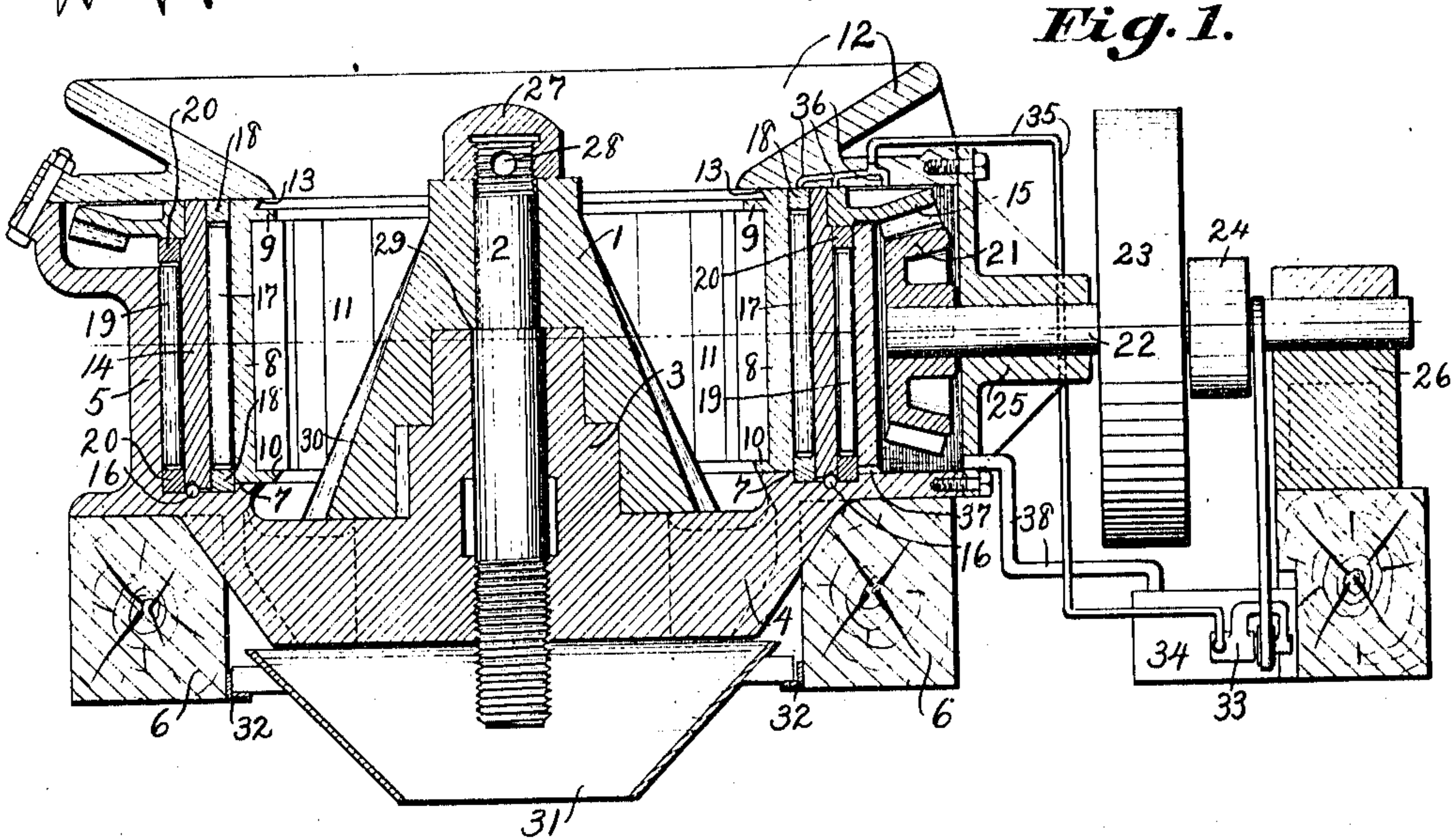
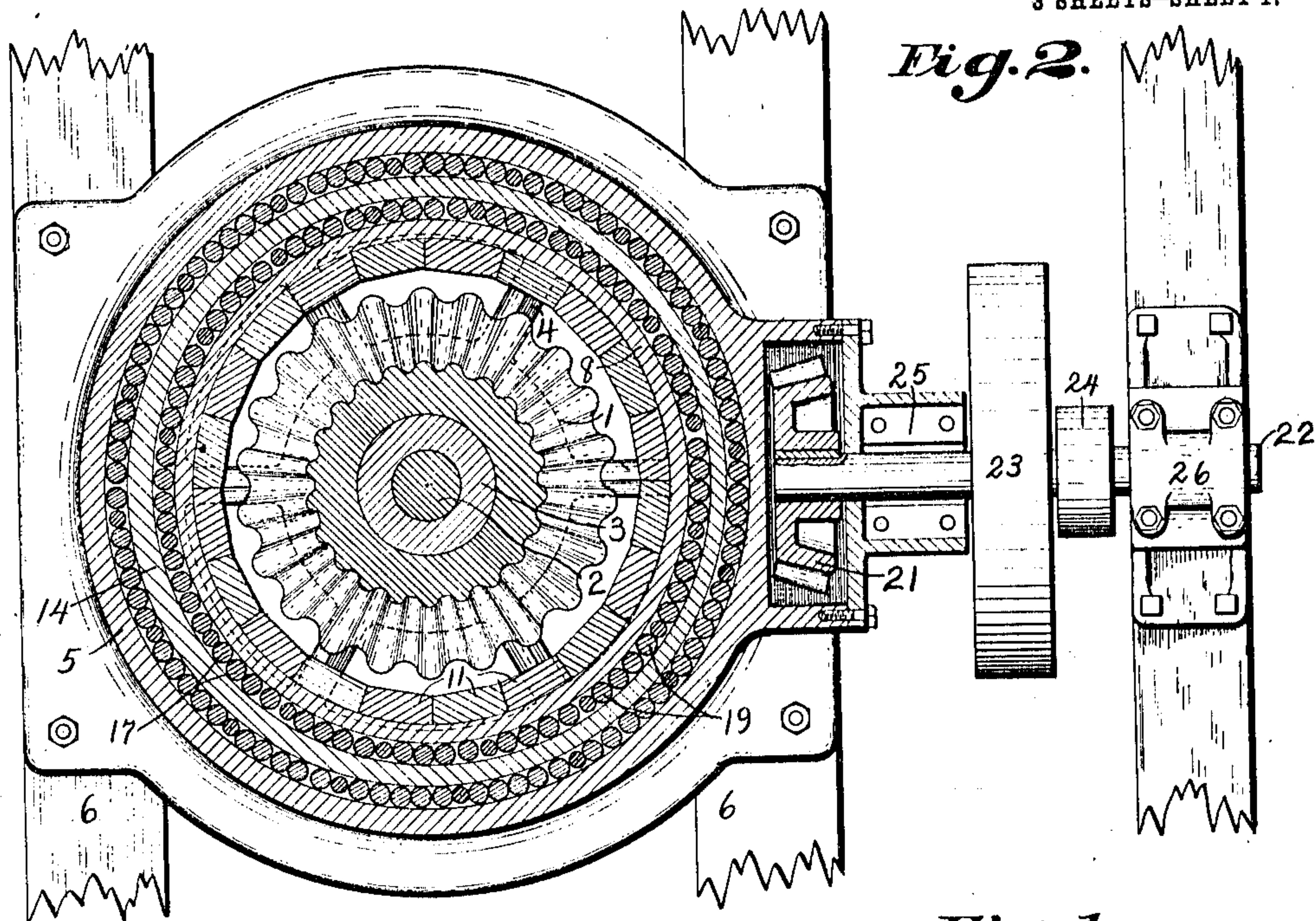


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CRUSHING MACHINE.  
APPLICATION FILED AUG. 15, 1907.

970,571.

Patented Sept. 20, 1910.

3 SHEETS—SHEET 1.



*Josiah E. Symons* Inventor

Witnesses  
*F. A. Otto*  
*Anna S. Ferguson*



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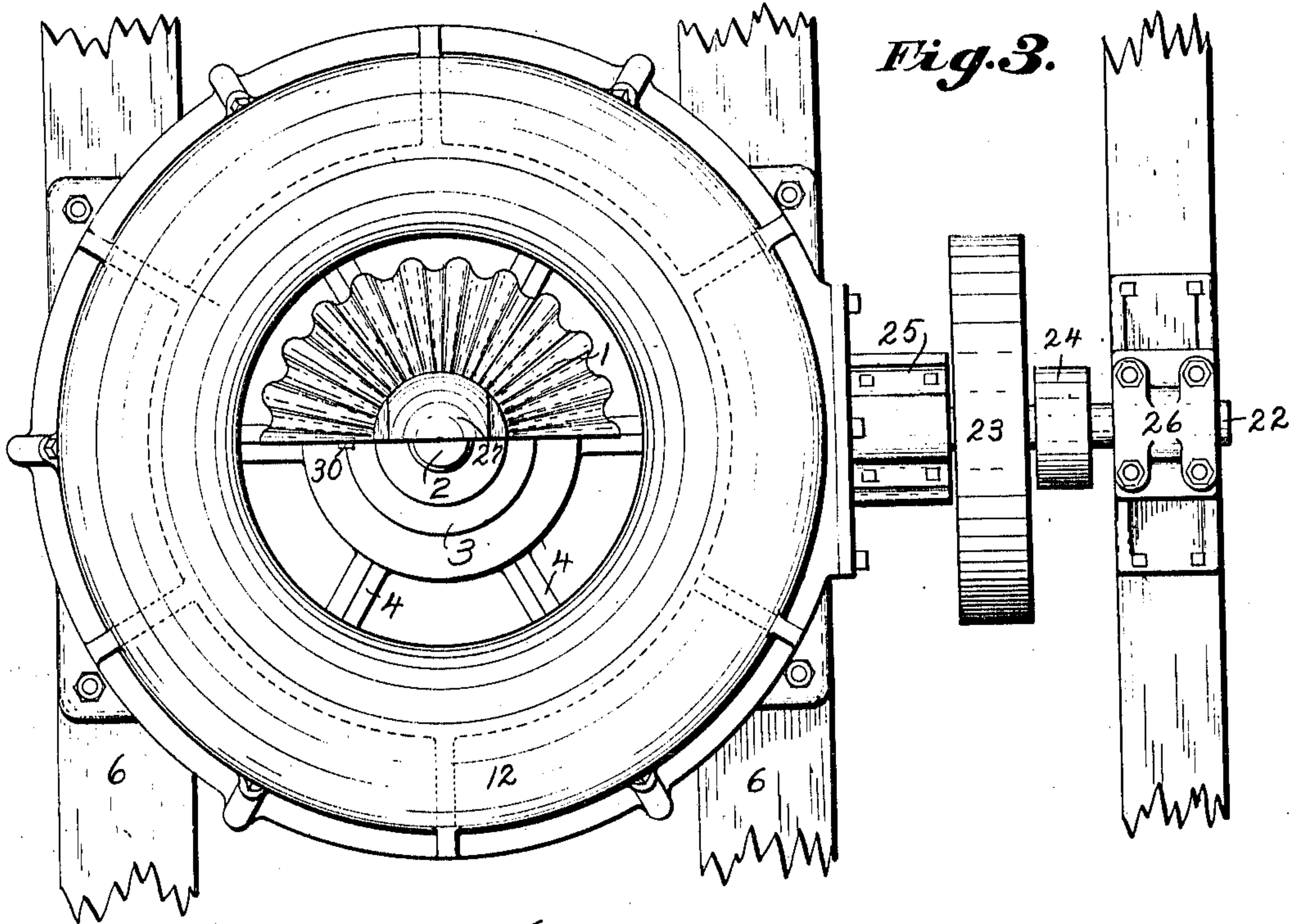
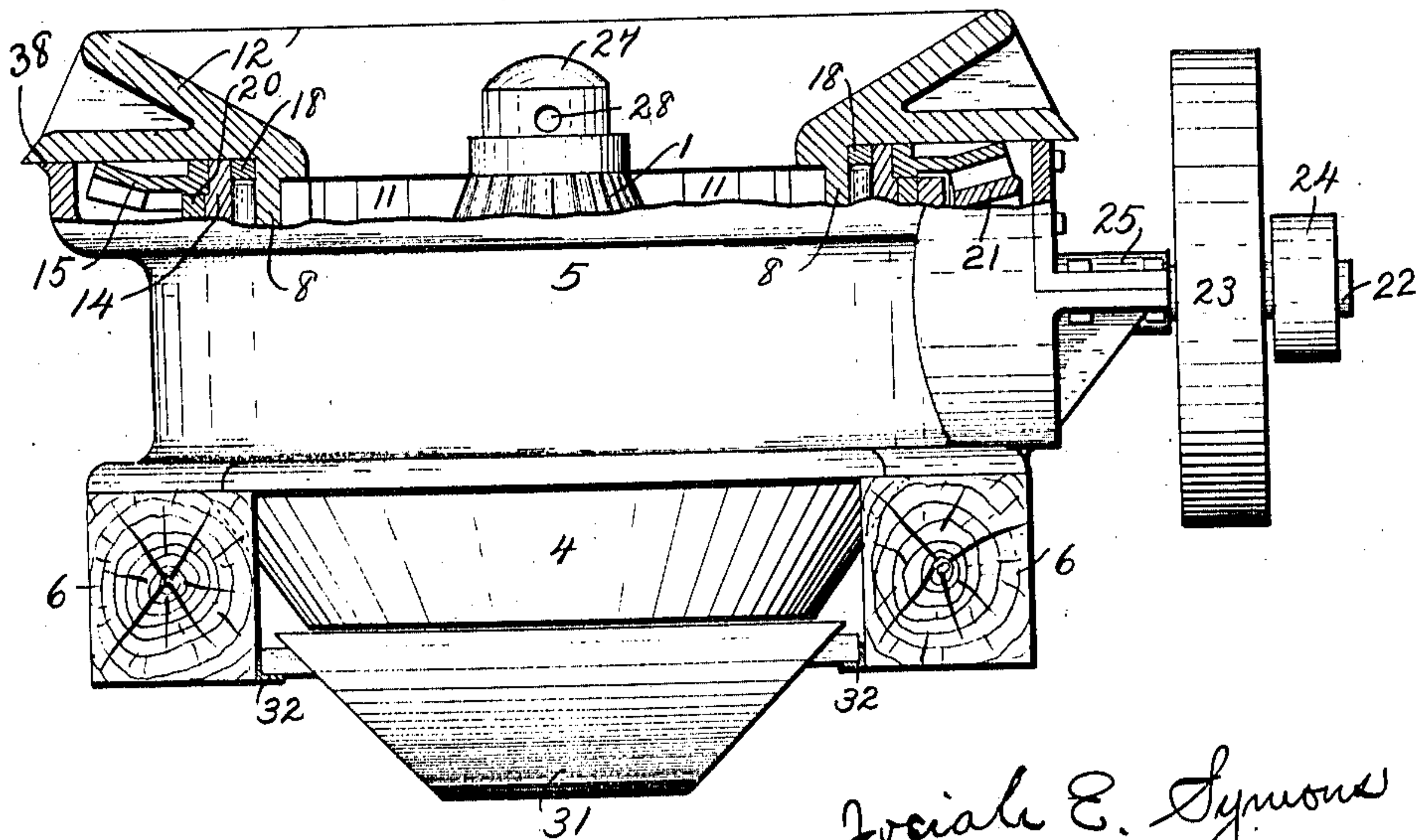


Fig. 4.



Josiah E. Symons Inventor

Witnesses  
F. A. O'Leary  
Anna L. Ferguson

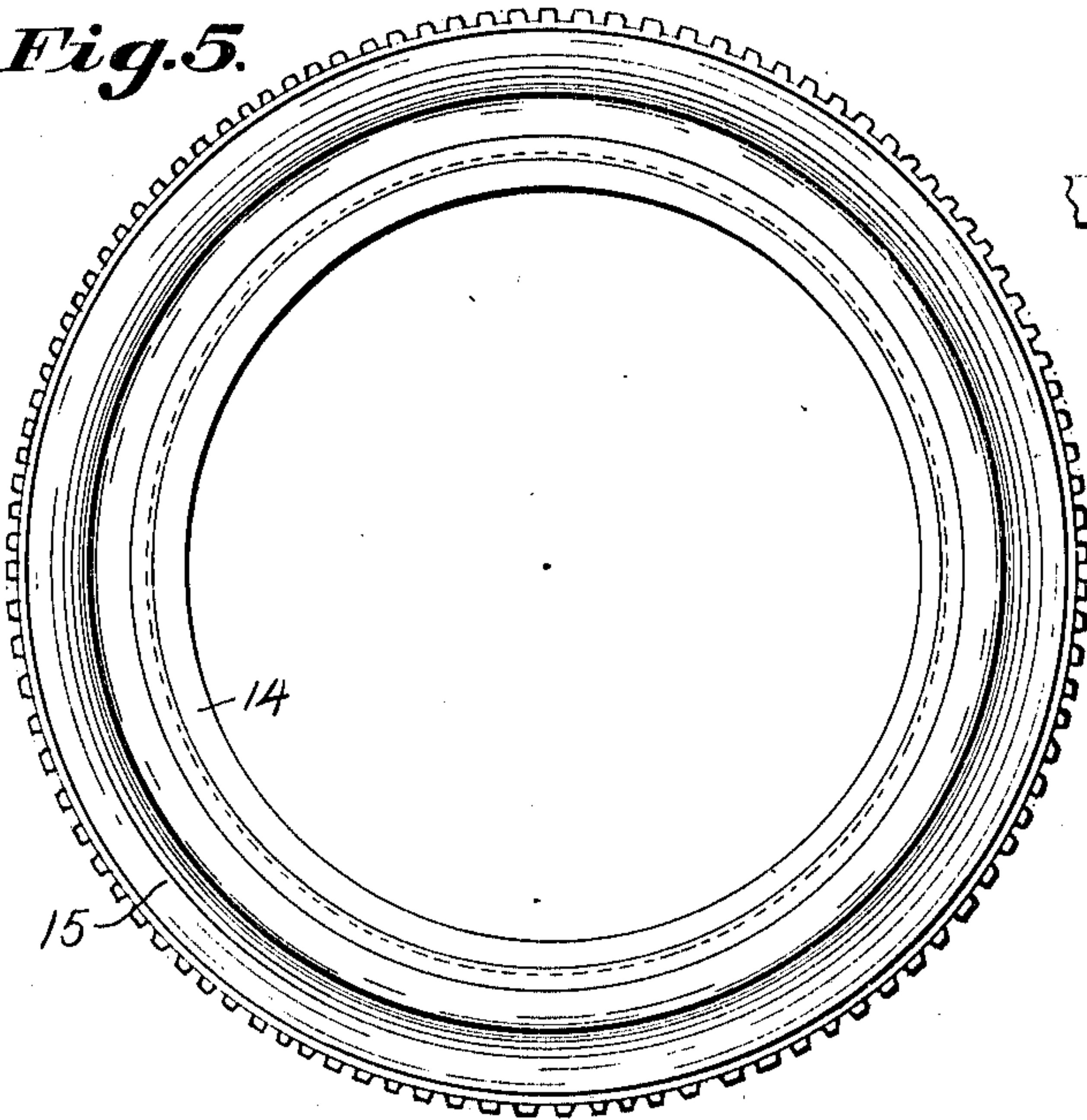
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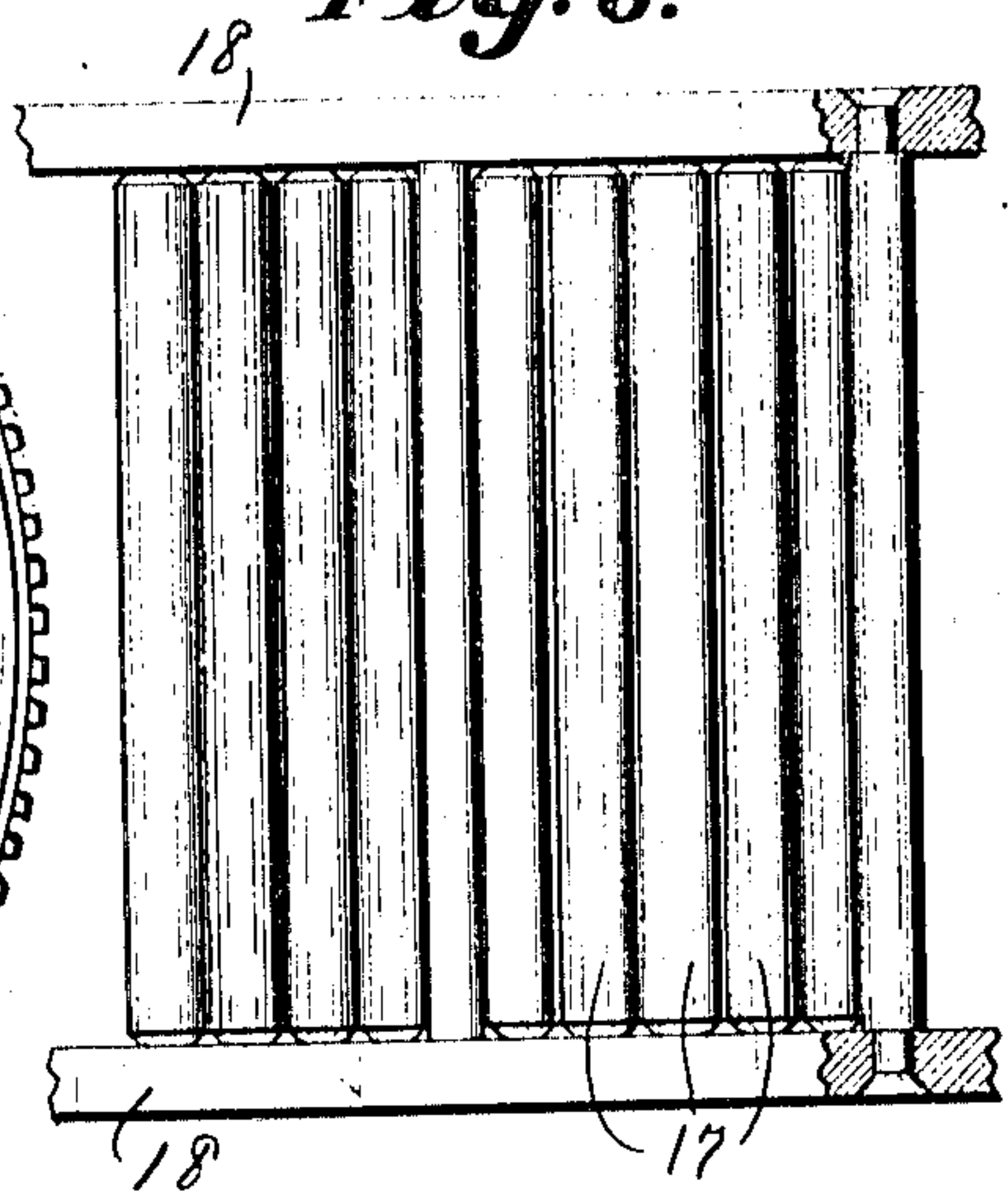
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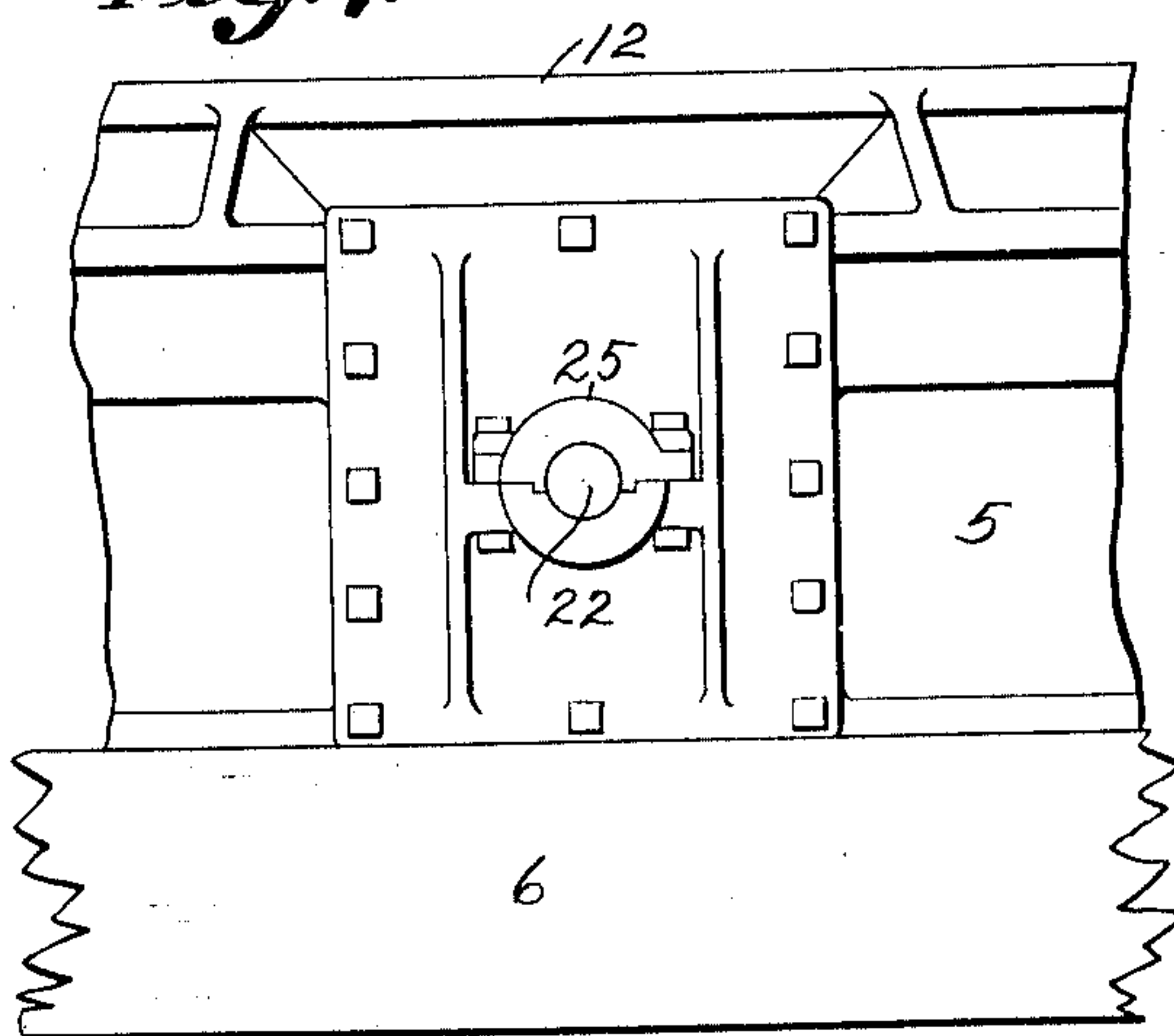
*Fig. 5.*



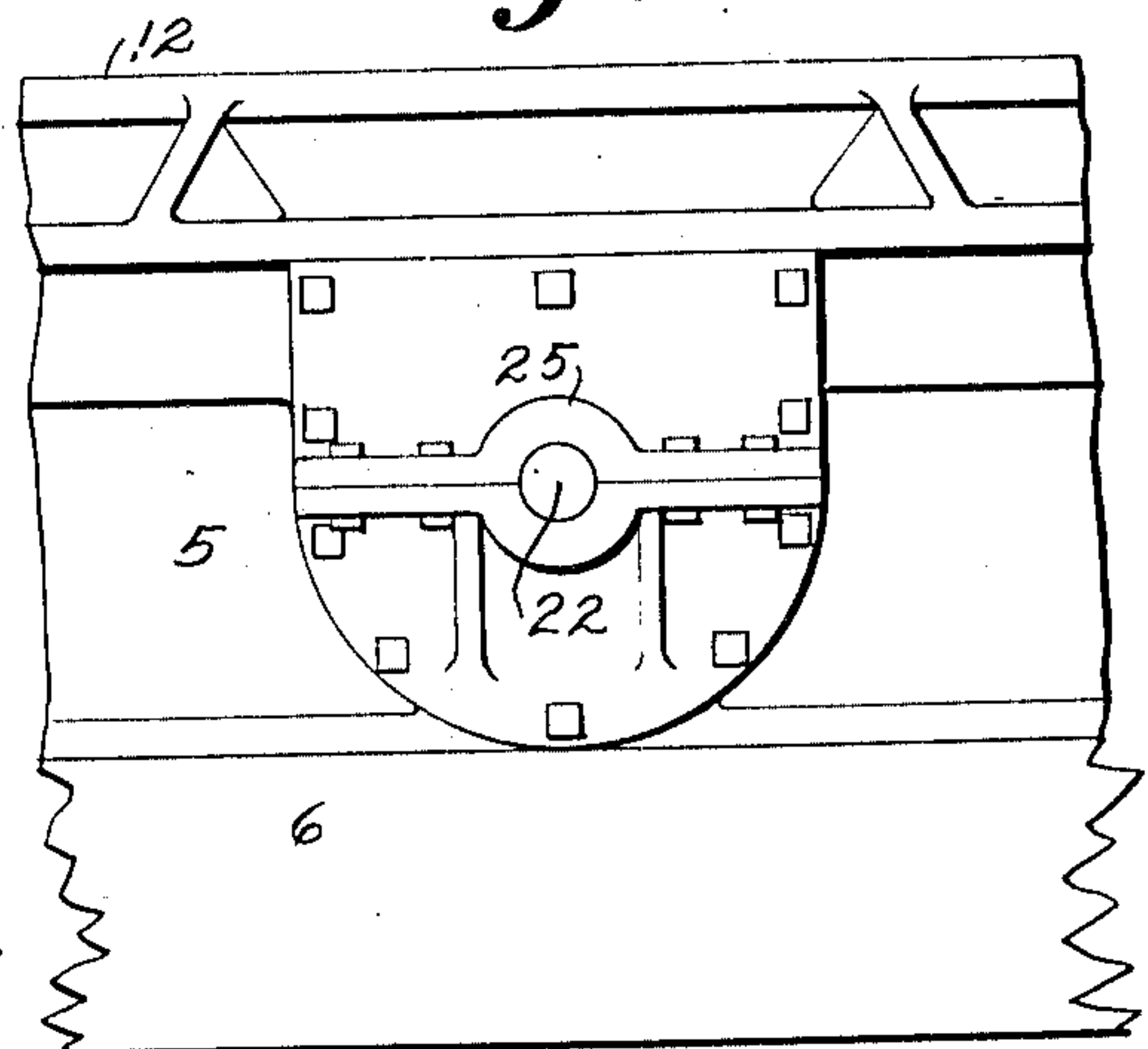
*Fig. 6.*



*Fig. 7.*



*Fig. 8.*



Josiah E. Symons Inventor

Witnesses

*Paul A. Allen*  
*Amos S. Ferguson*



# UNITED STATES PATENT OFFICE.

JOSIAH E. SYMONS, OF SHERIDAN, INDIANA.

## CRUSHING-MACHINE.

970,571.

Specification of Letters Patent. Patented Sept. 20, 1910.

Application filed August 15, 1907. Serial No. 388,723.

*To all whom it may concern:*

Be it known that I, JOSIAH E. SYMONS, a citizen of the United States, and resident of Sheridan, in the county of Hamilton and State of Indiana, have invented certain new and useful Improvements in Crushing-Machines, of which the following is a specification.

My invention relates to that class of machines characterized by a circular, or bowl-shaped main bed or frame inside of which a series of dies or concave wall is set in opposition to a centrally located crushing-head.

The objects of my invention are, first, to improve the method of holding the crushing-head in position, and the means for adjusting same; second, to provide means for imparting to the concaves an oscillating or crushing movement; third, to so locate the gears and other working parts as to render them easily accessible and allow them to be made of sufficient relative size to provide ample wearing surfaces; fourth, to obviate the necessity of using supporting spider-arms above the crusher-head, and so remove impediments usually found in the way of feeding other machines; and fifth, to produce a simple crushing-machine, compact in form, efficient, durable, and easily constructed; one which has both its height and weight reduced approximately to minimum limits consistent with requirements necessary for strength.

My invention consists in the parts and combinations of parts hereinafter described and shown in the accompanying drawings in which—

Figure 1 is a sectional elevation of my machine, showing the pulleys, shafts, and four of the rolls in full form. Fig. 2 is a sectional plan of the machine. Fig. 3 is a plan view of the machine having half of the crusher-head removed to show a portion of its support. Fig. 4 is an elevation, partly in section, illustrating a modified form of my machine in which the crown-piece, or hopper, is shown extended downwardly to form the outer support for the concaves, and supported movably on the main frame to allow said crown-piece to oscillate with the concaves. Fig. 5 is a plan of the eccentric sleeve with the gear attached thereto. Fig. 6 is a detail elevation of a portion of one of the roller cages, partly sectioned to show the vertical bars connecting the upper

and lower rings, together with some of the rolls in position. Fig. 7 is a detail elevation of the main frame, showing the removable bearing for the driving-shaft. Fig. 8 is a detail elevation of parts corresponding to those shown in Fig. 7, changed in construction to suit the modified form of the machine illustrated in Fig. 4.

In the following description, similar numerals refer to similar parts throughout the several views.

1 is the crusher-head, fitted for partial support around the central shaft 2, the latter being held in place by the hub 3, which is projected upwardly from and made preferably continuous with the spider arms 4,—a further function of said hub being to afford an interior support to said crusher-head. The spider-arms 4, are preferably made an integral part of the main frame, or bed 5. The main frame 5 is bolted to, and supported on the wood-sills 6. The frame 5 is so modified as to form the annular support 7, on which the cylindrical shell 8 is slidably mounted. The shell 8 is provided with inwardly projecting flanges 9, and 10, by which it is suited to incase and support the concaves, or crushing dies, 11, which are preferably fitted and zinced into said shell to secure them therein.

12 is the crown-piece or hopper, which in the preferred form of my machine, as shown in Fig. 1, is securely bolted to the main frame, and projects inwardly, affording on its lower side a bearing against which the upper end of shell 8 slides when oscillating.

The shell, 8, at its upper end is so formed as to present an inner circular knife edge 13, which is designed during the operation of the machine, to shave the under side of the crown-piece 12, for the purpose of excluding dust from the adjacent working parts.

14 is the eccentric sleeve, to which at its upper end, is keyed the gear-rim 15. At its lower end the eccentric sleeve 14, is supported by and travels on a ball-bearing 16, a groove or raceway for which is provided in the main frame.

The series of rolls 17, are interposed between the eccentric sleeve 14 and the shell 8. Said rolls 17 are held in the roller cage 18 to preserve their alinement, as illustrated in Fig. 6, and constitute, together with said cage a roller bearing which operates to lessen friction and allow easy lubrication. A similar roller bearing, comprising rolls 19, set in



cage 20, is interposed for like purposes, between sleeve 14, and the main frame 5.

All surfaces on which the rolls travel are machine-finished. The gear pinion 21, is secured to the driving shaft 22, to which the drive pulley 23 is keyed. Pulley 24 mounted on shaft 22, may be used to drive an elevator. The shaft 22, is carried in removable bearings 25, and 26.

The cap 27, has a threaded engagement with the central shaft 2, and serves to protect the latter against falling material fed into the crusher, as well as to clamp down the head, after the manner of a nut. When said cap, or nut, is loosened or removed, shaft 2 is free to turn within the crusher-head. It will be noted that shaft 2, has a threaded engagement in the lower part of hub 3. By the use of a bar inserted in the hole 28, through shaft 2, the operator may revolve said shaft in the direction required to raise it and so raise the crusher-head which is carried on the shoulder of shaft 2, at 29. During this operation the crusher-head is prevented from revolving by its loose feather-key engagement with the hub 3, at 30. When the head is raised to the desired position, the cap 27 is again brought down firmly against the head.

By use of the means described, in reverse operation, the head may be lowered. This provision for the vertical adjustment of the crusher-head enables the operator readily to change the size of the product by varying the distance between the head and concaves.

The hub 3 is preferably cast as a part of the main frame, and being sized to different diameters, as shown in Figs. 1 and 3, affords to the crusher-head, into which it is fitted, a lower interior support of great strength to resist lateral pressure, while allowing the head to be raised and lowered as occasion requires.

The discharge spout 31, suited to deliver the product into an elevator, has a drawer support on the angle-irons 32, attached to the wood-sills, and so is easily removable.

33 is an oil pump which is belted to the drive-shaft 22, and forces a stream of oil from the oil-tank 34, through the pipe 35, and into the oil-channel 36, in the crown-piece from whence the oil is distributed to the gears and to the main bearings on each side of the eccentric sleeve,—the surplus oil finding its way, by gravity, back to the oil-tank through pipe 37.

When, to operate my machine, power is applied to the driving-shaft, the geared eccentric sleeve 14 is driven by pinion 21. The revolution of 14 between the roller-bearings described, imparts to shell 8, and the concaves set therein, an oscillating or crushing movement. Every part of said shell and concaves is successively forced a given distance toward and away from said crusher-

head, thereby acting to crush stone or other material placed in the crushing cavity between the head and concaves.

When the crushing machine is constructed in the modified form shown in Fig. 4, it is to be noted that since the hopper 12, and the shell 8, are merged into a single piece, the hopper also oscillates and so serves to shake downward into the crushing cavity any stone placed in said hopper, thereby reducing the work of feeding the crusher. In said modified form of the machine, the main frame 5, is so formed as to afford at 38 (Fig. 4) a bearing upon which the hopper is slidably supported.

The fact that upper spider-arms, found necessary in the construction of other gyratory crushers, are not needed in my machine affords to it the marked advantage of an unobstructed opening.

Experience has shown that wear on the head and concaves is greatest near the lower or discharge opening.

It will be noted that the concaves are set in shell 8, in vertical position. Furthermore, they are held in place by the use of zinc in the usual manner, and hence are removable. Owing to their form and position as described, they may, after being removed, be again set in place with the positions of their ends reversed,—i. e., turned upside-down—and so take up wear. Also the head may be raised, by the method hereinbefore described, for taking up wear.

I am aware that concaves set in vertical position have been used by others. But experience has shown that when so used an immense downward pressure on the slanted surface of the crusher head results from crushing stone. This downward pressure limits the use of an oscillating head, as employed by others to machines of very small capacity. While, by the use of a fixed crusher-head in my machine, the difficulty arising from downward pressure is eliminated, and the use of vertical reversible concaves is rendered practical in machines of all sizes.

Having thus described my invention what I claim as new, and desire to secure by Letters Patent is:

1. In a crushing-machine, in combination, a circular main frame having a spider-armed bottom provided with a central hub projected upwardly from said bottom; and a crusher-head fitted for support around said hub and slidably mounted thereon.

2. In a crushing-machine, the combination of a main circular frame having a spider-armed bottom provided with a hollow upwardly-projected hub sized to different diameters to accommodate the interior of a crusher-head, with a crusher-head fitted for lateral support around said hub and slidably mounted thereon.



3. In a crushing machine, in combination, a main frame having a spider-armed bottom comprising a hollow hub projected upwardly within said frame; and a substantially vertical shaft fitted into said hub,—said shaft and said hub being together adapted to slidably support a centrally located crusher-head.

4. In a crushing-machine, in combination, a main frame having a spider-armed bottom comprising a hollow hub; a centrally located vertically adjustable crusher-head mounted around said hub; and means for raising and lowering said crusher-head.

5. In a crushing-machine, in combination, a main frame having a spider-armed bottom comprising a hollow hub; a centrally located, vertically adjustable shaft fitted into, and held by said hub in a fixed lateral relation to said frame,—said shaft having a shoulder for supporting a crusher-head; and a crusher-head mounted around said shaft and carried on said shoulder when said shaft is raised to give vertical adjustment to said head.

6. In a crushing-machine, in combination, a circular main frame having a spider-armed bottom comprising a hollow hub; a central shaft having a threaded engagement in said hub; and a crusher head slidably fitted for support around said hub and said shaft,—said hub engaging with said head to prevent the revolution of the latter while affording it lateral support.

7. In a crushing machine, in combination, an outer stationary frame; a cylindrical gyrative crusher-wall supported within said frame; and rotating means interposed between said frame and said wall for imparting to the latter a gyrating or crushing movement substantially equal in amplitude at its top and bottom.

8. In a crushing-machine, in combination, a circular stationary main frame; a cylindrical crusher-wall slidably mounted on a circular support connected with said frame; and a rotative eccentric device interposed and supported between said frame and said crusher-wall for imparting to the latter a gyrating movement.

9. In a crushing-machine, in combination, a circular stationary main frame; a crusher-head located centrally within said frame, and held in fixed relation thereto while said machine is in operation; a gyrating cylindrical crusher-wall surrounding said head in opposition thereto, and slidably supported within said frame; and means for gyrating said crusher-wall for the purpose specified.

10. In a crushing-machine, in combination, a circular main frame; a gyrative concave crushing wall supported on a circular bearing held by said frame; a centrally supported crusher-head set within said wall; and means for causing every part of said

concave crushing wall in its gyrating movement successively to approach and recede from said head substantially equal and like distances.

11. In a crushing-machine, in combination, a circular main frame; a gyrative cylindrical wall slidably mounted on a support connected with said frame; and a rotative eccentric sleeve interposed between said frame and said gyrative wall, said sleeve being provided with two roller bearings,—one of said roller bearings traveling between the sleeve and the frame, the other traveling between the sleeve and the gyrating wall.

12. In a crushing machine, the combination of a circular stationary bed or frame, a concave crusher wall in opposition to a centrally located head and a rotative eccentric device for giving said crusher wall a gyrative motion substantially equal at its top and bottom, said eccentric being provided with roller bearings supported in fixed relation to said frame.

13. In a crushing machine, in combination, a circular main frame, a crusher wall; a crusher-head located centrally within said frame; and a crown-piece,—said crown-piece and said crusher-head both being rigidly connected to and held in a fixed lateral relation with said frame and means for gyrating said crusher wall in opposition to the said crusher head.

14. In a crushing machine, in combination, a centrally located crusher-head fixedly connected to, and held in position by a surrounding main frame; a gyrative circular crushing wall surrounding said head and suitably supported in opposition thereto; and rotary means for imparting to said crushing wall a substantially horizontal gyratory movement.

15. In a crushing-machine the combination of a centrally supported, fixed crusher-head, with a central shaft rotative within said head and base and engaging therewith to provide for the vertical adjustment of said head.

16. In a crushing-machine, in combination, a circular main bed, or frame, provided with a spider-armed bottom having a crusher-head secured thereto; a series of concaves set into and held by a cylindrical shell and comprising in connection with said shell a gyrative concave wall; and rotative means contained within and supported by said frame, for imparting to said concave wall an oscillation of substantially the same amplitude at its top and bottom.

17. In a crushing machine, in combination, a circular main frame provided with a spider-armed bottom having a fixed crusher-head removably secured thereto; and means for vertically adjusting said head,—said means comprising a central



shaft, having a threaded engagement in said spider-armed bottom and a shoulder engaging the head.

18. In a crushing-machine, in combination, a circular main frame provided with a spider-armed bottom having a crusher-head secured thereto; a gyrative crushing-wall supported upon a bearing within said frame and comprising a series of substantially vertical concaves removably secured within a cylindrical shell; and a rotative eccentric device containing roller bearings for gyrating said crushing-wall,—said device being adapted to travel between said crushing-wall and said frame.

19. A crushing machine comprising a frame, a crushing head, a slidable crushing ring thereabout and a rotating device to gyrate the ring said device adapted to impart substantially the same amplitude of gyration to top and bottom of the ring.

20. A crushing machine comprising a frame, an adjustable removable crushing head, a slidable crushing ring thereabout and a rotating device to gyrate the ring said

device adapted to impart substantially the same amplitude of gyration to top and bottom of the ring.

21. A crushing machine comprising a frame, a crushing head, a slidable crushing ring thereabout and a rotating eccentric ring device to gyrate the ring said device adapted to impart substantially the same amplitude of gyration to top and bottom of the ring.

22. A crushing machine comprising a frame, a crushing head, a slidable crushing ring thereabout and a rotating device between the ring and frame to gyrate the ring said device adapted to impart substantially the same amplitude of gyration to top and bottom of the ring.

In witness whereof I hereunto subscribe myself this 12th day of August, in the year 1907.

JOSIAH E. SYMONS.

Witnesses:

ANNA S. FERGUSON,  
LEE IVINS.