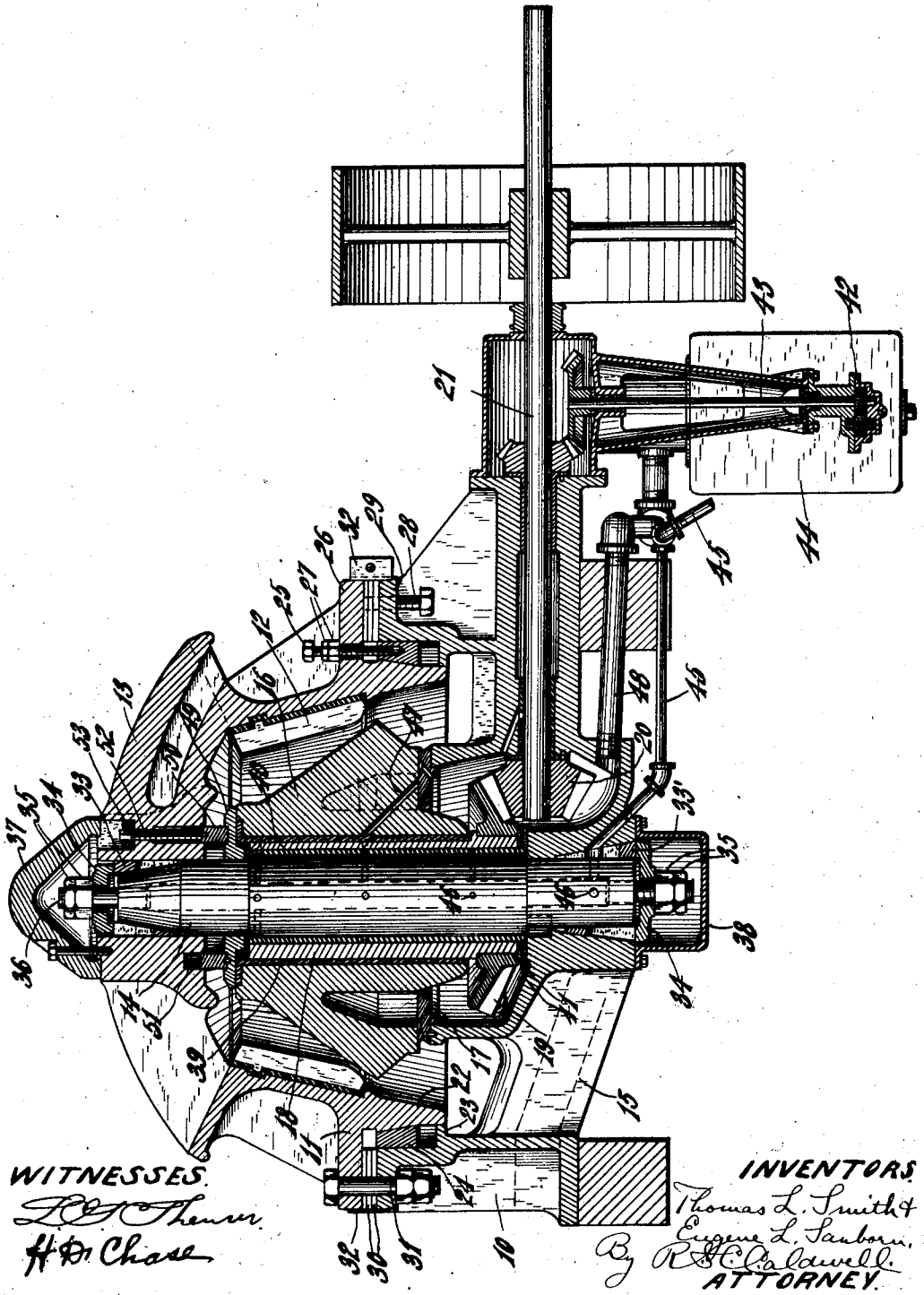
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REDUCTION CRUSHER.

APPLICATION FILED NOV. 6, 1916.

1,355,922. Patented Oct. 19, 1920.



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REDUCTION-CRUSHER.

1,355,922. Specification of Letters Patent. Patented Oct. 19, 1920.

Application filed November 6, 1916. Serial No. 129,665.

To all whom it may concern:

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

This invention relates to reduction crushers of the type in which the crusher head is revolubly mounted upon a fixed stationary upright shaft and coöperates with a concave surrounding it, and has for its object to vary the size of the product by an adjustment of the concave supporting portion of the frame on the upright shaft and on the base portion of the frame to move the concave nearer to or farther from the crusher head.

Another object of the invention is to fix the concave rigidly in place in the various adjustments thereof by providing means for preventing play or lateral motion between the upright shaft and the concave supporting portion of the frame and between the latter and the base portion of the frame.

A further object of the invention is to provide such a crusher adapted to supply lubricant to the various working parts and maintaining tight connections for confining the lubricant to the working parts and for excluding grit therefrom in all positions of adjustment for varying the size of the product.

With the above and other objects in view the invention consists in the reduction crusher as herein claimed and all equivalents. Referring to the accompanying drawing the figure represents a central vertical sectional view of a reduction crusher constructed in accordance with this invention.

In this drawing 10 indicates the base portion of the frame which, instead of continuing upwardly as an integral casting to include the support for the crushing concave as usual, terminates on a horizontal plane about the elevation of the widest portion of the crusher head. The upper portion of the frame is made in a separate frame section 11 which is adjustably fitted with and secured to the lower frame section 10 so as to be capable of being raised and lowered thereon.

The upper frame section 11 is provided with the crushing concave 12, of the type which flares downwardly. Across the hopper-like mouth of the upper frame section is the usual arched spider 13 integrally formed with the upper frame section and constituting a support for the stationary vertical crusherhead shaft 14, which, at its lower end, is supported by the spider 15 integral with the lower frame section 10. A broad conical crusher head 16 rests on a flat bearing ring 17 mounted on the edge of the gear housing of the lower spider and an eccentric sleeve 18 surrounding the vertical shaft 14 and fitting within the bore of the crusher head 16 has a beveled gear wheel 19 fixed on its lower end and meshing with a beveled pinion 20 on a suitably driven countershaft 21 by which a turning movement is given thereto to cause the crusher head to slide on the flat bearing ring 17 and cause the part of nearest approach to the concave 12 to travel around said concave and thus enlarge and then reduce the size of the opening between the crusher head and the concave at each part thereof to effect the crushing operation on the rock or other material within the hopper.

The upper frame section 11 has a downwardly extending annular skirt portion 22 fitting within a horizontal flange 23 of the lower frame section and having a tapering outer face corresponding in its inclination with the inclined inner surface of a wedge ring 24 which is confined within the space between said skirt portion 22 and the lower frame section. The wedge ring 24 is provided with a number of screws 25, one of which is shown in the drawing, said screws being threaded in the wedge ring and passing through openings in the outwardly extending horizontal flange 26 of the upper frame section and having lock nuts 27 threaded thereon and bearing on said flange. These screws 25 may be made to draw the wedge ring 24 upwardly by turning the nuts 27 thereon, thus firmly wedging the ring between the lower frame section and the

upper frame section to prevent lateral or sidewise movements of the latter in any adjusted position thereof. The vertical adjustments of the upper frame are accomplished by means of jack screws 28 threaded in the horizontal flange 29 of the lower frame section and bearing on the flange 26. When the clamping ring is loose said jack screws 28 may be turned to either raise or lower the upper frame section. Distance plates 30 may be placed between the flanges 26 and 29 to fill the space between them when the proper adjustment has been obtained and then the two frames are clamped together by clamping bolts 31 passing through said flanges. A steel band 32 is placed around the flanges 26 and 29 where it is removably clamped to protect the space between the two frames against the entry of dirt which might interfere with adjustments.

In order that this vertical adjustment of the upper frame section with relation to the lower frame section may not be interferred with by its connection with the vertical shaft 14, the latter is given a sliding fit in the hub of the spider 13 and its conical upper end is surrounded by a tapering bushing 33 which is slotted vertically from the top and bottom to make it expansible. A cup washer 34 bears on the tapering bushing and is forced thereagainst by set nuts 35 threaded on a stud 36 projecting from the end of the shaft. With the nuts 35 loose so that the bushing 33 contracts away from the walls of the bore through the hub of the spider 13, the vertical adjustments of the upper frame section 11 may be accomplished without hindrance by the shaft 14, the upper end of said shaft and its clamping parts freely moving within the bore of the spider. When the desired adjustment is accomplished, the tightening of the nuts 35 forces the washer 34 against the bushing 33 and causes the latter to expand along the conical surface of the shaft until it becomes tightly wedged between the shaft and the bore of the spider where it firmly holds the shaft against play by rigidly connecting it with the spider of the upper frame section.

For convenience the lower end of the shaft may be similarly connected to the spider 15 of the lower frame section, though here it is preferred to taper the bushing 33′ externally to fit within the bore of the spider which is correspondingly flaring. The upper shaft connection is preferably covered by a cap 37 as usual and the lower shaft connection is inclosed by a cap 38.

Besides the flat bearing ring 17 for supporting the crusher head, there are other renewable friction wearing parts such as the flanged Babbitt sleeve 39 which is removably fitted within the bore of the crusher head and consists of a die casting so as to be renewable in the field without requiring the melting or pouring of Babbitt metal. Also there is the Babbitt sleeve 40 surrounding the shaft 14 and the antifriction rings 41 between the lower end of the eccentric sleeve 18 and the hub of the lower spider 15.

The fact that the upper frame section is vertically adjustable on the lower frame section in order to vary the size of the opening between the crusher head and the concave makes it impracticable to conduct lubricant to the wearing parts through a pipe secured to the frame as heretofore and consequently in the present invention the vertical shaft 14 is cored out to provide a central opening through which lubricant is delivered to the wearing parts. A gear pump 42 driven by a shaft 43 in driving connection with the counter-shaft 21 takes oil from a lubricant reservoir 44 and delivers it through a lubricant supply pipe 45 to an opening in the hub of the lower spider 15 which leads to the bore thereof. This opening communicates through the slots of the taper bushing 33′ with radial openings 46 drilled in the shaft 14 so that the oil is thus pumped to the central bore of the shaft from which it passes out through other radial openings 46 at different elevations to lubricate the bearing between the shaft and the eccentric sleeve. Continuations of these radial openings passing through the walls of the eccentric sleeve serve to conduct the lubricant to the bearing between the eccentric sleeve and the crusher head, while inclined passageways 47 through the crusher head conduct a part of the lubricant to the flat bearing surface between the crusher head and the bearing ring. Lubricant is thus conducted to all wearing parts and eventually finds its way to the gear casing in the lower spider 15 where it serves to lubricate the driving gears and the countershaft bearings. From the gear housing the oil is conducted by a return pipe 48 to the reservoir 44.

The vertical adjustment of the upper frame section makes it necessary to provide an expansible shield around the upper portion of the shaft to prevent grit from entering between the upper spider 13 and the crusher head and to prevent oil from being forced out above the crusher head. A circular plate 49 surrounds the shaft and rests on the upper end of the crusher head while an annular groove in its upper face receives an oil ring 50 which also fits within an annular groove 51 in the bottom of the hub of spider 13. The oil ring 50 is held firmly in place and in turn serves to hold the circular plate 49 down upon the crusher head in all adjustments of the upper frame section by means of screws 52 threaded through the hub of the spider and engaging the ring 50. To prevent the screws 52 backing away

from their adjustments they are provided with square heads at their upper ends on which square collars 53 are fitted, said collars being let into recesses in the upper part of the spider hub, and the engagement of the collars with one or more of the flat sides of the recesses serving to prevent their rotation.

In operation the crusher head is revolved about the shaft by means of the turning of the eccentric sleeve 18 therebetween. This movement is without positive rotation, though the head is free to turn. Its weight and downward stress are taken by the flat bearing ring 17 with which the edge of the crusher head maintains a tight fit preventing the loss of lubricant and avoiding the introduction of dust or grit. This seat for the crusher head is fixed and adjustment to change the size of the product is effected by the raising or lowering of the upper frame section with respect to the lower frame section. This adjustment is readily accomplished by means of the jack screws 28 and is maintained by the distance plates 30 and the clamping bolts 31, while all lateral play of the upper frame section within the lower frame section is taken up by the wedge ring 24 lifted into its crowding fit between the vertical and inclined walls of the frame sections by turning the nuts on screws 25. This adjustment of the upper frame section to move the crushing concave nearer to or farther from the crusher head is made possible, notwithstanding the fact that the vertical shaft is engaged at its upper end by the spider of the upper frame section, because of the adjustable clamping connection for the upper end of the vertical shaft in said spider. Furthermore, this vertical adjustment of the upper frame section to vary the size of the product is accomplished without a waste of lubricant through the varying gap between the upper end of the crusher head and the hub of the upper spider, for the oil ring 50 serves with the plate 49 to complete the inclosure to confine the oil and exclude dust and grit in all positions of adjustment.

The difficulty of providing a proper flow of lubricant to the wearing parts in a reduction crusher of this type because of the adjustability of the upper portion of the frame is overcome by the present method of utilizing the stationary vertical shaft as a lubricant conductor with outlet ducts leading therefrom to the various wearing surfaces. The lubricated interior working parts are entirely inclosed, preventing the introduction of dust and grit so that lubrication is effective without undue cutting or abrasion of bearings.

By supporting the concave on an adjustable portion of the frame having clamping engagement with the stationary vertical shaft as well as with the stationary base portion of the frame adjustment may be made for varying the size of the product without weakening the structure or permitting lateral play of either the crusher head or the concave. The concave support being tightly clamped to the vertical shaft above the level of the concave and being tightly clamped to the base portion of the frame below the level of the concave insures an unyielding relation between the crusher head and the concave notwithstanding the adjustment of the latter. The efficiency and the durability of the crusher are thus increased by reason of the structure constituting this invention.

Another advantage for dividing the frame into an upper and lower frame section along a line between the concave and the crusher head support is that it permits of the removal of the crusher head without the necessity for removing the concave from the shell or frame even though the concave is of the downwardly flaring type to produce with the bell-shaped crushing head a mean discharge of greater diameter than the mean feed diameter. In order to make the crushing head, the shell and the concave liners all of an outwardly and downwardly flaring shape with the bottom diameter of the crushing head greater than the top crushing diameter of the concave liners and the shell such division of the frame into upper and lower frame sections is necessary to permit of the introduction and removal of the crusher head.

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

1. A reduction crusher, comprising a lower frame section, a stationary shaft secured thereto, a suitably operated crusher head on the stationary shaft, a downwardly flaring crushing concave surrounding the crusher head and coöperating therewith, and an upper frame section supporting the crushing concave and having adjustable supporting connection with the upper end of the shaft and with the lower frame section respectively and removable to permit of the removal of the crusher head.

2. A reduction crusher, comprising a lower frame section, a vertical shaft thereon, a suitably operated crusher head surrounding the shaft, a downwardly flaring crushing concave surrounding the crusher head and coöperating therewith, and an upper frame section carrying the crushing concave and having adjustable connection with the shaft above the concave and with the lower frame section below the concave.

3. A reduction crusher, comprising a lower frame section, an upstanding shaft rigidly mounted thereon, a crusher head mounted on the shaft, a downwardly flaring crushing concave, and an upper frame

section carrying the concave and adjustably mounted on the lower frame section to vary the distance between the concave and the crusher head and provided with a spider having adjustable clamping connection with the shaft.

4. A reduction crusher, comprising a frame section, an upstanding shaft secured thereto, a crusher head mounted thereon, a downwardly flaring crushing concave, and an adjustable support for the crushing concave adjustably mounted on the upstanding shaft and having lateral engagement with the frame section.

5. A reduction crusher, comprising a frame, an upstanding shaft secured at both ends to the frame, a crusher head mounted on the shaft, a downwardly flaring concave mounted on the frame coöperating with the crusher head, said frame being split between the concave and the lower end of the shaft whereby the upper frame section with the concave may be adjusted toward and away from the lower frame section with the crusher head, the connection between the frame and one end of the shaft being adjustable.

6. A reduction crusher, comprising a frame having an upper spider and a lower spider, an upstanding shaft connecting the two spiders and having its connection with one spider adjustable, a crusher head surrounding the shaft, and a downwardly flaring concave mounted on the frame, said frame being split between the concave and the lower spider to permit of adjustment between the upper frame section and the lower frame section to vary the distance between the concave and the crusher head.

7. A reduction crusher, comprising a lower frame section, an upstanding shaft mounted thereon, a crusher head surrounding the shaft, an upper frame section adjustably clamped on the shaft and adjustably fitting on the lower frame section, a crushing concave carried by the upper frame section, means for adjusting the upper frame section on the lower frame section, a wedge ring fitting between the frame sections to take up lateral play therebetween, and means for moving the wedge ring.

8. A reduction crusher, comprising a lower frame section, an upstanding shaft thereon, a crusher head mounted on the shaft, a concave, an upper frame section carrying the concave and adjustably connected with the shaft, said upper frame section having a telescoping fit with the lower frame section with an annular space between them, a wedge ring within the annular space, means for moving the ring and means for raising and lowering the upper frame section.

9. A reduction crusher, comprising a lower frame section, and an upper frame section having outwardly projecting flanges, clamping bolts passing through the flanges, jack screws threaded through one flange and engaging the other flange for adjusting the upper frame section on the lower frame section, distance plates between the flanges, an inwardly projecting flange on the lower frame section at a distance from the outwardly extending flange, a downwardly extending flange on the upper frame section having an inclined surface and a telescoping fit with the said inwardly projecting flange, a wedge ring fitting in the annular space between the lower frame section and the downwardly extending flange, screws for moving the ring into clamping engagement with the inclined surface of the downwardly extending flange, a band surrounding the joint between the upper and lower frame sections, a shaft mounted on the lower frame section, a crusher head thereon and a concave carried by the upper frame section.

10. A reduction crusher, comprising upper and lower frame sections adjustable with relation to each other, an upstanding shaft on the lower frame section, a crusher head mounted thereon, a downwardly flaring concave carried by the upper frame section, a spider on the upper frame section having an opening in its hub in which the upper end of the shaft fits, said upper end of the shaft being conical, a split tapering bushing fitting between the conical end of the shaft and the wall of the opening, and means for forcing said bushing to tightly clamp the end of the shaft in the spider in adjusted positions thereof, the upper frame section being detachable from the lower frame section to permit of the removal of the crusher head.

11. A reduction crusher, comprising an upper and lower frame section adjustable with relation to each other, a stationary upstanding hollow shaft mounted on the lower frame section and adjustably secured to the spider of the upper frame section, a crusher head mounted on the shaft, a concave mounted on the upper frame section, an oil ring recessed within the hub of the spider of the upper frame section, a plate engaged thereby and bearing on the upper end of the crusher head, adjusting screws countersunk within the hub of the spider and bearing on the oil ring, and a means for supplying lubricant under pressure to the interior of the shaft, there being openings through the shaft for conducting lubricant to the wearing parts.

12. In a reduction crusher, a vertical shaft, a bell-shaped crushing head surrounding the shaft, an outer shell supporting the crushing head and shaft above and below, concave liners for said shell coöperating with the crushing head and the said crushing head and shell and concave liners all

being flared outwardly and downwardly with the bottom crushing diameter of the crushing head greater than the top crushing diameter of the concave liners and of the shell, said shell being sectioned horizontally below the concave liners to permit the removal of the crushing head without removing the liners from the shell.

In testimony whereof we affix our signatures, in presence of two witnesses.

THOMAS L. SMITH.
EUGENE L. SANBORN.

Witnesses:
A. VAN KOOY,
FRANK A. WUSSON.