ADJUSTING MEANS FOR GYRATORY CRUSHER BOWL

Fred Curtis Archer, Whitefish Bay, and Ronald Bruce De Demar and Le Roy Schuman, Milwaukee, Wis., assignors to Barber-Greene Company, Aurora, Ill., a corporation of Illinois

Filed Dec. 7, 1964, Ser. No. 416,318

11 Claims. (Cl. 241—37)

ABSTRACT OF THE DISCLOSURE

This disclosure relates to improvements in gyratory crushers, and relates more particularly to an improved means for rotating the bowl or concave of the crushe. 

Yet another object of this invention is to provide an adjusting mechanism for rotating a gyratory crusher bowl which is capable of substantially trouble-free and extremely safe operation for a substantial period of time.

These and other objects of this invention are obtained by providing a plurality of vertical ribs on the exterior of the crushing bowl, an endless chain surrounding the exterior of the crushing bowl and engaging ribs, and a means to drive said chain to rotate the bowl. Means may be provided to sense the inability of the adjustment means to rotate the bowl because of jammed threads in the crusher bowl adjusting mechanism due to rust, corrosion, material jamming, or the like and to thereupon stop the adjustment means to prevent damage to it or to the crusher. Means may also be provided to lock the crushing bowl in the desired position after adjustment.

The drawings

The invention, both as to its structure and mode of operation, will be better understood by reference to the following specification and drawings, forming a part thereof, wherein:

FIGURE 1 is a partially sectioned view of a typical crushe employing one form of adjusting mechanism of this invention;

FIGURE 2 is a fragmentary top view of the adjusting mechanism shown in FIGURE 1;

FIGURES 3 and 4 are additional fragmentary detailed views of the same adjusting means;

FIGURES 5 and 6 are views showing mechanism which may be advantageously employed to lock the crushing bowl in position on the frame of the crusher after adjustments have been made; and

FIGURE 7 is a view showing a somewhat modified embodiment of the invention.

Detailed description

Referring now to FIGURE 1, the numeral 1, indicates a gyratory crushe employing the adjusting means of the present invention. The numeral 3 indicates the frame or base of gyratory crushe 1. The gyrating crushing head 5 is mounted inside frame 3 and gyrates about a vertical axis. Crushing head 5 is driven by a motor and belt drive (not shown) connected to a grooved pulley 7. Concave crushing bowl 9 is also mounted on frame 3 and forms the other crushing surface of crushe 1. The crushing action takes place in the space or gap between crushing head 5 and crushing bowl 9. Relief springs 11 are mounted on frame 3 to provide protection to the crushing surfaces of head 5 and bowl 9 should uncrushable material, such as scrap iron, enter the crushing gap. Relief springs 11 permit the crushing bowl 9 to shift 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 crushe 1 is determined by the size of the crushing gap between crushing head 5 and crushing bowl 9. If it is desired to change practice size, it is necessary to change the dimensions of the crushing gap. This is done by raising or lowering crushing bowl 9 on crushe frame 3 relative to crushing head 5. Crushe 1 provides for the raising or lowering of crushing bowl 9 by employing a threaded adjusting ring 13 mounted on frame 3. Crushing bowl 9 has threaded flange 15 which engages the adjusting ring 13. Shield 17 is mounted on crushing bowl 9 adjacent the hopper or funnel 18 to form an integral part of the bowl 9 and protect the adjusting ring 13 and threaded flange 15 from dust and dirt. Rotating the crushing bowl 9 causes flange 15 to follow the helix of the threads of adjusting ring 13, thus raising or lowering the bowl.

Summary of the invention

It is a primary object of this invention, therefore, to provide an improved adjusting mechanism for rotating the crushing bowl to adjustably position the bowl on the crushe frame.

Another object of this invention is to provide a simple, compact adjusting mechanism which is capable of rapidly rotating the bowl in either direction to accurately position the bowl on the crushe frame while affording utmost safety.
The adjusting mechanism of this invention which provides rotation to crushing bowl 9 includes a plurality of vertical ribs 19 mounted on the shield 17 or some other integral part of the bowl 9. Ribs 19 in their preferred embodiment are elongated to engage endless chain 21 along the length throughout the entire range of raised and lowered crushing positions of bowl 9. Chain 21 is driven by pulley 29, which is driven by the motor 27 and pulley 10. Pulley 29 is rotated by a motor 27 as through a right angle gear reducer unit 25. In the embodiment of FIGURE 1, base 23 is pivotally mounted on lugs 22 of crusher frame 3, and this swinging base 23 supports right angle gear reducer unit 25, motor 27 and pulley 10. Base 23 is normally maintained in an operating position by means of pins or bolts 24 fastened to the crusher frame as by lugs 22 and connected to base 23 in a manner whereby the base 23 is resiliently urged to its normal position, as by means of Belleville washers or springs 26 on the bolts 24 between stops 23'.

Motor 27 may be energized by a source of electric power (not shown) to rotate pulley 29 through gear reducer 23. This drives chain 21 and rotates crushing bowl 9 by engagement of the vertical ribs 19 between the links of chain 21, to raise or lower the crushing bowl 9 in the pendulous direction of rotation of motor 27. As chain 21 is endless, rotation of crushe 95 r bowl 9 may be continued until the desired gap size is obtained.

Upon the obtaining of the required gap size, it is necessary to lock crushing bowl 9 in position to maintain the gap during the crushing operation. Various means may be employed to accomplish this locking of the crushing bowl in its adjusted position.

As shown, an electric brake 31 is coupled to the motor 27 so that when motor 27 is de-energized at the conclusion of the adjusting operation, the electric brake is set, preventing rotation of pulley 29. This in turn prevents movement of chain 21, engaged in pulley 29 and crushing bowl 9, engaged through ribs 19, in chain 21. The electric brake also prevents reverse rotation of the pulley 29 upon stoppage of the motor to thereby maintain the chain 21 under tension.

FIGURES 2, 5, and 6 show a manually operable mechanical means which may be advantageously used to lock the crushing bowl 9 and/or to supplement the electric brake in locking the crushing bowl 9 in position after adjustments. This mechanism provides for the insertion of a stop 33 behind one of the ribs 19 to prevent movement of the crushing bowl 9 in a direction to increase crushing gap. Toggle mechanism 35 provides for the insertion of stop 33. A base member 37 is mounted on frame 3. Stop 33 is rotateably affixed to base member 37. A toggle lever 39 is also rotateably fastened to base 37. Locking handle 41 links stop 33 to lever 39 to lock or unlock mechanism 35. FIGURE 2 shows mechanism 35 in the locked position with stop 33 assisting ribs 19 to prevent rotation of crushing bowl 9 in one direction, while FIGURE 6 shows mechanism 35 in the unlocked position, allowing rotation of crushing bowl 9 on frame 3 to adjust the gap.

When adjustments are being made in the crushing gap, jamming sometimes occurs due to rust and corrosion, sticking or the adjustment threads or material remaining in the crushing gap from the previous crushing operation which becomes jammed between the crushing bowl and the crushing head, and rotation of the crushing bowl in a direction to increase or narrow the gap is accordingly impeded. To prevent continued operation of the adjusting means under these conditions, which could result in damage to the adjusting means or to the crushing bowl, a protective shut off circuit is employed.

Micro-switch 43 is mounted on a bracket 44 affixed to frame 3. Adjacent gear reducer unit 25. This micro-switch is connected between the power supply and motor 27 to cut off power to the motor when actuated. If the crushing bowl is unable to rotate to close the crushing gap as because of material jammed therein, the pull of chain 21 on pulley 29 will cause base 23 to tilt toward frame 3 against the action of the springs 26. This causes the easing of gear reducer unit 25 to actuate the micro-switch 43 to thereby cut off power to motor 7 and stop operation of the adjusting means while the brake 31 effectively maintains the chain 21 in its position. A sensing gap may then be cleared of the material causing the jamming, permitting the springs 26 to again cause base 23 and micro-switch 43 to resume their operating positions, and allowing the adjusting operation to proceed.

It will be appreciated from the foregoing that there has been provided an improved adjusting mechanism for quickly and accurately rotating the crushing bowl of a gyratory crusher in either direction. The use of the electric switch 43, the springs or Belleville washers 26, and the electric brake 31 on the motor 27 in the combination described imparts to the adjusting mechanism the ability to safely stop whatever an overload occurs such as may be caused by sticking of the adjusting parts or jamming. Furthermore, upon stopping, a pull is maintained on the chain by this combination of cooperating elements which causes the adjusting means to start in motion promptly upon release of the control.

Referring now to FIGURE 7, an alternative embodiment is shown which utilizes a hydraulic oil pump driven by an electric motor to provide a hydraulic motor. In this embodiment, the hydraulic oil pump 50 as driven by the electric motor 51 conveys oil under pressure from reservoir 52 to and from the hydraulic motor 53 by way of conduits 54, 55. The hydraulic motor 53 is, in turn, connected to a reduction gear box 56 mounted on the frame 3 of the crusher 1 as a fixed bracked 57. The output shaft of the gear box 56 carries the chain sprocket 29 driving the chain 21 engaging the links 19 of the lock nut or shield 17, and the electric motor 51 and pump 50 may be mounted on the supply tank 52 along with a relief valve 58 and an oil filter 59.

This modified device will rotate the adjusting parts just as the device of FIGURES 1 through 4. However, the hydraulic motor and pump of the system of FIGURE 7 will continue to run in the event of sticking or jamming, and the relief valve 58 will vent fluid back to the oil supply tank 52. This accordingly provides a controlled pull on the clutch while preventing the motor from overloading, and the combination of the hydraulic motor, pump and relief valve therefore replaces the combination of the electric switch, springs and electric motor brake of FIGURES 1 through 4.

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 which is regarded as the invention:

We claim:

1. In a crusher having a frame, a gyratory crushing head mounted in said frame, a concaev crushing bowl mounted on the frame and adjustable by rotation to form an adjustable crushing gap with the crushing head, means to rotate the crushing bowl comprising: a plurality of vertical ribs on the exterior of the crushing bowl; an endless chain surrounding the crushing bowl and engaging the ribs; a motor drive means mounted on the frame; a pulley connected to the motor and carrying the chain; whereby, when said motor rotates the pulley, the pulley drives the chain rotating the bowl and adjusting the crushing gap.

2. The means to rotate the crushing bowl of claim wherein said motor drive means is movably mounted on the frame and including:

...
operating position and to allow the motor drive means to change position when overloaded; switch means mounted on the frame to sense the change of position of the motor drive means and to stop the motor when overloaded.

3. The means to rotate the crushing bowl of claim 2 wherein the means to position the motor drive means includes a plurality of springs acting on said motor drive means against the tension exerted on said pulley by said chain.

4. The means to rotate the crushing bowl of claim 1 wherein the motor drive means includes an electric braking means operating with the motor to maintain tension on said chain and hold said crushing bowl in position.

5. The means to rotate the crushing bowl of claim 1 which includes a mechanical locking means mounted on the frame and engaging the crushing bowl to lock the crushing bowl in position on the frame during a crushing operation.

6. The means to rotate the crushing bowl of claim 5 wherein the mechanical locking means includes a support rigidly secured to the crusher frame and an arm selectively engageable with the ribs of the crushing bowl.

7. The means to rotate the crushing bowl of claim 1 wherein the motor drive means includes a pump and a hydraulic motor and a relief valve cooperating to provide a controlled pulley and constant tension on the chain.

8. In a crusher having a frame, a gyratory crushing head mounted on the frame and adjustable by rotation to form an adjustable crushing gap with the crushing head; means to rotate the crushing bowl to adjust the gap comprising:
   a motor mounted on the frame;
   means coupling said motor with the crushing bowl to rotate the same; and
   means responsive to the load imposed upon the motor and reacting through said coupling means for automatically interrupting motor operation while maintaining the coupling means under tension upon occurrence of a predetermined overload.

9. The means to rotate the crushing bowl of claim 8 wherein the motor is pivotally mounted on the frame and is normally urged to operative position by spring action which is overcome upon imposition of a predetermined load on said motor.

10. The means to rotate the crushing bowl of claim 9 wherein the means for interrupting motor operation and for maintaining the coupling means under tension includes a switch operable upon swinging movement of the motor about its pivot and a brake coating with the motor to prevent reverse movement.

11. In a crusher having a frame, a gyratory crushing head mounted on the frame and adjustable by rotation to form an adjustable crushing gap with the crushing head; means to rotate the crushing bowl to adjust the gap comprising:
   a hydraulic motor mounted on the frame and having a rotatable drive shaft;
   means coupling said motor shaft with the crushing bowl to rotate the same upon operation of said motor;
   means for continuously supplying operating fluid under pressure to said motor to drive the same and rotate the bowl; and
   means for relieving the pressure of said fluid on the motor under predetermined overload caused by the occurrence of abnormal conditions while maintaining the coupling means under constant tension.

References Cited
UNITED STATES PATENTS
3,201,053 8/1965 Rumpel 241—286
ANDREW R. JUHASZ, Primary Examiner.