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[57] **ABSTRACT**[57] **ABSTRACT**

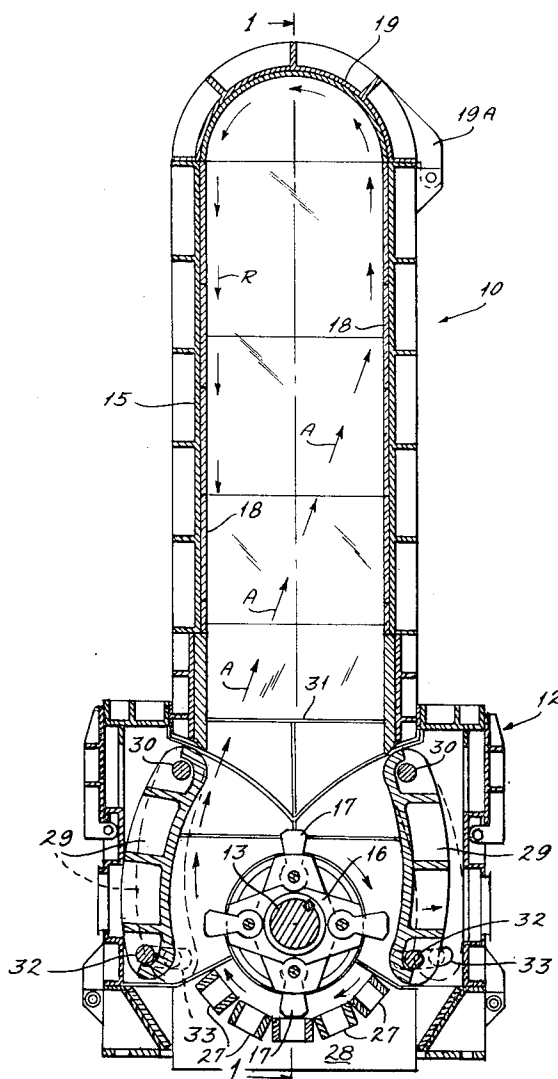
[51] **Int. Cl.**.....B02c 13/02

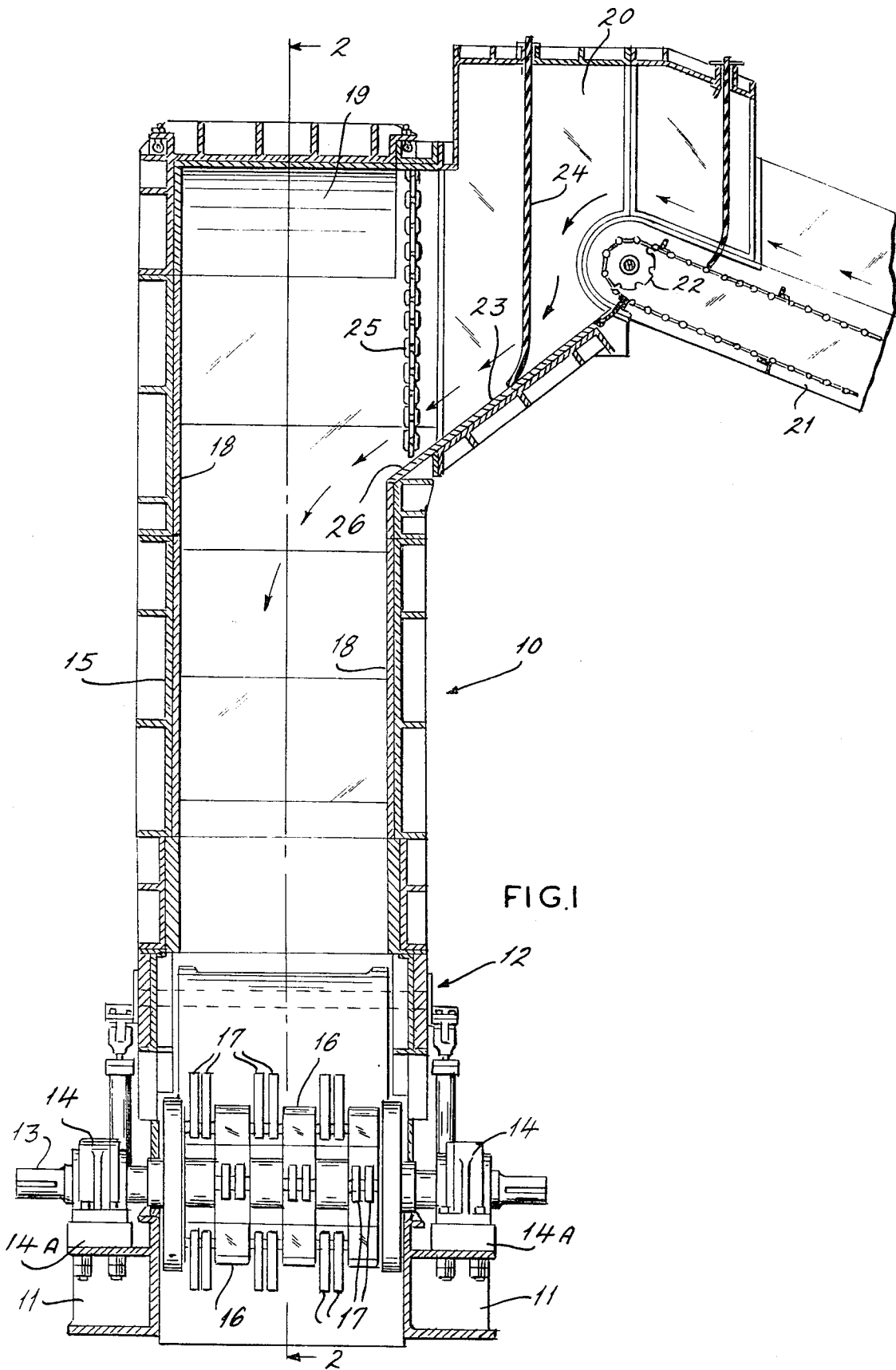
[58] **Field of Search**.....241/97, 138, 154, 185 R, 186 R,
241/187, 189 R, 189 A

[57] **ABSTRACT**

A material reducing hammer mill of reversible character having a material feed stack and breaker bars arranged to control the trajectory of the material being reduced such that the material flung reversely in the feed stack may be directed in its flight to reduce the damaging wear on the walls of the feed stack. The control is obtained by utilizing the breaker bars on the off-side relative to rotation of the hammer rotor to direct the trajectory of the flying material in a predetermined path in the feed stack to minimize the impact and wear on the walls of the feed stack.

9 Claims, 4 Drawing Figures





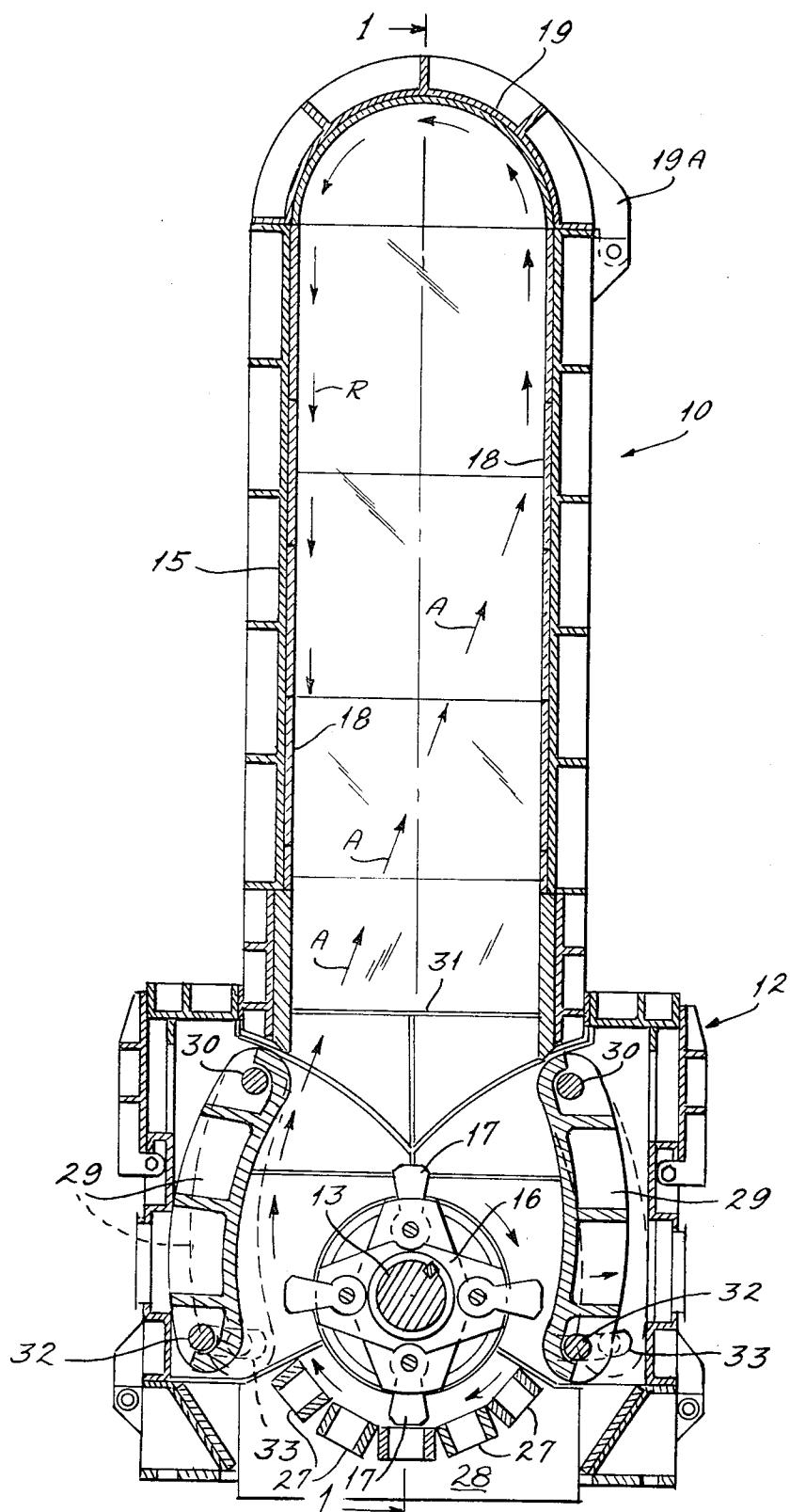
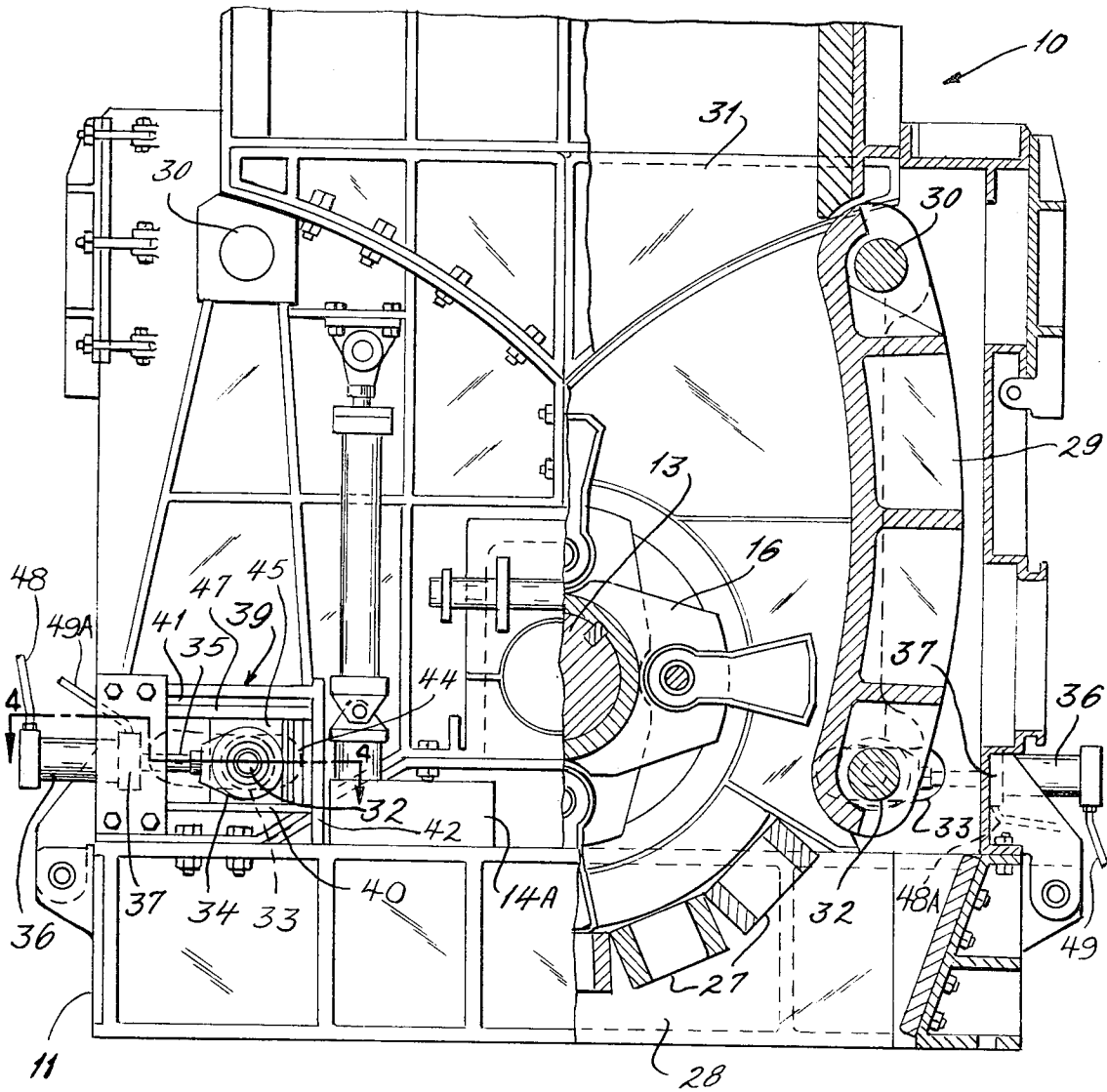
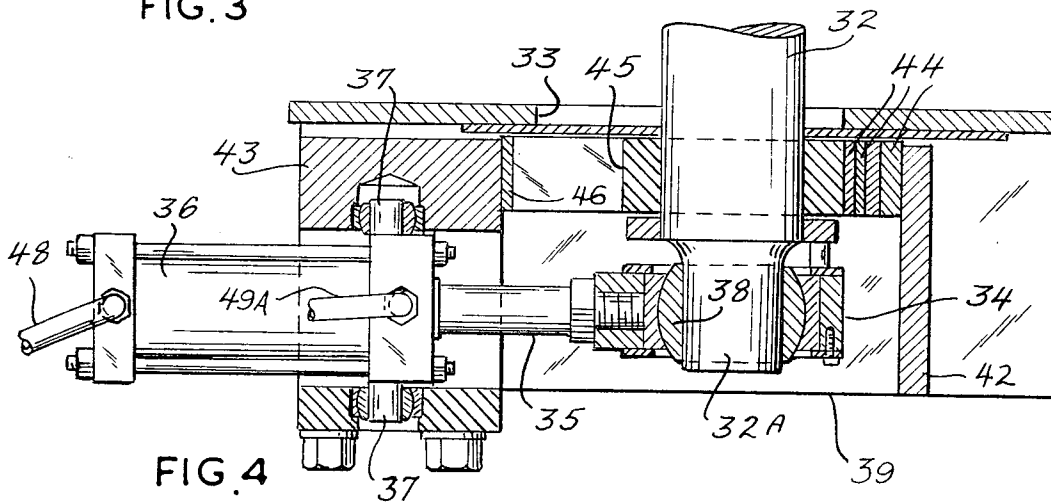


FIG. 2



MATERIAL REDUCING HAMMER MILL

BRIEF DESCRIPTION OF THE INVENTION

This invention relates to reversible material reducing hammer mills and more particularly to improvements in the construction of the mill components for reducing wear and damage to the mill housing by flying objects that fail to be adequately reduced by the rotor hammers during the initial phases of impact with the hammers. It is a frequent occurrence in hammer mills for reducing hard or metallic material that certain objects will be carried through the rotor and fly backwardly in the feed stack with tremendous velocity. The impact of this character of material on the walls of the feed stack causes damage to and rapid wear of the stack walls.

It is, therefore, an important feature of this improved hammer mill to construct a material feed stack of such length and shape that the flying objects rejected by the hammer rotor will be caused to follow a path that will reduce the impact effect and redirect the objects back to the rotor at reduced velocity and in a path such that retaining objects will impact with the high velocity objects and cause material reduction and fracturing. It is also an important feature to utilize the breaker bars at the off-side of the hammer rotor direction of rotation as a means for causing the objects to follow a desired path in the feed stack that will minimize wear of and impact on the walls of the feed stack.

A preferred embodiment of reversible hammer mill comprises a hammer mill casing for the hammer rotor in which the breaker bars on each side of the hammer rotor are selectively adjustable, an elongated material feed stack connected to the mill casing and formed with a material return wall, a material inlet to the feed stack arranged to introduce the material to be reduced in a zone laterally displaced from the path of flying objects, and means to control the breaker bars so that the bars are yieldable and those bars on the off-side of the rotor will be effective to predetermine the path of movement of the rejected flying objects so that impact and wear in the feed stack is reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

The principle of operation of the preferred embodiment of this reversible hammer mill is illustrated in the accompanying drawings, wherein:

FIG. 1 is a sectional elevational view of the hammer mill showing the casing, feed stack and material feed conveyor housing;

FIG. 2 is a sectional elevational view of the hammer mill taken at line 2—2 in FIG. 1 showing the important internal details of assembly of the operating components;

FIG. 3 is a fragmentary and partial sectional elevational view of the hammer mill showing the means for controlling the breaker bars to determine the path of movement of the flying objects rejected by the rotor; and

FIG. 4 is an enlarged and fragmentary view of a typical yieldable assembly and adjustment means for the mill, the view being taken along line 4—4 in FIG. 3.

DESCRIPTION OF THE APPARATUS

As may be seen in FIG. 1 and 2, the reversible hammer mill 10 includes a base 11 on which the casing 12 for the hammer rotor is mounted. A rotor shaft 13 is mounted in suitable end bearings 14 carried on blocks 14A attached to the base 11 for the casing structure. Suitable prime mover means (not shown) is operably connected to the rotor shaft 13. The casing 12 supports an elongated material feed stack 15 which opens to the casing for the hammer rotor 16, and the rotor is provided with a plurality of pivoted hammers 17 spaced around the rotor in the usual manner. A plurality of wear plates 18 are mounted to line the interior walls of the feed stack. The top portion of the feed stack is circularly formed at 19 to provide a dome surface for redirecting the flying objects of rejected material back to the rotor in casing 12. A material inlet hopper 20 (FIG. 1) is mounted at one lateral side of the feed stack 15 and a suitable

conveyor 21 has its upper end equipped with a sprocket 22 so that the material to be reduced falls onto the chute surface 23 of the inlet hopper 20. The hopper is provided with a dust curtain 24 and beyond that is a protective curtain 25 of chain links suspended across the feed stack inlet opening 26 to contain the material within the feed stack 15.

Referring to FIGS. 2 and 3 it can be seen that grate bars 27 are mounted over the outlet 28 in the base 11 of the casing 12 to gauge the size of the material to be discharged from the mill. Across each side of the hammer rotor 16 are positioned breaker bars 29. The breaker bars 29 are pivotally supported on shafts 30 carried by the casing 12 near the junction of the feed stack 15 and casing inlet opening 31. The lower ends of the respective breaker bars 29 are provided with shafts 32 which project outwardly of the casing walls through arcuate slots 33. The opposite outer ends of these shafts 32 are engaged by thrust heads 34 and, in turn, the heads 34 are connected to the rods 35 of position control cylinders 36. The cylinders 36 are mounted in pivot bearings 37 on the casing 12 so that they may move in conformity to the arcuate motion of the shafts 32 connected to the breaker bars 29.

In FIGS. 3 and 4 it can be seen that a typical breaker bar control assembly is connected to the projecting end 32A of the shaft 32. The thrust head 34 includes a suitable alignment bearing 38 to accommodate angular alignment. The head 34 is movable in an open face guide box 39 having a bottom wall 40, a top wall 41, an inner end wall 42, and an outer wall 43 in which the pivot bearings 37 for the cylinder 36 are mounted. A plurality of shims 44 of various selected thickness are disposed in the guide box 39 between the shaft 32 and the inner end wall 42, and more particularly adjacent to the slide block 45 attached to the shaft 32 behind the thrust head 34. A single shim 46 may be disposed between the slide block 45 and the outer wall 43. The shims are retained in position on the bottom wall 40 by a removable keeper 47.

The cylinders 36 at the right and left (FIG. 3) are supplied with either air or hydraulic fluid under pressure through a conduit system having branches 48 and 48A, and 49 and 49A for allowing reversing the thrust. That is when branch 48 at the left is pressurized its companion branch 48A is also pressurized so that the cylinders move together. In this state branches 49 and 49A become return lines so as not to oppose the thrust. Reversing the pressure to branches will cause cylinder 36 to shift the breaker bars 29 in unison, thereby locating the breaker bars 29 attached to the shaft 32 in a desired position relative to the hammers 17. It is observed that more or less shims 44 will determine the angular position of the breaker bars 29 by limiting the inward travel of shaft 32 in the slot 33. Concurrently the cylinder will function as a shock absorber to allow the shaft 32 to move outwardly when hard to reduce material is forced by the hammers 17 to pass the breaker bars 29, but due to the continued thrust of the pressure fluid the shaft 32 will return to its starting position against the shims 44.

The description given with respect to FIGS. 3 and 4 is typical of the control assembly at the opposite ends of each shaft 32. Therefore only one such assembly needs to be disclosed. The conduit system 48, 48A, 49 and 49A is believed to be understood from the foregoing description and its complete disclosure is deemed unnecessary.

OPERATION OF THE MILL

It will be assumed that the rotor 16 will be rotated in a clockwise direction (FIG. 2) and in which condition the right hand breaker bars 29 will be positioned inwardly adjacent the path of travel of the hammers 17. The left hand breaker bars 29 will therefore be positioned in retracted position relative to the hammer circle by the proper stack of shims 44 such that hard objects passing around the rotor 16 will be properly controlled to follow a trajectory, indicated by arrows A, to fly upwardly in the elongated stack 15 and strike a glancing blow on the lining plates 18 at the right side of the stack. These objects

will then slide around the dome surface 19 at the top of the stack 15 and return along a path indicated by arrows R. The returning objects will be caused to impinge at sufficient velocity between the hammers to aid in the reduction thereof, thus relieving the hammers 17 of some of the work of material reduction. The chain curtain 25 will, of course, retain the flying objects within the stack 15, and dust raised by the reducing action will be kept within the mill by the flexible curtain 24 in the feed hopper 20.

When the rotor 16 is reversed to counter clockwise rotation the breaker bars 29 will be adjusted to the dotted outline positions by reversing the power fluid to each cylinder.

As is seen in FIG. 3 the cylinder 36 at the left is provided with conduits 48 and 49A; and the cylinder 36 at the right has conduits 48A and 49. Conduits 48 and 48A connect to a common line and conduits 49 and 49A connect to a different common line. The connections are such that pressure fluid supplied to conduits 48 and 48A will be accompanied by making conduits 49 and 49A returns. In this manner the cylinders 36 will be coordinated to change the positions of the breaker bars 29 in the manner described.

SUMMARY

The herein described material reducing mill has certain novel and improved features. It is noted that the breaker bars 29 are shaped so that they may be interchangeable top for bottom and side for side so that wear thereon may be accommodated for improved efficiency and longer useful life. The rotor is reversible to obtain longer life from the hammers 17, and the lining plates 18 in the stack 15 may be easily replaced by opening the stack dome 19 at the hinge 19A. The employment of fluid pressure cylinders 36 will allow the breaker bars 29 a desired degree of yielding response to hard to reduce objects so that damage to the working components is minimized. Finally, the provision of the elongated stack 15 in combination with positional control of the breaker bars 29 and provision of a circular shape in the stack dome 19 will cause the objects flying into the stack 15 to follow a path which will avoid pounding the stack lining plates and supporting structure, thereby increasing the life of the mill and more importantly, increasing the efficiency and life of the hammers 17 by having the objects follow path R and impinge on the rotor between hammers 17. The stack lining plates 18 are preferably made in segments which are bolted (not shown) or otherwise replaceably attached to the stack structure for ease of replacement when necessary.

What is claimed is:

1. A material reducing hammer mill comprising a hammer rotor, a casing enclosing said rotor and having a material outlet below said rotor, an elongated stack on said casing open to said rotor to direct incoming material into said rotor, breaker bars operatively mounted in said casing at opposite sides of said rotor, means pivoting said breaker bars from the upper ends thereof in said casing, control means operatively connected to said breaker bars below said upper ends, said control means positioning said breaker bars selectively inwardly about said rotor and accommodating movement of said breaker bars away from said rotor and including means cooperating with the breaker bars at one side of said rotor to space the breaker bars at said one side of said rotor in a position to direct objects projected upwardly in said elongated stack by said rotor to strike in said stack at an angle to the stack elongation, said stack being provided with a dome top section to redirect the projected objects back toward said rotor to impinge at said hammer rotor with substantial velocity to increase the efficiency of material reduction.

2. A material reducing hammer mill comprising a hammer rotor, a casing enclosing said rotor and having a material outlet below said rotor, an elongated stack on said casing open to said rotor to direct incoming material into said rotor, breaker bars operatively mounted in said casing at opposite sides of said rotor, means pivoting said breaker bars from the upper

ends thereof in said casing, control means operatively connected to said breaker bars below said upper ends, said control means positioning said breaker bars selectively inwardly about said rotor and accommodating movement of said breaker bars away from said rotor and including means cooperating with the breaker bars at one side of said rotor to space the breaker bars at said one side of said rotor in a position to direct objects projected upwardly in said elongated stack by said rotor to strike in said stack at an angle to the stack elongation, said control means including pressure fluid means to absorb the shock of objects impinging on said breaker bars.

3. The mill of claim 2 wherein said means cooperating with said breaker bars at one side of said rotor to space the breaker bars at said one side in a position to direct objects projected upwardly in said elongated stack comprise a stack of shims.

4. A material reducing hammer mill comprising a casing having an inlet and an outlet, grate means at said outlet, a reversible rotor in said casing adjacent said grate means, hammers on said rotor describing a circular path and traveling across said grate means, breaker bars mounted adjacent said hammer path and at each side of said grate means, said breaker bars being movable about pivot axes remote from said grate bars, means adjustably operable to position the breaker bars selectively close to and spaced from said hammer path to accommodate the direction of rotation of said rotor and hammers, and a material feed stack connected at one end to said casing inlet and having a dome surface at its opposite end remote from said casing inlet, said breaker bar adjustably operable positioning means being adjusted to position the breaker bars at unequal spacing relative to said hammer path to make use of said breaker bars farthest from said hammer path to control the trajectory of hard to reduce material impelled by said rotor hammers past said grate means and reversely into said feed stack, said trajectory causing the material to strike glancingly in said feed stack and traverse said dome surface for return toward said casing inlet.

5. The mill of claim 4 wherein said adjustably operable means includes pressure fluid cylinders connected to said breaker bars remote from said pivot axes, said cylinders normally urging said breaker bars toward said hammer path and yielding to the passage of hard to reduce material.

6. The mill of claim 4 wherein said adjustably operable means includes shim elements set to prevent movement of said breaker bars inwardly toward said hammer path beyond a predetermined position, and pressure fluid cylinders connected to said breaker bars and normally acting to retain said breaker bars in positions determined by said shim means.

7. The mill of claim 4 wherein said material feed stack has a material receiving surface to direct material into said stack, and a protective curtain is positioned across said receiving surface to retain material in said stack.

8. The mill of claim 7 wherein said receiving surface is adjacent said dome surface to direct incoming material into the path of material impelled by said rotor hammers reversely into said stack.

9. A material reducing hammer mill comprising a hammer rotor reversibly rotatable, a casing enclosing said rotor, an elongated stack open to said casing above said rotor, breaker bars in said casing at opposite sides of said rotor, means pivoting said breaker bars from the upper ends for movement toward and away from said rotor, breaker bar position control means operatively connected to each of said breaker bars below said upper ends, each of said position control means including a slide block and pressure fluid thrust means connected to said breaker bar to move said breaker bar toward said rotor, and shim means cooperating with said slide blocks to limit the inward travel of said breaker bars, said shim means being more numerous at one side of said rotor to space the associated breaker bar farther from said rotor to direct objects propelled by said rotor upwardly in said elongated stack at an angle to the stack elongation.

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