April 14, 1964 F. WAGENEDER 3,128,953

ROCK CRUSHER

Filed March 9, 1962

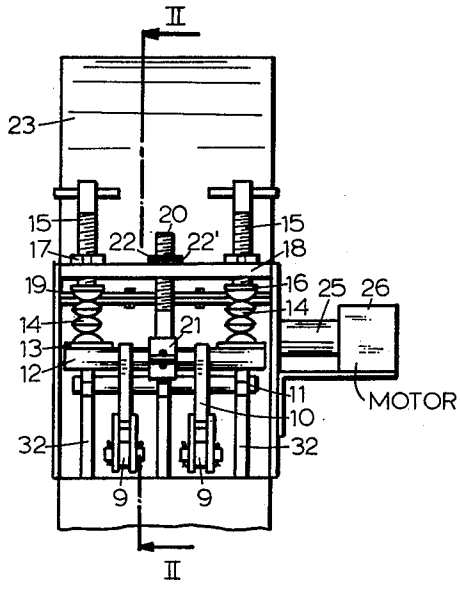
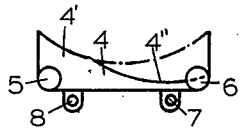


FIG. 1

FIG. 3



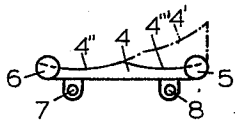


FIG. 4

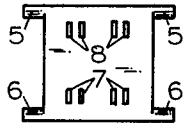


FIG. 5

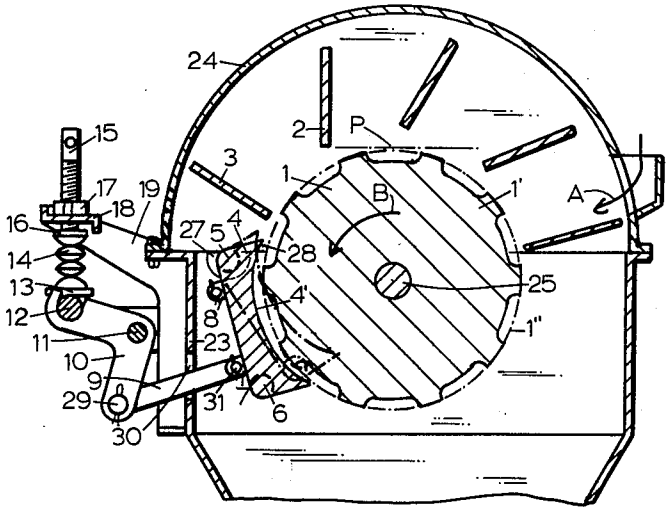


FIG. 2

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ROCK CRUSHER

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My present invention relates to a rock crusher of the type wherein large chunks of material are fragmentized by impact and further comminuted by grinding.

Difficulties encountered in conventional rock crushers are mainly due to the relatively rapid wear of grates, screens and similar parts used in the grinding process. This wear, unless compensated by suitable adjustment, leads to a situation in which the rock fragments are no longer directly ground between metal surfaces but are indirectly comminuted by their contact with one another, the latter mode of grinding involving a substantially increased power consumption.

It is, therefore, an object of my present invention to provide an improved rock crusher of the general type referred to in which the necessary adjustment of parts subject to rapid wear can be carried out in a quick and simple manner.

Another object of my invention is to provide a rock crusher of this type in which the principal grinding surface is formed by a solid member which, in contradistinction to the known grates and screens, is better able to withstand the wearing action of the grinding process.

It is also an object of this invention to provide means for carrying out the necessary adjustments from outside the machine proper.

A further object of the instant invention is to provide a grinding element which, after being worn down by its co-operation with a rotating element of a rock crusher, can be mounted in an alternate operating position in which a fresh grinding surface is available.

The foregoing objects are realized in my improved rock crusher which includes, within a housing, a generally cylindrical rotor with peripheral vanes and, alongside that rotor, a cheek plate with a concave surface closely spaced from the rotor periphery and forming therewith a gap which converges in the direction of rotation. The housing may also contain one or more baffle plates which, in a manner known per se, intercept rock fragments by the rotor vanes to break up the fragments by the resulting impact; it has been found highly advantageous, in accordance with a specific feature of this invention, to interpose between these baffle plates and the cheek plate a preferably radially oriented shield plate which extends close to the entrance end of the converging gap and serves to slow down the rock particles moving toward the gap.

As the particles are continuously comminuted between the rotor periphery and the concave surface of the cheek plate, the latter wears along an arc centered on the rotor axis whereby the lower reaches of the gap tend to increase in width. This increase can be conveniently compensated, according to a further feature of my invention, by pivotally mounting an upper portion of the cheek plate in the housing, advantageously for rotation about an axis just below the aforementioned shield plate, and linking the cheek plate with an adjusting mechanism outside the housing adapted to swing the cheek plate about its pivotal axis. The adjusting mechanism includes, in a preferred embodiment, one or more springs urging the cheek plate toward the rotor while enabling it to yield to an occasional chunk that may become wedged between its concave surface and the rotor vanes, the approach of the cheek plate to the rotor periphery being limited by an adjustable stop also acting upon the linkage. Moreover, in accordance with still another feature of my invention, the connection between the linkage and the cheek plate

is releasable and the cheek plate itself can be inverted, e.g. by means of two alternately effective pairs of pivot studs, for presenting another portion of its concave surface to the rotor periphery whereby the original convergence of the gap is restored.

The above and other features and advantages of my invention will become more fully apparent from the following description of a preferred embodiment, reference being made to the accompanying drawing in which:

FIG. 1 is an end-elevational view of a rock crusher according to the invention;

FIG. 2 is a sectional view taken on line II—II of FIG. 1;

FIGS. 3 and 4 are side views of a cheek plate, forming part of the apparatus of FIGS. 1 and 2, in different stages of wear; and

FIG. 5 is a rear view of the same cheek plate.

The rock crusher shown in FIGS. 1 and 2 comprises a main housing portion **23** covered by a hood **24** into which the material to be comminuted is admitted as indicated by the arrow A. A horizontal shaft **25**, journaled in the side walls of the housing portion **23** and driven by a motor **26** in the direction of arrow B, carries a rotor **1** formed with peripheral vanes **1'**. The orbit of these vanes is a cylinder surface **1''**.

Fixedly mounted in the hood **24** above rotor **1** are several baffle plates **2** which are perpendicular to planes P that are tangent to the effective rotor periphery **1''** at generatrices located ahead of the respective baffle plates as viewed in the direction of rotation. In contradistinction to these off-radial plates **2**, a substantially radial shield plate **3** is fixedly mounted in the upper quadrant of the housing on the descending side of the rotor, i.e. the left-hand part of hood **24** as seen in FIG. 2. Immediately below this shield plate there is swingably suspended, within a pair of U-shaped journal brackets **27** (only one shown) fastened to the side walls of housing portion **23**, a cheek plate **4** having a concave surface **4'** in close proximity to the rotor **1**. Cheek plate **4**, which has a generally rectangular outline as best seen in FIG. 5, is provided at symmetrical locations (i.e. at the corners of the rectangle) with two pairs of pivot studs **5** and **6** of which only the former are operative in the position shown in FIG. 2; thus, pivot studs **5** are shown received in brackets **27** to define a horizontal pivotal axis for plate **4**, the plate being swingable about this axis to vary the width of the initially crescent-shaped gap **28** between surface **4'** and periphery **1''**.

The cheek plate **4** also carries on its flat rear surface, again at symmetrically disposed locations, two groups of lugs **7** and **8** alternately engageable by a linkage composed of two lever arms **9** and two bell-crank levers **10** articulated to each other at **29**. Arms **9** pass through slots **30** in housing portion **23** and are hinged via pins **31** to the pairs of operatively positioned lugs on plate **4**, i.e. the lugs **7** in the position shown in FIG. 2. A rod **11**, clamped to a pair of arms **32** in the outer wall of housing portion **23**, serves as a fulcrum for the bell cranks **10** in whose free extremities a rod **12** is cradled. A pair of spring plates **13** are fixedly secured to rod **12** and serve as the lower anchors for a pair of compression springs **14** here shown to be, advantageously, of the dished type; the upper spring anchors a pair of pressure plates **16** which are fastened to the lower ends of adjusting bolts **15** threadably received in two stationary nuts **17**. A bracket **18**, spanning two arms **19** on the outer housing wall, supports the nuts **17** as well as nut **22** which is threadedly engaged by a central adjusting screw **20**; the rod **12** is clamped by a split boss **21** and can be vertically adjusted by the nut **22** and a retaining nut **22'** in contact therewith.

Before the beginning of operations, but preferably with

the rotor **1** running idle, the adjusting mechanism **20**, **22**, **22'** is set to bring the rear end of cheek plate **4** into the desired proximity to rotor **1**. The pressure of springs **14** can be adjusted to the requisite extent by the bolts **15**. Next, rocks and stone are admitted into the housing **23**, **24** and are peripherally entrained by the rotor vanes **1'** so that at least the larger particles are centrifugally propelled against the plates **2** for impact fragmentation. The smaller granules advance towards the shield plate **3** and, after being slowed down by this plate, enter the wider upper end of the converging gap **28**.

In operation, the fragments cast off the last baffle plate **2** are directed by the rotor **1** toward shield plate **3** whence they drop into the gap **28** at reduced speed and under their own weight. The descending rock particles ground between vanes **1'** and cheek plate **4** gradually erode the working surface **4'** of the latter whereby, with progressive readjustment of the plate **4** to compensate for wear, this plate will eventually assume the form shown in FIG. 3 in which its lower two thirds now follow the curve **4''** (solid lines) rather than the continuation of curve **4'** (dot-dash lines). When the thickness of the lower part of plate **4** has been reduced to its permissible minimum, operations are discontinued and the linkage **9**, **10** is detached or disassembled, e.g. by removal of the hinge pins **29**. The plate **4** can now be swung back (clockwise in FIG. 2) to a sufficient extent to let the lugs **7** project outwardly through slots **30** whereby the levers **9** may be disengaged from the plate through removal of pins **31**. Next, the plate **4** is inverted and suspended in its alternate position by a lodging of its steps **6** in the journals **27**. Now the remaining third of original grinding surface **4'** is available to restore the gap **28** to its erstwhile shape in the lowermost portion thereof. The upper part of plate **4** then defines an enlarged funnel whose shape has a favorable quieting effect upon the descending granular material which compensates for the reduced grinding surface now available. Tests have shown, in fact, that the overall comminuting action is substantially the same whether the plate **4** is used in its virgin state or in progressively eroded condition as illustrated in FIGS. 3 and 4. The latter figure shows the final curvature **4'''** (solid lines) of the plate surface to which it is worn down from the shape **4'** (dot-dash lines) it had upon reversal.

The apparatus illustrated in the drawing can be modified in various ways, particularly with reference to the number of rotor vanes **1'** and/or baffle plates **2**. Thus, an increase in the number of vanes enhances the grinding action of the crusher, with augmented output of prismatic granular material and intensified comminution, whereas a reduction in the number of vanes will cause the impact effect to predominate. It will also be apparent that larger fragments will be receivable by the gap **28** upon the inversion of the partly worn plate **4**.

A rock crusher according to the invention with a rotor diameter of 100 cm. and an axial length of 60 cm., driven by a motor of 54 H.P. operating considerably below capacity, has been found to be equivalent in qualitative and quantitative output to a pair of beam-type crushers of conventional construction each requiring a drive motor of 100 H.P. Generally, a power saving of 50–80%, compared with known devices of equivalent capacity, is readily realizable with the system of my invention.

Rock crushers according to the invention may have rotor diameters ranging from about 60 cm. for 60-mm. particle size to about 120 cm. for up to 250-mm. particle size, the output consisting in all cases essentially of granules with a particle size from 0–15 mm. with only a very insignificant percentage of particles up to 30 mm. and with approximately 50% of the granules in the range of 0–4 mm.

The cheek plate **4** of my improved rock crusher does not require any welded parts and may be cast integral from high-quality steel, with a further reduction in wear.

I claim:

1. A rock crusher comprising a housing, a substantially cylindrical rotor horizontally mounted in said housing and provided along its periphery with spaced-apart, generally axially extending vanes, at least one baffle plate in said housing positioned close to said periphery above said rotor for intercepting rock fragments propelled by said vanes, said baffle plate being perpendicular to a plane tangent to said periphery at a location ahead of said baffle plate as viewed in the direction of rotation of said rotor, a solid cheek plate adjacent the descending side of said rotor having a concave surface closely spaced from the orbit of said vanes and forming therewith a narrow arcuate gap converging in said direction of rotation, and a substantially radially extending fixed shield plate disposed immediately above the entrance to said gap at close spacing from said periphery for slowing down rock fragments propelled by said vanes toward said gap.

2. A rock crusher according to claim 1 wherein said housing is provided just below said shield plate with a pair of horizontally aligned journals, said cheek plate having an upper portion provided with projections pivotally received in said journals, said cheek plate being further provided with adjusting means for swinging it about the axis of said journals to compensate for wear of said concave surface.

3. A rock crusher according to claim 2 wherein said adjusting means comprises a movable member disposed outside said housing, link means passing through said housing and connecting said member with said cheek plate, spring means on said housing bearing upon said member with adjustable pressure tending to move said cheek plate toward said rotor, and stop means on said housing connected with said member for adjustably limiting the approach of said cheek plate to said rotor.

4. A rock crusher according to claim 3 wherein said housing is provided with a slot, said link means including a lever traversing said slot, said cheek plate being provided opposite said concave surface with a lug engaged by said lever and positioned to pass outwardly through said slot upon an outward swinging of said cheek plate about said axis for facilitating disconnection of said lever from said cheek plate.

5. A rock crusher comprising a housing, a substantially cylindrical rotor horizontally mounted in said housing and provided along its periphery with spaced-apart, generally axially extending vanes, at least one baffle plate in said housing positioned close to said periphery above said rotor for intercepting rock fragments propelled by said vanes, said baffle plate being perpendicular to a plane tangent to said periphery at a location ahead of said baffle plate as viewed in the direction of rotation of said rotor, a solid cheek plate adjacent the descending side of said rotor having a concave surface closely spaced from the orbit of said vanes and forming therewith a narrow arcuate gap converging in said direction of rotation, a substantially radially extending fixed shield plate disposed immediately above the entrance to said gap at close spacing from said periphery for slowing down rock fragments propelled by said vanes toward said gap, resilient means bearing upon said cheek plate for urging it toward said rotor, and stop means on said housing coupled with said cheek plate for limiting its approach to said rotor.

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