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McClure

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[54] ROCK CRUSHER

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[51] **Int. Cl.**.....**B02c 13/286,** B02c 23/02

[58] **Field of Search** .....241/82, 98, 186 R, 202, 222, 241/225, 245, 248, 249, 280, 301, 33, 187, 275

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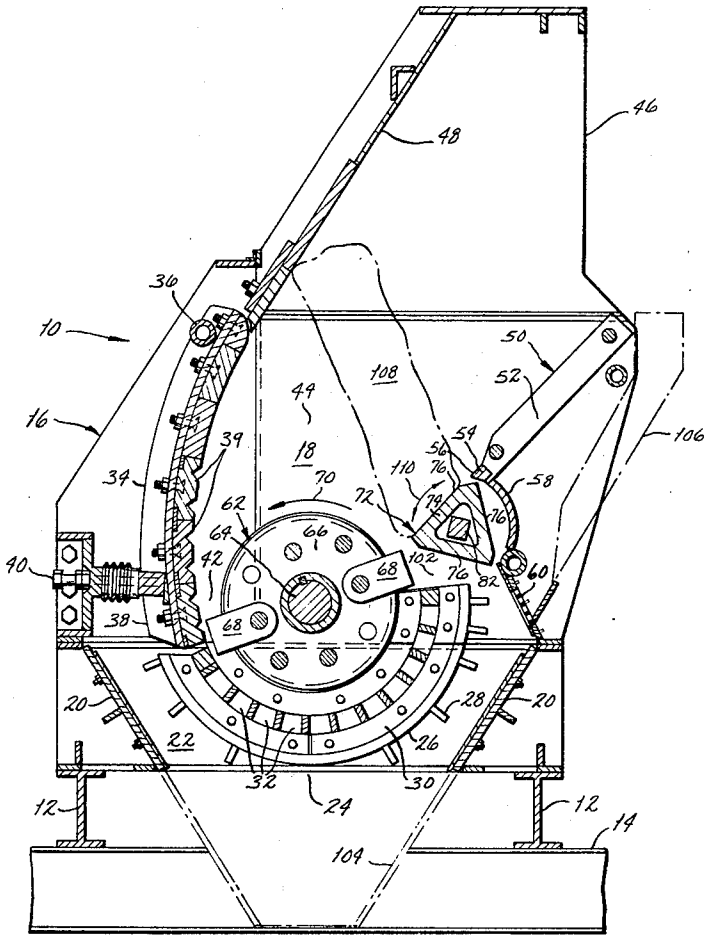
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[57] **ABSTRACT**

This invention is an improvement in a rock crusher having a crushing chamber with an opening therein, a rotor rotatably mounted in the chamber, hammers carried adjacent the outer radial edge of the rotor, and a feeder chute having its lower end adjacent the opening. The improvement includes an elongated member rotatably mounted within the chamber between the lower end of the chute and the hammer tip circles defined by the hammers as the rotor rotates. The elongated member has a polygonal cross-sectional configuration which is preferably triangular. It is adapted to be rotated selectively for dislodging rocks which become jammed in the chute.

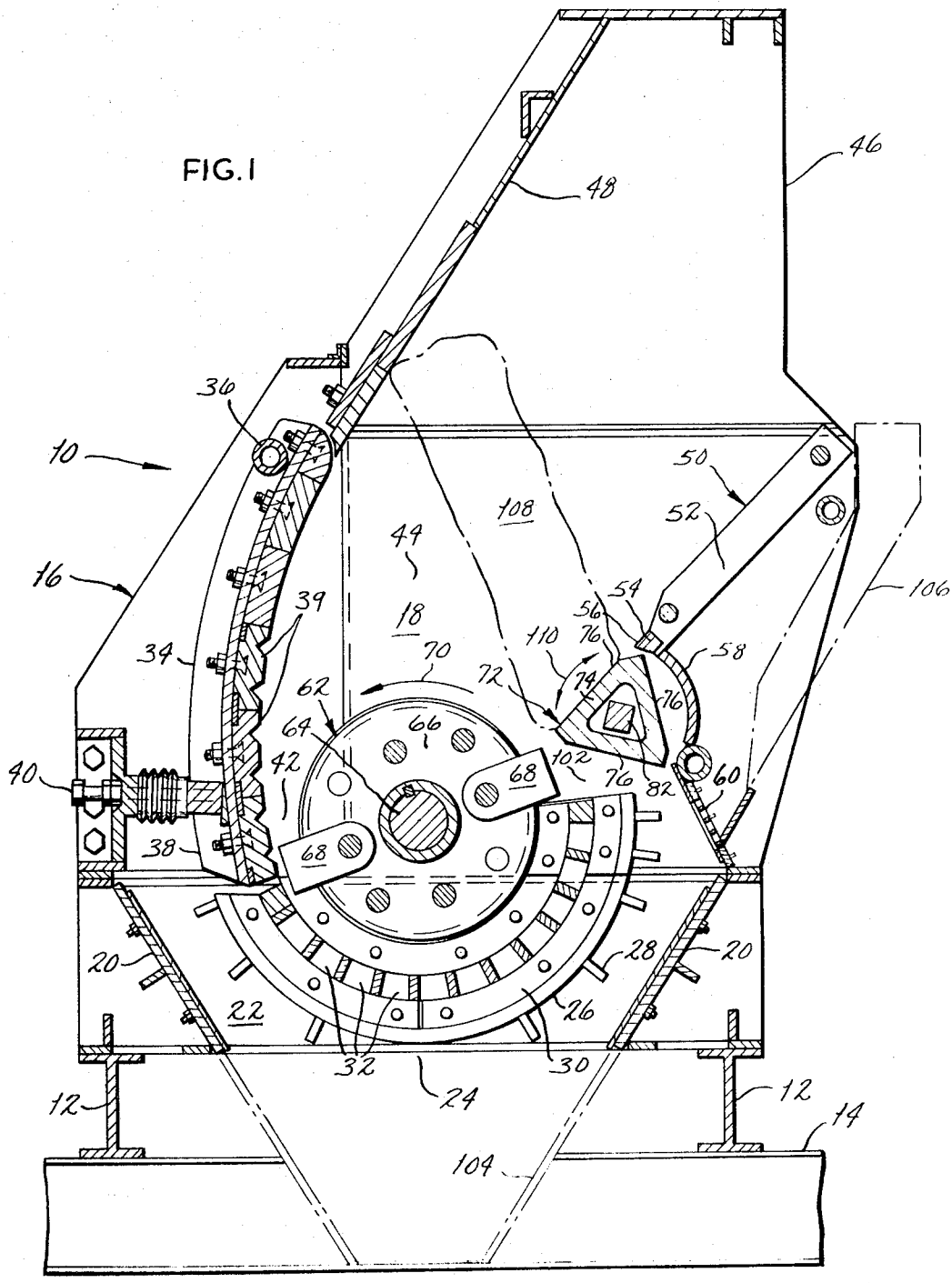
26 Claims, 3 Drawing Figures



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FIG. 1



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2 Sheets-Sheet 2

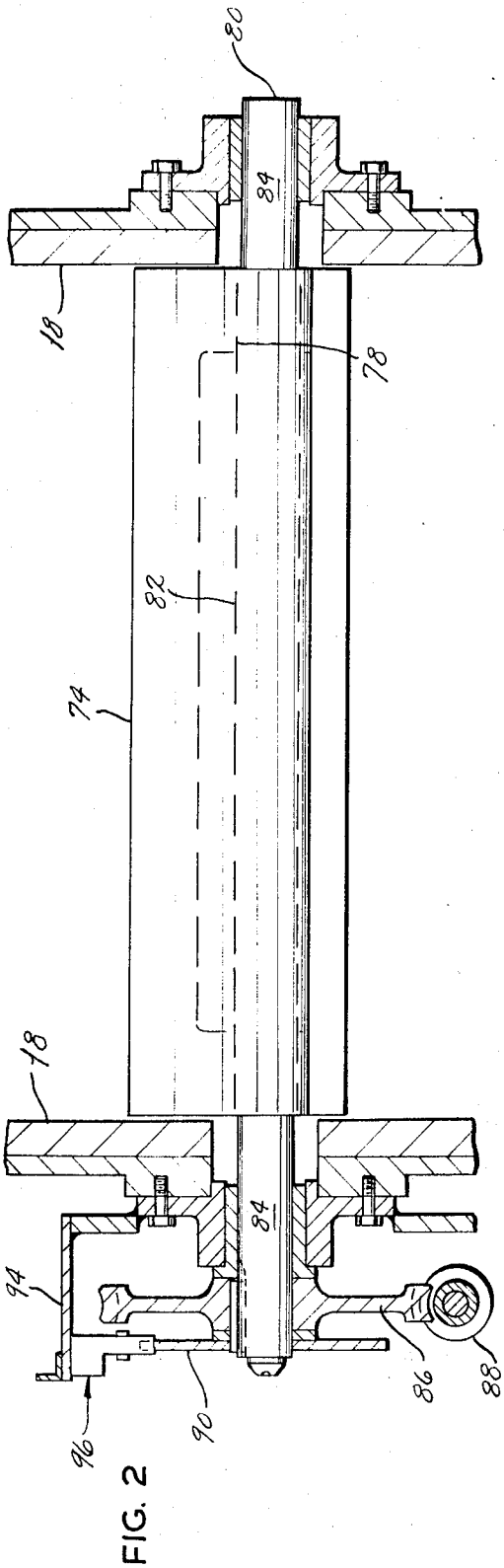


FIG. 2

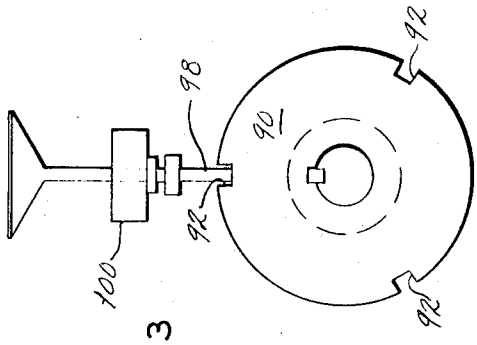


FIG. 3

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ROCK CRUSHER

This invention relates to an improvement in a rock crusher and more particularly to a rotatable member for dislodging rocks which become jammed in the feeder chute.

Conventional rock crushing machines include a rotor rotatably mounted in a crushing chamber. The rotor includes hammers which define hammer tip circles as the rotor rotates. A plurality of breaker bars are provided on the internal surface of the chamber and are adapted to facilitate the breaking up of the rocks as they are impelled and battered by the hammers. A feeder chute usually leads to an opening at the upper end of the crushing chamber for gravity feeding of the material to be crushed. Occasionally rocks become lodged in the chute and block the flow of material into the chamber. In order to correct this situation the operator must stop the crusher and remove the rocks with a crowbar or some other heavy tool. Usually the rocks which become lodged have a long dimension so that they tumble and stop with their lower ends on the lower end of the feeder chute and their top ends leaning against the upper portion of the feeder chute. In this position the rocks are held out of reach of the rotating hammers.

This invention utilizes a rotatable member at the base of the feeder chute. The rotatable member has a plurality of flat surfaces and can be rotated so that the surfaces urge a lodged rock toward the rotor hammers, thereby causing it to be dislodged and fed into the crushing chamber. In its normal operating position the rotatable member leaves a space between itself and the rotor for permitting the escape of non-crushable tramp metal which becomes trapped within the rotor chamber. The rotatable member can be installed in present rock crushers with a minimum alteration of the present structure in these crushers. This can be done by repositioning the feeder chute to provide a space for the rotatable member between the base of the feeder chute and the circles defined by the hammers on the rotor.

Among the several objects of the present invention may be noted the provision of an improvement in a rock crusher which permits the dislodging of rocks which become jammed in the feeder chute; the provision of an improvement in a rock crusher which urges these lodged rocks into the impeller or rotor chamber for crushing; the provision of an improvement in a rock crusher which provides a space for permitting the exit of uncrushable materials such as tramp metal; the provision of an improvement in a rock crusher including a rock dislodger which is normally inoperative but which can be actuated to dislodge a rock; the provision of an improvement in a rock crusher including a rock dislodger which normally forms an extension of the feeder chute; the provision of an improvement in a rock crusher which can be easily incorporated into rock crushers presently being used; and the provision of an improvement in a rock crusher which is durable in use, simple in construction and economical to manufacture. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

FIG. 1 is a sectional view of a rock crusher which includes the improvement of this invention;

FIG. 2 is a partial plan view of the rotatable member showing the chamber walls in partial section; and

FIG. 3 is a detailed elevational view of the means for stopping the rotatable member at a plurality of rotational positions.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, a rock crusher **10** is supported by a pair of I-beams **12** on a support surface **14**. A housing **16** includes a pair of side walls **18** and a pair of slanted lower walls **20** extending downwardly and converging toward one another to form an outlet chamber **22**. At the extreme lower end of outlet chamber **22** is an outlet opening **24**. On each side wall **18** is an arcuate flange **26** which is reinforced by a plurality of gussets **28**. A semicylindrical screen plate **30** is rigidly secured at its axial ends to arcuate flange **26**. Screen plate **30** includes a plurality of screen apertures **32** which may be of varying size depending upon the particular size of screening desired. Also secured within housing **16** is a swingable breaker plate **34** which is hinged at its upper end about an axis **36** and which has its lower end **38** adjacent one end of screen plate **30** to provide a tangential continuation thereof. Bolted to the inwardly presented surface of breaker plate **34** are a plurality of breaker bars **39**. An adjustment bolt **40** is journaled within housing **16** and is threadably connected to lower end **38** of breaker plate **34** to provide means for adjustment of the position of lower end **38**.

Breaker plate **34**, screen plate **30**, and side walls **18** define a crushing chamber **42** having an inlet opening **44** at its upper end. Secured over inlet opening **44** is a feeder chute **46** having an upper inclined wall **48** and a lower inclined wall **50**. Lower inclined wall **50** is formed from a plurality of elongated slats **52** which are parallel and spaced from one another and which are commonly referred to as "grizzly bars". At the lower end of each slat **52** is a toe **54** having an inclined edge **56** which lies in an inclined plane and which forms the lower end of wall **50**. Spanning the distance between toe **54** and slanted lower wall **20** are an arcuate plate **58** and a flat screen plate **60** having a plurality of apertures therein.

Mounted within crushing chamber **42** is a rotor **62**. Rotor **62** includes a rotor axle **64** which is journaled in side walls **18** of housing **16**. Keyed on rotor axle **64** are a plurality of disks **66** to which are mounted a plurality of hammers **68**. The drawings disclose only two hammers **68** but any desired number may be secured to the outer edges of disks **66**. Hammers **68** are adapted to define hammer tip circles **70** illustrated by an arrow when rotor **62** rotates about its cylindrical axis on axle **64**.

Mounted in the space between toe **54** and hammer tip circles **70** is a rock server **72** including an elongated member **74** which is triangular in cross section and has three flat surfaces **76**. The apexes of member **74** are flattened off at a predetermined angle. This angle is such that one of the flattened off apexes will be parallel to a line tangent to hammer tip circles **70** when one of flat surfaces **76** is parallel to inclined edge **56** of toe **54**. This relative position is illustrated in FIG. 1. Thus the flattened off apexes provide a somewhat blunt edge presented towards the hammers, thereby minimizing the wear at the apexes of member **74**.

Referring to FIG. 2, elongated member **74** is hollow and includes square apertures **78** at its opposite ends. A server axle **80** includes a square portion **82** intermediate its ends and rounded shafts **84** at its opposite ends. Square portion **82** extends through square aperture **78**, and shafts **84** are journaled in side walls **18** of housing **16** so that elongated member **74** will rotate with respect to housing **16**. The journaling of shafts **84** in side walls **18** causes the rotational axis of elongated member **74** to be held against movement with respect to the rotational axis of rotor **62** and hammer tip circles **70**. A circular gear **86** is keyed to one of shafts **84** and is adapted to be driven by an intermeshing worm gear **88**. When worm gear **88** turns it causes elongated member **74** to rotate. The gear ratio between worm gear **88** and circular gear **86** may vary but the preferred ratio is 100 to 1 so that the rotational velocity of elongated member **74** is slow with respect to the rotational velocity of worm gear **88**. Also keyed on one of shafts **84** is a circular stop plate **90** which includes three notches **92** equally spaced around its peripheral edge (FIG. 3). Rigidly mounted to side walls **18** of housing **16** is a bracket **94** having a latch mechanism **96** mounted thereon. Latch mechanism **96** includes a pawl **98** which is weighted so as to be urged by gravity into one of notches **92** in stop plate **90**. Pawl **98** is slidably mounted within a solenoid **100** and is adapted to slide longitudinally between a lower position wherein it protrudes within notch **92** and an upper position wherein it is withdrawn from

notch 92. Movement of pawl 98 from its lower to its upper position is caused by actuation of solenoid 100. Upon deactuation of solenoid 100, pawl 98 drops to its lower position. Thus when pawl 98 is in its lower position it prevents rotation of stop plate 90 and consequently prevents rotation of elongated member 74. The relative positions of notches 92 are such that when pawl 98 stops rotation of elongated member 74 one of flat surfaces 76 forms a continuation of inclined edge 56 of toe 54. The control mechanism (not shown) for actuating and driving worm gear 88 and solenoid 100 is adapted to cause the two to be actuated at the same time so that pawl 98 moves to its upper position whenever worm gear 88 is rotated. This particular structure of latch mechanism 96 may vary without detracting from the invention. However it is important that member 74 be held against movement when it is in each of these predetermined positions and that structure such as latch mechanisms 96 be provided for selectively permitting the rotation of elongated member 74 from these predetermined positions.

Referring to FIG. 1, the relative position of the upper end of arcuate screen plate 30, rock server 72, and flat screen plate 60 are such that a tramp metal bypass 102 is formed therebetween and provides a line of communication from inlet opening 44 and crushing chamber 42 into outlet chamber 22. As indicated by the arrow at hammer tip circles 70, rotor 62 normally rotates in a counterclockwise direction (as viewed in FIG. 1) so that hammers 68 first pass by rock server 72 and then pass by the margin of inlet opening 44 which is opposite rock server 72.

In operation, rotor 62 is rotated at very high speeds and material to be crushed (usually limestone) is gravity fed through feeder chute 46 and inlet opening 44 into crushing chamber 42. Hammers 68 hurl the rocks against breaker bars 39, causing them to be broken up and pulverized. The pulverized materials then filter through screen apertures 32 in screen plate 30 and fall into outlet chamber 22. Shown in phantom lines is a hopper 104 which may be secured under outlet opening 24 to collect the pulverized materials. Normally during the crushing operation rock server 72 is in the position shown in FIG. 1 wherein one of its flat surfaces 76 forms a continuation of the inclined edge 56 of toe 54. Because of the spaced relationship of elongated slats 52 any fine materials which are in the uncrushed rocks fall between slats 52 and continue falling through the apertures of flat screen plate 60 until they reach outlet chamber 22. Shown in shadowed lines is a chute 106 which normally covers the space between slats 52 and flat screen plate 60, but which can be removed to provide access to this space.

Occasionally tramp metal and/or other uncrushable material becomes mixed with the rocks to be crushed. Such tramp metal will continue to be buffeted around the crushing chambers of conventional crushers and must be removed by stopping the rotor and removing the tramp metal. In the crusher of this invention, however, tramp metal bypass 102 permits such tramp metal and/or other uncrushable material to exit if it becomes trapped in the crushing chamber.

Many of the rocks fed into a crusher are very large in size and occasionally one of these rocks will become lodged in the feeder chute, thereby clogging the chute and preventing the gravity feed of materials into a rotor chamber. The type of rock susceptible to lodging usually has an elongated configuration which can cause it to tumble and stop with its lower end on the lower end of the feeder chute (out of reach of the hammers) and with its top end leaning against the upper portion of the feeder chute or breaker plates. Referring now to FIG. 1, a lodged rock 108 is shown in phantom lines and is typical of rocks which can become lodged in chute 46. In order to remove rock 108 the rotor of heretofore known crushers would have to be stopped and rock 108 manually dislodged. However, this invention provides means for serving the rock into the chamber 42 without stopping rotor 62. Worm gear 88 is actuated and solenoid 100 is simultaneously actuated so as to cause elongated member 74 to rotate. During such rotation the apexes of member 74 define a circle indicated by arrow 110. They thus protrude inwardly beyond the plane defined by inclined edge 56 of toe 54 and cause rock 108 to become dislodged and its lower end to be thrust into the path of rotating hammers 68. While stop plate 90 rotates approximately 120°, pawl 98 rides on its outer arcuate surface until it drops within notch 92, thereby stopping the rotation of rock server 72. At this point, elongated member 74 is again in a position wherein one of its flat surfaces 76 forms a continuation of inclined edge 56 of toe 54.

Rock crushers presently being used can be easily modified to accommodate rock server 72. Slats 52 need only be positioned to provide sufficient space for rock server 72. Addition of arcuate plate 58 and installation of rock server 72 completes the modification.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A rock crusher comprising a housing forming a chamber including chamber walls, a rotor member rotatably mounted in said chamber, and having means provided thereon for engaging and moving rocks, said chamber having an inlet portion including a feeder chute leading to said rotor member, impact means provided on one side of said chamber for receiving rocks moved by said rotor member, and an elongated member having a polygonal cross section rotatably mounted within said chamber opposite said impact surface and adjacent one end of said chute, such that said elongated member forms a continuation of said chute leading to said rotor member, said elongated member including electro-mechanical drive control means for controlling the rotation of said elongated member through a predetermined arc to jar loose any rock wedged between said elongated member and the walls of said chamber to permit the wedged rock to engage said rotor member.

2. A rock crusher as claimed in claim 1 wherein said housing includes walls surrounding said chamber, said elongated member having its opposite ends journaled in said walls so as to make its rotational axis stationary with respect to said rotor member.

3. A rock crusher as claimed in claim 1 wherein the length of said predetermined arc is governed by said drive control means.

4. A rock crusher as claimed in claim 1 wherein said drive control means includes a stop member arranged to move with said elongated member and a locking member arranged to engage said stop member, said engagement preventing rotation of said stop member and said elongated member.

5. A rock crusher as claimed in claim 1 wherein the rotational axis of said elongated member is stationary.

6. A rock crusher as claimed in claim 1 wherein said drive control means is operable to terminate the rotation of said elongated member independently of the rotation of said rotor member.

7. A rock crusher as claimed in claim 1 wherein said chute is elongated and is disposed in an inclined position in said chamber, said chute having spaced upper and lower inclined walls, said elongated member being positioned adjacent the lower end of said lower inclined wall.

8. A rock crusher as claimed in claim 7 wherein said lower end of said lower inclined wall is spaced from the periphery of said rotor member, said rotor member being disposed in the space between said elongated member and said impact means.

9. A rock crusher as claimed in claim 1 wherein said drive control means is operable to rotate said elongated member independently of the rotation of said rotor member.

10. A rock crusher as claimed in claim 1 wherein said elongated member is triangular in cross section and has three elon-

gated flat outer surfaces, the rotational axis of said elongated member being positioned so that said elongated member can rotate to a predetermined position wherein at least one of said flat outer surfaces forms a continuation of said lower inclined surface.

11. An improvement in a rock crusher; said crusher having a housing forming a chamber with an opening therein, a rotor rotatably mounted in said chamber, hammers carried adjacent the outer radial edge of said rotor, and a feeder chute outside said housing having one end adjacent said opening; said chute being elongated and disposed in an inclined position; said chute having an upper inclined wall and a lower inclined wall; said hammers defining hammer tip circles during rotation of said rotor; said improvement comprising an elongated member rotatably mounted within said chamber adjacent said one end of said chute; said elongated member having a polygonal cross-sectional configuration and being positioned adjacent the lower end of said lower inclined wall and including at least one shoulder; the rotational axis of said elongated member being positioned so that rotation of said elongated member moves said shoulder from an inoperative position wherein it is spaced from a plane defined by said lower inclined surface to an operative position wherein it moves through said plane toward the interior of said chute.

12. A rock crusher as claimed in claim 4 wherein said locking member is movable to a position of disengagement from said stop member to permit rotation of said stop member and said elongated member.

13. A rock crusher comprising a housing forming a chamber including chamber walls, a rotor member rotatably mounted in said chamber and having hammer means provided thereon for engaging, moving and crushing rocks, said chamber having an inlet portion including a feeder chute leading to said rotor member, impact means provided on one wall of said chamber for receiving rocks moved by said rotor member, and an elongated member having a polygonal cross section rotatably mounted within said chamber adjacent a wall opposite said impact surface and adjacent one end of said chute such that a portion of the peripheral surface of said elongated member forms a continuation of said chute leading to said rotor member, said elongated member including driving means for bidirectionally rotating said elongated member through a predetermined arc to jar loose any rock wedged between said portion of the peripheral surface of said elongated member and the walls of said chamber to permit the wedged rock to engage the hammers of said rotor member.

14. A rock crusher as claimed in claim 4 wherein said lock member includes solenoid means movable from a position of locking engagement with said stop member wherein said stop member and said elongated member are non-rotatable to an unlocked position wherein said stop member and said elongated member are rotatable.

15. A rock crusher as claimed in claim 4 wherein said drive control means include driving means for moving said elongated member, said driving means being operable when said lock member is disengaged from said stop member.

16. A rock crusher as claimed in claim 4 wherein said stop member includes means for stopping said elongated member at at least one predetermined position.

17. A rock crusher as claimed in claim 1 wherein said drive control means includes a rotatable stop member keyed to said elongated member to rotate with said elongated member, said stop member including indexing means corresponding to a predetermined position of said elongated member, said drive control means further including actuating means movable to a position of locking engagement with said stop member at one of said indexing means to lock said stop member and said elongated member in a predetermined position, said actuating means being further movable to an unlocked position wherein said stop member and said elongated member are rotatable.

18. A rock crusher as claimed in claim 1 wherein said chute includes spaced upper and lower inclined walls, said elongated member including at least one shoulder, the rotational axis of said elongated member being positioned so that rotation of said elongated member moves said shoulder from an inoperative position wherein it is disposed away from the space defined by said upper and lower inclined walls to an operative position wherein it moves into said space toward the interior of said chute.

19. A rock crusher as claimed in claim 1 wherein said elongated member is substantially triangular in cross section.

20. A rock crusher as claimed in claim 19 wherein the sides of said triangular cross section are substantially equilateral, each pair of said sides being intersected by a planar surface substantially perpendicular to one side of said pair.

21. The improvement of claim 11 wherein said housing includes walls, said elongated member having its opposite ends journaled in said walls so as to make its rotational axis stationary with respect to said rotor member.

22. The improvement of claim 11 wherein the rotational axis of said elongated member is stationary.

23. The improvement of claim 11 wherein said rock crusher includes impact means opposite to said elongated member, said rotor member being disposed in the space between said elongated member and said impact means.

24. The improvement of claim 11 wherein said elongated member is triangular in cross section and has three elongated flat outer surfaces, the rotational axis of said elongated member being positioned so that said elongated member can rotate to a predetermined position wherein at least one of said flat outer surfaces forms a continuation of said lower inclined surfaces.

25. The improvement of claim 11 wherein said elongated member is substantially triangular in cross section.

26. The improvement of claim 25 wherein the sides of said triangular cross section are substantially equilateral, each pair of said sides being intersected by a planar surface substantially perpendicular to one side of said pair.

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