United States Patent

[11] 3,604,640

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[21] Appl. No. **804,100**
[22] Filed **Mar. 4, 1969**
[45] Patented **Sept. 14, 1971**

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[32] Priority **Mar. 8, 1968**
[33] **Great Britain**
[31] **11322/68**

[54] **HYDRAULIC CONTROL FOR GYRATORY CRUSHER**
6 Claims, 2 Drawing Figs.

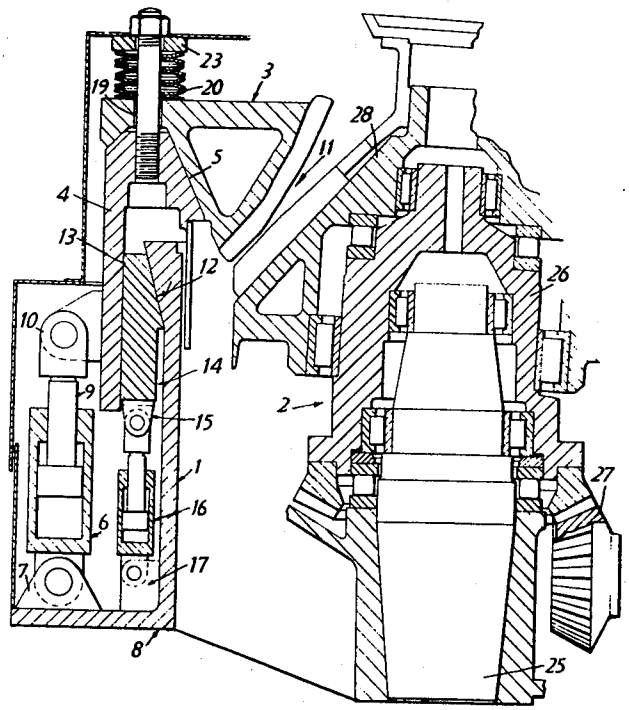
[52] **U.S. Cl.** **241/215,** 241/290
[51] **Int. Cl.** **B02c 2/04**
[50] **Field of Search** 241/207–216, 286, 290, 299; 279/4

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ABSTRACT: A gyratory crushing machine is equipped with hydraulic appliances for lifting and lowering the upper concave bowl relatively to the gyratory head, and thereby adjust the size of the crushing chamber, and for locking and centralizing the bowl in its adjusted position.



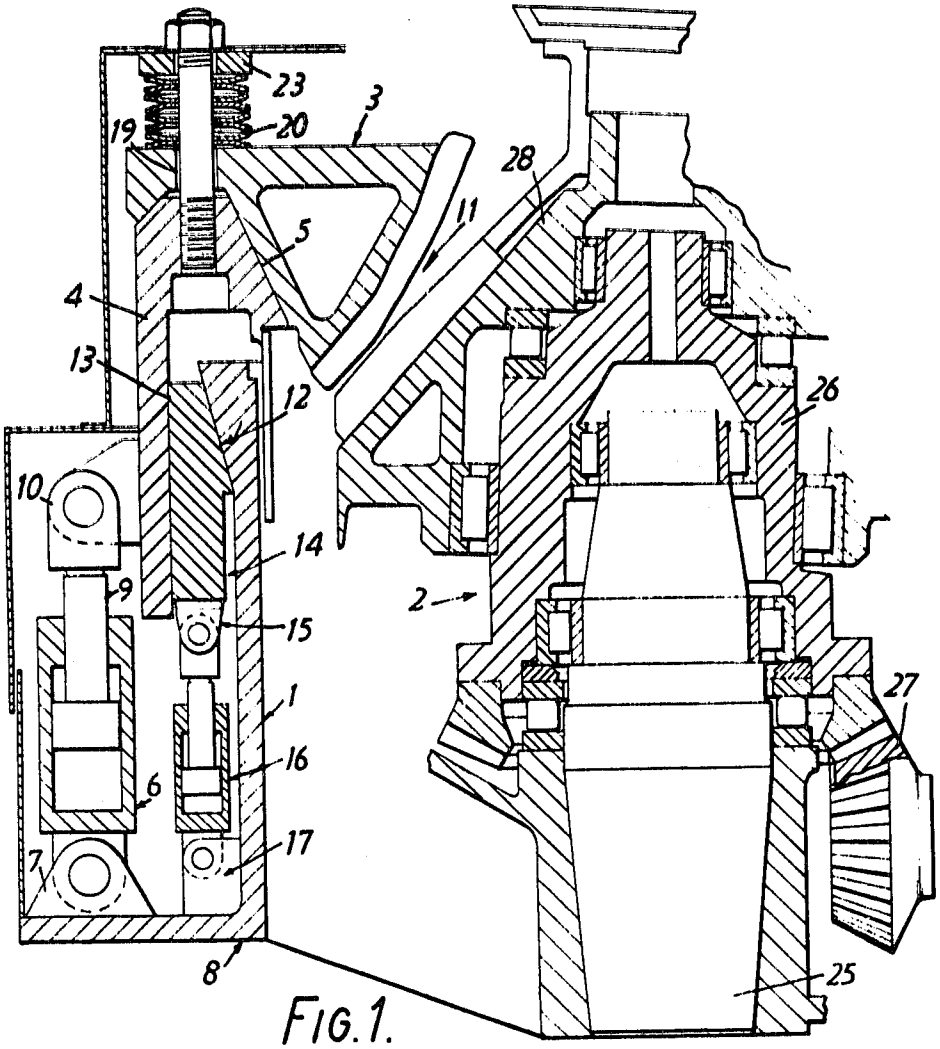


FIG. 1.

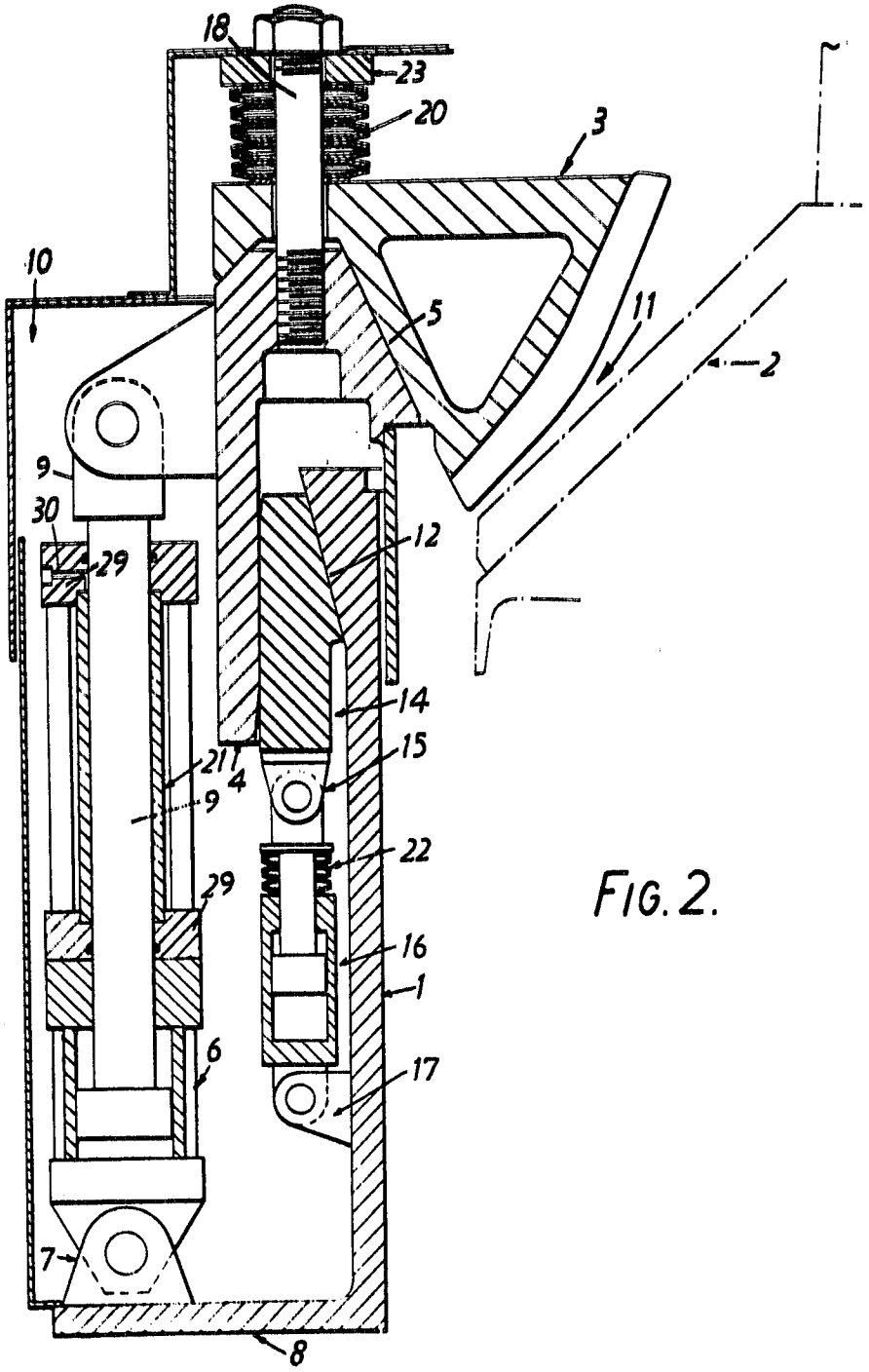


FIG. 2.

HYDRAULIC CONTROL FOR GYRATORY CRUSHER

FIELD OF THE INVENTION

This invention relates to gyratory crushers, that is to say to crushers having a head which gyrates within and below an upper and normally fixed frame (or "concave support bowl") from which it is spaced to define an annular gap (or "crushing chamber") into and through which rock or other material to be treated is passed and crushed between the head and the bowl.

BACKGROUND OF THE INVENTION

The maximum size of the individual pieces of the broken material, i.e. the grade of crushing, is ultimately determined determined by the width of said crushing chamber and provision has to be made for varying this width to cater for changes in product size. Normally this is achieved by the use of a screw-threaded coupling between the structures respectively supporting the crushing head and the bowl, and the turning of one part of this coupling relatively to the other to effect the adjustment. In practice this is a burdensome and laborious procedure, involving as it does the turning of a heavy load in a near horizontal motion which is subject all the time to the restriction imposed by the screw-threaded engagement. The present invention has been devised with the aim of eliminating this shortcoming.

DESCRIPTION OF THE INVENTION

The gyratory crusher devised in accordance with this invention is of the kind set forth above and the bowl is adjustable relatively to the head, to vary the width of the crushing chamber, by operation of a plurality of hydraulic piston/cylinder units connected between said base frame and the bowl, and hydraulically controlled means are provided for locking and centralizing the bowl with respect to the base frame in the adjusted position.

With this arrangement all the operations required in an adjustment procedure, viz unlock, adjust, relock, are carried out under the dictation of hydraulic means. This not only confers the benefit of a powerful operating agency to move the heavy masses involved, but also enables the whole procedure to be remotely controlled, even while the machine is running.

The features of the crusher can be implemented in various ways, some of which will be referred to below. The piston/cylinder units, for example, will most conveniently comprise a set of vertically disposed cylinders distributed along an annular flange around a central cylindrical lower base frame which defines a housing for the eccentric carrying the head and a passageway for the crushed material. The lower ends of these cylinders may be rigidly connected to the base frame, or the aforesaid flange, or pivotally coupled thereto. Specific examples will be described below.

The bowl centralizing means comprises an annular set of wedges disposed around the base frame and movable by piston/cylinder means into and out of wedging engagement between the base frame and the bowl assembly.

The bowl-locking means may be constituted primarily by hydraulic piston/cylinder units themselves, means being provided for locking hydraulic fluid in said units after an adjustment has been effected.

Alternatively, or in addition, the bowl-locking means may include hydraulically expansible metal sleeves clamping around telescopic couplings between the bowl and the base frame, for example around the rams of said piston/cylinder units. Once again, explanatory examples will be described in more detail below.

The means which have been described above for varying the size of the crushing chamber or gap can, of course, be exploited to afford a quick method of opening the chamber fully to release a load which has choked-up the gap owing, say, to the intrusion of a piece of tramp iron or other unbreakable material. The novel crushers will, however, additionally include safety means which will cater for an automatic yielding of the bowl, and protect the crushing surfaces against damage in the event that uncrushable bodies should intrude. Various alternative methods of providing an overriding safety release of this character, preferably incorporating stacks of disc springs, will also be described below.

FIGS. 1 and 2 each show a partial vertical cross sectional view through one of two different embodiments of gyratory crusher in accordance with this invention. The same reference numerals are used in each of the two drawings to designate like parts.

In FIG. 1 the cylindrical bottom frame of the crusher is designated 1, this constituting a housing, in the usual way, for the gyratory head which has been generally designated 2. The form of this head is not material to the invention, but in the case illustrated is shown as having a central fixed shaft 25, an eccentric cap 26 which is rotatable on shaft 25, from a power unit (not shown) through a bevel gear 27, and a cone 28 which is given a consequent eccentric motion.

The concave support bowl of the machine is designated 3, and it will be observed that this is mounted on an upper frame structure 4, by virtue of a bevelled angular shoulder 5 of the latter receiving a corresponding outer bevelled face of the bowl 3.

The upper frame structure 4, and with it the bowl 3, are supported and adjusted when required by a set of piston/cylinder units disposed at regular intervals around the base frame 1. One of these units is illustrated at 6 and it will be observed that the cylinder thereof is pivotally mounted at 7 on a peripheral flange 8 extending outwards from the frame 1. The piston rod or ram 9 of the unit is pivotally coupled at 10 to a bracket on the structure 4. The latter can therefore be raised and lowered by appropriate routing of hydraulic fluid into the assembly of units 6, thereby to increase or decrease the size of the gap 11 between the confronting faces of the head 2 and the bowl 3, i.e. of the "crushing chamber."

It is further to be noted that the base frame 1 is provided at its upper end with an annular bevel surface 1. This, in conjunction with the opposed cylindrical wall portion 13 of the structure 4 forms a tapered bight to receive a set of bowl-centralizing wedges, again spaced around the periphery of the base frame 1. One of these wedges is shown at 14 and it will be observed that it is pivotally connected at its lower end 15 to a piston/cylinder unit 16 hinged at 17 to the lower exterior of frame 1.

As will be evident from the drawings, when the wedges 14 are withdrawn the bowl 3 will be supported only by the hydraulic fluid in cylinders 6, but with the bowl centralizing wedges 14 pushed into position so as to centralize the bowl the load of the latter the load of the bowl is, partly at least, taken by the base frame 1. The bowl is both supported and restrained axially to resist crushing loads and the assembly of wedges 14, which, in effect forms a split wedge ring, restrains the crushing forces radially and to some extent axially. Although the wedges 14 play only a small part in supporting the bowl 3 and adjustment could be effected by simply pressurizing the cylinders 6 to lift or lower the bowl 3 as required, it may be more convenient to release these wedges before adjusting the bowl. Thus, in order to carry out an adjustment of the size of crushing chamber 11, and starting with the mechanism in the working position illustrated in FIG. 1, the wedges 14 are first released by pressurizing the upper chamber of hydraulic cylinders 16. The bowl 3 is then supported solely by the cylinders 6, the ports of which are blocked to prevent movement of fluid in either direction.

The cylinders are next pressurized at one side or the other to raise or lower the bowl whereafter, with the latter at the required setting, fluid is again locked in cylinders 6. The cylinders 16 are then pressurized to raise and lock the wedges 4 thereby centralizing the bowl.

The mechanism illustrated further includes means to cater for a safety release of the bowl 3 in the event that tramp metal

or other uncrushable material enters the crushing chamber. To this end the upper frame structure **4** is provided with an annular set of upstanding bolts **18** each passing through a corresponding opening **19** in bowl **3** and, through a disc **23**, trapping a stack of disc springs **20** against the top face of this bowl. The advent of tramp metal will cause the bowl **3** to lift and safeguard the working faces against serious damage. It may also be, however, that the offending material may cause the machine to stall. This can quickly be rectified by following out the adjusting procedure described above sufficiently to empty the crushing chamber of material. This has a distinct advantage over current arrangements wherein the crushing chamber has to be manually dug out or the bowl assembly removed altogether.

The construction illustrated in FIG. **2** is based on similar principles to that of FIG. **1**, but includes a number of exemplary modifications.

In the first place each of the hydraulic cylinders **6** of FIG. **1** has, associated with it, a hydraulically operated device for clamping the extended piston rod or ram **9** thereof in any selected and adjusted position of the concave **3**. Each such device comprises a metal sleeve **21** which is secured between end rings **29** and fitted around the ram or extended piston rod **9** of the corresponding unit **6**. The lower ring **29** is firmly attached to the head of cylinder **6**, whilst the upper ring **29** is ducted at **30** for connection to the control hydraulic system and to admit hydraulic liquid to the interior of sleeve **21** and between the latter and ram **9** to expand the sleeve.

Although these clamping and locking devices **21**, **29** have been shown and described and being applied directly to the rams or piston rods of the hydraulic units **6**, it will be appreciated that they could be otherwise disposed, for example around secondary rods depending from the structure **4** and slidable in guides in frame **1**.

FIG. **2** also indicates a modification of the form of the means for operating wedges **14**. Thus in the present instance each of these wedges is normally urged upwards by a stack of disc springs **22** arranged between the associated cylinder **16** and the wedge, whilst the latter is unlocked by admission of hydraulic fluid to the upper end of the corresponding cylinder **16**.

Thus, to adjust the size of the crushing chamber arrangement illustrated in FIG. **2**, the cylinders **16** are pressurized at the upper side to retract the wedges **14** against the action of disc springs **22**. At the same time pressure fluid is applied to the inside of the sleeves **21** to break the mechanical lock which these sleeves provide between the corresponding rams or piston rods **9** and the frame of the machine. The cylinders **6** can then be pressurized to lift or lower (as required) the bowl **3** to adjust the crushing chamber. When the required setting is achieved, the reverse procedures are gone through, and the original conditions reestablished.

It is to be understood that the procedure described could be modified by disengaging the wedges **14** by axial movement of the structure **4**, leaving the wedges stationary, where conditions in the crushing chamber so admit.

The embodiment of FIG. **2** also incorporates an overload safety means similar to that of the FIG. **1** embodiment, and may be here observed that an additional overload device may be incorporated in the locking mechanism **21**, **29** which, in the event of an excessively high load, would act in a similar manner to a slipping clutch to release the structure **4** and the bowl **3**.

I claim:

1. In a gyratory crusher comprising a fixed base frame, an upper concave bowl structure supported on said base frame, and a head rotatable with a gyratory motion within said base frame for crushing material against said concave bowl, the improvement wherein a plurality of hydraulic piston/cylinder units are connected between said base frame and said bowl, supporting the latter in an adjustable fashion, and including wedge means positioned around said bowl and between the latter and said base frame for centralizing the bowl with respect to the base frame, said wedge means being hydraulically movable into and out of wedging engagement.

2. A gyratory crusher according to claim **1**, in which the wedge means are arranged around the bowl in an annulus.

3. A gyratory crusher according to claim **2**, in which each of the wedge means is movable by hydraulic piston/cylinder means into and out of wedging engagement between the base frame and the bowl structure.

4. A gyratory crusher according to claim **1**, in which said hydraulic piston/cylinder units are provided with means for locking fluid therein, whereby to support said bowl against axial movement.

5. A gyratory crusher according to claim **1**, in which said hydraulic piston/cylinder units include hydraulically expansible metal sleeves which provide an interference fit clamp with at least one member operatively associated with telescopic coupling members arranged between the bowl and the base frame.

6. A gyratory crusher according to claim **1**, in which the hydraulically controlled locking means include hydraulically expansible metal sleeves providing an interference fit clamp with the rams of said piston/cylinder units.