Oct. 25, 1949. A. R. EBERSOL 2,485,718

PLURAL STAGE JAW CRUSHER INCLUDING INDEPENDENT MEANS FOR ADJUSTING THE DISCHARGE GAP OF EACH STAGE

Filed Nov. 1, 1945 3 Sheets-Sheet 1

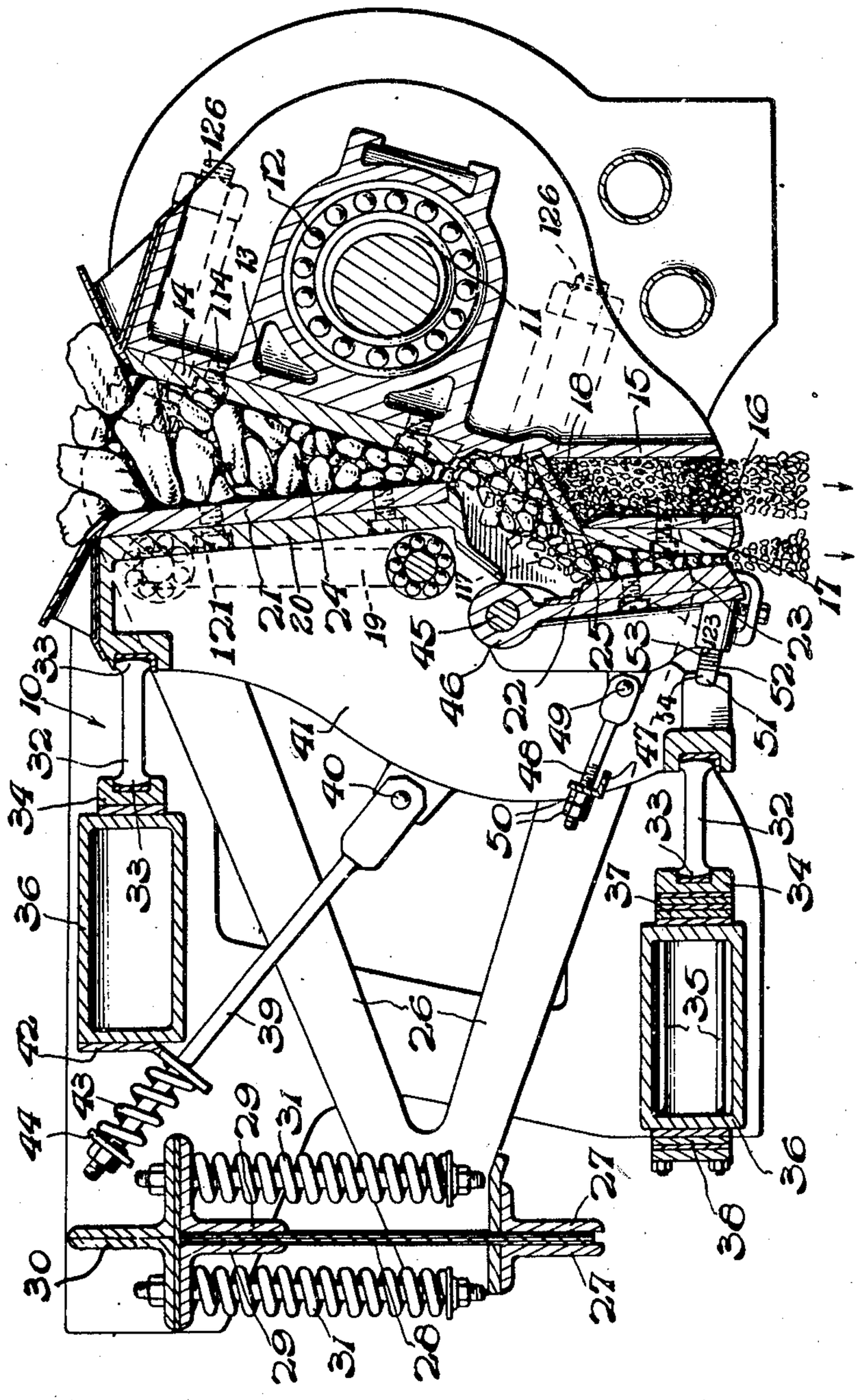

Fig. 1.

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Fig. 2.

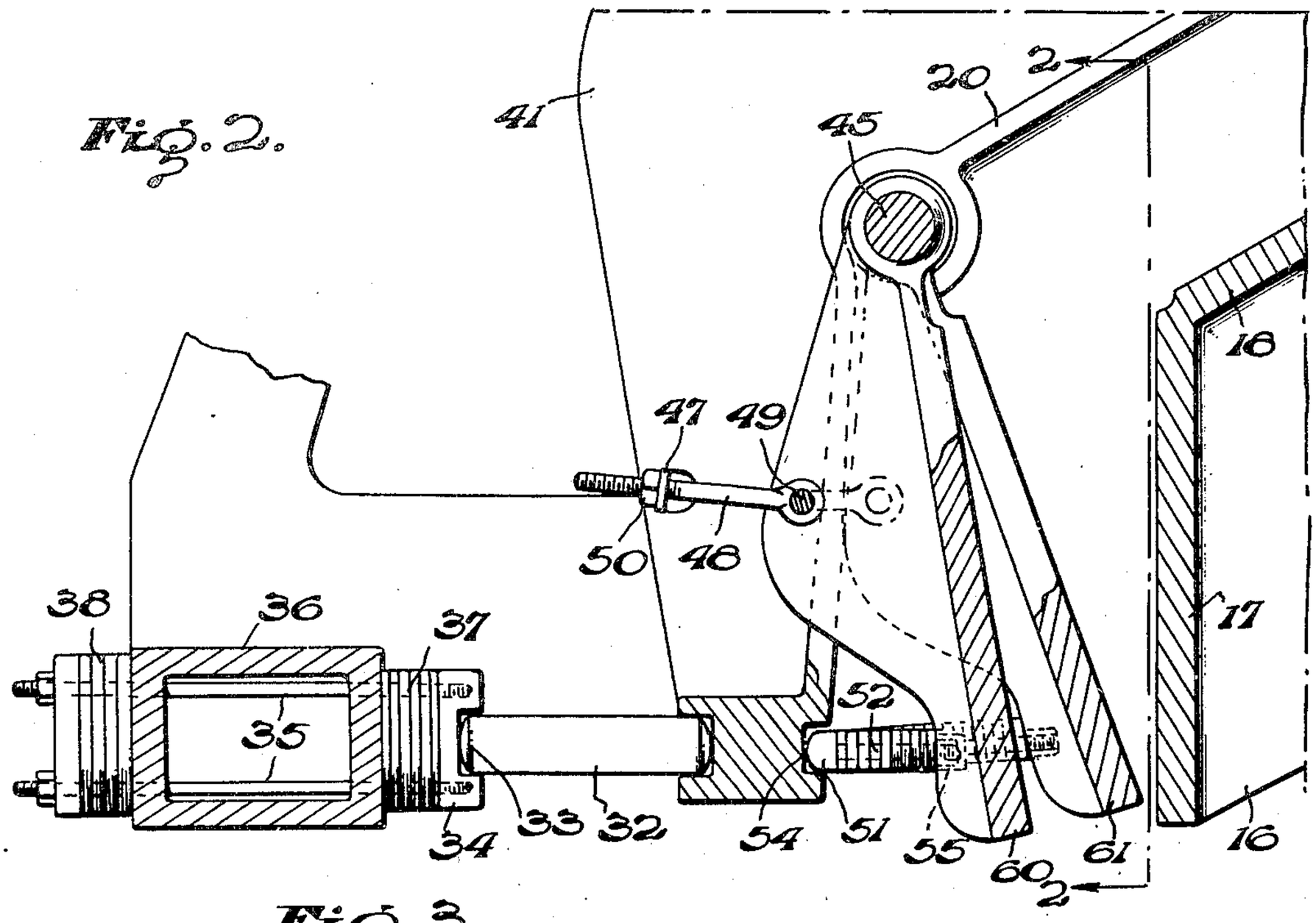
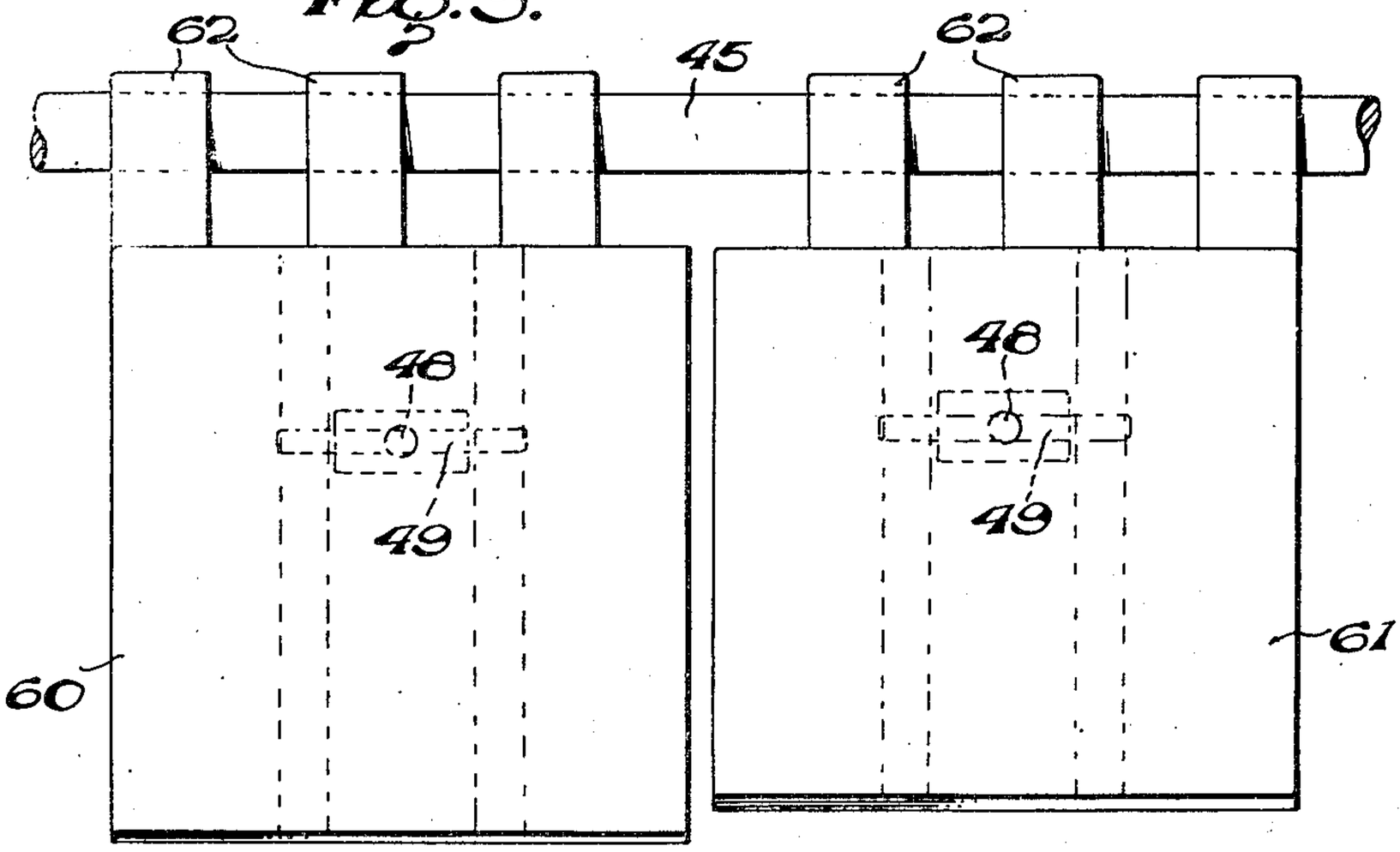


Fig. 3.



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Filed Nov. 1, 1945 3 Sheets-Sheet 3

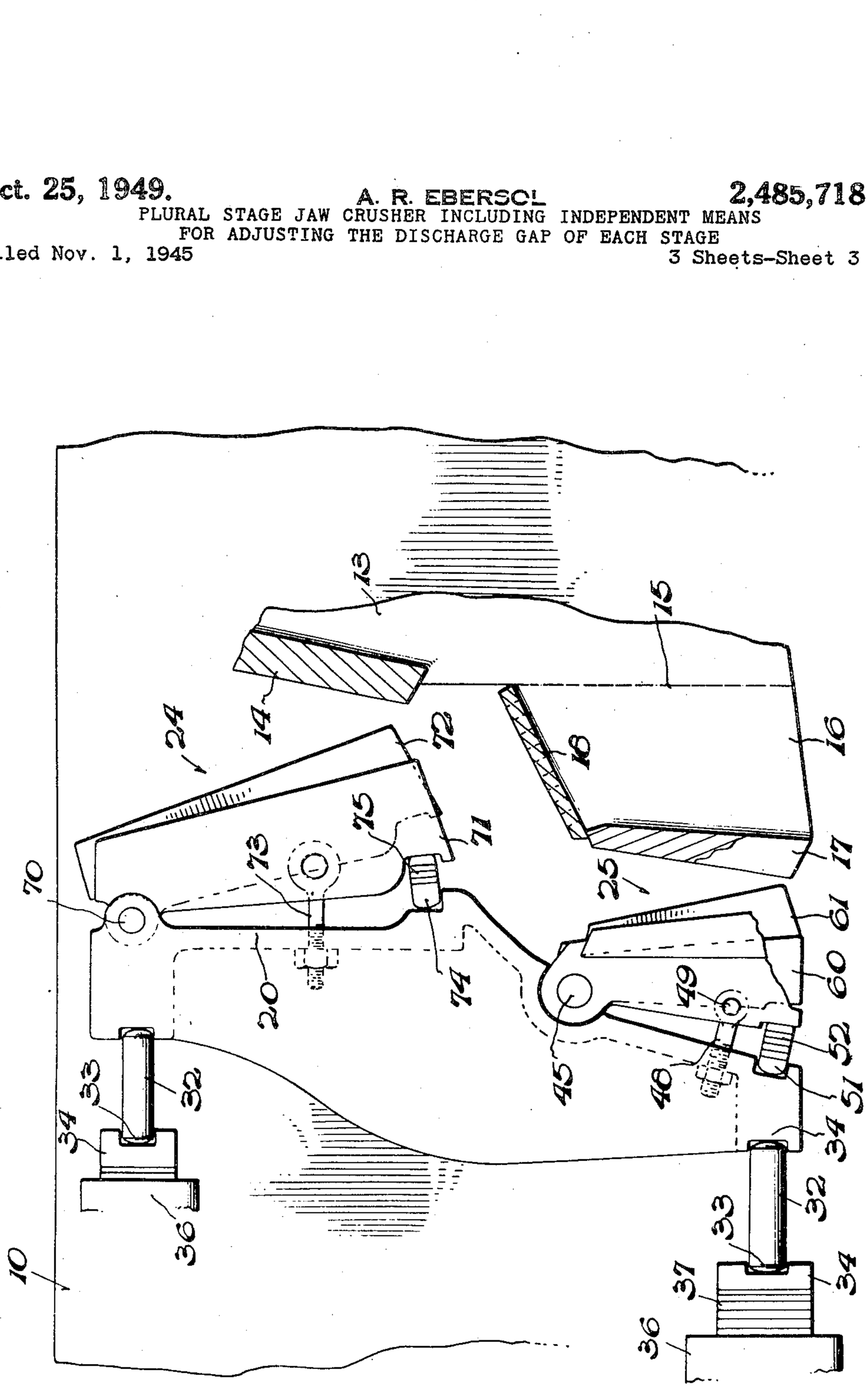

Fig. 4.

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UNITED STATES PATENT OFFICE

2,485,718

PLURAL STAGE JAW CRUSHER, INCLUDING INDEPENDENT MEANS FOR ADJUSTING THE DISCHARGE GAP OF EACH STAGE

Amos R. Ebersol, Lancaster, Pa.

Application November 1, 1945, Serial No. 626,031

15 Claims. (Cl. 241—164)

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

In my Patent No. 2,380,419, granted July 31, 1945, I have disclosed and claimed an improved crusher wherein cyclically movable and oscillating jaws are moved in synchronism in one embodiment of which the crushing path was divided into two separate crushing chambers, one above the other, with a grader or screen in between. While means was provided in this embodiment to change the discharge opening of the lower or secondary crushing chamber, by removing or inserting shims behind the bottom toggle plate, no means was provided whereby the two discharge openings of the primary and secondary chambers respectively could be adjusted separately and independently of each other. Since wear of the jaw faces, especially at the discharge points in both the upper and lower chambers, may vary the sizes of the openings, convenient adjustment of at least one of these discharge openings with respect to the other is desirable.

It is the object of this invention to provide an improved crusher of the type characterized with means permitting the adjustment of the secondary discharge opening without effecting the size of the primary discharge opening.

Another object of this invention is to provide a device of the type characterized with means enabling a plurality of different maximum sizes of crushed material to be delivered simultaneously from the crusher.

Another object of this invention is to provide a device of the type characterized wherein a jaw is so constructed as to facilitate adjustment of the size of the crushed material delivered by the crusher and also capacitated, if desired, to simultaneously deliver a plurality of different maximum sizes of crushed material.

Another object of this invention is to provide a crusher of the type characterized with means for adjusting the discharge opening of the primary chamber to various predetermined dimensions and means for adjusting the discharge opening of the secondary chamber to various predetermined dimensions.

While the present invention is particularly concerned with improvements in a crusher of the type disclosed in my Patent No. 2,380,419, the invention is susceptible of wider application, and therefore within the broader aspects of the present invention it is an object thereof to provide a crusher

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having improved means for adjusting the size of the discharge opening of the crushing chamber.

Another object of this invention is to provide a device of the type last characterized including improved means whereby a plurality of different maximum sizes of crushed material may be delivered simultaneously by the crusher.

Another object of this invention is to provide a device of the type last characterized including improved means whereby the discharge openings of different portions of the crushing space may be separately and independently adjusted.

Another object of the present invention is to provide a crusher having improved jaw adjusting means which are so constructed as to be easily operated to effect the desired adjustments.

Other objects will appear as the description of the invention proceeds.

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

Referring in detail to the accompanying drawings,

Fig. 1 is a vertical section, somewhat diagrammatic in character, through one embodiment of the present invention;

Fig. 2 is an enlarged sectional view, somewhat diagrammatic in character, to illustrate a lower portion of a jaw provided with independently adjustable sections;

Fig. 3 is a section on the line 2—2 of Fig. 2; and

Fig. 4 is an elevation, somewhat diagrammatic in character, illustrating an embodiment of the invention wherein both upper and lower portions of the jaw are provided with relatively adjustable sections.

While the embodiment of the present invention selected for exemplifying the same on the accompanying drawings in general follows the type of crusher construction shown in my Patent No. 2,380,419, it is to be expressly understood that in its broader aspects, as before explained, the improvements to be described can be incorporated in crushers of other forms and constructions, as will be apparent to those skilled in the art, and such is contemplated.

Referring first to Fig. 1, the crusher is supported on any suitable rigid frame shown as comprising side plates 10 held in spaced relation by

suitable cross connections. Extending horizontally through the frame adjacent one end thereof is a drive shaft carrying an eccentric 11, said shaft being mounted in appropriate bearings in the side plates and being driven in any well known manner from any suitable source of power. Driven by said eccentric 11, through the interposition of a roller bearing 12, is a jaw 13, shown as provided with a removable face member 14 which may be made of any suitable wear resisting material and which is secured to the jaw body in any suitable way as by bolts or screws indicated at 114. The removable face member 14 may have any suitable formation to facilitate the crushing operation. As here shown, the jaw body 13 has a downwardly extending portion 15 which carries, in suitably spaced relation thereto, a second portion 16 of the jaw body, here also shown as provided with a removable face member 17 which may be of any suitable formation and material and attached thereto in any suitable way as by bolts or screws one of which is indicated at 117. Interposed between the jaw portions 15 and 16 is a grading device 18, for example a suitable bleeding screen having an appropriate mesh for separating fines from the partly crushed material, said jaw portions 15 and 16 being so disposed that said grading device 18 underlies the throat or discharge opening formed by the converging faces of the upper portions of the jaws.

Also mounted between said side plates is the second jaw 20, and while this second jaw may be independently driven in suitably coordinated relationship with the jaw 13, this second jaw 20 is preferably driven from the first jaw or its driving means as fully explained in my aforesaid Patent No. 2,380,419. Jaw 20 is also shown as provided with a removable jaw face member 21 which may be of any suitable material and formation and secured thereto in any suitable way as by bolts or screws indicated at 121. Jaw 20 is provided with a downwardly extending portion 22 disposed oppositely to the jaw portion 16 and as shown is provided with a removable face member 23 which also may be of any suitable material and formation and secured thereto in any suitable way as by bolts or screws one of which is indicated at 123. Jaws 13 and 20 are so disposed, as shown in Fig. 1, as to provide a downwardly converging crushing space 24 between the face members 14 and 21, and the jaw portions 16 and 22 are so disposed as to provide a downwardly converging crushing space 25 between the face members 17 and 23, the latter crushing space being displaced laterally with respect to the first crushing space so that the partially crushed material delivered from the discharge opening of the space 24 is received on the grading device 18 and then deflected laterally into the entrance of the second crushing space 25 as disclosed in my aforesaid patent.

Jaw 13 has a cyclic movement, i. e., a movement in which any selected point on the jaw face moves in a closed curve, by reason of its drive from the eccentric 11, and associated with said jaw is means to control its cyclic movement so as to minimize the extent to which said jaw rocks on its driving means, said means taking the form of a relatively long arm 26 properly flanged and secured to the jaw 13 in any suitable way as by the bolts schematically indicated at 126, said arm extending therefrom to a floating mounting shown as associated with its end remote from said jaw. As here shown, said remote end of the arm 26 is provided with a pair of L-shaped

clamping members 27 between which is secured the lower end of a flexible or yieldable strap 28, made of any suitable material, the upper end of said strap being clamped between a pair of L-shaped members 29. Members 29 are normally held against the bracket 30, suitably carried by the frame, by the action of compression springs 31 suspended on bolts and normally restraining said end of the arm against movement in a vertical direction. Movement of the arm lengthwise thereof, however, is permitted by the flexible strap 28 as the jaw 13 is driven by the eccentric 11, the flexible suspension 28 bending to permit the movement of said arm 26 in the direction of its length, all as explained in my aforesaid patent. Thereby the end of the arm 26 remote from the jaw 13 is provided with a floating mounting which assures that the movement of said arm shall be restrained to one that is substantially in the direction of its length, whereby the face of the jaw 13, although given a cyclic movement, is controlled so that its crushing face remains substantially parallel to itself throughout its cyclic movement. In the event the jaw encounters noncrushable material, however, jaw 13 can turn on its eccentric, the springs 31 yielding to permit downward movement of the end of the arm 26.

Jaw 20, on the other hand, is preferably so mounted and operated that its movement is substantially rectilinear, i. e., so that it has a reciprocating movement, in synchronism with the cyclic movement of the jaw 13, with the crushing face of said jaw remaining parallel to itself at all times and having substantially no movement of advance and recession with respect to the jaw 13. To this end, as explained in greater detail in my aforesaid patent, jaw 20 is mounted on parallel linkage plates 32, shown as having arcuate end surfaces 33, that are suitably retained in channel-shaped recesses provided in the jaw body 20 and in members 34 carried by bolts 35 extending through frame members 36. To adjust the jaw member 20 toward and away from its opposed jaw member 13, shims 37 may be interposed between the channel members 34 and the frame members 36. Spare shims 38 may be carried between the heads of said bolts and said frame members 36. The mounting of the upper plate 32 and its associated parts may be identical with the construction shown at the lower half of the figure or the provision for adjustment at this point may be omitted. Jaw 20 is suitably held against the parallel linkage plates 32, as by one or more tie rods 39, each tie rod being pivotally connected at 40 to a rearwardly extending rib or projection 41 on the jaw 20 and extending thorugh an aperture in a bracket 42 suitably carried by the frame 10 with a coil spring 43 interposed between said bracket and a thrust plate 44 carried on the end of the tie rod. Thereby the jaw 20 is yieldably held against the parallel linkage plates 32, and all points on the face of said jaw 20 are made to move in, or substantially in, a straight line as said jaw 20 is reciprocated up and down in synchronism with the cyclic movement of the jaw 13 by any suitable connection between said jaw and the arm 26 as by a link 19 pivoted at its opposite ends to said jaw and arm, all as fully explained in my aforesaid Patent No. 2,380,419.

As so far described the crusher illustrated on the drawing has substantially the same construction and mode of operation as explained in detail in the aforesaid patent, to which cross ref-

erence is made for further details of construction and operation.

In conformity with the present invention the lower section **22** of the jaw **20** is made adjustable independently of the upper section thereof so that the discharge opening of the lower chamber **25** can be set to a given size without affecting the size of the discharge opening of the upper chamber **24**.

In the embodiment shown in Fig. 1 the jaw **20** is shown as provided with rearwardly extending ribs **41** and mounted in any suitable way in or on said ribs is a pivot pin **45** extending substantially the full width of the jaw **20**. Jaw section **22** is provided with one or more eyes **46** which receive said pivot pin **45** and on which the jaw section **22** is pivotally mounted. Any suitable means may be provided for effecting the adjustment of the jaw section **22**. As shown the rib **41** carries an angle bracket **47** through which extends a tie rod **48** pivoted at **49** to the section **22** or a rearwardly extending projection thereon. Tie rod **48** is threaded at its outer extremity and carries one or more nuts **50** so that by adjusting said nuts the section **22** may be moved around its pivot pin **45** until the desired discharge setting is secured. Any suitable means may be interposed between the body of the jaw **20** and the pivoted section **22** to transmit the thrust from the pivoted section **22** to the body of jaw **20**. As shown (compare Fig. 2) a rocker faced bar **51** with any suitable means thereon for holding shims is interposed between the body of jaw **20** and the pivoted section **22** and held in position in any suitable way as in recesses **54** and **55** provided in said parts (see Fig. 2), and shims **52** are mounted on said bar and held between the same and a suitable abutment surface **53** on the pivoted section **22** by the tension of the tie rod **48**.

As will now be apparent from the foregoing description, if it is desired to change the size of the discharge opening of chamber **25** the nuts **50** may be loosened, shims **52** may be added or withdrawn from bar **51**, depending upon the direction of adjustment desired, and then the nuts **50** may be retightened to hold the section **22** rigidly in position as a part of the jaw **20**. Thereafter the jaw section **22** will move as a unit with the jaw **20**. This constitutes a much simpler and easier provision for changing the size of the discharge opening from the crushing space **25** than is effected by adjusting the entire jaw **20** toward and away from its opposed jaw **13**. If for one reason or another a change in the size of the discharge opening of the upper chamber **24** were desired while the size of the lower discharge opening is to remain the same, then by loosening the bolts **35** and tie rod **39** shims can be added or taken away as desired at **37**, which will directly effect the discharge opening of the upper chamber. This adjustment will also change the size of the discharge opening of the lower chamber **25**, but after the desired opening has been secured for the upper chamber then the original setting of the discharge opening for the lower chamber can be secured by changing shims at **52**.

In the embodiment of Fig. 1 the lower section **22** of the jaw **20** may extend throughout the transverse or widthwise dimension of the main jaw **20** and be adjusted as a unit about its pivot axis **45**. A preferred feature of the present invention, however, comprises the subdivision of the adjustable section of the jaw into at least two separately and independently adjustable sections to the end that the crusher may simultaneously deliver crushed material of at least two different maximum sizes or through a larger range of sizes of crushed material than previously possible. For example, one portion of the jaws may be set to provide a discharge opening of say ¾''; with such a setting by far the greater percentage of the delivered material will be below ¾''. But the producer may desire to supply 1½'' crushed material simultaneously with the smaller material. An embodiment of the present invention whereby the producer can so deliver simultaneously crushed material of different maximum sizes or a wide range of sizes is shown in Figs. 2 and 3 wherein parts corresponding to those appearing in Fig. 1 are designated by the same reference characters. As here shown, the lower portion of the jaw **20** is provided with two pivotally mounted jaw members **60** and **61** disposed side by side, both being pivotally mounted on the pivot pin **45**, as by eyes **62** projecting rearwardly therefrom. Each of the jaw sections **60** and **61** is provided with its individual provision for adjustment, here shown as in the form of a pivoted tie rod **48** and a rocker faced bar **51** provided with shims **52** as in the embodiment of Fig. 1. If preferred, however, only one adjustable section, extending part way across the lower portion of jaw **20**, as **60** for example, may be provided, the remaining width of said lower portion being non-adjustable with respect to the upper portion.

By independent operation of the tie rods **48** and the introduction or withdrawal of shims **52** as explained in conjunction with the embodiment of Fig. 1, the two jaw sections **60** and **61** may be independently operated to establish the desired jaw settings and consequent maximum sizes of crushed material delivered, by predetermining the sizes of the throats or discharge openings existing between the opposed crushing faces widthwise of the jaws, whereby partly crushed material delivered from the upper crushing space **24** will be simultaneously delivered to the two crushing spaces defined by the crushing faces on sections **60** and **61** and the opposed crushing face **17**. Thereby crushed material of two different maximum sizes will be simultaneously produced.

Still greater flexibility of use may be obtained by making the upper portion of the jaw **20** so that its crushing face may be adjusted with respect to the lower portion of its face. While the upper section of the jaw may comprise a single adjustable section extending the full transverse dimension of the jaw **20**, like the lower adjustable section **22** of Fig. 1, maximum flexibility of use is obtained if the upper portion of the jaw **20** is provided with at least two independently adjustable sectons, analogously as in the case of the jaw sections **60** and **61**. This is illustrated in the embodiment of Fig. 4 wherein the upper portion of the jaw **20** is provided with a transversely extending pivot pin **70** which carries two independently movable jaw sections **71** and **72**. Here again, any suitable means for adjusting the pivotal sections may be provided, such as pivoted tie rods **73** and rocker faced bars **74** with shims **75** that may be of the same construction as the elements **48**, **51**, **52**, etc. of Fig. 1.

In this embodiment, which also includes independently adjustable lower jaw sections **60** and **61** as in the embodiment of Fig. 2, there are thus four independently adjustable jaw sections which may be separately manipulated so as to establish and maintain a wide variety of discharge openings between different portions of the crushing

faces so as better to control the flow of material and the size of the crushed material delivered.

While the adjustment of the independently movable jaw sections has been shown as provided by pivotally mounted tie rods and thrust members comprising bars with shims that may be added or withdrawn as desired, it is to be understood that any other suitable provision for effecting the adjustment as by wedges, threaded connections, and the like, may be used if preferred. Again, while, as preferred, the provisions for modifying the discharge opening or openings, and by preference including provisions for the independent adjustment of different portions of the jaw faces, have been shown as incorporated in a crusher utilizing a grader between the upper and lower portions of the cooperating jaw faces, so that fines may be removed from the crushed material before the latter is subject to the action of the lower portions of the crushing faces, it will be apparent to those skilled in the art that such grader may be omitted and the upper and lower portions of the jaw 20 with its aforesaid provision for adjustment may then be in substantial alignment with each other instead of laterally offset. Again, while it is preferred to embody the present invention in a crusher wherein the two jaws have simultaneous and synchronous cyclic and reciprocating movements with provision for maintaining the angularity between the opposed crushing faces substantially constant throughout the crushing movements as fully disclosed in my aforesaid patent, it will be apparent to those skilled in the art that some of the advantages of the present invention may be obtained by incorporating the provisions herein disclosed in crushers whose jaws have other constructions and characters of movement than disclosed in my aforesaid patent.

It will therefore be perceived that by the present invention a crusher has been provided wherein the discharge opening or openings between different portions of the crushing faces may be adjusted independently as desired to meet different requirements and different conditions, and this adjustment can be effected more rapidly and easily than by previous provisions. Furthermore, provision has been made whereby the crusher can be readily set to deliver a plurality of maximum sizes of crushed material simultaneously, and, if desired, the flexibility of the crusher may be extended to the point where, in addition to the foregoing, desired discharge openings between different portions of the crushing faces both vertically and transversely may be modified separately to the extent desired.

While the embodiments of the invention illustrated on the drawings have been described with considerable particularity it is to be expressly understood that the invention is not limited thereto, as the same is capable of receiving a variety of expressions, as will now be apparent to those skilled in the art, while changes may be made in the details of construction, size, form, relationship, etc., of the parts, without departing from the spirit of this invention. Reference is therefore to be had to the appended claims for a definition of said invention.

What is claimed is:

1. In a crusher of the type employing a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw to move the crushing face thereof in a closed curved path, means for oscillating said second jaw, and means cooperating with said jaws to maintain a substantially constant angular relationship between the crushing faces of said jaws, said oscillating jaw having its crushing face divided into upper and lower sections and including at least one pivotally mounted member which carries one of said jaw sections, and means mounted on said oscillating jaw and cooperating with said member for moving said member to change the delivery opening from the crushing space defined on one side by said movable member independently of the dimensions of the other crushing spaces associated with the other jaw sections.

2. In a crusher of the type employing a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw to move the crushing face thereof in a closed curved path, means for oscillating said second jaw, and means cooperating with said jaws to maintain a substantially constant angular relationship between the crushing faces of said jaws, said oscillating jaw having its crushing face divided into upper and lower sections and including at least one member which carries a lower jaw section, a pivotal mounting for said member carried by said oscillating jaw, and means mounted on said oscillating jaw and cooperating with said member for pivotally moving the same independently of the upper jaw section to predetermine the delivery opening from the lower end of the crushing space between said jaws.

3. In a crusher of the type employing a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw to move the crushing face thereof in a closed curved path, means for oscillating said second jaw, and means cooperating with said jaws to maintain a substantially constant angular relationship between the crushing faces of said jaws, said oscillating jaw having its crushing face divided into upper and lower sections and having at least one of its upper and lower sections subdivided into a plurality of jaw faces, movable members mounted on said oscillatable jaw and respectively carrying said last named jaw faces, pivotal mountings for said members carried by said oscillatable jaw, and means carried by said oscillatable jaw and cooperating with said members for separately moving said members to adjust independently the delivery openings from the different crushing spaces defined on one side by said last-named jaw faces.

4. In a crusher of the type employing a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw to move the crushing face thereof in a closed curved path, means for oscillating said second jaw, and means cooperating with said jaws to maintain a substantially constant angular relationship between the crushing faces of said jaws, said oscillating jaw having its crushing face divided into upper and lower sections and having the crushing face of its lower section subdivided into a plurality of side by side jaw faces, a like plurality of pivotally mounted members carried by said oscillatable jaw and respectively carrying said last named jaw faces,

and means for separately and independently moving said members with respect to said oscillatable jaw to alter the discharge openings associated with different portions of the cooperating jaw faces whereby said crusher may deliver simultaneously crushed material of different maximum sizes.

5. In a crusher of the type employing a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw to move the crushing face thereof in a closed curved path, means for oscillating said second jaw, and means cooperating with said jaws to maintain a substantially constant angular relationship between the crushing faces of said jaws, said oscillating jaw having its crushing face divided into upper and lower sections and having the jaw face of its lower section subdivided into a plurality of side by side jaw portions, a member pivotally mounted on said oscillatable jaw and carrying the upper section of the jaw face, a plurality of members pivotally mounted on said oscillatable jaw and respectively carrying the different portions of the lower section of said jaw face, and means for separately and independently adjusting said members with respect to each other to vary the delivery openings from different portions of the crushing space.

6. In a crusher of the type employing a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw to move the crushing face thereof in a closed curved path, means for oscillating said second jaw, and means cooperating with said jaws to maintain a substantially constant angular relationship between the crushing faces of said jaws, said oscillating jaw having its crushing face divided into upper and lower sections, the upper and lower sections of said oscillatable jaw having their crushing faces respectively subdivided into a plurality of crushing portions arranged side by side, pivotally mounted members carried by said oscillatable jaw and each in turn carrying one of said portions of the crushing face of said jaw, and separately and independently adjustable means for severally moving said members with respect to each other to change the delivery openings from different portions of the crushing space.

7. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, and means for driving said jaws to produce relative approach and recession, a movable jaw having its crushing face divided into upper and lower jaw sections and including at least one member which carries one of said jaw sections, a pivotal mounting for said member carried by said last named jaw, and means carried by said last named jaw and cooperating with said member for moving said member to alter the delivery opening from the crushing space defined on one side by said movable member.

8. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, and means for driving said jaws to produce relative approach and recession, a movable jaw having its crushing face divided into upper and lower jaw sections and including at least one member which carries a lower section of the crushing face, a pivotal mounting for said member carried by said last named jaw, and means mounted on said last-named jaw and cooperating with said member for pivotally moving the same to predetermine the delivery opening from the lower end of the crushing space between said jaws.

9. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, and means for driving said jaws to produce relative approach and recession, a movable jaw having its crushing face divided into upper and lower jaw sections and having at least one of its upper and lower sections subdivided into a plurality of side by side jaw faces, movable members mounted on said last-named jaw and respectively carrying said last-named jaw faces, and means mounted on said last named jaw and cooperating with said members for separately moving said last-named members to adjust independently the delivery openings from the different crushing spaces defined on one side by said last-named jaw faces.

10. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, and means for driving said jaws to produce relative approach and recession, a movable jaw having its crushing face divided into upper and lower jaw sections and having the crushing face of its lower section subdivided into a plurality of side by side jaw faces, a like plurality of pivotally mounted members carried by said last named jaw and respectively carrying said last-named jaw faces, and means mounted on said last named jaw and cooperating with said members for separately and independently moving said members with respect to said jaw to alter the discharge openings associated with different portions of the cooperating jaw faces whereby said crusher may deliver simultaneously crushed material of different maximum sizes.

11. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, and means for driving said jaws to produce relative approach and recession, a movable jaw having its crushing face divided into upper and lower jaw sections and having the jaw face of its lower section subdivided into a plurality of side by side jaw portions, a member pivotally mounted on said last-named jaw and carrying the upper section of the jaw face, a plurality of members pivotally mounted on said jaw and respectively carrying the different portions of the lower section of said jaw face, and means mounted on said last named jaw and cooperating with said members for separately and independently adjusting said members with respect to each other to vary the angular delivery openings from different portions of the crushing space.

12. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces posi-

tioned to provide a path for the flow of material therebetween, and means for driving said jaws to produce relative approach and recession, a movable jaw having its crushing face divided into upper and lower jaw sections, the upper and lower sections of said last-named jaw having their crushing faces respectively subdivided into a plurality of crushing portions in side by side arrangement, pivotally mounted members carried by said last named jaw and each in turn carrying one of said portions of the crushing face of said jaw, and separately and independently adjustable means carried by said last named jaw and cooperating with said members for severally moving said members with respect to each other to alter the delivery openings from different portions of the crushing space.

13. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw cyclically to move the crushing face thereof in a closed curved path, and means for oscillating said second jaw, said oscillating jaw having its crushing face divided into upper and lower sections and including at least one member which carries one of said jaw sections, a pivotal mounting for said member carried by said oscillating jaw means carried by said oscillating jaw and cooperating with said member for moving said member to alter the delivery opening from the crushing space defined on one side by said movable member, and means carried by said cyclically movable jaw and disposed substantially at the junction of the upper and lower jaw sections of said oscillatable jaw for removing fines from the material crushed between the upper sections of said jaw faces before delivery of the partly crushed material to the crushing space defined by the lower sections of said jaw faces.

14. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw cyclically to move the crushing face thereof in a closed curved path, and means for oscillating said second jaw, said oscillating jaw having its crushing face divided into upper and lower sections and having at least one of its upper and lower sections subdivided into a plurality of side by side jaw faces, members mounted on said oscillatable jaw and respectively carrying said last-named jaw faces, pivotal mountings for said members carried by said oscillating jaw, means carried by said oscillating jaw and cooperating with said members for separately and independently moving said members to relatively adjust the delivery openings associated with said last-named jaw faces, and means carried by said cyclically movable jaw and disposed substantially at the junction of the upper and lower jaw sections of said oscillatable jaw for removing fines from the material crushed between the upper sections of said jaw faces before delivery of the partly crushed material to the crushing space defined by the lower sections of said jaw faces.

15. In a crusher, in combination with a supporting frame, cooperating first and second crusher jaws having opposed crushing faces positioned to provide a path for the flow of material therebetween, means for driving said first jaw cyclically to move the crushing face thereof in a closed curved path, and means for oscillating said second jaw, said oscillating jaw having its crushing face divided into upper and lower sections, said oscillatable jaw having the jaw face of its upper and lower sections each subdivided into a plurality of jaw portions, a plurality of side by side members mounted on said oscillatable jaw and respectively carrying the different portions of said jaw face, means mounted on said oscillating jaw and cooperating with said members for separately and independently adjusting said members with respect to each other to vary the delivery openings from different portions of the crushing space, and means carried by said cyclically movable jaw and disposed substantially at the junction of the upper and lower jaw sections of said oscillatable jaw for removing fines from the material crushed between the upper sections of said jaw faces before delivery of the partly crushed material to the crushing space defined by the lower sections of said jaw faces.

AMOS R. EBERSOL.

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The following references are of record in the file of this patent:

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