No. 797,616. PATENTED AUG. 22, 1905.

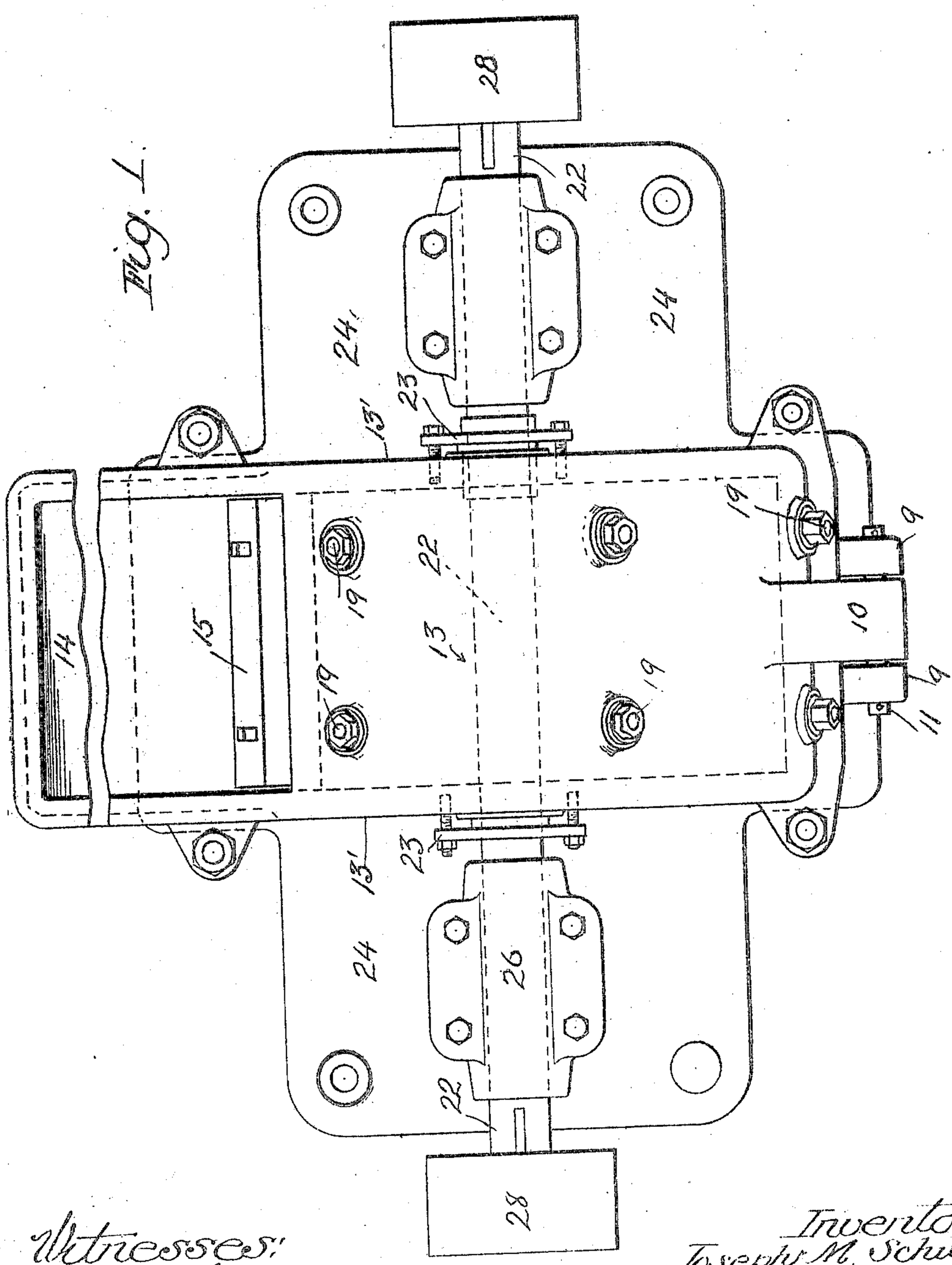
J. M. SCHUTZ.

ROTARY BREAKER.

APPLICATION FILED JAN. 26, 1903.

3 SHEETS—SHEET 1.

Fig. 1.



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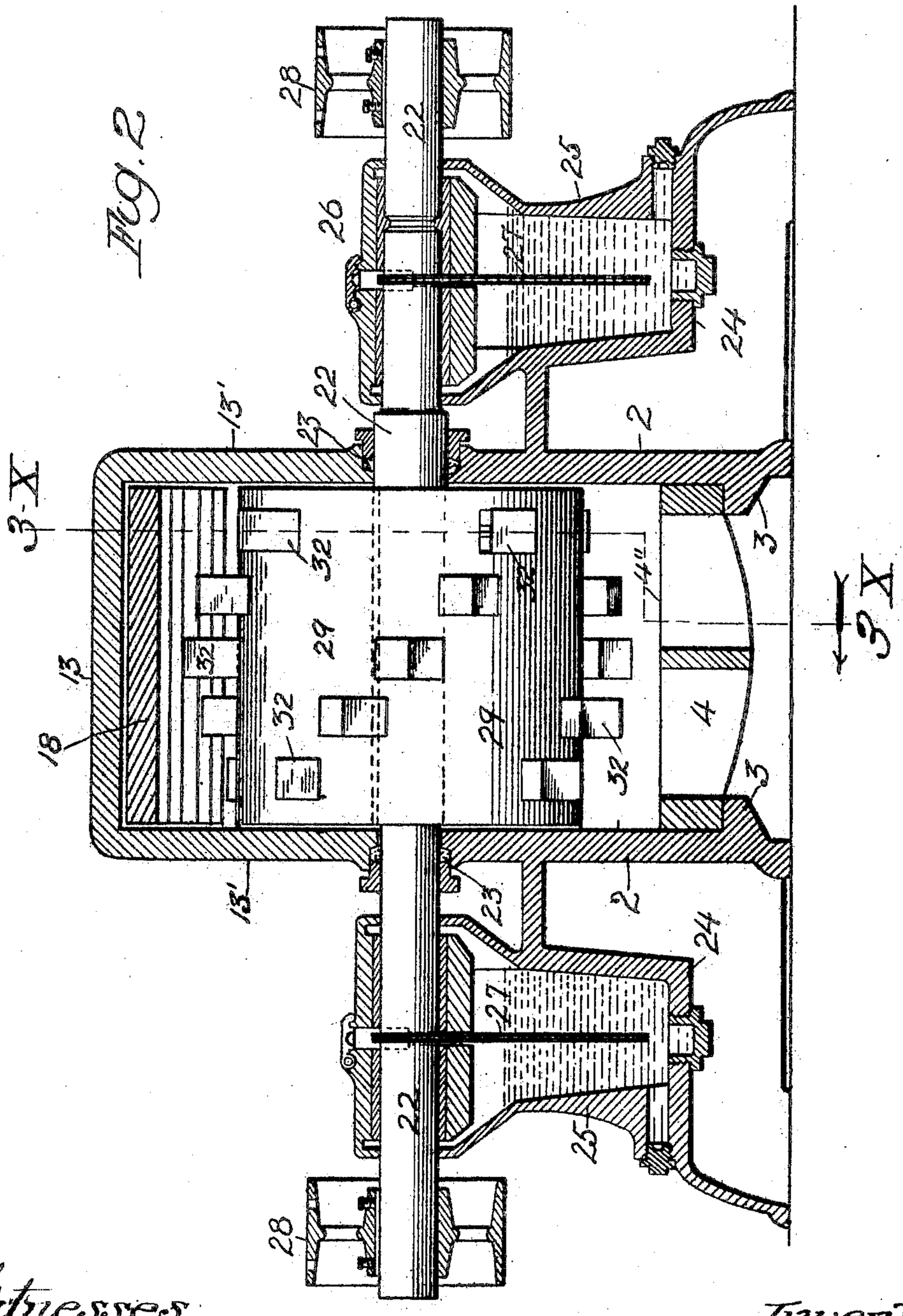
3 SHEETS—SHEET 2.

Fig. 2



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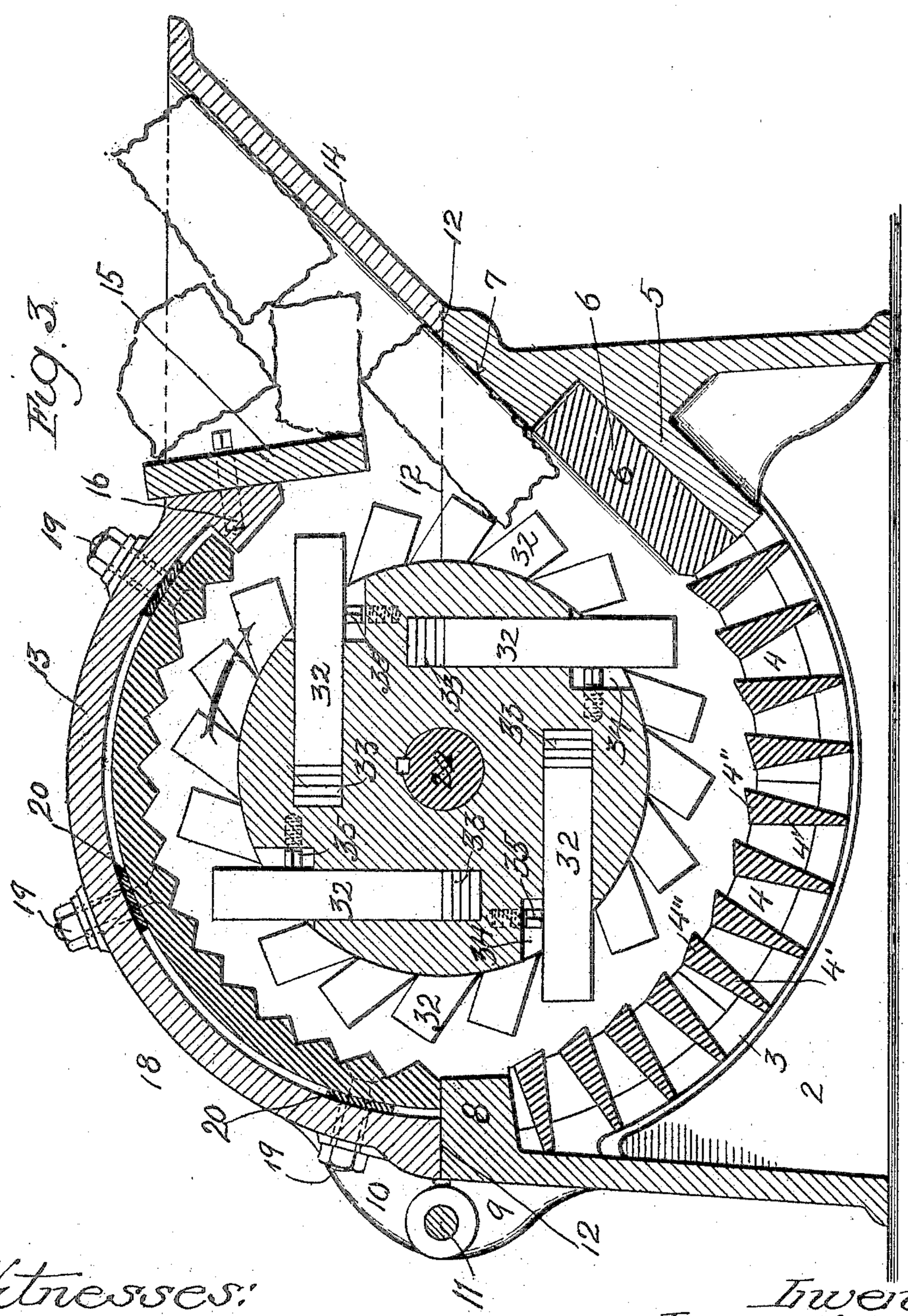
3 SHEETS—SHEET 3.

Fig. 3



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ROTARY BREAKER.

No. 797,616. Specification of Letters Patent. Patented Aug. 22, 1905.

Application filed January 26, 1903. Serial No. 140,559.

To all whom it may concern:

Be it known that I, JOSEPH M. SCHUTZ, of the city of Minneapolis, county of Hennepin, and State of Minnesota, have invented certain new and useful Improvements in Rotary Breakers, of which the following is a specification.

My invention relates to machines for crushing, shattering, breaking, and pulverizing hard substances, and particularly rock and lump materials.

My invention has special reference to that class of machines wherein a heavy rotary member provided with projections is relied upon for crushing the material; and the object of my invention is to provide a machine of this class which shall in all respects take the place of the common vertical gyrating-head rock-crushers that are extensively used for crushing and breaking various kinds of rock and ore.

The particular object of my invention is to provide a rotary breaker of large capacity and adapted for the heaviest kinds of work, but which may be operated with the expenditure of much less power than is commonly employed for driving the ordinary crushers and breakers of equal capacity.

Another object of my invention is to provide a rotary breaker of small height, whereby the usual elevators are dispensed with.

My invention consists generally in a rotary breaker comprising a shell or casing similar to a hollow cylinder in shape and having a feed opening or chute in its side, in combination with a grating provided in the lower part of the casing and a solid metal cylinder or roll arranged within the casing and nearly filling the same and provided with a plurality of tangentially-arranged bars or projections adapted to strike substantially tangential blows with their ends to break and shatter the rock at the foot of said chute; and my invention further consists in the various details of construction and in combinations and parts, all as hereinafter described, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a plan view of a rotary breaker embodying my invention. Fig. 2 is a vertical longitudinal section of the machine, the breaking or shattering roll being shown in full lines; and Fig. 3 is a transverse vertical section on the line *x x* of Fig. 2.

The machine illustrated is that which I employ for crushing large chunks or blocks of limestone and similar rock. Obviously such a machine must possess stability, and as the speed of the rotary breaking or shattering cylinder, which usually exceeds a ton in weight, approximates fifteen hundred revolutions per minute it is most desirable that the machine be made in few parts and those of simple, strong, and compact construction and arrangement. I therefore prefer to make the machine practically from three elements or members—the base, the top, and the breaking-cylinder. The base comprises the lower part of the machine-casing, the machine-chute, the wide-flaring base parts, and the shaft-bearing pillars. The top is the semi-cylindrical heavy upper part of the casing and contains the upper part of the feed-chute. The breaking or shattering cylinder or roll comprises a solid metal cylinder and a long shaft whereon the same is mounted and which has ample bearing in said pillars.

Referring now to the drawings, it will be seen that the end walls 2 2 of the lower part of the casing extend to the bottom line of the machine-base. Upon their inner sides these are provided with the curved ribs 3 3 to carry the heavy grating 4, which is preferably made in sections and occupies the bottom of the casing. The bars 4′ of the grating are tapered in cross-section, as shown in Fig. 3, and their upper edges 4″ are preferably inclined, making them tooth-like to catch the shattered material. In its forward part the casing is provided with the heavy inclined wall or seat 5 for the heavy steel block or breaking-plate 6, inclined at about forty-five degrees, and which rests against the adjacent grating.

8 is a heavy rib extending across the back of the casing, which holds the grating from sliding on the ribs. 3. No screws, bolts, or pins need be or are employed for holding the sections of the grating or the breaking-plate, as the weight thereof and the force of the flying material striking thereon are sufficient to prevent their displacement. The breaking-plate constitutes the foot of the feed-chute,

and the surface 7 of the chute above the plate is in the same plane with the surface of the plate 6. The machine is usually placed over a hopper, into which the material drops from the grating in the casing.

The upper and lower parts of the casing are preferably provided with integral hinge-lugs 9 and 10, that are pivoted by the heavy pin 11, and the upper part of the casing joins the lower part on the line 12, resting thereon. The front of the upper part or top 13 of the casing is provided with the inclined chute-bottom 14, flush with the surface 7, in order to provide for regulating the quantity of material to be fed to the roll. The other wall of the chute may be constituted by the adjustable gate 15, which in such cases is fastened upon the cross-rib 16 of the top. The side walls 13′ of the top are directly above the lower walls of the casing, and to provide a further and larger breaking-surface there may be placed in the top the longitudinally-grooved inner casing-plate 15, curved to conform to the top and providing an inner grinding-surface 18. In such cases this plate rests upon the rib 8 of the lower part of the machine, while the rib 16 serves to prevent its dropping down at the front end. The lining 18 is also held by a number of bolts 19 to prevent its falling in case it is cracked or fractured.

20 represents washers arranged between the lining 18 and the casing 13 to prevent the escape of dust. In this connection it should be noted that the joint between the top and bottom parts of the casing is made by planing the surfaces thereof along the line 12, making a dust-tight joint. The only other joints about the machine are those about the shaft 22, where it extends through the side walls of the casing, and these are made tight by the packing boxes and glands 23, which prevent the discharge of dust from the casing.

The base extensions 24 carry the integral pillars 25, at the tops of which are the heavy shaft-bearings 26 26 for the shaft 22. The pillars are hollow, as shown, and contain large quantities of oil, which is elevated to the shaft by the chains 27. The bearings are arranged close to the ends or side walls of the casing and are alone depended upon for holding the shaft—that is, the shaft has no actual bearings in the casing. I provide a small pulley 28 on each end of the shaft, securing a better result with the two-belt drive than from the single-belt drive, the shaft being thereby relieved from torsional strain. On the shaft and within the casing is the large shattering or momentum cylinder 29, keyed to the shaft. This drum is of such length as to completely fill the casing, and its speed of rotation is so great as to exclude particles from the cracks or spaces between its ends and the sides of the casing. It will be noted that the shaft is eccentrically placed with relation to the substantially cylindrical casing and that the peripheral space between the drum and the grating and lining has the form of a volute. This arrangement is of especial advantage with the lining 18, as the constantly-decreasing space between the roll and the lining makes possible the further reduction and crushing of the particles during the entire revolution of the roll. The drum or cylinder is of solid metal throughout, with the exception of a plurality of pockets 31 provided therein and occupying tangential position with respect to the shaft 22. The pockets, as shown best in Fig. 2, are arranged in staggered or spiral lines, and in these I place the heavy square chrome-steel breaking or shattering bars 32. Differences of length in the bars are corrected by plates or washers 33, placed in the bottoms of the pockets, so that the faces of the bars are equidistant from the center of the cylinder. The under or forward side of each pocket is provided with a recess 34, and for each bar I provide a heavy set-screw 35, which, being turned out beneath the bars, jams each in its pocket. The tendency of the screws is to turn out, and therefore the vibration of the machine tends to tighten the bars 32 in the pockets rather than loosen them.

The pockets and bars, which are here described as tangential, are not tangential to the periphery of the drum, the bars projecting at something more than a tangent. They are, however, tangential to a minor circle passing through their bases, this circle being concentric with but of less diameter than the peripheral circle of the roll or drum. The longest axis of each bar, moreover, is perpendicular to a plane passing through the center of the drum and coincident with the chord of a segment of the peripheral circle. The bars being arranged in this manner strike blows with their square ends, and as they are seated in the solid drum each blow of each bar of the staggered rows is backed by practically the entire weight and momentum of the drum or roll.

The operation of my machine is as follows: The parts being assembled as shown, the cylinder, with its large number of bars, is set into rotation and is soon brought to its normal speed, approximately fifteen hundred revolutions per minute. The machine is then ready to receive the material to be broken, being usually in large lumps, blocks, or pieces which are dumped or thrown into the feed-chute. As a rock passes beneath the gate 15 and slides down over the breaker-plate 6 it is struck by the flat end of one of the bars. The blow struck is prodigious by reason of the great weight and the momentum of the revolving mass and because the stroke is a di-

rect one, being made by an end blow of the hammer on the lump of material which has been delivered on the breaker-plate, and the rock instead of being crushed will be instantly burst and scattered, leaving but little work for the next bar or bars to do. The broken material is thrown back onto the grating and passes through the same. If the broken material contains any chunks that are too large to pass the grating, such chunks will be caught by the bars and thrown upward against the lining 18 and there shattered and reduced in the constantly-decreasing space between the roll and the lining. From thence the broken material will be whirled around past the block 6 and deposited on the grating. The weight of the breaking-cylinder, with its hammers or bars, is so great that while rotating at a high speed its center of gravity is not disturbed by the interference of a heavy rock upon the breaking-plate, and the machine operates noiselessly and with almost imperceptible vibration.

The bars 32 are extremely hard and wear for a long time; but when they become worn the top of the machine is lifted to expose the rotary member, after which the bars are removed and more washers are placed beneath them.

It will be noted that the bars are in each case backed by a heavy mass of metal, and as the bars are staggered there is no danger of the roll being cracked by the reaction from the hammer-blows.

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

1. The rotary breaker comprising a horizontal cylindrical shell or casing having a feed-chute in its side and having a grating in its bottom, in combination with the shaft extending through the casing, the heavy solid metal momentum-roll provided upon said shaft and extending between the ends of said casing and a plurality of staggered rows of tangential hammer projections upon said roll, substantially as described.

2. The rotary breaker comprising a horizontal cylindrical shell or casing having a feed-chute in its side and provided with a grating in its bottom, in combination with the shaft-supported metal momentum-roll revoluble within the casing, a plurality of spiral rows of hammer-bars each tangentially arranged in said roll, and the breaker-plate in said casing at the foot of said chute, substantially as described.

3. The rotary breaker comprising a horizontal cylindrical shell or casing having a feed-chute in its side and provided with a breaker-block at the foot of said chute, in combination with a curved grating extending from said block across the bottom of the casing, a corrugated lining provided in the top of said casing, a shaft extending through the casing, the bearings therefor, a roll mounted on said shaft within the casing, and the flat faced or ended hammer-bars tangentially fixed in said roll and therewith nearly filling said casing, substantially as described.

4. The rotary breaker comprising a horizontal cylindrical shell or casing having a feed-chute in its side, provided with a breaker-plate and a grating in its bottom and having an internally-corrugated top, in combination with an eccentrically-placed shaft having suitable bearings, a heavy roll on said shaft within the casing provided with spiral rows of pockets in its periphery and hard-metal hammer-bars secured in said pockets and projecting tangentially from a minor circle of said roll, substantially as described.

5. The rotary breaker comprising a horizontal cylindrical shell or casing having a feed-chute in its side, provided with a breaker-plate and a grating in its bottom and having an internally-corrugated top, in combination with an eccentrically-placed shaft having suitable bearings, a heavy momentum-roll on said shaft within the casing provided with spiral rows of pockets and the hardened-steel bars fixed in said pockets and projecting from the periphery of said roll and adapted for striking relatively tangential blows, substantially as described.

6. The rotary breaker comprising the breaker-casing provided with an inclined breaker-plate, in combination with a horizontal shaft, parallel with said plate and having suitable bearings, a heavy metal roll provided in said casing upon said shaft, means for driving the same at a high speed, and staggered rows of hammer-bars, each extending tangentially from the periphery of said roll, substantially as described.

7. The rotary breaker comprising the horizontal cylindrical casing having a feed-chute in its side and provided with a grating in its bottom, in combination with the shaft extending through the casing parallel with its axis, the bearings for said shaft outside said casing, the stuffing-boxes for the shaft in the ends of said casing and the rotary breaker comprising a heavy roll provided with tangential fixed hammer projections, substantially as and for the purpose specified.

8. A rotary breaker, comprising a substantially cylindrical case, in combination with a shaft arranged eccentrically in said case and having bearings upon the exterior of said case, a solid metal breaker-roll of relatively great length and diameter mounted upon said shaft within said case and provided with a plurality of spiral rows of tangential pockets in its periphery, the longest axis of each pocket being perpendicular to a plane including the axis of said roll, hard-metal hammer-bars ad-

justably secured in said pockets and projecting from the periphery of the roll, a feed-chute for said cylindrical case, and an inclined breaker block or plate arranged at the base of said chute, whereon the material is shattered by the end blows of said hammer-bars, substantially as described.

In witness whereof I have hereunto set my hand, this 13th day of January, 1903, at Chicago, Cook county, Illinois.

JOSEPH M. SCHUTZ.

In presence of—

E. G. VREELAND,

C. G. HAWLEY.