

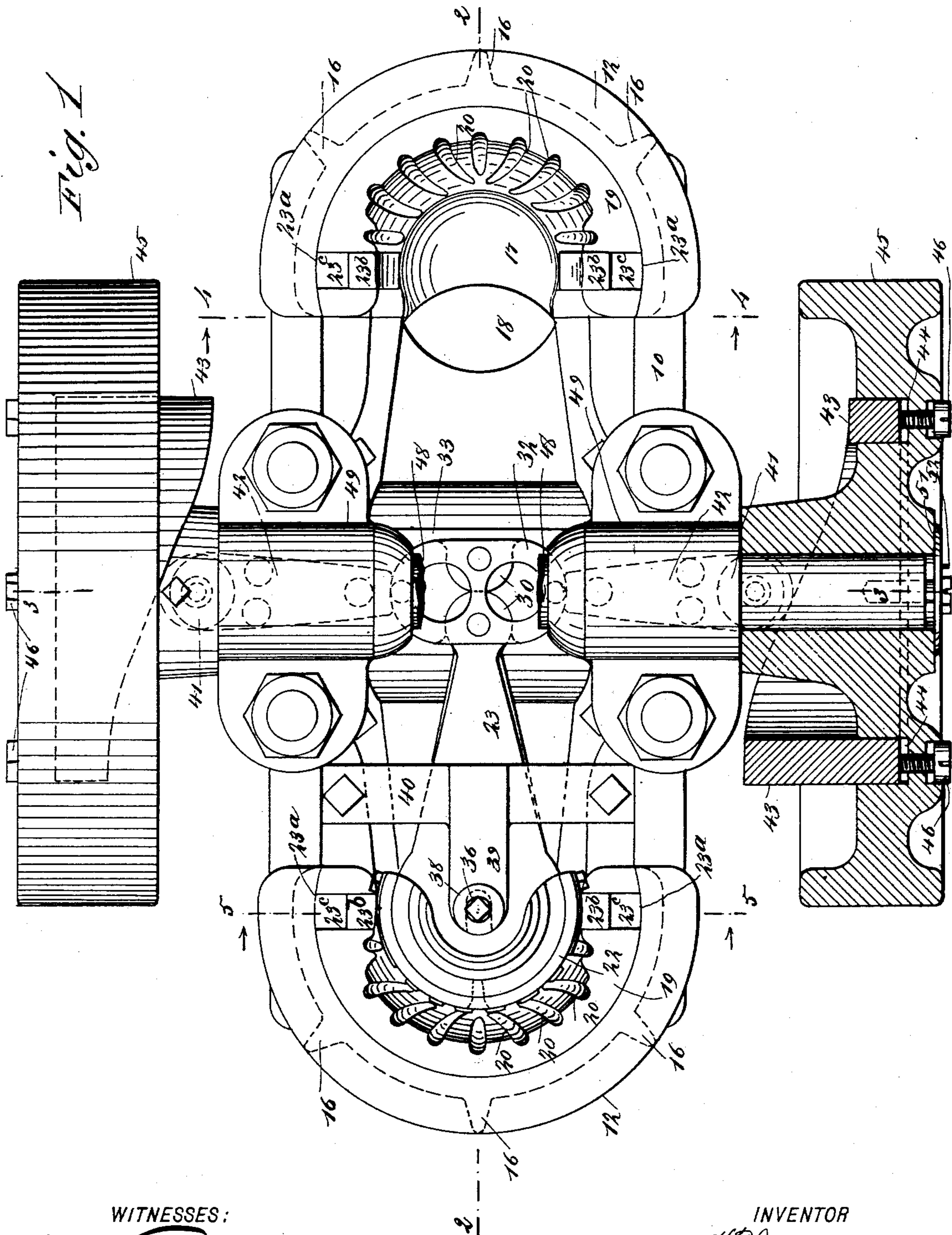
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4 Sheets—Sheet 1.

H. P. JONES.
COMBINED ROCK BREAK AND ORE GRANULATOR.

No. 520,317.

Patented May 22, 1894.



WITNESSES:

C. Neveu
L. Sedgwick

INVENTOR

H. P. Jones

BY

Munn & Co
ATTORNEYS.

(No Model.)

4 Sheets—Sheet 2.

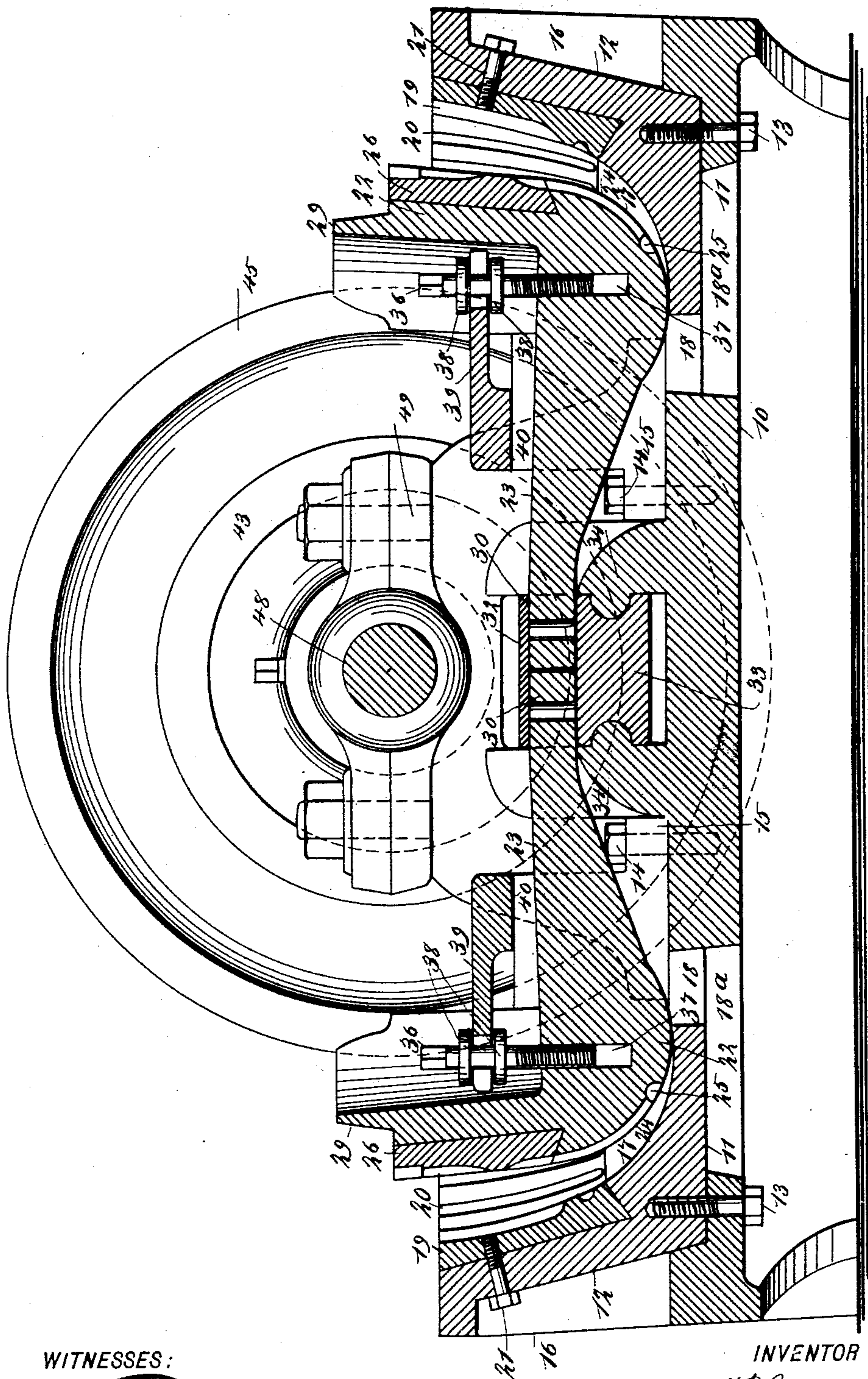
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Fig. 2



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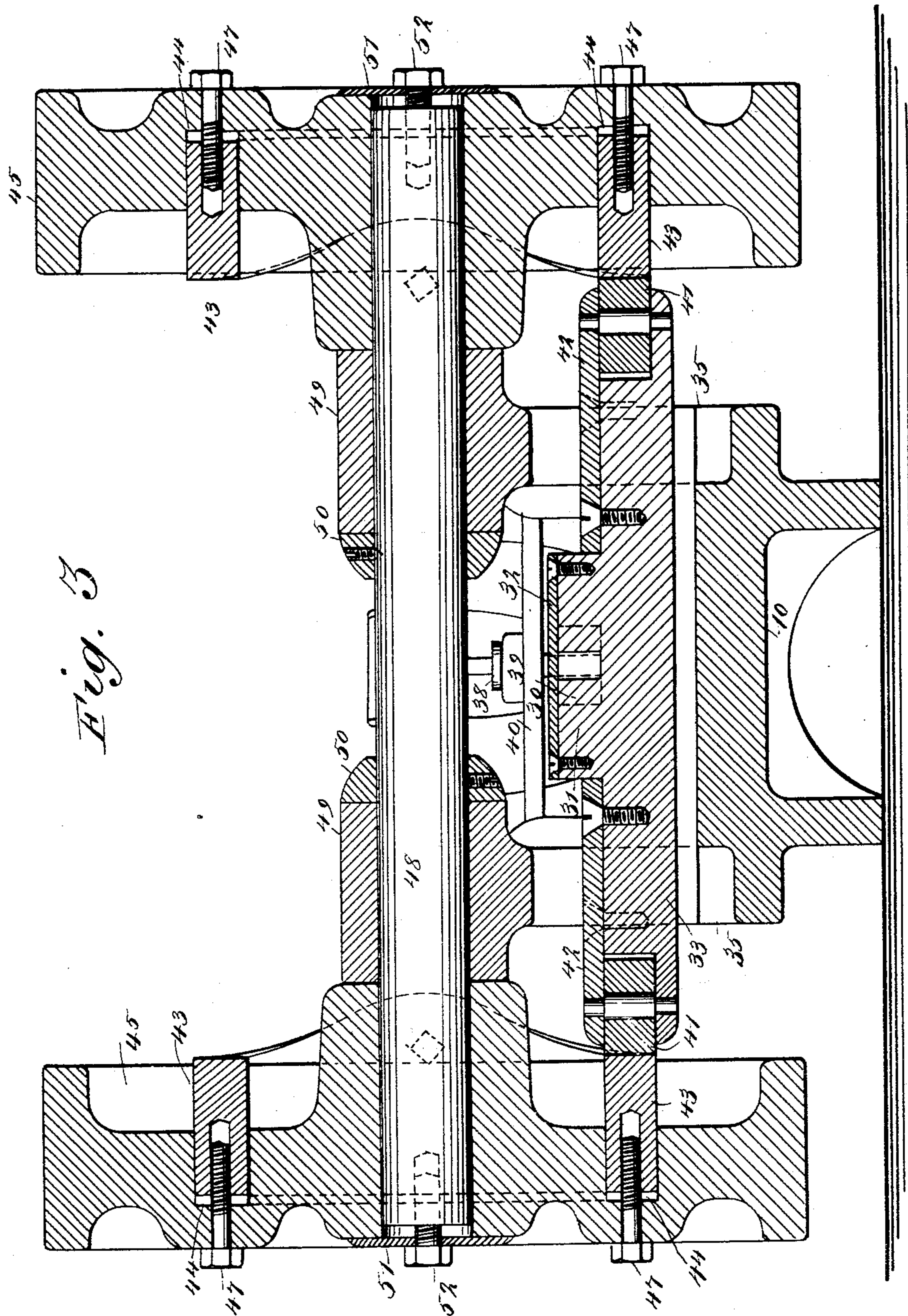


Fig. 3

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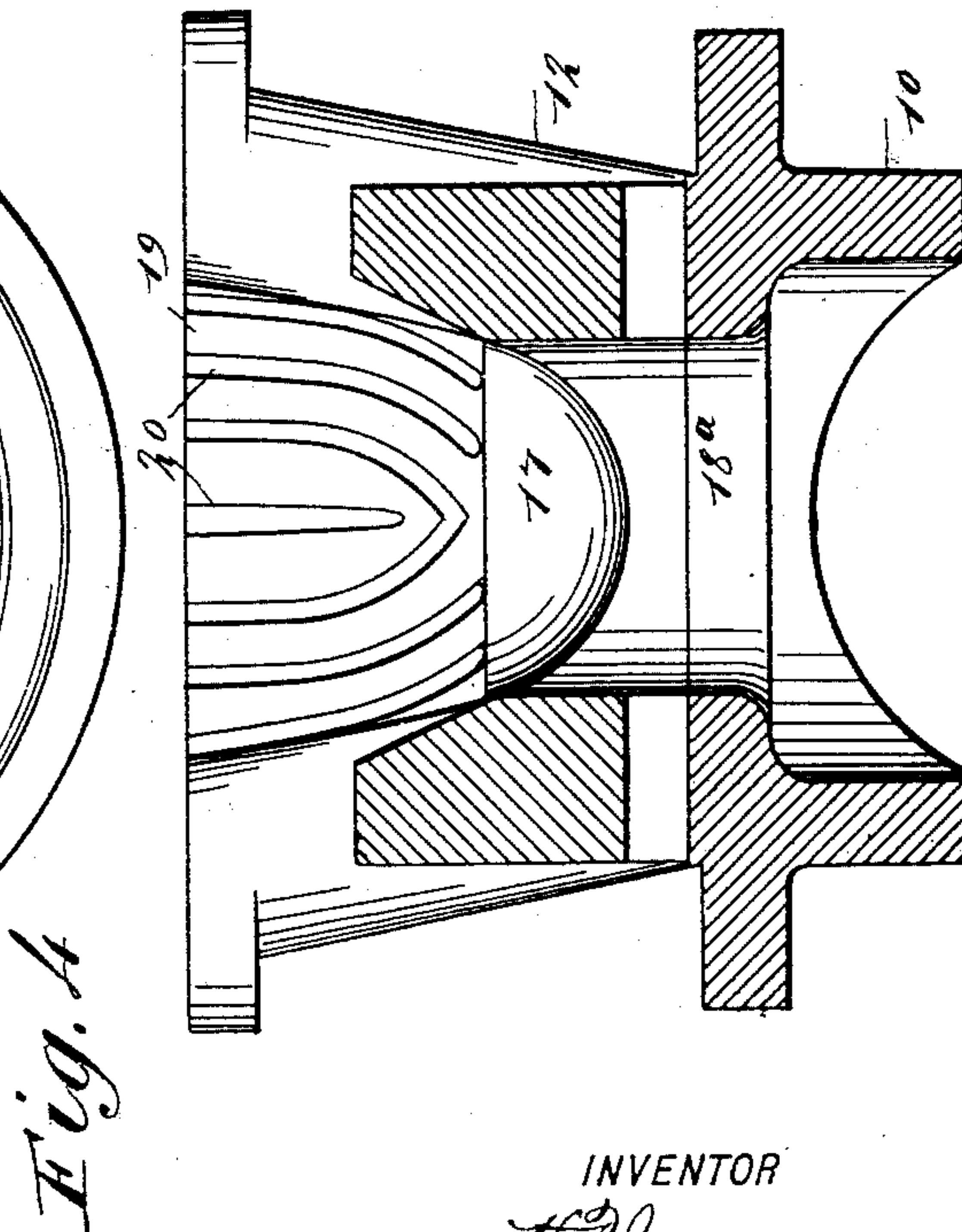
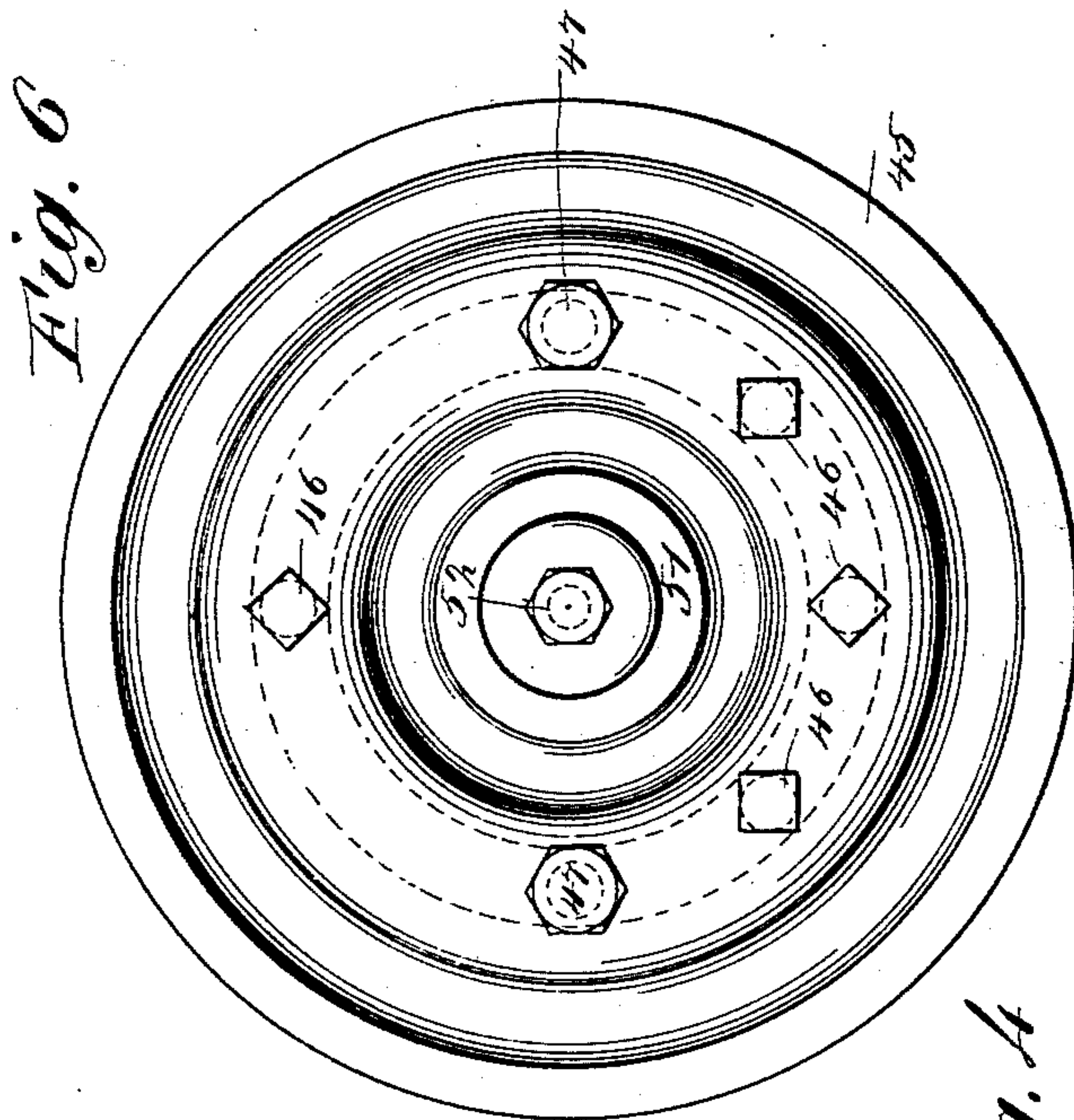
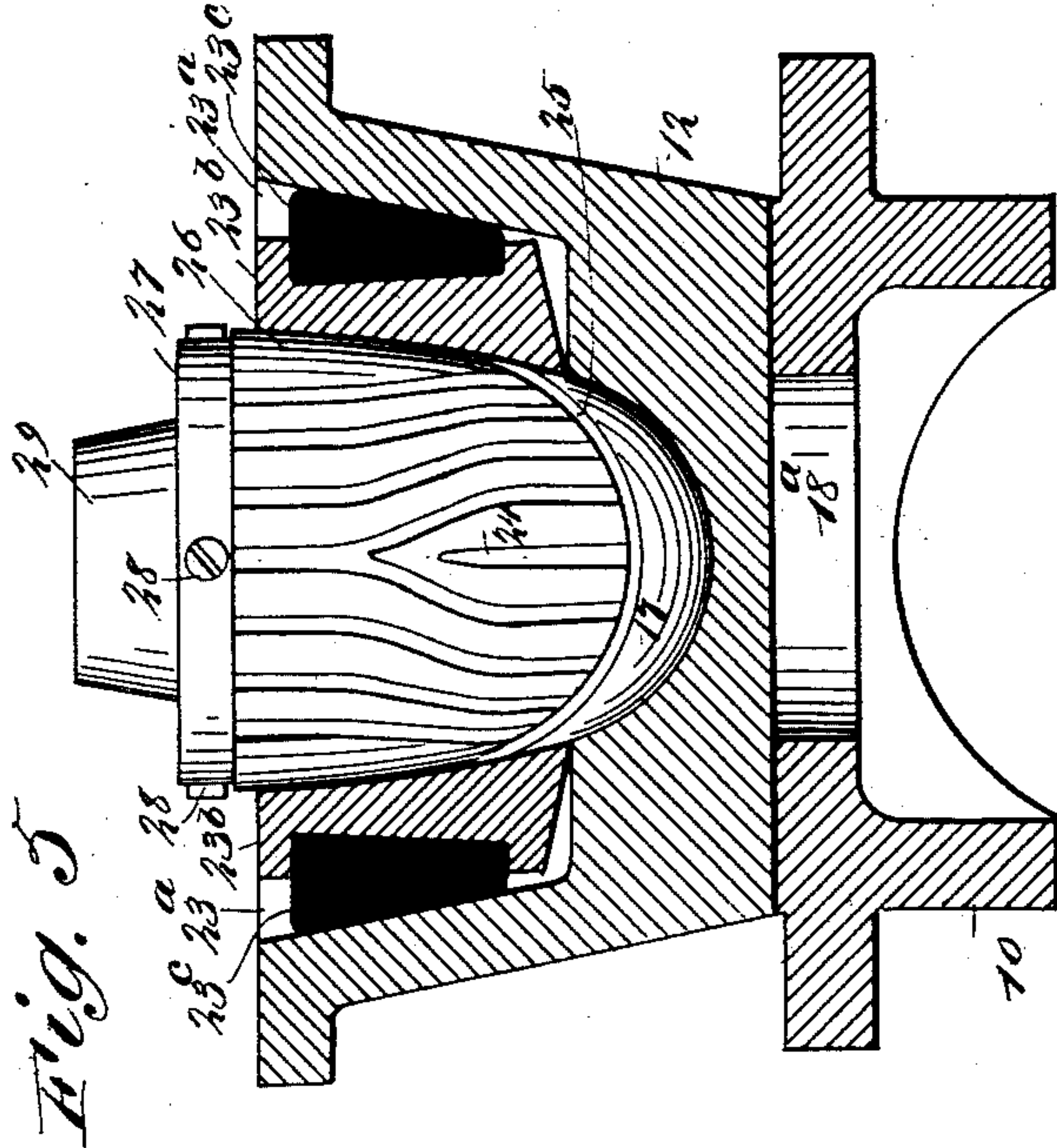
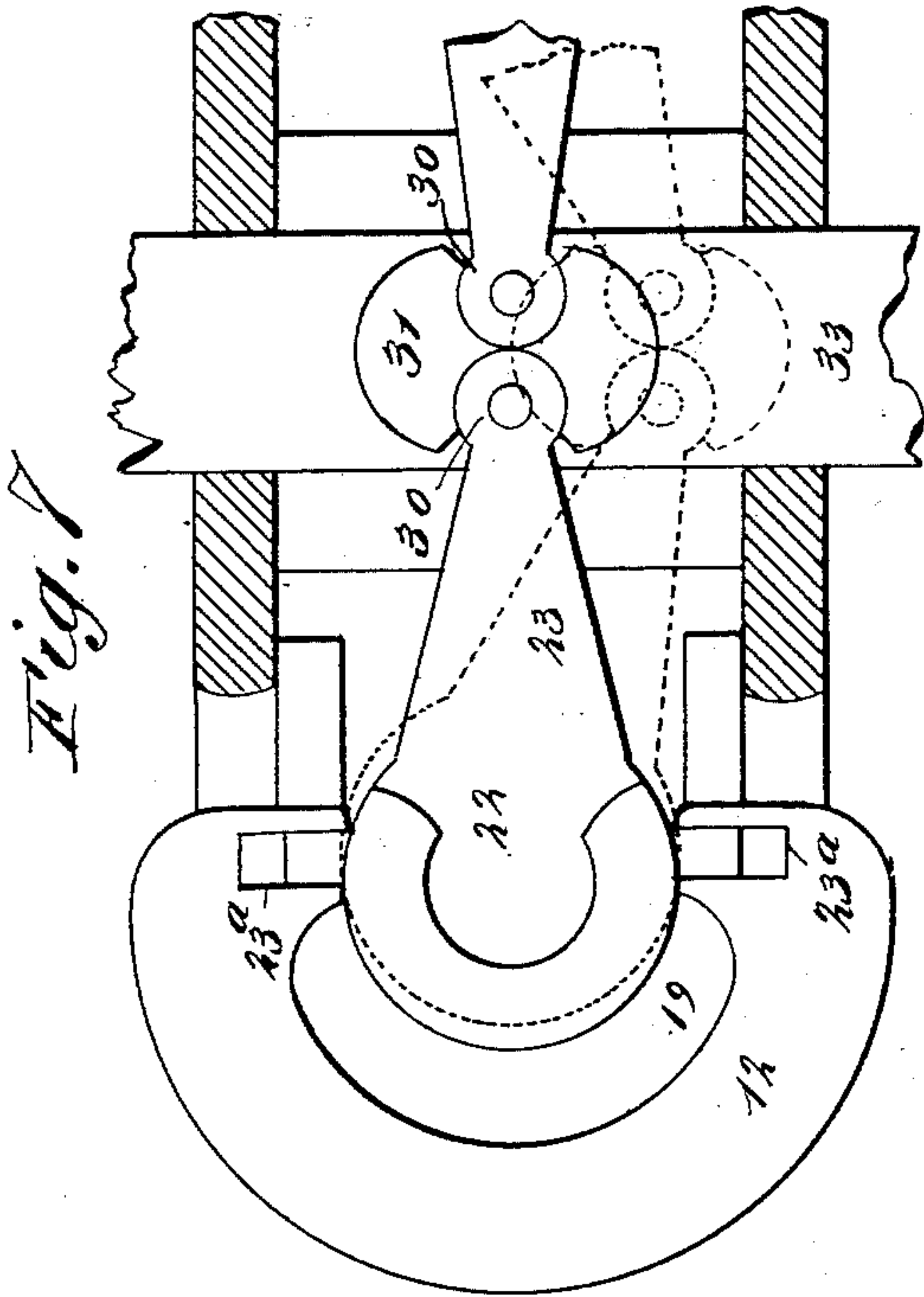
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UNITED STATES PATENT OFFICE.

HARVEY P. JONES, OF DENVER, COLORADO.

COMBINED ROCK-BREAK AND ORE-GRANULATOR.

SPECIFICATION forming part of Letters Patent No. 520,317, dated May 22, 1894.

Application filed July 31, 1893. Serial No. 481,966. (No model.)

To all whom it may concern:

Be it known that I, HARVEY P. JONES, of Denver, in the county of Arapahoe and State of Colorado, have invented a new and Improved
5 Combined Rock-Break and Ore-Granulator, of which the following is a full, clear, and exact description.

My invention relates to improvements in rock crushing and ore granulating machines;
10 and the object of my invention is to produce a very simple and very powerful machine, by means of which rock or ore may be crushed to any desired degree of fineness and by means of which also ore may be rapidly granulated.

15 A further object of my invention is to produce a very compact and durable machine having all the wearing parts removable, to the end that they may be easily and cheaply removed as often as they become broken or
20 badly worn.

Another object of my invention is to produce a double ended machine having grinding bowls or mortars in each end, and to provide a simple means for actuating the grinding
25 levers or pestles and to utilize all the power by transmission from one end to the other and to give the pestles a simultaneous reciprocating and oscillating movement so that they will crush and grind rapidly and co-
30 instantaneously.

To these ends my invention consists of certain features of construction and combinations of parts, as will be hereinafter described and claimed.

35 Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views.

Figure 1 is a broken plan view of the machine, partly in section, and with one of the grinding levers removed. Fig. 2 is a longitudinal section on the line 2—2 in Fig. 1. Fig. 3 is a cross section on the line 3—3 in Fig. 1. Fig. 4 is a cross section on the line 4—4
45 in Fig. 1, looking in the direction of the arrows. Fig. 5 is a cross section on the line 5—5, Fig. 1, looking in the direction of the arrows. Fig. 6 is a side elevation of one of the fly wheels; and Fig. 7 is a diagrammatic plan, illustrating the movements of the grinding le-
50 vers or pestles.

The machine is provided with a substan-

tially flat bed or base 10, which is held at a sufficient height to enable the granulated rock or ore to accumulate beneath it and to pass
55 out at the ends, and this bed is recessed in the upper side and near opposite ends, as shown at 11, to enable the grinding bowls 12 to be firmly seated upon it, these bowls being of a nearly semi-circular spherical shape in-
60 ternally and of a nearly semi-circular shape on top, and they are made of suitable hard and strong material such as steel and are fastened in place by bolts 13 and 14, the former projecting upward through the bed bottom
65 into the bottoms of the bowls, and the latter projecting downward through lugs 15 on the inner ends of the bowls and screwing into the bed. The bowls are provided with vertical
70 external ribs 16, as this gives them great strength with comparatively light weight of metal. The bowls 12 have smooth seats 17 at the bottom in which the granulation takes place, as hereinafter described, and they are
75 also provided with openings 18 at the bottom which are arranged just above openings 18^a in the bed, see Fig. 2, and through these openings crushed and granulated material is dropped. The bowls 12 are also provided,
80 near their upper ends, that is, at points above the smooth seats 17, with removable linings 19 which are dovetailed into the bowls and which are made of suitable material which
85 will resist the great grinding and battering to which they are subjected, the linings having flutes or grooves 20 thereon which preferably extend straight downward for a short distance and then curve inward at an angle, but the flutes may be of any desired shape or pitch. The linings are held in place by bolts 21
90 which project through the bowls and into the linings, and it will be observed that if one of the linings becomes badly worn or broken, it can be quickly removed and another one substituted for it. The bowls 12 receive the en-
95 larged ends 22 of the pestles or grinding levers 23, these enlarged grinding ends 22 being shaped to fit the bowls, and the pestles have their grinding faces fluted, as shown at 24, these flutes running preferably up and
100 down the pestles and the flutes 24 are, at their lower ends, intersected by a main flute 25 in which the crushed material is gathered and from which it passes beneath the smooth

lower faces of the pestles and over the smooth seats 17 of the bowls, the material during this process being granulated so that it passes in a finished condition through the openings 18.

5 The pestles or grinding levers 22 are provided near their upper ends and their grinding faces with hardened face plates 26 which are arranged opposite the linings 19 of the bowls and which are fluted up and down, the
10 flutes of the face plates merging into the flutes 24 of the pestles. The face plates are dovetailed into place and are also bound in position by bands 27, which encircle the upper reduced portions of the face plates and the upper
15 ends 29 of the pestles, the face plates being held in place by screws 28. The pestles or grinding levers are adapted to reciprocate slightly and to move with a grinding or other movement also in the bowls, and to prevent
20 the ore from shifting out from the ends of the bowls, the bowls are provided, near these points with vertical grooves 23^a, see Figs. 1 and 5, in which are held tongues 23^b and these are pressed against the faces of the pestles
25 by rubber cushions 23^c behind them, although suitable springs may be substituted for the cushions if desired. The grinding levers or pestles 23 are reduced at their inner ends, and these ends are rounded, as shown at 30
30 in Figs. 1 and 7, and these ends roll one end tight against the other so that the transmitting of the power from one end to the other is perfect. The rounded ends are pivoted in corresponding recesses of a head 31 and are
35 covered and held down by a suitable washer 32. The head 31 is formed on the top side and near the center of a slide 33, which moves transversely through the machine, sliding in a suitable slideway 34 formed on the bed of
40 the machine and traveling outward through side openings 35 in the frame of the machine, as shown clearly in Fig. 3. The manner of imparting motion to the slide and through this to the levers will be described presently.

45 It is necessary to adjust the grinding levers or pestles vertically so that the rock or ore may be crushed and granulated to any desired fineness, and to this end bolts 36 are used which fit sockets 37 in the tops of the
50 enlarged heads 22 of the grinding levers or pestles, each bolt 36 having near its upper end a pair of fixed collars 38 between which is held the outer end of an arm 39 which is formed integral with a cross bar 40, although
55 it may be bolted to the cross bar if preferred, and the cross bar is securely fastened to the opposite side and rear end of the grinding bowl 12, as shown clearly in Fig. 1. It will be seen that as the arm 39 is rigid,
60 the turning of the bolt 36 will cause the grinding lever or pestle with which it connects to be raised or lowered, according to the direction in which the bolt is turned. The slide 33 which, by its transverse reciprocating movement, actuates the grinding levers
65 or pestles, is provided at its outer ends with anti-friction rollers 41 and, for convenience,

the rollers are journaled partly in the slide and partly in the top plates 42 which are
70 bolted to the top of the slide. This arrangement enables the rollers to be easily inserted and to be easily taken out, so that new ones may be substituted for them when necessary. The rollers extend into the paths of convex
75 circular cams 43 which are held in recesses 44 on the inner sides of the fly wheels 45, which are arranged on opposite sides of the machine and on the main shaft, as described presently. The cams 43 are removable so that new ones
80 may be substituted when the old ones are worn out or broken, and they have sinuous faces, that is, faces which are alternately convex and concave, the convex portion of one cam being opposite the concave portion of
85 the other, and it will be seen that as the cams revolve, the rollers 41 will follow their faces and the slide 33 will be transversely reciprocated. The cams are adjusted in and out so that they may be made to give the desired
90 throw to the slide, and to this end each fly wheel is provided with a plurality of set screws 46 which are threaded in the fly wheel and the inner ends of which abut with the cams, see Fig. 1, and each fly wheel is also provided
95 with a plurality of bolts 47 which project through the wheel and are threaded into the cams, and these bolts may be tightened so as to pull the cams into the recesses 44, while by turning in the set screws 46, the cams are
100 pushed out of the recesses so that by means of the set screws and the bolts, the cams may be very nicely adjusted. The fly wheels are secured to the main shaft 48 which is mounted in brackets 49 on the bed, and the shaft is held against endwise movement by collars 50
105 which are secured to the shaft and bear against the inner sides of the brackets. The fly wheels are placed upon the shaft in such a way that while bearing against the bracket 49 at the inner ends of their hubs, the shaft
110 will not quite project through them, and the fly wheels have stiff washers 51 on their outer ends through which project bolts 52, these being screwed into the ends of the main shaft 48 and, by tightening the bolts as occasion re-
115 quires, all the lost motion occasioned by wear may be taken up.

The operation of the machine is as follows:—
The machine, being started by means of belts applied to the fly wheels or by equivalent
120 gearing, the ore or rock to be crushed and granulated is fed into the bowls 12 at opposite ends of the machine. As the fly wheels revolve, the cams 43 cause the slide 33 to reciprocate transversely and the slide is re-
125 ciprocated twice at every revolution of the wheels, although it is obvious that the cams may be so formed that the slide will reciprocate a greater or less number of times. At each reciprocation of the slide 33, the grind-
130 ing levers or pestles 23 are withdrawn and then thrown forward, as shown by dotted lines in Fig. 7, and they are also caused to oscillate in the bowls 12 so that the ore or rock in the

bowls is caught between the lining of the bowls and the pestles and crushed and ground. The flutes in the grinding levers or pestles and bowls cause the rock to be readily caught
 5 between the stationary and movable parts, so that it is rapidly crushed and ground, and the finer portions dropped downward until they are reduced to such dimensions that they pass
 10 down to the smooth granulating seats 17 and beneath the smooth faces of the pestles or grinding levers, and here the materials, acting frictionally with each other, are granulated and pass out through the openings 18.

15 Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A combined rock break and ore granulator, comprising an elongated bed having openings therein and recesses in the upper side, grinding bowls fastened in the said recesses and provided with openings delivering through the openings in the bed, fluted linings for the grinding bowls, and oscillating
 20 and reciprocating grinding levers or pestles shaped to fit snugly in the bowls and having fluted surfaces, substantially as described.

2. A combined rock break and ore granulator, comprising an elongated bed having recesses on its upper side and near the ends and openings for the passage of ore, grinding bowls fastened in the recesses on the bed and delivering through the openings therein, and oscillating and reciprocating grinding levers
 30 or pestles held to move in the bowls, substantially as described.

3. A combined rock break and ore granulator, comprising a supporting bed, grinding bowls fastened to the bed and provided with
 40 fluted grinding surfaces, and oscillating and reciprocating grinding levers or pestles having enlarged fluted ends to move in the bowls, substantially as described.

4. A combined rock break and ore granulator, comprising oppositely arranged grinding bowls having removable fluted linings, and oscillating and reciprocating grinding levers or pestles having enlarged ends to fit the bowls, these ends having removable fluted face
 50 plates, substantially as described.

5. The combination, with the grinding bowls having recesses near their open ends, and the removable grinding levers or pestles having enlarged ends to enter the bowls, of
 55 inwardly-pressed tongues held in the recesses

of the bowls and fitting against the faces of the grinding levers or pestles, substantially as described.

6. The combination, with the fluted grinding bowls, of the oscillating and reciprocating
 60 grinding levers or pestles having enlarged ends to enter the bowls, and a screw mechanism for adjusting the pestles or grinding levers vertically, substantially as described.

7. The combination, with the grinding
 65 bowls, and the movable pestles or grinding levers having enlarged ends to enter the bowls, of cross bars secured to the bowls, arms secured to the cross bars and projecting above the grinding rollers, and bolts fitting sockets
 70 in the grinding levers and provided with fixed collars to clasp the ends of the arms, substantially as described.

8. The combination, with the grinding bowls, and the movable grinding levers hav-
 75 ing enlarged ends to enter the bowls, of a transversely reciprocating slide arranged between the bowls, and a pivotal connection between the slide and the inner ends of the grinding levers, substantially as described. 80

9. The combination, with the grinding bowls, the grinding levers having enlarged ends to fit the bowls and the reciprocating slide to which the levers are connected, of rollers journaled in the ends of the slide, the
 85 revoluble fly wheels on opposite sides of the machine, and the cams secured to the fly wheels and arranged to strike the rollers of the slide, substantially as described.

10. The combination, with the reciprocating
 90 slide, of the main shaft arranged parallel with the slide, the rollers in the end of the slide, the fly wheels on the main shaft, and cams adjustable in and out on the inner faces of the fly wheels, the cams being arranged to strike the
 95 rollers of the slide, substantially as described.

11. The combination, with the reciprocating slide having rollers in its ends and the driving shaft arranged parallel with the travel of the slide, of the fly wheels on the shaft hav-
 100 ing annular recesses therein, the cams held in the recesses and adapted to strike the rollers of the slide, and a screw mechanism for adjusting the cams in and out, substantially as described.

HARVEY P. JONES.

Witnesses:

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 GEO. W. ROSE.