C. O. MICHAELSEN.

ORE CRUSHER.

APPLICATION FILED AUG. 14, 1908.

931,210.

Patented Aug. 17, 1909.

5 SHEETS—SHEET 1.

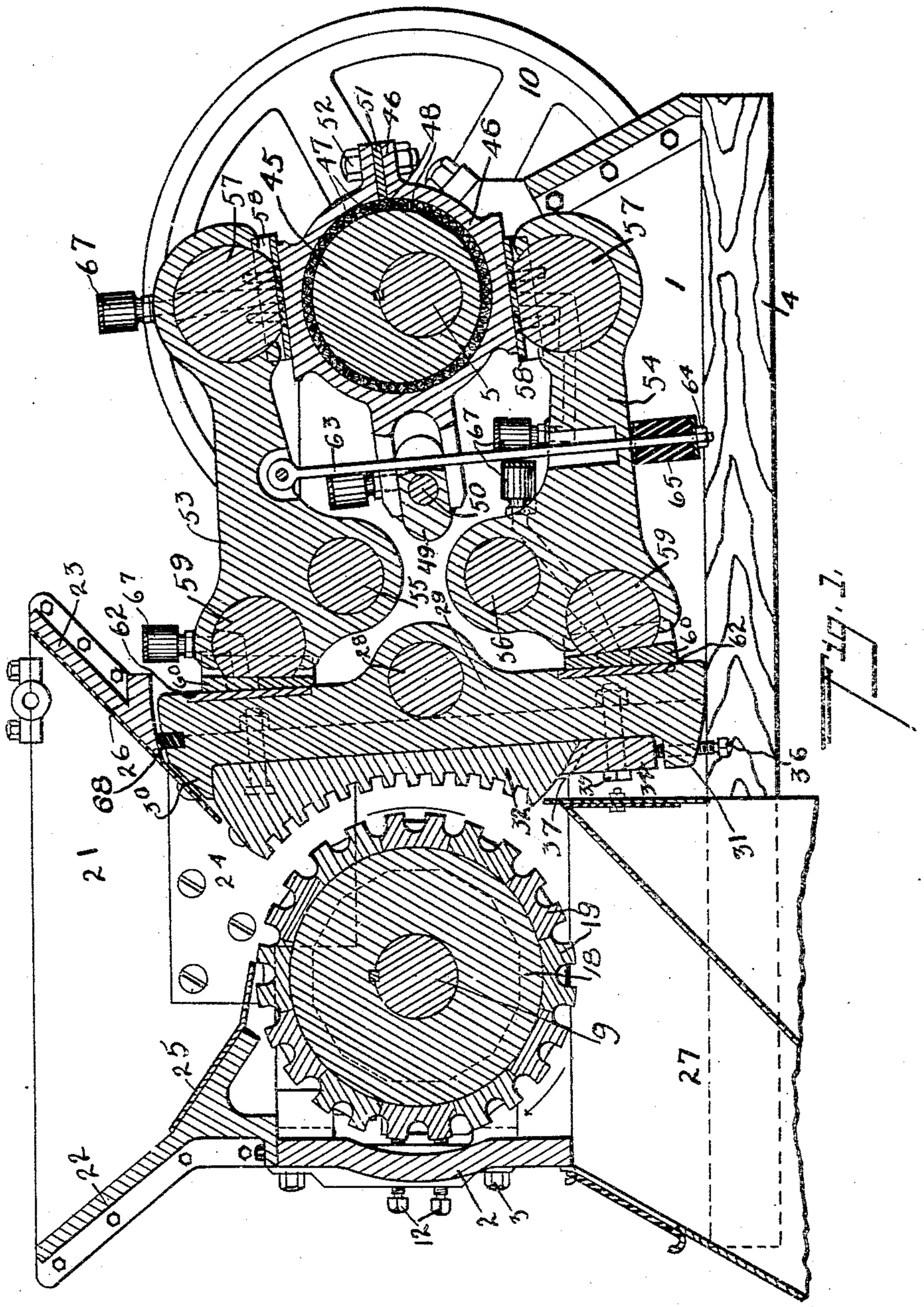

Fig. 1.

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M. L. Gaffney

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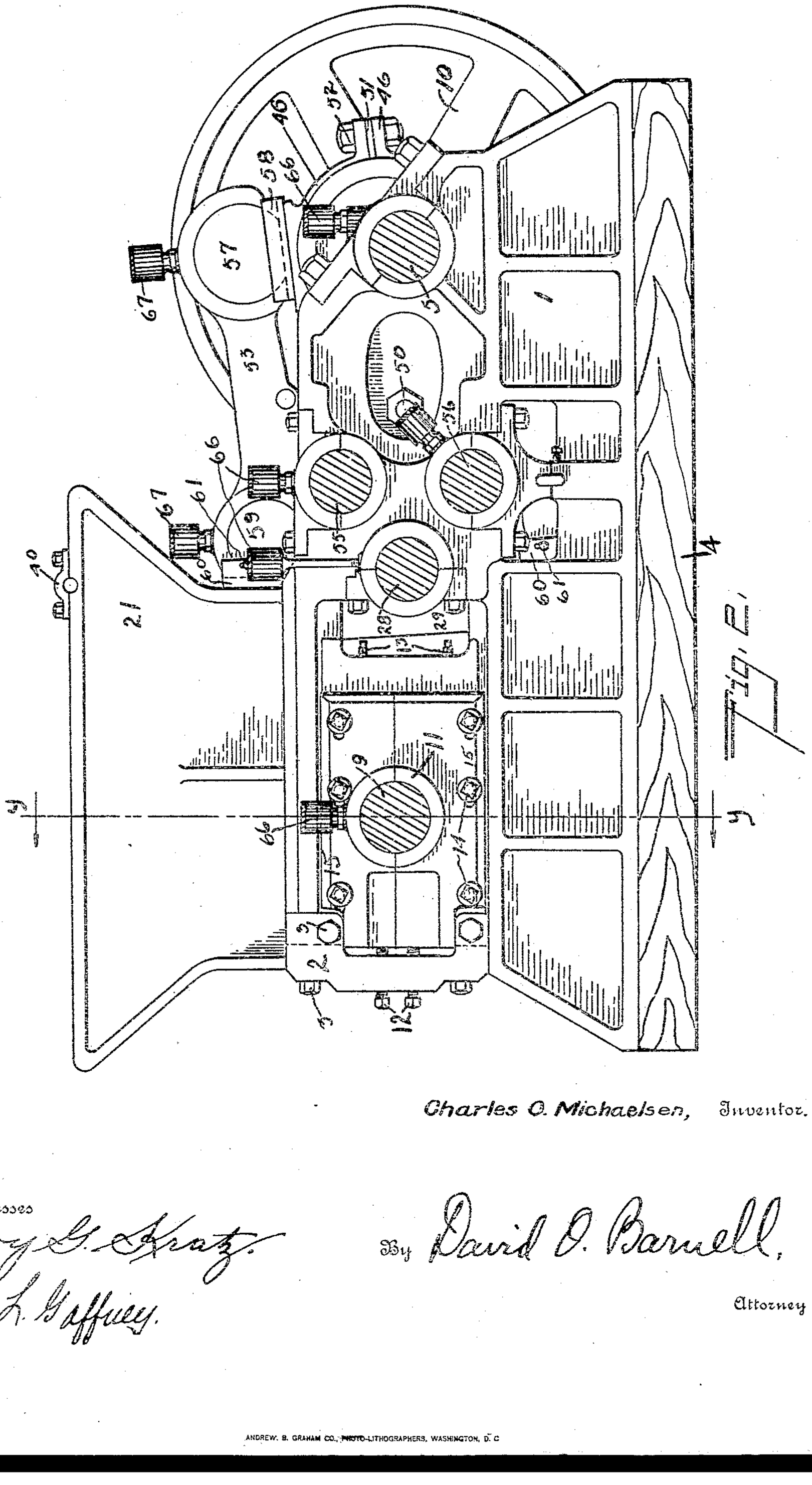

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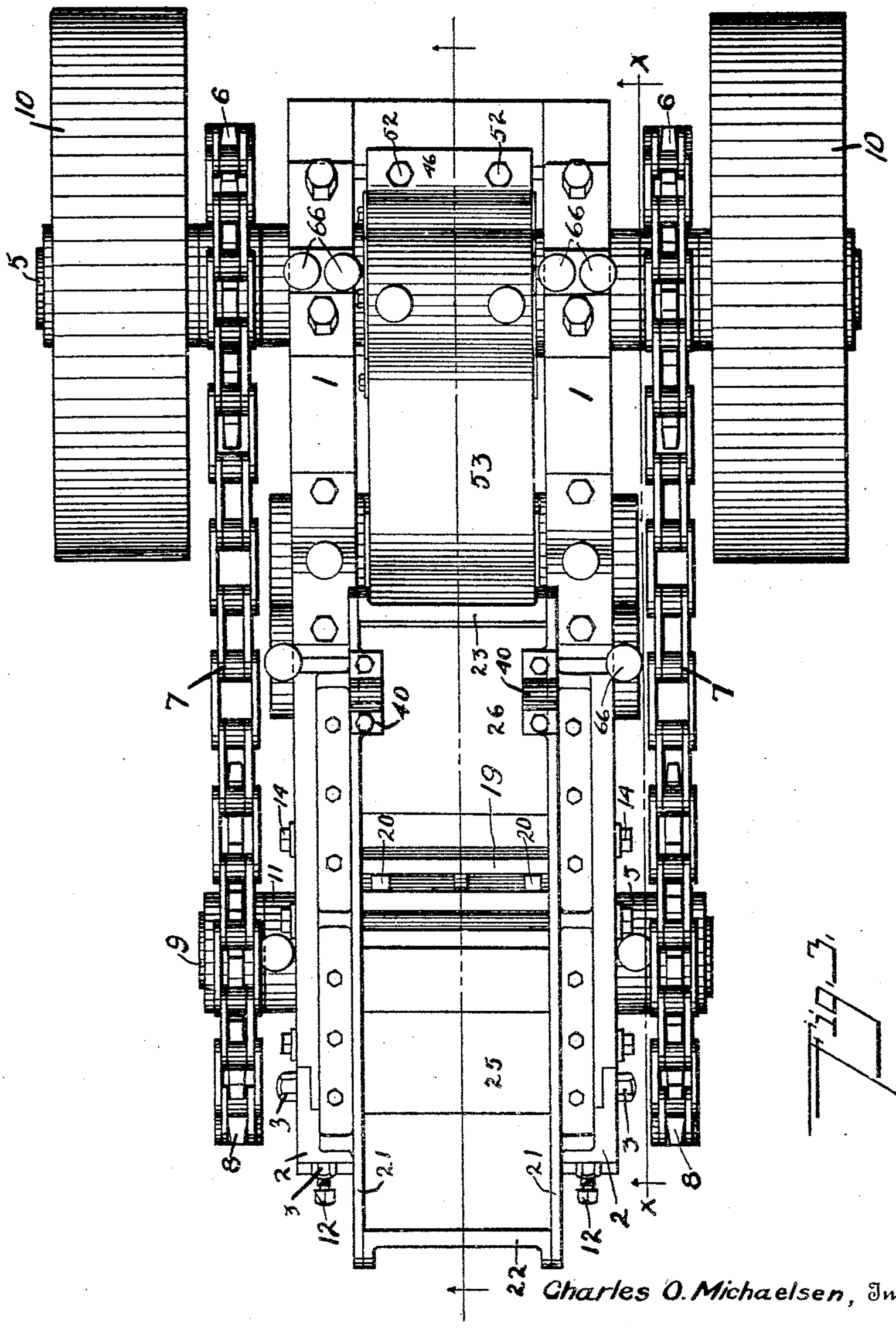

Fig. 3.

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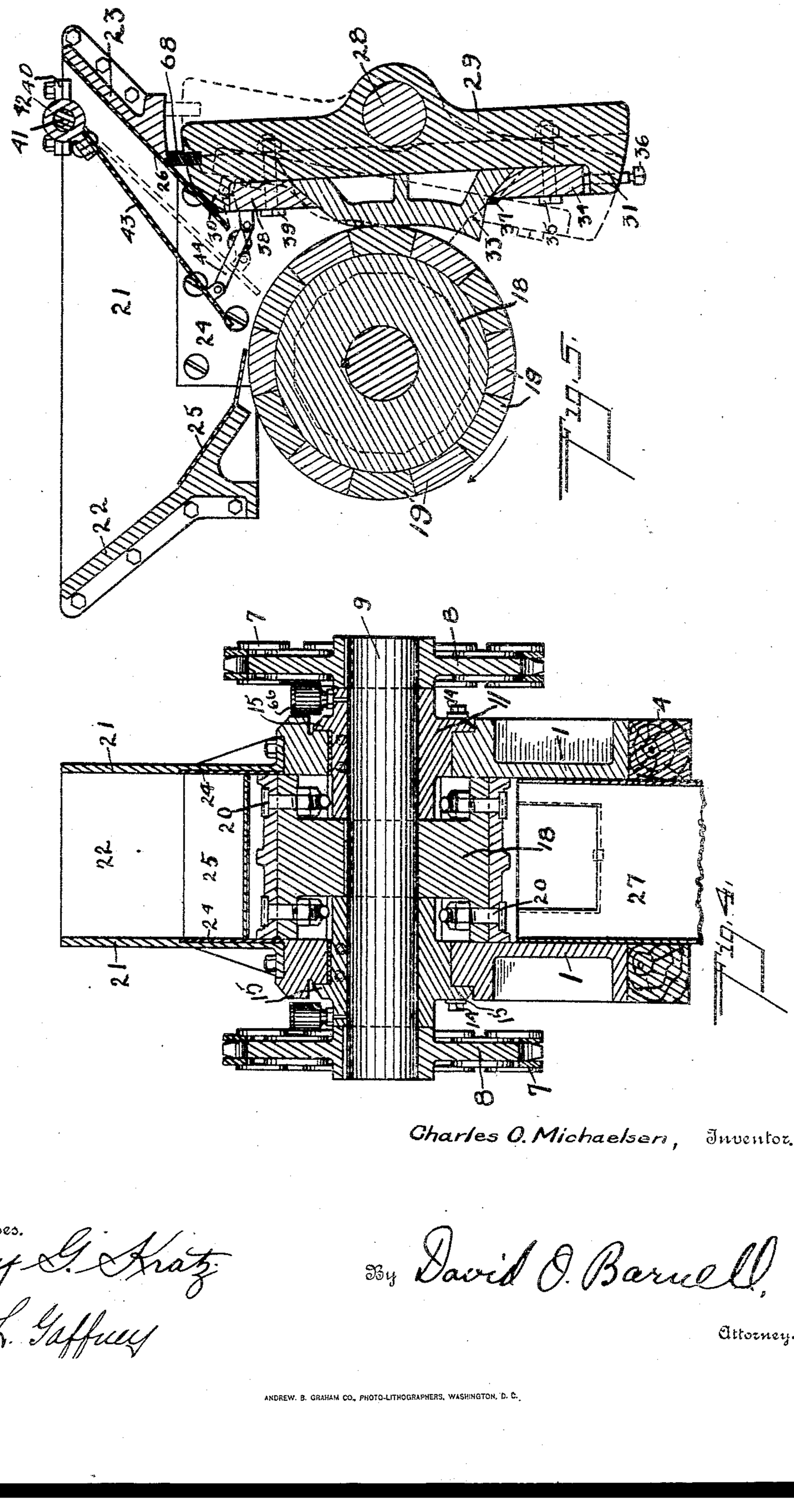
5 SHEETS—SHEET 4.



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5 SHEETS—SHEET 5.

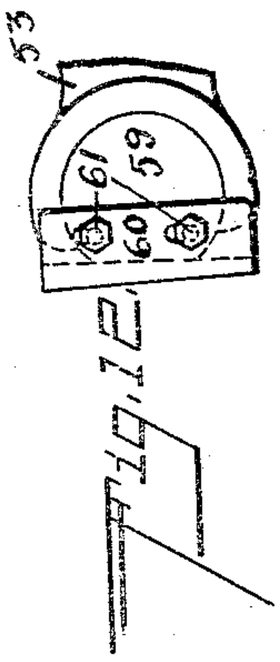

FIG. 11.

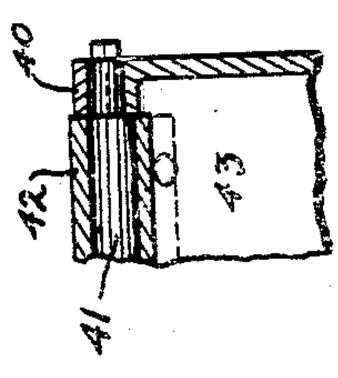

FIG. 5.

FIG. 12.

FIG. 10.

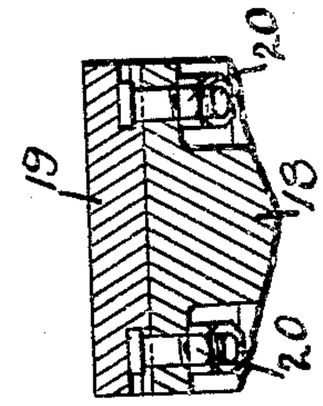

FIG. 6.

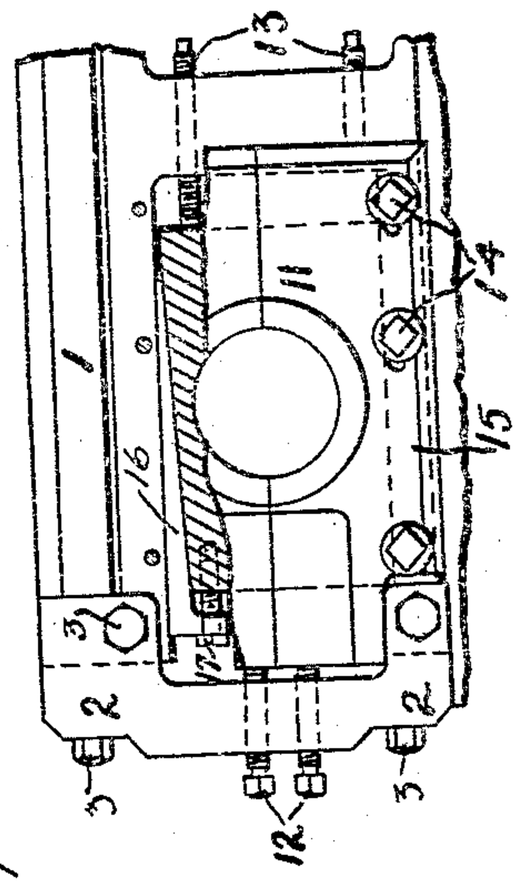

FIG. 9.

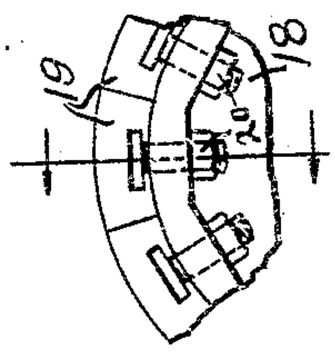

FIG. 7.

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UNITED STATES PATENT OFFICE.

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ORE-CRUSHER.

No. 931,210. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed August 14, 1908. Serial No. 448,619.

To all whom it may concern:

Be it known that I, CHARLES O. MICHAELSEN, a citizen of the United States, and a resident of Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Ore-Crushers, of which the following is a specification.

My invention relates to ore crushers of the type having a roller coöperating with crushing-jaws carried by an oscillatory beam.

It is the object of my invention to provide, in a machine of this class, an improved driving mechanism for the oscillatory beam, means for causing a regular feeding of material to the crushing devices, means for regulating the feed, means for compensating wear of the bearings, and interchangeable means to enable the machine to be used for either coarse or fine reductions of the ore.

Constructions embodying my invention are shown in the accompanying drawings in which—

Figure 1 is a longitudinal section of the machine, Fig. 2 is a side elevation, partly in section on the line *x*—*x* of Fig. 3, Fig. 3 is a plan view, Fig. 4 is a transverse section on the line *y*—*y* of Fig. 2, Fig. 5 is a longitudinal section showing the crushing-roll, beam, hopper and adjustable feeding devices as arranged for fine reductions of ore, Fig. 6 is a detail side elevation, partly sectional, of one of the bearings for the roller-shaft, Figs. 7 and 8 are details showing the manner of attaching the facing-plates to the crusher-roll body, Fig. 9 is a detail of the feed-plate eccentric-shaft bearing, Figs. 10 and 11 are details of the facing-plates used on the crusher-roll for coarse reductions, and Fig. 12 is a detail showing the facing-plates used on the oscillating bearing devices employed in the driving mechanism for the oscillating beam.

In the construction shown I provide outwardly-flanged side-frames 1 in which are formed bearings for the various transverse shafts. At one end of said side-frames the same are connected by means of the end-block 2, the flanged ends of which extend over the sides of the frame 1 and are secured thereto by screws 3. The frames are preferably mounted on a base formed of timbers 4, as shown. Near the end of the frames opposite the end-block 2 are formed bearings for the main- or driving-shaft 5. On said shaft just outside of the frame are secured sprockets 6 from which chains 7 extend to the sprockets 8 carried on the roller-shaft 9. At the ends of the driving-shaft are fly-wheels 10 either of which may also be used as a belt pulley for driving the shaft. The sprockets 6 and 8 are made slightly different in size so that the speeds of the driving-shaft and roller-shaft will be slightly different.

The bearings of the roller-shaft 9 are formed in the split boxes 11 which are held in suitable guideways formed in the side-frames, there being set screws 12 and 13 arranged at each end of the guideways and bearing upon the ends of the boxes whereby they may be adjusted as to longitudinal position. Each of the boxes has flanges 15 extending over the sides of the frames in which flanges are slotted openings for the bolts 14 by which the boxes are held in position transversely of the frames. Between the upper half of each of the boxes and the frame is arranged a wedge-shaped liner 16 the end of which is turned downwardly over the end of the box, as shown in Fig. 6, and a screw 17 passed through said end and into the body of the box, by which the longitudinal position of the liner may be adjusted to compensate wear of the box.

Between the side-frames on the shaft 9 is the crusher-roll which consists of a central cylindrical body 18 of ordinary soft cast metal, around which are placed a plurality of facing-plates 19 of hard or chilled metal. For use in coarse reductions the said facing-plates are of the form shown in Figs. 1, 10 and 11, having grooves therein extending longitudinally thereof. For fine reductions the facing-plates are made smooth, as shown in Figs. 5, 7 and 8. The facing plates are secured to the central body 18 by bolts 20 passed through the peripheral end-flanges of the body 18, the smooth plates shown in the latter figures being provided with T-slots in the ends thereof to receive the heads of the bolts.

At the upper edges of the side-frames adjacent to the crusher-roll are secured the plates 21 between which at the front and rear sides thereof the plates 22 and 23 are bolted to form a feed hopper. Adjoining the ends of the crusher-roll the hopper is lined by steel plates 24, and sheet-metal plates 25 and 26 are secured to the plates 22 and 23 at the lower edges thereof and extended in toward the roller as shown in Fig.

1. Below the roller is arranged a discharge chute 27, in the front side of which a small swinging door is arranged as shown in Fig. 1 to permit access to the chute.

At about the center of the side-frames and in approximate horizontal alinement with the roller-shaft 9 are formed bearings for the shaft 28 on which is mounted the oscillating beam 29. On the face of said beam 29 at the upper and lower ends thereof adjoining the crusher-roll are lugs 30 and 31 between which the interchangeable crushing-jaws 32 and 33 may be secured upon the face of the beam as shown in Figs. 1 and 5, respectively. The jaw 32 is of the form shown in Fig. 1, having a concave face adjoining the crusher-roll and there being transversely extending teeth formed on said concave face. The upper end of said jaw 32 is secured to the beam by bolts of which the heads are set in T-slots formed in the sides of the jaw. The lower end of said jaw is beveled as shown and is engaged by a block 34 which is secured to the beam by bolts 35 and engaged at the lower end by set-screws 36 passing through the end lug 31. On the beveled end face of the jaw is a tongue 37 which fits into a corresponding groove in the end of the block 34, by which lateral displacement of the jaw is prevented.

The jaw 33 is used for fine reductions, the working face thereof being smooth instead of toothed. The lower end thereof is beveled and is secured to the beam by means of the block 34 in the same manner as the jaw 32. The upper end of the jaw 33 is also beveled and is secured to the beam by means of a block 38 which is fastened to the beam by bolts 39. The central portion of the working face of the jaw 33 is convex, being curved concentrically to the shaft 27 an amount equal to the arc of oscillation of the beam. Above and below said convex portion of the face are concave portions of which the radius of the arc of curvature is equal to the radius of the crusher-roll. When the beam is in the position shown in full lines in Fig. 5 the upper concave portion of the face of the jaw fits around the crusher-roll, and when the beam is in the position shown by dotted lines in Fig. 5 the lower concave portion of the face fits around the roll, while at intermediate positions the convex portion of the face of the jaw remains at a constant relation to the roll, either in contact therewith or at a uniform distance therefrom.

For preventing any overloading of the crushing devices, especially when used for fine reductions, an adjustable feeding device is provided as follows: At the top of the side plates 21 of the hopper, adjacent to the plate 23, are formed boxes 40 in which are held the ends of a transverse shaft 41 of which the ends which fit in the boxes are made eccentric to the rest of the shaft, as shown in Figs. 5 and 9. On said shaft 41 is pivotally mounted the block 42 to which is secured the feed-plate 43, the same extending therefrom diagonally downward to a point near the crusher-roll. The lower end of the feed-plate is connected by a link 44 with the block 38, so that at each oscillation of the beam 29 the feed-plate is moved between the positions shown in full and dotted lines in Fig. 5. By said movements of the feed-plate a definite quantity of material from the hopper is admitted to the crushing devices at each movement of the oscillating beam, and the quantity so admitted may be regulated by raising or lowering the feed-plate by turning the eccentric-shaft 41 in the boxes 40 and then clamping down the covers of the boxes to hold the shaft in its adjusted position. One end of the shaft, outside of the box, is squared as shown in Fig. 9 to adapt it for engagement with a wrench in turning it to adjust the position of the feed-plate.

Between the side-frames 1 on the driving-shaft is secured the eccentric 45. Surrounding said eccentric is the eccentric-slide 46, and between the eccentric and eccentric-slide a roller-bearing is formed by means of the steel rollers 47 alternating with rollers 48 of vulcanized fiber or similar material. The forward end of the eccentric-slide is forked and passes over the swivel-block 49 which is pivotally mounted on a small transverse shaft 50. The rearward side of the eccentric-slide is flanged outwardly and slotted through to the roller-bearing, a spacing plate 51 being inserted in the slot and the flanges connected by bolts 52. By replacing the spacing-plate with a thinner one and tightening up the bolts 52, any wear of the roller-bearing may be compensated.

The levers 53 and 54 are mounted on the fulcrum-shafts 55 and 56 which are journaled in suitable bearings formed in the side-frames, as shown. The rearwardly extending arms of the levers have cylindrical transverse openings therein which are open at the sides of the levers adjoining the eccentric-slide. In said openings are disposed the blocks 57 which are of the form of a cylinder having a segment removed from the side thereof. On the flat sides of the blocks 57 between the same and the eccentric-slide are secured the facing-plates 58 which are of a suitable bearing-metal such as bronze. At the ends of the facing-plates are flanges which extend over the sides of the levers and retain the blocks 57 in position therein. In the forward faces of the levers 53 and 54 are transverse cylindrical openings, similar to those in the rearward ends of the levers, and in said openings are disposed blocks 59 similar to the blocks 57. The blocks 59 are provided with facing-plates 60 of bearing-metal and having end-flanges extending over the

sides of the levers to hold the blocks therein, in the same manner as the flanges on the facing-plates 58, but the plates 60 instead of being of uniform thickness are wedge-shaped and are secured to the blocks by screws 61 passing through slotted openings in the end-flanges thereof, as indicated in Fig. 12. The facing plates 60 bear upon plates 62 set in the rearward face of the beam 29, and by adjusting the vertical position of the wedge-shaped plates, wear of the same and also of the plates 58 may be compensated.

In the lower side of the lever 53 is a recess in which the end of the rod 63 is pivotally connected. Said rod extends downwardly, passing through slots in the forward end of the eccentric slide and the rear edge of the swivel-block 49, and extending through the lower lever 54. At the lower end of the rod is an adjusting-nut 64 and a washer between which and the lever 54 is a rubber spring 65. By means of the nut 64 the tension of the spring may be adjusted so that the same will maintain the facing-plates 58 in constant engagement with the eccentric-slide.

Provision is made for lubricating the bearings in the side-frames by oil cups 66 arranged along the upper edges of the frames and connected with the various bearings as shown in Figs. 2 and 3. The bearings of the blocks 57 and 59 in the levers, and of the facing-plates 58 and 60 with the eccentric-slide and beam 29, are lubricated from oil cups 67 arranged on the levers 53 and 54. The said oil cups 67 are connected with the various bearings lubricated thereby by passages made through the bodies of the levers, and through the blocks 57 and 59, as indicated by the dotted lines in Fig. 1.

In the operation of the machine the materials to be crushed are fed into the hopper, and the driving-shaft is actuated by belts applied to the fly-wheels 10, the crusher-roll being driven by the chains 7 in the direction indicated and at a speed slightly different from that of the driving-shaft. The movement of the eccentric 45 causes a longitudinal reciprocating movement of the eccentric-slide accompanied by a vertical oscillatory movement about the center of the swivel-block shaft 50. The latter movement is communicated to the levers 53 and 54 and from them to the beam 29 which moves between the positions shown by full and dotted lines in Fig. 5. The variations between the axes of the levers and the eccentric-slide and the beam are compensated by rolling of the cylindrical blocks 57 and 59 in their sockets, and the relative longitudinal movements between said parts being permitted by sliding of the facing-plates 58 and 60 on the plane surfaces engaged thereby. The action between the crusher-roll and the crushing-jaws carried by the beam 29, and the action of the roller in carrying the material into the crushing area and in discharging the crushed material, will be obvious.

Now, having described my invention, what I claim and desire to secure by Letters Patent is:

1. In an ore crusher, a crusher-roll, a beam mounted to oscillate on an axis parallel with the axis of the roll, a crushing-jaw carried by the beam and adapted to coöperate with the crusher-roll to crush materials between the same, a hopper arranged above the crushing devices, a feed-plate pivotally supported in the hopper on an axis parallel with the axes of the roll and beam, said plate extending to a point adjacent to the roll, the roll revolving in such a direction as to carry materials from the hopper beneath the plate and means connecting the plate and beam whereby the plate will be oscillated synchronously with the beam.

2. In an ore crusher, a crusher-roll, a beam mounted to oscillate on an axis parallel with the axis of the roll, a jaw carried by the beam and adapted to coöperate with the roll to crush materials between the same, a hopper arranged above the crushing devices, a feed-plate pivotally supported in the hopper on an axis parallel with the axes of the roll and beam, said plate extending to a point adjacent to the roll, the roll revolving in such a direction as to carry materials from the hopper beneath the plate adjusting means for varying the proximity of the plate to the roll, and means connecting the plate and oscillating beam, whereby the plate will be actuated by the same.

3. In an ore crusher, a crusher-roll, a beam mounted to oscillate on an axis parallel with the axis of the roll, a jaw carried by the beam and adapted to coöperate with the roll to crush materials between the same, a hopper arranged above the crushing devices, a feed-plate pivotally supported in the hopper on an eccentric-shaft arranged parallel with the axes of the roll and beam, said feed-plate extending to a point adjacent to the roll and its proximity thereto being variable by rotation of the eccentric-shaft, the roll revolving in such a direction as to carry materials from the hopper beneath the plate and means for actuating the feed-plate whereby the same will be oscillated synchronously with the beam.

4. In an ore crusher, a crushing-jaw, an oscillatory beam carrying said jaw, levers fulcrumed near said beam and having arms extending away from the same, means connecting said levers and the beam, an eccentric disposed between the said arms of the levers, a body inclosing said eccentric and having flat faces thereon adjoining said arms of the levers, cylindrical blocks arranged in the said arms of the levers, the

blocks being inclosed by the levers for more than half of their circumference, there being flat faces on the blocks adjacent to the eccentric, and facing-plates of bearing metal secured to the flat faces of the blocks and engaging the flat faces of the body inclosing the eccentric.

5. In an ore crusher, a crushing-jaw, an oscillatory beam carrying said jaw, and means for actuating the beam, said actuating means comprising levers fulcrumed near the beam and having long arms extending away from the beam and short arms extending adjacent to opposite ends of the beam, an eccentric disposed between the long arms of the levers, an eccentric-slide inclosing said eccentric, cylindrical blocks arranged in the long arms of the levers adjacent to the eccentric-slide and in the short arms of the levers adjacent to the beam, the said blocks being inclosed by the levers for more than half of their circumference, there being flat sides on the blocks adjacent to the eccentric-slide and the beam, and facing-plates of bearing metal secured to the flat sides of the blocks and engaging the eccentric-slide and the beam.

6. In an ore crusher, a crushing-jaw, an oscillatory beam carrying said jaw, and means for actuating said beam, said actuating means comprising levers fulcrumed near the beam and having short arms adjoining opposite ends of the beam and long arms extending away from the beam, an eccentric disposed between the long arms of the levers, means connecting the eccentric and said arms of the levers whereby the levers will be oscillated by rotation of the eccentric, cylindrical blocks arranged in transverse openings in the short arms of the levers adjacent to the beam, the said blocks being inclosed by the levers for more than half of their circumference, there being flat sides on the said blocks, and wedge-shaped facing-plates adjustably secured on the flat sides of the said blocks between the same and the beam.

In testimony whereof I have hereunto subscribed my name in the presence of two witnesses.

CHARLES O. MICHAELSEN.

Witnesses:
D. O. Barnell,
Roy G. Kratz.