

Oct. 25, 1949.

A. R. EBERSOL

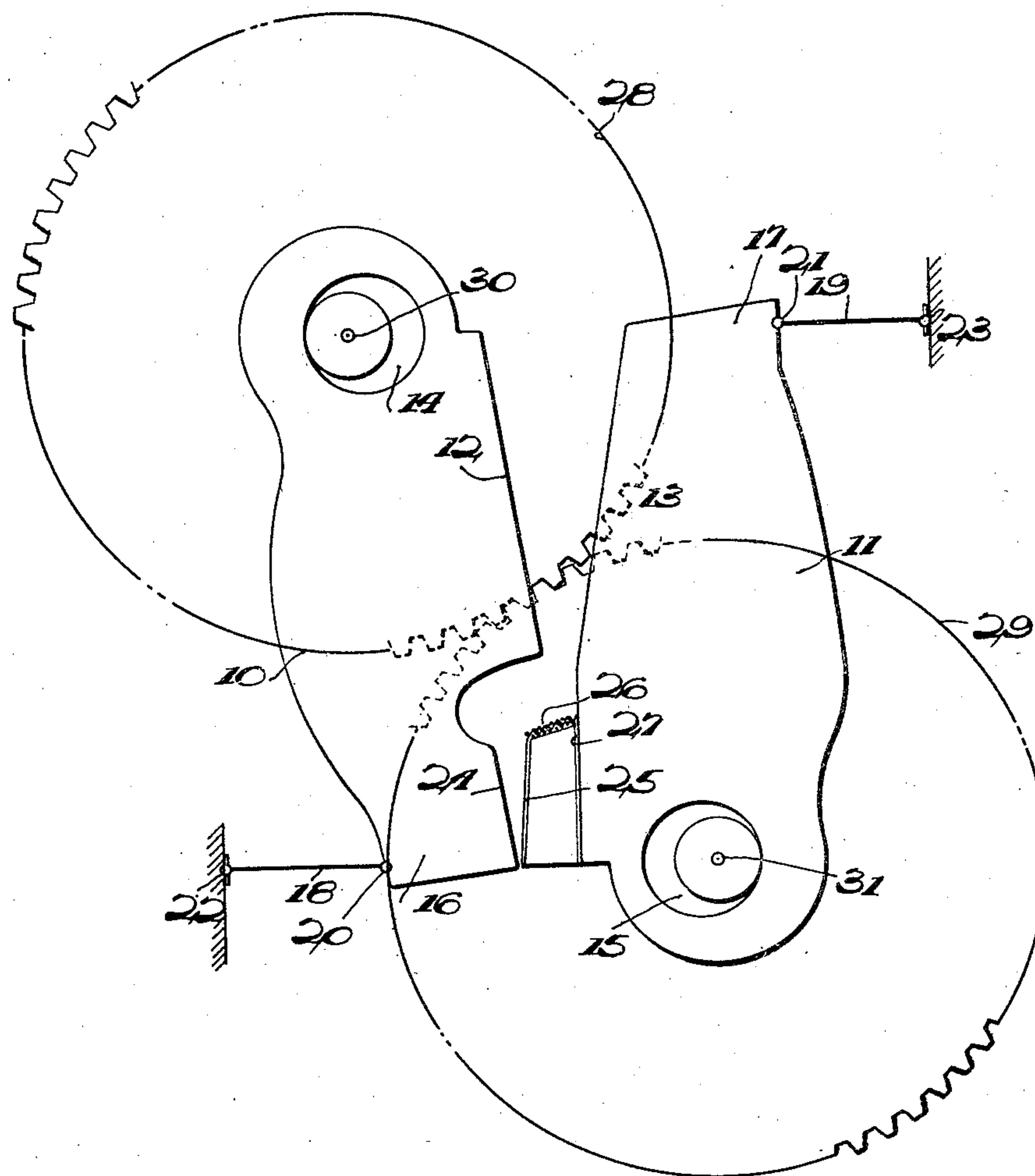
2,485,717

JAW CRUSHER, COMPOUND MOVEMENT

Original Filed June 16, 1942.

2 Sheets-Sheet 1

*Fig. 1.*



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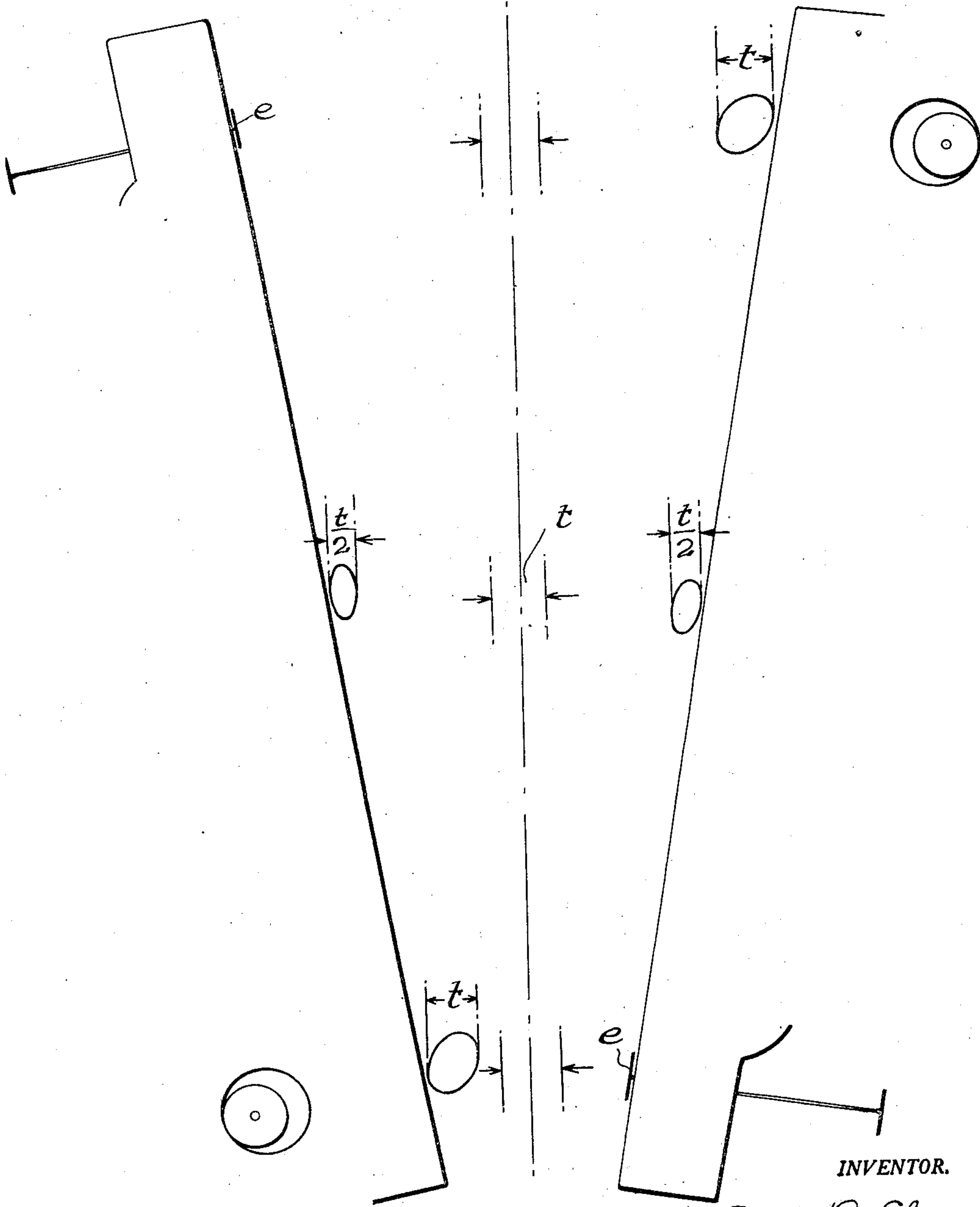
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*FIG. 2.*



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## UNITED STATES PATENT OFFICE

2,485,717

## JAW CRUSHER, COMPOUND MOVEMENT

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Original application June 16, 1942, Serial No. 447,258. Divided and this application April 12, 1945, Serial No. 587,848

10 Claims. (Cl. 241—78)

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This invention relates to apparatus for crushing relatively hard material such as rock, ore, and the like, and more particularly to what are known as jaw crushers.

In my application Serial No. 447,258, filed June 16, 1942, of which this application is a division, and which became Patent No. 2,380,419 on July 31, 1945, I have disclosed and claimed a novel jaw crusher wherein both jaws receive their movement from a single eccentric, one jaw being moved thereby through a closed curved path while the opposing jaw, moved indirectly by the same eccentric, is reciprocated in substantially a straight line path. Among the many advantages possessed by a crusher embodying said invention are: one, the magnitude of the relative movement between the crushing faces of the opposing jaws is substantially uniform throughout and as the relative movement between the jaw faces is substantially equal at the top of the jaws and at the bottom of the jaws there is substantially the same amount of crushing work throughout their crushing faces; two, the opposing jaws move the material downwardly during the crushing act and then rapidly release it to the action of gravity at the precise moment when the greatest possible impetus is imparted to it by the downward movement of both jaws; three, the movement of the jaws in the direction of material flow is substantially equal to the total relative approach of the crushing faces throughout. In the preferred embodiments disclosed in said application these advantages are obtained by keeping the crushing faces of both jaws at a substantially constant angle to the horizontal throughout the crushing cycle, using a control means for the eccentrically driven jaw which is remote from the crushing face of said jaw.

It has been proposed in the patent to Cockfield, No. 1,133,101, and also in the German Patent No. 306,017, to provide a crusher in which each of the two opposing jaws is provided with an eccentric individual thereto at the same end, while the opposite ends of the two jaws are each under the control of links or the like, commonly known as toggles, individual thereto. This arrangement results in a crushing stroke of great magnitude at the end where the eccentrics oppose each other while the opposite ends under the control of the toggles have a relatively small crushing stroke. Another disadvantage of this construction is that

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the releasing movement is not of the same character at the top and bottom of the jaws, it being obvious that at the end under the control of the eccentric the recession of the jaw faces after each crushing stroke is much more rapid than at the end under the control of the toggles. Moreover, in this arrangement the downward movement of the jaws can only be approximately one half of the maximum total relative approach of the crushing faces.

It is an object of this invention to provide a novel crusher wherein the opposing jaws are each moved by an eccentric means individual thereto and controlled by a floating mounting individual thereto but arranged in such way that the above referred to disadvantages are eliminated.

Another object of this invention is to provide a novel crusher wherein each jaw is moved by a single eccentric means individual thereto cooperating with a control means individual thereto but arranged in such way that the total relative approach and recession of the crushing faces are substantially uniform and equal throughout.

Another object of this invention is to provide a novel crusher wherein the movements of relative approach and recession of the jaw faces are maintained substantially uniform throughout without use of the relatively long arm or pair of arms extending to relatively remote control means employed in my aforesaid parent application.

Another object of this invention is to provide a novel crusher wherein the rocking movement in the crushing face of one jaw is offset by the opposite rocking movement in the crushing face of the other jaw to maintain substantially uniform movements of approach and recession throughout their crushing faces at all times similar to that obtained by embodiments in my parent application through use of other means.

Another object of this invention is to provide a novel crusher of the character referred to which is actuated by two opposed eccentrics but wherein the movement of the jaws in the direction of the material flow is substantially equal to the maximum total relative approach or recession of said jaws.

Another object of this invention is to provide a novel crusher wherein the relative recession of the jaw faces throughout is initiated at the moment the greatest downward impetus is imparted to the



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material being crushed by the downward movement of both jaws.

Another object of this invention is to provide a novel crusher of the character referred to whereby some of the advantages pointed out in my aforesaid parent application can be obtained by using only two eccentrics.

Another object of this invention is to provide a novel crusher which will obtain the desired character of jaw movement without using more than one eccentric with each jaw.

Another object of this invention is to provide a crusher of the character referred to wherein the control means and moving means for each jaw are so arranged as to produce a substantial mechanical advantage.

Another object of this invention is to provide a crusher as above characterized which is simple in construction, compact particularly in length, strong and rugged, and highly efficient in operation.

Other objects will appear from the following description.

The invention is capable of receiving a variety of mechanical expressions only one of which is shown diagrammatically on the accompanying drawing, but it is to be expressly understood that the drawing is for purposes of illustration only and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

The drawing shows schematically one embodiment of the present invention, reference being had to my aforesaid parent case for details of construction that may be used in embodying principles which here can best be explained by diagrammatic showing. In said drawing Fig. 1 is a schematic elevation and Fig. 2 is a diagram to illustrate the relative movements of the crushing faces.

As illustrated, the crusher has two jaws 10 and 11 of any suitable size and construction provided with crushing faces 12 and 13 of any suitable character and so arranged as to provide a space therebetween which decreases in width towards the lower end thereof for receiving and acting on the material to be crushed in conformity with principles well understood in the art. The crushing face of each jaw is driven through a closed curved path by an eccentric, 14 and 15 respectively, or other suitable means, associated with the relatively opposite ends of said jaws, said eccentrics being mounted on and driven by shafts 30 and 31 mounted in bearings on any suitable frame (not shown).

To support each jaw at the opposite end 16 or 17 from its respective eccentric there is provided a floating or yieldable connection, 18 and 19 respectively, which may be of any suitable construction and material. In the drawing these yieldable connections extend from the jaws in planes which are substantially at right angles to the crushing faces. Even with both connections in this position an ample crushing stroke is provided at the top and bottom of the crushing path because the opposed jaw in each case has its eccentric in approximately horizontal alignment therewith.

As shown the floating mountings are in the form of links pivoted to the members 10 and 11 at 20 and 21 respectively, and to the frame of the machine, or other solid support, at 22 and 23 respectively, and extending at substantially right angles to the lengths of the jaws. But any other

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suitable form of support yieldable in the direction of the length of each jaw may be employed.

While the crushing faces 12 and 13 may be uninterrupted so as to extend the full length of the jaws proper, I prefer for some purposes to subdivide the crushing faces into two or more pairs of crushing faces as shown in the drawing, wherein a second pair of crushing faces is provided at 24 and 25 with a grading device 26 interposed between the two pairs of crushing faces for separating the fines from the material operated upon by the faces 12 and 13 before the coarser material passes to the faces 24 and 25. The fines separated by the grading device 26 may be led away through any suitable passage 27. As the grading device 26 is mounted directly on the jaw 11 not far from its eccentric 15 it will be observed that it moves through a closed curved path with the crushing face of this jaw whereby the crushed material leaving the throat between the faces 12 and 13 is thoroughly agitated for separation of the fines before the coarser material is delivered to the action of the faces 24 and 25.

The two eccentrics are driven in synchronism by any suitable intermeshing gearing as diagrammatically indicated at 28 and 29, which gearing may be driven in any suitable way as by motor, belt pulley, chain drive, etc., on either shaft 30 or 31.

In operation the two jaws 10 and 11 are driven in synchronism by the eccentrics 14 and 15, the two eccentrics having their eccentricities displaced substantially 180 degrees with respect to each other as illustrated so that under the action thereof the two jaws simultaneously approach and simultaneously recede from each other in unison. The crushing face of each jaw therefore moves through a closed curved path at the end thereof driven by the eccentric as indicated at *t* in Fig. 2, but at the ends 16 and 17 the movement is constrained to that of a relatively flat arc by reason of the floating mounting 18 and 19 as indicated at *e* in Fig. 2. As both upper and lower ends of the two jaw faces are concurrently possessed of cyclic and substantially straight line movement the midpoint on each crushing face has a cyclic movement of  $t/2$  as shown in Fig. 2, while the faces of both jaws are relatively approaching or receding throughout their upward and downward movements. Thereby said jaws have relative movements of approach and recession which are approximately equal and substantially uniform throughout their areas. The crushing faces throughout approach relatively during the last half of their upward movement and the first half of their downward movement, after which they recede rapidly to release the material to gravity until it is caught in the next crushing stroke. The movement of relative recession throughout the jaw faces begins at approximately that instant at which the jaw faces have their maximum speed in the downward direction and continues through the last half of their downward movement and the first half of their upward movement.

Hence a crusher in conformity with the present invention possesses much of the improved operation and advantages explained in detail in my aforesaid application Serial No. 447,258 to which cross reference is made for details as to the construction, support, etc., of floatingly controlled and eccentrically driven jaws which can be used in embodying the present invention. It is to be expressly understood, however, that the present invention is not limited to the use of details there-



in disclosed, as any suitable construction of jaw, driving means, floating control, etc., can be used in embodying the principles of the present invention without departing from the spirit thereof as will now be apparent to those skilled in the art. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving the respectively opposite ends of the jaws to move the crushing face of each in a closed curved path, each of said jaws including control means cooperating therewith at a location remote from its driving means and coacting with said driving means to maintain the adjacent portion of said jaw moving approximately in a flat arc, means for driving said driving means substantially in synchronism, and a grading means entirely supported on one of said jaws to partake of the full movement thereof and positioned in the path of material passing between the faces of said jaws.

2. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving the respectively opposite ends of the jaws to move the crushing face of each in a closed curved path, each of said jaws including control means cooperating therewith at a location remote from its driving means and coacting with said driving means to maintain the adjacent portion of said jaw moving approximately in a flat arc, means for driving said driving means substantially in synchronism, crushing faces of said jaws being subdivided into at least two pairs of cooperating crushing sections, and grading means entirely supported on one of said jaws and disposed between upper and lower sections of said faces, said grading means delivering the coarse material to the space between a pair of cooperating face sections below said grading means.

3. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, eccentric driving means operatively connected with and cooperating only with the relatively opposite ends of the respective jaws to move the adjacent portions of the respective jaw faces in closed curved paths, said eccentric means cooperating with said jaws to move the jaw faces thereof in the direction of material flow by an amount which is substantially equal to the amount said faces are moved toward and away from each other by said eccentric means, means cooperating with the respective jaws to effect bodily movement of the portions thereof which are relatively remote from their associated eccentric means in directions lengthwise of their crushing faces along approximately straight lines, and means for driving said eccentric means.

4. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, eccentric driving means operatively connected with and cooperating only with the relatively opposite ends of the respective jaws to move the adjacent portions of the respective jaw faces in closed curved paths, said eccentric means cooperating with said jaws

to move the jaw faces thereof in the direction of material flow by an amount which is substantially equal to the amount said faces are moved toward and away from each other by said eccentric means, mounting means cooperating with the respective jaws at portions thereof relatively remote from their eccentric means to effect bodily movement of the adjacent portions of the jaw faces lengthwise of their crushing faces along approximately straight lines, and means for driving said eccentric means.

5. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, eccentric driving means cooperating with each jaw only at the relatively opposite ends thereof to move the adjacent portions of the associated jaw faces in closed curved paths and to move both jaws bodily lengthwise of their crushing faces by an amount approximately equal to their relative approach and recession, control means cooperating with each jaw at a portion thereof which is remote from the associated eccentric means to restrain the movement of the associated jaw face adjacent thereto to one along a relatively flat arc, and means for driving said eccentric means substantially in synchronism.

6. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, eccentric driving means associated with the relatively opposite ends of said jaws and control means associated with each jaw adjacent the driving means associated with the other jaw to effect movement of the jaw face associated with and adjacent to each control means to one along a relatively flat arc, said eccentric means cooperating with said jaws to move the jaw faces substantially simultaneously toward and substantially simultaneously away from each other and to move the jaw faces bodily in the direction of their length by an amount approximately equal to their relative approach and recession, and means for driving said eccentric means substantially in synchronism.

7. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, eccentric driving means associated with the relatively opposite ends of said jaws and control means associated with each jaw adjacent the driving means associated with the other jaw to effect movement of the jaw face associated with and adjacent to each control means to one along a relatively flat arc, said eccentric means cooperating with said jaws to move the jaw faces substantially simultaneously toward and substantially simultaneously away from each other and to move the jaw faces downwardly in the direction of material flow during the last part of their relative movement toward each other and the first part of their relative movement away from each other, and means for driving said eccentric means substantially in synchronism.

8. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, an eccentric driving means associated with each jaw, said jaws extending in opposite directions from their respective driving means, said eccentric means cooperating with said jaws to move their jaw faces toward and away from each other with



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substantial simultaneity and to move said jaw faces in the direction of their length by amounts substantially equal to their relative approach and recession, means for impressing an approximately rectilinear movement lengthwise of its jaw face on the portion of each jaw remote from its eccentric driving means, and means for driving said eccentric driving means substantially in synchronism.

9. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, an eccentric driving means associated with each jaw, said jaws extending in opposite directions from their respective driving means, said eccentric means cooperating with said jaws to move their jaw faces toward and away from each other with substantial simultaneity and to move said jaw faces in the direction of their length by amounts substantially equal to their relative approach and recession, means for impressing an approximately rectilinear movement lengthwise of its jaw face on the portion of each jaw remote from its eccentric driving means, each of said last named means including a control member disposed approximately in opposition to the eccentric driving means associated with the other jaw, and means for driving said eccentric driving means substantially in synchronism.

10. In a crusher, the combination of cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, eccentric driving means associated with each jaw, said

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jaws extending in opposite directions from their respective driving means, control means associated with a portion of each jaw remote from said driving means and restraining the adjacent portion of said jaw to an approximately rectilinear movement in a direction lengthwise of the jaw face, said eccentric driving means cooperating with said jaws to effect relative movement of approach and recession of the jaw faces which are approximately equal for the opposite ends of said jaw faces and movements of the jaw faces in the direction of material flow which are approximately equal to said movements of approach and recession, and means for driving said eccentric means substantially in synchronism.

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