No. 738,889. PATENTED SEPT. 15, 1903.

M. DRURY.

MILL FOR CRUSHING SAND.

APPLICATION FILED MAR. 15, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

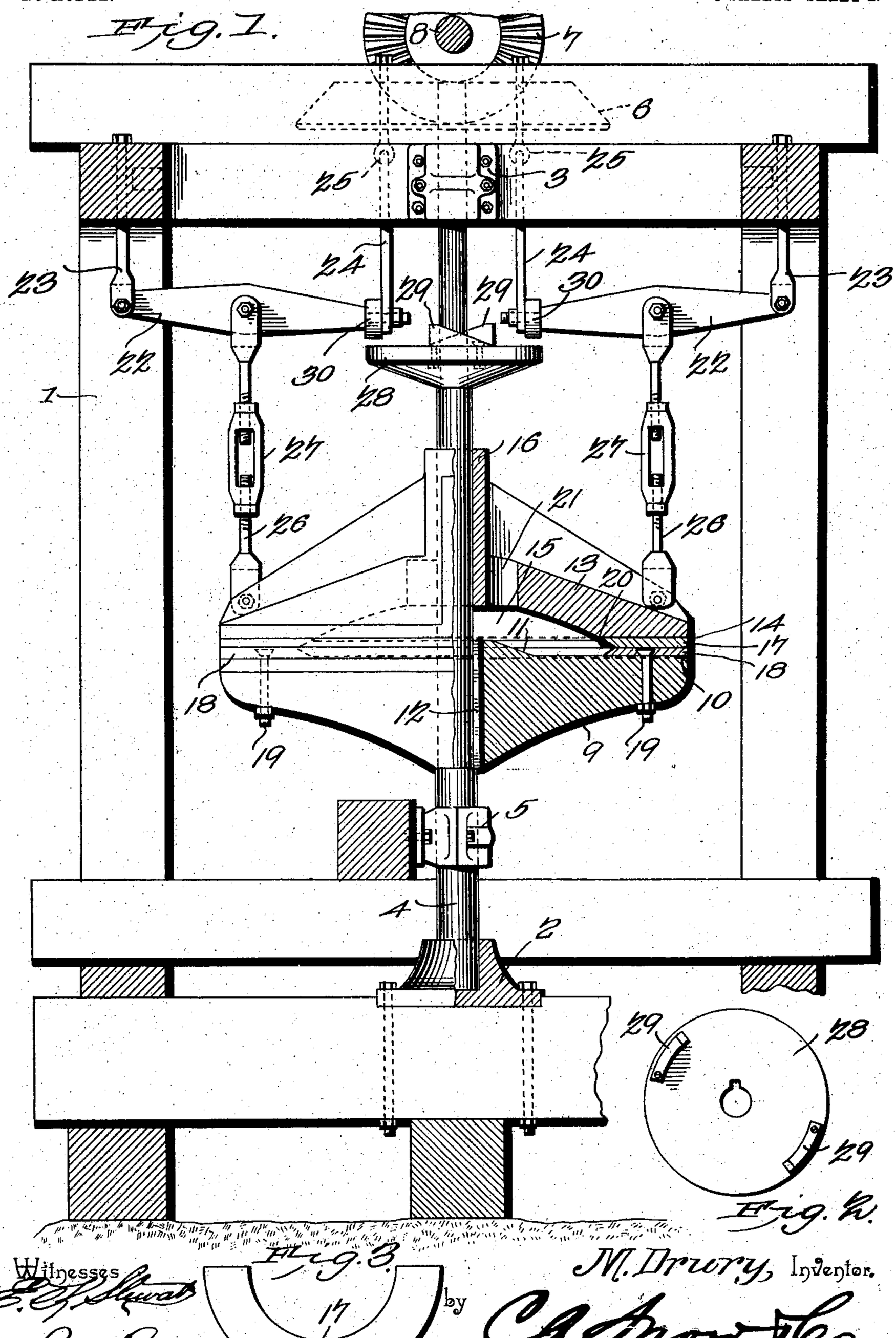

Fig. 2.

Fig. 3.

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NO MODEL. 3 SHEETS—SHEET 2.

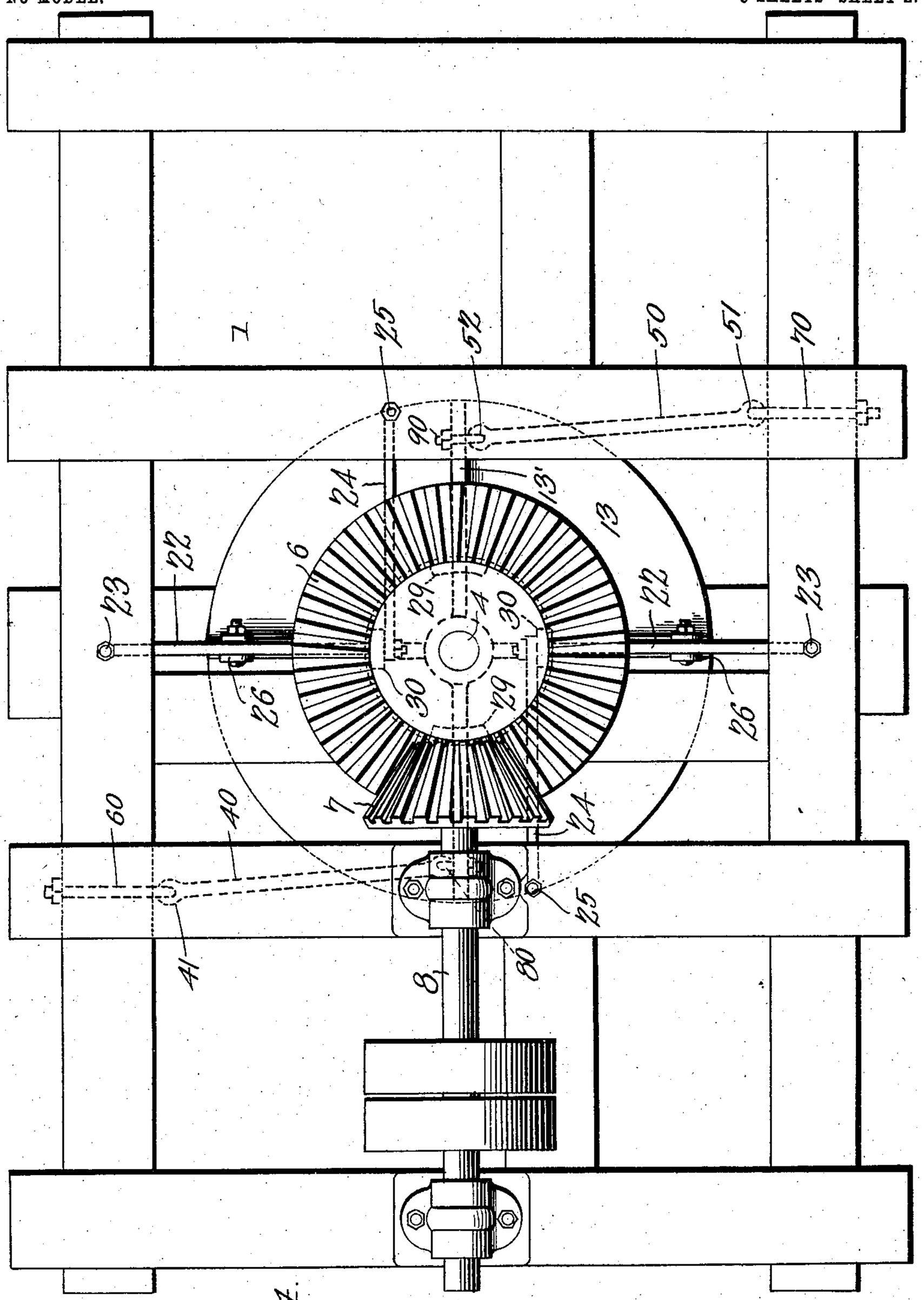

Fig. 4.

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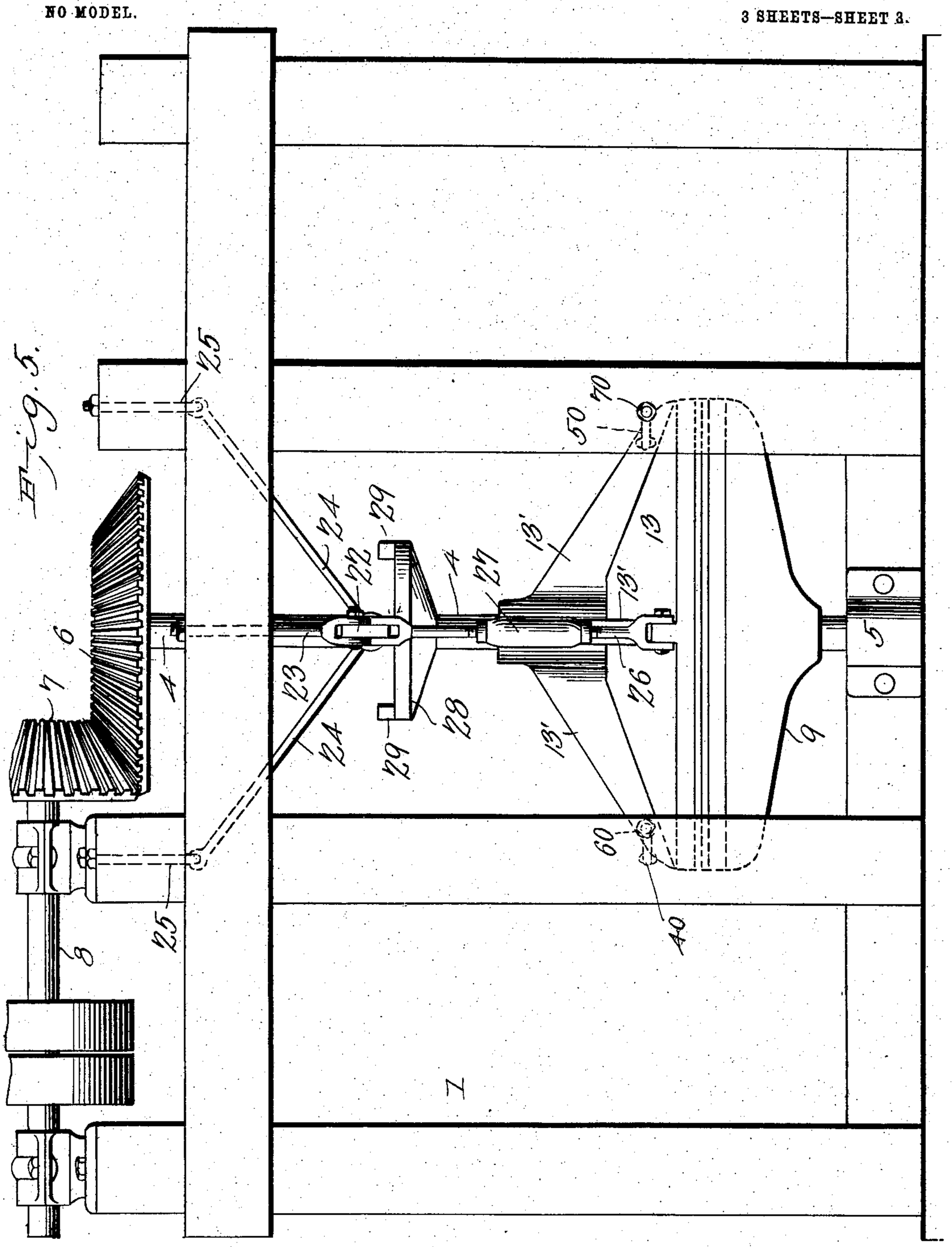
NO MODEL. 3 SHEETS—SHEET 3.

Fig. 5.



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UNITED STATES PATENT OFFICE.

MICHAEL DRURY, OF HOUGHTON, MICHIGAN.

MILL FOR CRUSHING SAND.

SPECIFICATION forming part of Letters Patent No. 738,889, dated September 15, 1903.

Application filed March 15, 1902. Serial No. 98,400. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL DRURY, a citizen of the United States, residing at Houghton, in the county of Houghton and State of Michigan, have invented a new and useful Mill for Crushing Sand, of which the following is a specification.

My invention is an improved mill for crushing sand and similar substances; and it consists in the peculiar construction and combination of devices hereinafter fully set forth and claimed.

The object of my invention is to combine with a revoluble grinding element and a non-revoluble grinding element means to vertically move the latter so that it alternately rises from and drops upon the revoluble grinding element to pound the material between the grinding-surfaces of the said grinding elements and assist in the disintegration thereof.

In the accompanying drawings, Figure 1 is partly an end elevation and partly a vertical sectional view of a sand-crushing mill embodying my improvements. Fig. 2 is a detail plan view of the cam-wheel. Fig. 3 is a detail view of one section of one of the grinding-rings. Fig. 4 represents a plan view of this improved grinding-mill. Fig. 5 represents a side elevation thereof.

The same reference characters indicate corresponding parts in all the figures.

In the embodiment of my invention here shown I provide a frame 1, which may be of any suitable construction and which has a lower bearing 2 and an upper bearing 3. A vertical shaft 4 has its lower end stepped in the bearing 2 and is journaled near its upper end in the bearing 3. I also provide an additional bearing 5 for the lower portion of said vertical shaft. A beveled gear-wheel 6 is indicated in dotted lines in Fig. 1 on the upper end of the shaft 4 and shown in full lines in Figs. 4 and 5, and said gear 6 is engaged by a similar gear 7, carried by a power-shaft 8, through which shaft 4 may be rotated. The lower grinding element 9, which is circular in form, has a plane upper surface 10, and its central conical portion 11 is secured to the shaft 4 by a key 12 and rotates with said shaft. The upper grinding element 13 is likewise circular in form. The outer portion of its lower side forms a plane annular face 14, and the said grinding element 13 is hollowed or concaved on its lower side within the said face 14 to form a chamber 15 between the grinding elements. The said upper grinding element 13 has a central sleeve or hub 16, through which the shaft 4 extends; but the shaft turns freely in the said hub or sleeve, and the said element 13 is non-revoluble and is free to move vertically on the shaft 4, which forms the guide therefor, so that it may be raised from and dropped upon the lower revoluble grinding element 9. The opposing grinding or plane faces of the grinding elements are shod with removable annular grinding-rings 17 18, respectively, which grinding-rings are detachably secured to the grinding elements, as by means of bolts 19, and the said grinding-rings are preferably made of chilled steel and in semi-annular sections. One of the sections of one of said grinding-rings is shown in detail in Fig. 3.

It will be understood from the foregoing and by reference to Fig. 1 of the drawings that the griding-ring of the upper grinding element is coincident with that of the lower grinding element. The said grinding-rings have their inner sides beveled or inclined, as at 20, the said bevels converging outwardly, as shown in Fig. 1, to facilitate the passage of the sand outwardly between the said grinding-rings. The upper vertically-movable non-revoluble grinding element 13 is provided near its center with openings 21, through which sand is fed to the space or chamber 15, and it is provided on the upper surface thereof with four radial webs, as 13′, which are disposed in diametrically opposite pairs and divide the grinding element 13 into four equal parts.

A pair of supporting-arms 22 are here shown as having their outer ends pivotally connected to hangers 23 and their inner ends pivotally connected to guide-links 24, the outer upper ends of which are pivotally connected to suitable supports, here shown in dotted lines as eyebolts 25. Thereby the inner ends of the supporting-arms 22 are free to vibrate vertically or substantially in vertical planes. The said supporting-arms 22 are connected,

by means of link-rods 26, to the vertically-movable non-revoluble upper grinding element, and the said link-rods are provided with turnbuckles 27, by means of which they may be lengthened or shortened, as may be required, to adjust the upper non-revoluble grinding element. The latter normally bears on the lower revoluble grinding element.

To the shaft 4, at a suitable distance above the upper grinding element, is secured a wheel 28, on the upper side of which at diametrically opposite points are cams 29, which are wedge-shaped and disposed in reverse order, and the said arms 22 have antifriction tappet-rollers 30 at their inner ends, which are simultaneously engaged by the reduced ends of the wedge-shaped cams 29 at each rotation of the shaft 4 and the revoluble grinding element, and as the wheel rotates the increasing upward incline of the cams serve to lift the inner ends of the arms 22 simultaneously, and hence raise the grinding element 13 a slight distance. When the cams 29 reach their highest point and clear the tappet-rollers 30, the inner ends of the arms 22 are released and drop down the distance of the height of the straight edge of the wedge-shaped cams, and the upper grinding element connected thereto drops upon the material between the grinding faces or rings of the grinding elements and crushes the same. Hence the material is subjected to attrition between the faces of the revoluble and non-revoluble elements and also to the pounding action of the vertically-movable non-revoluble grinding element and becomes thoroughly disintegrated. The links 24 guide the arms 22 in their upward and downward movements.

The grinding-rings being removable may be readily replaced by others when they become worn and prevent wearing of the grinding elements 9 13. The upper grinding element 13 is held against rotation by two bolts 40 and 50, disposed diagonally opposite and pivotally connected to two diagonally opposite corner-posts of the frame 1 by means of bolts 60 and 70, which engage the eyes 41 and 51 of the bolts 40 and 50. These bolts 40 and 50 are connected to two of the diametrically opposite webs, as 13′, of the grinding element 13 at points near the periphery of said element by means of short bolts 80 and 90, which engage the eyes 42 and 52 of said bolts 40 and 50, and thus the element 13 is securely held against rotation, the links 26 being pivotally connected with the other two diametrically opposite webs, as 13′, at points near the periphery of the element 13.

Having thus described my invention, I claim—

1. In a mill of the class described, the combination of a revoluble vertically-disposed shaft, bearings therefor, a lower grinding element carried and revolved by the shaft, an upper grinding element guided but non-revoluble on the shaft, pivoted lever-arms connected to the upper grinding element, and cams, revolved by the shaft, coacting with said lever-arms to intermittently raise and drop the upper non-revoluble grinding element while the lower grinding element is revolving, substantially as described.

2. In a mill of the class described, the combination of a revoluble vertically-disposed shaft, bearings therefor, a lower grinding element carried and revolved by the shaft, an upper grinding element guided but non-revoluble on the shaft, pivoted lever-arms, guides therefor, cams, revolved by the shaft and engaging the lever-arms to raise and drop them, and adjustable connections between the upper grinding element and lever-arms, whereby the non-revoluble upper grinding element is intermittently raised and dropped from and on the lower grinding element while the latter is revolving, substantially as described.

3. In a mill of the class described, the combination of a revoluble vertically-disposed shaft, bearings therefor, a lower grinding element carried and revolved by the shaft, an upper grinding element, guided for vertical movement but non-revoluble on the shaft, and means to intermittently raise and drop the upper grinding element, while the lower grinding element is revolving, substantially as described.

4. In a mill of the class described the combination of a lower grinding element having a central cone rising from its upper side and a raised annular lateral grinding-surface concentric with and spaced from said cone, with an upper grinding element having a lateral annular grinding-surface to bear on that of the lower grinding element and having its central portion hollowed on its under side to form a chamber over the central portion of the lower grinding element, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

MICHAEL DRURY.

Witnesses:
J. M. KELLY,
RICHARD ROURK, Jr.