945,160.

H. A. GOETZ.

PULVERIZER.

APPLICATION FILED MAY 5, 1908.

Patented Jan. 4, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

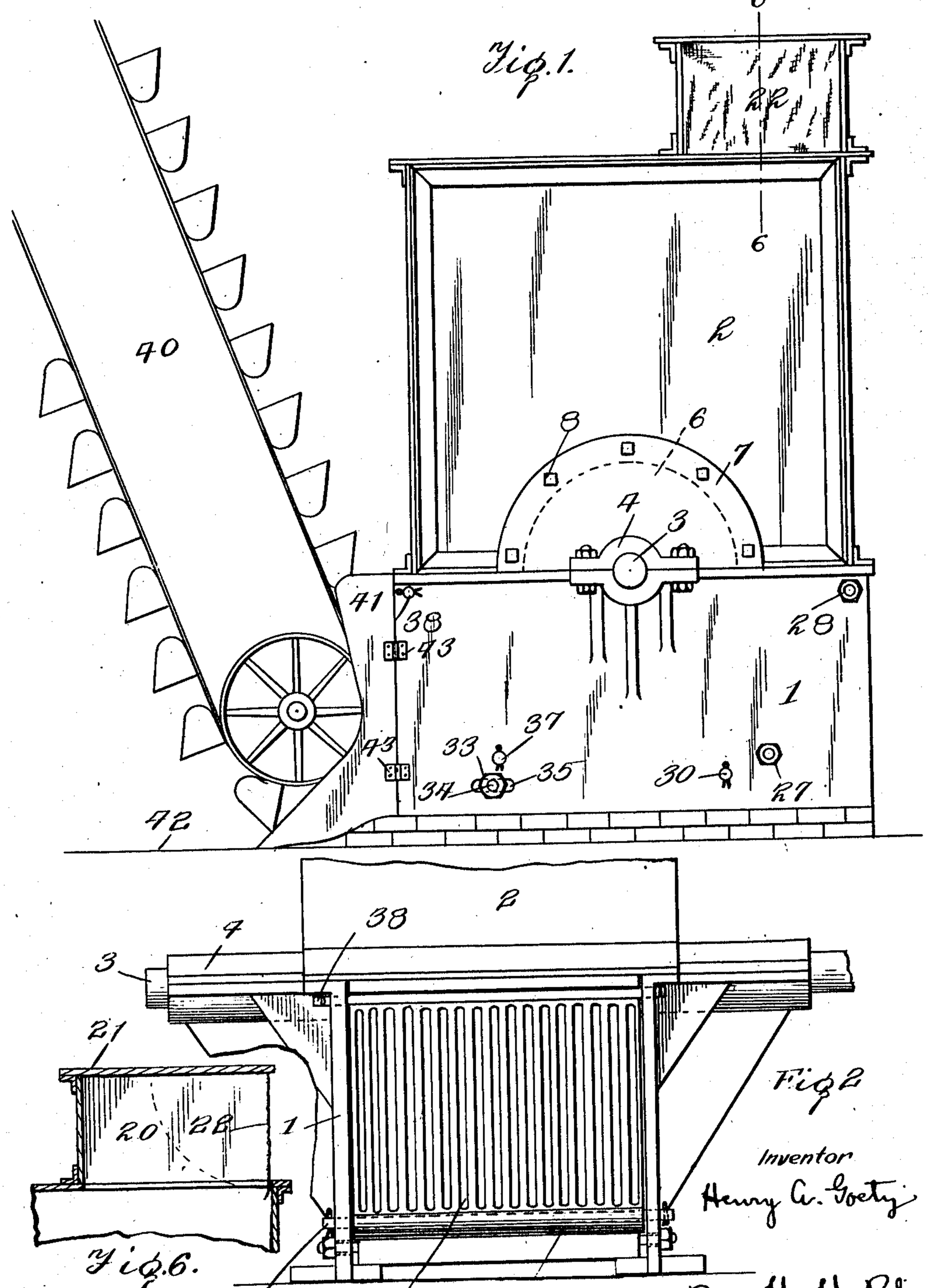

Fig. 2.

Fig. 6.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

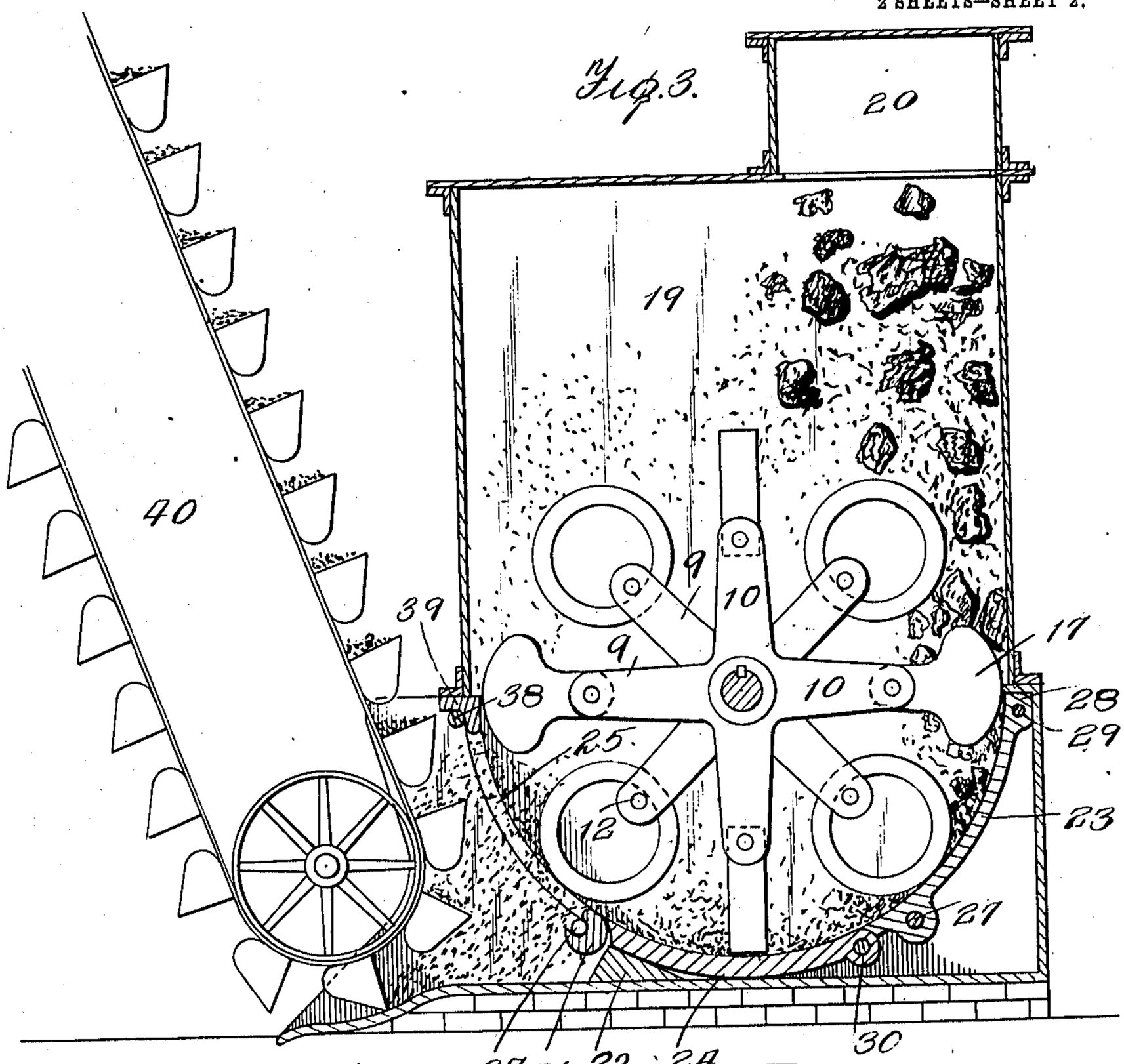


Fig. 4.

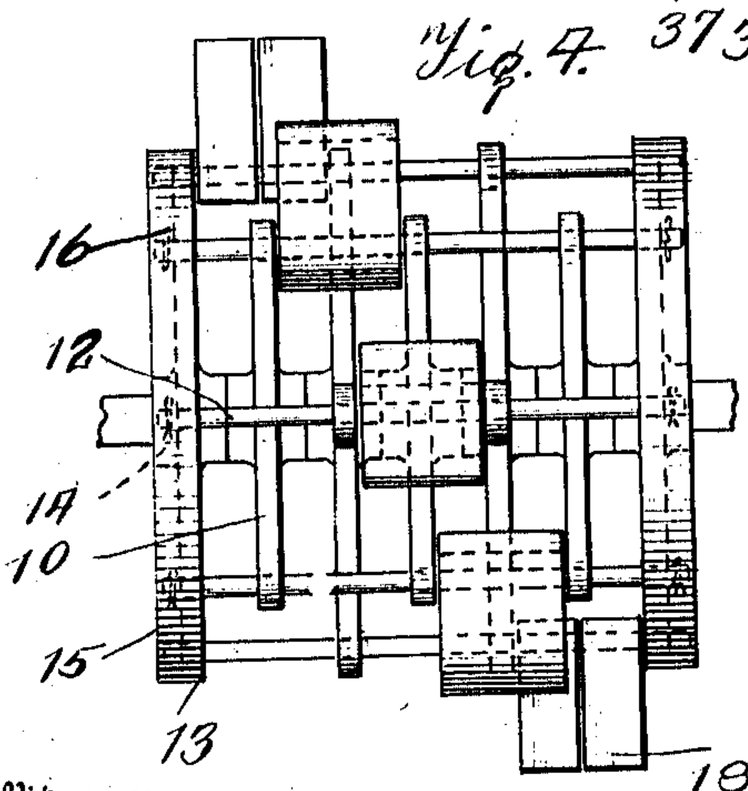
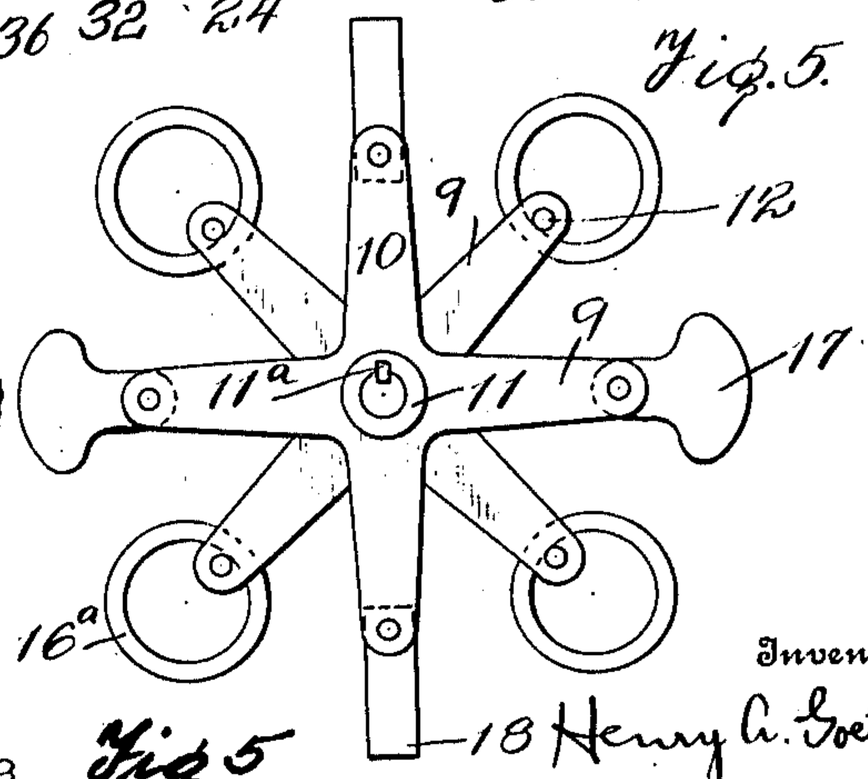


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

HENRY A. GOETZ, OF NEW ALBANY, INDIANA, ASSIGNOR TO AMERICAN PULVERIZER COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

PULVERIZER.

945,160. Specification of Letters Patent. Patented Jan. 4, 1910.

Application filed May 5, 1908. Serial No. 431,035.

To all whom it may concern:

Be it known that I, HENRY A. GOETZ, a citizen of the United States, residing at New Albany, in the county of Floyd and State of Indiana, have invented certain new and useful Improvements in Pulverizers, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to pulverizing machines and has for its object to provide improved hammer mechanism, improved grinding concaves and screens and an improved general arrangement of the casing and frame parts.

Figure 1 is a side elevation of a pulverizer containing my improvements. Fig. 2 is a rear elevation of the lower part of the pulverizer, the conveying devices being removed. Fig. 3 is a sectional view in elevation of the machine. Figs. 4 and 5 show the construction of the hammers and hammer supporting mechanism. Fig. 6 is a detail sectional view of the feeder housing taken in a plane at right angles to the plane of Fig. 3 looking toward the front of the machine and along the line 6—6 of Fig. 1.

In the drawings, 1 designates the base on which is mounted and to which is suitably secured the casing 2. I prefer to make the base 1 and casing 2 as generally rectangular, box-like structures, with the open top of the base lying next to the open bottom of the casing. In the top of the side walls of the base and preferably between the base and the casing are mounted suitable bearing boxes for the hammer-carrying shaft 3.

The opposite side walls 5—5 of the upper casing 2 are made with semicircular recesses 6—6 in their lower edges. The semicircular plates 7—7 are secured to the side walls 5—5 over these recesses by means of cap screws 8 and fit closely around the bearing boxes 4.

The great speed at which the main shaft 3 rotates when the machine is in operation, and the heavy work done by the hammers which it carries, requires frequent rebabbitting of the bearing boxes 4. In machines as usually built heretofore, it has been necessary to remove the entire upper portion of the machine housing to rebabbitt the bearing boxes. When it becomes necessary to rebabbitt a machine constructed according to this invention, the side plates 7 are removed, the upper and lower halves of the bearing boxes separated and the shaft raised from its usual position, ready access being thereby given to the bearing box parts.

The shaft 3 carries the hammer-supporting bars 9 having the radially extending arms 10 and the central hubs 11. These hubs 11, which are of relatively greater thickness than the arms which they carry, abut against one another in a continuous row and are secured in any desirable manner against rotation with respect to the shaft 3, as by the key 11^a. These hammer supports may have any desired number of arms, those in the drawings being shown for the purpose of illustration with four such arms, each two of the arms being 90° apart. The hammer supports are arranged in two sets, each set comprising alternate supports. As to the position of the arms, the supports in one set are displaced 45° with respect to the supports of the other set. Mounted in the outer ends of the arms 10 are the cross rods 12 which extend from end to end of the machine.

The outer hammer supports upon each end of the shaft are differently constructed from the others, each of these end supports being a disk plate 13 provided at its center with a hub 14 and at its periphery with the outwardly extending rim flange 15. The cross rods 12 of each helical series are extended through these end plates 13 and secured by split pins 16 against longitudinal displacement. Upon these cross rods 12 the hammers are pivotally mounted in helical rows about the circumference of the machine. The angular displacement between each two sets of hammer supports makes this helical arrangement of the hammers possible, the axial distance between two radial arms of adjacent hammer supports in each series being equal to the width of one of the hammers. Because of this helical arrangement of hammers and the relative overlapping of successive hammers in each helical series, the whole grinding concave is covered by one half revolution of the shaft. Other advantages gained by this helical arrangement of the hammers are the lack of vibration, especially in comparison with a machine of the older type, where several hammers in

one row may become worn more than the hammers in another row; a more uniform and gradual attack on fresh material; ease of starting the machine from rest; and decreased probability of the machine becoming clogged.

Broadly speaking, hammers constructed according to my invention are made with working surfaces presenting a curvilinear contour in cross sectional planes. One convenient and easily manufactured hammer with such a curvilinear working surface is exemplified in the ring hammers, designated in the drawings as 16ª. The rods 12 pass through the central opening of these rings thereby holding them against outward motion. At the same time the rings are free to rotate about their axis, and the treatment of the material becomes a combined striking and rubbing. This form of hammer is suitable when damp or sticky material is being ground. It will be observed that due to the short radius of the ring and the larger radius of the grinding surface, the tendency of the hammers will be to draw the material under and between the hammers and concave. It will also be observed that the hammer is yieldable centrally so that when sudden obstructions, such as unusually large pieces of material or metal parts accidentally fed to the machine are encountered, they are passed without injury to the hammers or to the machine generally. In addition to striking the material these hammers also roll upon and, due to centrifugal force, crush the material against the concave. I find in practice that these hammers can be made of cast iron with chilled wearing surfaces, whereas the hammers formerly used were made for durability of expensive carbon steel.

I have also shown in the drawings an alternate form of hammer 17 which I have found desirable to use in conjunction with the ring hammer 16ª. These hammers 17 are similar to the common hammers now in use, with the exception that their outer ends are enlarged and rounded so as to have a working face similar to the working face of the ring hammers 16ª.

I have found it desirable for grinding most kinds of material to combine with the two kinds of hammers already described or with the ring hammers alone, hammers of the well known plane bar type, indicated on the drawings by 18. These hammers serve not only to pulverize the material by attrition but also serve to stir up and agitate any material which the other hammers have compressed against the grinding surface.

The casing 2 is enlarged upwardly above the rotary parts. The material which is thrown by the hammers into the empty space 19, thus formed in the upper part of the casing, strikes other particles of material which have been previously thrown against the upper top wall of the casing or which may be falling from the feed opening. This impact of the pieces of material, one upon the other, assists in the pulverizing process, and the heat generated by the attrition causes the moisture to be evaporated from damp material and obviates the necessity for steam heating pipes, such as are now very commonly used.

The feed opening 20 is situated in that side of the small housing 21, mounted on top of the casing, which is flush with the side wall of the casing. The feed opening is therefore out of line with the material which moves upward under the blows of the hammers, and nothing can be at any time ejected from the casing. This feed opening is protected by the inwardly swinging door 22. The air pressure generated by the rapidly moving hammers is sufficient to keep this door normally closed, while, at the same time, fresh material can be readily fed into the machine, pushing the door 22 inwardly open as it enters, I prefer to make the door of yieldable cloth.

The grinding concaves 23, 24 and 25 are mounted in close proximity to the lower half of the outer circles of rotation of the hammers. The first of these concaves 23 is imperforate and mounted at its lower end upon the hinge rod 27. The upper extremity 28 rests in fixed position upon the rod 29. The rods 27 and 29 are secured in the side walls of the base. The forward end of the lower concave 24, which is likewise imperforate, is pivotally mounted upon the rod 30 which is carried by the walls of the base. The rear end of this concave 24 is adjustable about its forward end as an axis, the proximity of the rear end to the outer ends of the hammers determining the degree of fineness to which the material is ground the rolling or rubbing action of the hammers 16ª and 17 tending to crush the material against the concaves 23 and 24 until the material is pulverized to a degree of fineness such that the hammers can no longer act upon it. The material is gradually forced along by the continued action of the hammers, until it is finally discharged through the space in the concave 25. The adjustment of the concave 24 is effected by means of the wedge block 32. The position of the wedge is changed by loosening the nuts 33 and moving the bolt 34, fixedly carried by this wedge block, backward and forward in the slots 35 of the base walls. The third and rear grinding concave is formed of a plurality of bars spaced apart and hinged at one end, as in the drawings at their lower end, by means of the hook 36, to the hinge rod 37; and at their other end, supported in position by the rod 38 which

engages the flange 39 of the grate bars. These grate bars are spaced apart in any suitable manner. As shown in the drawings, the bars are all cast in one piece, adjacent bars being integrally connected at each end.

The circumferential, as against transverse arrangement of the slots of the concave, has the advantage of allowing the material to be more easily ejected from the machine, particularly when the material is of a damp and sticky character. It is almost impossible to clog a machine equipped with this kind of a grinding concave. The wear upon the bars is also considerably less, and the liability of the bars being bent decreased.

The endless bucket conveyer, indicated as a whole at 40, is mounted to pass very close to the rear concave and to carry the material away from the outside face of the concave as fast as it is thrown through the openings. Considerable difficulty has been experienced in the clogging of the openings of the concaves, as the conveyers generally used have been of the horizontally moving type, upon which the material has been dropped. By using a bucket conveyer and causing the scooping edges of the buckets to cut close to the outside surface of the concave, any clogging of the material in the concave opening is effectually prevented.

The base of the machine is provided with extending lateral guard plates 41 hinged to swing outwardly on the hinges 43 and the floor 42, both walls and floor adapted to lie very close to the edges of the buckets of the conveyer as they pass in front of the discharge opening. By this device, the material is prevented from clogging the discharge opening, very little dust escapes; and ready access can be had to the lower end of the conveyer and adjacent parts of the pulverizing machine by swinging back the side guards 41.

When it becomes necessary to have access to the interior of the machine or to replace a worn concave, the supporting rods 27, 28, 30, 37, 38 can be readily removed and the concaves taken from position. If the conveyer above described is not used, the forward or rear concave can be freed at its upper end and swung down to permit inspection and cleaning of the interior of the machine.

When the material to be ground is extremely wet or sticky so that it would tend to clog the grate or slotted concave 25, the latter may be entirely removed from the machine by withdrawing the rods 37 and 38, thus permitting the pulverized material to be freely discharged from the pulverizer and removed by the conveyer 40.

What I claim is—

1. In a pulverizing machine, the combination of a rotatable hammer carrying mechanism, grinding rings mounted on the hammer carrying mechanism, so as to be free to rotate on their own axes and so as to be centrally yieldable, hammers pivotally mounted on the said hammer carrying mechanism and a concave grinding surface adapted to coöperate with the rings and hammers, substantially as set forth.

2. In a pulverizing machine, the combination of a rotatable hammer carrying mechanism, grinding rings mounted on the hammer carrying mechanism, so as to be free to rotate on their own axes and so as to be centrally yieldable, hammers pivotally mounted on the said hammer carrying mechanism, and a concave discharge grating adapted to coöperate with the rings and hammers, substantially as set forth.

3. In a pulverizing machine, the combination of a concave grinding surface, a concave discharge grating, rotatable hammer carrying mechanism, grinding rings mounted on the hammer carrying mechanism so as to be free to rotate on their own axes, so as to be centrally yieldable, and so as to be capable of swinging laterally in relation to the hammer carrying mechanism, and hammers pivotally mounted on the said hammer carrying mechanism and adapted to agitate the material on the grinding surface and on the discharge grating, substantially as set forth.

4. In a pulverizing machine, the combination of a rotatable horizontal shaft, hammer supports mounted on the shaft, supporting pins parallel to the shaft and passing through the hammer supports, hammers mounted on the pins, some of the hammers being grinding rings free to revolve upon the pins about their own axes and some of the hammers being rectangular and pivotally mounted upon the pins, and a grinding bottom in close proximity to the rings and hammers, substantially as set forth.

5. In a pulverizing machine, the combination with a rotatable hammer carrying mechanism, of a plurality of grinding rings mounted on the hammer carrying mechanism so as to be free to rotate on their own axes, and hammers pivotally mounted on the hammer carrying mechanism, each pivoted hammer being behind and overlapping a grinding ring, and a concave grinding bottom in close proximity to the rings and hammers, substantially as set forth.

6. In a pulverizing machine, the combination with a rotatable hammer carrying mechanism, of a plurality of grinding rings mounted on the hammer carrying mechanism so as to be free to rotate about their own axes, and hammers pivotally mounted on the hammer carrying mechanism, each pivoted hammer being behind and overlapping a grinding ring, an imperforate

concave bottom, and a concave screening gate, the said grinding bottom and screening grate being in close proximity to the rings and hammers, substantially as set forth.

7. In a pulverizing machine, the combination of a supporting structure, a rotatable ring carrying mechanism, crushing rings mounted on the ring carrying mechanism so as to be centrally yieldable and capable of rotation about their own axes, a concave grinding surface adapted to coöperate with the said crushing rings, the said surface being provided with discharge slots parallel to the motion of the rings and located at the end of the grinding surface, substantially as set forth.

8. In a pulverizing machine, the combination of a concave pulverizing surface, a concave discharge grating, a rotatable shaft, hammers having convex working surfaces with radii less than the radius of the pulverizing surface and discharge grating, the said hammers being so mounted on the shaft as to be yieldable centrally, to be capable of swinging laterally in relation to the shaft and capable of rolling in relation to the pulverizing surface and discharge grating, a part of the pulverizing surface being adjustable toward or away from the hammers, substantially as set forth.

9. In a pulverizing machine, the combination of a concave pulverizing surface, a rotatable shaft, hammers having convex working surfaces with radii less than the radius of the pulverizing surface, the said hammers being so mounted on the shaft as to be centrally yieldable, to be capable of swinging laterally in relation to the shaft, and capable of rolling in relation to the pulverizing surface, a part of the pulverizing surface being adjustable toward or away from the hammers, substantially as set forth.

10. In a pulverizing machine, the combination with a frame and casing, of rotatable hammer carrying mechanism, a pivotally supported imperforate concave bottom grinding plate, a longitudinally movable wedge supporting the free end of said grinding plate, fastening bolts rigidly carried by said wedge and projecting through the side walls of the casing, nuts for clamping said bolts in position and a horizontal support for said wedge, substantially as set forth.

11. In a pulverizing machine, the combination of a rotatable hammer carrying mechanism, grinding cylinders mounted on the hammer carrying mechanism, a casing surrounding said hammer carrying mechanism and having a feed opening, a grinding surface adapted to cooperate with the grinding cylinders and a discharge opening, a grating normally covering the discharge opening and adapted to be removed therefrom, the said grating being also adapted to coöperate when in normal position with the grinding cylinders, the feed opening and the discharge opening being located on opposite sides of the hammer mechanism whereby material passing from the feed opening to the discharge opening must pass beneath the grinding cylinders, substantially as set forth.

12. In a pulverizing machine, the combination of a rotatable ring carrying mechanism, rings mounted on the said mechanism, so as to be centrally yieldable and capable of rotation about their own axes, a concave grinding surface beneath the rings and extending through approximately 180°, and a casing inclosing an empty space above the hammers, substantially as set forth.

13. In a pulverizing machine, the combination of a rotary horizontal hammer carrying mechanism, rings mounted on the said hammer carrying mechanism, so as to be centrally yieldable and capable of rotation about their own axes, a concave grinding surface adapted to coöperate with the said ring hammers, and a casing inclosing an empty space above the hammers, the said casing having a feed opening so located that the entering material will fall directly upon the hammers, substantially as set forth.

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

HENRY A. GOETZ.

Witnesses:
J. F. GRUBBS,
E. E. KAPPER.

Correction in Letters Patent No. 945,160.

It is hereby certified that in Letters Patent No. 945,160, granted January 4, 1910, upon the application of Henry A. Goetz, of New Albany, Indiana, for an improvement in "Pulverizers," an error appears in the printed specification requiring correction as follows: Page 4, line 2, for the word "gate" read *grate;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of March, A. D., 1912.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.