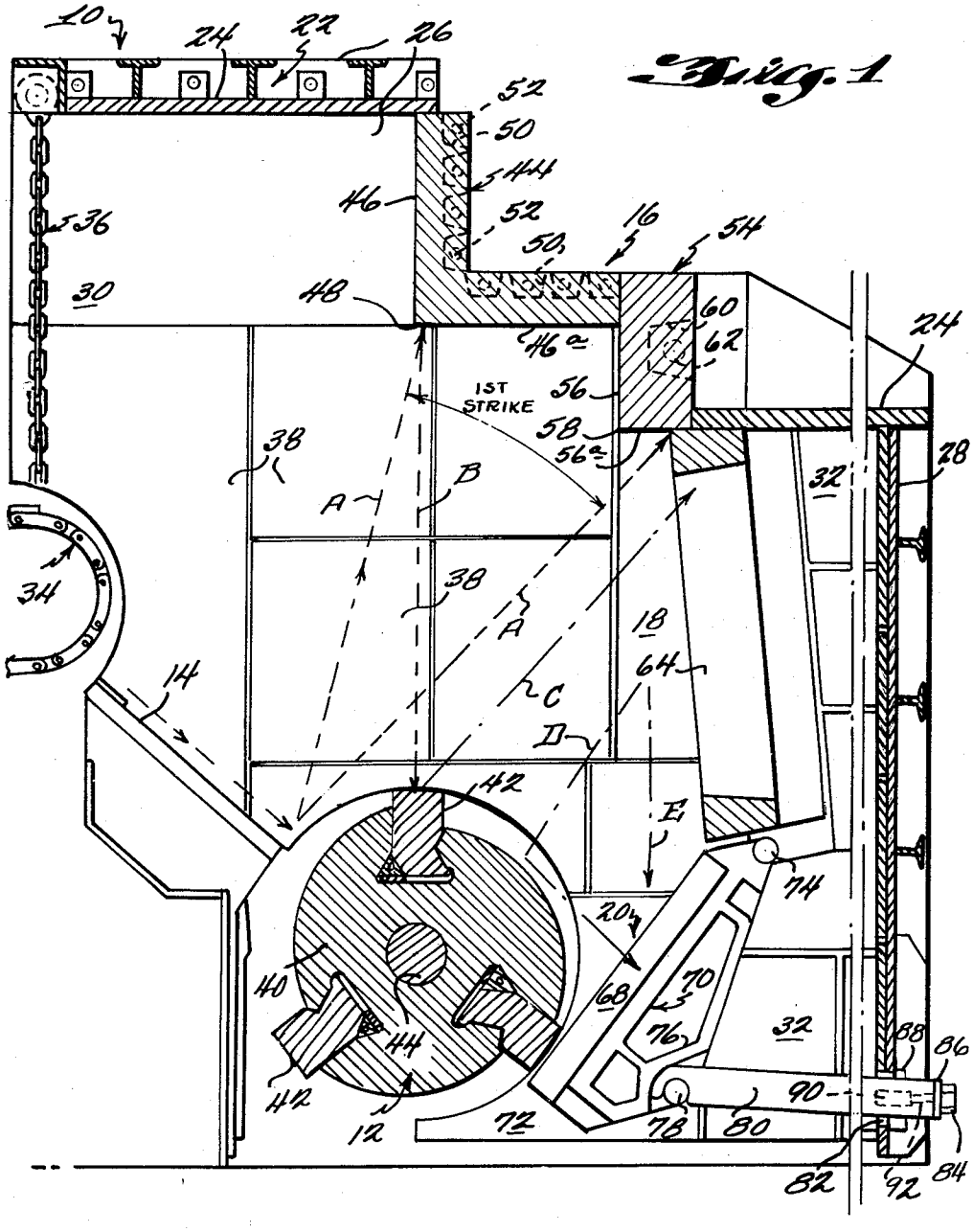
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Fig. 1



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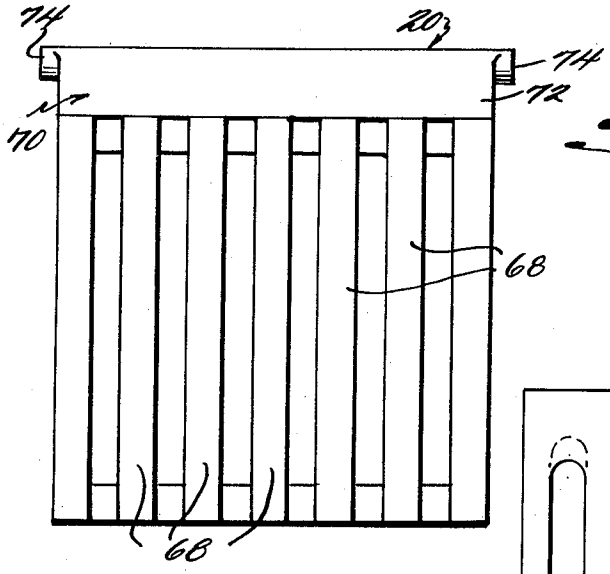


Fig. 3

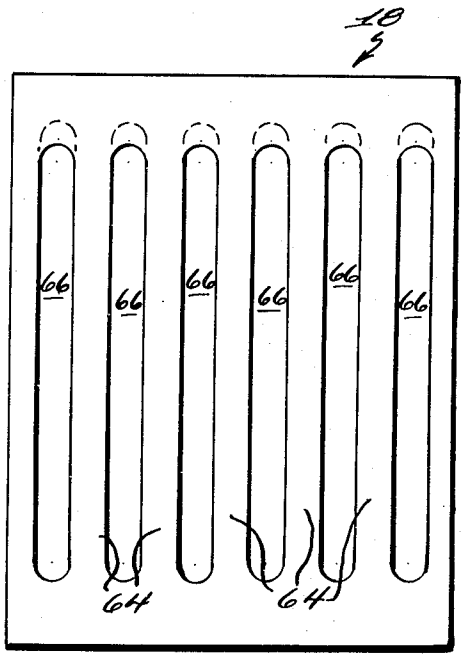


Fig. 2

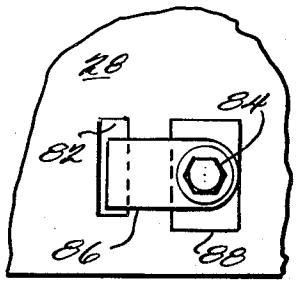


Fig. 4

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This invention relates to impact breakers and in particular to an improved construction and arrangement of the stationary breaking surfaces within a breaker.

Typically, impact breakers include one or more massive rotors carrying a series of hammers projecting radially therefrom. Material to be broken or crushed into smaller fragments, such as rock, ore, coal or the like is delivered into the path of the rotating hammers which strike the material with sufficient speed and force to shatter it and/or to throw it against various stationary breaker members which are fixed within a housing enclosing the rotor. In one common type of compact breaker the stationary breaking members include one or more heavy grates which face the rotor and against which the fragments of material are thrown. Smaller fragments pass between the bars of the grates to a collection chute while larger fragments are either broken by impact on the bars or returned to the hammers for further strikes. An impact breaker of this general type which utilizes two rotors is described in Patent No. 2,767,928.

It is the primary object of the present invention to provide an impact breaker of the type having a sizing and breaking grate in which the first strike of the hammers against material entering the breaker throw the material against a continuous, non-perforated breaking surface from which the fragments rebound into the path of the hammer for a second strike and subsequent impact on the grate.

It is a further object to provide an impact breaker of the above type having a continuous breaking surface positioned above the grates in the trajectory of the material which is first struck by the hammers upon entering the breaker.

These and other objects and advantages will become apparent from a reading of the following description taken in conjunction with the drawings in which:

FIGURE 1 is an elevational sectional view of an impact breaker embodying the principles of the present invention; and

FIGURES 2, 3 and 4 are fragmentary views of parts of FIGURE 1.

Referring to FIGURE 1, there is shown an impact breaker **10** which includes, as major elements, an impact rotor **12** mounted for rotation about a horizontal axis, a spreader apron **14** positioned radially of the rotor **12** for delivering material to be crushed thereto, a first-strike breaking assembly **16** above the rotor **12**, an upper grate **18** below the assembly **16** and a lower grate **20** below the upper grate **18**. A housing **22**, including horizontal top wall sections **24**, vertical side walls **26** and a vertical rear wall **28** surround the rotor **12** and grates **18** and **20** and defines an inlet **30** above and forwardly of the rotor **12**, a crushing chamber and an outlet duct **32** rearwardly of the grates **18** and **20**. A conveyor **34** is positioned in the inlet adjacent the spreader apron **14** for delivering material to be crushed to the machine and a conventional, vertical chain curtain **36** is suspended from the top wall **24** above the discharge end of the conveyor **34**. As is conventional in the art, the side walls **26** are provided with hard, protective plates **38**.

According to the invention, the breaking assembly **16** is arranged in the trajectory of the material which is first struck by the rotor **12**. The rotor **12** may be of any suitable construction and, as shown, includes a body **40** and three, equi-spaced radially projecting hammer bars **42** and a shaft **44** which is suitably journaled at its ends and which is provided with drive means (not shown) for rotating the same clockwise as viewed in FIGURE 1.

The trajectory of material such as rock, when it is struck by the rotating hammer bars **42**, depends on, among other variables, the size of the rock relative to the exposed radial height of the hammer bars **42**. Thus, a relatively small rock having a diameter approximately equal to the exposed height of a hammer bar will be thrown on a trajectory approximately tangent to the path of the hammer bar at the impact point because the rock is struck generally in a direction of motion which intersects its center of gravity. On the other hand, the center of gravity of a large rock cannot enter the path of the hammer bar and the force impacted to a large rock by the bar is applied off-center with respect to the rock. The trajectory of a large rock is therefore outwardly, with respect to a tangential line, meeting the path of the hammer bar at the point of impact. Therefore, according to the invention, the breaking assembly **16** is located above a plane tangent to the path of the hammer bars at the zone of impact. Actually, of course, a plurality of tangent planes exist because the points of impact between hammer and rocks vary with the size and position of the entering rocks.

Regardless of any theory or calculations as to the trajectory of the first-struck fragments thrown by the hammers **42**, it is desired as pointed out above, that the breaker assembly **16** be located in this trajectory so that fragments will be subjected to impact thereon before they are thrown against either of the grates **18** or **20**. In accordance with the above discussion of the trajectory, substantially the entire assembly **16** will generally be located above a plane tangential to the path of the periphery of the hammers **42** at the impact zone. The upper portion of the grate **18** will thus be generally located below this plane so that only small rocks can be thrown against this grate on the first-strike. However, since other variables of construction and operation of the machine may influence the trajectory of the first-struck material the positions of the assembly **16** and the upper grate **18** should be determined ultimately by the observed trajectory rather than solely by the calculated tangential plane.

As seen in FIGURE 1, the breaking assembly **16** which is constructed of hard wear-resistant material such as manganese steel, includes a breaker bar **44** having two mutually perpendicular legs **46** and **46***a* which form a structure which is generally L-shaped in transverse cross section. The bar **44** is located with its longitudinal axis parallel to the axis of the rotor **12** and with the outer corner **48** formed by the two legs **46** and **46***a* facing inwardly of the housing **22** and forwardly toward the inlet **30**. In the particular embodiment illustrated, the bar **44** is located substantially directly above the rotor **12** with one of the legs **46***a* in a horizontal plane. The surfaces of the bar **44** which intersect to form the inner corner of the L-shaped structure are provided with a plurality of lightening cavities **50**. The cavities **50** near the longitudinal ends of the bar **44** are provided with longitudinal holes for bolts **52** which retain the bar in the housing **22** by being secured, for example, to the side walls **26** or other suitable structure.

Preferably, the bar **44** is adapted to be reversible to the extent that either of the outer surfaces of the L-shaped structure may be placed in a horizontal position while maintaining the outer corner facing forwardly. This feature permits the area of highest wear, the horizontal surface, to be distributed to both surfaces **46** and **46***a*. With the present construction this is accomplished merely by removing the bar **44** from the housing **22**, rotating it 180° about a horizontal axis transverse to the bar and 90° clockwise as viewed in FIGURE 1 and replacing it with the bolts **50**. In the particular embodiment illus-

trated the bar 44 forms a part of the housing 22 when in either of its operative positions and thus no disassembly of the apparatus is required for reversing the positions of surfaces 46 and 46*a*.

The breaking assembly 16 also includes a second cornered breaking bar 54 located below and rearwardly of the bar 44. As seen in FIGURE 1, the bar 54 is generally rectangular in transverse cross section and is positioned immediatedly adjacent the rear extremity of leg 46*a* of the bar 44 with two of its surfaces 56 and 56*a* facing inwardly of the housing and the corner 58 formed by these surfaces facing forwardly. The wider of the two surfaces which face outwardly of the housing is provided with one or more longitudinal lightening cavities 60, the cavities nearest the ends of the bar 54 being provided with longitudinal holes through which retaining bolts 62 may be inserted into the side walls 26 of the housing 22 or into other supporting structure.

The breaking bar 54, like bar 44, is preferably adapted to be reversibly mounted to permit the positions of its surfaces 56 and 56*a* to be readily interchangeable. Thus, in the construction illustrated the bar 54 may be removed, rotated 180° about a horizontal transverse axis and replaced without disassembly of the machine, particularly if, as shown, the bar forms a portion of the housing.

The construction of the upper grate 18 may be conventional and, as seen in FIGURE 2, may be a cast rectangular plate having vertical breaking bars 64 separated by spaces 66 having a width equal to the diameter of the rocks that are desired to pass therethrough. If desired, the spaces 66 may be wider at the rear face of the plate so that rocks passing into the spaces at the front face will not tend to jam therein. The location of the grate 18 will be generally below the above-discussed tangential plane through the zone of impact, but in any event will be below the trajectory of fragments thrown by the hammers 42 upon entering the machine. The grate is positioned in a generally upright position by any suitable mounting means, the exact position being preferably one at which maximum breakage of fragments occurs rather than one of maximum deflection of the fragments.

The lower grate 20, as is conventional in the art, is located below the upper grate 18 and similarly consists primarily of generally upright spaced bars 68. In the particular construction illustrated in FIGURE 3, the grate includes a generally rectangular frame-like backing member 70 to which the ends of the spaced parallel bars 68 are secured in any suitable manner. The backing member 70 includes an upper member 72 transverse to the bars 68, each end of which is provided with a laterally extending pivot pin 74. Each pin 74 is pivoted on suitable support members within the housing 22 so as to permit the lower portion of the grate 20 to be moved toward and away from the rotor 12. Extending rearwardly from each lateral edge of the backing member 70 is a web 76 having a laterally extending pin 78 thereon for pivotal connection with a rearwardly extending adjusting bar 80 which passes through an aperture 82 in the rear wall 28 of the housing 22.

The adjusting bar 80 is moved forwardly and rearwardly by means of its cooperation with a bolt 84 which is generally parallel to the bar and which is threaded into a suitable support on the exterior of housing 22. As seen in FIGURES 1 and 4, the rear end of the adjusting bar 80 is provided with a laterally extending member 86, the remote end of which overlies a support block 88. The bolt 84 passes through the member 86 and is threaded into the block 88 as at 90. According to the principles of the invention the shank of the bolt is necked down a predetermined amount as at 92. This construction affords a variable safety factor in that the same size bolts with different neck diameters may be used under different conditions to predetermine the point at which the bolt will give way under excessive pressure applied to the face of the grate 20.

The operation of the impact breaker 10 has been generally indicated in the description of the various elements. Material to be crushed, such as rock, is delivered to the breaker 10 by the conveyor 34 from which it slides downwardly along the spreader apron into the path of the hammers 42. The normal trajectory of the rocks, upon being struck by one of the hammers, is upwardly into the breaking assembly 16 where impact with the surfaces 46*a*, 56*a* and with the corners 48 and 58 breaks the rocks into smaller fragments. In general, all the incoming rock will be given a trajectory lying between the arrows A in FIGURE 1. The surfaces 46 and 56 are subject to considerably less wear and after a period of operation they may be interchanged with the surfaces 46*a* and 56*a* in order to distribute the wear evenly.

Fragments falling from the assembly 16 normally drop along path B into the path of the hammers 42 near the upper part of their path for a second strike from which their normal trajectory intersects the bars 64 of the grate 18 along path C. Fragments small enough to pass between the bars 64 enter the outlet chamber 32 and fall by gravity toward the bottom of the machine. Oversized rock impinging on the bars 64 is deflected therefrom and either drops again to the hammers 42 along path D for a third strike or drops to the lower grate 20 along path E.

Thus, it will be appreciated that in the construction of the present invention a single rotor normally acts on material to be crushed at least twice before the fragments are thrown against a grate, that is, the first strike of the rotor throws the material against a continuous non-perforated breaking surface and the second strike throws the same material against a grate for further breaking and for sizing. This feature, together with the reversibility of the breaking members 44 and 54 and with the adjustable safety release feature provides a particularly versatile impact breaker which is capable of long periods of use without disassembly. It will be appreciated that the particular embodiment described herein is given by way of illustration and that the details thereof are not intended to be limiting except as they appear in the appended claims.

What is claimed is:

1. In an impact breaker: rotary hammer means mounted for rotation about a generally horizontal axis; means for directing material to be broken along a line of feed into the path of the periphery of said hammer means at a predetermined impact zone; a plurality of upwardly extending generally parallel, spaced bars located on the opposite side of said axis from said impact zone, the upper ends of said bars being positioned below the normal trajectory of material which is struck by the periphery of said hammer means at said impact zone; and means positioned above said bars defining a material-breaking surface extending in a plane which is generally parallel to said axis whereby material struck by said hammer in said impact zone is thrown against said breaking surface, returns to the path of the periphery of said hammer means and is then thrown against said bars; said means defining a breaking surface including a member having a breaking corner formed by two intersecting surfaces and being reversibly mountable in a support which is fixed with respect to said hammer means so that either of said intersecting surfaces may be mounted in a generally horizontal position above said bars.

2. Apparatus as in claim 1 further including a housing above and spaced from said hammer means and wherein said member forms a part of said housing and is reversibly mounted in the remainder of said housing in either of two positions each of which places a different one of said intersecting surfaces in a generally horizontal position.

3. Apparatus as in claim 1 wherein said bars are positioned below a plane tangent to the path of the periphery of said hammer means at said impact zone.

4. In an impact breaker: rotatable hammer means mounted for rotation about a generally horizontal axis; means for directing material to be broken along a line of feed into the path of the periphery of said hammer means at a predetermined impact zone; a first grate located on the opposite side of said hammer means from said directing means and facing said hammer means, the top of said first grate being located below the normal trajectory of the majority of material which is struck by the periphery of said hammer means at said impact zone; means defining a breaking surface above said first grate and substantially directly above and facing said hammer means whereby incoming material is thrown by said hammer means against said breaking surface and then drops downwardly to be struck again by said hammer means; a second grate facing said hammer means and located below said first grate and extending toward said hammer means, said second grate being pivoted near its upper end for rotation about an axis parallel to the axis of said hammer means; and yieldable adjusting means for adjusting the pivotal position of said second grating.

5. Apparatus as in claim 4 in which said yieldable adjusting means includes: a link pivoted to the back of said second grate, said link being movable with respect to a fixed support member; a bolt threaded into said frame member for adjustable movement toward and away from said hammer means, a portion of the shank of said bolt intermediate its ends being of smaller diameter than the remainder of the shank; means secured to said link and loosely surrounding the shank of said bolt whereby movement of said bolt toward and away from said support member pivots said second grate toward and away from said hammer means and whereby said second grate will be released upon breakage of said bolt by excessive pressure on the face of said second grate.

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