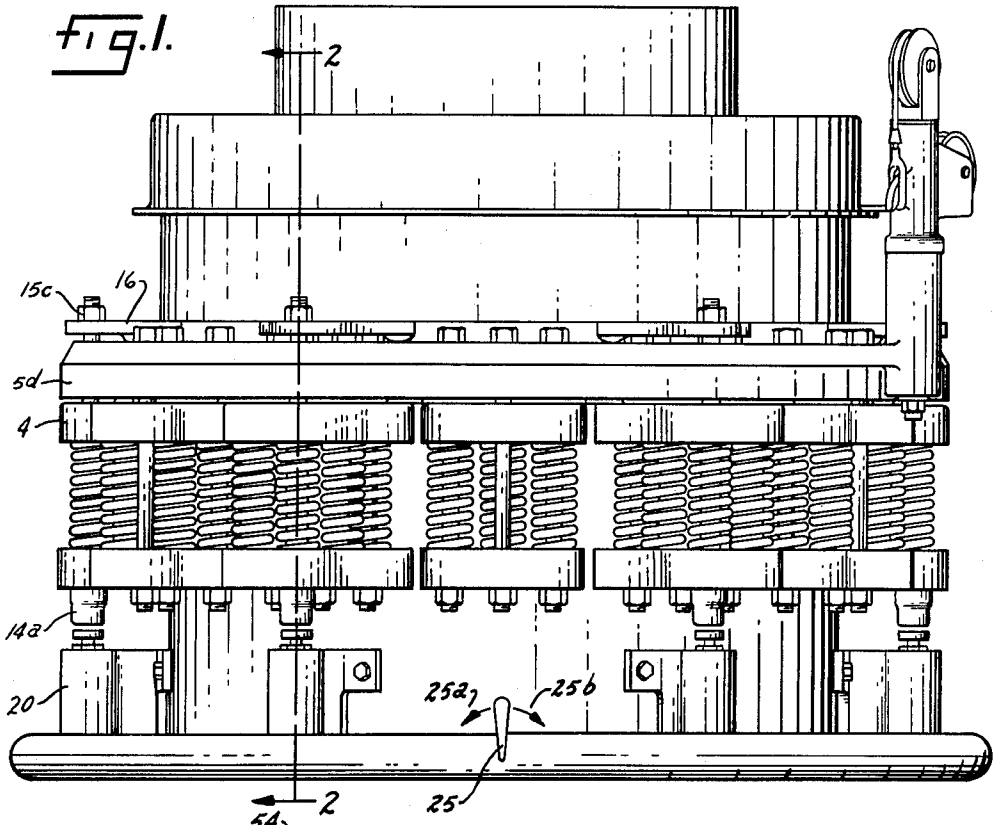
Feb. 6, 1962 L. G. SYMONS 3,019,994

HYDRAULIC BOWL RELEASE FOR CONE CRUSHERS

Filed Oct. 16, 1957 2 Sheets-Sheet 1

Fig. 1.



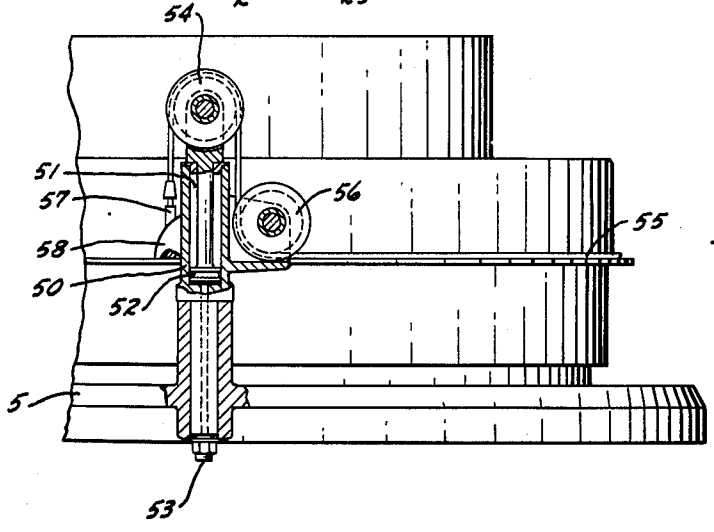


Fig. 4.

INVENTOR.
LOREN G. SYMONS,
BY
Parker and Carter
ATTORNEYS.

Feb. 6, 1962 L. G. SYMONS 3,019,994

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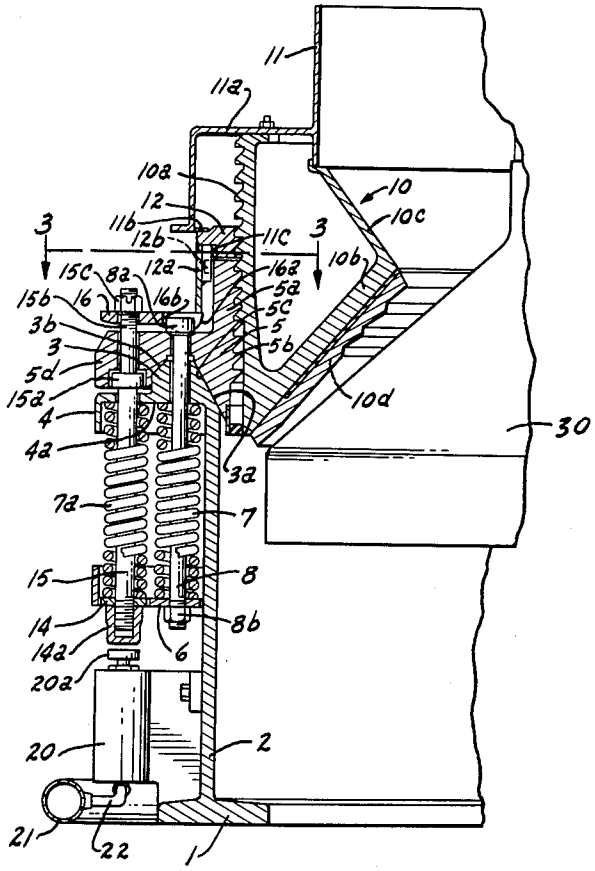


Fig. 2.

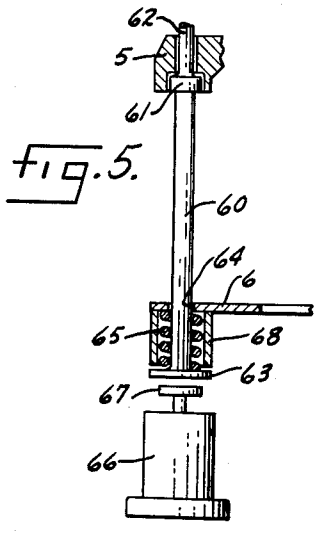


Fig. 5.

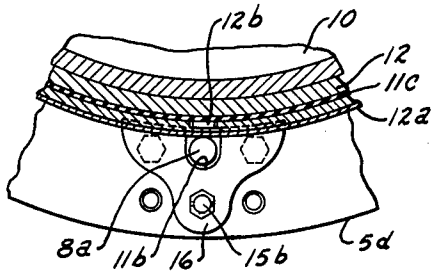


Fig. 3.

INVENTOR.
LOREN G. SYMONS,
BY
Parker and Carter
ATTORNEYS.

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3,019,994

HYDRAULIC BOWL RELEASE FOR CONE CRUSHERS

Loren G. Symons, North Hollywood, Calif., assignor to Nordberg Manufacturing Company, Milwaukee, Wis., a corporation of Wisconsin

Filed Oct. 16, 1957, Ser. No. 690,458
3 Claims. (Cl. 241—290)

The present invention relates to an improvement in cone crusher adjusting and release means, and has for one purpose to provide improved and quickly releasable and yieldable locking means for locking the bowl of a cone crusher against unintended movement in relation to the bowl supporting ring.

Another purpose is to provide means for quickly releasing such locking means and for thereby permitting quick adjustment of the bowl and ring.

Another purpose is to provide improved means for adjusting the bowl of a cone crusher in circumstances where the bowl is in screw-threaded relation to a bowl support by rotating the bowl in relation to the support.

Another purpose is to provide improved releasing means for moving the bowl of a cone crusher when uncrushable material is wedged between bowl and head.

Another purpose is to provide improved control means for controlling the bowl adjusting and bowl releasing means.

Other purposes will appear from time to time in the course of the specification and claims.

I illustrate the invention more or less diagrammatically in the accompanying drawings wherein:

FIGURE 1 is a side elevation of a typical cone crusher;

FIGURE 2 is a vertical radial section, on an enlarged scale, on the line 2—2 of FIGURE 1;

FIGURE 3 is a partial section, with parts broken away, on the line 3—3 of FIGURE 2;

FIGURE 4 is a side elevation on the same scale as FIGURE 2, with parts broken away and parts in section, illustrating another feature of my invention; and

FIGURE 5 is a more or less diagrammatic illustration of a varying structure.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, **1** generally illustrates the base flange of the circumferential crusher frame **2**. The crusher frame terminates at its upper edge in a flange **3** having outwardly extending aprons **4**. The flange **3** has an inner, upwardly conic surface **3***a* and an outer, generally conic surface **3***b*. Conforming to and centered on and normally in fixed relation to the flange **3** is the bowl ring or support **5**. This support has an inner component **5***a* which is inwardly screw-threaded as at **5***b*. It extends outwardly and has a circumferential channel, generally indicated as **5***c*, having portions conforming to the conic faces **3***a* and **3***b* of the main frame flange. The ring has also an outward extension or extensions, as at **5***d*.

In the form of crusher herein shown, the bowl ring **5** is normally held downwardly against the main frame flange **3** by a plurality of springs arranged in clusters. The upper ends of the springs of a particular cluster are positioned within the apron **4** on the flange **3** and abut against the flat lower surface **4***a* of the main frame flange **3**. A lower movable abutment for the spring cluster is indicated at **6**. Compressed between the abutment **6** and the lower main frame flange surface **4***a* are a plurality of springs **7**. One spring, indicated at **7***a*, operates somewhat differently from the remaining springs **7** of the cluster, as will later be seen. Extending through some or all of the springs **7** are spring bolts **8** which may be headed at the top, as at **8***a*, and which may have securing

nuts or other suitable adjustable abutments **8***b* at their lower end. By adjustment of the nuts **8***b*, the compression of the springs **7** may be adjusted. Since the bolts extend through suitable apertures in the main frame flange **3** and in the bowl supporting or adjusting ring **5**, with the heads **8***a* abutting against the top of the bowl supporting or adjusting ring, the springs **7** are effective normally, through the abutment **6** and the bolts **8**, to hold the ring **5** firmly downwardly against the main frame flange **3** in the position in which the parts are shown in FIGURE 2.

The bowl structure proper is generally indicated at **10**. It includes an outer, outwardly screw-threaded cylindrical portion **10***a* which is in screw-threaded relation with the portion **5***a* of the adjusting ring **5**. It is shown as having an upwardly and inwardly conic portion **10***b* which may receive a bowl liner **10***d* and an upwardly and outwardly conic portion **10***c*, upon which any suitable hopper or material guide **11** may be positioned. In order to lock the adjusting ring **5** and the bowl **10** against unintended relative rotation, I provide a threaded locking ring **12**, shown as having a downwardly extending skirt **12***a*. To prevent rotation of the locking ring **12** relative to the adjusting ring **5**, they may be keyed together as at **12***b*. The connection between the threads may be protected in any suitable way, for example, by the outwardly and downwardly extending hood **11***a* which may wipe across any suitable oil seal **11***b* on the locking ring **12** and a seal **11***c* between the locking ring **12** and the adjusting ring **5**. In order to lock the locking ring in place, and to prevent undesired relative rotation of the members **5** and **10**, I find it advantageous to employ the individual springs **7***a*. I may, for example, employ one spring in each cluster, or I may employ springs in some clusters while omitting such springs in others, depending upon the required locking pressure.

Taking the cluster shown in vertical section in FIGURE 2 as typical, it will be noted that the spring **7***a* has a separate washer **14** at its lower end and a separate adjustment or adjusting nut **14***a*. The abutment **6** is apertured or cut away to permit this. The spring bolt **15** of the spring **7***a* has the washer **14** adjustably secured by the adjusting nut **14***a*. The bolt **15** is shown as having an enlargement **15***a* which enters an appropriate cavity in the lower part of the main frame flange portion **5***d*. The parts are so proportioned that a slight upward travel of the spring bolt **15** is permitted before the enlargement **15***a* contacts the upper end of the cavity in the portion **5***d* in which it is positioned. Thus, a slight upward movement of the spring bolt **15** is permitted, without any movement of the adjusting ring **5**. I employ this slight upward movement to permit or effect a release of the locking ring **12**. The locking ring is normally urged upwardly by locking levers **16**, of which the lever shown in FIGURE 2 is typical. These levers may be fulcrumed on heads **16***a* at or adjacent their inner ends which are notched at **16***b* to straddle the heads **8***a* of spring bolts **8**. The short end of the lever abuts the bottom of the apron **12***a* of the locking ring **12**. The outer portion of the lever **16** is shown as apertured to permit the passage therethrough of an upward extension **15***b* of the spring bolt **15**. The nut **15***c*, when the spring **7***a* and the spring bolt **15** are in the position in which they are shown in FIGURE 2, operates to exert a downward pressure on the outer end of the locking lever **16**, which exercises a corresponding upward thrust against the apron **12***a* of the screw-threaded locking ring **12**. To increase the length of the lever, it may be inclined to the radial. It will be understood, of course, that a sufficient number of the spring bolts **15** and their associated springs **7***a* are freed from the normal clusters to exercise an adequate upward locking thrust against the locking ring **12**.

When it is desired to adjust the crusher by imparting a rotation of the bowl **10** in relation to the adjusting ring **5**, I provide means for lifting the spring bolts **15** a sufficient distance to free the locking pressure of the locking ring **12**. A slight travel is sufficient, and this travel may be obtained, for example, by the use of hydraulic jacks such as are shown at **20** in FIGURE 2. There will preferably be an individual hydraulic jack for each of the spring bolts **15**, each jack constituting thereby a release for one of the locking levers **16**. The details of the jacks do not of themselves form part of the present invention. It will be understood, however, that they may be connected by any suitable manifold **21** to which the interior of each jack is connected by any suitable passage **22**. I prefer to employ conventional spring return jacks so that when hydraulic pressure is admitted to the interior of the jack, its piston **20***a* rises, the spring being effective to depress the piston **20***a* when hydraulic pressure is released.

It is thought not necessary to show the hydraulic system in detail. I illustrate, however, in diagrammatic form, a valve control lever **25** which, when moved in one direction or to one position, permits only sufficient pressure to build up in the jacks to raise the spring bolts **15** a distance effective merely to release the lever **16**. I may, for example, employ any suitable by-pass valving so that the only possible result of moving the lever **25** in the direction **25***a* would be to elevate the spring bolts **15** as far as they are permitted to rise without lifting the bowl adjusting ring **5**. On the other hand, when the lever **25** is moved in the direction **25***b* or to a different position, it will be understood that the valving is effective to permit sufficient pressure to build up in the jacks to elevate the adjustment ring **5** as high as the springs **7** and **7***a* will permit it to rise. I may say that the possible excursion in a known type of cone crusher having a cone with a diameter of 7 feet at the lower edge is of the order of 4½ to 5 inches. However, the particular size of the crusher, or the particular permitted excursion, are not critical. What I wish to be able to do, and can do by the herein described structure, is to employ a set of jacks alternatively to release the locking pressure on the locking ring **12**, or to elevate the bowl adjustment ring **5**. A purpose for elevating the ring **5** is to permit the interior of the crusher to be freed of uncrushable material which has stalled the crusher.

It will be understood that, in the normal use of the device, the crushing head, generally indicated at **30**, is gyrated toward and away from the bowl **10**. The crushing takes place as the result of the gyration of the head within the normally fixed bowl. In the event that uncrushable material, such as a mass of packed particles or a dipper tooth, or some other piece of tramp iron, is in the crushing cavity and does not pass through, the crusher may stall. In such case, with the machine stalled, I may use the jacks **20** to compress the springs **7** as well as **7***a*, and to thereby elevate the adjusting ring **5**. The result is to increase the clearance between the bowl and head. The blocking material then normally passes downwardly from the crushing cavity. When the tramp iron or dipper teeth are involved, and are of too great a size to pass downwardly through the cavity, they can easily be lifted upwardly out of the bowl.

In many crushing operations frequent adjustment is necessary because of the high degree of wear. I illustrate in FIGURE 4 a suitable means for applying hydraulic pressure to impart rotation to the bowl **10** in relation to the adjusting ring **5**. I illustrate, for example, a post **50** positioned on the adjusting ring **5**. I form this post as a jack, with a bore **51** and a piston **52**. Oil entering the bore of the cylinder **51** through the oil connection **53** will raise the piston or plunger, and its plunger sheave, upwardly. An adjusting cable or suitable flexible member **55** passes around the sheave **56** on the adjusting ring, and passes upwardly about the sheave **54** and can be hooked by the eye or ring **57** on the hook **58** fixed in relation to the jack. Thus, as the sheave **54** is elevated, the cable **55** is drawn in about the sheave **56** and it is secured at its opposite end to the bowl structure **10**. Therefore, the result of the upward movement of the sheave **54** is to rotate the bowl **10** in relation to the adjusting ring **5**. This rotation is permitted only when the locking ring **12** has already been moved to the release position by a suitable upward movement of the lower jacks **20**. When the ring has thus been released the upper jack structure above described may be operated to pull in on the cable **55** and thus to rotate the bowl structure **10** to its desired adjustment. It will be understood that I may use one or more such jacks. It will also be understood that I may employ the above described system of FIGURE 4 to rotate the bowl **10** in either direction. I may, for example, have a pair of such jacks with sheaves **56** and hooks **58** on opposite sides of each jack. It will be further understood that when a greater movement than that obtained by the possible elevation of the sheave **54** is desired, the cable ring **57** may be released from the hook **58**, and may be secured to or by any suitable crane or hoist, whereby a greater rotational excursion may be obtained.

In the form of FIGURE 5, I illustrate an alternative application of force. The disclosure can be taken somewhat diagrammatically, with the main frame and top flange omitted, but with a rod element **60** illustrated, which passes upwardly through the bottom of the spring cluster plate or abutment **6**, and passes upwardly through the bowl supporting ring **5** to connect with a leverage which may be as shown in FIGURE 2. I am, therefore, illustrating in FIGURE 5 the material which actually differs from the structure shown in FIGURE 2. The rod **60** resembles the spring bolt **15** of FIGURE 2, in that it has a top enlargement **61** fitting into an appropriately formed apertured in the bottom of the bowl supporting ring **5**, and also has an upward extension **62** which may engage any suitable leverage for applying force to the locking ring **12**, as shown in FIGURE 2. The rod **60** has a bottom plate or abutment **63** which is located substantially below the plate **6**. The rod passes through an appropriate aperture **64**, centrally located in the plate **6**, or so located as to be on the general axis of the combined spring thrust of the cluster of springs taken as a whole. A separate spring **65**, located below the cluster plate or abutment **6**, is compressed between it and the bottom plate **63** of the rod **60**, and normally urges the rod downwardly in such fashion as to deliver, through a suitable leverage, such as is shown in FIGURE 2, a locking up-thrust against the locking ring **12** of FIGURE 2. However, when adjustment or release is necessary, hydraulic pressure is admitted to the jack **66** and urges its operating piston **67** upwardly against the bottom plate or abutment **63** of the rod **60**. The piston **67** urges the rod and the plate **63** upwardly, and the first contact is with a downwardly extending abutment or abutments **68** below the plate **6**. This elevation is sufficient to move the rod **60** upwardly far enough to release the locking ring **12** of FIGURE 2, or its equivalent. The bowl can then be adjusted, as above described. If, however, the hydraulic system is operated to give the maximum upward movement of the jack element **67**, then the second contact takes place between the rod enlargement **61** and the bowl supporting ring **5**, and the jack system is effective to lift the ring **5** to the extent permitted by the full, or substantially full, compression of the springs **7**. FIGURE 5 will, of course, be read as if the springs **7** were in position and were compressed between the plate **6** and the main frame flange **16** of FIGURE 2.

The structure of FIGURE 5 has certain definite advantages. For example, the thrust of each jack is balanced with the thrust of the particular nest of springs with which it is associated. It will be understood, of course, that a suitable number of jacks is positioned around the main frame, there being one for each of

the selected number of spring nests. In some circumstances, in heavy duty crushers, it may be advantageous to have a jack and a push rod **60** for each nest of springs. Under most circumstances, however, this is not necessary.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless, many changes may be made in size, shape, number and disposition of parts without departing from the spirit of my invention. I, therefore, wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic rather than as limiting me to my specific disclosure herein. It will be understood, for example, that whereas I have illustrated a crusher in which the springs are arranged in clusters, my system may be applied equally well to crushers in which the springs are equally distributed in a single tier about the exterior of the main frame. Whereas I illustrate the jacks **20** as below the main frame flange **3**, and, of course, below the adjusting ring **5**, they may be put at any other desired or desirable location. Likewise, whereas I find it advantageous to apply the lifting thrust through the spring bolts **15** to the adjusting ring **5**, by the use of the heads **15***a*, I do not wish to be limited to this specific arrangement.

It will be understood, also, that whereas I find it advantageous to have each of the thrust members **15** or **60** operate initially to release the bowl for adjustment, and to operate thereafter by a longer travel to elevate the bowl, I may segregate the system and have some members operating to release for adjustment and other members operating to release the bowl.

The use and operation of the invention are as follows:

Stated simply, I employ springs to hold a bowl or bowl support against movement in relation to a main frame. I find it desirable normally to rely on these springs. In currently employed cone crushers, such springs are used, and give adequate service. In cone crushers now on the market, adjustments, however, are somewhat lengthy and difficult, and no means are provided for a quick release of a stalled crusher. My invention provides both quick adjustment in normal use and quick release of the crusher, when stalled, by an hydraulic system which normally idles. It operates only when needed. Normally, the springs operate to hold the adjusting ring **5** downwardly against the main frame flange **3**, while permitting the necessary yielding safety release to prevent breakage and to permit occasional overloads to pass through. However, when adjustment is

desired the movement of the lever **25** in the direction **25***a* immediately releases the locking ring **12**. This permits rotation of the bowl **10** in relation to the adjustment ring **5**. If the head is gyrated in the proper direction, the immediate result of such a release of the locking ring **12** is to permit the bowl to rotate in response to the movement of the head and the material compressed therebetween. Otherwise, the structure of FIGURE 4 may be used. As soon as the desired adjustment is reached, the hydraulic jacks **20** are released by a return of the lever **25** to neutral, and the springs **7***a* resume their normal locking thrust of the lever **16** against the locking ring **12**. If desired, additional locking means may be employed, such as any suitable links or connections, not herein shown, between the bowl **10** and the adjusting ring **5**. If desired, the cable **55**, which is normally hydraulically operated to impart a limited rotation of the bowl **10**, may be connected to any other suitable crane or outside source of power in order to impart a movement of greater amplitude.

I claim:

1. For use with a crusher having a gyrated head, a frame, and a bowl structure rotatably adjustable in relation to said frame, hydraulic means for rotatably adjusting said bowl structure in relation to the frame, said hydraulic means including a flexible tension member, means for securing spaced parts of the flexible tension member to the bowl structure and the frame, a contact element about which said flexible tension member passes, and hydraulic means for moving said contact element from a predetermined initial position and for thereby exerting tension on the tension member effective to move the spaced parts of the tension member closer together and thereby to rotate the bowl in relation to the frame.

2. The structure of claim 1 characterized in that the contact element is constituted by a sheave.

3. The structure of claim 1 characterized by the employment as a contact element of a sheave and a hydraulic ram for moving said sheave to exert tension on the flexible tension member.

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