No. 860,782. PATENTED JULY 23, 1907.

M. F. ABBÉ.

GRINDING MILL.

APPLICATION FILED MAR. 15, 1907.

3 SHEETS—SHEET 1.

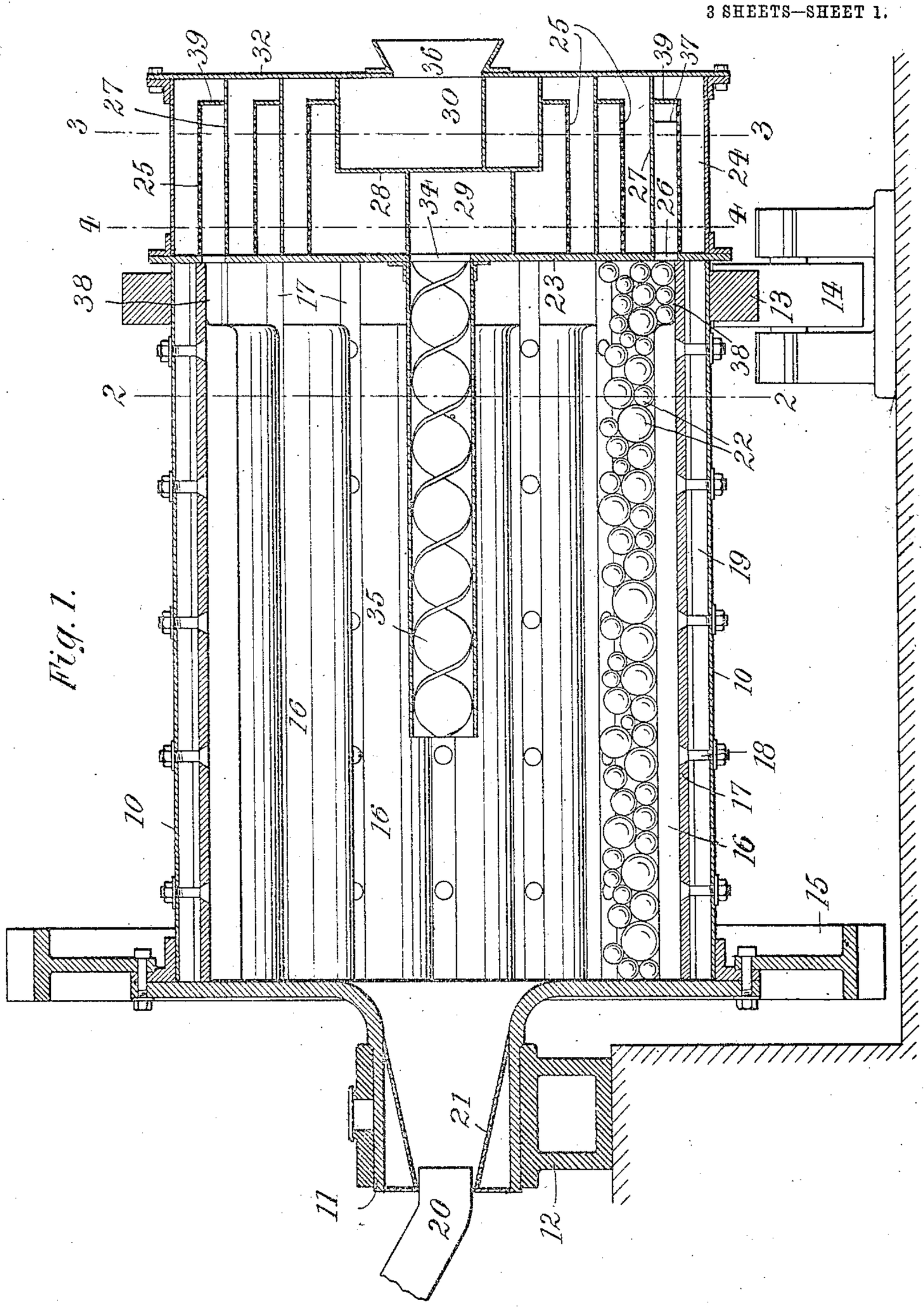

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

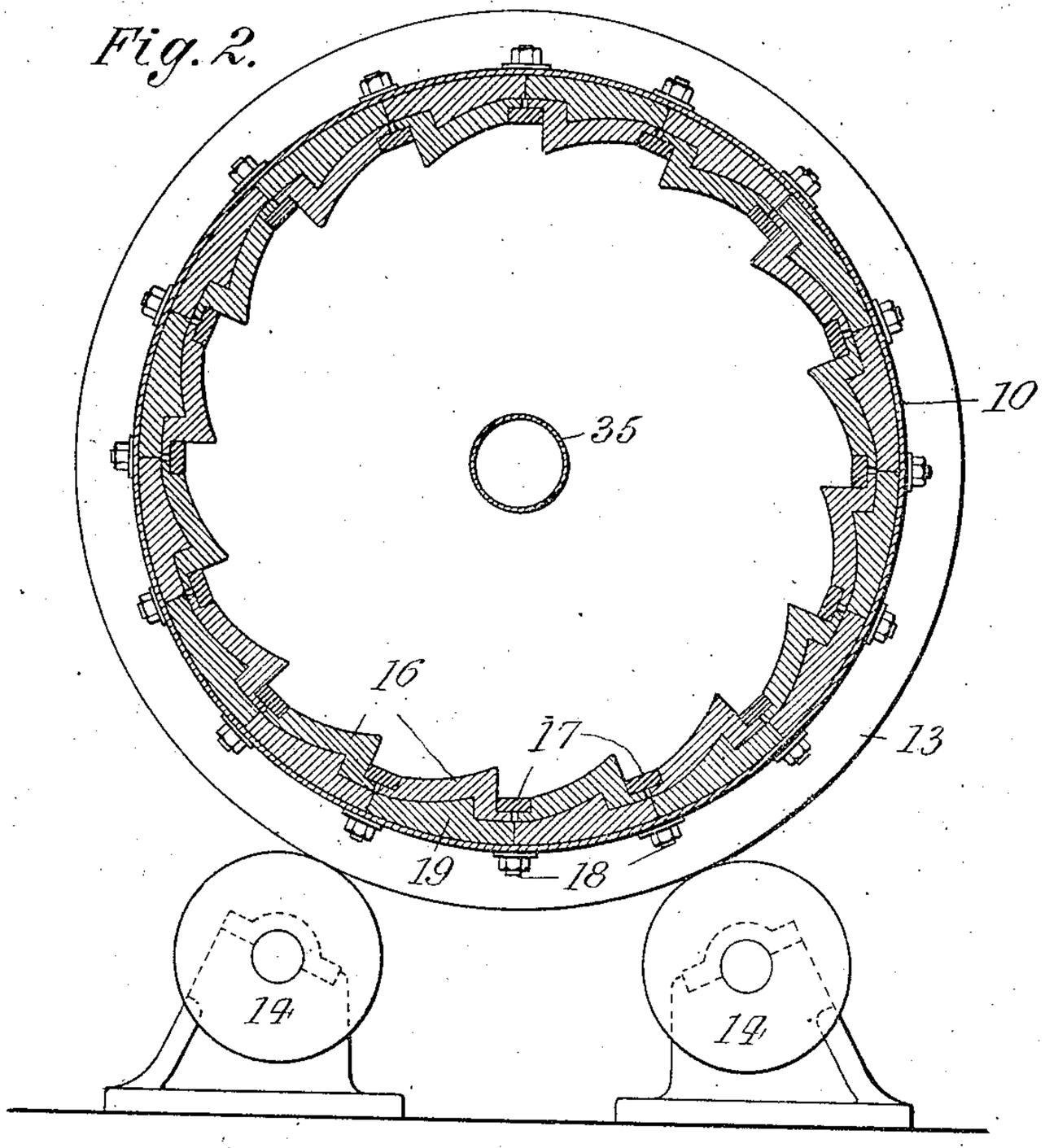
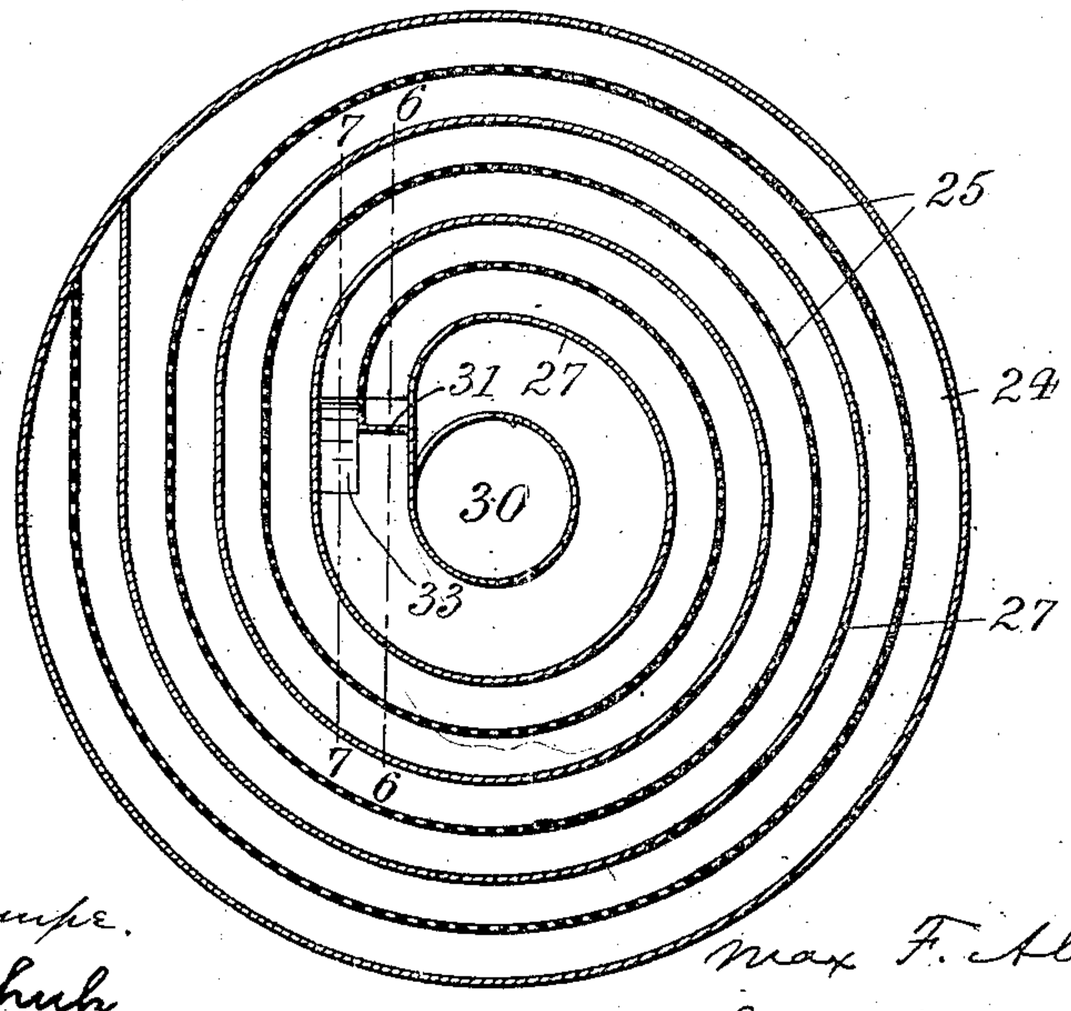


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

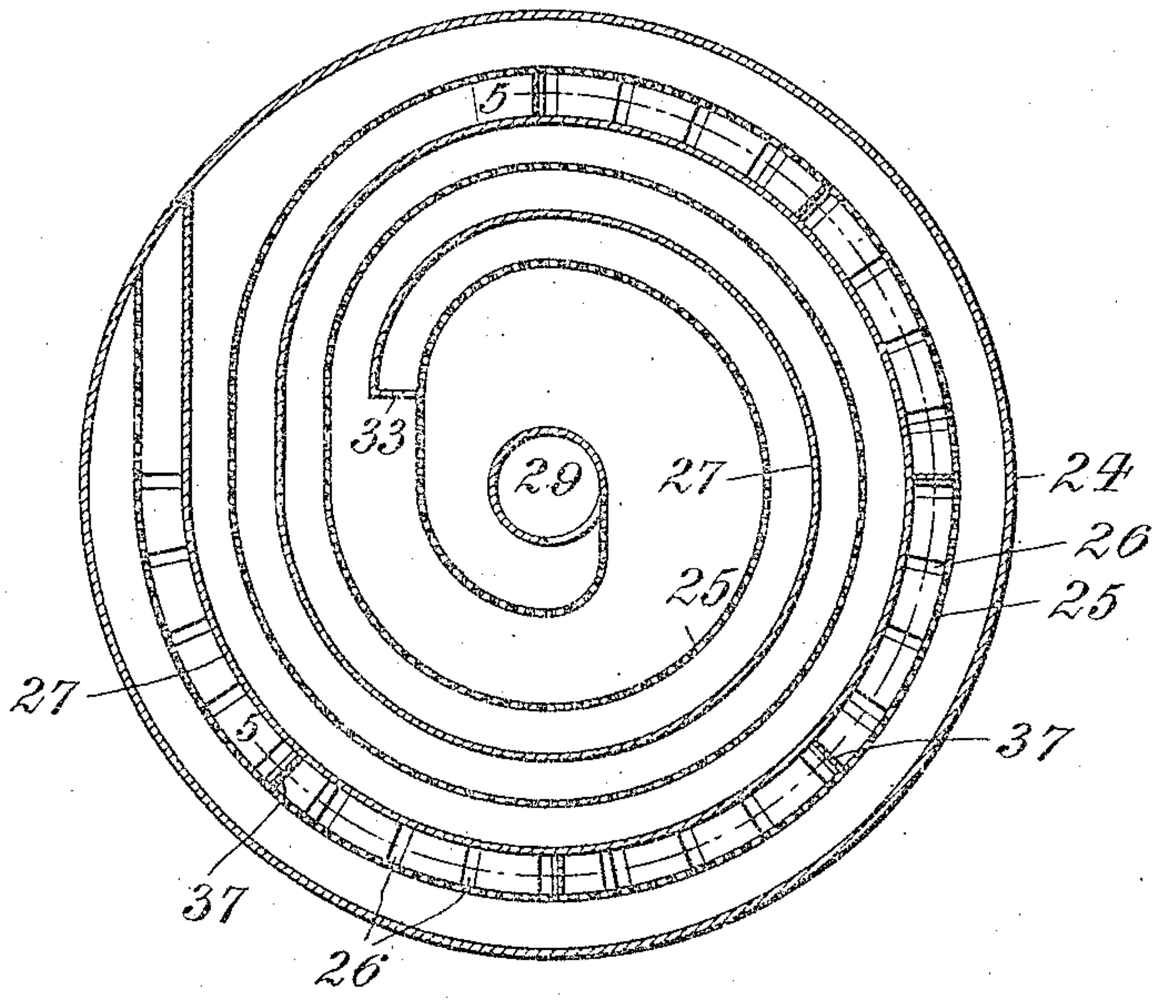


Fig. 5.

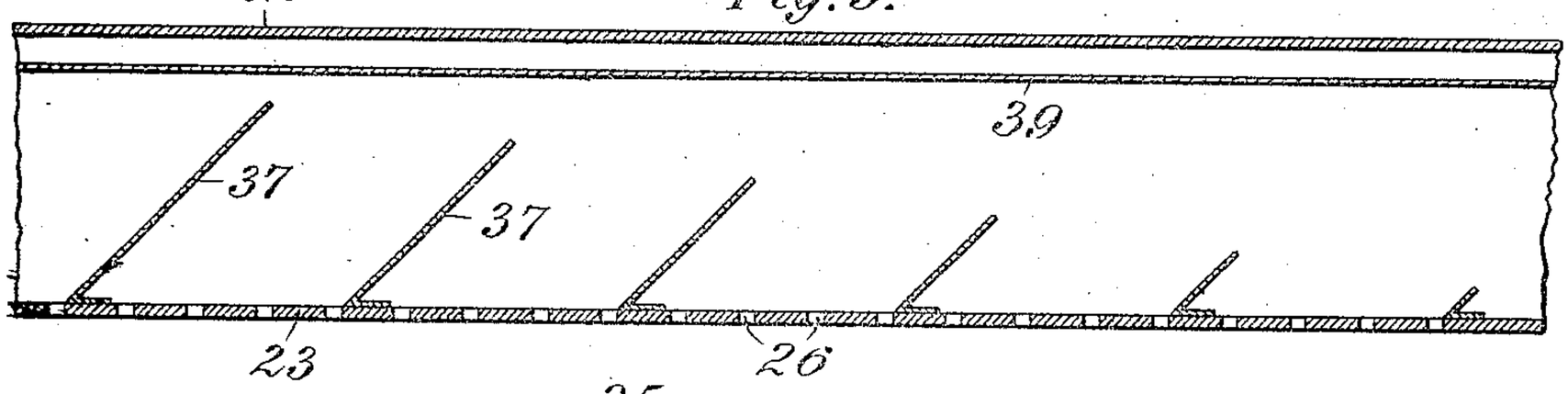


Fig. 6.

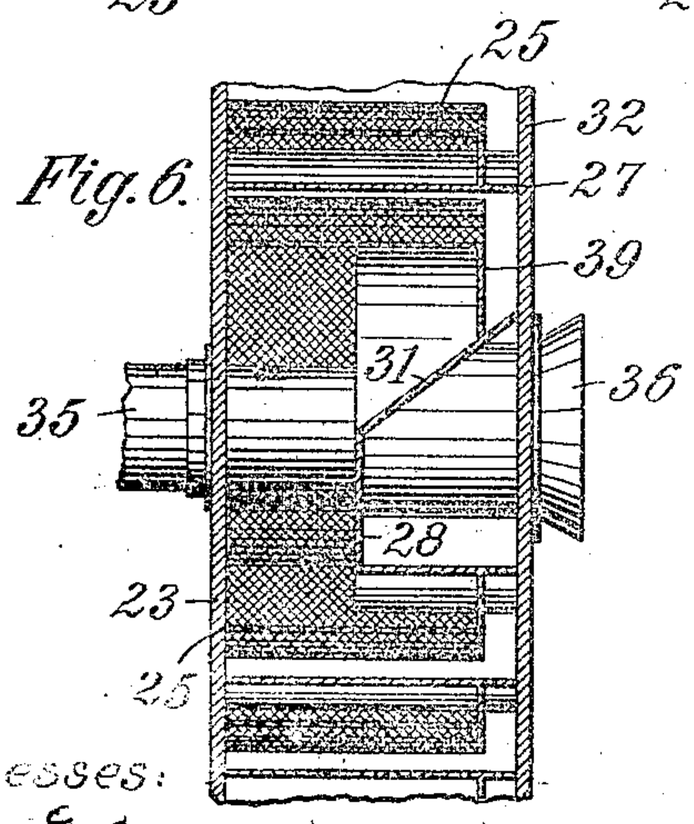
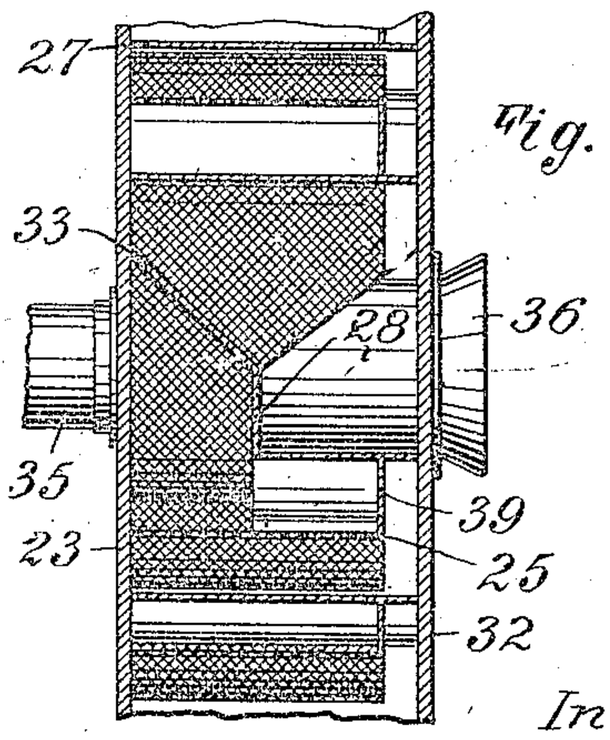


Fig. 7.



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UNITED STATES PATENT OFFICE.

MAX F. ABBÉ, OF NEW YORK, N. Y.

GRINDING-MILL.

No. 860,782. Specification of Letters Patent. Patented July 23, 1907.

Application filed March 15, 1907. Serial No. 362,449.

To all whom it may concern:

Be it known that I, MAX F. ABBÉ, a citizen of the United States, residing at New York city, (Manhattan,) county and State of New York, have invented new and useful Improvements in Grinding-Mills, of which the following is a specification.

This invention relates to a grinding mill and more particularly to improved means for screening the ground material and returning the tailings to the mill.

By my invention the screening capacity of the mill may be greatly increased and is rendered independent from the capacity of the working chamber.

In the accompanying drawings: Figure 1 is a vertical longitudinal section of a grinding mill embodying my invention; Fig. 2 a cross section on line 2—2, Fig. 1; Fig. 3 a cross section on line 3—3, Fig. 1; Fig. 4 a cross section on line 4—4, Fig. 1; Fig. 5 a section on line 5—5, Fig. 4, laid out in a plane; Fig. 6 a section on line 6—6, Fig. 3, and Fig. 7 a section on line 7—7, Fig. 3.

The cylindrical shell 10 of the mill which incloses the usual grinding or working chamber, is provided at its inlet end with a hollow trunnion 11 supported upon bearing 12. Near its discharge end, shell 10 is embraced by a ring 13 supported upon rollers 14. Shell 10 is rotated through a gear wheel 15, by a suitable power-transmission, (not shown).

Within shell 10 is fitted a step-shaped lining 16 composed of a series of angular plates which are connected to each other and to the shell by means of longitudinally arranged keys or locking-bars 17. The latter are seated within grooves formed between adjoining liners and are attached to the shell by bolts 18. Between liners 16 and shell 10, there may be interposed a wooden backing or cushion 19 having a stepped face, to properly seat the liners.

The material to be ground is introduced into the mill by an axial feed pipe 20 that enters hollow trunnion 11, the latter being preferably provided with a tapering inner wall 21 that assists the discharge of the material along the trunnion into the mill. Within the mill, the material may be reduced by means of balls 22, coöperating with the stepped liners 16, or in other suitable manner.

At its discharge end there is secured to head 23 of shell 10 a screening chamber 24, which forms an axial addition to the working chamber. This screening chamber may be made of any dimensions desired, its diameter, as well as its length, being independent from the corresponding dimensions of the working chamber, so that the screening capacity of the mill is not in any way defined or restricted by the capacity of the working chamber.

Within chamber 24 is fitted a continuous spiral screen 25, having a point on the axis of the mill for its pole and composed of a number of convolutes which thus surround such axis. Upon the outermost convolute of screen 25 the ground and partly ground material is discharged from shell 10 through a suitable number of peripheral openings 26 in head or partition 23. Concentric to the spiral screen 25, there is further fitted within chamber 24, a helical imperforate conveyer 27, the convolutes of which are inter-coiled, or alternate with those of the screen. By arranging the windings of the screen and conveyer more or less closely, the length of the screen and consequently the screening capacity of the mill may be made to conform to the capacity of the working chamber and to the character of the particular material triturated.

It will be seen that during the operation of the mill, the material received from shell 10 will glide along screen 25 until it is carried from the outer volute to the inner volute thereof. In this way the material is simultaneously screened and lifted towards the axis of the mill. During the travel of the material along the screen, the finer particles passing through the meshes will fall upon the volutes of the spiral conveyer 27. Thus, these finer particles are also gradually lifted from the periphery towards the axis of the mill.

Means are provided for returning the coarser particles or tailings from the central or innermost volute of the screen into shell 10, and for discharging the properly ground particles from the central or innermost convolute of the conveyer. These means are shown to consist of a central partition 28 fitted parallel to head 23 between the innermost windings of screen and conveyer. This partition forms a left pocket 29 and a right pocket 30, the former being adapted to receive the tailings, while the latter is adapted to receive the powdered material. In order to gather the tailings occupying the entire width of the screen into pocket 29, there is provided an inclined guide 31 extending inwardly from head 32, of chamber 24, to partition 28. In like manner the ground material is gathered from conveyer 27 into pocket 30 by an inclined guide 33 extending outwardly from head 23 to partition 28. From pocket 29 the tailings pass through a central opening 34 of head 23 into a screw conveyer 35, extending a suitable distance into shell 10, within which it is axially mounted. Thus the tailings are returned to the mill for re-grinding, the length of conveyer 35 being selected to deliver the tailings at the point desired.

From pocket 30 the ground material passes out of the mill through an axially arranged discharge hopper 36, which is preferably made of the flaring shape shown.

To distribute the material received from shell 10, over the entire width of screen 25, there extend obliquely over the outer volute of the latter, a series of inclined baffle-plates 37. These plates are of gradually decreasing length and are preferably attached to head 23, (Fig. 5).

It is preferred to cut away or reduce the steps of the liners 16 at the discharge end of shell 10, (Fig. 1), by which construction there is formed an annular recess 38 adjoining head 23 and communicating with chamber 24 by the openings 26. Within this recess the ground and partly ground material accumulates, to be delivered to screen 25 through such openings.

The head 32 of chamber 24 is preferably removable, so that access to the latter may be readily obtained. Screen 25 may be made of less width than conveyer 27, it being in that case supported along its outer edge by a spiral partition 39. In this way the screen remains properly supported when head 32 is removed.

It will be seen that with the construction described, the screening capacity of the mill is not limited by the capacity of the working chamber, but is entirely independent therefrom. Furthermore, by providing an axial discharge for the ground material in lieu of the bottom discharge usually found in ball mills, the height of the mill and its mountings is considerably reduced, resulting in a corresponding economy in shop space.

I claim:

1. A grinding mill composed of a rotatable cylindrical grinding chamber, a communicating screening chamber, a spiral screen and a spiral conveyer within the screening chamber and rotatable therewith, the convolutes of said screen and conveyer surrounding the axis of the mill, means for returning the tailings from the screen to the grinding chamber, and means for discharging the ground material from the conveyer, substantially as specified.

2. A grinding mill composed of a rotatable cylindrical grinding chamber, a communicating screening chamber, a spiral screen and a spiral conveyer within the screening chamber and rotatable therewith, the convolutes of said screen and conveyer surrounding the axis of the mill, and a screw conveyer communicating with the screening chamber and extending into the grinding chamber, substantially as specified.

3. A grinding mill provided with a rotatable shell, inclosed grinders, a chamber communicating with the shell, a helical screen and an inter-coiled conveyer within said chamber, a transverse partition across the inner convolute of the screen and conveyer, and oppositely inclined guides at opposite sides of said partition, substantially as specified.

4. A grinding mill composed of a rotatable cylindrical grinding chamber, a communicating screening chamber, a spiral screen and a spiral conveyer within the screening chamber, a transverse partition across the inner convolutes of the screen and conveyer to form a first and a second pocket, means for returning the tailings from the first pocket to the grinding chamber, and means for discharging the ground material from the second pocket out of the mill, substantially as specified.

5. A grinding mill provided with a rotatable shell, inclosed grinders, a chamber communicating with the shell, a helical screen within said chamber, and a series of baffle-plates of gradually decreasing length that extend over the screen, substantially as specified.

Signed by me at New York city, (Manhattan,) N. Y., this 14th day of March, 1907.

MAX F. ABBÉ.

Witnesses:
FRANK V. BRUESEN,
WILLIAM SCHULZ.