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3,516,613

ROTARY IMPACT CRUSHER

Filed Oct. 27, 1967

2 Sheets-Sheet 1

FIG. 2.

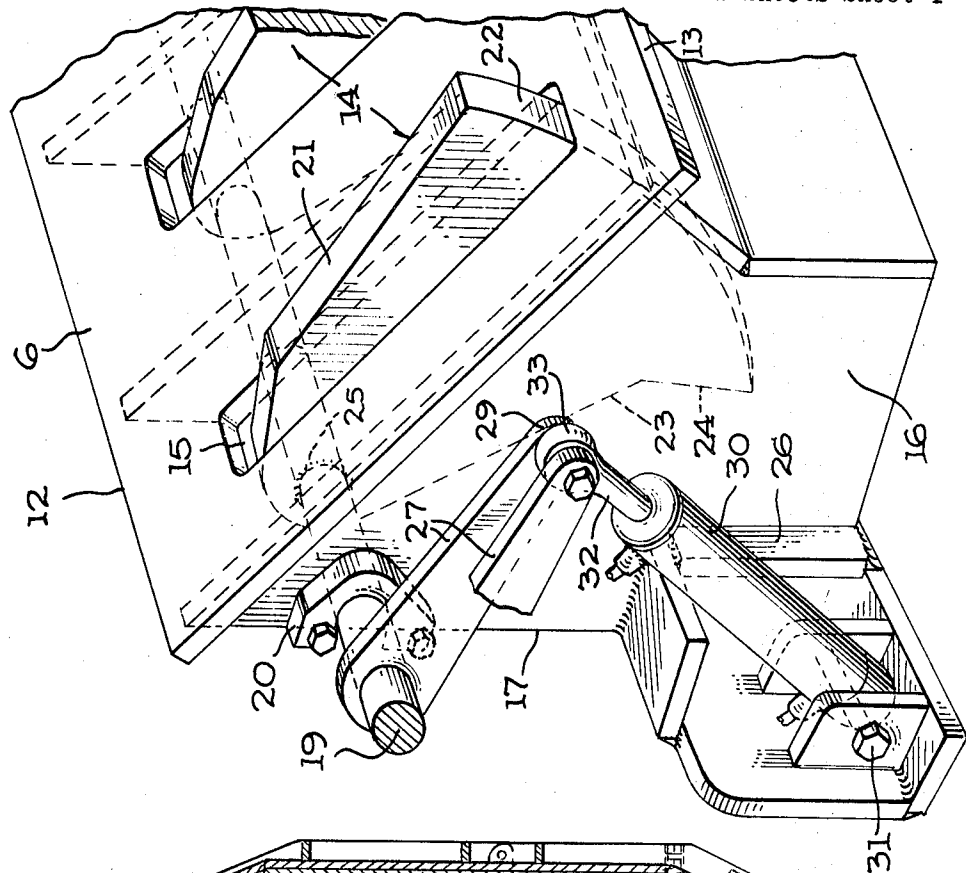
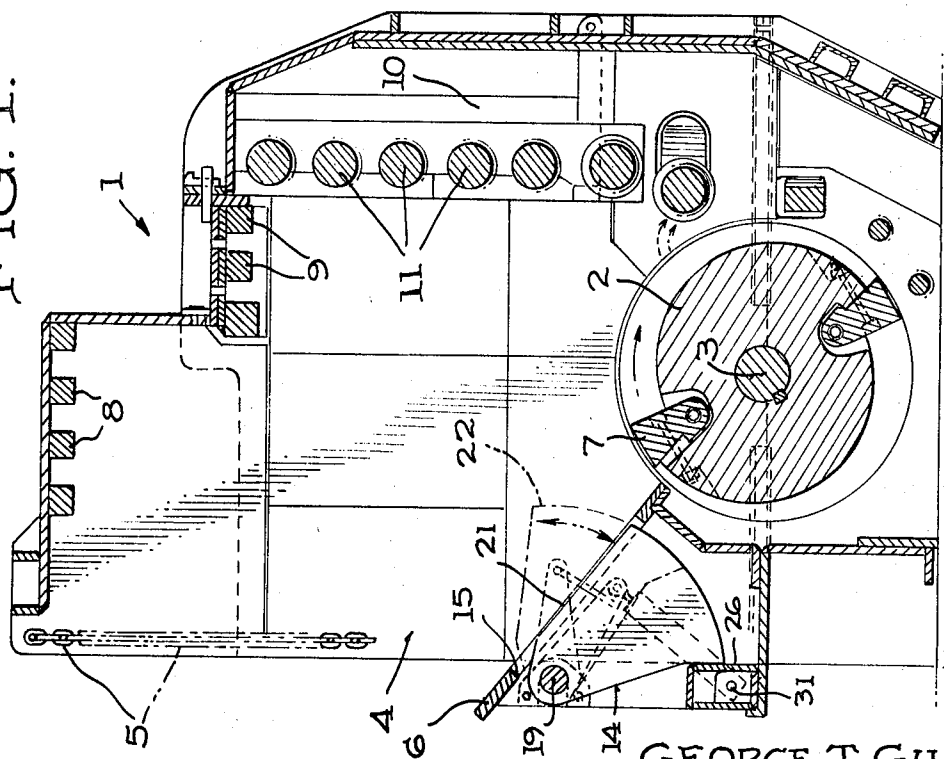


FIG. 1.



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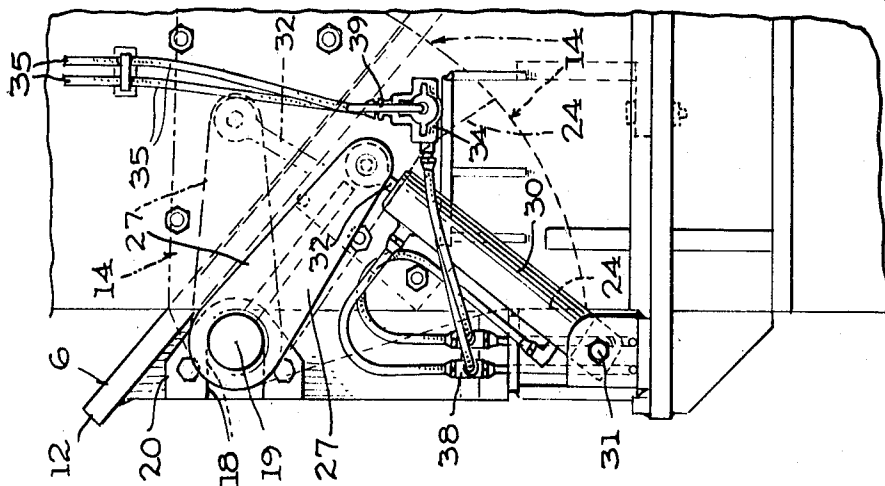


FIG. 4.

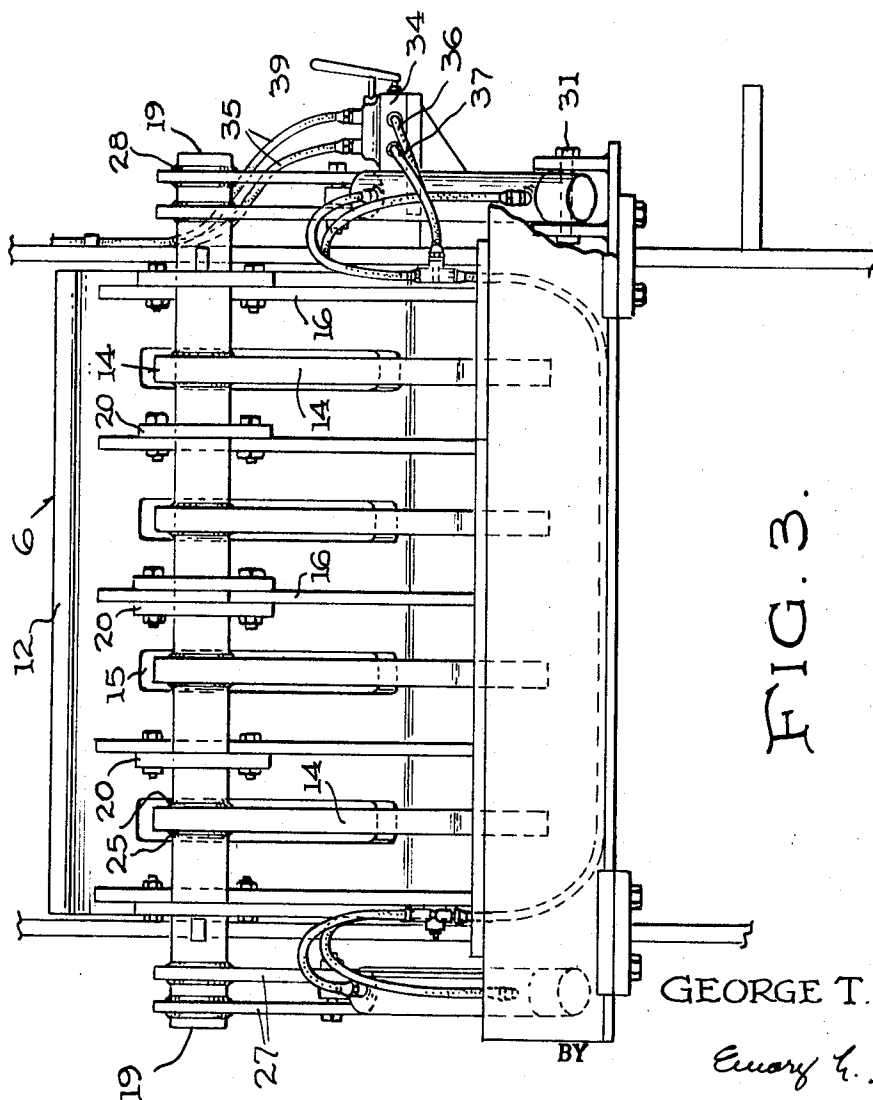


FIG. 3.

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ROTARY IMPACT CRUSHER

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8 Claims

ABSTRACT OF THE DISCLOSURE

An anti-bridging mechanism for a crushing apparatus including a plurality of spaced apart clearing members movable from a retracted position below the in-feed plane to an elevated extended position projecting upwardly from a receiving plate.

This invention relates generally to crushing apparatus and more particularly to a crusher of the rotary impact type having improved anti-bridging means.

In apparatus according to the present invention, hard yet brittle material such as ore and quarry rock is reduced or disintegrated by impact with itself and against impact members, comprising first, a plurality of rigid impact hammer members disposed within the periphery of a rotor, and secondly, a plurality of relatively fixed breaker bars mounted within a housing.

It is generally recognized that an impact crusher is one of the most efficient means for breaking large pieces of rock-like substances into smaller fragments. However, there are many objections to be found in the construction of some of the prior known devices which greatly reduce the efficiency of such apparatus. An all too common objection in the use of many of the presently known devices is that during operation thereof the raw product, as it is being delivered through a feed chute toward the hammer circle described around the rotating rotor, becomes clogged or jammed due to the inability of the rapidly moving hammers to carry away all of the incoming rock as fast as it is delivered toward the hammer circle. The existence of a bridging condition is immediately apparent to the operators of the crusher as the discharge of crushed material suddenly decreases and the raw product being delivered to the feed opening of the crusher begins to back up. Heretofore, the only solution when this bridging occurs has been to cease operation of the hammer rotor to permit the operators safe access to the bridged material to allow its removal, and it will be obvious that the down time resulting from this operation substantially decreases the output from the crusher while also increasing the cost of operation.

Efforts have been made in the past to decrease the likelihood of bridging of in-feed material by various modifications of the feed chute of the crusher. One such example has included a feed chute which is adjustable to vary the angle of approach of the in-feed as it is directed toward the hammer circle in order to increase or decrease the actual rate of speed of the incoming raw material; however such efforts have failed to completely preclude the possibility of bridging of the in-feed material primarily due to the fact that when a bridging condition starts it progresses extremely rapidly and is rarely obviated merely by tilting or pivotally adjusting the feed chute itself, due to the tightly packed condition of the material above the hammer circle.

Accordingly, one of the primary objects of the present invention is to provide a rotary impact crusher including improved anti-bridging means.

Another object of the present invention is to provide a rotary impact crusher having a fixed in-feed or receiving plate provided with a plurality of adjustably mounted anti-bridging members.

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A further object of the present invention is to provide a rotary impact crusher having hydraulically actuated anti-bridging members which are actuated during operation of the crusher rotor to break up any bridged material in the area of the juncture of the receiving plate and hammer circle.

With these and other objects in view which will more readily appear as the nature of the invention is better understood, the invention consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

A preferred and practical embodiment of the invention is shown in the accompanying drawings, in which:

FIG. 1 is a vertical sectional view of a rotary impact crusher according to the present invention and illustrates in broken lines the alternate positioning of the movably mounted clearing fingers of the anti-bridging mechanism.

FIG. 2 is an enlarged partial perspective view of the anti-bridging mechanism of the present invention.

FIG. 3 is an end elevation of the anti-bridging mechanism of the present invention.

FIG. 4 is a partial side elevation of the anti-bridging mechanism shown in FIG. 3.

Similar reference characters designate corresponding parts throughout the several figures of the drawings.

Referring now to the drawings, particularly FIG. 1, it will be seen that the impact crusher of the present invention comprises an exterior casing, generally designated 1, having disposed within the lower area thereof a rotor 2 mounted upon a rotor shaft 3, which is journaled by suitable and conventional means within the side walls of the casing 1. The general operation of the apparatus will be readily understood by reference to this figure. The material to be disintegrated is delivered through the feed opening 4 where it is directed with the assistance of the depending chains 5 down the inclined receiving plate 6 in a radial direction toward the rotating hammers 7 fixedly attached to the rotor 2. The in-feed of the material along the receiving plate 6 intersects the hammer circle at a point approximately 40 degrees ahead of the top of the hammer swing. The resulting impact on the rock causes it to break down into smaller particles which are projected largely upwardly against a plurality of rigid primary breaker bars 8 and 9 fixedly attached to the top walls of the casing 1. Considering that the primary crushing occurs upon the initial impact of the hammers 7 upon the feed material, it will be understood that maximum secondary crushing occurs when the resulting broken product drops back after impact with the breaker bars 8 and 9 into the rotor area to receive another impact whereafter this material is again projected away from the hammer circle, but this time toward the discharge area 10 of the crushing chamber. Before proceeding to the lower portion of the discharge area 10, the particles are impacted against a vertical curtain of spaced horizontal breaker bars 11 which may be referred to as the secondary breaker bars.

Considering now the specific details of the present invention, the receiving plate 6, which is most clearly illustrated in FIGS. 1 and 2 of the drawings, will be seen to comprise a planar member fixedly mounted within the casing 1 in an inclined position and includes an upper input edge 12 and a lower feed edge 13, which latter edge is disposed in close proximity to the swinging hammers. It is in the area of this lower feed edge 13 that bridging of the in-feed material normally begins to occur with the rate of build-up or the likelihood of bridging being dependent upon several factors, such as type of input material, size of input material, rate of in-feed and hardness of input material.

The present invention includes a plurality of clearing fingers, generally designated 14, which are arranged to be

movably controlled during operation of the crusher apparatus to break up any material as soon as a bridging condition is evident. As will be seen in FIG. 2, the receiving plate 6 is provided with a plurality of elongated slots 15, the ends of which are spaced inwardly from the upper input edge 12 and lower feed edge 13 of the receiving plate, whereby the major axis of the slots 15 coincides with the longitudinal axis of the in-feed material as it proceeds from the input edge 12 to the lower feed edge 13 of the receiving plate 6.

As previously described, the receiving plate 6 is fixedly disposed beneath the feed opening 4 of the crusher, and is supported in this position by means of a plurality of vertically extending support plates 16. In view of the substantial weight from a mass of in-feed material being delivered to the receiving plate, it is desirable to provide for a support plate 16 at not only the ends of the plate but also between each pair of adjacent elongated slots 15, as will be seen most clearly in FIG. 3. The rear edge 17 of each of the support plates 16 is provided with an elongated recess 18 at the upper portion of the support plate for the reception of a horizontal finger shaft 19. This shaft 19 passes through a plurality of journal blocks 20, with at least one of said blocks being attached to each of the support plates 16. Fixedly secured to the shaft 19 beneath each one of the slots 15 are the clearing fingers 14.

From an examination of the construction shown in FIG. 2 the arrangement of each of the fingers 14 will be most readily apparent. Each finger comprises an arcuate plate-like member mounted in a vertical position upon the finger shaft 19 and including a flat top surface 21, an arcuate free end 22, and a bottom portion comprising an intersecting lower surface 23 and shoulder portion 24. Any suitable manner of attachment may be utilized to secure the fingers 14 to the shaft 19, such as the welds, as shown at 25.

Under normal operating conditions the anti-bridging mechanism of the present invention will appear as shown in full lines in FIG. 1 of the drawings, wherein it will be seen that all of the clearing fingers 14 are pivotally disposed in the lowermost or retracted position with the top surfaces 21 thereof flush with the top surface of the receiving plate 6. Limit means to positively position the clearing fingers in the fully retracted position is provided in the form of a vertically disposed stop plate 26, which extends transversely the entire width of the mechanism encompassing all of the support plates 16 thereof. The position of the stop plate 26 together with the size of the clearing fingers 14 is determined so that when the fingers 14 are in the fully retracted position, shown in full lines in FIG. 1, the aforescribed shoulder 24 on the lower portion of the fingers abuts and is contiguous with the vertically disposed stop plate 26.

The manner of actuating the clearing fingers 14 will now be described. A preferred hydraulic actuating system is disclosed in the drawings, however it will be understood that any suitable arrangement may be provided for rotating the shaft 19 to cause the clearing fingers 14 to be elevated for the purpose of breaking up bridged material being fed into the crusher. The finger shaft 19 extends outwardly from each of the two outermost support plates 16 a substantial distance, as shown in FIG. 3, and mounted upon each of these extensions of the shaft 19 are a pair of parallel crank arms 27—27. Each crank arm 27 is suitably fixedly attached to the finger shaft 19 such as by the welds 28 and includes a free end 29 which projects forwardly in the general direction of the hammer rotor 2. Cooperating with the crank arms 27—27 is a hydraulic actuating cylinder 30 having its base pivotally mounted as at 31 at a point beneath the finger shaft 19 and which includes a movable piston rod 32 having its outer end 33 pivotally attached to the free ends 29—29 of each pair of crank arms.

The aforescribed actuating cylinder 30 and attendant structure is provided at both ends of the finger shaft 19 in

order to insure even and smooth operation of the clearing fingers 14.

Any suitable control mechanism may be provided to operate the actuating cylinders 30—30 and thus, it will be apparent that the arrangement described hereinafter is merely exemplary. A four-way control valve 34 is mounted in close proximity to the anti-bridging mechanism of the present invention and includes pressure supply lines 35—35 connected to any suitable means for providing a continuous source of hydraulic fluid under pressure (not shown). Passing from the control valve 34 and connecting with each of the double-acting cylinders 30 is an extension circuit 36 and a retraction circuit 37. Dual control of both of the hydraulic cylinders 30—30 is achieved by means of a conventional branch fitting 38 which insures an equal distribution of hydraulic fluid to each of the extension and retraction circuits leading to the two hydraulic cylinders. When it is desired to actuate the anti-bridging mechanism the operator manipulates a selector lever 39 on the control valve 34 which shifts the positive hydraulic fluid pressure into the extension circuit 36 which leads to the bottom of each of the cylinders 30, whereupon it will be seen that a positive pressure is applied to the base of the piston rods 32—32 so that these rods are extended upwardly to cause the crank arms 27—27 to be, in turn, pivoted upwardly or in a counterclockwise direction when viewed as in FIG. 4 of the drawing. In view of the rigid attachment of the crank arms and the clearing fingers to the common finger shaft 19 it will follow that any arcuate displacement of the crank arms 27 will be followed by a corresponding displacement of the clearing fingers 14, and that, as the crank arms are urged upwardly the top surfaces 21 of each of the clearing fingers will in turn be extended upwardly into the path of the in-feed material, thereby breaking up any bridge condition which may be present. As long as the selector lever 39 is positioned to permit positive fluid pressure to be directed into the extension circuits 36, the clearing fingers 14 will continue to be moved to their fully raised position and will thereafter remain in this position until the selector lever 39 is shifted, which will introduce the positive fluid pressure into the retraction circuits 37 to drive the piston rods 32—32 back downwardly toward the base of the cylinders 30—30.

I claim:

1. In a rotary impact crushing apparatus, anti-bridging feed means comprising, an inclined receiving plate including a slot therein, a clearing member pivotally mounted beneath the plane of said receiving plate and positioned within said slot, said member substantially filling said slot at all times and provided with a top surface, and means operable to lower said member to place said top surface planar with said receiving plate and subsequently operable to extend said finger upwardly through said slot to break up bridge material on said inclined receiving plate.

2. In a rotary impact crushing apparatus including a rotor provided with a plurality of hammers extending therefrom, anti-bridging feed means comprising, a receiving plate including a slot therein and mounted with its surface extending radially from said rotor, a clearing member pivotally mounted beneath the plane of said receiving plate and vertically aligned with said slot, and means operable to extend said member upwardly through said slot to break up bridged material on said receiving plate.

3. A rotary impact crushing apparatus according to claim 2, wherein, said receiving plate includes a lower feed edge disposed adjacent the swing of said hammers.

4. In a rotary impact crushing apparatus, anti-bridging feed means comprising, a receiving plate including a slot therein, a clearing member pivotally mounted beneath the plane of said receiving plate and vertically aligned with said slot, said member including a top sur-

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face and a lower shoulder, a stop plate mounted beneath said receiving plate, and means operable to position said top surface substantially flush with said receiving plate at which point said shoulder abuts said stop plate and subsequently operable to extend said member upwardly through said slot to break up bridged material on said receiving plate.

5. In a rotary impact crushing apparatus, anti-bridging feed means comprising, an inclined receiving plate having a plurality of laterally spaced slots therein, a separate clearing finger mounted beneath the plane of said receiving plate and positioned within each said slot, said fingers substantially filling their respective slots at all times and each provided with a top surface, a shaft journaled below said plate, said fingers fixedly attached to said shaft, and means operable to rotate said shaft to lower said fingers to place said top surfaces planar with said receiving plate and subsequently operable to extend said fingers upwardly through said slots to break up bridged material on said inclined receiving plate.

6. A rotary impact crushing apparatus according to

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claim 2, wherein said receiving plate includes a plurality of said slots and each is provided with a separate clearing member.

7. A rotary impact crushing apparatus according to claim 3, wherein said receiving plate includes a plurality of said slots and each is provided with a separate clearing member.

8. A rotary impact crushing apparatus according to claim 4 wherein said receiving plate includes a plurality of said slots and each is provided with a separate clearing member.

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