This invention relates to certain new and useful improvements in machines for crushing stone and the like.

It has for one of its objects to provide a machine of this character which is so designed as to crush the material by impact in an enclosure or casing having a system of rotatable and stationary impact bars or members so arranged as to centrifugally direct the stone or other material by the rotatable impact bars against the stationary impact bars, the crushing of the material taking place by impact of the material itself while in suspension, as well as that created by the impact bars.

Another object of the invention is to provide a stone crushing apparatus having a novel arrangement of rotatable and stationary impact members disposed for efficiently crushing the material and at the same time function as a screen for sizing, and wherein such impact members are so mounted as to be readily accessible for adjustment or replacement when desired.

A further object of the invention is to provide a machine of this character having a rotatory impact member and a plurality of impact bars disposed in predetermined relation about such rotatable member whereby the stone intercepted by the latter is centrifugally thrown against and between the impact bars to effectually crush the stone in a minimum period of time and to any size desired.

A still further object is to provide a crusher which is simple, compact, and sturdy in construction, which is self-feeding and will effectually handle any amount of material delivered to it, and wherein the design of the crushing chamber is such that the weight of the material is effectually relieved from the rotating parts of the machine.

Other features of the invention reside in the construction and arrangement of parts herein-after described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a side elevation partly in section, of the improved crusher. Figure 2 is an end view thereof. Figure 3 is an enlarged fragmentary vertical section taken on line 3—3, Figure 2. Figure 4 is a transverse vertical section taken on line 4—4, Figure 3. Figure 5 is an enlarged fragmentary face view of the rotor and one of its impact blades or members. Figure 6 is a cross-section taken on line 6—6, Figure 5. Figure 7 is a detached perspective view of one of the rotor impact blades. Figure 8 is a side view of a modified form of the invention.

Similar characters of reference indicate corresponding parts throughout the several views.

Referring now to the drawings, 10 indicates a supporting frame or table upon which the crush-
bars 24 are preferably uniformly spaced and function as a screen in predetermining the size to which the stone is to be crushed. If desired, the bars 24 may be alternately of different thickness, for the purpose of changing the spacing to suit the size of the material desired.

It will be noted in Fig. 3, that the inclined wall of the casing 11 at the loading side of the crushing chamber is directly opposite the rotor 17, whereby the maximum weight of the stone contained therein is sustained and the rotor correspondingly relieved of such weight. Extending across the feed opening 13 of the casing is a flexible curtain 25, which may consist of chain-lengths or the like, and which serves as a guard to prevent the stone being projected out through the hopper during the crushing operation.

The rotor-blades 21 are so mounted in the rotor that they can be readily replaced or renewed when necessary with a minimum of effort and without disturbing the rest of the machine. To this end, each impact blade is removably seated in a groove or recess 25 formed in the periphery of the rotor and extending crosswise thereof parallel to its axis, while the casing 11 is provided in its opposite side walls, as shown in Figs. 3 and 4, with slitting openings 27 of a size to permit the insertion and removal of one or another of the impact blades when its grooves are presented in registration therewith. Normally the openings 21 are closed by cover-plates 28 detachably secured to the casing by bolts or like fastenings. Each of the impact blades is provided in one of its faces with a key or tongue 28 which slidingly engages a corresponding groove or key-way 30 in the casing wall of the groove 28, whereby such blade is effectually held against radial displacement relative to the rotor. To prevent its axial displacement, clamping or wedging jaws or cleats 31 are provided which are seated in companion recesses 32 formed at the opposite ends of the rotor 17 and which function to effectively wedge the blade against endwise movement. Bolts 33 are provided for anchoring the jaws in place.

When it is desired to remove an impact blade from the rotor, such blade is lined up with the casing-openings 27, the cover-plates 30 and the wedging jaws 31 are removed, after which the blade is slipped endwise from the rotor and through one of the casing-openings. Obviously, the insertion and attachment of a blade into place is accomplished by a reversal of such steps.

The stationary impact bars 22, 23 and 24 are likewise so mounted as to be readily replaced and are preferably seated at their opposite ends in companion seats or openings 34 formed in the casing side walls, while cover-plates 35 are provided for normally closing such openings.

In Fig. 8 I have shown the crusher in the form of a duplex unit and the various parts thereof bear the corresponding reference characters as are borne by the disclosure shown in Figs. 1–7 inclusive. In this case the crusher units are disposed at opposite sides of the casing and the feed opening and hopper are arranged centrally between such units.

Briefly stated, the operation of the crusher is as follows:

The material to be crushed is introduced through the hopper 14 into the crushing chamber of the casing and in this connection the chamber may be filled to capacity. After the rotor 17 is started, its impact blades 21 smartly and forcibly and repeatedly contact the material within their range and initiate the breaking down of the material, at the same time directing it by centrifugal force against the various stages of impact bars 22, 23 and 24. As the material impinges against these bars, it is further crushed and when reduced to the size determined by the spacing of the last stage of impact bars 24, which bars likewise function as a screen or size, the sized stone is discharged through the opening 18. It will be appreciated that in practice the material being crushed takes a tortuous beating, first by the rotor blades which cause it to be projected at a high velocity against the impact bars in its path of trajectory, thereby making a further reduction of the material and the effect of the impact blows afforded by the material pieces themselves while being projected in suspension through the crushing chamber. The walls 18 of the casing also function as impact faces against which the material is directed by the rotor-blades, and the arrangement of the impact bars is such as to create a baffling effect on the material and maintain it in the crushing zone until it has been properly sized.

I claim as my invention:

1. A stone crusher, comprising a casing having openings therein for the introduction of stone to be crushed and for the discharge of the crushed stone, a rotor arranged in said casing having a substantially radial recess in its periphery, an impact blade that is transversely in said recess, means applied to the opposite ends of the rotor and engageable with said blade for detachably securing it thereto, the opposite sides of said casing having an opening therein disposed for registering endwise alignment with said blade for positioning it and removal to and from said rotor, and a cover plate detachably applied to said opening.

2. A stone crusher, comprising a casing having openings therein for the introduction of stone to be crushed and for the discharge of the crushed stone, a rotor arranged in said casing and having a radial recess in its periphery, one of the walls of said recess having a transverse key-way therein, an impact blade detachably fitted in said recess and having a key thereon engaging said key-way for retaining said blade against radial displacement relative to said recess, and detachable clamping jaws applied to opposite sides of the rotor for operative wedging engagement with said blade to retain it against displacement axially of said rotor.

3. A stone crusher, comprising a casing having an intake in the upper portion thereof for the stone to be crushed and a discharge in the lower portion thereof for the crushed stone, a rotor arranged in said casing between its intake and discharge for intercepting the introduced stone and having rigid stone-engaging impact members projecting from the periphery thereof, said rotor being positioned in adjoining relation to one of the casing walls to obstruct the downward flow of stone along such wall to said discharge and being peripherally spaced from the remaining surrounding wall of said casing to provide a trajectory path of travel for the stone certain of said walls constituting stone-crushing surfaces against which the stone is directed by said impact members, and a plurality of stationary impact members disposed in the centrifugal path of motion of the rotor in the space between the latter and said remaining surrounding walls of said casing and against and between which the stone while in suspension is successively directed, crushed and delivered to the cas-
ing-discharge, certain of said stationary impact members being disposed in substantially horizontally-spaced relation, others being disposed in vertically-spaced relation, and still others being disposed in spaced relation and inclined to the vertical.

4. A stone crusher, comprising a casing forming an enclosed crushing chamber having upper and lower openings therein for the introduction of the stone to be crushed and for the discharge of the crushed stone, a rotor arranged in said casing between said openings and having stone-engaging impact members projecting therefrom for intercepting and transmitting successive crushing blows to the introduced stone and directing it centrifugally in a trajectory path about the casing, said rotor being disposed in a predetermined relation in said casing to prevent the flow of the introduced stone downwardly between the same and one side of the casing and to provide a clearance space between the rotor and the remaining sides of the casing for the trajectory of the stone in suspension from the upper inlet opening through the rotor, said rotor being disposed in a plurality of stationary impact members disposed in such space and against and between which the trajectory of the stone is directed in a defined path to the discharge opening, said impact members being arranged in advance of one another and in different angular planes relative to the periphery of the rotor and with the members of each set spaced relatively to each other and the rotor and casing-walls to provide interconnecting passages for the flow of the suspended stone therebetween from one set of impact members to the other.

5. A stone crusher, comprising a casing forming an enclosed crushing chamber having upper and lower openings therein for the introduction of the stone to be crushed and for the discharge of the crushed stone, a rotor arranged in said casing between said openings and having stone-engaging impact members projecting therefrom for intercepting and transmitting successive crushing blows to the introduced stone and directing it centrifugally in a trajectory path about said casing, said rotor being disposed in a predetermined relation in said casing to provide a crushing zone over the top portion of the rotor between the tip ends of its impact members and the companion opposing walls of the casing for the trajectory of the stone in suspension from the inlet opening to the discharge opening, and for successive stages of stationary impact bars disposed in predetermined side by side spaced relation in said crushing zone with the bars of each stage in substantially vertically spaced relation to one another and the rotor and casing-walls and against which the stones impinge and are reduced and between the resulting spaces of which the stones travel while maintained in suspension by successive crushing blows of the rotor impact members, the final stage of impact bars being spaced to provide for passage therethrough of stone particles of less than a predetermined size, and for subsequent travel by gravity between such bars and the opposing casing-wall for the lower discharge opening.

7. In a crushing apparatus, a casing forming an enclosed crushing chamber having an inlet at its upper end for introducing the material to be crushed and an outlet at its lower end for the crushed material, a rotor journaled crosswise in the lower portion of the chamber in a plane between the inlet and outlet thereof and having fixed impact blades applied thereto for intercepting the material and trajectories it by successive crushing blows from the inlet portion of said chamber over the top of the rotor and thence downwardly toward the outlet, the rotor being disposed below the inlet and in predetermined relation in said casing to provide a clearance space constituting an initial crushing zone between one end of the casing-chamber and the rotor in which the introduced stone is directed generally upwardly by the impact blades to maintain the stone in suspension in said chamber and being spaced below the top of the latter to provide an overhead clearance space constituting a second crushing zone communicating with said first-named clearance space, said rotor being spaced from the opposite end of said chamber to provide a clearance space constituting a final crushing zone communicating at its upper end with said second crushing zone and at its lower end with the crushed stone outlet, and groups of laterally-spaced impact members disposed in substantially vertical rows crosswise of said chamber in said second and final crushing zones and against which the stone while in suspension is directed and between which it travels as it is reduced and crushed to said outlet, those impact bars against which the stone is first projected by the rotor-blades from the initial crushing zone being disposed in superposed spaced relation radiallly over the rotor and the impact bars in the final crushing zone disposed beyond the rotor and between the latter and the opposing end of the casing-chamber in substantially spaced relation and relatively spaced to size the stone for travel therebetween and thence downwardly between such bars and the adjoining casing wall to the crushed stone outlet.

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