Aug. 20, 1968 F. C. ARCHER 3,397,846

HYDRAULIC RELEASE FOR GYRATORY CRUSHERS

Filed Dec. 2, 1966 2 Sheets-Sheet 1

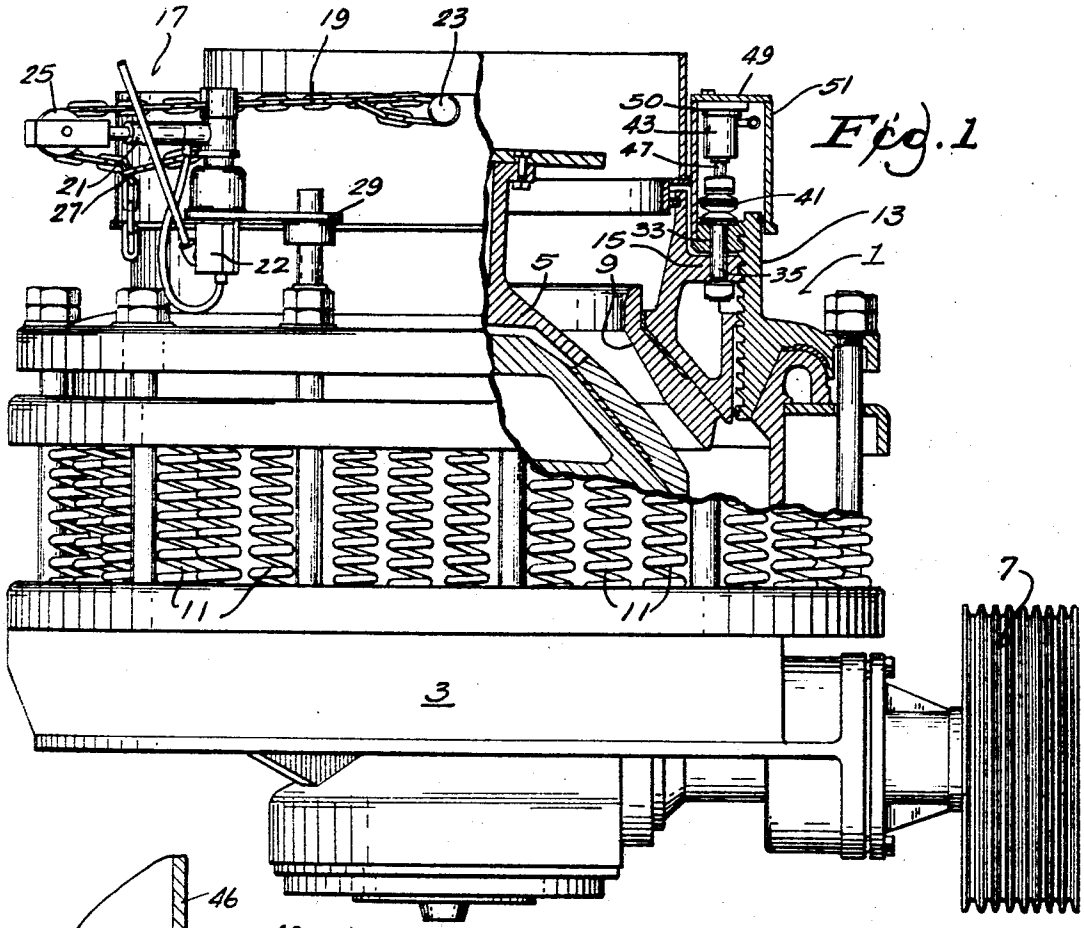


Fig. 1

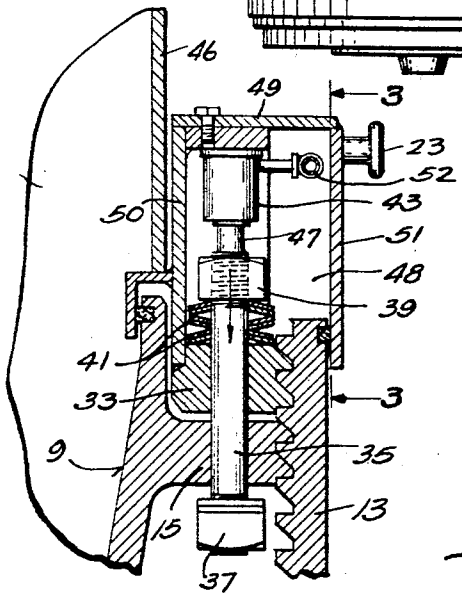


Fig. 2

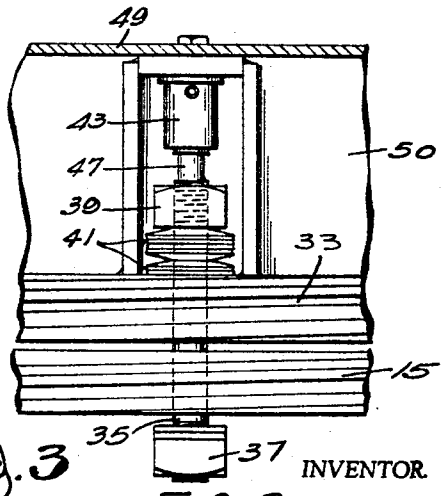


Fig. 3

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Fig. 6

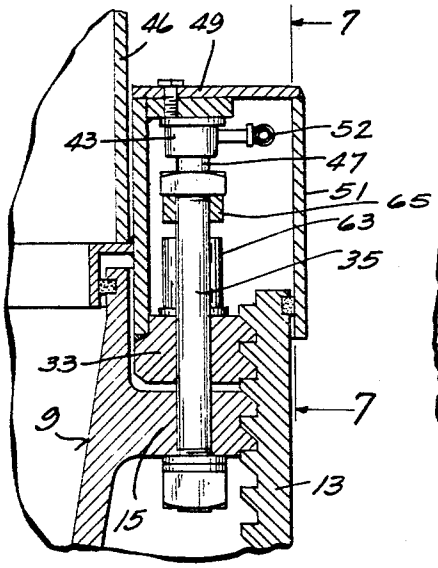


Fig. 7

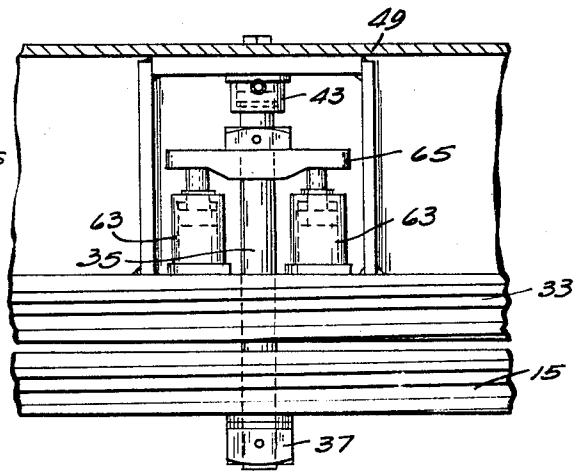


Fig. 5

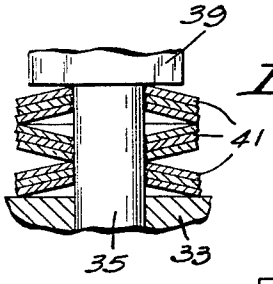
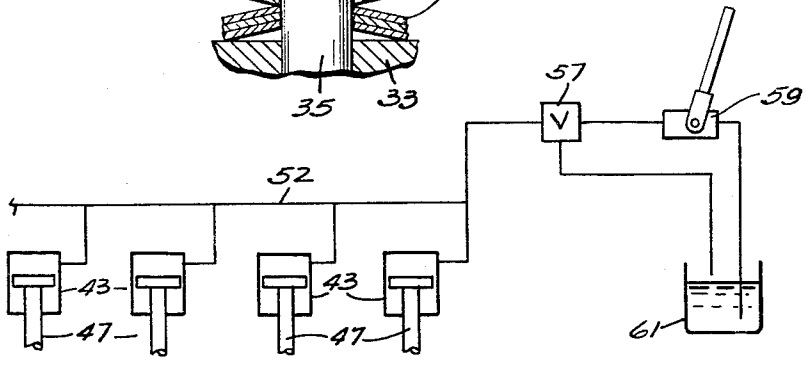


Fig. 4



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HYDRAULIC RELEASE FOR GYRATORY CRUSHERS

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Continuation-in-part of application Ser. No. 378,637, June 29, 1964. This application Dec. 2, 1966, Ser. No. 607,110

12 Claims. (Cl. 241—286)

ABSTRACT OF THE DISCLOSURE

The present invention relates generally to improvements in gyratory crushers, and relates more particularly to an improved mechanism for mechanically clamping the crushing bowl to the frame of the crusher and for hydraulically releasing the clamping action to permit bowl rotation.

Cross-references

This application is a continuation-in-part of United States patent application Ser. No. 378,637, filed June 29, 1964, now abandoned, in the name of Fred Curtis Archer.

Background and prior art

Crushers of the type to which this invention relates are commonly employed to crush rock and ore aggregate to a size suitable for use or further processing. Such crushers employ a rotating crushing head carried by an upright shaft and mounted for movement eccentrically of the axis of rotation so that the head gyrates as it is rotated. A crushing bowl or concave is mounted on the stationary frame of the crusher and surrounds the crushing head. The material to be processed is fed into the bowl, and the crushing action takes place in the crushing zone as formed by the gap between the crushing head and the bowl.

The particle size of the crushed product produced by the crushing action depends on the size of the gap between the bowl and the head, and to vary the particle size, it is necessary to change the dimensions of this gap. One way in which this is commonly accomplished is by adjustably positioning the crushing bowl on the frame of the crusher so that it may be moved in relation to the head. To provide for such adjustment, it has been heretofore proposed to provide the bowl and the stationary crusher frame with coacting screw threads whereby the bowl may be raised or lowered upon rotation thereof relative to the frame.

In crushers of this type, it is also necessary to provide a means for clamping or locking the crushing bowl in adjusted position on the frame in order to prevent creeping and to maintain the crushing gap constant during crushing operations. In addition, it is customary to provide means for releasing the clamp on the bowl to permit readjustments to be effected in the size of the gap. For the purpose of clamping the bowl in its adjusted positions and releasing the same to permit readjustments, various mechanisms have heretofore been proposed, the most common of which employs means for exerting a binding thrust on the threads between the bowl and the crusher frame together with means for releasing such thrust to permit rotation of the bowl whenever it is desired to effect readjustments.

In some instances, the means thus employed for exerting a binding thrust on the threads and for releasing the same has comprised various forms of mechanical jacking devices reacting on the bowl. In other instances, hydraulic or pneumatic pressure has been utilized for such purpose, and in still other cases, fluid pressure has been combined with mechanical means to clamp and release the crusher

bowl. However, all such means as have been heretofore proposed have left something to be desired either from an operational or functional standpoint, or due to space requirements, or because of manufacturing and assembly time and expense, or inaccessibility in the event of malfunction and need for replacement or repair.

Summary

An object of this invention is, therefore, to provide an improved means for mechanically clamping the crushing bowl of a gyratory or cone crusher in adjusted position on the crusher frame for crushing operations and for hydraulically releasing the bowl for permitting readjustments in the position of the bowl and which obviates the aforesaid disadvantages of prior devices.

Another object of the invention is to provide an improved mechanical crusher bowl clamp and hydraulic release device which is extremely simple and compact and which is moreover conveniently located for ready access for assembly, repair, and replacement.

Still another object of the present invention is to provide an improved spring clamp and hydraulic release mechanism for gyratory crusher bowls which is readily interchangeable with existing mechanical devices for performing similar functions, the entire mechanism being protectively confined within an annular cap and being located entirely above the locking ring for the bowl.

A further object of the invention is to provide an improved crusher bowl clamping and release means which is mechanically actuated to effective clamping condition and which employs hydraulic means for releasing the clamping action, the mechanical clamping and hydraulic release mechanism being so located and positioned as to be readily accessible without need for dismantling or otherwise disturbing any of the principal crusher parts such as the bowl, locking ring, adjustment ring, and either the stationary main frame or the upper frame.

The invention is characterized by the provision of a plurality of spaced rods or bolts extending through the clamping member or so-called lock nut and a flange formed integral with the threaded bowl or concave, spring means compressed between the clamping member and a head on the adjacent end of each rod to transmit the forces of the spring means directly to the bowl through the rods for urging the bowl threads into clamping relation with the threads of the bowl supporting member or adjustment ring, and hydraulic means carried by the clamping member and operable directly on each of said adjacent rod ends to further compress the spring means and release the crushing bowl for adjustment.

These and other objects and advantages of the invention will become apparent from the following detailed description.

Drawings

A clear conception of the features constituting the present improvements, and of the construction and operation of typical crusher bowl clamping and release mechanisms embodying the invention, may be had by referring to the accompanying drawings forming part of this specification wherein like reference characters designate the same or similar parts in the several views.

FIGURE 1 is a partially sectionalized view of a crusher embodying this invention;

FIGURE 2 is a fragmentary sectional view of the crushing bowl clamping means;

FIGURE 3 is a section along line 3—3 of FIGURE 2;

FIGURE 4 is a digrammatic view of a typical hydraulic system employed in the invention;

FIGURE 5 is a fragmentary section illustrating a modification of the embodiment of the invention shown in FIGURES 2 and 3;

FIGURE 6 is a fragmentary section similar to FIGURE 2 but showing another embodiment of the invention; and

FIGURE 7 is a section along line 7—7 of FIGURE 6.

Detailed description

Referring now to FIGURE 1, the numeral **1** indicates a typical gyratory or cone crusher employing the present invention. The numeral **3** indicates the stationary main frame or base of gyratory crusher **1**. The gyrating crushing head **5** is mounted within the frame **3** and gyrates about a vertical axis. Crushing head **5** is driven in a customary manner as by a motor and belt drive (not shown) connected to grooved pulley **7**. A crushing bowl or concave **9** is also mounted in frame **3** and forms the other crushing surface of the crusher **1**. The crushing takes place in the gap or space between crushing head **5** and crushing bowl **9**. Relief springs **11** are mounted between a floating reaction ring and an adjustment ring or support **13** seated on the frame **3** to provide protection to the crushing surfaces of head **5** and bowl **9** should uncrushable matter, such as scrap iron, enter the crushing gap. Relief springs **11** permit the adjustment ring **13** and crushing bowl **9** to rise under these conditions, expanding the gap and allowing the uncrushable material to pass through.

As previously mentioned, the particle size of the crushed material produced by crusher **1** is determined by the size of the crushing gap between the crushing head **5** and crushing bowl **9**. If it is desired to change particle size it is necessary to change the dimensions of the crushing gap. This is done by raising or lowering the crushing bowl **9** on the crusher frame **3** relative to the crushing head **5**. In the typical crusher illustrated, the means provided for raising and lowering the crushing bowl **9** includes the threaded adjusting ring **13** non-rotatably mounted on frame **3**. In turn, the crushing bowl **9** has a threaded flange **15** which has screw-threaded engagement with the adjusting ring **13**. Rotating the crushing bowl **9** thereby causes flange **15** to follow the helix of the threads of the adjusting ring **13**, thus raising or lowering the bowl.

Numerous means may be employed to rotate the crushing bowl **9** to adjust the crushing gap. By way of example, the crusher **1** as shown in FIGURE 1 employs a chain and hydraulic ram mechanism **17** to obtain the required rotation. This mechanism consists of a chain or cable **19**, one end of which is fastened to a lug **23** on the crushing bowl **9**. The chain is passed about a pulley **25** on the end of hydraulic ram **21**. In the illustration, the other end of chain **19** is held by a hook **27** or the like. To rotate crushing bowl **9**, hydraulic ram **21** is extended by hydraulic pressure produced by a pump **22** or the like, thus pulling chain **19** and lug **23** to the left, as viewed in FIGURE 1. This moves crushing bowl **9** in the same direction. The ram and chain mechanism is pivotally mounted on support **29** allowing it to be moved to either side of the support to rotate the crushing bowl **9** in the desired direction.

To provide satisfactory crushing operation, crushing bowl **9** must be firmly clamped on frame **3** during crushing, i.e., the threaded flange **15** on bowl **9** must be retained in the selected position of adjustment along the thread of adjusting ring **13**. During adjustment of the crushing gap to change particle size, however, the crushing bowl **9** must be released from frame **3** and adjustment ring **13** so that the bowl may be rotated and moved up or down along the threaded ring **13**.

As shown and described in United States Patent No. 2,881,981, dated Apr. 14, 1959, to Harvey H. Rumpel, a threaded clamping or locking ring **33** is employed for the purpose of clamping the bowl in adjusted position and releasing the same to permit readjustment. This ring **33** is located above the flange **15** of the bowl **9** and likewise has threaded engagement with the adjustment ring **13**. The clamping ring **33** is keyed to the bowl **9** for rotation therewith by means of an annular series of rods or bolts **35**, and the ring **33** and bowl **9** are free to rotate along the threads of the adjustment ring **13** as long as no axial clamping pressure is imposed between ring **33** and bowl flange **15** by the rods **35**. However, to clamp the bowl **9** in adjusted position, an axial force is placed on each of the rods **35** and is transmitted through the ring **33** to the flange **15** of the bowl **9** to thereby bind the coacting threads of the bowl flange **15** and the adjustment ring **13**.

In accordance with the present invention, each of the rods **35** is provided with heads **37**, **39** which form abutment means at the opposite ends thereof, at least one of these heads being adjustable. A plurality of conical spring washers **41**, commonly referred to as Belleville springs, are stacked about each of the rods **35** at the upper end thereof between the head **39** and the upper surface of the clamping ring **33**. These conical spring washers **41** are placed under predetermined compression, and the lower head **37** of each rod **35** accordingly reacts against the adjacent surface of the bowl flange **15** to bind or wedge the threads thereof against the coacting threads of the adjustment ring **13**. Accordingly, with the adjustment ring **13** non-rotatably keyed to the stationary main frame **3**, the bowl **9** is effectively clamped against rotation by the binding or wedging action imposed on the threads.

To provide for the release of the bowl to permit readjustments to be effected, hydraulic power devices **43**, **47** are utilized. As shown, the clamping ring **33** is formed with an integral cap providing an annular chamber **48**, the cap being suitably formed as by means of plates **49**, **50** and **51** rigidly secured together and to the ring **33**. This cap contains the lugs **23**, and the chamber **48** formed thereby serves to house the bowl clamping and adjustment mechanism. Each of the hydraulic cylinders **43** is mounted on the top plate **49** directly above the respective rods or bolts **35** with the piston **47** of each power device adapted to engage the upper end of the corresponding rod **35**. Thus, with the hydraulic devices deenergized, the springs **41** provide their bowl clamping action as aforesaid, but when the cylinders **43** are supplied with fluid under pressure from the manifold **52**, the pistons **47** act downwardly to further compress the springs **41** and depress the rods **35** as indicated by the arrow in FIGURE 2.

Thus, to release or unlock crushing bowl **9** from the threaded adjusting ring **13** to change the size of the crushing gap, each hydraulic cylinder **43** is supplied with sufficient hydraulic pressure through manifold **52** to force piston **47** and the associated rod or bolt **35** downwardly. The downward motion of bolts **35** overcomes the clamping force of Belleville springs **41** by further compressing the same against the clamping ring **33**, and such action releases the crushing bowl **9** for adjustment along the adjusting ring **13**. When released, crushing bowl **9** may be moved to a new position by the ram and chain mechanism **17** or by other suitable means. When the new position is obtained, the hydraulic pressure is removed from hydraulic cylinders **43** and the Belleville springs **41** once again act on bolts **35** to urge the threaded bowl flange **15** toward the clamping ring **33** to clamp crushing bowl **9** in the new position on adjusting ring **13**.

The hydraulic system employed to release crushing bowl **9** from adjusting ring **13** is shown in FIGURE 4. Reservoir **61** provides hydraulic fluid to a pump **59**. Pump **59** is activated to supply hydraulic pressure through a three-way valve **57** and manifold **52** to hydraulic cylinders **43** when it is desired to release the crushing bowl. The increased hydraulic pressure moves pistons **47** downward, as shown in FIGURE 2, overcoming the action of the Belleville springs **41** on bolts **35** and releasing crushing bowl **9** from the adjusting ring **13**. It will be apparent from the foregoing disclosure that any number of Belleville springs other than the number shown in FIGURES 2 and 3 may be employed to most effectively clamp the crushing bowl **9** on adjusting ring **13** (see FIGURE 5).

Another embodiment of this invention is shown in FIGURES 6 and 7. This embodiment employs compressible liquid cylinders **63** as the spring means in place of Belleville springs **41**. Two such cylinders are employed, and the counteracting force of hydraulic cylinder **43**, necessary to release the crushing bowl **9** from adjusting ring **13**, is applied to cylinders **63** as by means of cross heads **65**. The clamping and release of the crushing bowl in this embodiment is the same as hereinabove described, and additional modifications and embodiments of the invention will become apparent to those skilled in the art.

It is apparent from the foregoing that the adjustment ring **13** provides a threaded support on the frame **3** for receiving the threads of the flange **15** of the crushing bowl **9** to permit adjustment of the bowl when the clamping pressure of the springs **41** is overcome or released by the hydraulic power devices. In normal operation of the crusher, the spring means **41** or **63**, as the case may be, coact with the rods **35** and the ring **33** to urge the threaded bowl flange **15** into clamping relation with the thread of the support **13**, and the fluid actuated means **43**, **47** carried by the clamping ring cover are operable directly on the rods **35** to overcome the clamping action of the spring means in order to release the crushing bowl **9** for adjustment along the threaded support **13**.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter that is regarded as the invention.

I claim:

1. In a crusher having a frame, a gyrating crushing head mounted in said frame, a crushing bowl mounted on said frame and cooperable with said crushing head to form a crushing zone, and means to effect adjustments in the position of said crushing bowl relative to said crushing head to vary the size of the crushing zone; a threaded support on the frame, a threaded flange on the crushing bowl engaging said threaded support for adjustably positioning said bowl, a clamping ring engaging said threaded support adjacent said bowl flange, a series of rods extending through said clamping ring and said bowl flange, each of said rods being provided with abutment means at the opposite ends thereof, spring means seated on said clamping ring and coacting with said rods through said abutment means to normally urge said threaded bowl flange into clamping relation with the thread of said support, and fluid actuated means carried by said clamping ring and operable upon energization thereof directly on said rods for overcoming the clamping action of said spring means to release the crushing bowl for adjustment along said threaded support.

2. A crusher according to claim **1**, wherein the spring means for normally urging the threaded bowl flange into clamping relation with the thread of the support comprises a plurality of conical spring washers stacked about each rod between the clamping ring and the adjacent abutment means.

3. A crusher according to claim **2**, wherein the conical spring washers are normally compressed between the clamping ring and the adjacent abutment means, said abutment means being adjustable axially along its respective rod.

4. A crusher according to claim **1**, wherein the spring means for normally urging the threaded bowl flange into clamping relation with the thread of the support comprises compressible liquid cylinders coacting with each rod between the clamping ring and the adjacent abutment means.

5. A crusher according to claim **1**, wherein the spring means for normally urging the threaded bowl flange into clamping relation with the thread of the support are normally compressed between the abutment means on one end of each rod and the adjacent surface of the clamping ring, and the fluid actuated means are operable on the rods to further compress the spring means and release the crushing bowl for adjustment.

6. A crusher according to claim **1**, wherein the fluid actuated bowl release means comprises a plurality of hydraulic cylinder and piston units each operable on one of the rods and connected to a common source of pressurized fluid for simultaneous operation.

7. A crusher according to claim **1**, wherein the clamping ring is provided with an annular cap removably secured thereto and forming a chamber within which all of the spring means and the fluid actuated release means are housed.

8. A crusher according to claim **7**, wherein the fluid actuated release means comprises a plurality of hydraulic cylinders mounted within the annular cap and each having a piston extendable against the adjacent end of one of the rods.

9. A crusher according to claim **1**, wherein the rods are threaded and the abutment means consist of threaded nuts adjustable therealong for varying the clamping force exerted by the spring means.

10. A crusher according to claim **1**, wherein the clamping ring has threaded coaction with the support above the bowl flange and the spring clamping means and fluid actuated bowl release means are all positioned above the clamping ring.

11. A crusher according to claim **4**, wherein the compressible liquid cylinders are mounted on the clamping ring adjacent each of the rods and cross heads are mounted on the rods and engage the adjacent compressible liquid cylinders with the fluid actuated means being operable on said cross heads to overcome the force of the liquid cylinders to release the crushing bowl for adjustment.

12. In a crusher having a frame, a gyrating crushing head mounted in said frame, a concave crushing bowl adjustably positioned on said frame to form a crushing gap with the crushing head, and means to position said crushing bowl; means to clamp the crushing bowl to the frame for crushing operations and release it for adjustment comprising: a threaded adjusting ring mounted on the frame; a threaded flange on the crushing bowl engaging the adjusting ring for positioning the crushing bowl; an annular clamping member on the crushing bowl adjacent said threaded flange and engaging the adjusting ring; a plurality of bolts extending through the clamping member and the threaded flange; spring means seated on the clamping member and coacting with the bolts for urging the threaded flange and the clamping member into clamping relation with the threads of said adjusting ring; hydraulic means carried by said clamping member and operable directly on the bolts to overcome the spring means to release the crushing bowl for adjustment.

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