July 21, 1953 J. CHRYSTAL 2,646,224

IMPACT CRUSHER ROTOR WITH RIGID HAMMERS

Original Filed March 29, 1950 2 Sheets-Sheet 1

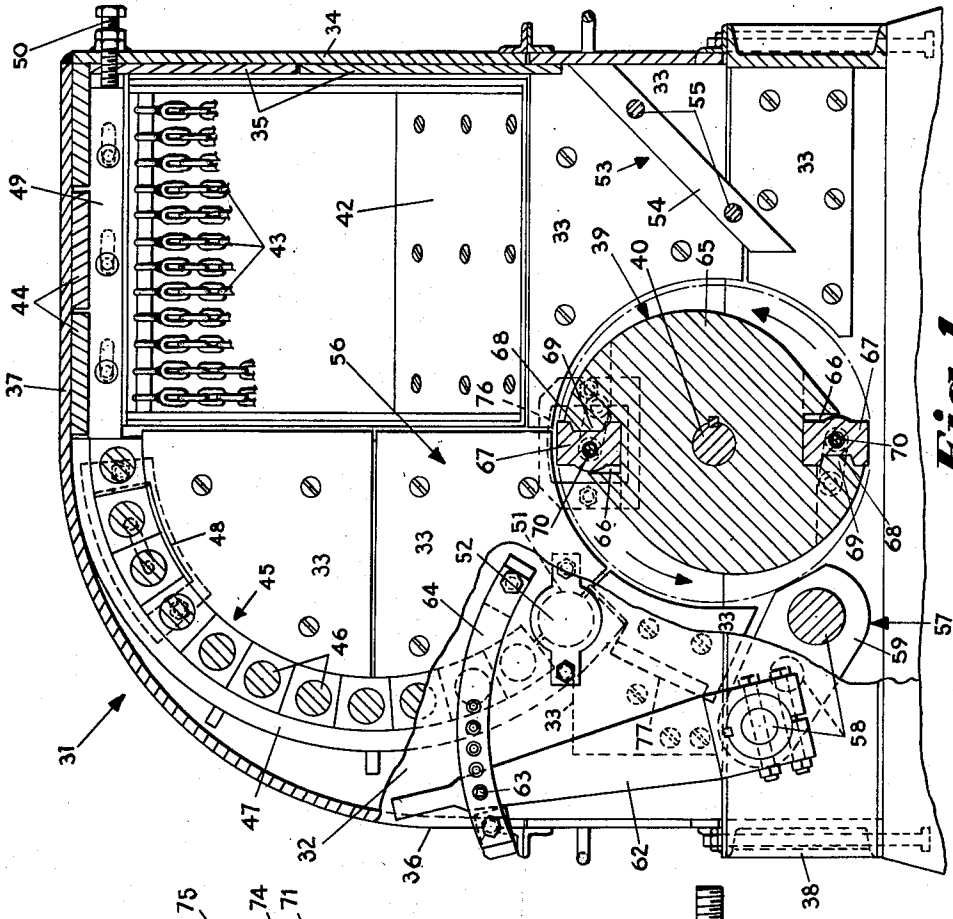


Fig. 1

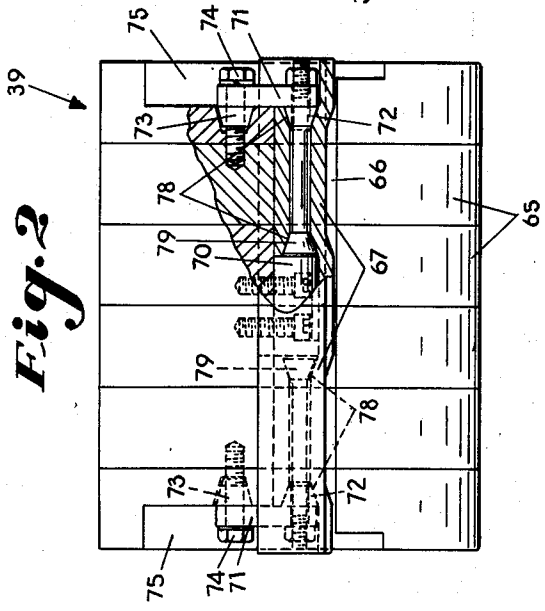


Fig. 2

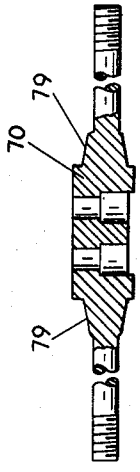


Fig. 3

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IMPACT CRUSHER ROTOR WITH RIGID HAMMERS

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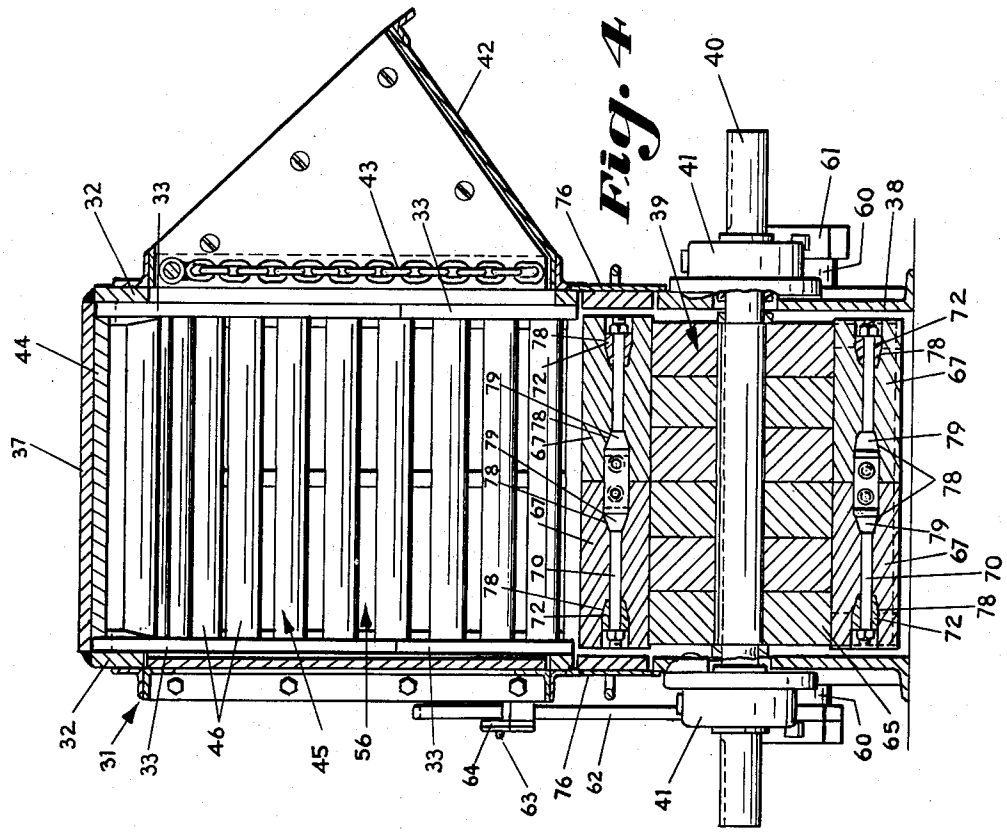


Fig. 4

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IMPACT CRUSHER ROTOR WITH RIGID HAMMERS

John Chrystal, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company, a corporation of Ohio

Original application March 29, 1950, Serial No. 152,529. Divided and this application May 15, 1951, Serial No. 230,862

3 Claims. (Cl. 241—191)

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This invention relates to a rigid hammer impact type crusher, and an object of the invention is to provide in a crusher of this type an improved rotor including improved rigid hammer holding means.

A further object of the invention is to provide an improved crusher or crusher rotor per se wherein rigid hammer means are secured within a peripheral axial rabbet or groove in the rotor body by hammer holding means constructed to pull rather than push the hammer means against one wall of the rabbet whereby there is no wedging force tending to separate the side walls of the rabbet provided by the hammer holding means.

A still further and more specific object of the invention is to provide an improved crusher or crusher rotor per se wherein rigid hammer means are secured within a peripheral axial rabbet or groove in the rotor into which they may be inserted or removed only by endwise axial movement with respect to the rabbet and wherein there is provided an improved hammer holding means constructed to pull rather than push the hammer means against one wall of the rabbet whereby there is no wedging force tending to separate the side walls of the rabbet provided by the hammer holding means.

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 side sectional elevational view of an impact crusher incorporating features of my invention;

Fig. 2 is a plan view of the rotor, with parts broken away and in section;

Fig. 3 is a sectional view of an element of the rigid hammer holding means; and

Fig. 4 is an end sectional elevational view of the machine of Fig. 1, showing chains across the feed chute.

This application is a division of my application Serial No. 152,529, filed March 29, 1950, now Patent No. 2,618,438, dated November 18, 1952, for Breaker Bar Screen Means for Rigid Hammer Rotary Impact Crusher.

In the drawings one form of impact crusher incorporating the features of my invention is disclosed. This machine includes a housing or casing 31 having a pair of parallel laterally spaced upright side walls 32, 32 provided with removable liners 33. The housing or casing 31 also includes a transversely extending upright end wall 34, the upper portion of which is provided with removable liners 35. Opposite the end wall 34 is an end wall 36 which curves into an integral top wall 37. The side, end and top walls are all rigidly attached together and are supported on and removably attached to a heavy rectangular base 38 which may be anchored above an opening in the supporting floor, through which opening reduced material is discharged from the open bottom of the housing or casing 31.

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Within the housing 31 there is a rotor 39 which, as illustrated, is built up of a plurality of steel discs 65 stacked on a rotor shaft 40 and keyed thereto. The rotor 39 is supported for rotation on a transverse horizontal axis by spaced bearings carried in appropriate bearing boxes 41 at opposite sides of the housing 31. A selected one of the side walls 32 is provided with a feed chute 42 which, if desired, may be provided with chain screen 43. Opposite the chute 42 is a removable door interchangeable therewith. The top wall 37 is preferably provided with removable liner or breaker plates 44 directly above the feed chute 42.

Within the housing 31 and spaced from the adjoining end and top walls 36 and 37 there is a breaker bar screen 45 which is made up of a plurality of closely adjacent but spaced apart breaker bars 46 preferably of cylindrical shape, which extend transversely or axially of the rotor between the side walls 32. The axes of said bars 46 are points along a smooth concave curve which is generally or substantially horizontal at the top of the chamber 31 where it is radially the greatest distance from the axis of the rotor 39, this curve being substantially radial with the rotor 39 at its bottom.

The bars 46 are provided with individual end plates by which they are slidably carried in guides on the oppostie side walls 32 provided by liners 33 and guide ribs 47. The breaker bars 46 may be inserted and removed by extending them transversely through an opening 48 (see Fig. 1) in one of the side walls 32,, which opening may be closed by a filler type cover plate after the breaker bars 46 are all inserted. They may be clamped with their end pieces held tightly together by abutting clamping bars 49 and associated clamping screws 50.

There is a larger and heavier breaker bar or anvil 51 which is the lowermost of those forming the screen 45 or which is the closest bar of this screen to the rotor 39. The breaker bar 51 is not inserted as are the breaker bars 46, but it is carried at opposite ends in receiving cups on the side walls 32 and is individually removable lat-

erally through holes in the side walls 32 covered by the cover plates 52. It has been found desirable to make this breaker bar 51 heavier than the others because it is subjected to severe shocks occasioned by large particles being caught between it and one of the rotor hammers.

Below the feed chute 42 there is a bar screen 53 which is formed by a plurality of parallel laterally spaced downwardly sloping screen bars 54 which extend at right angles to the axis of the rotor 39 and are held together by a pair of transversely extending rods 55. It is to be noted that the bar screen 53 extends from the end wall 34 sloping downwardly therefrom to a position close to the rotor 39, the bottom thereof being below a horizontal plane passing through the axis of said rotor 39. This cooperates with the breaker bar screen 45 to provide a large reducing chamber 56 in which substantially 180° of the rotor 39 is exposed to the material undergoing reduction.

Below the bar screen 45 there is another or supplemental bar screen 57 which, as illustrated, includes three cylindrical transversely extending breaker bars 58 extending between and rigidly attached to end plates 59. The top-most of the breaker bars 58 extends axially beyond the end plates 59 and through sleeves 60 (see Fig. 4) formed integral with the plates 59, which sleeves 60 are journaled in appropriate journal bearings formed on the base 38. This top breaker bar 58 is keyed or otherwise rigidly attached to the sleeves 60 and at one end is provided with a locking collar 61, the other end being provided with an upstanding lever 62 bolted thereto. Lever 62 is keyed by a shear pin 63 at any one of a plurality of positions provided by threaded openings in a pair of spaced apart holding straps 64 between which lever 62 extends and which are attached to and spaced from one of the side walls 32 of the housing 31.

By adjusting the lever 62 the clearance between the bottommost breaker bar 58 and the rotor 39 may be adjusted. This bottommost breaker bar 58 is preferably heavier than the other two since it is subjected to more severe shocks. The shear pin 63 constitutes an overload release in case too severe a shock is transferred to the lowermost breaker bar 58. The adjustability of the screen 57 provided by the lever 62 makes for a rough adjustment of the fineness of the material produced. A stationary transversely extending plate 77 extends between the bottom of the screen 45 and the screen 47 and in effect forms a stationary part of said supplementary screen 57.

As above set forth, the body of the rotor 39 may be built up of a plurality of heavy steel discs 65 stacked on the shaft 40 and keyed thereto. The discs 65 are also preferably tack welded together. At diametrically opposite positions the body of the rotor 39 is provided with peripheral axially extending grooves or rabbets 66 adapted to receive rigid hammers 67 which, as illustrated, are two-piece members (see Fig. 4).

The rotor body is so formed that the leading edge and a substantial portion of the leading face of each of the hammers 67 is exposed so that it may strike the material, such as stone, to be reduced. The rear or trailing side or face of each hammer 67 is provided with an axially extending groove 68 adapted to receive a projecting tongue 69 formed on the back or trailing face of the groove or rabbet 66 and on a backing or reinforcing portion of the body of the rotor 39. The tongue 69 and groove 68 cooperate to provide matching walls or surfaces of irregular contour, one on each hammer 67 and one in the peripheral axial groove or rabbet 66 so that it is impossible for the rigid hammer 67 to be inserted or removed radially from the groove or rabbet 66, having regard for the depth of groove or rabbet 66, the limited clearance provided by the opposite walls of said groove or rabbet 66, and the pertinent dimension (thickness) of the hammer 67. This interlock prevents the hammer 67 flying off the rotor 39 in case its holding means, hereinafter described, becomes broken or inoperative for any reason and the hammers can be inserted or removed from the rabbets 66 only by endwise axial movement.

As above stated, each of the rigid hammers 67 is made up in two parts. In other words, it is split at its longitudinal center, the two parts being in end to end relation in one of the rabbets 66 and being individually removable by being moved axially of the rotor 39 in opposite directions. To hold each rigid hammer 67 removably to the body of the rotor 39 a one-piece symmetrical tie rod 70 is provided, the center of which is bolted adjacent the axial center of the body of the rotor 39 within the groove 66. Each half of the rigid hammer 67 is of similar construction and is bored or hollow and is adapted to slide over the laterally extending wings of the tie rod 70, said hammer halves and tie rods having cooperating frusto-conical bearing areas or cams 78 and 79 respectively, so that when clamped in position the rigid hammer halves are cammed and held rigidly by said tie rod 70 against one wall of the rabbet 66.

At each outer end of each tie rod 70 there is a pivoted clamping strap 71 having integral frusto-conical projections or cams 72 and 73 adjacent opposite ends thereof. The projections 72 are received in cooperating frusto-conical cam or bearing areas 79 of the hollow rigid hammers 67 to which the straps are rigidly but removably clamped by nuts cooperating with the threaded ends of the wings of the tie rods 70. The frusto-conical projections or cams 73 are received in similar cam recesses in the body of the rotor 39. Machine screws 74 extend freely through the clamping straps 71 and are threaded into the body of the rotor 39.

The parts are so dimensioned that as the screws 74 are tightened a clamping camming action will be effected so as to place the straps 71 under tension, thereby pulling the rigid hammers 67 against one of the side walls of the groove or rabbet 66 and away from the opposite side wall thereof and without there being any wedging force tending to separate any of the walls or side surfaces of the rabbet 66 exerted directly by the hammer holding structure. In other words, tension on the side straps 71 effects a tight engagement between the areas defining the tongue 69 and the groove 68 and the cams 79 on the rods 70 do likewise.

The ends of the body of the rotor 39 are provided with appropriate receiving pockets 75 so that the ends of the tie rods 70 do not extend axially beyond the ends of the body of the rotor 39 and so that the straps 71 and machine screws 74 are within the axial dimensions of the body of said rotor 39, thus protecting all of these parts from damage. The rigid hammers 67 are also formed at their outer ends so as to shroud or protect the clamping parts just mentioned, as clearly illustrated in Fig. 2 of the drawings.

It is particularly significant to note that in this construction there are no forces tending to spread the groove **66**. Likewise the portion of the rotor body **39** which backs up or reinforces the rigid hammers **67** and which constitutes a cantilever is not subjected to any strain because of any clamping means for the rigid hammers. This is believed to be of considerable importance and constitutes a feature of my invention.

The two parts of the rigid hammers **67** may be removed through the opposite side walls **32** which are provided with access openings and removable cover plates **76** (see Fig. 4) which are essentially similar to the cover plates **52** and that provided for the opening **48**.

In the operation of the crusher material to be reduced which may be any hard friable material, of which stone is illustrative, will be delivered to the interior of the housing **31** through the feed chute **42**. Most of the fine material will escape radially through the screen **53** and be discharged through the open bottom of the housing. The oversize material incapable of passing through this screen will be struck a shattering blow by one of the rigid hammers of the rotor, which rotor will be traveling at a relatively high speed in the direction indicated by the arrows. The rigid hammers on striking the material will initially shatter it and propel it through the reducing chamber where it will strike a liner or breaker plate of the reducing chamber, such as the liner **12**, **33** or **44**, or some of it may strike the breaker bar screen **45** following the initial impact of the rigid hammer.

Material which strikes the breaker bar screen **45** and which is adequately reduced to pass through said screen may do so whereupon it will be free to fall downwardly through the housing and out the bottom thereof. Oversize material will be retained in the reducing chamber until adequately reduced to pass through this screen or the screen **53** or some of it may pass below the breaker bar screen **24** and be further treated until it can pass through the screen **45**.

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 applicant therefore wishes not to be restricted to the precise construction herein disclosed.

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

1. A rotor assembly for a crusher including means forming a rotor body having a peripheral axial rabbet having spaced side walls, hammer means in said peripheral axial rabbet including cam means at opposite ends, hammer holding means constructed to pull rather than push said hammer means against one wall of said peripheral axial rabbet whereby there is no wedging force tending to separate the walls of said peripheral axial rabbet provided by said hammer holding means, said hammer holding means including strap means adjacent each end of said hammer and the rotor body, cam means associated with said strap means, and means fastening said strap means to said hammer means and rotor body whereby said cam means cooperate to secure said hammer means in said peripheral axial rabbet as aforesaid.

2. A rotor assembly for a crusher including a rotor, a rigid hammer attached to said rotor and extending radially beyond the periphery and axially thereof, said rotor having a peripheral axial rabbet into which said hammer extends, said rotor and hammer each having means extending substantially throughout their lengths adapted to be interlocked to prevent radial movement of said hammer out of said peripheral axial rabbet, and tension type holding means constructed to pull rather than push said hammer against one side wall of said peripheral axial rabbet to hold said hammer tightly therein whereby there is no wedging force tending to separate the opposite walls of said peripheral axial rabbet produced by said hammer holding means, said holding means including straps one adjacent each end of said hammer and rotor extending transversely of said rotor axis and each including cam means cooperating when said straps are clamped to said hammer and rotor body to place the straps under tension as aforesaid, and means including a rod extending transversely axially of said rotor and hammer for clamping said straps to said hammer and rotor as aforesaid.

3. A rotor assembly for a crusher including a rotor, a rigid hammer attached to said rotor and extending radially beyond the periphery and axially thereof, said rotor having a peripheral axial rabbet into which said hammer extends, and tension type holding means constructed to pull rather than push said hammer against one side wall of said peripheral axial rabbet to hold said hammer tightly therein whereby there is no wedging force tending to separate the opposite walls of said peripheral axial rabbet produced by said hammer holding means, said holding means including straps one adjacent each end of said hammer and rotor extending transversely of said rotor axis and each including cam means cooperating when said straps are clamped to said hammer and rotor body to place the straps under tension as aforesaid, and means including a rod extending transversely axially of said rotor and hammer for clamping said straps to said hammer and rotor as aforesaid.

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