May 29, 1956 H. H. RUMPEL 2,747,804

GYRATORY CRUSHER CONCAVE ADJUSTMENT

Filed July 10, 1953

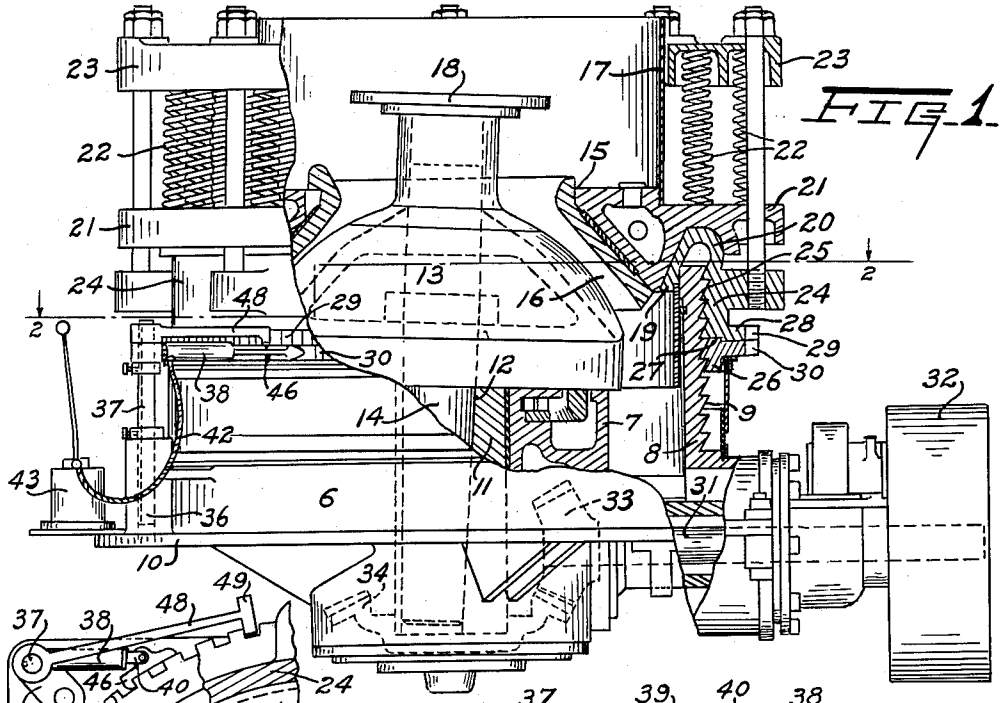


FIG. 1.

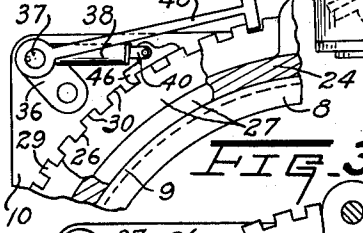


FIG. 3.

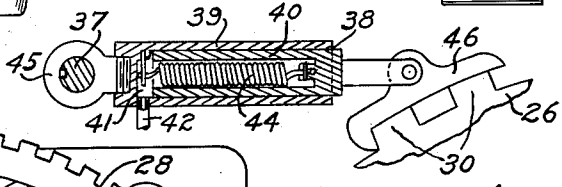


FIG. 4.

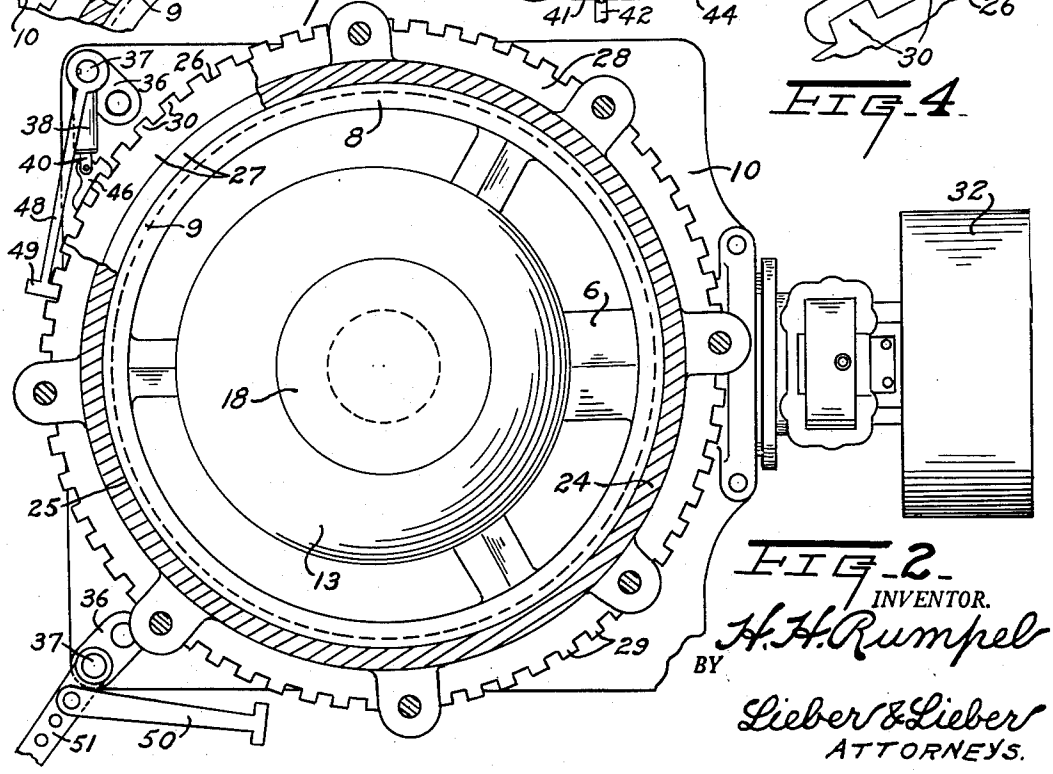


FIG. 2.

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GYRATORY CRUSHER CONCAVE ADJUSTMENT

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12 Claims. (Cl. 241—286)

This invention relates generally to improvements in gyratory crushers for rock, ore and other hard substances, and relates more specifically to improvements in the construction and mode of manipulating the parts of a gyratory crusher in order to effect relative adjustment of the crushing members.

The primary object of the present invention is to provide simplified and more efficient mechanism for effecting relative adjustment of the crushing members of a gyratory crusher and for positively retaining these members in various adjusted positions.

In gyratory crushers intended for the production of a relatively fine and uniform final product, it is very desirable to have the cooperating crushing head and concave members accurately adjustable with respect to each other, and to maintain these members in various positions of relative adjustment, in order to insure production of a commodity having the desired uniform size. In this type of crusher, the crushing head is ordinarily gyratable within a fixed frame and coacts with bearings which retain its crushing surface in fixed position, while the crushing concave which cooperates with the head to provide the crushing chamber is adjustably supported by the frame so that its crushing surface may be periodically moved toward or away from the head surface either in order to compensate for wear on the cooperating crushing surfaces, or to vary the size of the final product, or to effect access to the head and concave surfaces.

As shown and described in my Patent No. 2,668,015, granted February 2, 1954, it has heretofore been proposed to provide the main frame of such a gyratory crusher with an annular upright wall provided with external screw threads while the concave member support is provided with internal screw threads coacting with the frame threads so that the concave may be manipulated to cause its crushing surface to move toward or away from the crushing surface of the head. In order to effect rotation and resultant movement of the concave crushing member its support has an annular series of external teeth with which a manually operable pawl is cooperable, and in order to effect locking or positive holding of the concave in various adjusted positions a clamping ring nut also coacting with the external screw threads of the frame wall and adapted to clampingly engage an end surface of the concave support is provided. This ring nut also has a similar annular series of teeth with which the same manually operable pawl coacts while the nut is being released or driven into clamping position.

When manipulating the locking ring nut of such a manually operable assemblage, it is difficult to drive the nut into locking engagement with the frame wall and with the concave support, without causing the latter to rotate and thereby moving the concave crushing surface out of its adjusted position. It is also difficult with such assembly, to release the locking ring nut when it is desired to make a new adjustment, because the ring nut and the concave support tend to adhere to each other and to

rotate simultaneously. In order to eliminate such undesirable actions, it has been found highly desirable to positively hold the concave against possible rotation both when the locking ring nut is being driven into locking position and when it is being released, and it has also been found advantageous to provide powerful means such as a fluid pressure actuated ram for effecting operation of the lock nut.

It is therefore an important object of my present invention to provide an improved gyratory crusher embodying a screw thread adjustment for the concave crushing member and a locking ring nut for maintaining the concave in adjusted position, and wherein the concave member is adapted to be positively held against possible movement while the nut is being manipulated.

Another important object of this invention is to provide improved mechanism for effecting assembly, adjustment, and dismantling of the crushing members of a gyratory crusher having a screw threaded frame and a concave support adjustably associated with the screw threads of the frame.

A further important object of the invention is to provide an improved mode of relatively adjusting the cooperating crushing surfaces of a gyratory crusher so as to vary the size of the final product and to accurately maintain these surfaces in various positions of adjustment in order to insure uniformity in the product.

Still another important object of the present invention is to provide improved power actuated means for facilitating the actuation of the concave clamping nut of a gyratory crusher having a screw thread adjustment adapted to compensate for wear on the crushing surfaces and which also permits variation of the gap between these surfaces.

An additional object of my invention is to provide an improved gyratory crusher of the type having a main frame provided with an externally threaded upright wall, a gyratory head journalled in the frame, a normally fixed concave cooperating with the head to provide a crushing chamber, a concave support having internal screw threads coacting with the frame threads to effect movement of the concave toward and away from the head, and a clamping ring also coacting with the frame threads and with the concave support to maintain the concave in various selected positions.

These and other more specific objects and advantages of the invention will be apparent from the following detailed description from which it will be noted that the gist of the improvement is the provision of a gyratory crusher having a frame provided with a screw threaded wall, a concave having screw threads cooperable with the frame threads to effect adjustment of the concave relative to the frame, a ring nut also having screw threads cooperable with the frame threads and being engageable with the concave to lock the latter in various adjusted positions, means for rotating the nut, and means for positively holding the concave against possible rotation while the nut is being rotated.

A clear conception of the features constituting the present improvement, and of the construction and operation of a typical gyratory crusher embodying the invention, may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views.

Fig. 1 is a part sectional side elevation of a typical commercial gyratory crusher having the improved concave adjusting and holding mechanism applied thereto, the partial section having been taken centrally and vertically through the crushing chamber;

Fig. 2 is a slightly enlarged transverse horizontal sec-

tion through a gyratory crusher of the type shown in Fig. 1, the section having been taken along the line 2—2, but the adjusting and holding mechanism having been applied to a different corner of the main frame of the machine;

Fig. 3 is a fragmentary section similar to that of Fig. 2, taken adjacent to the concave adjusting and holding mechanism but showing this mechanism in an alternative position or condition of use; and

Fig. 4 is an enlarged longitudinal section through a typical hydraulic ram for actuating the concave clamping ring nut.

While the invention has been shown and described as having been applied to a particular type of gyratory crusher having a frustro conical concave and a semi-spherical head cooperating therewith, it is not the intent to unnecessarily restrict its use to such a crusher; and it is also intended that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawing, the high speed gyratory crusher shown therein comprises in general, a sturdy main frame 6 having a bored central hub 7 and an annular upright outer wall 8 provided with external screw threads 9, both the hub 7 and wall 8 being formed rigid with a base plate 10; an eccentric sleeve 11 having an outer cylindrical surface journalled in the bore of the frame hub 7 and being supported upon a suitable thrust bearing and provided with an inclined eccentric bore 12; an inner gyratory crushing head or member 13 supported upon the eccentric sleeve 11 and having a depending central shaft 14 journalled for free rotation within the eccentric bore 12; a normally stationary outer crushing concave or member 15 surrounding the head member 13 and having a frustro-conical inner crushing surface cooperating with the external semi-spherical crushing surface of the head to form an annular downwardly and outwardly flaring crushing chamber 16; a coarse material supply hopper 17 carried by the concave member 15 in open communication with the inlet of the chamber 16 and cooperating with a gyratory feed plate 18 carried by the head member 13 to deliver material to be crushed into the crushing chamber; a concave support 19 having an annular upper ridge 20 cooperable with an outer annular flange 21 on the concave member 15 to tiltably support the latter under the influence of a plurality of helical compression springs 22 reacting against a fixed top plate 23, the support 19 having an integral depending outer wall 24 provided with internal screw threads 25 coacting with the external screw threads 9 of the annular frame wall 8; a ring nut 26 also having internal screw threads coacting with the frame threads 9 and being provided with a flat upper surface 27 clampingly engageable with a bottom flange 28 formed on the support wall 24; an annular series of teeth 29 formed upon the periphery of the flange 28 and a similar but independent annular series of teeth 30 formed on the periphery of the ring nut 26; and a power shaft 31 journalled on the main frame 6 and having a driving pulley 32 at one end and a bevel pinion 33 at its opposite end meshing with a bevel gear 34 secured to the eccentric sleeve 11 to rotate the latter.

All of the foregoing gyratory crusher structure including the coacting screw threads 9, 25 formed on the frame wall 8 and concave support wall 24 respectively, and the ring nut 26 coacting with the screw threads 9 and having a flat top surface 27 engageable with the lower flange 28 of the concave support 21 to clamp the latter in various positions of adjustment, are shown and described in my prior patent above identified, but in this prior structure the concave support 24 and the ring nut 26 were rotatable by means of the usual manually oscillatable pawl and no means were provided for positively holding the support 15 against rotation whenever the nut 26 was rotated. In accordance with the present improvement, the square base plate 10 of the main frame 6 may be provided with several corner bosses 36, each having therein several holes for detachably receiving an upright pivot shaft 37 provided with a vertically adjustable collar near its upper end. Swingably suspended from one of these shafts 37 above the collar and in approximately horizontal alinement with the ring nut 26 is a power device such as a screw jack or a hydraulic ram 38 having a cylinder 39 and a plunger 40, both exposed to an intervening displacement chamber 41 as illustrated in Fig. 4. The displacement chamber 41 is connected by a flexible conduit 42 with a source of liquid under pressure such as a pump 43 having the usual release valve for the pressure fluid, and the cylinder 39 and plunger 40 are connected to each other by a tension spring 44 which is adapted to retract the plunger 40 when the relief valve is opened. The closed end of the ram cylinder 39 has an eye fixture 45 swingable about the adjacent pivot shaft 37, while the outer end of the plunger 40 has an arcuate shoe 46 pivotally attached thereto and provided with a lug adapted to alternately engage the successive teeth 30 of the nut 26 on opposite sides of the pivot shaft 37 as illustrated in Figs. 2 and 3.

Also swingably suspended from the same pivot shaft 37 above the ram 38 and in approximately horizontal alinement with the flange 28 of the concave support 24, is a holding strut or arm 48 having a pair of oppositely directed lugs 49 at its outer swinging end. These lugs 49 are also adapted to alternately engage the successive teeth 29 of the concave flange 28 on opposite sides of the pivot shaft as shown in Figs. 2 and 3. The ram 38 and the holding arm 48 may be swingably suspended from either of the corner posts or shafts 37, and since these elements are utilized primarily for the purpose of locking or clamping the concave 15 and its support 24 in various positions of adjustment and for releasing these parts when a new adjustment is to be made, and also because the range of such adjustment is never very extensive, a manually operable pawl arm 50 pivotally attached to a hand lever 51 cooperable with the other pivot shaft 37 may also be provided as shown in Fig. 2, for more rapid rotation of the support 24 and ring nut 26 beyond the range of action of the ram 38 and arm 48. The clamping ring nut 26 is also preferably connected to the frame 6 by means of a telescopic seal surrounding the screw threads 9 as illustrated in Fig. 1 and as shown more in detail in my prior patent above referred to.

When the various parts of the improved gyratory crusher have been constructed and assembled as shown and described, and power is applied to the pulley 32 to rotate the eccentric sleeve 11 through the shaft 31 and gearing 33, 34, the head member 13 will be gyrated while the concave member 15 wil lnormally remain stationary. Material to be crushed may then be admitted to the upper annular inlet opening of the crushing chamber 16 by the hopper 17 and feed plate 18, and as the admitted material advances through the chamber 16 it will be reduced to the desired uniform size and the final product will eventually be delivered by gravity through the lower annular outlet opening of the chamber 16 and through the annular opening in the frame 6 between the central hub 7 and the upright outer wall 8. If uncrushable material is accidentally admitted to the crushing chamber 16 the springs 22 will permit the concave 15 and its flange 21 to move upwardly away from the normally fixed concave support 24 thus enabling the abnormally hard material to pass through the crusher without damaging the structure, and while the head member 13 is positively gyrated relative to the concave 15 it is also freely rotatable within the eccentric bore 12 in either direction.

During such normal operation, the clamping ring nut 26 will be positioned with its upper flat surface 27 in firm clamping engagement with the flange 28 of the concave support 24 so as to lock the concave member

15 to the frame wall 8 and to prevent movement of the support 24 relative to the frame 6 and head member 13. The crusher will then produce crushed material of uniform size until considerable wear on the crushing surfaces of the head and concave members has resulted from continued operation. When such excessive wear has occurred, or when it is desired to vary the size of the final product, the ring nut 26 must first be released from clamping position before the concave member 15 and its support 24 can be adjusted. Such release may be readily effected by utilizing one lug 49 of the holding arm 48 to positively prevent rotation of the support 24 relative to the frame wall 8, and by operating the ram 38 to cause its shoe 46 to rotate the ring nut 26 in a clockwise direction as viewed in Fig. 2, assuming the screw threads 9, 25 to be right hand threads. After the clamping nut 26 has been thus released, the holding arm 48 should be swung out of holding position, and the hand lever 51 and pawl 50 may thereafter be employed to rotate the concave support 24 and to move the concave member 15 into the desired new position of adjustment.

When such newly adjusted position of the concave support 24 has been effected, the ring nut 26 should again be returned to clamping position, and this may be done by swinging the holding arm 48 about its pivot shaft 37 into the position shown in Fig. 3, whereupon the opposite lug 49 of this arm will again engage the adjacent tooth 29 of the support 24 to positively prevent rotation of the concave member 15 relative to the frame 6. The ram 38 should also be swung about its pivot shaft 37 and the shoe 46 should be applied to a tooth 30 of the clamping ring nut 26, as in Fig. 3, whereupon the ram 38 may be operated to rotate the ring nut in a counterclockwise direction as viewed in Fig. 3 until the flat surface 27 of the nut again clampingly engages the flange 28 of the support 24. The manually operable pawl 50 if used, may of course be released whenever the holding arm 48 is in effective position, and the pawl 50 or any other suitable device, may be utilized to rapidly rotate both the support 24 and the ring nut 26 after the latter has been released from clamping engagement with the concave; but it is important both when effecting clamping and when releasing the clamping action, that the support 24 be positively held against rotation while the power device or hydraulic ram 38 is forcibly rotating the nut 26 in order to prevent the support and the nut from rotating in unison whenever the nut is being rotated by the ram.

It is also to be noted that when a powerful device as a hydraulic ram 38 is employed to drive the ring nut 26 into locking position, a heavy lateral pressure is exerted against the pivot shaft 37, but this pressure is counterbalanced and the shaft 37 is reinforced by the holding arm 48 which is subjected to tension forces. While the use of the manually operable pawl 50 may be desirable when utilizing certain kinds of screw threads 9, 25, it has also been found that when buttress type screw threads such as shown in Fig. 1 are utilized, the support 24 and the nut 26 may be readily rotated with the aid of an ordinary spanner wrench after the nut 26 has been released from clamping position. Then too, it is only necessary to have the concave member 15 formed as a part separate from its support 24 in cases where the safety release springs 22 are employed, so that for all intents and purposes of this invention these elements may be treated as a single concave unit. The ram 38, holding arm 48, and the hand lever 51 may also be interchangeably applied to pivot shafts associated with any of the four holes in the bosses 38 of the frame 6.

From the foregoing detailed description of a typical gyratory crusher installation, it should be apparent that the present invention in fact provides simple and readily manipulable mechanism for effectively preventing the concave member 15 of the crusher from rotating and becoming displaced from a desired position of adjustment whenever the clamping ring nut 26 is being driven home or

released. The improved ram structure while being capable of exerting a powerful force against the clamping ring 26, is subjected to effective resistance by the holding arm 48 capable of counter-acting this force, thereby protecting the common pivot shaft 37 of the ram 38 and arm 48 from possible distortion. Any suitable type of ram 38 may be utilized to actuate the clamping ring nut 26 and the arcuate shoe 46 is preferably formed of sufficient length so that it will contact several teeth 30 simultaneously; and by mounting the ram 38 and the arm 48 as illustrated so as to swing to either side of the common pivot shaft 37, these elements may be utilized to both clamp and to release the ring nut 26. The invention has proven highly satisfactory and successful in actual commercial use, and makes it possible to positively clamp the concave member 15 in various positions of adjustment while still permitting rapid and effective release of the clamping effect.

It should be understood that it is not desired to limit the invention to the exact details of construction and operation of the type of gyratory crusher specifically shown and described herein, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. In a gyratory crusher, a frame having an annular wall provided with screw threads, a concave having screw threads cooperable with said frame threads to effect adjustment of the concave relative to the frame, a lock nut having screw threads also cooperable with said frame threads and being engageable with said concave to lock the latter in various positions of adjustment, means coacting with a fixed part of the crusher for rotating said nut, and means also coacting with a fixed part of the crusher for positively preventing rotation of said concave while said nut is being driven into locking engagement therewith.

2. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a concave having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the frame, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave to lock the latter in various positions of adjustment, means coacting with said frame for rotating said nut, and means also coacting with said frame for positively preventing rotation of said concave while said nut is being driven into locking engagement therewith.

3. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a concave support having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the frame, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave support to lock the latter in various positions of adjustment, means reacting against a fixed part of said frame for effecting rotation of said nut in opposite directions, and other means coacting with a fixed part of said frame for positively preventing rotation of said concave support while said nut is either being driven into locking engagement with the support or is being released from such engagement.

4. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a concave support having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the frame, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave support to lock the latter in various positions of adjustment, a hydraulic ram mounted upon a fixed part of said frame for effecting rotation of said nut in opposite directions, and means carried by said frame for positively prevent-

ing rotation of said concave support while said nut is being rotated to lock and to release the support.

5. In a gyratory crusher, a frame having an annular wall provided with screw threads, a crushing head gyratable within said frame, a crushing concave cooperating with said head to form a crushing chamber and having screw threads cooperable with said frame threads to effect adjustment of the concave relative to the head, a lock nut having screw threads also cooperable with said frame threads and being engageable with said concave to firmly clamp the latter in various positions of adjustment, means mounted upon said frame for rotating said nut, and other means also mounted upon said frame for positively preventing rotation of said concave while said nut is being driven into locking engagement therewith.

6. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a crushing head gyratable within said frame, a crushing concave cooperating with said head to form a crushing chamber and having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the head, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave to lock the latter in various positions of adjustment, means pivotally suspended from said frame for rotating said nut, and other means also pivotally suspended from said frame for positively preventing rotation of said concave while said nut is being driven into locking engagement therewith and is being released from such engagement.

7. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a crushing head gyratable within said frame, a crushing concave cooperating with said head to form a crushing chamber and having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the head, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave to lock the latter in various positions of adjustment, means for rotating said concave for adjustment purposes, means carried by said frame for effecting rotation of said nut in opposite directions, and other means also carried by said frame for positively preventing rotation of said concave while said nut is either being driven into locking engagement therewith or is being released from such engagement.

8. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a crushing head gyratable within said frame, a concave cooperating with said head to form a crushing chamber and having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the frame, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave to lock the latter in various positions of adjustment, a hydraulic ram for effecting rotation of said nut in opposite directions, an arm for positively preventing rotatation of said concave support while said nut is being rotated to lock and to release the support, and a common pivot fixedly mounted upon said frame swingably supporting said ram and said arm.

9. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a crushing concave support having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the frame, means for rotating said support for concave adjustment purposes, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave support to lock the latter in various positions of adjustment, means mounted upon said frame for effecting rotation of said nut in opposite directions, and other means also mounted upon said frame for positively preventing rotation of said concave support while said nut is either being driven into locking engagement with the support or is being released from such engagement.

10. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a crushing concave support having internal screw threads cooperable with said external frame threads to effect adjustment of the concave relative to the frame, means for effecting rotation of said support for concave adjustment purposes, a lock nut having internal screw threads also cooperable with said external frame threads and being engageable with said concave support to lock the latter in various positions of adjustment, a hydraulic ram reversibly suspended from said frame for effecting rotation of said nut in opposite directions, and an arm also reversibly suspended from said frame cooperable with said ram to positively prevent rotation of said concave support while said nut is being rotated to lock or to release the support.

11. In a gyratory crusher, a frame having an annular wall provided with screw threads, a concave having an annular series of teeth and also having screw threads cooperable with said frame threads to effect adjustment of the concave relative to the frame, a lock nut having an annular series of teeth and also having screw threads cooperable with said frame threads and being engageable with said concave to lock the latter in various positions of adjustment, a power ram pivotally suspended relative to said frame and being cooperable with the teeth of said nut to rotate the same, and means also pivotally suspended relative to said frame coaxially of said ram suspension and being cooperable with the teeth of said concave to positively prevent rotation of the concave while said nut is being driven into locking engagement therewith.

12. In a gyratory crusher, a frame having an annular wall provided with external screw threads, a concave having internal screw threads rotatably cooperable with said external frame threads to effect adjustment of the concave relative to the frame, a lock nut having an annular series of peripheral teeth and also having internal screw threads cooperable with said external frame threads and being engageable with said concave to lock the latter in various positions of adjustment, a pivot mountable upon said frame at different ltocations relative to said concave and said nut, power means swingably suspended from said pivot for alternately rotating said nut in opposite directions, and holding means also swingably suspended from said pivot and being cooperable with said teeth to positively prevent rotation of said concave while said nut is being driven into locking engagement therewith or released therefrom.

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