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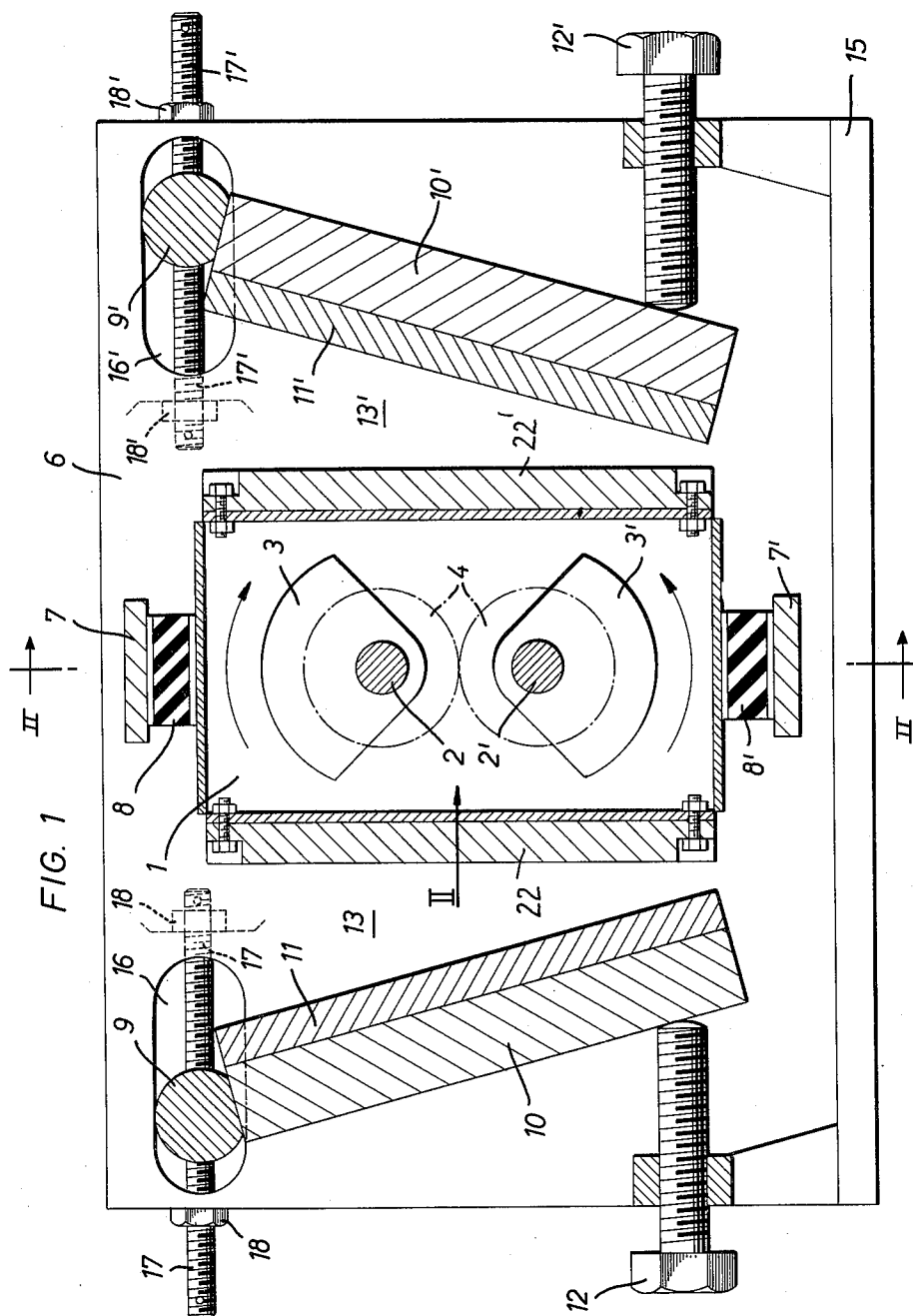
A. GARTNER

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CRUSHER WITH RECIPROCATING MOVEMENT

Filed March 15, 1962

3 Sheets-Sheet 1



INVENTOR

ALFRED GARTNER

BY *Dicke and Craig*
ATTORNEYS.

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A. GARTNER

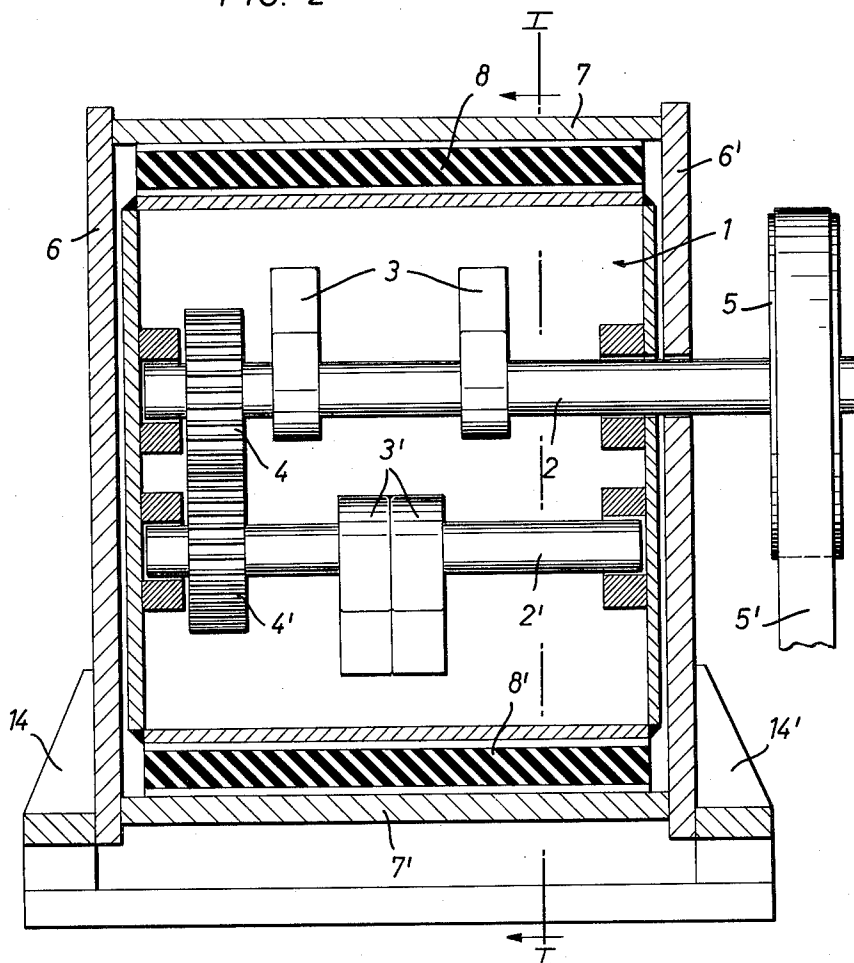
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FIG. 2



INVENTOR

ALFRED GARTNER

BY *Dicke and Craig*
ATTORNEYS

Oct. 12, 1965

A. GARTNER

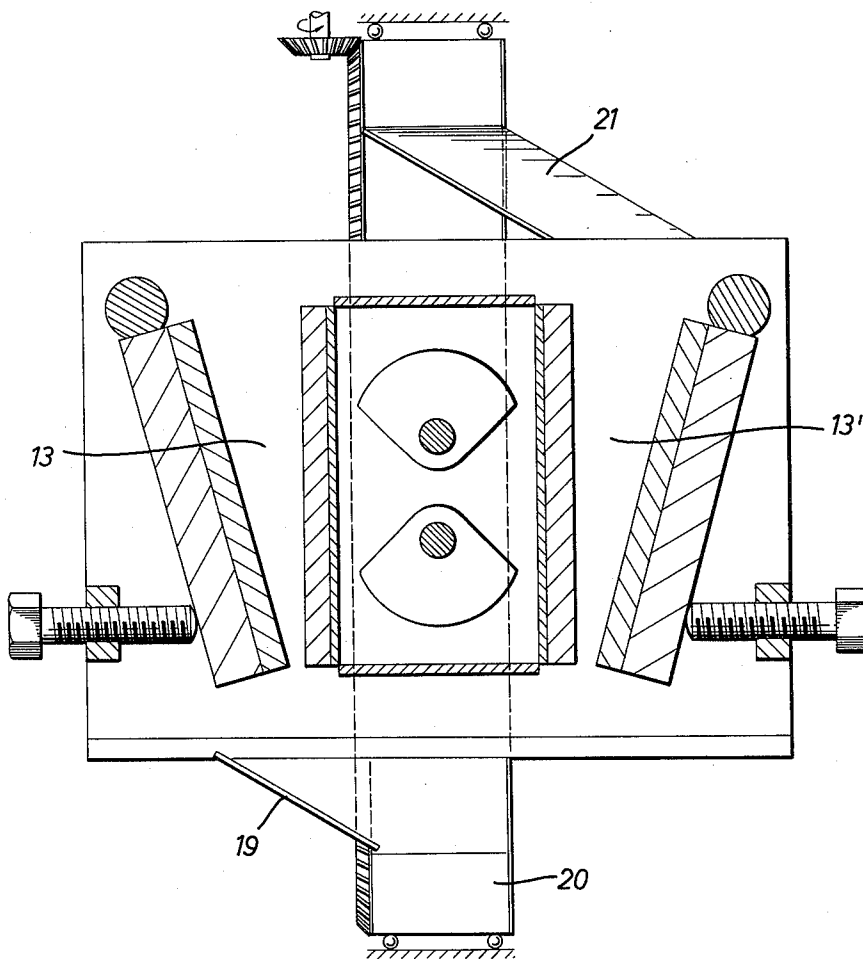
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FIG. 3



INVENTOR
ALFRED GARTNER
BY *Dicke and Craig*
ATTORNEYS

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CRUSHER WITH RECIPROCATING MOVEMENT

Alfred Gartner, Romerweg 136, Hambach an der

Weinstrasse, Germany

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The present invention relates to a jaw crusher for breaking up ore, rock, coal, or similar materials.

Although various types of crushers according to prior designs have proved to be practical insofar as their crushing action is concerned, they are relatively inefficient and their operation must often be interrupted as the result of damage on some of their parts. Especially the shaft of such a crusher can be sufficiently protected from bending or breaking only by making it of high-grade steel and of a considerable thickness which renders these prior crushers very expensive. The cost of operation of these crushers is also very high because of the wear and breakage of their crushing jaws. This applies particularly to the known types of oscillating crushers in which the upper part of the crushing jaw carries out a circular motion, while the lower part thereof swings in an elliptical direction. The operation of such a crusher requires considerable driving power, and the wedging action between the stationary and movable jaws and the friction thereon result in considerable heating of the jaws.

The crushers of the known type in which a crushing element may be oscillated between two fixed but adjustable crushing jaws have the disadvantage that, since the oscillation of the crushing element is produced by its eccentricity on the drive shaft on which it is mounted, parts of the material to be crushed or other substances which might enter between the crusher elements might cause the drive shaft to be bent or breakable safety members, for example, of cast iron, to be too easily destroyed so that these parts have to be replaced which requires the operation of the crusher to be stopped at least for a considerable length of time.

If such a crusher is of a design in which the crusher jaws are movable along a circular or elliptical path, it has the additional disadvantage that, because of the up-and-down motion of the crushing member the material to be crushed will only partly be conveyed and discharged in the downward direction.

The present invention relates to a crusher of the type which is provided with a movable crushing element which acts upon a fixed but adjustable crusher jaw and is supported by elastic means and adapted to be oscillated by an eccentric. Instead of oscillating the crushing element directly by means of a cam, crank, or eccentric, the present invention effects the oscillation by means of at least two eccentric weights which are disposed at an angle of 180° relative to each other and are rotatable within the crushing element in opposite directions about horizontal axes which are disposed within the same perpendicular plane. This structure has the effect that the crushing element is not oscillated with a circular or elliptic motion as occurred in the prior crushers of this type but with a motion extending in the horizontal direction.

Although the crusher according to the invention may be provided with only one crushing chamber, it is another important feature of the invention that the crusher be provided with two crushing chambers which are formed at both lateral sides of the oscillating crushing element and between the crusher jaws thereon and two stationary crusher jaws which are adjustable to different angular positions relative to the oscillating crushing element. In this manner it is possible to make double use of each

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individual stroke of the oscillating crushing element. By suitable adjustments of the speed of rotation of the two eccentric weights in accordance with the particular kind of rock or other material to be crushed, it is then possible to carry out the crushing operation at the highest possible degree of efficiency.

The crusher according to the invention may be started when its crushing chambers are either empty or charged. It does not require any breakable safety elements which in prior crushers were often provided to prevent their total destruction, and it is entirely immaterial in direction the two eccentric weights are rotated, as long as they are rotated simultaneously in opposite directions. Since the eccentric weights which produce the oscillations are mounted within the crushing element, the entire crusher except for its charging and discharge openings may be made of a completely closed construction which does not require any servicing of its elements. By means of this crusher it is easily possible to reduce the size of the material inserted therein at least up to a ratio of 1:12. With the prior crushers such a reduction in size could never be attained unless the material was crushed in at least two different crushers and preferably first in a crusher of one type and thereafter again in a crusher of another type. Any possibility that uncrushed material might fall freely through the crusher according to the invention may be absolutely prevented by driving the crusher so as to have a sufficiently high rate of oscillation, for example, 1000 to 3000 oscillations per minute. On the other hand, experience with the new crusher has shown that it will not become clogged even though it is driven at a relatively low speed.

It is another important feature of the invention that the new crusher may not only be employed in the conventional manner either for a preliminary or a fine-crushing operation, but for also carrying out both operations simultaneously. This could not be achieved by any of the crushers according to prior designs. For this purpose, it is merely necessary to adjust the stationary crusher jaws or plates relative to the more or less central oscillating crushing element so that the two crushing chambers will be of different sizes. It is then also advisable to provide each stationary crusher plate with adjusting means not only at their lower ends, but also at their upper ends. It is then possible to vary the degree of inclination of each stationary crusher plate relative to the central oscillating crushing element, to vary the width of the discharge opening at the lower end of each crusher chamber, and also to vary the size of each chamber. If the new crusher is to be used simultaneously as a preliminary and fine crusher, it is advisable to provide it with suitable conveying means, for example, with a bucket conveyer wheel, for mechanically conveying the material which has been precrushed in one crusher chamber to the other chamber in which it is to be fine-crushed. If the crusher is adjusted so that the crushing ratio attainable in each crusher chamber amounts to 1 to 10, the total crushing ratio attainable will amount to 1 to 100.

The features and advantages of the present invention will become more clearly apparent from the following detailed description of a preferred embodiment thereof as illustrated in the accompanying diagrammatic drawings, in which—

FIGURE 1 shows a longitudinal section of a crusher according to the invention which is provided with two crushing chambers;

FIGURE 2 shows a cross section of the driving elements within the crusher, as seen in the direction of the arrow II in FIGURE 1; while

FIGURE 3 shows a diagrammatic view of the crusher

according to FIGURE 1 in combination with a conveyor wheel as indicated in cross section.

As illustrated particularly in FIGURES 1 and 2 of the drawings the crusher according to the invention comprises a more or less central crusher element 1 which forms a housing in which a pair of shafts 2 and 2' carrying eccentrics 3 and 3' are rotatably mounted and connected to each other by gears 4 and 4' so as to drive the eccentrics 3 and 3' in opposite directions to each other. For this purpose, one of the shafts, for example, shaft 2, may be driven by a pulley 5 and a belt 5' or by any other suitable driving means. The crusher element 1 is mounted between a pair of side walls 6 and 6', one of which has an aperture through which shaft 2 is inserted with sufficient lateral play, and it is supported by a pair of crossbars 7' and 7'' which connect the side walls 6 and 6' and by elastic means such as vibration dampening connectors 8 and 8' between the upper and lower walls of housing 1 and the crossbars 7 and 7'. When the eccentrics 3 and 3' are rotated about the axes of shafts 2 and 2', crusher element 1 is oscillated in the horizontal direction. The two outer sides of the crusher element 1 carry crusher plates 22 and 22'.

Between the side walls 6 and 6', plates 10 and 10' carrying crushing jaws 11 and 11' are pivotably mounted on trunnions 9 and 9'. Plates 10 and 10' may be set to different inclined positions by a rotary adjustment of the setscrews 12 and 12', whereby the width of the outlet sides of the crushing chambers 13 and 13' may be changed. It is expedient to provide the walls 6 and 6' with bases 14 and 14', and to mount the latter resiliently, for example, in the manner shown by strips 15. Although the trunnions 9 and 9' may be disposed in such fixed positions that one crushing chamber is larger than the other, they may also be made slidable in guide slots 16 and 16' to permit them to be adjusted to different positions, for example, by means of setscrews 17 and 17' and to be locked in the adjusted positions by nuts 18, 18' or the like, as indicated in FIGURE 1 in dotted lines. Since the lower setscrews 12 and 12' are also adjustable to different positions, it is then possible to adjust each crushing chamber 13 and 13' to different sizes and to vary the inclination of the crushing jaws 11 and 11' to any desired angle. Obviously, the slots and setscrews should then be covered from the material to be crushed.

This material may, for example, first be filled into the crushing chamber 13 in which it is precrushed. After falling out of the lower open end of this chamber, this precrushed material may slide along a chute 19 to a conveyer wheel 20, as illustrated in FIGURE 3, which lifts the material and then deposits it either directly or via a second chute 21 in the second crushing chamber 13' in which it is crushed again into smaller pieces.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A crusher for coal, rock, ore and the like comprising a crushing element, means for supporting said element in said crusher for oscillating movements relative thereto in substantially horizontal directions, said means for supporting including a pair of mutually opposite side walls, a pair of cross bars connecting said pair of side walls, said element having upper and lower walls, and elastic vibration damping means between said upper wall

and one of said pair of cross bars and between said lower wall and the other of said pair of cross bars, means for imparting said oscillating movements to said crusher element comprising at least two eccentric weight members, two parallel, horizontal shafts supporting said weight members, one of said shafts being disposed above the other of said shafts, means for rotating said shafts simultaneously in opposite directions to cause said movements in said horizontal directions, a pair of substantially stationary plate-like crusher jaws at both sides and spaced from said crushing element and each disposed at an oblique angle thereto so as to form a pair of downwardly converging crushing chambers between said element and said jaws, each of said chambers being adapted to receive the material to be crushed through the open upper end thereof and to discharge the crushed material through the open lower end, and separate means acting upon the upper and lower ends of each of said jaws for adjusting it to different angular positions relative to said element, for adjusting the width of the upper and lower openings of each of said chambers to thereby adjust said chambers to different capacities.

2. A crusher according to claim 1, further comprising chute means and conveying means for receiving the crushed material from the lower end of one of said pair of chambers and conveying it to the upper end of the other of said pair of chambers.

3. A crusher for coal, rock, ore and the like comprising a crushing element having upper and lower walls, means for supporting said element in said crusher for movements relative thereto in substantially horizontal directions, two eccentric weight members, two parallel, horizontal shafts supporting said weight members between said upper and lower walls, one of said shafts being disposed above the other of said shafts, means for rotating said shafts simultaneously in opposite directions to cause said movements of said elements in said horizontal directions, said supporting means comprising means facilitating said movements, said facilitating means comprising supporting elements extending in directions of their length parallel to said shafts and elastic vibration damping members extending in directions of their length parallel to said shafts, each of said damping members being secured to a respective one of said supporting elements and to one of said upper and lower walls, a pair of substantially stationary plate-like crusher jaws at both sides of and spaced from said crushing element and each disposed at an oblique angle thereto so as to form a pair of downwardly converging crushing chambers between said element and said jaws, each of said chambers being adapted to receive the material to be crushed through the open upper end thereof and to discharge the crushed material through the open lower end, and separate means acting upon the upper and lower ends of each of said jaws for adjusting it to different angular positions relative to said element, for adjusting the width of the upper and lower openings of each of said chambers, to thereby adjust said chambers to different capacities.

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J. SPENCER OVERHOLSER, *Primary Examiner.*

EVERETTE W. KIRBY, *Examiner.*