T. L. SMITH.

CRUSHER.

APPLICATION FILED NOV. 9, 1911.

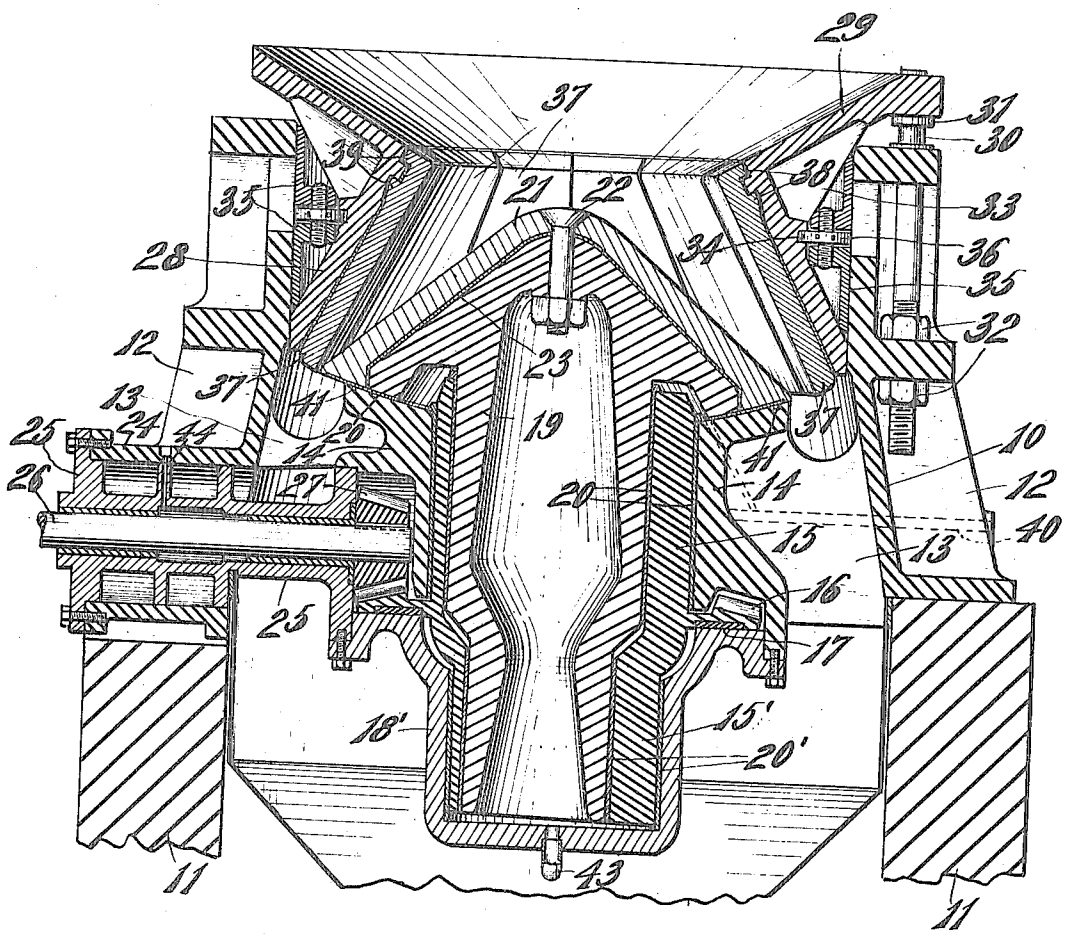
1,145,929.

Patented July 13, 1915.

4 SHEETS—SHEET 1.

a

FIG. 1.



c b

WITNESSES.

L. C. Thurer.

Katherine Holt

INVENTOR.

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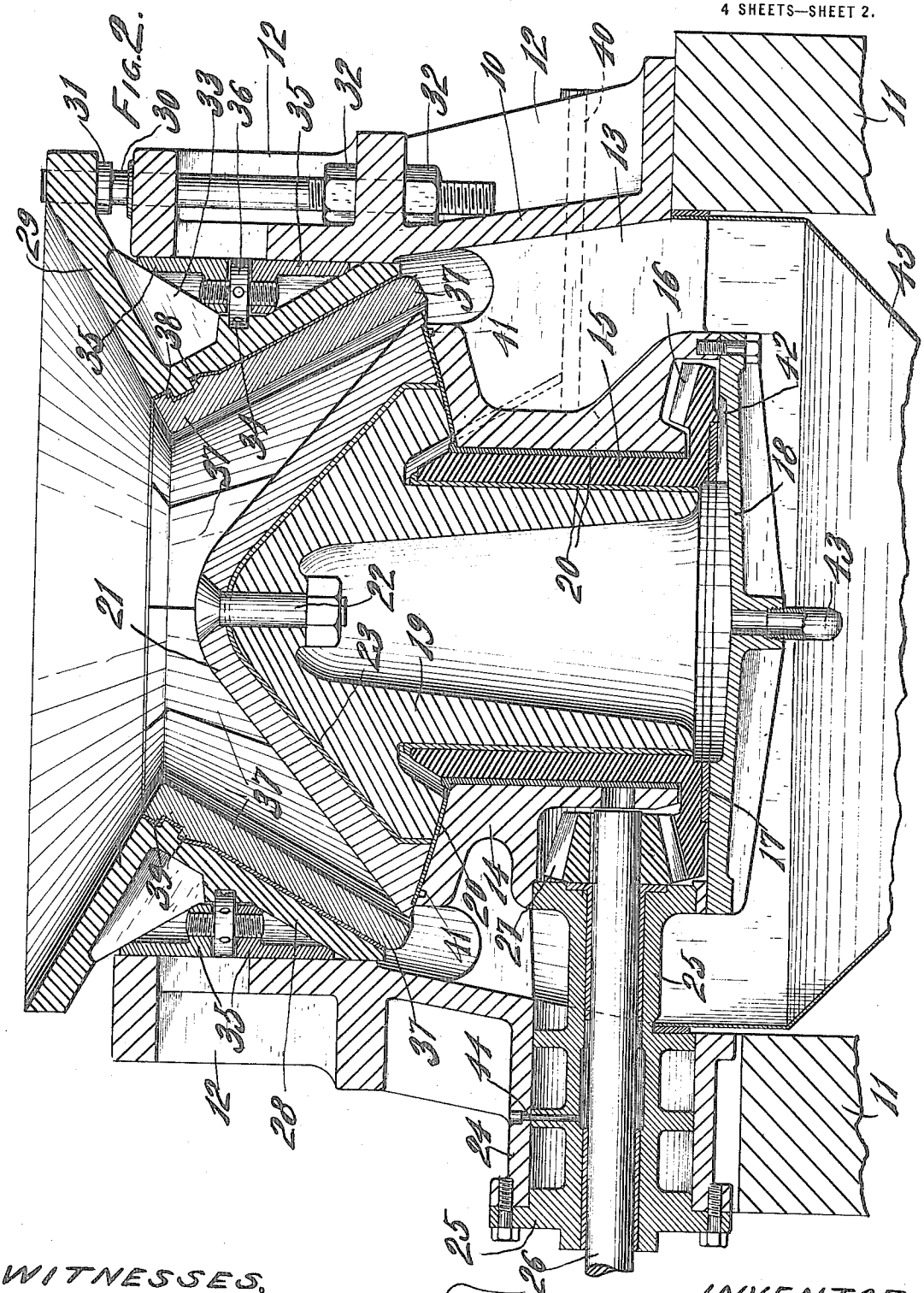
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4 SHEETS—SHEET 2.

FIG. 2.



WITNESSES.

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4 SHEETS—SHEET 3.

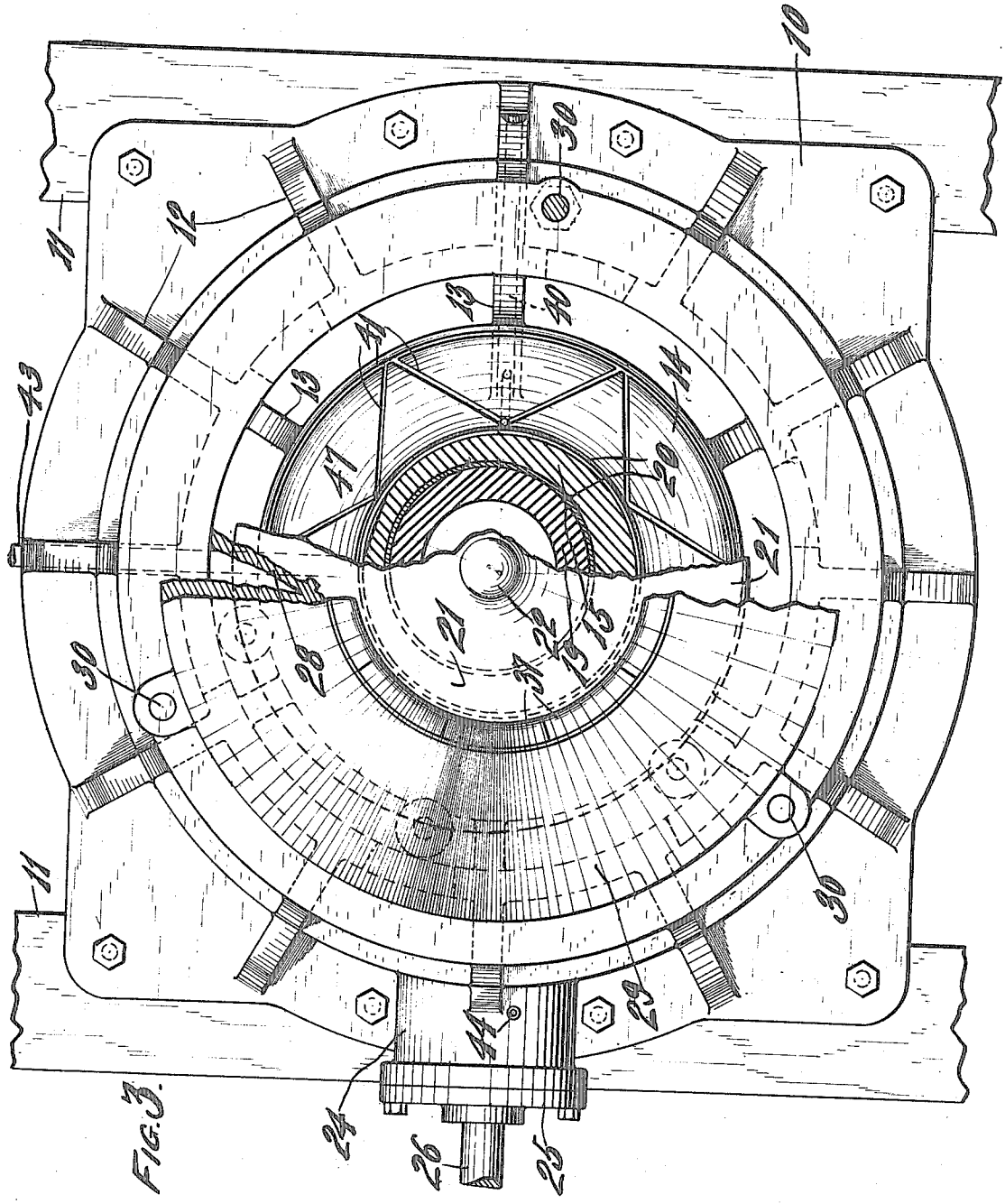


FIG. 3.

WITNESSES.

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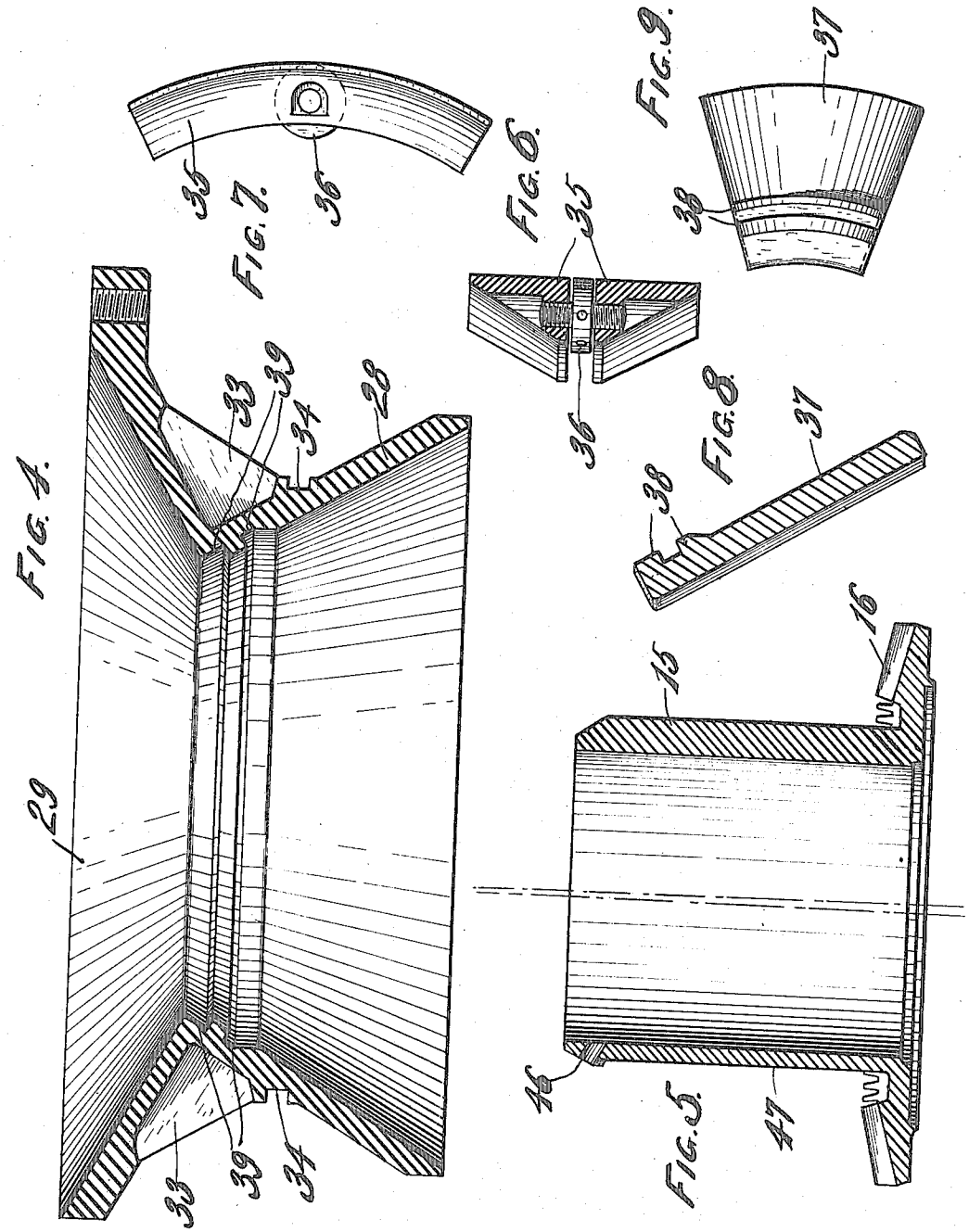
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4 SHEETS—SHEET 4.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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CRUSHER.

1,145,929. Specification of Letters Patent. Patented July 13, 1915.

Application filed November 9, 1911. Serial No. 659,321.

To all whom it may concern:

Be it known that I, THOMAS L. SMITH, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Crushers, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

This invention has for its object to provide a crusher having a head working with a gyratory motion about a center above the feed hopped, but free from the suspending connections interfering with the feed which are usual with suspended crusher heads.

An object of this invention is to provide a crusher head with a bearing or support beneath it of such shape that its driving motion will correspond with the driving motion of a suspended crusher head and its acting faces will operate upon the material with a rocking motion. While the swinging action for a crusher head is most conveniently produced by suspending the crusher head from a point centrally above it and then giving to it a circular motion, this method is objectionable as the suspension connections obstruct the feed hopper between the crusher head and the surrounding concave. In the present invention the suspension means is dispensed with and the desirable rocking motion of the crusher head is given to it by mounting it on a spherically convex bearing portion which rides upon a spherically concave bearing seat so that when a circular motion is given to it by the driving mechanism it will ride on its spherical bearing with its axis describing a cone, as if it were suspended from the point forming the apex of the cone.

Another object of the invention is to provide a crusher with the concave flaring downwardly whereby the crushing space between the crusher head and the concave increases in diameter downwardly to provide a greater area to be occupied by the material operated upon as it progresses and becomes crushed to smaller particles.

Another object of this invention is to provide novel means for adjustment of the concave with relation to the crusher head, and novel means for clamping and reinforcing it in its adjusted positions.

Another object of the invention is to provide a crusher with removable wearing faces which may be replaced at a nominal cost when they have become worn.

Another object of the invention is to provide for proper lubrication of the bearing surfaces of a crusher.

Another object of the invention is to improve upon details of construction whereby the parts may be easily assembled, and the machine is made simple in its construction and durable and efficient in use.

With the above and other objects in view the invention consists in the crusher as hereinafter claimed, its parts and combination of parts, and all equivalents.

Referring to the accompanying drawings in which like characters of reference indicate the same parts in the different views: Figure 1 is a sectional elevation of a crusher constructed in accordance with this invention; Fig. 2 is a similar view on a larger scale of a crusher of a slightly different construction in which the eccentric sleeve terminates at the driving gear; Fig. 3 is a plan view thereof, with portions broken away to show the bearing seat for the crusher head; Fig. 4 is a detail sectional view of the concave with the wearing plates removed; Fig. 5 is a detail sectional view of the eccentric sleeve; Fig 6 is a detail sectional view of one of the pairs of wedge blocks; Fig. 7 is a plan view thereof; Fig. 8 is a sectional detail view of one of the wearing plates for the concave; and, Fig. 9 is a plan view thereof.

In these drawings 10 indicates a frame which desirably constitutes a single casting suitably mounted on sills 11 and of a substantially cylindrical shape at its upper part, well braced by external radial ribs 12 at regular intervals. In the lower or base portion, which is slightly flaring, there are radial internal webs 13 in addition to the external ribs, and these webs serve to support a bearing 14 for the crusher head.

In a vertical central opening through the bearing 14 is fitted an eccentric sleeve 15 which may terminate in a beveled gear 16, as shown in Figs. 2 and 5, or which may continue below the beveled gear with an extension 15′ as shown in Fig. 1. In either case the eccentric sleeve is held in place by a bearing ring 17 let into the bottom of beveled gear 16 and riding on the upper surface of a bottom plate 18, as shown in Fig. 2, which takes the form of an extension bearing cap 18′ in Fig. 1 and in either case is

bolted to the bottom of bearing 14. Within the eccentric sleeve 15 is fitted a cylindrical stem portion of a crusher head 19, which is of a conical shape at its upper end and of larger diameter than the stem portion so as to overhang the upper end of the eccentric sleeve and bear upon the top surface of the bearing 14. This bearing surface of the upper portion of the crusher head, which rests upon bearing 14, is not a plain surface but is convex, as if that portion of the crusher head were cut from a sphere, and consequently it may be said to be spherically convex, while the top surface of the bearing 14 is correspondingly shaped to fit the spherically convex bearing portion of the crusher head, and may be said to be spherically concaved. In that form of the construction shown in Fig. 1 the stem of the crusher head 19 continues below the beveled gear 16 where it is perfectly reduced in diameter and fits within the extension 15′ of the eccentric sleeve. The bearing surfaces between the upper portion of the crusher head and bearing 14 and between the stem of the crusher head and the eccentric ring 15 and between the eccentric ring and the bearing 14, are shown to be lined with Babbitt metal 20, as well as the bearing surfaces between the extension of the crusher head stem and the extension of the eccentric ring 15′ and between the extension of the eccentric ring and the bearing cap 18′ in that form of the device shown in Fig. 1. The upper end of the crusher head 19 is inclosed within a conical crown 21 of chilled iron, which is held in place by means of a clamping bolt 22 passing through its center and the center of the crusher head, and this crown is fitted to the crusher head with a layer of zinc 23 between them and may be removed and replaced when worn.

A cylindrical box 24 is formed in the frame 10 and registers with a recess formed in the bearing 14, and in this box and recess is fitted a tubular bearing 25, having annular flanges engaging their walls to hold the bearing in place. In this bearing 25 is journaled a drive shaft 26 carrying a bevel pinion 27 on its end, which meshes with the bevel gear 16 of the eccentric sleeve, and when it is desired to remove the pinion 27 it is only necessary to remove the connecting bolts for the bearing 25 and said bearing, with its shaft and pinion, may be withdrawn through the cylindrical box 24.

A conical ring 28 forms a concave above the crusher head and an outwardly and upwardly extending flange at its upper edge forms a feed hopper 29 of the shape of an inverted cone, the feed hopper and ring being preferably integral and held in place primarily by means of jack screws 30 which are threaded into outstanding lugs at the edge of the hopper, with collars 31 bearing thereagainst to keep the screws from turning, said jack screws passing through openings in outstanding flanges of the frame and having nuts 32 threaded on them above and below one of said flanges. By turning the nuts 32 on the jack screws the concave ring and hopper may be adjusted vertically to the desired position above the crusher head.

The combined concave ring and feed hopper has radial strengthening webs 33 at its waist portion and the edges of these strengthening webs are inclined at substantially the same angle of inclination as the outside of the concave ring 28, but in the opposite direction, and between these inclined surfaces the concave ring 28 is provided with an annular groove 34, and arc shaped wedge blocks 35, arranged in pairs, surround the concave with their vertical faces bearing against the cylindrical wall of the frame and their inclined faces bearing against the inclined surface of the concave and the webs 33, respectively, each pair of wedge blocks being connected by right and left threaded screws 36 with a central head positioned between the wedge blocks and engaging the groove 34 of the concave. By turning the screws 36 in a direction to separate the wedge blocks, said wedge blocks are forced into the space between the concave and the frame to tightly clamp the concave in its position whatever its vertical adjustment may be, and in order to change its adjustment, it is first necessary to turn the screws 36 in the opposite direction, to draw the wedge blocks together, and release the clamping action on the concave before the adjustment may be accomplished by means of the jack screws.

The concave is preferably provided with a sectional lining of chilled iron plates 37 which are sector shaped, as shown in Fig. 9, and are provided with flanges 38 near their upper edges to engage in corresponding grooves 39 in the inner face of the concave. These chilled iron lining plates are backed with the zinc in the same manner as the crown 21.

In forming the eccentric sleeve 15 the bore therethrough is not made on an axis *a*—*b* parallel with the axis of the outer surface, as would usually be the case, but it is made on an oblique axis *a*—*c* so that the stem of the crusher head will always be inclined in one direction or another, with its axis intercepting the axis of the outside of the sleeve at a fixed point *a* which constitutes the center of the spherically convex bearing of the crusher head.

In operation the crusher head is free to turn within the eccentric sleeve, but its stem is constantly shifted by the eccentric sleeve so that its inclined axis describes a cone with its apex some distance above the top of

the crusher head. This causes the crusher head to change in its relation to the concave which is concentric with the axis *a*—*b* of the outside of the eccentric sleeve, so that that portion thereof which is closest to the concave will have the effect of traveling around the concave though in fact the crusher head may not actually rotate on its own axis in doing so. In practice the crusher head does rotate on its axis, in the opposite direction from the rotation of the eccentric sleeve. Furthermore, by the present construction the crushing face of the crusher head approaches the horizontal to such an extent that the force exerted in crushing material is in an inclined direction, approximating the angle of 45 degrees from the horizontal, so that the reaction is taken to a great extent by the spherical bearing 14 to the relief of the eccentric sleeve. This obtuse formation of the crusher head and the corresponding flaring downwardly of the coöperating concave further serves to provide a greater area of outlet space for the crushed material than would be the case with a narrower crusher head. The wedge block clamping reinforcement backing for the concave materially strengthens it and rigidly holds it in position while being quickly released for changing the adjustment when desired to vary the size of the output.

In order that the bearing parts may all be provided with proper lubrication, there is an oil passage way 40 which passes through one of the ribs 12 and one of the webs 13 and terminates at the spherical bearing surface on bearing 14. This bearing surface, as shown in Fig. 3, has oblique grooves 41 extending from the end of oil passage way 40, which in turn connect with other oil grooves running in and out across this bearing surface and oil grooves passing around the inner and outer edges of the bearing surface, so that oil which is fed to the oil passage way 40, by any suitable means under pressure, finds its way throughout the bearing of the crusher head on the bearing 14. The oil will also be forced from the passage way 40 to the bearing surfaces inside and outside of the eccentric sleeve 15, there being an opening 46 through the upper end of the eccentric sleeve, as shown in Fig. 5, to conduct the oil to the interior thereof, and a flat surface 47 on the outside of the eccentric sleeve, to form a passage way for the oil, and that oil which passes outside of the eccentric sleeve will find its way over the teeth of the bevel gear 16 and into the drain cup formed by the bottom plate 18, through a groove 42 provided for the purpose. The oil traveling inside of the eccentric sleeve also falls into this drain cup, and a drain pipe 43 leads from the bottom thereof to carry the oil away. An oil opening 44 leads through the box 24 and one of the flanges of the shaft bearing 25 to the shaft 26, and oil therefrom also finds its way to the drip pan 18.

A discharge hopper 45 is desirably located beneath the machine to catch the material dropping from the crusher head.

While the supporting bearing for the crusher head has been shown and described as being spherically concave, I do not wish to be confined thereto as some of the advantages of the present invention may be attained by a structure in which the supporting bearing is of other shape.

What I claim as new and desire to secure by Letters Patent, is:

1. A crusher, comprising a crusher head, a stationary bearing beneath the crusher head forming the support for the crusher head, means for moving the crusher head on the bearing, said bearing being spherically concaved from a center above the crusher head to cause the movements of the crusher head to resemble the movements which it would have if pivotally suspended at such point, and a concave surrounding the crusher head.

2. A crusher, comprising a crusher head, a stationary bearing beneath the crusher head forming the support for the crusher head, means for moving the crusher head in a circular direction on the bearing, said bearing being spherically concaved from a center above the crusher head to cause the axis of the crusher head to describe a cone with its apex above the crusher head, and a concave surrounding the crusher head.

3. A crusher, comprising a crusher head provided with a depending stem, a stationary bearing beneath the crusher head forming the support for the crusher head, a suitably mounted eccentric means engaging the stem for giving the crusher head a circular motion on the bearing, said bearing being spherically concaved from a center point above the crusher head to cause the axis of the crusher head to describe a cone with its apex above the crushed head, and a concave surrounding the crusher head.

4. A crusher, comprising a crusher head having an axial stem, a stationary bearing beneath the crusher head forming the support for the crusher head and provided with an opening through which the stem passes, a suitably driven eccentric sleeve fitting within the opening and around the stem for giving the crusher head a circular movement on the bearing, said bearing being spherically concaved from a center point above the crusher head to cause the axis of the crusher head to describe a cone with its apex above the crusher head, and a concave surrounding the crusher head.

5. A crusher, comprising a conical crusher head free of support at its upper part, a sta-

tionary bearing beneath the crusher head for directly supporting the crusher head, means for giving the crusher head a circular movement, and a conical concave surrounding the crusher head and so positioned with relation to the crusher head that the space between them through which the crushed material passes increases in diameter in the direction of travel of the crushed material.

6. A crusher, comprising a frame, a crusher head supported thereby, means for moving the crusher head, a concave adjustably mounted on the frame and surrounding the crusher head and provided with oppositely inclined bearing surfaces, and a pair of oppositely disposed adjustable wedge blocks fitting between the concave and the frame and bearing on the bearing surface of the concave.

7. A crusher, comprising a frame, a crusher head supported thereby, means for moving the crusher head, a concave adjustably mounted on the frame and surrounding the crusher head and provided with V-shaped bearing surfaces and recesses, pairs of wedge blocks fitting between the concave and the frame and bearing against the V-shaped bearing surfaces, right and left clamping screws connecting the wedge blocks of each pair for forcing them apart to clamp the concave firmly in position, and annular heads on the clamping screws engaging the recesses in the concave.

8. A crusher, comprising a frame, a crusher head supported thereby, means for moving the crusher head, a combined concave and feed hopper rigidly united and mounted within the frame with the concave surrounding the crusher head, jackscrews connected with the feed hopper, adjusting nuts threaded on the jackscrews and engaging the frame for adjusting the position of the concave and hopper with relation to the crusher head, and means fitting between the concave and the frame for clamping the concave in its adjusted positions.

9. A crusher, comprising a frame, a bearing therein having a central opening, a crusher head supported on the bearing with a stem passing through the opening, an eccentric sleeve fitting within the opening and around the stem, a gear wheel carried by the eccentric sleeve, an extension of the eccentric sleeve below the gear wheel, an extension of the stem fitting within the extension of the eccentric sleeve, a bottom plate on which the eccentric sleeve rests forming an extension of the bearing in which the eccentric sleeve extension fits, means for driving the gear wheel, and a concave mounted on the frame and surrounding the crusher head.

In testimony whereof, I affix my signature, in presence of two witnesses.

THOMAS L. SMITH.

Witnesses:
C. H. KEENEY,
CLARA MUEHLBACH.