Feb. 23, 1954 H. J. DOUGLAS 2,670,140

LIFTING SHELF

Filed Oct. 14, 1950

Fig. 2

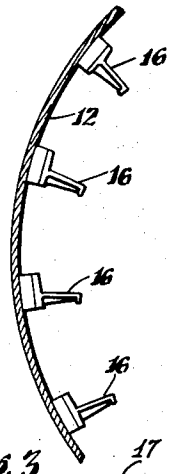


Fig. 1

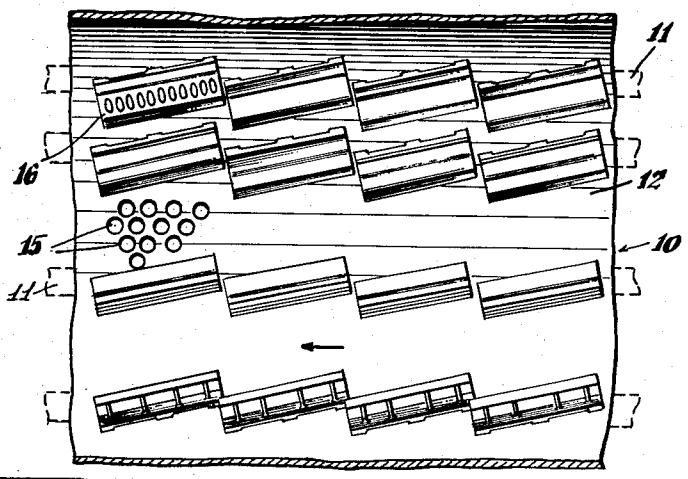


Fig. 3

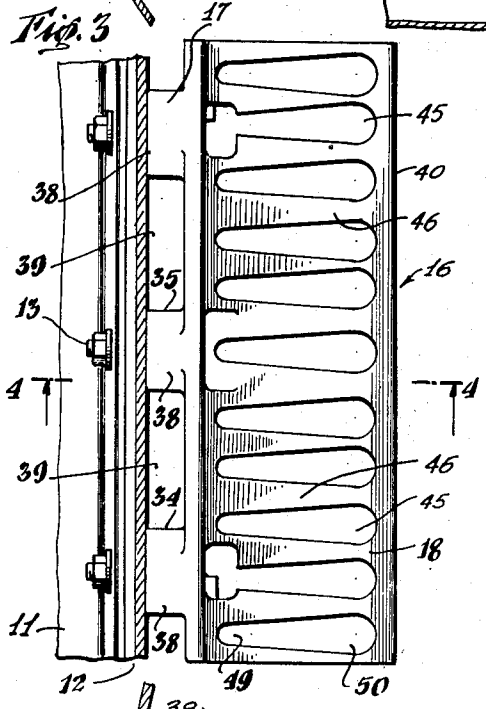


Fig. 5

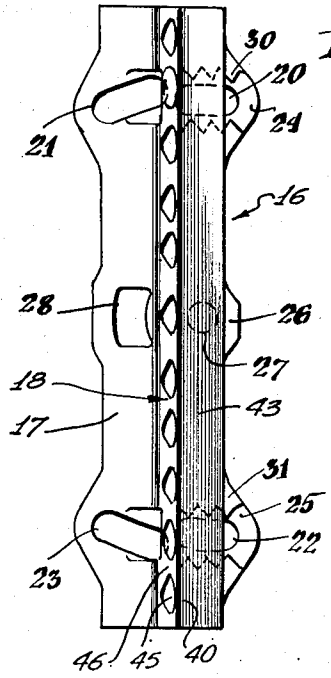
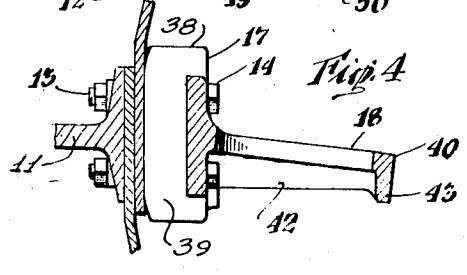


Fig. 4



INVENTOR
Harry J. Douglas
BY
Frank A. Bauer
ATTORNEY

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LIFTING SHELF

Harry J. Douglas, Philadelphia, Pa., assignor to Pennsylvania Crusher Company, Philadelphia, Pa., a corporation of New York

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2 Claims. (Cl. 241—91)

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This invention relates to a material reducing mill of the Bradford breaker type and more particularly to the lifting shelf structures of such a mill.

The object of this invention is to provide such a mill stirring and lifting the material in an effective manner and dropping and screening the lifted material by specially constructed shelving giving a very efficient reducing action and high output of properly sized product.

Another object of this invention is to provide a novel lifting shelf structure screening and material and shattering it by impact as it drops back from the shelving above.

A still further object is to provide a shelf having a grid-like formation with self-clearing openings.

Other and further objects of the invention will appear from the following description in which

Fig. 1 is a fragmentary view of the wall of the mill showing the lifting shelves;

Fig. 2 is a fragmentary end view of the wall of the mill with the shelves;

Fig. 3 is a top view of a shelf mounted on the wall of the mill;

Fig. 4 is a cross-sectional view of Fig. 3 along lines 4—4, and

Fig. 5 is a front view of the shelf.

Referring to Fig. 1 of the drawings there is shown a fragmentary portion of a drum 10 of a material reducing mill of the Bradford breaker type comprising longitudinal beams 11 and perforated metal sheets 12 fastened to the longitudinal beams 11 to form the walls of the drum. The drum is rotated and frangible material is fed in at one end and moved longitudinally in the direction of the arrow by the lifting shelves 16 that carry the material up the sides of the drum and drop it. The shelves are set at an angle sliding the material off in the direction of the arrow. The shelves 16 are closely spaced in longitudinal rows, each shelf having its trailing edge (to the left, Fig. 1) below the leading edge (to the right, Fig. 1) of the following shelf on the lifting side of the drum as it turns. The resulting approximately vertical gap is substantially as shown and material sliding along the shelf drops through the gap at the trailing edge. The dropped material hits against the following shelves and the walls of the drum breaking into smaller pieces. When the broken pieces are of the proper size they fall through the openings 15 in the wall of the drum.

One of the shelves 16 is shown in Figs. 3, 4 and 5 and comprises a bracket portion 17 and a shelf portion 18 extending from the bracket portion. The bracket portion is fastened rigidly against the wall of the drum by the nuts 13 and the bolts 14 extending through the bracket and the flanges of beams 11. The bracket has curved slotted openings 20, 21, 22, 23, 28 extending through the brackets in the raised portions 24, 25, 26 respectively. The shelf is pivotally adjusted about the opening 27 in the raised portion 26. The bolts 14 extending through the beam 11 and drum wall 12 extend through the slotted openings. The curve of the slotted portions is preferably centered about the opening 27. The slots are extended so that the shelves may be tilted in either direction depending on the direction of movement desired. Sets of opposing notches 30, 31 are provided on shelf side of the openings 20, 22 to grip the head of the bolt and retain the shelf in a given angular position or in a level position. The bosses 38 are raised or extended from the bracket 17 to form passages 39 between the bracket portion 17 and the wall of the drum wall through which pieces of material may pass (Fig. 4). As the drum turns and moves upwardly the frangible material is picked up by the shelves. The small and medium size pieces may fall through these passages 39 while the larger pieces slide off of the edge 40.

The shelf portion 18 extends in a generally radial direction and is set at a slight angle from the radial to facilitate the sliding of the pieces as the shelf is moved upwardly. Ribs 42 are evenly spaced on the back of the shelf portion and lip 43 extends along the edge 40 to reinforce the shelf portion and strengthen it.

The shelf portion is perforated forming spaced slots 45 and webs preferably extending laterally of the shelf. The slots screen out the larger particles for breaking and help spread the smaller pieces over the drum surface and drop them through the wall openings 15.

The edges of the slots 45 form fracturing edges which tend to shear the material on impact. Webs 46 are formed between the slots 45 to receive the blows of the falling material. The pieces may drop from a preceding shelf and crack against the shelf or may hit a piece that is sitting on the shelf. The perforations permit the rapid removal of the smaller pieces from the shelf reducing and softening effect on the impact of the larger falling pieces. With the smaller pieces out of the way they are not ground into such smaller pieces but fall through the slots and the openings 15 in the drum.

The slots 45 preferably extend from the bracket portion 17 forward towards the edge 40 with the slots widening towards the edge. The inner portions 49 of the slots are larger than the outer portions 50. Pieces that are caught in the smaller portions may slide or be forced into the larger portion and drop through the slot clearing it of the clogged piece.

As each shelf gathers its material at the bottom of the drum the grid like structure selects for lifting only the larger pieces and rejects the smaller pieces passing through the openings, the larger ends of the openings engaging the larger pieces at the top of the pile while the lower reduced widths below are in mesh with the finer fragments at the bottom. The load lifted by each shelf is thus reduced to the pieces still requiring fracture and unnecessary lifting is avoided, the discarded fines being passed out by the peripheral drum openings 15. As the shelves move up the smaller particles pass through the slots and passages and slide down the drum wall spreading the pieces over a larger screening area and culling out the oversize pieces. The rain of pieces through the passages 39, 45 bombards any pieces caught therein breaking them and clearing the passages. As the shelves move up into the more horizontal position the pieces falling through the passage 39 hit against the following shelves and are broken by impact. The material sliding along the wall through the passages 39 will generally slip past the shelves without catching. The pieces that become enlodged in the slots 45 are cleared by the pounding of pieces against the slots driving the enlodged pieces into the larger openings and dropping out of the slots. This is done largely by the pieces that fall through the passage 39 from the preceding shelves. Pieces that are jammed in the largest portions 50 and cannot move down into a larger area to drop through have to be broken or shattered to be cleared from the slot. With the shelves at an angle the large pieces of material picked up by the shelves will slide along the shelf hitting any such pieces caught and fracture them into smaller pieces thus clearing the slots. The slots will also be cleared when the drum is upside down with the larger width portion downward so that with the vibration and jarring of the drum some of the enlodged pieces will be shaken loose and drop out of the slot.

It is understood that the number of rows of shelves to be positioned around the inside of the drum, the spacing between the rows, and the size, number and distance between the slots in a shelf depend on the speed of rotation of the drum, the type of material to be broken and the desired size of the broken material. Preferably, as illustrated in Fig. 2, the rows of shelves are spaced closely around the circumference of the drum, for instance, at least four rows in succession at all times at the side of the drum and moving upward and dropping the coal pieces from shelf to shelf to fracture against the slot edges of the shelves as they move upward.

I claim:

1. A material reducing mill comprising a drum turning on a generally horizontal axis and having a peripheral perforated drum wall circular in cross section around said axis and carrying shelving formed by successive rows of separate shelves having inwardly directed shelf portions extending longitudinally along the inner surface of said wall in close sequence to each other and moving with the drum to lift material upward as the drum turns, the rows of shelves being circumferentially closely spaced to provide at least four rows simultaneously moving upward on the rising side of the drum and the shelves of each row being tilted with relation to each other so that the trailing edge of each shelf portion is below the leading edge of the following shelf portion a substantial distance on the lifting side of the drum as it turns on its axis providing an open vertical gap and so that lifted material slides off in a direction from the leading edge toward the trailing edge and in the direction of progress of the material through the drum and drops through the gaps between the shelves against the next lower row of shelves, each shelf portion being formed as a grid with a series of parallel elongated apertures each of which extends inward from adjacent the wall edge of said shelf portion to adjacent the inner edge thereof to form lateral fracturing edges positioned in side-by-side relation and extending from the wall edge to the said inner edge of the shelf portion and acting to engage and fracture material dropped from the preceding shelves on the upward moving side of the drum.

2. A material reducing mill as set forth in claim 1 in which the elongated apertures are pear-shaped with the narrow portion adjacent the wall edge of said shelf portion so that at the lower travel of the shelf portions in the material at the bottom of the drum the larger ends of said apertures engage the larger pieces of the material at the top of the pile while the lower reduced widths are in mesh with the finer fragments at the bottom.

HARRY J. DOUGLAS.

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