Oct. 23, 1956 A. B. HANSE ET AL 2,767,928

PLURAL STAGE IMPACT BREAKER WITH IMPACTING ROTORS AND ADJACENT DEFLECTOR SCREEN GRATES

Filed Dec. 18, 1950 3 Sheets-Sheet 1

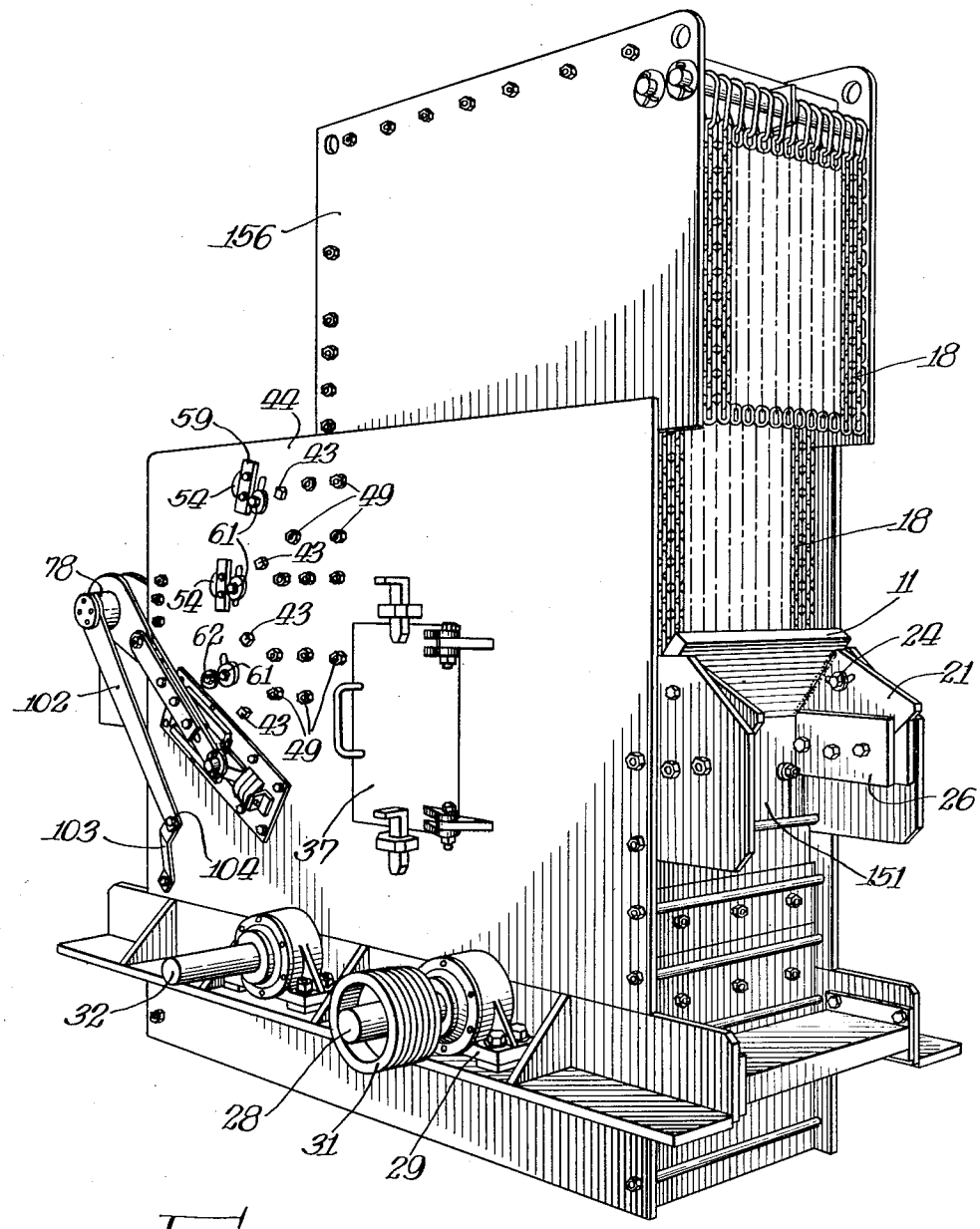

Fig. 1.

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Fig. 2.

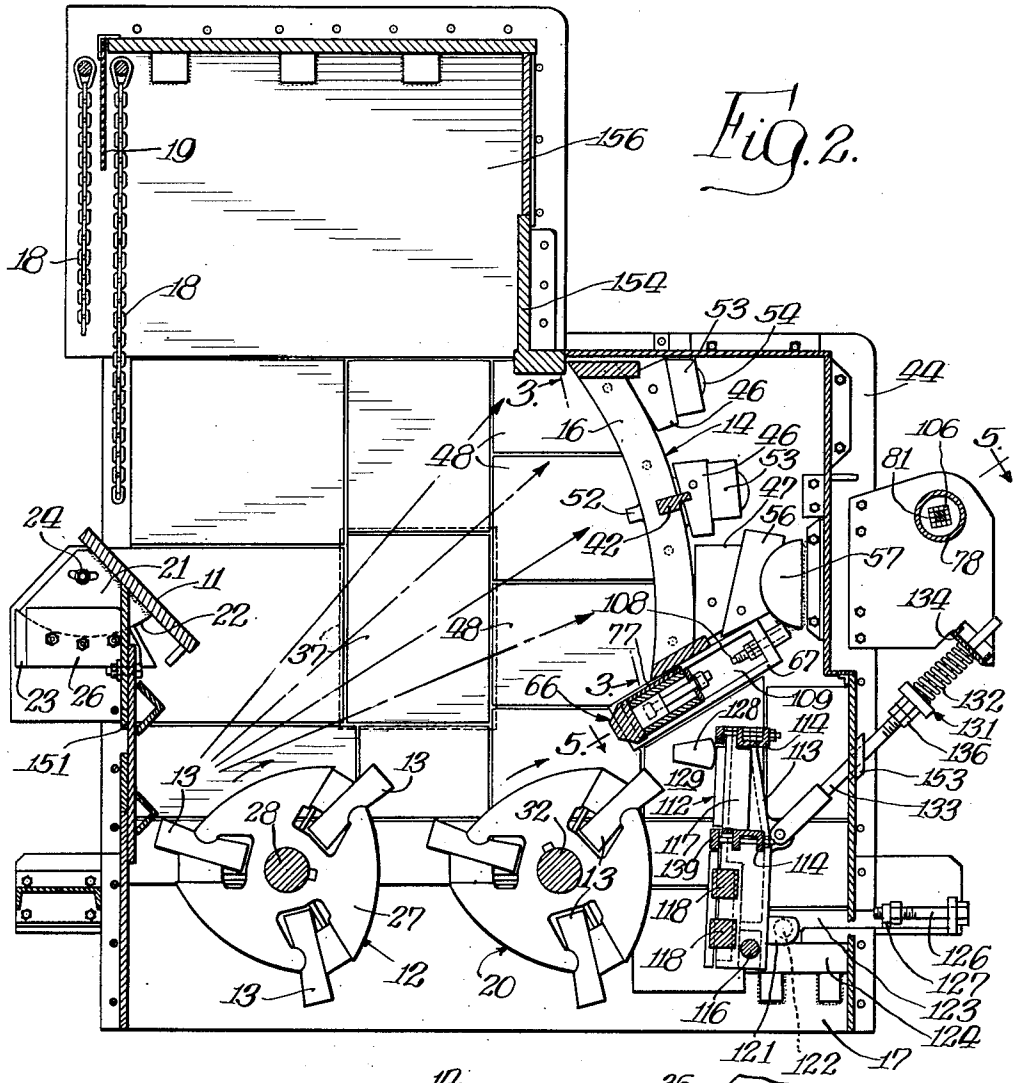

Fig. 3.

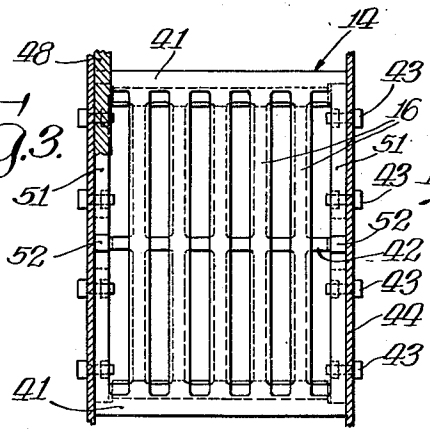

Fig. 4.

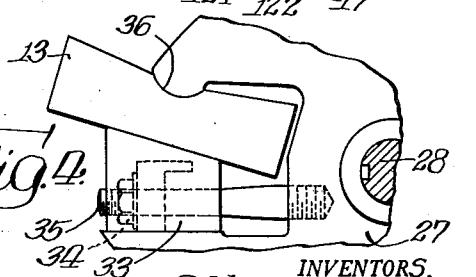

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Fig. 5.

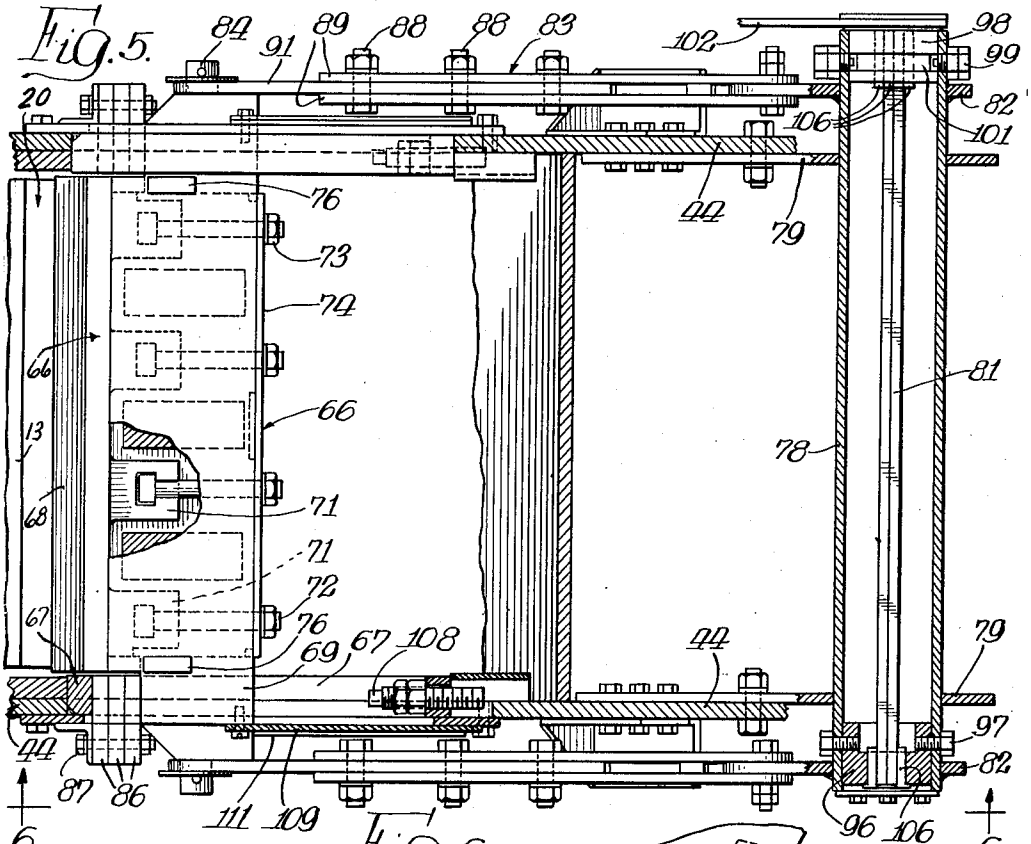


Fig. 6.

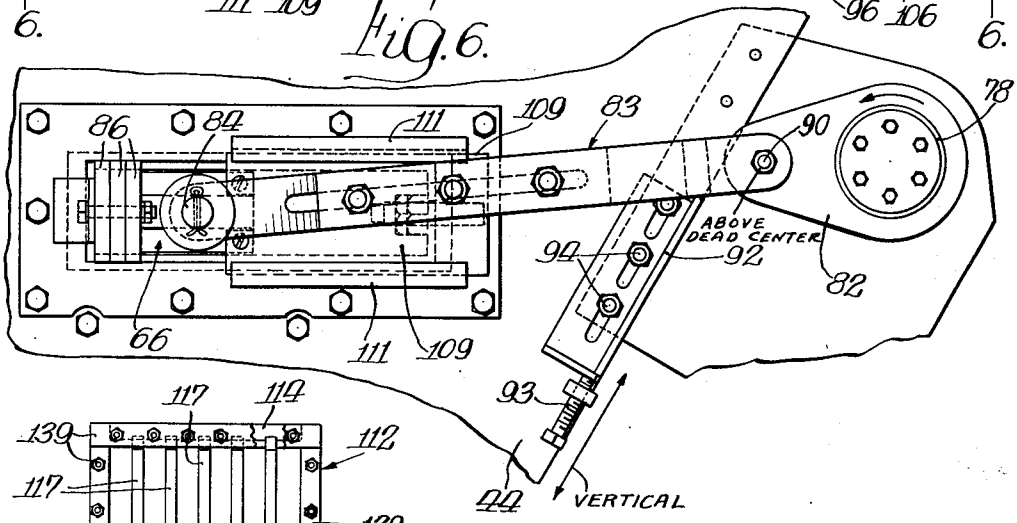
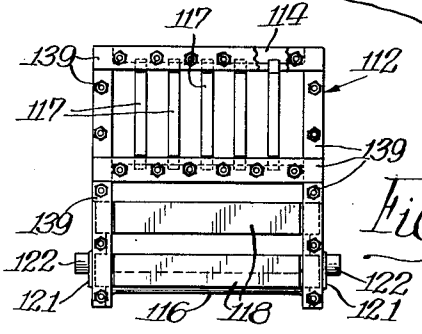


Fig. 7.



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PLURAL STAGE IMPACT BREAKER WITH IMPACTING ROTORS AND ADJACENT DEFLECTOR SCREEN GRATES

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Application December 18, 1950, Serial No. 201,364

12 Claims. (Cl. 241—86)

In breaking up large rocks, it has long been recognized that one of the most efficient methods of breaking the rocks comprises impact breaking. Typically, the large rock is dropped into the path of a rotating hammer, which strikes the rock with sufficient speed to shatter it. A number of different impact breakers have been provided. Nevertheless, impact breakers have not, prior to the present invention, reached the potential attainable with this invention. The present invention provides various improvements for increasing the efficiency and effectiveness of impact breakers and in some respects, is suitable for use with other breakers as well.

According to one of the features of the invention, the rock, upon being impacted by the hammer and shattered, is thrown toward a deflector screen grate or grid having its bars disposed with their length lying in vertical planes. This disposition of the bars (compared to horizontal bars) allows a larger percentage of the rock fragments which have been reduced to the desired size to pass through the grid and drop out of the breaker without the wastage of power that would be attendant upon retaining them within the breaking zone, where they would again be struck by the hammers.

According to another feature of the invention, the bars of this grid are so disposed that the rock fragments which are too large to pass through the grid are, for the most part, ricocheted upwardly by the bars, so that they tend to drop at a good speed well clear of the grid to be struck again by the hammers at an efficient position.

Another feature of the invention provides for controlling the path of the incoming stream of fresh rock so as to adapt the path to the type of incoming rock so that the hammers will strike it in the zone which is most suitable for that rock.

A final grating provided beyond the stripper bar also includes novel features. The portion of it against which rock is likely to be thrown by impact of the hammers on the rock includes vertically-disposed bars with the above-mentioned advantage. The whole grating is mounted in a simple manner which facilitates adjusting its tension and also facilitates adjustment of it for clearance with respect to the circle of movement of the hammers.

According to another feature of the invention, improved wedging action is provided, all wedges being assured of a full bearing on the wedged parts by virtue of a self-aligning feature which enables one of the wedged parts to rock about a cylindrical bearing surface to accommodate itself to the wedge. This wedging construction has been found to provide the wedged parts with a high degree of dependability as well as relative ease in application.

Additional objects and advantages will be apparent from the following description and from the drawings.

Designation of figures

Figure 1 is a perspective view of a rock breaker, built in accordance with the present invention and which has been chosen for illustration thereof.

Figure 2 is a longitudinal, vertical, cross-sectional view taken, for the most part, approximately through the middle of the structure of Figure 1.

Figure 3 is a fragmentary, approximately vertical, sectional view, taken near the line 3—3 of Figure 2 and showing particularly the face of the main deflector screen grate.

Figure 4 is a fragmentary view on a larger scale, showing the wedging features for holding a hammer in place.

Figure 5 is a sectional view taken approximately on the line 5—5 of Figure 2, showing particularly the construction and mounting of the stripper bar and its tensioning means.

Figure 6 is a fragmentary side view of the structure shown in Figure 5, being taken approximately on the line 6—6 of Figure 5, the parts being shown slightly tilted in a clockwise direction, so that the parts may be positioned as projections of like parts in Figure 5, for greater clarity.

Figure 7 is a face view of the lower grating.

Although the law requires setting forth the prepared form of the invention and the inclusion of a full and exact description of at least one form of the invention, such as that which follows, it is, of course, the purpose of a patent to cover each new inventive concept therein no matter how it may later be disguised by variations in form or additions of further improvements; and the appended claims are intended to accomplish this purpose by particularly pointing out the parts, improvements, or combinations in which the inventive concepts are found.

General operation

The form of the invention chosen for illustration is seen generally in Fig. 1. The internal structure is seen generally in Fig. 2. Large rocks are fed to inclined slide **11** and slide from this slide into the circle of rotation of a rotary hammer assembly **12**. Here the rock is struck by one of the hammers **13**, which shatters or fractures the rock and throws the pieces toward grid **14**, composed mainly of spaced bars **16** in vertical planes. Most of the pieces which are small enough pass through the grid **14** and fall through the discharge area **17**. Usually a conveyor is provided below the illustrated apparatus to receive the broken rock and carry it to a vibratory screen. The larger pieces of fractured rock will strike the bars **16** and usually be deflected upwardly and inwardly to drop clear of grid **14** and be struck by the hammers, sometimes being broken by this impact.

The bars **16** preferably have faces flat transversely and curved longitudinally, as shown, about a point a little above the zone of impact of fresh rock with rotary hammer. Accordingly, many of the rock fragments will ricochet upwardly and rearwardly, so that they will drop back into one of the hammer circles of hammers **13** and **20**, at a sufficient speed so that many fragments will be struck by the faces of hammers **13** instead of their corners. Particles are blocked from flying out of the breaker by curtains formed of chains **18**. Flying dust may be reduced by one or more curtains **19**, which may be formed of reinforced rubber, such as conveyor belting. If desired, laterally overlapping strips of belting, each hung from the top in the manner of chains **18**, may be used in place of chains. Some of the rock which does not pass through grid **14** will fall onto a second rotary hammer **20**, which will again shatter it, most of the pieces flying against or through grid **14**.

Adjustable slide

The slide or chute **11** is preferably adjustable in angularity to shift the course of the incoming rock. In this way, the direction toward which the fragmented pieces are thrown by the hammers can be controlled to give the best results with different types of rocks.

The adjustability is accomplished by supporting the slide or chute **11** on arcuate brackets **21**, the brackets preferably being welded to the slide **11**. The bottom edge **22** of the brackets **21** is arcuately shaped with the top centered approximately about the guide **11**, so that the whole structure may shift about this top edge. Support blocks **23**, carried by the frame of the breaker, are correspondingly shaped along their upper faces to give movable support to the brackets **21**. Once adjusted, the brackets **21** are held firmly in place by bolts **24**, each of which extends through a slot in the brackets **21**, and by clamp plates **26** which may be tightened against the brackets **21** adjacent the arcuate surfaces **22**.

Rotary hammers

The rotary hammers **12** and **20** may be identical and may therefore both be described with reference to rotary hammer **12**. A rotor **27** is carried by a shaft **28**, which is rotatably supported at opposite ends by bearing blocks **29**, one of which is seen in Fig. 1. Each end of the shaft may carry a multiple V pulley **31** for V-belts, connecting it either with a motor or with the shaft **32** of rotary hammer **20**. It is desirable for the hammers to be jointly driven, so that the entire power available from the motor and from momentum will be behind every impact.

Each rotor **27** is provided with three slots along its length, in each of which a hammer **13**, extending the length of the rotor **27**, is positioned. As seen best in Fig. 4, each hammer is held firmly in place by wedges **33**. The wedges **33** are cast pieces and may extend the full length of rotors **27**; but it is preferred that several different ones may be used for each of the hammers **13**. Each wedge **33** is drawn tight by a nut **34**, threaded on a stud **35**, which has previously been screwed into rotor **27**.

It is desired that the hammers **13** be very rigidly held. This is accomplished by wedges **33** without expensive machining by rockably mounting the hammer **13** with respect to the rotor **27**. Thus the hammer **13** and rotor **27** are provided with correspondingly shaped cylindrical surfaces **36**, positioned to lie directly opposite the midzone of the wedge **33** in the expected position of the wedge. It will be observed that the hammers **13** are reversible so that when one side thereof, which is exposed, has been excessively worn, the hammer may be inverted, end for end, to expose the other side thereof, which has, until then, been protected within the rotor **27**. Access for turning or placing the hammers may be had in any convenient manner. For example, a door **37** may be provided in one or both sides of the rock breaker, as seen best in Fig. 1. It will be understood that the illustrated rock breaker is of a fairly large size, the door **37** being large enough for a man to pass through, say 28" high.

Deflector screen grate

The grid **14** is preferably a manganese steel casting, its details of construction being reasonably apparent from Figs. 2 and 3. It may be turned end for end as it wears, to prolong its life. It comprises mainly the parallel bars **16** supported by cross pieces **41** at top and bottom. At present, reinforcing webs **42** at the center are desired. This permits using thinner bars **16** than would otherwise be sufficiently sturdy in the lateral direction. The webs **42** are preferably set back from the face of the grid **14** so that most of the rock fragments will strike only the bars **16**.

The bars **16** are preferably wider at their front faces than at their trailing faces. In other words, their walls diverge from one another rearwardly, so that rock passing the front face will pass easily through the grid instead of occasionally becoming jammed within the grid.

The grid **14** should be secured very firmly. Accordingly, it is not desired to rely on bolts **43**, which bolt it to the side plates **44**. In addition, the grid **14** is held by wedges **46** and **47** against liner plates **48**. It will be understood that the liner plates are provided in any event throughout the main chamber in front of grid **14** for the protection of the side plates **44**. The liner plates are heavy plates of manganese steel and they may be bolted to the side plates **44**. Thus, various bolts **49** have been illustrated in Fig. 1 for securing the liner plates **48** immediately in front of grid **14**. These liner plates are cut to fit the side bars **51** of the grid, and preferably one of them is notched to receive a lug **52** cast on grid **14** for supporting the grid in the proper vertical position.

Proper action of the wedges **46** and **47** is ensured by providing them with self-adjusting reaction surfaces. Thus, each of the wedges **46** bears against a backing block **53** carried by a circular plate **54**, fitting a circular hole in the side plate **44**, and movable therein. Wedge **47** bears on a block **56** which has shiftable arcuate engagement with a fixed block **57** secured on the inside of a side plate **44**.

In the course of assembly, the grid **14** may be lowered by a crane into position, resting on the side plates **48**. The block **56** may then be placed against the block **57** and the wedge **47** applied. Next the blocks **53** are put in place, each with its plate **54**, these being previously welded or otherwise secured together and being inserted in the circular holes in plate **44** from the inside of the plates **44**. Retaining plates **59** are then bolted to the circular plates or discs **54** so that the discs are held in place but can turn. The wedges **46** are then inserted. When the wedges **46** and **47** have been hammered home to press the grid **14** firmly against plates **48**, the various parts may be secured in place. Thus the wedges **46** and **47** will be secured by tightening bolts **61**. The block **56** may be secured by tightening bolt **62**, although tightness of this bolt is not essential, except to prevent loosening by vibration. Bolts **43**, which will probably have been previously loosely applied through side walls **44** and side bars **51**, will now be tightened.

Stripper bar

A stripper bar **66** (an assembly of parts) is positioned as seen best in Fig. 1 to lie close to the hammer circle of the rotary hammer **20**. This stripper bar is carried in a stripper bar guide **67**, which forms an opening through the side plates **44**. The stripper bar assembly, at both ends, extends through the side plates. It is shiftable in guides **67** to move toward or away from the hammer circle, the position control being described under the next heading. The form of stripper bar at present is best understood from Fig. 5. From this, it is seen that the stripper bar comprises two main parts, namely, a head **68** and a carrier **69**, which latter extends through the guides **67** and side walls **44**. The head **68** is provided with tongues **71**, into which draw bolts **72** are dropped through an open-sided slot. The head and bolt assembly is then slipped into carrier **69** and drawn tight by nuts **73**, which may rest on washers or an apertured plate **74**. A carrier **69** may have guide lugs **76** welded thereto. A wear plate **77** (Fig. 2) may be applied to the exposed face of the carrier **69**, having been omitted from Fig. 5, partly for clarity and partly because it is not deemed necessary, at least unless the rock is very abrasive.

Stripper positioning and control

The position of the stripper bar assembly **66** is determined with reference to a torque tube **78**, which is pivotally carried by plates **79** secured to side plates **44**. The torque tube is urged by spring bars **81** in the direction of the arrow shown in Fig. 6 to turn plates **82** thereon in a direction to thrust stripper bar **66** forwardly, namely, to the left, as seen in Figs. 5 and 6. The plates **82** are welded to torque tube **78** and comprise links of a pair of toggle link systems. Thus each plate or link **82** engages a link assembly **83**, which engages a pin **84** ex-

tending outwardly from the end of carrier **69**. It is apparent from Fig. 6 that as the plate **82** is turned counterclockwise toward its illustrated position, the toggle linkage comprising link **83** and plate **82** approaches alignment and the stripper bar **66** is thrust forwardly. The stripper bar is preferably placed firmly against a stop, such as shims **86**, which may be inserted or removed in accordance with the desired position of the stripper bar **66**. The shims **86** may be of T-shape, with the legs fitting into the slot formed by guide **67** and with the heads provided with an aperture through which a bolt **87** may pass to hold the shims in place.

The length of the toggle link **83** is preferably adjustable. This adjustment may be accomplished by wedges, but in the illustrated form it is accomplished by bolts **88**. When these bolts are tightened, they clamp link plates **89** against link plate **91**. Link plate **91** engages a pin **84**, while link plate **89** engages plate or link **82**, being pivoted thereto by a bolt **90**.

The length of link **83** is adjusted to keep the toggle linkage slightly out of dead center alignment when the stripper bar **66** is thrust home. As a further safeguard to prevent the toggle linkage from swinging into alignment, an adjustable stop **92** is provided. This stop may be mounted on side plates **44** and adjusted by a screw **93**, bolts **94** being tightened when it is properly positioned.

The spring bars **81** are anchored at one end to a torque ring **96** which may be secured to tube **78** by bolts **97**. At their other ends, the spring bars **81** are anchored in a torque ring **98**, which is held within tube **78** by bolts **99**. In this instance, however, the bolts **99** ride in an annular groove **101** in torque ring **98**, so that it may turn with respect to tube **78**. As seen best in Fig. 1, a tensioning lever **102** is secured to torque ring **98** so as to turn this torque ring and twist the spring rods **81**. The tensioning lever **102** is held in its tensioned position by a link **103** secured to the side plate **44**. In making any adjustment, the bolt **104** securing lever **102** to link **103** is first removed and the lever **102** eased to its natural position to relieve the tension on the parts.

The tension can be varied by changing the number of spring bars **81**. These are anchored to the torque rings **96** and **98**, as seen in the cross section of ring **96** in Fig. 5. The center aperture in ring **96** is squared in cross section. In the illustrated form, it is large enough to hold 16 of the bars **81** arranged in four rows of four each. It may be assumed, however, that only four of bars **81** are illustrated, the space of the remaining twelve being occupied by filler pieces **106**.

The force required for a piece of tramp iron or the like to press the stripper bar **66** outwardly depends on the number of spring bars **81** used and also on the proximity of the toggle links **82** and **83** to alignment. Hence, minor variations in the seating force applied to stripper bar **66** may be made by adjusting the length of composite links **83**, the position of stop **92** preferably being changed accordingly. It is usual, however, for the stop **92** to be slightly spaced below the toggle link **83** so as to ensure firm seating of the stripper bar **66** on the shims **86**.

As the toggle linkage collapses, its mechanical advantage decreases rapidly, more than offsetting the increasing spring tension, at least in the initial part of the stroke which is all that usually occurs. It is desirable for the stripper bar to move back relatively easily once it has started, and it is especially desirable for it not to increase its opposition to movement, as this would necessitate setting the initial tension lower than the optimum or would fail to give the degree of protection desired.

To limit the outward movement of the stripper bar, one or more stops **108** may be provided, these stops preferably being adjustable to permit as much movement as is safe. They should protect spring bars **81** against being twisted far enough to acquire a set.

A seal plate **109** is preferably provided in conjunction with the stripper bar to seal the opening in guide **67** against the passage of flying dust therethrough. The plate **109** may be secured to the stripper bar carrier **69** and may slide in guidways **111**.

Lower grating

Beyond the stripper bar **66** a lower grating **112** is provided. This grating includes a cast frame **113**, including cross pieces **114** and **116**. Vertical grate bars **117** are carried by the cross pieces **114**. Horizontal grate bars **118** are carried by the side members of the frame **113**. Vertical grate bars **117** are preferred in at least the upper portion of this grating, perhaps extending further down than is shown. Much of the material which approaches these grate bars **117** is in the nature of flying rock fragments and those already reduced to size are less likely to strike the side faces between the bars if the bars are vertical, hence passing through better and causing less wear. For the final breaking of the residue, at least one horizontal bar **118** is more effective, tending to restrain the passage of the oversized particles until they are struck by a hammer.

The side portions of frame **113** have formed integrally therewith rearwardly extending lugs **121**, on each of which is formed an outwardly-extending pin **122**. These pins fit in holes in slide brackets **123**, each of which slides on a ledge **124**. The extent of inward movement of the slide brackets **123** is adjustably limited by bolts **126** threading into a lug **127**, each formed on or welded to a slide bracket **123**.

The upper end of grating **112** bears against a lug **128** carried by the side of the breaker. The lug **128** may, for example, be welded to or cast on plate **129**, which comprises one of the heavy protective lining plates. The grating **112** is pressed by spring assemblies **131** against the stop lug **128** and as far toward the rotary hammer **20** as is permitted by bolts **126**. Each of the spring assemblies **131** includes a pressure spring **132** surrounding a pressure rod **133**. The pressure rod **133** is pivoted to the grating frame **113** and slides in a cross beam **134**. The tension on spring **132** may be adjusted by nuts **136** threaded to rod **133**.

It will be noted that the grating **112** floates freely except for being restrained against excessive forward or downward movement, and except for the spring loading thereof.

The arrangements of the bars **117** and **118** are best seen in Fig. 7. These bars are retained in place by plates **139**, which may be bolted to frame **113** and serve additionally as wear plates.

Further details

Various provisions may be made for reducing the amount of dust escaping from the rock breaker. For example, an adjustable plate **151** may be provided to be moved upwardly against the chute **11** after each adjustment thereof. A hopper, not shown, would naturally be secured to the bed of the rock breaker, closing the entire bottom thereof and directing the broken rock to a conveyor. A sliding shield **153** may be provided to move vertically as the pressure rod **133** is shifted to close off the slots which must be provided in the back plate for movement of this rod.

Various features may be resorted to for reducing wear. Beads of welding alloy may be applied to leading corners and other portions of the rotary hammers and rotor structures on which wear is concentrated. All bolts and nuts within the rock breaker may be countersunk and the heavy lining plates may be gradually thickened in the area surrounding each bolt to provide extra thickness for such countersinking.

The heavy protective plates are preferably provided wherever the walls of the breaker are exposed to severe wear. In some instances, it is more practical to use the heavy plate as the sole wall member rather than as a replaceable liner. A special casting **154** (Fig. 2) may be

provided at the bottom of the entrance hood **156**. In addition to receiving impacts of fragments thrown directly from the rotor, it may be struck by the upper corners of the largest incoming rocks and its bottom will be struck by pieces ricocheting from the bars **16**, especially pieces thrown against them by the second rotary hammer **20**.

The discharge passage behind grid **14**, stripper bar **66** and grating **112** is preferably wide and unobstructed, as shown. The various demarcations shown therein in Fig. 2 are all as shallow as the thickness of plates **48**, so that even clay is not likely to accumulate and clog.

As stripper head **68** wears, it may be turned over for longer life.

It will be observed that the rock, both fresh rock and fragments which fall with it, follows a nearly radial course into the path of the hammers **13**, as has long been recognized to be desirable.

The provision of bars in the main grid **14** which lie predominantly in planes perpendicular to the axes of the rotors allows a larger percentage of rock fragments which have already been reduced to size to pass through the grid. This results from the fact that the angularity of approach of the rock fragments toward the grid is considerably wider in this plane than in planes parallel to the axes. This is especially true of a plurality of hammer rotors, because the starting points of the rock fragments from the two rotors is so widely separated.

The subject matter described under the heading "Stripper Positioning and Control" is claimed in a continuing application filed before issue of this patent, Serial No. 550,439.

We claim:

1. An impact rock breaker, including rotary hammer means, means for directing rock to be broken into the path of the hammer means at a predetermined impact zone, and a plurality of bars against which the fragmented rock is thrown by the hammer, said bars being disposed above the hammer means and generally vertically in parallel relationship, with the length of the bars lying in planes perpendicular to the rotary axis of the hammer, and the front faces of the bars struck by the fragmented rock being curved concavely toward the impact zone.

2. A rock breaker including a rotary hammer, a grating facing said hammer and means for yieldably mounting said grating, including stop means for positioning the end of the grating first approached by the hammer, slide means for slidably supporting the other end of the grating for movement toward and from the rotary hammer, spring means for urging the grating in a direction toward the stop and toward the hammer with floating yieldability permitting movement away from the hammer at any point of the grating and adjustable means for limiting the movement of the slide means toward the hammer.

3. A rock breaker including a housing, a hammer within the housing, a grid structure against which the hammer throws rock fragments, a protective lining for the housing secured to the side walls thereof and extending only part way along the walls, and means wedging the grid against the edge of the protective lining to secure the grid rigidly in place, said means including a wedge and a rockable backing member positioned to receive the wedge between it and the grid and adapted to rock to accommodate itself to the wedge.

4. An impact rock breaker, including a rotary hammer, means for directing rock to be broken into the path of the hammer at a predetermined impact zone, and a plurality of bars against which the main stream of fragmented rock is thrown by the hammer directly from said zone; said bars being parallel with their length generally lying in planes perpendicular to the axes of the rotary hammer, with their front faces curved approximately about a point in the path of the rock approaching the hammer, said bars being of reducing width rearwardly, and said means for directing the rock including a slide down which the rock passes, and adjustable support means for adjustment of the inclination of the slide to shift the impact zone.

5. An impact type rock breaker including a housing having feed and discharge openings, rotary hammer means in the housing, means for rotating the hammer in a given direction, said hammer being spaced from a wall toward which the upper part of the hammer moves, the spacing providing a discharge passage, feed means for dropping rock over a member parallel to the hammer axis and approximately radially into the hammer circle along the axial length of the hammer to be crushed by free impact of the hammer from which it will be thrown mainly along a predetermined trajectory path approximately perpendicular to the line of feed, and screening means directly in said path, and widely spaced from the hammer means and entirely above the level of hammer means where the hammer means approaches nearer to the screen to avoid pinching rock between the screen and the hammer, extending substantially entirely across said path and having openings aligned with said path to allow smaller fragments of rock to discharge after the first hammer impact, while retaining larger pieces for further breakage, said screening means comprising bars of a thickness parallel to said path greater than their width perpendicular to said path; the spaces between the bars all opening at their rear directly to the discharge passage.

6. An impact type rock breaker including a housing having feed and discharge openings, a rotary hammer in the housing spaced from a wall toward which the upper part of the hammer moves, the spacing providing a discharge passage, feed means for dropping rock over a member parallel to the hammer axis and approximately radially into the hammer circle along the axial length of the hammer to be crushed by free impact of the hammer in a zone from which it will be thrown mainly along a predetermined trajectory path approximately perpendicular to the line of feed, and screening means directly in said path, widely spaced from the hammer to avoid pinching rock against the hammer, extending substantially entirely across said path and having openings aligned with said path to allow smaller fragments of rock to discharge after the first hammer impact, while retaining larger pieces for further breakage, a second rotary hammer positioned beneath said path to strike and crush by free impact of the hammer fragments dropping after being retained by said screening means; the openings of said screening means all opening at their rear directly to the discharge passage.

7. An impact type rock breaker including a housing having feed and discharge openings, a rotary hammer in the housing spaced from a wall toward which the upper part of the hammer moves, the spacing providing a discharge passage, feed means for dropping rock over a member parallel to the hammer axis and approximately radially into the hammer circle along the axial length of the hammer to be crushed by free impact of the hammer in a zone from which it will be thrown mainly along a predetermined trajectory path approximately perpendicular to the line of feed, and screening means directly in said path, widely spaced from the hammer to avoid pinching rock against the hammer, extending substantially entirely across said path and having openings aligned with said path to allow smaller fragments of rock to discharge after the first hammer impact, while retaining larger pieces for further breakage, a second rotary hammer positioned beneath said path to strike and crush by free impact of the hammer fragments dropping after being retained by said screening means, and a second screening means positioned in the path of material which, after being rejected by the first-named screening means has been struck by the second rotary hammer, to pass to discharge smaller fragments while retaining larger pieces for further breakage; the spacing of the openings of both screening means all opening at their rear directly to the discharge passage.

8. An impact type rock breaker including a housing

having feed and discharge openings, a rotary hammer in the housing spaced from a wall toward which the upper part of the hammer moves, the spacing providing a discharge passage, feed means for dropping rock over a member parallel to the hammer axis and approximately radially into the hammer circle along the axial length of the hammer to be crushed by free impact of the hammer at a zone from which it will be thrown mainly along a predetermined trajectory path approximately perpendicular to the line of feed, and screening means widely spaced from the hammer to avoid pinching rock against the hammer extending substantially entirely across said path having openings aligned with said path to allow smaller fragments of rock to discharge after the first hammer impact, while retaining larger pieces for further breakage, said feed means being adjustable to shift the position at which fed rock enters the hammer circle, to direct the throw of rock toward the screening means under varying conditions; the openings of said screening means all opening at their rear directly to the discharge passage.

9. A rock crusher including first and second hammer rotors, feed means for dropping rock to be broken steeply into the hammer circle of the first rotor along the length of the rotor, a first impact zone extending the length of the rotor parallel to the axis thereof, both rotors having hammers faced for rotation in the same direction, the direction being that in which the top of the first rotor moves toward the second, stationary impingement means parallel to the axis of the first rotor spaced widely from the first impact zone, and in the path of the fragmented rock thrown from the first impact zone for intercepting at least the oversize fragments of rock and dropping them mainly in a zone spaced in the direction of hammer movement from the path of unbroken rock for further breakage by the hammer rotors, a discharge passage beyond the second rotor from the feed means, and additional impingement means including a pair of screen gratings exposed at their rear to the discharge passage; a forward part of this additional impingement means, including the first of said gratings, being positioned in a path of fragments thrown from the first rotor with all of the passages within said forward portion of the additional impingement means throughout the area exposed to fragments thrown directly from the first rotor exposed at their rear directly to discharge and so aligned with the hammer circle of the first rotor that fragments as thick as the thickness of these passages can be thrown from the first rotor straight through these passages; and the second grating being positioned in a path of fragments of rocks which have been thrown from the second rotor and to receive only fragments which have passed under the forward part of the additional impingement means including the first grating; the second rotor being positioned to receive directly from the first grating oversized fragments retained by it, to impact said fragments and to throw the resulting fragments below the first grating to the second grating.

10. A rock crusher including a casing, rotary hammer means within the casing spaced from an end wall thereof to provide a discharge passage between the end wall and the hammer means, means for dropping material to be crushed steeply into a hammer circle of the rotor hammer means along an impact zone extending the length of the hammer means parallel to a rotary axis of the hammer circle; a first screen grating positioned in the main path of fragments thrown from said impact zone, having substantially its entire rear face exposed directly to said discharge passage for discharge through said grating of fragments sufficiently small, and having its front face positioned to drop oversize fragments into a secondary impact zone extending the length of the hammer means parallel to said axis and positioned closer to the discharge passage than the first-mentioned impact zone, said secondary impact zone also being positioned so that the fragments thrown therefrom mainly pass under the first grating; a second screen grating positioned in the path of fragments thrown from the secondary impact zone, having its rear face exposed to the discharge passage and having its front face positioned to again return the oversize fragments to the hammer means.

11. An impact rock breaker according to claim 1, in which the bars are disposed at an angle to deflect upwardly fragments thrown against it from the impact zone.

12. An impact-type rock breaker including a housing having feed and discharge openings; rotary hammer means in the housing spaced from a wall toward which the upper part of the hammer means moves the spacing forming a discharge passage, feed means for dropping rock over a member parallel to the hammer axis and directing it approximately radially into the path of the hammer means along the axial length of the hammer means to be crushed by free impact of the hammer means in an impact zone from which it will be thrown mainly along a predetermined trajectory path approximately perpendicular to the line of feed, and screening means having a bar-like screening area directly in said path, steeply inclined to cause rebounding therefrom, widely spaced from the hammer means and steeply angled with respect to the nearest part of the path of the hammer means to avoid dragging rock by the hammer means along the screening area, extending substantially entirely across said path, exposed substantially throughout its rear directly to said passage and having openings all substantially fully aligned with said path to allow smaller fragments of rock, of thicknesses up to the thickness of the openings, to pass straight to discharge after the first hammer impact, while retaining larger pieces for further breakage, said rotary hammer means rotating under the entire zone between the feed means and the screening means through which the fragments retained by the screening means drop.

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