resistance-plate, of a grinding screw or propeller, within said casing, held under yielding pressure to move toward and from said resistance-plate, and a discharge-gate controlled by the longitudinal motion of said propeller to vary the size of the outlet from the grinding-chamber, substantially as described.

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

EMIL R. DRAVER.

Witnesses:

HENRY C. DRAVER,

CHAS. E. KLAER.