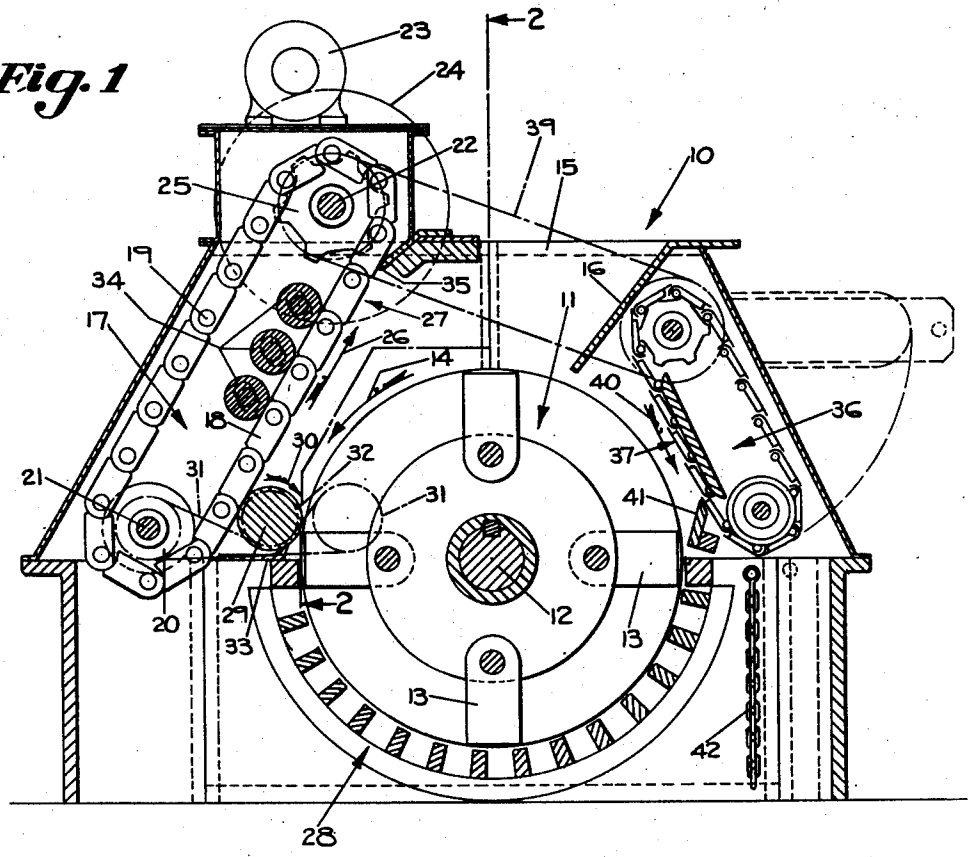
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HAMMER MILL WITH TRAVELING BREAKER PLATE

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Fig. 1



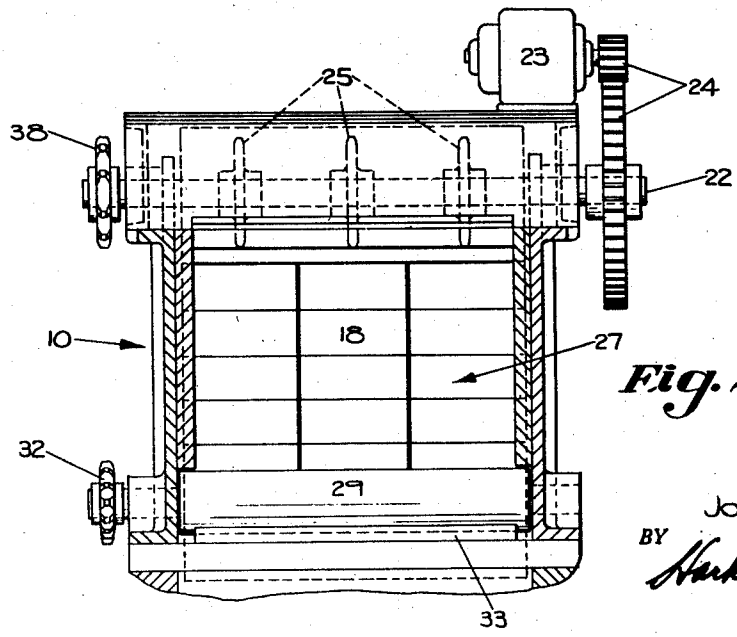


Fig. 2

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Fig. 4

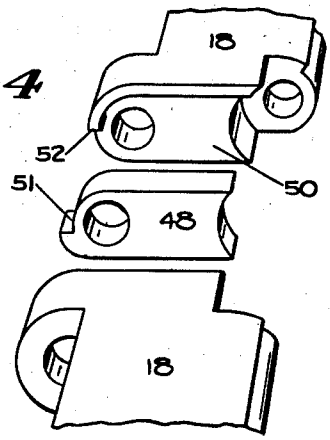


Fig. 3

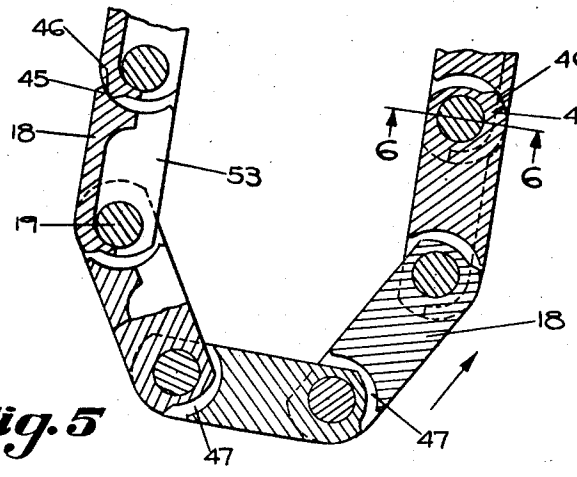


Fig. 5

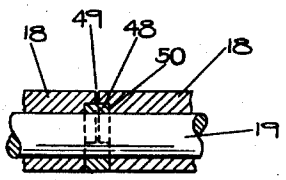


Fig. 6

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HAMMER MILL WITH TRAVELING BREAKER PLATE

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Application November 18, 1944, Serial No. 564,014

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 an improved pulverizer or crusher preferably, but not necessarily, of the swing hammer type in which endless chain or belt means forms an upwardly traveling primary breaker plate positioned to be struck by material initially impacted by the rotor, the upwardly traveling breaker plate conveying or elevating sticky material upwardly whereby sticky material will not accumulate on the breaker plate in sufficient quantity to prevent efficient operation of the apparatus, there preferably, but not necessarily, being provided a material removing means adjacent the top of the breaker plate whereby sticky material will be positively removed from the breaker plate and which removed material preferably is directed to be struck again by the rotor.

In carrying out the foregoing object it is another object of the invention to provide in the improved crusher or pulverizer another traveling chain or belt means positioned generally opposite the upwardly traveling breaker plate and at another side of the axis of the rotor for conveying reduced sticky material from the reducing chamber or housing of the apparatus, the said other chain or belt means preferably, but not necessarily, having a material removing means associated therewith for positively removing from it sticky material adhering thereto.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings,

Fig. 1 is a transverse sectional elevational view of a pulverizer or crusher incorporating the features of my invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a view similar to Fig. 1, of a modified form of pulverizer or crusher;

Fig. 4 is an exploded view showing certain details of the endless chain breaker plate of the device of Figs. 1 and 2 or of Fig. 3;

Fig. 5 is a sectional view through the endless chain conveyor device showing particularly the construction of the chain links of either modification; and

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5, looking in the direction of the arrows.

Referring first to the structure of the pulverizer or crusher illustrated in Figs. 1 and 2 of the drawings, said device includes a main frame 10 which forms a casing or housing. The interior of the casing or housing 10 forms a reducing chamber within which is a rotor 11 which includes a transversely extending shaft 12 and a plurality of swing hammers 13 which constitute the initial crushing, pulverizing or reducing means of the rotor 11. The rotor 11 is designed and adapted to be driven in the direction of the arrow 14 by a driving motor, not illustrated.

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The top of the main frame housing 10 is provided with a feed opening 15 by which material to be crushed, such as wet marl, lime shell marl, a mixture of stone and mud, or any other material, whether wet and sticky or dry, may be fed to the pulverizer or crusher to be reduced thereby. A plate 16 adjacent the feed opening 15 acts as a chute to guide the material into the path of the rotor 11.

Adjacent the left-hand side of the main frame or casing 10, as viewed in Fig. 1 of the drawings, I provide an endless chain conveyor 17 which is made up of a group of heavy block links 18, preferably of cast steel, which are pivotally connected together by cross-rods 19 (see Fig. 5). The conveyor 17 also includes a plurality of bottom idler wheels 20 mounted on a foot shaft 21, the wheels 20 providing support for the bottom portion of the endless chain formed by block links 18.

At is upper end the conveyor 17 includes a head shaft 22 which is driven from an electric motor 23 through reduction gearing 24. The head shaft 22 is provided with a plurality of drive sprockets 25 which drive sections of the endless chain formed by links 18. As clearly illustrated in Fig. 1 of the drawings, the conveyor 17 is within the housing formed by the main frame 10 and is driven so that the lower or working run or portion, or the run closest to the rotor 11, travels in an upward direction, as illustrated by the arrow 26.

As best illustrated in Fig. 2 of the drawings, the lower or exposed faces of the block links 18 of conveyor 17 form a traveling primary breaker plate 27 which travels in an upwardly and inwardly direction. In other words, the axis of the conveyor 17 or the plane of the traveling breaker plate 27 extends upwardly and is inclined inwardly above the rotor 11. This inclination of the breaker plate may have as its limits a substantially vertical position and a position as great as forty degrees to the vertical. In the particular structure illustrated in Fig. 1 the

breaker plate is inclined at an angle of thirty degrees to the vertical.

Adjacent the lower half of the rotor 11 and in a bottom casting forming the bottom portion of the main frame 10, is an arcuate bar screen 28 which co-operates with the swing hammers 13 to reduce the material after its initial fracture, until it is capable of passing between the bars of said screen 28.

As clearly illustrated in Fig. 1 of the drawings, the breaker plate 27 is close to the path of the peripheries of the swing hammers 13, though they are slightly spaced apart. Adjacent the bottom of the breaker plate 27, or, in other words, near the bottom of the conveyor 17, I place a member in the form of a roll 29 between the breaker plate 27 and the upper left-hand portion of the screen 28 so as substantially to fill this area and prevent material dropping down through it. It is also to be noted that the right-hand extremity of the roll 29 is very close to the peripheral path of the hammers 13, so that material which strikes the roll 29 will be diverted into the path of a swing hammer 13 for further pulverizing.

The roll 29 is rotated preferably in the direction of the arrow 30, being driven by a sprocket on the outer end thereof, which is driven from a chain and sprocket mechanism 31 driven from the foot shaft 21 of conveyor 17. The drive sprocket for said roll 29 is seen at 32 in Fig. 2 of the drawings. Associated with the bottom of the roll 29 is a scraper 33 which scrapes any sticky material therefrom and directs it into the path of the swing hammers 13.

To reinforce the breaker plate 27 so that it can withstand the forces of the stone and like material which are impacted against it, I provide supporting means which, in the structure of Fig. 1, is illustrated as a plurality of rolls 34 which are provided with trunnions, preferably adjustable toward and from the rear face of the breaker plate 27 in supports formed in the casing or frame 10. If desired, a backing plate, as illustrated in Fig. 3 of the drawings, may be substituted for the rolls 34.

Adjacent the top of the breaker plate 27, I provide a transverse scraper 35 which scrapes the sticky material therefrom and drops it into the path of the rotor 11. It is thus seen that the traveling breaker plate 27 is cleaned of sticky material at all times and the sticky material is delivered to the rotor 11 to be reduced thereby.

Adjacent the right hand side of the main frame or housing 10, or, in other words, to the right of the rotor 11 and thus on the opposite side of the feed opening 15 from that where conveyor 17 is located, I provide a second conveyor 36 which is above the right hand end of the screen 28 and which slopes upwardly and inwardly. The conveyor 36, while generally similar to the conveyor 17, need not be formed of heavy block links 18, but may be formed of much lighter links which overlap, however, to provide a substantially continuously exposed collecting surface 37 which is exposed to the interior of the casing 10. The conveyor 36 is driven from a sprocket 38 (see Fig. 2) on the shaft 22 by appropriate chain and sprocket drive mechanism 39 so that it travels in the direction of the arrow 40 or downwardly, rather than upwardly, as compared with the active run of conveyor 17. The exposed surface 37 does not act as a breaker plate but merely as a traveling articulated accumulator plate to accumulate sticky material and convey it downwardly where it is scraped from the surface 37 by a transversely extending scraper 41 which removes it from said surface and delivers it into the path of the rotor 11.

Hanging below the conveyor 36 is a plurality of chains 42 which will swing or vibrate when the machine is in operation, to prevent a building up of sticky material in this portion of the housing. If desired, similar chains may be provided beneath the conveyor 17.

In Fig. 3 of the drawings, I have illustrated certain modifications of the structure of Figs. 1 and 2 which I shall now describe, it being understood that unless a contrary fact is indicated, the structure of Fig. 3 follows that of Figs. 1 and 2. In the modification illustrated in Fig. 3, the conveyor 17 and the traveling breaker plate 27 are set at a smaller angle to the vertical. As illustrated, the angle is approximately ten degrees to the vertical. In addition, in place of the rolls 34, I have substituted an adjustable reinforcing or supporting plate 43 to reinforce the traveling breaker plate 27. Also, in place of the roll 29 I have substituted a sloping filler member 44 which will guide material to the path of the rotor 11. The conveyor 36 has been changed slightly in that it has been extended downwardly a greater extent so that the material which it accumulates, is not scraped off to fall in the path of the rotor 11, but, on the other hand, is scraped off in the bottom of the main frame or housing 10 outside the screen 28.

It is to be understood that any one of the features of the structure of Fig. 3 which differs from that of Fig. 1, may be employed in the structure of said Fig. 1, and vice versa.

In Figs. 4, 5 and 6 I have illustrated in some detail the structure of the links 18 and associated mechanism which provides the continuous breaker plate 27. It may be stated, first of all, by reference to Fig. 2 of the drawings, that there are three rows of said block links 18 side by side, which form the traveling breaker plate 27, though this number may be increased or decreased as desired. As previously mentioned, the links 18 are of very heavy construction, being preferably made as steel castings so that they can withstand great impacts. On their back faces they include sprocket tooth receiving recesses 53. (See Fig. 5.)

In the operation of the device, some material will pass between the joints of the traveling breaker plate and be caught on the inside of the endless chain formed by the links 18. To reduce this action to a minimum, adjacent links 18 have co-operating arcuate surfaces 45 and 46 which overlap and are in rubbing contact with each other when two adjacent links 18 are in alinement, or, in other words, during the straight run of the chain. As the chain bends while traveling around the idler wheels 20, discharge spaces 47 are formed between adjacent links 18 by the illustrated cut-away portions thereof adjacent the pivot rods 19, thus providing for free discharge of the accumulated material inside said chain, particularly after the material has become dry.

Also to reduce to a minimum the amount of material which passes between the links 18, I provide a filler block 48 (see Figs. 4 and 6), which overlaps the gap 49 (see Fig. 6), between the lateral edges of adjacent blocks 18, the filler blocks 48 being carried on the pivoting cross-rods 19 and held in recesses provided by similarly recessed portions 50 of the links 18. The blocks 48 are provided with ledges 51 which co-operate with abutments 52 on the block links 18 to hold

them in their proper positions, since they are preferably not welded or otherwise rigidly attached to block links 18.

In the operation of the device of Figs. 1 and 2, the rotor 11 will be traveling in the direction of the arrow 14 and the conveyors 17 and 36 and the roll 29 will travel in the directions indicated by their associated arrows. Material to be reduced, such as sticky material of the type above mentioned, will be delivered to the feed opening 15 and be guided by the feed chute 16 into the path of the hammers 13 of rotor 11. The hammers 13 on striking the material will cause an initial pulverizing or reducing action and impel the material against the traveling breaker plate 27 where a primary pulverizing or reducing action will take place. At least part of the material will fall from the breaker plate 27 into the path of the rotor 11 where additional reducing action will take place and this will continue until the material is adequately pulverized or reduced so as to pass through the screen 28.

The sticky material which adheres to the traveling breaker plate 27 will be scraped therefrom by the scraper 35 and returned to the path of rotor 11. The roll 29 will prevent material passing between the bottom of the breaker plate 27 and the rotor 11 and will direct said material into the path of said rotor 11; any sticky material adhering to it, being removed by scraper 33.

Any material which passes through the breaker plate 27 and accumulates inside the conveyor 17 will be discharged, particularly when it becomes dry, by passing through bottom spaces 47. Any sticky material which is accumulated on the working face 37 of conveyor 36 will be scraped therefrom by scraper 41 and delivered to the path of the rotor 11. As illustrated in Fig. 1 of the drawings, the conveyor 36 is preferably pivotally mounted about its upper shaft so that it can be swung upwardly to provide inspection of the rotor 11.

While the pulverizer or crusher is designed particularly so that it can 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 23 may not be operated at all, or if so, it may be operated only periodically, in which case the conveyors 17 and 36 and the roll 29 will be stationary. The breaker plate 27 in this instance will be a stationary breaker plate, but one which can be adjusted to present different block links 18 to form the effective breaker plate 27.

The operation of the pulverizer or crusher of Fig. 3 is essentially as that above described, except that the stationary filler member 44 takes the place of the roll 29, and the material accumulated on the surface 37 of conveyor 36 is not delivered to the path of the rotor 11, but is discharged from the open bottom of the housing 18. The remarks made concerning the operation of the pulverizer or crusher of Figs. 1 and 2, also apply to that of Fig. 3.

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 therefore wish 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. A crusher including a casing, a rotor having crushing means thereon and mounted for rotation in said casing, a feed opening in the top of said casing, and a pair of endless chain means, one on each side of the axis of rotation of said rotor at least one of which constitutes a traveling breaker plate, means for driving each of said endless chain means, each of said endless chain means having a scraper associated therewith to remove sticky material gathered thereby, said endless chain means both sloping upwardly and inwardly.

2. A crusher including a frame, a rotor on said frame having reducing hammers, an endless primary breaker plate extending upwardly from one side of said rotor and positioned to be struck by material impelled by an initial strike from said rotor, a roll contacting the bottom of said breaker plate and located between it and said rotor, a scraper adjacent said roll for scraping material therefrom, a scraper adjacent said breaker plate for scraping material therefrom, and means for driving said breaker plate and roll.

3. In a crusher, the combination with a frame forming a housing having a top feed opening, of a material crushing rotor therein, an arcuate screen adjacent the bottom portion of said rotor, an upwardly and inwardly inclined endless chain breaker plate near the top of said rotor on one side but spaced therefrom and spaced from said top feed opening, and means comprising a roll interposed between the bottom of said chain breaker plate and said screen to close the gap between them, the inner portion of said means being adjacent the outer path of travel of said crushing rotor.

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