C. O. MICHAELSEN.

ORE CRUSHER.

APPLICATION FILED DEC. 17, 1907.

908,592.

Patented Jan. 5, 1909.

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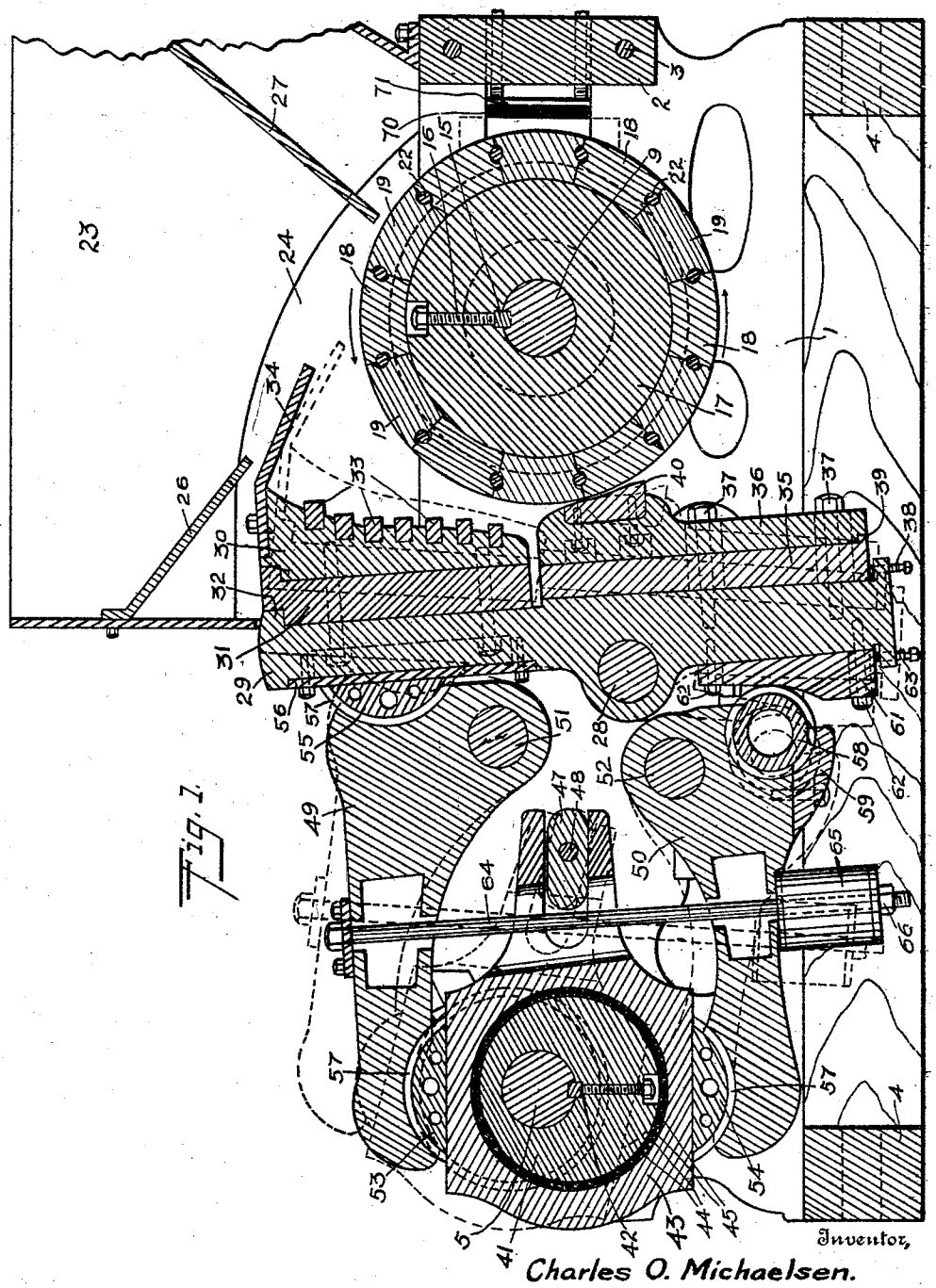


Fig. 1.

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Witnesses

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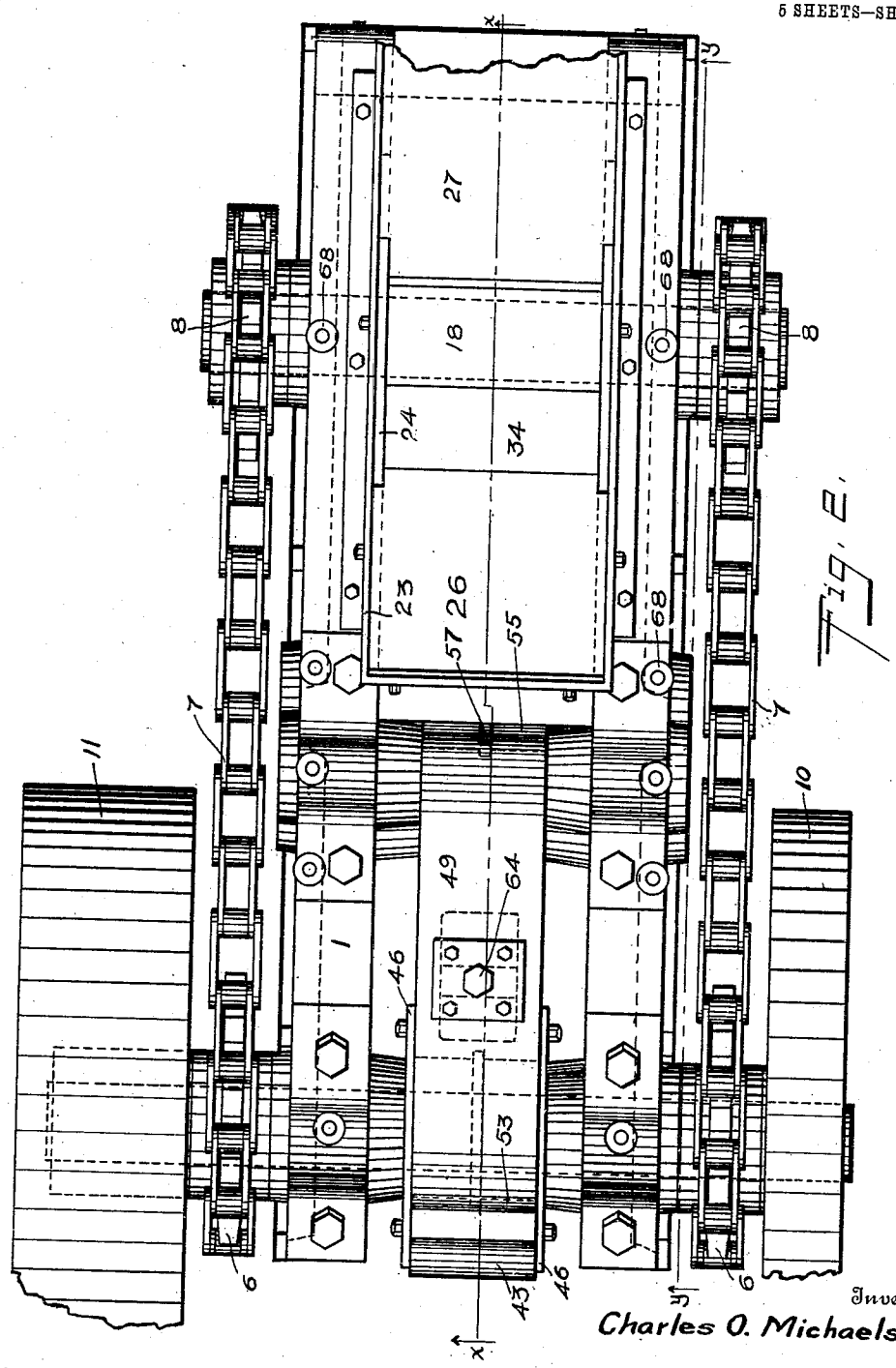



Fig. 2.

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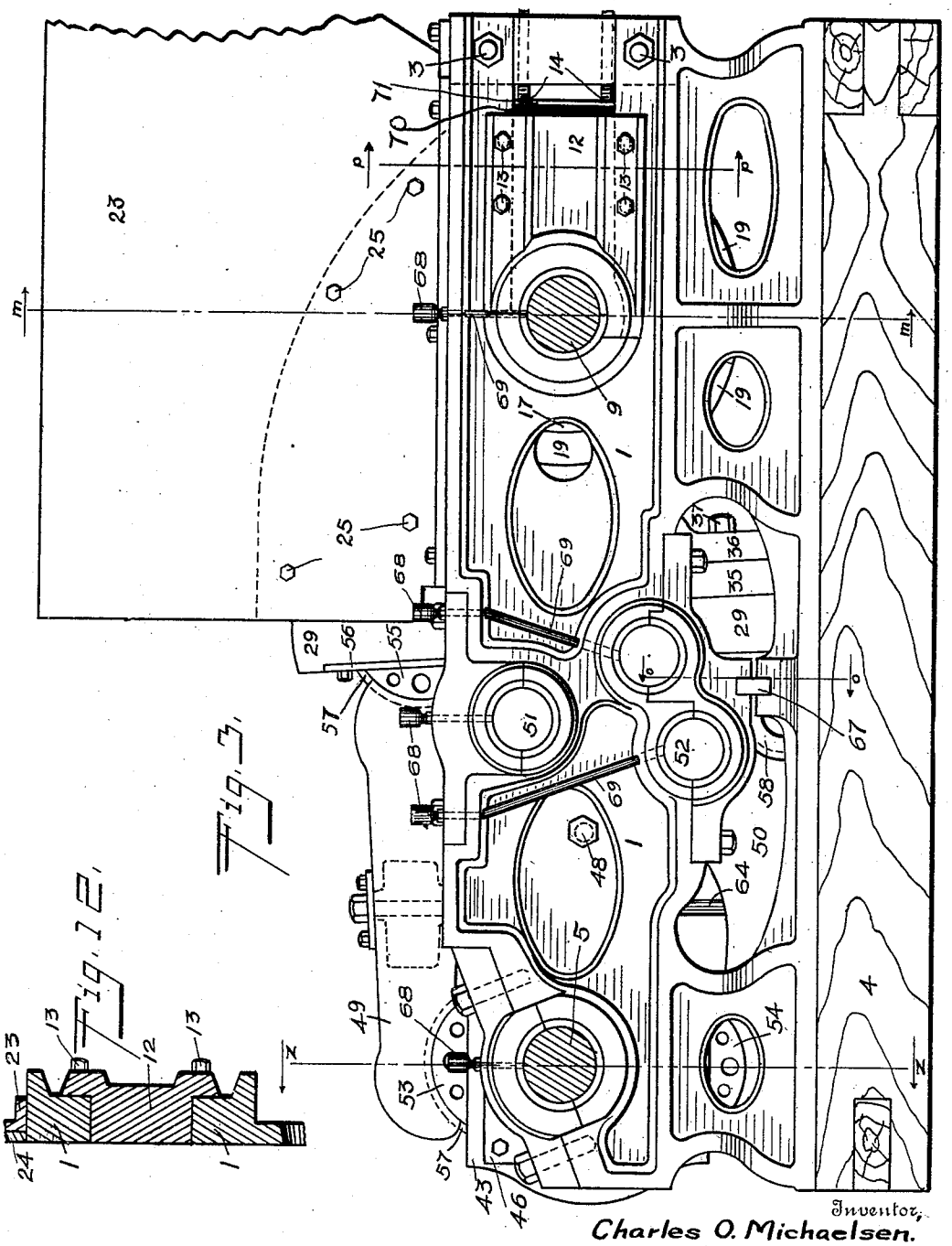



Fig. 3.

Fig. 12.




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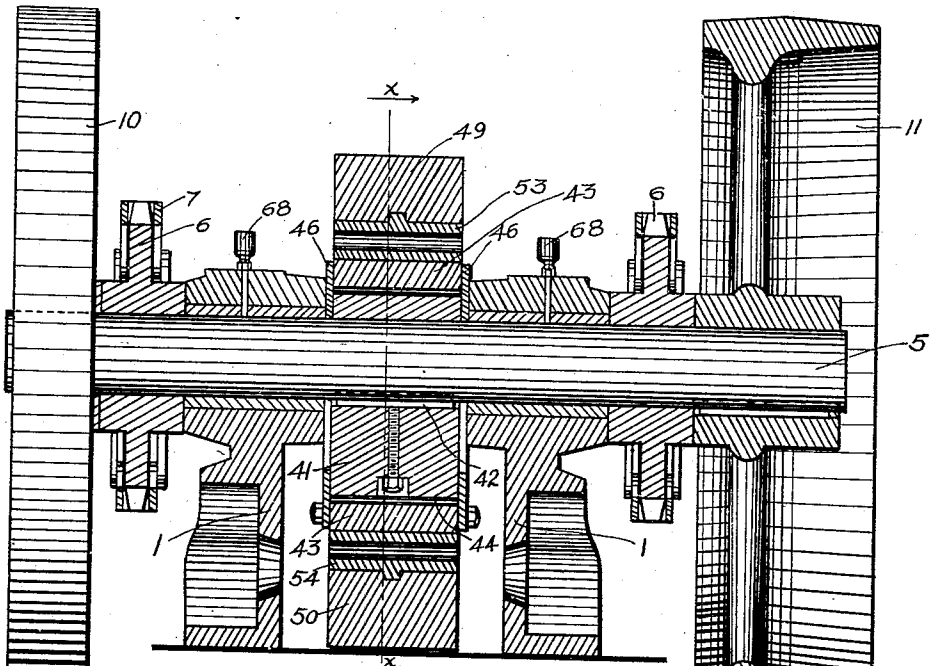



Fig. 4.

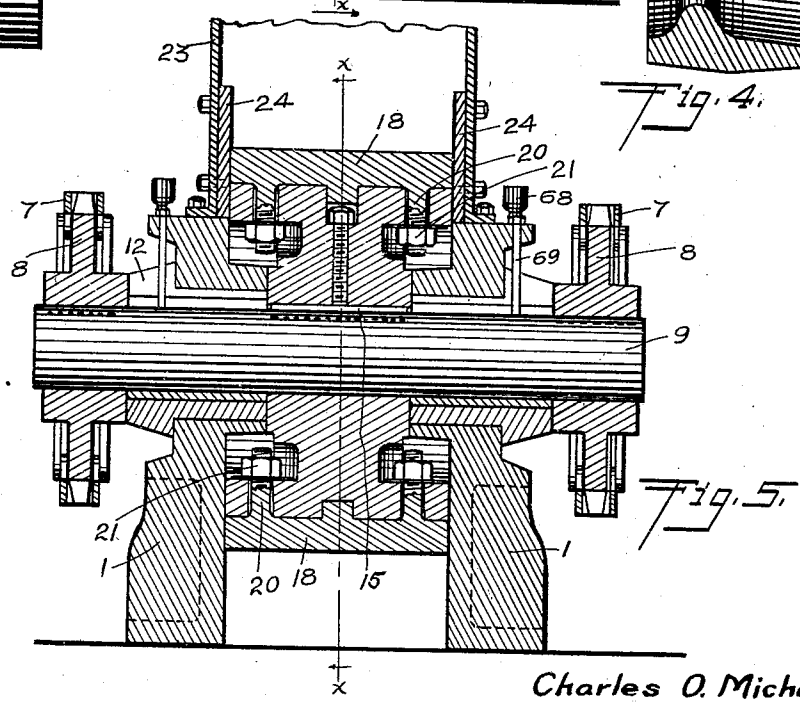



Fig. 5.

Witnesses

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5 SHEETS—SHEET 5.

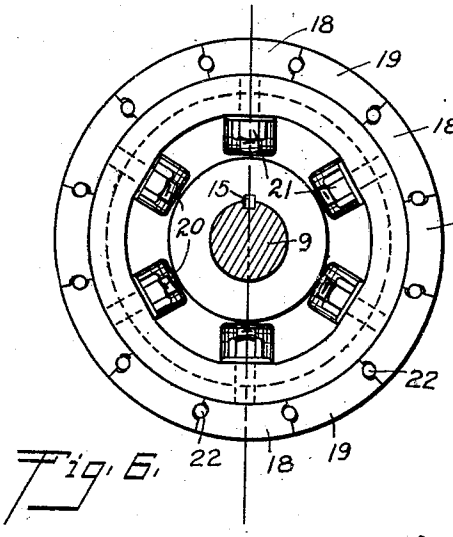



Fig. 6.

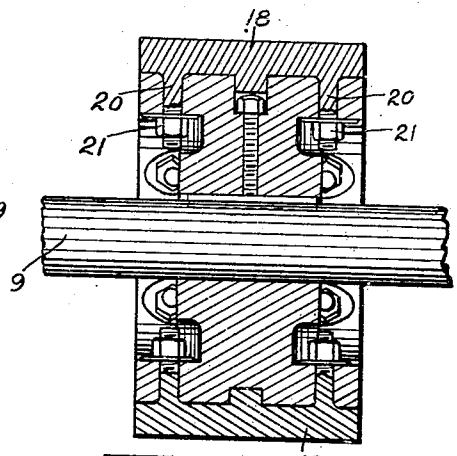



Fig. 7.

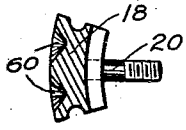



Fig. 9.

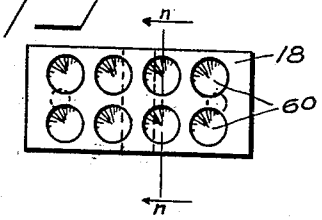



Fig. 8.

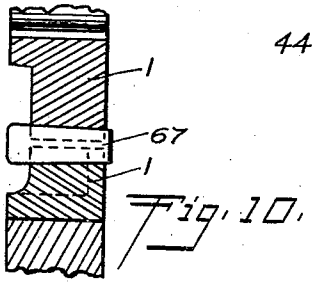



Fig. 10.

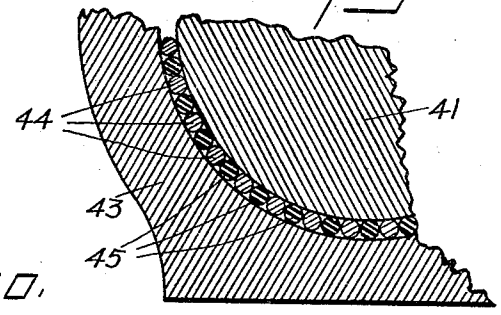



Fig. 11.

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# UNITED STATES PATENT OFFICE.

CHARLES O. MICHAELSEN, OF OMAHA, NEBRASKA.

## ORE-CRUSHER.

No. 908,592. Specification of Letters Patent. Patented Jan. 5, 1909.

Application filed December 17, 1907. Serial No. 406,944.

*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 a tiltable beam.

It is the object of my invention to provide, in a machine of this class, a driving mechanism for the crushing-jaws which will permit of large and well-lubricated bearing surfaces, thereby adapting the machine for heavy and long-continued service without replacement of said parts.

Further objects of my invention are to provide means for reducing to a minimum the friction between the working parts of the driving mechanism, means for taking up lost motion in and compensating wear of the driving mechanism, means for readily replacing and adjusting the crushing-jaws and the working face of the roller, and means for adjusting the crushing-jaws to enable a wide variation in the sizes to which the ore must be reduced in passing through the machine.

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

Figure 1 is a longitudinal section of the crusher, the section being on the planes indicated by the lines *x*—*x* in Figs. 2, 4 and 5, Fig. 2 is a plan view of the machine, Fig. 3 is a side elevation partly in section on the line *y*—*y* of Fig. 2, Fig. 4 is a transverse section on the line *z*—*z* of Fig. 3, Fig. 5 is a transverse section on the line *m*—*m* of Fig. 3, Fig. 6 is an end elevation of the crusher-roll, Fig. 7 is an axial section of the same, Fig. 8 is a plan view of one of the facing-plates of the crusher-roll, Fig. 9 is a transverse section of the same on the line *n*—*n* of Fig. 8, Fig. 10 is a detail section of the frame on the line *o*—*o* of Fig. 3, Fig. 11 is an enlarged detail showing a portion of the roller-bearing between the driving eccentric and the eccentric-slide, and Fig. 12 is a detail section of the frame on the line *p*—*p* of Fig. 3.

In the construction shown I provide outwardly-flanged side-frames 1 in which are formed bearings for the various transverse shafts. At one end said side-frames are spaced apart by the end-block 2 and rigidly connected therewith by bolts 3 passing through said end-block and both frames. The frames may be mounted upon a base 4 formed of timbers, as shown. Near the end of the frame 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 and 11, the latter having a wide, crowned face adapting the same for use as a driving pulley. 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 for the roller-shaft 9 are divided vertically, one side thereof being formed in the flanged blocks 12 which are secured to the frame by screws 13, the end thrust on said blocks being received upon a rubber plate 70 backed by a metal plate 71 which, in turn, engages the ends of the screws 14 passing through the end-block 2, as shown. The rubber plate 70 imparts a very slight resilience to the bearing when the same is subjected to extreme pressure, the openings for the screws 13 being slightly elongated to permit the same, and also in order that a slight longitudinal adjustment of the blocks 12 may be made to compensate wear of the shaft-bearing.

Between the side-frames, on the shaft 9, the crusher-roll is secured thereto by means of a key 15 which is held against longitudinal displacement by means of a set screw 16. The crusher-roll comprises a central cylindrical body 17 of ordinary soft cast metal, around which are secured a plurality of curved facing-plates, 18 and 19, of hard or chilled metal. The facing plates are held against displacement longitudinally of the roll by means of tongues formed on the inner faces thereof and extending into a peripheral groove in the body 17. The facing-plates 18 are removably secured to the body 17 by means of studs 20 which pass through the overhanging end-flanges of the body 17 and have nuts 21 screwed on the inner ends thereof, as shown. The alternate facing-plates 19 are

not provided with studs but are held in position by the plates 18, as follows: Both sets of plates 18 and 19 have semicircular grooves formed in the radial faces thereof, which grooves, when the plates are in position on the roll, form longitudinally extending openings through which are passed rods 22, as shown in Figs. 1 and 6.

To the side-frames 1, adjoining the crusher-roll, is secured a hopper 23, at the sides of which steel lining-plates 24 are removably secured by screws 25. Inside the hopper are secured guide-plates or shields 26 and 27, as shown in Fig. 1.

At about the center of the side-frames are formed bearings for the shaft 28 on which is mounted the oscillatory beam 29. At the upper end of said beam, on the face thereof adjacent to the crusher-roll, the crushing-jaw 30 and the spacing-block 31 are secured thereto by means of screws which extend thereinto from the rear side of the beam, as indicated by dotted lines in Fig. 1. At the upper end of the beam is a lug 32 which extends into a recess in the spacing-block, and on the face of the spacing-block is a similar lug which engages the crushing-jaw 30 and receives the end-thrust thereof. In the face of the crushing-jaw are set transverse bars 33 of hard steel. At the upper end of the jaw is secured a plate 34 which extends out over the crusher-roll and is inclined slightly downward as shown.

On the lower part of the face of the beam 29 the spacing-block 35 and jaw-block 36 are secured by means of screws 37 passing through the same from the face of the jaw-block. The holes for said screws are elongated to permit of adjustment of the blocks longitudinally of the beam, said adjustment being made by means of the set-screws 38. A lug 39 at the lower end of the spacing-block receives the end-thrust of the jaw-block and said end-thrust is, in turn, received by the adjusting-screws 38. In the face of the jaw-block near the upper end thereof is a transverse recess in which is set the steel crushing-jaw 40, the same being held in place by screws passing thereinto from the rear face of the jaw-block 36. A portion of the face of said jaw 40 is curved to a radius approximately the same as the outside of the crusher-roll so that when said jaw is nearest the roll, as shown in Fig. 1, there is a uniform clearance between the same for a considerable portion of the face of the jaw. The upper part of the jaw 40 and the jaw-block 36 are curved concentrically to the shaft 28 so that when the beam is tilted to the position shown by dotted lines in Fig. 1 the clearance between the jaw and crusher-roll remains constant.

The above described arrangement of the crushing-jaws is that adapted for reducing materials to very small particles. For coarser reductions the spacing-blocks 31 and 35 may be removed or thinner blocks substituted therefor. In the coarser reductions, also, the facing-plates, 18 and 19, of the crusher-roll may have conical recesses 60 made therein, as shown in Figs. 8 and 9.

Between the side-frames on the main or driving-shaft 5, an eccentric 41 is secured by means of a key 42 which is held against longitudinal displacement by means of a set-screw, as shown in Figs. 1, 4 and 7. Surrounding said eccentric is the eccentric-slide 43, and between the eccentric and eccentric-slide a roller-bearing is formed by means of steel rollers 44 alternating with rollers 45 of vulcanized fiber or similar material. The rollers 44 and 45 are retained longitudinally by the plates 46 secured to the sides of the eccentric-slide and extending in over the ends of said rollers and the sides of the eccentric, as shown in Fig. 4. The forward end of the eccentric-slide is forked and passes over the swivel-block 47 which is pivotally mounted on a small transverse shaft 48.

The levers 49 and 50 are mounted on the fulcrum-shafts 51 and 52 which are journaled in suitable bearings formed in the side-frames as shown. The longer arms of said levers adjoin the eccentric-slide and have curved recesses formed therein in which are fitted the segment-blocks 53 and 54, the flat sides of which bear, respectively, upon the upper and lower surfaces of the eccentric-slide. The segment-blocks are preferably made of bronze or similar bearing-metal and have one or more longitudinal openings therein which may, if desired, be plugged at the ends and used as oil chambers. On the forward face of the upper lever 49 is a curved recess in which is fitted a segment-block 55 of the same form as the blocks 53 and 54. The flat side of said block bears upon the plate 56 which is secured on the rear side of the beam 29, as shown. The segment-blocks 53, 54 and 55 are interchangeable and all of the same are held against lateral displacement by tongues 57 formed on the curved side thereof and extending into recesses of similar form in the levers, as shown in Figs. 1 and 4.

Connection between the lower lever 50 and the tiltable beam is made by means of the roller 58 which fits into a cylindrical recess in the lever, being held therein by the removable cap 59. The said roller 58 engages the wedge-block 61 which is adjustably secured on the rear face of the beam 29 near the lower end thereof by means of screws 62 which pass through elongated holes therein, as indicated by dotted lines in Fig. 1. The end-thrust of the wedge-block is received by the screws 63. Passing through the long arms of the levers 49 and 50 is a bolt 64 around the lower end

of which is placed a rubber spring 65, the tension of which is adjusted by means of the nut 66 so that the segment-blocks 53 and 54 are held thereby in constant engagement with the eccentric-slide. Any wear of the segment-blocks 53, 54 and 55, or of the roller 58, may be compensated and all lost motion removed from the lever system by raising the wedge-block 61 by means of the adjusting-screws 63.

In the side-frames 1, the covers of the bearings for the shafts 28 and 52 are made integral and the central parts of said covers are supported by means of wedges 67 arranged between the covers and the lower flanges of the side-frames, as shown in Figs. 3 and 10. Provision is made for lubrication of the bearings in the side-frames, by oil cups 68 arranged along the upper edges of the frames and communicating with the bearings, where necessary, by tubes 69.

The operation of the crusher will be apparent by reference to Fig. 1, wherein is shown in full and dotted lines the extreme positions of the eccentric, eccentric-slide, levers, oscillatory beam, and crushing-jaws. It will be observed that the plate 34, when the upper crushing-jaw is in the position shown in dotted lines, incloses and prevents the materials between the jaw and crusher-roll from backing up into the hopper 23, while by the movement of the roll in the direction indicated the materials in the hopper are constantly carried under the said plate 34 and between the roll and jaw into position to be acted upon thereby.

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

1. In an ore crusher, a crusher-roll comprising a cylindrical body having peripheral end-flanges, a plurality of curved facing-plates placed over said cylindrical body, the alternate facing-plates having studs thereon extending through the end-flanges of the cylindrical body, nuts engaging the inner ends of said studs, all of the facing-plates having grooves in the adjoining sides thereof, and rods fitting in said grooves to connect the plates having studs with the other plates.

2. In an ore crusher, a crusher-roll comprising a central body of soft cast metal, a plurality of facing-plates placed around said central body, the alternate facing-plates being removably secured to the central body, there being grooves formed in the adjoining sides of the plates, and rods passing through said grooves.

3. In an ore crusher, a crusher-roll, a beam mounted to oscillate on an axis parallel with the axis of the roll, means for actuating the roll, means for actuating the beam, a crushing-jaw carried by said beam, the face of the said jaw intersecting a plane passing through the axes of the crusher-roll and the beam, a second crushing-jaw carried by the beam and disposed above said plane, and a plate carried by said upper crushing-jaw and adapted to partly inclose materials between said crushing-jaw and the crusher-roll.

4. In an ore crusher, a crusher-roll, a beam mounted to oscillate on an axis parallel with the axis of the roll, means for actuating the beam, means for actuating the roll, a crushing-jaw carried by said beam, the face of said crushing-jaw intersecting a plane passing through the axes of the crusher-roll and the beam, a portion of the face of said jaw being curved concentrically to the axis of the beam and a portion of the face of said jaw being curved concentrically to the crusher-roll, a second crushing-jaw carried by the beam and disposed above said plane of the axes of the roll and beam, and a plate carried by the upper crushing-jaw and adapted to partly inclose materials between said crushing-jaw and the roll.

5. In an ore crusher, a crusher-roll, a beam mounted to oscillate on an axis parallel with the axis of the roll, crushing-jaws carried by said beam, and means for actuating said beam, said actuating means comprising levers fulcrumed near the beam, an oscillating bearing device disposed between one of said levers and the beam, an eccentric disposed between the long arms of the levers, an eccentric-slide disposed around said eccentric, and segment-blocks placed between the faces of the eccentric-slide and the long arms of the levers.

6. In an ore crusher, crushing-jaws, an oscillatory beam carrying said crushing-jaws, levers fulcrumed near said beam, means connecting said levers and the beam, an eccentric disposed between the levers, a body inclosing said eccentric and having flat faces thereon adjoining said levers, and blocks of bearing metal disposed between the levers and the flat faces of said body, said blocks having the form of segments of a cylinder.

7. In an ore crusher, crushing-jaws, an oscillatory beam carrying said jaws, two levers fulcrumed near said beam, an adjustable wedge-block carried by the beam near one end thereof, a roller carried by one of the levers and engaging said wedge-block, a segment-block fitting in a recess in the other lever and engaging the beam near the end thereof opposite said wedge-block, an eccentric disposed between the levers, an eccentric-slide around said eccentric, segment-blocks disposed between the levers and the eccentric-slide, and a means for holding said levers and the segment-blocks and the eccentric-slide in constant engagement.

8. In an ore crusher, crushing-jaws, an oscillatory beam carrying the same, levers fulcrumed near said beam, connecting mechan-

ism between the levers and the beam, an eccentric disposed between the levers, an eccentric-slide inclosing said eccentric, a roller bearing formed between the eccentric and eccentric-slide, segment-blocks having flat faces engaging the faces of the eccentric-slide, said segment-blocks having curved sides and tongues formed on said curved sides, the same fitting into recesses formed in the levers, and an adjustable tension device for drawing the levers toward each other to maintain the same and the segment-blocks and eccentric-slide in constant engagement.

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.