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J. T. FOWLER
REVERSIBLE-ROTOR PULVERIZER WITH TRAVELING BREAKER-PLATE
MEANS AT EACH SIDE OF THE ROTOR

2,523,004

Filed June 25, 1945

2 Sheets-Sheet 1

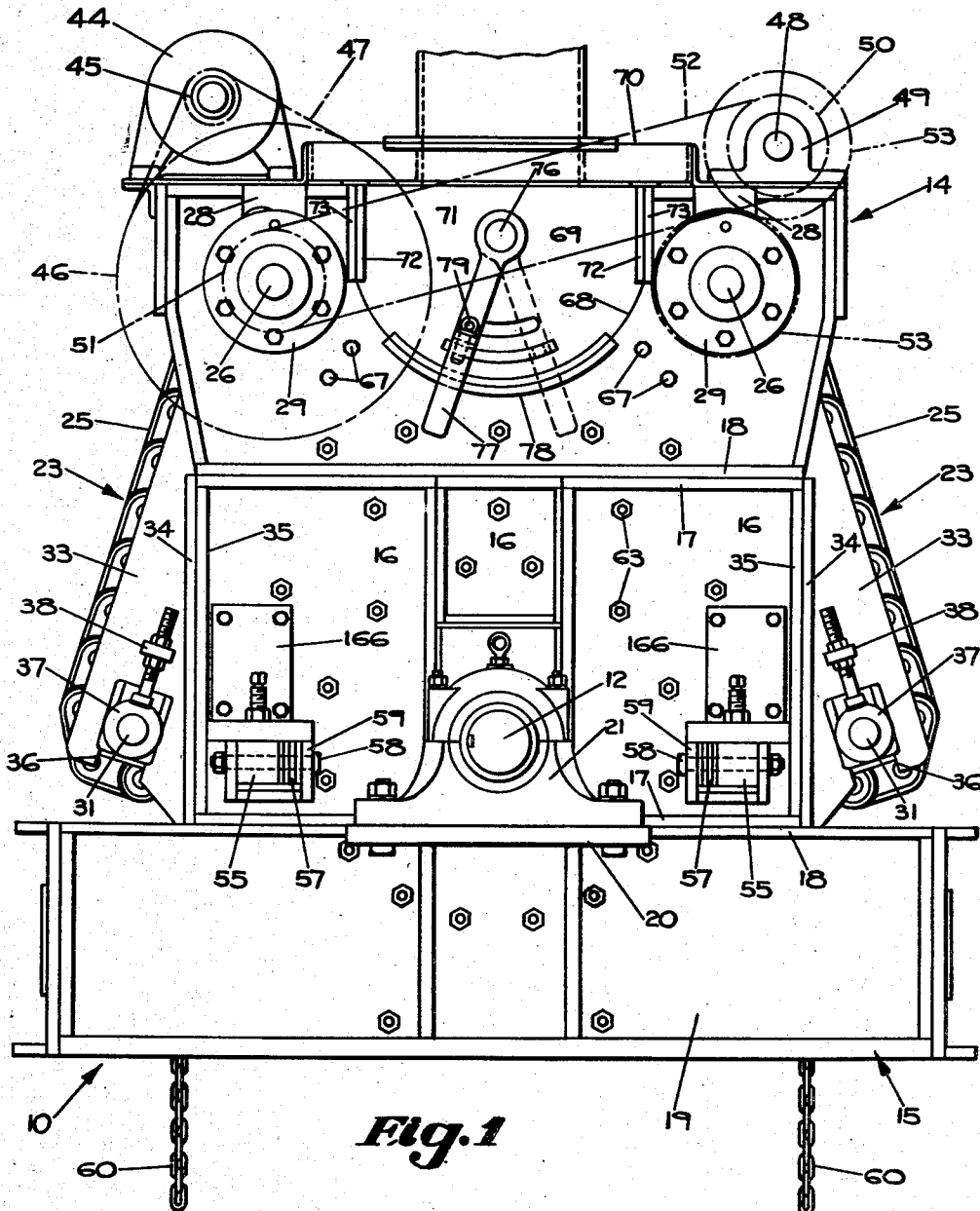


Fig. 1

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1950 J. T. FOWLER 2,52
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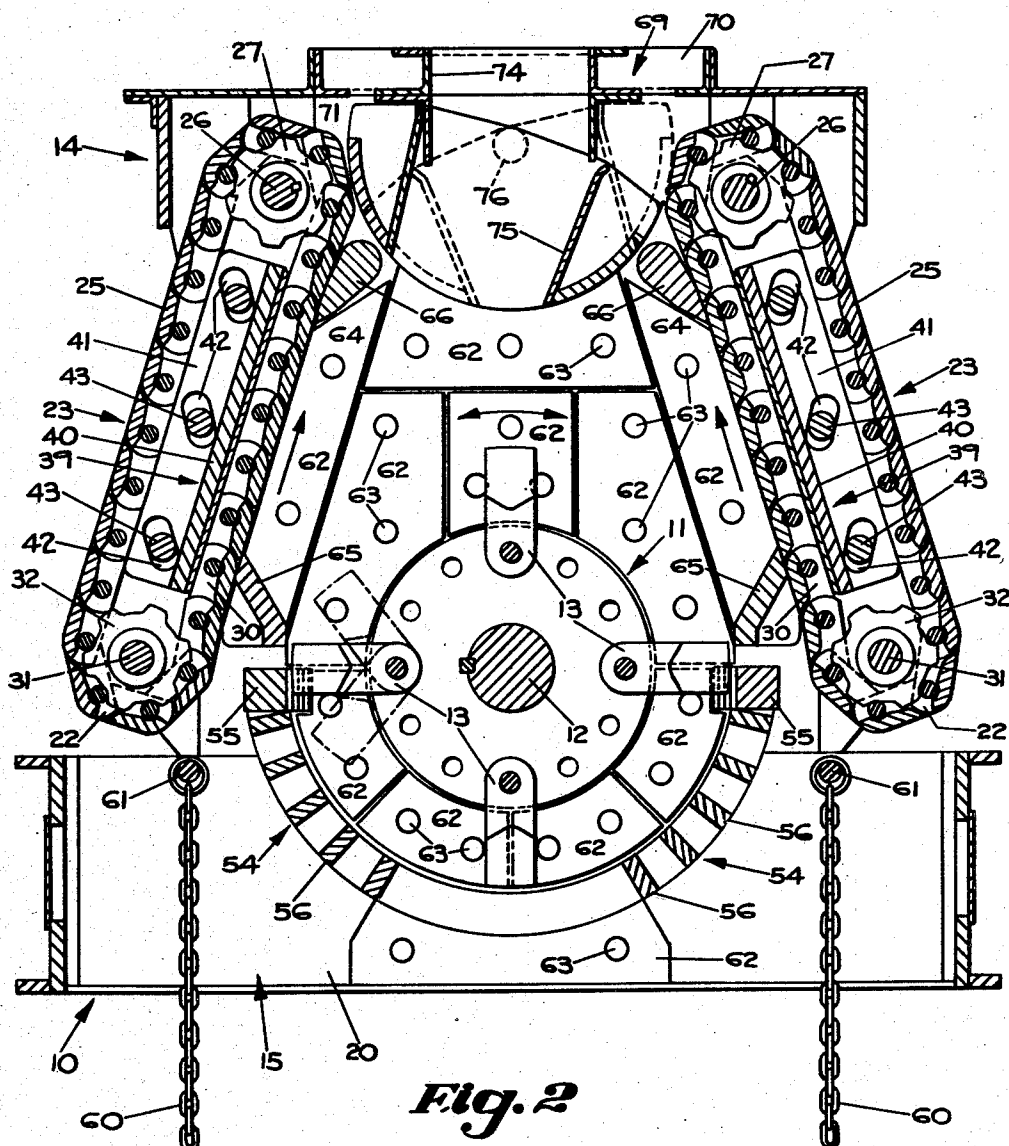


Fig. 2

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UNITED STATES PATENT OFFICE

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REVERSIBLE-ROTOR PULVERIZER WITH
TRAVELING BREAKER-PLATE MEANS AT
EACH SIDE OF THE ROTORJohn T. Fowler, Columbus, Ohio, assignor, by
mesne assignments, to The Jeffrey Manufac-
turing Company, a corporation of Ohio

Application June 25, 1945, Serial No. 601,468

3 Claims. (Cl. 241-187)

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This invention relates to a pulverizer or crusher. An object of the invention is to provide an improved pulverizer or crusher which is designed particularly to handle sticky material.

A further object of the invention is to provide a pulverizer or crusher preferably, but not necessarily, of the rotary swing hammer type, in which the direction of rotation of the pulverizer or crusher rotor is reversible and in which traveling breaker plates are positioned on each side of the rotor.

In carrying out the foregoing object, it is another object of the invention to provide a pulverizer or crusher wherein the traveling breaker plates are endless chains that are caused to cooperate with devices that remove sticky material that may adhere to the breaker plates whereby the sticky material will not accumulate in the housing and prevent efficient operation of the apparatus.

Other and further objects and advantages will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of my invention is shown.

In the drawings,

Fig. 1 is a side view in elevation of a pulverizer or crusher incorporating the features of my invention; and

Fig. 2 is a transverse sectional view of the pulverizer or crusher shown in Fig. 1.

The particular pulverizer or crusher shown in the drawings includes a main frame 10 that forms a casing or housing the interior of which forms a symmetrical reducing chamber within which is a rotor 11 located centrally thereof, that includes a transversely extending shaft 12 and a plurality of swing hammers 13 which constitute the crushing, pulverizing, or reducing means of the rotor. The rotor 11 is designed and adapted to be driven in either direction by a driving motor, not illustrated and to reduce material by substantially the same action for each direction of rotation. For this purpose hammers 13 are symmetrical for each direction of rotation. The main frame 10 that forms the casing or housing includes a head member 14, a foot or base member 15 that is open at its top and bottom, and side plates 16 interposed between the head member 14 and the foot or base member 15. The head member 14 is thus supported upon the foot or base member 15 by said plate members 16. Plates 16 are provided with flanges 17 that cooperate with flanges 18 on both the head and foot members. Preferably the frame members are removably secured together,

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as by bolts (not shown), that extend through the flanges 17 and 18. Each side member 19 of the foot or base member 15 carries, upon supports 20 that are made integral therewith, a self-aligning rotor supporting bearing 21 that receives the rotor shaft 12, the shaft 12 extending across and through the casing or housing and having its material reducing portion between the end walls thereof.

Positioned symmetrically with respect to a vertical plane taken through the axis of the rotor and to each side of the rotor is a pair of similar endless chain conveyors 23 that extend upwardly and inwardly and which function as traveling breaker plates which selectively or alternately receive and reduce material when first impelled by the rotor for reverse rotation thereof. At their upper ends the chains 25 of the conveyors 23 are carried and driven by shafts 26 that carry sprockets 27 over which the chains 25 ride. The side plates 16 of the head member 14 are notched or slotted at 28 to receive the shafts 26 and suitable self-aligning bearings 29 that are secured to the side plates of the head member 14 support the ends of the shafts 26. The bottoms of the chains 25 are carried by idler shafts 31 that carry sprockets 32. The idler shafts 31 are mounted on the main frame through plates 33 that are provided with flanges 34 that coincide with flanges 35 on the side plates 16, which flanges are preferably bolted together. The bottoms of the idler supporting plates 33 are notched at 36 to provide bearing ways that slidably receive idler shaft bearings 37. The bearings 37 are movable in the bearing ways 36 for adjusting the position of the idler shafts 31, and consequently the tension of the conveyor chains 25, and are secured in their adjusted positions by suitable adjusting mechanisms 38.

Positioned between the runs of each conveyor chain 25 is a backing or breaker plate reinforcing member 39 that includes a main plate 40 over which the back of the inner run of the conveyor chain 25 is adapted to slide. Extending outwardly from the back of the inner run of the backing or breaker plate reinforcing member is a plurality of ribs 41 that are slotted as at 42. Extending through the slots 42 in each backing or breaker plate reinforcing member 39 are three bars 43 that extend between the ends of the main frame 10 and are rigidly attached thereto as by suitable end plates (not shown) which are removably attached to the inside of the main frame end walls. The slots 42 in the backing plate or reinforcing member 39 preferably extend up-

wardly and outwardly so that the breaker plate reinforcing member 39, by reason of its weight, will bear at all times against the outside or back of the inner or breaker plate run 30 of the conveyor chain 25. The breaker plate reinforcing members 39 function to cause the portions of the breaker plate runs 30 of conveyor chains 25 which they abut to become in effect a solid sliding breaker plate.

I prefer to use conveyor chains 25 that are constructed as disclosed in my co-pending application Serial No. 564,014, filed November 18, 1944 (Patent 2,497,985 issued Feb. 21, 1950), for a Pulverizer. It may be stated, however, that the chain is of rugged structure and includes a self-cleaning feature in that as the chain articulates over its sprockets 27 and 32 discharge spaces 22 are formed between adjacent chain links, thus providing for free discharge of material which may have accumulated on the inside of the chain particularly after the material has become dry. The chains 25 of the conveyors 23 are driven by a motor 44 (see Fig. 1) that is mounted upon the head member 14 and is connected to the shafts 26 of the conveyors. The shafts 26 are driven through a speed reducing drive mechanism which includes a sprocket 45 mounted on the motor shaft and a large diameter sprocket 46 that is rigidly carried by the left hand conveyor drive shaft 26. Sprocket 45 drives sprocket 46 through a chain 47.

Mounted upon the main frame head 14 and on the right side thereof (as viewed in Fig. 1) is a jackshaft 48 which is carried by suitable bearings 49 and includes a sprocket 50 which is connected to a sprocket 51 of equal diameter that is secured to the left hand conveyor shaft 26 by a chain 52. The right hand conveyor shaft 26 and the jackshaft 48 each carry gears 53 that are of equal diameter but which are preferably of a greater diameter than the sprockets 50 and 51. Thus it will be seen that motor 44 drives both conveyors 23 in the same direction, namely, with their inner or breaker runs 30 moving upwardly and it will also be seen that the rate of travel of the right hand conveyor will be the same as that of the left hand conveyor since all of the sprocket and gear ratios except that of the speed reducing sprockets 45 and 46 are 1 to 1.

Positioned beneath the rotor 11 is a pair of material reducing bar screens 54, one of which is positioned to either side of a vertical plane taken through the rotor axis. Each bar screen includes an adjustable main breaker bar 55 and a plurality of stationary breaker bars 56. The main breaker bars 55 of each screen 54 extend through the end walls of the main frame 10 and are received by bar supporting elements 59 on the outside thereof. The main breaker bars are adjustable with respect to the rotor 11 by shims 57 and bolts 58 that extend through openings in the ends of the main breaker bars, shims and breaker bar supporting elements 59. The main breaker bars are adjustable mainly to compensate for wear of the hammers 13 and to assist in controlling the fineness to which material will be reduced by the apparatus.

Positioned outwardly of each bar screen and within the foot or base member 15 of the main frame 10 is a plurality of chains 60 that hang from cross bars 61. The functions of the bar screens 54 and chains 60 will be discussed in detail hereinafter.

The side walls of the main frame 10 are prefer-

ably lined with replaceable wear plate members 62 that are secured to said side walls, as by bolts 63. The outer edges of the outermost plates 64 of the wear plate members 62 form guide means for the upgoing or breaker plate runs 30 of the chains 25 of the conveyors 23.

Immediately below the outer plate members 64 are auxiliary stationary breaker plates 65 that extend crosswise of the casing and close the space 10 or gap between the bar screens 54 and the conveyors 23 thus acting as bottom framing means to determine the lower edge of the portion of traveling breaker plate surface of a run 30. The auxiliary breaker plates 65 are removable from the main frame 10 through openings in the sides thereof by removing the end mounting members 166 of the auxiliary breaker plate 65 and sliding the auxiliary breaker plate 65 endwise out of the housing. Positioned directly above each of the outer plate members 64 are scraper members 66 that extend between the end walls of the main frame 10 and are secured thereto by bolts 67 and act as upper framing means to define the upper edge of the exposed surface of a traveling breaker plate. The chains 25 bear against the scraper members 66 and the scrapers remove or scrape therefrom any sticky material that may have adhered thereto and cause the removed material to fall downwardly into the reducing zone of the apparatus where it will be further reduced by action of the hammers 13 and discharged from the machine.

The outer plate members 64, auxiliary breaker plates 65 and scraper members 66 constitute rectangular frames, one being on each end of the housing, which define areas on the faces of the upgoing runs 30 of the conveyor chains 25 which areas lie directly over the backing or breaker plate reinforcing members 39. The areas defined by the frames form the traveling breaker plates of the pulverizer or crusher.

Referring to Fig. 2 it will be seen that the inner run 30 of each conveyor chain 25 is maintained against the frame under tension since the outer edge of the frame is positioned outwardly of a plane that is tangent to the inner or breaker plate face of the chain at the driving or idler sprockets 27 and 32. Thus the inner, upward, or breaker plate run 30 of the chain is deflected outwardly and slides upon the auxiliary breaker plate 65, the outer ends or edges of the side plates 64 and the scraper members 66 and is reinforced or made rigid in the breaker plate area by the backing or breaker plate reinforcing member 39 which also causes the breaker plate area of the run 30 of the chain to be maintained against the frame.

The side walls of the head member 14 of the main frame 10 form a cradle 68 for receiving a feed chute assembly 69. The feed chute assembly 69 includes a stationary body 70 having end walls 71 that are received in the cradle 68 formed in the side walls of the head member 14 and in which they are preferably bolted through flanges 72 on the end walls of the chute assembly 69 and flanges 73 on the side walls of the head member 14. The body 70 of the feed chute assembly includes an inlet chute 74 that leads to a material directing chute 75 pivoted to and between the end walls 71 of the chute assembly by stub shafts 76 that extend through the end walls 71. A lever in the form of a handle 77 that is secured to the outer end of one of the stub shafts 76 cooperates with flanges 78 on one end wall 71 of the feed assembly and the outer walls of the

head member 14 through a locking pin 79 to position the pivoted chute 75. The chute 75 may occupy either of two positions which are indicated in Fig. 2 of the drawings. The feed chute assembly above described is disclosed and claimed in a co-pending application of Lloyd K. Knight for a Crusher, Serial No. 603,367, filed July 5, 1945. (Patent 2,463,631 issued March 8, 1949.)

In operation, the rotor of the pulverizer or crusher may travel in either direction as indicated by the arrow, but for purposes of description it will be assumed that the rotor is traveling in a counter-clockwise direction.

The pulverizer or crusher is adapted to reduce various kinds of material which may be, for example, wet marl, limeshell marl, various ores, a mixture of stone and mud, or other material whether wet and sticky or dry. Material to be reduced, such as sticky material of the type above mentioned, will be fed through the inlet chute 74 to the pivoted chute 75, which, when the rotor is traveling in a counter-clockwise direction, will divert the material to the left side of the apparatus (as viewed in Fig. 2) where it will drop into the reducing chamber and into the path of the hammers 13 of the rotor 11. The hammers 13 on striking the material will cause an initial pulverizing or reducing action and impel the material against the left hand traveling breaker plate area of the breaker plate run 30 of chain 25 where a secondary pulverizing or reducing action will take place. At least a part of the material will fall from the breaker plate into the path of the hammers 13 where additional reducing action will take place and this action will continue until the material is adequately pulverized or reduced so as to pass through the left hand screen 54.

The sticky material which adheres to the traveling breaker plate chain 25 will be scraped therefrom by the scraper 66 and returned to the path of the hammers 13. Any material which passes through the breaker plates and accumulates inside the conveyor chains 25 will be discharged therefrom, particularly when it becomes dry, by passing through the discharge spaces 22 in the chain.

I have found that for reducing most materials a pair of bar screens 54 are suitable. However, it may be desirable in certain instances to place screen bars 56 in the space between the ends of the screen 54 to form a single screen that encases the lower half of the rotor 11. The sticky material that is ejected through the bar screen 54 strikes the chains 60 but because the chains 60 hang freely, the material will not build up thereon to any great extent, it being loosened on the chains by vibrations of the machine and the impacts of additional material striking the chains. There is a tendency for sticky material to build up on the wall opposite the breaker plate which is acting to crush material and I have found that by forming each side wall as a traveling breaker plate that material cannot accumulate to any great extent within the housing, both traveling breaker plates being operative to cause their scrapers to return any material which may have accumulated thereon back to the reducing zone or area of the pulverizer or crusher.

The pulverizer or crusher is reversible, that is, its rotor may be driven in either direction and this is particularly advantageous in that when one face of the hammers 13 has become worn the original efficiency of the machine may be restored by changing the direction of rotation of the rotor

and by changing the position of the pivoted feed chute 75 so as to divert the material being fed to the opposite or right hand side of the apparatus.

While the pulverizer or crusher is designed particularly so that it will treat sticky material it is to be clearly understood that it is equally usable with dry material and in many installations it will be used in wet weather for sticky material and in dry weather for dry material, the material being the same in both instances, except for the water content.

When the pulverizer or crusher is used for dry material, the motor 44 may not be operated at all, or if so, it may be operated only periodically, in which former case the conveyors 23 will be stationary. In such case the breaker plates will be stationary but can be adjusted to present different block links to form an effective breaker plate.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended and I wish therefore not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In a crusher, the combination with a frame providing a central symmetrical reducing chamber, a reversible material crushing hammer rotor located centrally thereof and having symmetrical reducing devices thereon adapted to produce substantially the same reducing action for each direction of rotation, and adapted when rotating to strike material and reduce it while impelling at least some of said material, a pair of rectilinearly traveling breaker plate means symmetrical-ly arranged one on each side of said rotor selectively adapted first to receive said material when struck and impelled by said rotor as determined by its direction of rotation, upper and lower framing members adjacent the top and bottom, respectively, of said reducing chamber and defining a continuous area of each breaker plate means between said upper and lower framing members which is exposed to said reducing chamber, and means for operating said breaker plate means to present new surfaces between said framing members thereby presenting new surfaces to said reducing chamber, said traveling breaker plate means including endless traveling chains.

2. In a crusher, the combination with a frame providing a central symmetrical reducing chamber, a reversible material crushing hammer rotor located centrally thereof and having symmetrical reducing devices thereon adapted to produce substantially the same reducing action for each direction of rotation and adapted when rotating to strike material and reduce it while impelling at least some of said material, a pair of rectilinearly traveling breaker plate means symmetrical-ly arranged one on each side of said rotor selectively adapted first to receive said material when struck and impelled by said rotor as determined by its direction of rotation, upper and lower framing members adjacent the top and bottom, respectively, of said reducing chamber and defining a continuous area of each breaker plate means between said upper and lower frame members which is exposed to said reducing chamber, and means for operating said breaker plate means to present new surfaces between said framing

members thereby presenting new surfaces to said reducing chamber.

3. In a crusher, the combination with a frame providing a central symmetrical reducing chamber, a reversible material crushing hammer rotor located centrally thereof and adapted when rotating to strike material and reduce it while impelling at least some of said material, a pair of rectilinearly traveling breaker plate means symmetrically arranged one on each side of said rotor selectively adapted first to receive said material when struck and impelled by said rotor as determined by its direction of rotation, upper framing members defining the upper limit of each breaker plate means exposed to said reducing chamber, and means for operating said breaker plate means to present new surfaces to said reducing chamber, said traveling breaker plate means including endless traveling chains.

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