Aug. 10, 1943. O. C. GRUENDER 2,326,215

JAW CRUSHER

Filed Dec. 12, 1938 4 Sheets-Sheet 1

Fig. 1

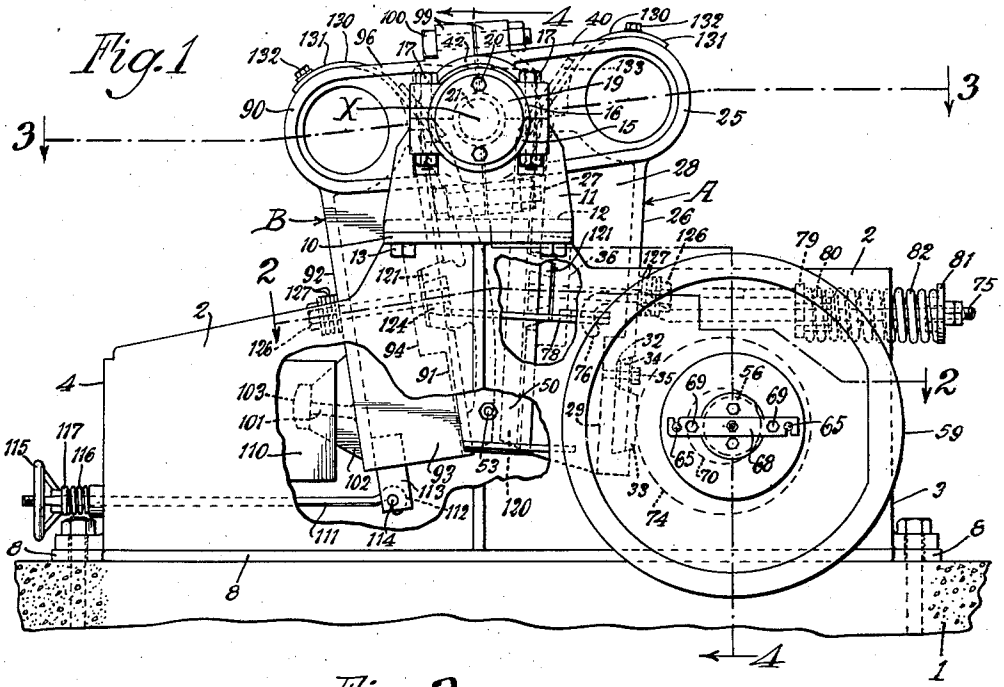
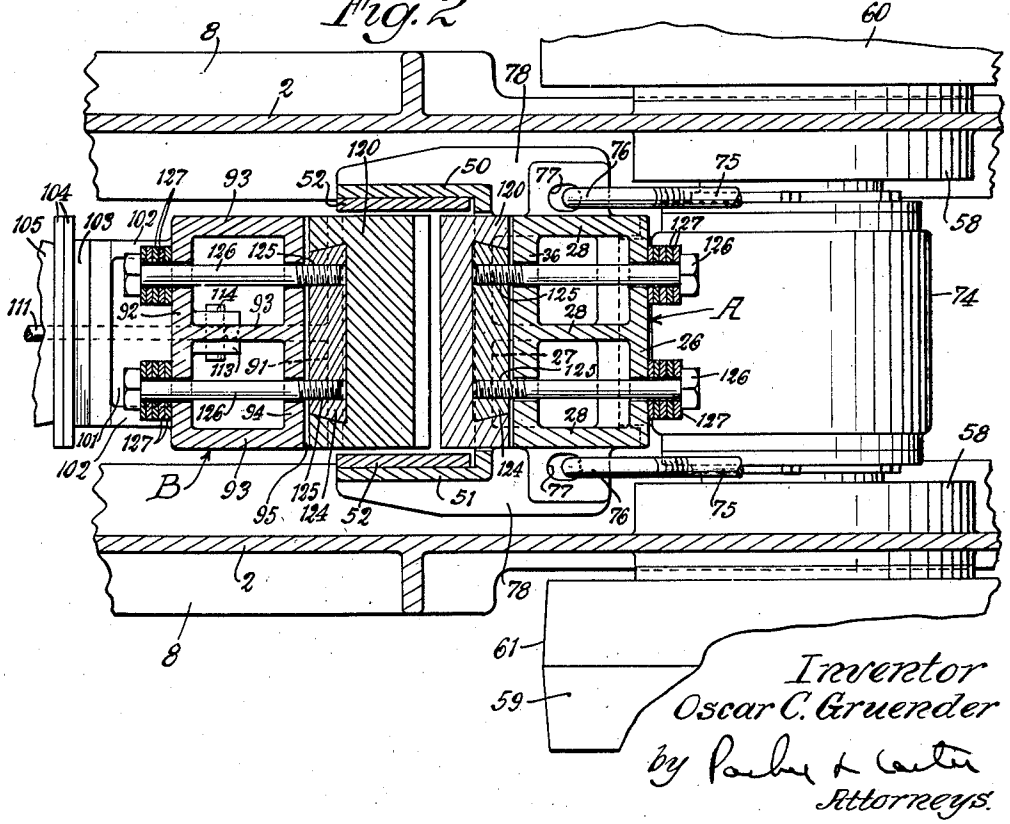


Fig. 2



Inventor
Oscar C. Gruender
by Parker & Carter
Attorneys.

Aug. 10, 1943. O. C. GRUENDER 2,326,215

JAW CRUSHER

Filed Dec. 12, 1938 4 Sheets-Sheet 2

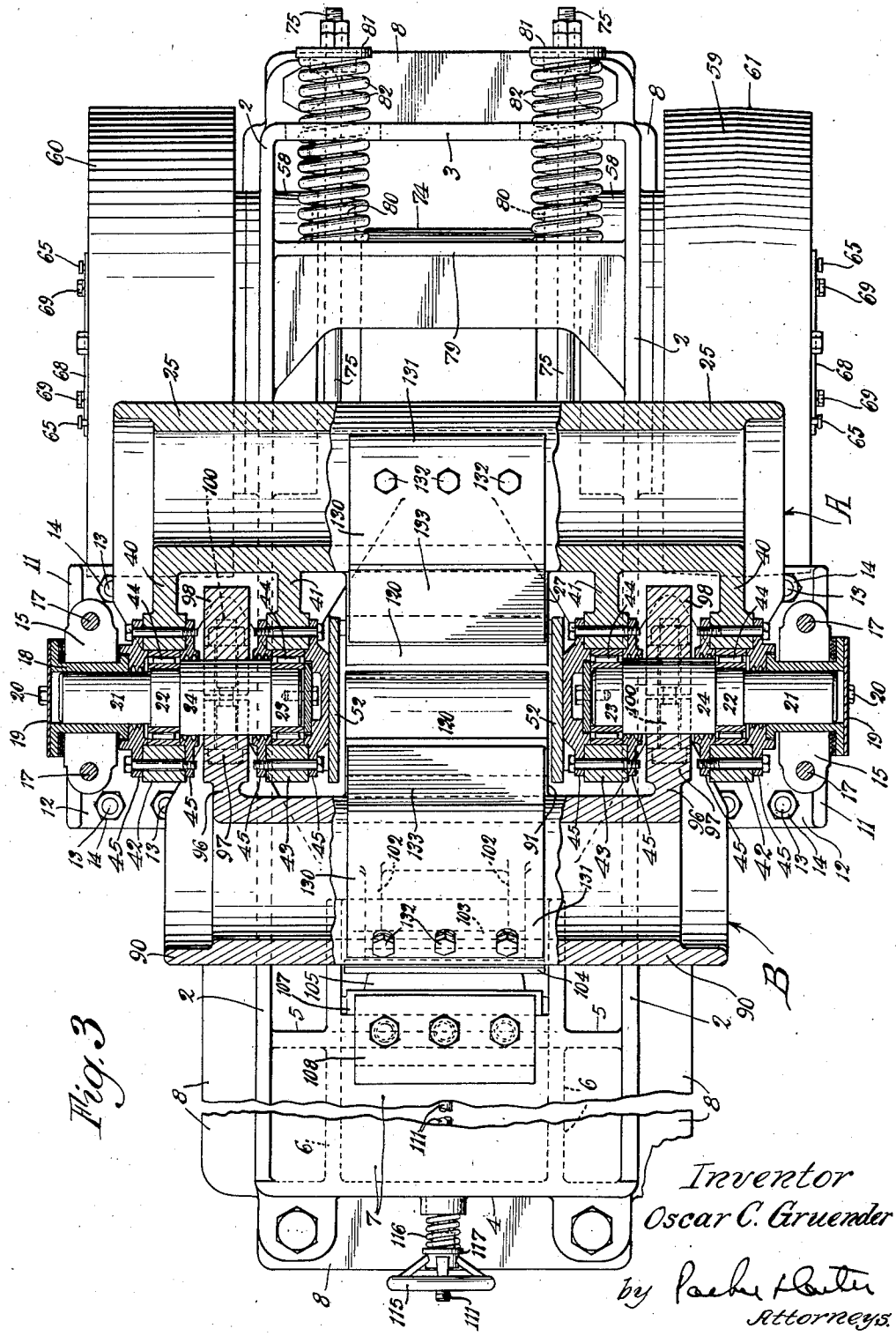


Fig. 3

Inventor
Oscar C. Gruender
by Parker & Carter
Attorneys.

Aug. 10, 1943. O. C. GRUENDER 2,326,215

JAW CRUSHER

Filed Dec. 12, 1938 4 Sheets-Sheet 3

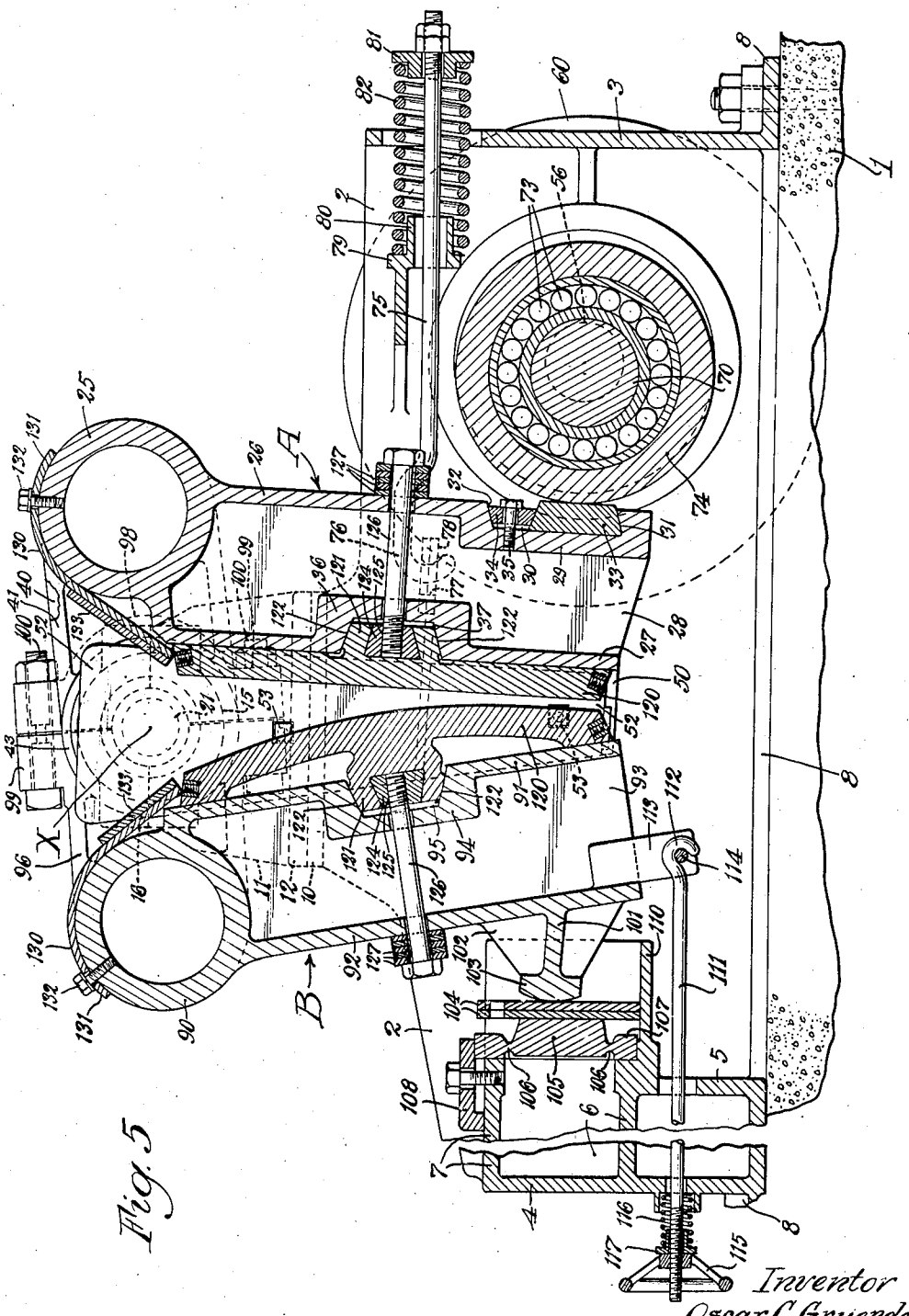


Fig. 5

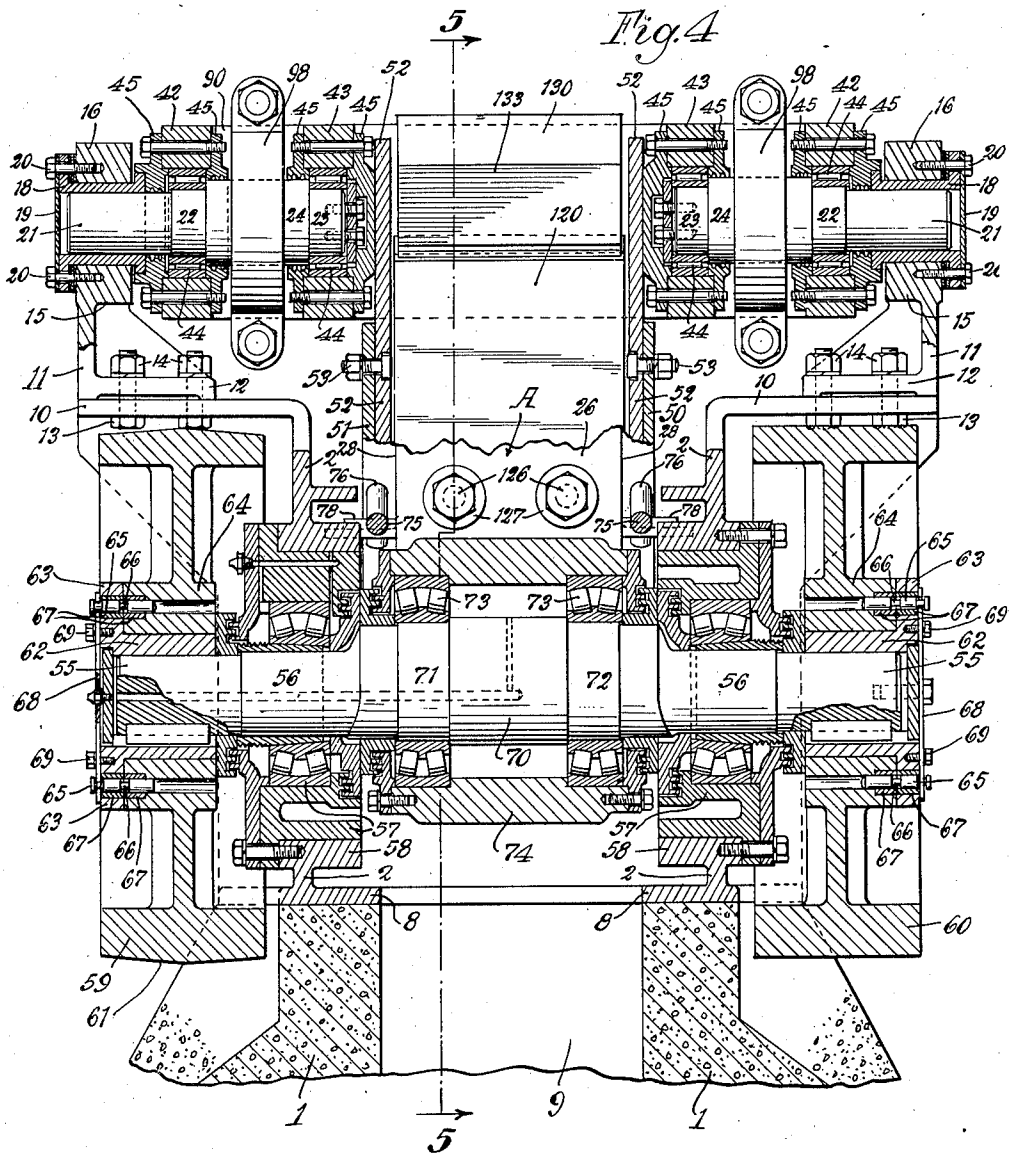
Inventor
Oscar C. Gruender
by Parker & Carter
Attorneys

Aug. 10, 1943. O. C. GRUENDER 2,326,215

JAW CRUSHER

Filed Dec. 12, 1938 4 Sheets-Sheet 4

Fig. 4



Inventor
Oscar C. Gruender
by Parker & Carter
Attorneys.

Patented Aug. 10, 1943

2,326,215

UNITED STATES PATENT OFFICE

2,326,215

JAW CRUSHER

Oscar C. Gruender, Milwaukee, Wis., assignor to Nordberg Manufacturing Company, Milwaukee, Wis., a corporation of Wisconsin

Application December 12, 1938, Serial No. 245,161

7 Claims. (Cl. 83—53)

My invention relates to an improvement in jaw crushers and has for one purpose the provision of a crusher which shall be cheap to manufacture and efficient in operation.

Another purpose is the provision of improved releasing means for permitting the jaws to separate in response to a predetermined excess crushing strain.

Another purpose is the provision of improved means for mounting the crushing jaws.

Another purpose is the provision of an improved movement of the crushing jaws.

Another purpose is the provision of improved actuating means for the moving jaw of a jaw crusher.

Another purpose is the provision of an improved adjusting means for adjusting the crushing cavity.

Other objects will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a side elevation;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a vertical section on the line 4—4 of Fig. 1, with the shaft in a different position; and

Fig. 5 is a section on the line 5—5 of Fig. 4.

Like parts are indicated by like characters throughout the specification and drawings.

Referring to the drawings, 1 generally indicates any suitable base or foundation upon which are mounted horizontally extending frame members 2, 2. 3 indicates an end wall connecting the members 2, 2. At the opposite end there is a species of box, including an end wall 4 and webs 5 and 6, with a top wall 7. 8 indicates any suitable bottom flanges for engaging with and securing to the foundation. 9 indicates an aperture or cavity in the foundation structure to permit the downward discharge of the crushed material.

In an upper portion of each side wall or frame member 2 there is an outwardly extending shelf 10 upon which are brackets 11 having portions 12 opposed to the upper faces of the shelves 10 and secured thereto by any suitable securing means, such as the bolts 13 with their nuts 14. In the upper portion of each bracket is a split sleeve including a bottom portion 15 and a top portion 16 secured together, for example by bolts 17. 18 indicates a sleeve mounted between the members 15 and 16, the outer aperture being closed for example by the plate 19 secured by the screws 20. 21 indicates a stub shaft mounted within each sleeve 18 and normally not rotating. Each shaft 21 has two bearing portions proper 22, 23 and an intermediate enlarged portion 24.

The function of the shafts 21 is to serve as a pivot for the rotary oscillation of the below-described moving crushing jaw, generally indicated as A. They also define the axis of rotation of a normally fixed jaw structure, generally indicated as B, when, in response to a predetermined excess crushing stress, said normally fixed jaw recedes from the moving jaw through a small arc of movement.

The moving jaw structure A includes a top tubular strut 25 from which downwardly extends a rear web 26 and a front web 27, the two being connected by intermediate reinforcing webs 28 to make a powerful box-like reinforced structure. The web 26 is inwardly extended as at 29 to provide room for the recess generally indicated as 30 and having inclined walls 31, 32. 33 is a contact insert of wear-resisting metal which is clamped in position, for example by the clamping wedge 34 and the screw 35. It will be understood that a plurality of such screws may be employed and that preferably the insert 33 extends across substantially the entire width of the jaw. The other web 27 is also inwardly enlarged as at 36 to give space for the inclined wall clamping aperture or recess 37, the purpose of which will later appear.

In order to mount the movable jaw structure A upon the shaft 21, I provide pairs of webs 40, 41 adjacent each end of the tubular strut 25. Such webs terminate in bearing sleeves 42, 43 surrounding the shaft portions 22, 23, respectively. Any suitable bearings such as roller or needle bearings 44 may be interposed between the shafts 21, and retaining rings or dust sealing members 45 may be employed. The movable jaw structure also includes side flanges 50, 51 which extend outwardly along each side of the crushing cavity and are adapted to receive removable wear plates 52 which may be secured for example by bolts 53.

In order to actuate the moving jaw I provide a shaft generally indicated as 55 which includes portions 56 mounted in any suitable bearing structures 57 positioned within sleeve enlargements 58 formed in the side frame members 2. The details of the bearing structure do not of themselves form part of the present invention. The shaft 55 may be rotated in any suitable manner but I illustrate for example a pair of fly wheels 59, 60, one of which may be beveled as at 61 in order to serve as a driven

member for any suitable belt, not herein shown, whereby power may be applied for the rotation.

In order to provide against breakage due to the passage of uncrushable material through the crushing zone, I may provide a releasing connection between the fly wheels 59 and 60 and the shaft 55. I illustrate for example a sleeve 62 keyed to the shaft 55. This sleeve has an outer flange 63 in alinement with the hub 64 which surrounds a cylindrical portion of the sleeve 62. As a connection between the members 63 and 64 I provide pins 65 having reduced or weakened portions 66 whereby, in response to a predetermined excess crushing pressure, the pins 65 may shear and break the driving connection between the shaft 55 and the fly wheels 59 or 60. Hardened sleeves 67 may be employed in connection therewith, to prevent damage to the adjacent parts. 68 is any suitable retaining member or plate secured for example by screws 69 to the flange 63.

70 indicates an eccentric portion intermediate the ends of the shaft 55 having associated therewith eccentric bearing portions 71, 72. Surrounding the portions 71, 72 are any suitable bearing structures 73, and 74 is a surrounding ring or roller structure adapted for engagement with the contact surface of the above described hard metal insert 33 located in the rear or outer web 26 of the moving jaw structure A.

In order to maintain a bearing contact between the members 33 and 74, I may provide any suitable means for drawing the movable jaw A outwardly against the member 74. I illustrate for example two rods 75 having hook ends 76 engaging eyes 77 in webs 78, which form part of the jaw structure. 79 are abutment members extending between the side members 2 and provided with sleeves 80 through which the rods 75 pass. 81 are adjustably mounted abutments at the outer ends of the rods, and springs 82, heavy enough to overcome the weight and inertia of the movable jaw, surround the rods 75 and are compressed between the abutment members 79 and 81 whereby the moving jaw structure A is yieldably drawn and held against the roller 74 and chattering is prevented.

It will be understood that in response to rotation of the shaft 55 the ring 74 is gyrated and, as it contacts the member 33, it causes a movement of the jaw A about its pivot X toward and away from the opposed fixed jaw structure B.

Referring to the fixed jaw structure B, it has a top tubular strut 90 corresponding to the strut 25 of the moving jaw. It will be observed that this strut is somewhat shorter than the strut 25. An inner web 91 extends downwardly therefrom at one side and a rear or outer web 92 at the other. The two webs and the strut 90 are tied into an integrally formed reinforced box-like structure by the intermediate webs 93. In the web 91 there is an enlargement 94, having a locking recess 95 corresponding to the recess 37 of the opposite jaw. A single web 96 extends from each end of the strut 90, each terminating in a split clamping portion 97 to which is secured the opposite split clamping portion 98, the two being connected for example by ears 99 and bolts 100. These bolts are preferably breaker bolts, and I illustrate them, as in Fig. 3, with a reduced central portion. Thus the moving jaw structure B is secured to the two shafts 21, the shafts and the fixed jaw structure being normally held against movement but being permitted to rotate through a slight arc in the event the release mechanism below described is required to operate.

Extending from the rear face of the web 92 is a web 101 with reinforcing webs 102. This structure supports an arcuate surfaced transversely extending abutment member 103, which may be opposed to plates 104 engaging the shearing plug 105. It will be observed that the plug 105 is connected by a reduced portion 106 with side plate members 107. 108 is any suitable locking bracket for holding the assembly 105, 106, 107 in position.

It will be understood that in response to a predetermined excess crushing thrust the member 105 may be sheared off and may then drop back into the space between the webs 6 and 7, relieving the excess crushing pressure and preventing breakage of the parts. The plates 104 serve as spacing members for adjusting the opening of the crushing cavity. It will be understood that they may be dropped into any suitable box structure generally indicated as 110.

111 is a tension rod having a hook at its inner end as at 112 to engage a downward extension 113 from the normally fixed jaw structure B. 114 indicates a pin on such extension 113 which is actually received by the hook 112. 115 is any suitable adjusting member for adjusting the compression of the spring 116 which is compressed between the abutment 117 on the rod 111 and the outer face of the end member 4. It will be understood that the normally fixed jaw structure B is thus normally held in the position in which it is shown in Fig. 5.

I apply removable jaw wear plates to each of the jaw members, these plates being removed as they are worn down. They are preferably reversible in that if one edge wears off faster than the other, they may be removed and turned upside down. Referring for example to the plate on the movable jaw, I illustrate a plate body 120 having a rearward extension or expansion 121 having inclined faces 122 opposed to the inclined faces of the depression 37 in the enlargement 36 of the web 27. As will be clear from Fig. 5, the parts are so proportioned that when the member 121 penetrates the depression 37, the opposed inclined faces abut while leaving a clearance between the inner end of the member 121 and the opposed bottom of the depression 37.

124 is an insert of a different material which is provided with securing apertures 125 for receiving the ends of the screws 126 whereby, in response to rotation of the screws 126, the plate 120 can be drawn snugly into position. 127 are any suitable adjusting or compression shims or washers. I find it advantageous under some circumstances to employ fiber washers.

It will be observed that one of the members 120 is flat and the other is arched, but it will be understood that any suitable form or contour may be employed.

In order to protect the struts 25 and 90 and to direct the material undergoing crushing into the crushing cavity defined by the two plates 120, I provide wear-taking and deflector plates 130 which include arcuate portions 131 conforming respectively to the tubular struts 25 and 90. These arcuate portions receive any suitable securing members or screws 132. 133

indicates reinforcing or outer plates welded or otherwise secured to the members 130 in order to take wear at the areas of maximum wear. It will be observed that the members 130 with the reinforcements 133 extend outwardly over the upper edges of the plates 120.

It will be realized that whereas I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and my drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

The use and operation of my invention are as follows:

I provide a single acting jaw structure in which two jaws are employed, one, the jaw A, being adapted for rotary oscillation about the center X, and the other, the jaw B, being normally held against movement but being adapted for a limited rotary excursion about the same center X, in response to an excess crushing stress.

Referring for example to Fig. 3, it will be observed that I employ two stub shafts generally indicated as 21 which are mounted one at each side of the frame. Rotatable about each such shaft are the extensions 42, 43 arranged in pairs at each side of the moving jaw A. In the space between each such pair is the extension 96, 97, 98 between the normally fixed jaw and the shaft 21. There is thus a balanced thrust with no tendency to tilt the axis of either shaft 21.

By posiitoning the axis X of the shafts 21 in vertical alinement with the crushing cavity, and adjacent the top of the crushing cavity, I am able to obtain a highly advantageous crushing movement of the jaw A. There is a minimum tendency, for example, to nip or pinch rounded rocks or boulders in such fashion as to cause them to shoot upwardly out of the crushing cavity. The actual movement of the jaw in the crushing direction is slightly downwardly as well as inwardly, with a minimum excursion, of course, at the top of the crushing cavity. This slight downward movement of the jaw prevents any tendency to throw the material upwardly out of the crushing cavity and results in a highly efficient crushing action, as the crushing excursion increases in amplitude from top to bottom of the crushing zone.

The ring 74 rolls against a hardened insert 33 which is removable for replacement or repair. The jaw A is yieldingly held at all times with the parts 33 and 74 in effective contact, by the employment of the springs 82.

The jaw B is normally in the position in which it is shown in Fig. 5. I find it desirable, however, to provide a release mechanism for permitting the jaw B to recede in response to an excess crushing pressure. A convenient arrangement is the employment in connection with a box formed by the members 4, 6 and 7 of a shear plate 105 weakened as at 106 and opposed to an extension 103 from the rear of the jaw B. When a predetermined crushing stress is exceeded, plate 105 shears along the weakened lines 106 and the jaw B is allowed to move rearwardly a distance sufficient to prevent breakage. The plate is normally urged rearwardly by the spring 116, the compression on such spring being adjustable. The position of the jaw may be adjusted by the employment of shims or adjusting plates 104. An additional safety factor is provided by the breaker bolts 100, which are designed to break in response to a predetermined excess pressure within the crushing cavity.

As a further release means I employ the shear plugs or shear members 65 interposed between the shaft 55 and the fly wheels or drive pulleys 59 and 60. It will be understood, of course, that either one of the pulleys 59 or 60 may be employed as a drive pulley and that they are of sufficient mass to have a fly wheel effect. In any event, the shearing connection assists in the stoppage of the device in the event uncrushable material passes into the crushing cavity.

It will be observed, as in Fig. 2, that the crushing zone is defined by the opposed plates 120, the side being closed by removable wear plates 52. Any suitable feeding means may be employed to deliver material to the crushing cavity and this feed is unrestricted by the pivotal means for mounting the jaw since, as is clear from Fig. 4, the shafts 21 are located entirely out of vertical alinement with the crushing cavity.

I claim:

1. Pressure release means for rock crusher jaws and the like including a box member open toward the direction from which the pressure is applied, a renewable break plate removably mounted on the box member, engaging the walls thereof in a plane normal to the line of pressure, the plate being weakened adjacent the inner boundaries of the engaging surfaces, a foot extending from the jaw toward and engaging the plate in that portion of its area in line with the open portion of the box and out of line with the weakened portion of the plate, an adjusting plate interposed between the foot and the break plate and adapted to transmit pressure from one to the other.

2. Pressure release means for rock crusher jaws and the like including a box member open toward the direction from which the pressure is applied, a renewable break plate removably mounted on the box member, engaging the walls thereof in a plane normal to the line of pressure, the plate being weakened adjacent the inner boundaries of the engaging surfaces, the plate being centrally thickened in line with the open portion of the box, the thickened portion being bounded by the weakened portion, a foot extending from the jaw toward the plate and adapted to engage the thickened portion of the plate, an adjusting plate interposed between the foot and the break plate and adapted to transmit pressure from one to the other.

3. Pressure release means for rock crusher jaws and the like including a box member open toward the direction from which the pressure is applied, a renewable break plate removably mounted on the box member, engaging the walls thereof in a plane normal to the line of pressure, the plate being weakened adjacent the inner boundaries of the engaging surfaces, a foot extending from the jaw toward and engaging the plate in that portion of its area in line with the open portion of the box and out of line with the weakened portion of the plate, an adjusting plate interposed between the foot and the break plate and adapted to transmit pressure from one to the other, means independent of the break plate and the foot for maintaining the adjusting plate in position.

4. Pressure release means for rock crusher jaws and the like including a box member open toward

the direction from which the pressure is applied, a renewable break plate removably mounted on the box member, engaging the walls thereof in a plane normal to the line of pressure, the plate being weakened adjacent the inner boundaries of the engaging surfaces, the plate being centrally thickened in line with the open portion of the box, the thickened portion being bounded by the weakened portion, a foot extending from the jaw toward the plate and adapted to engage the thickened portion of the plate, an adjusting plate interposed between the foot and the break plate and adapted to transmit pressure from one to the other, means independent of the break plate and the foot for maintaining the adjusting plate in position.

5. In a jaw crusher, a frame, opposed jaws mounted on said frame, one being normally fixed in relation thereto, the other being normally movable, means for imparting a crushing oscillation to said normally movable jaw, and means for supporting said jaws on said frame, including a pair of stub shafts located coaxially at opposite sides of the top of the crushing cavity defined between said jaws, and a rupturable connection between one of said jaws and said stub shaft adapted to permit a recession of said jaw in response to a predetermined excess crushing pressure within the crushing cavity.

6. In a jaw crusher, a frame, opposed jaws mounted on said frame, one being normally fixed in relation thereto, the other being normally movable, means for imparting a crushing oscillation to said normally movable jaw, and means for supporting said jaws on said frame, including a pair of stub shafts located coaxially at opposite sides of the top of the crushing cavity defined between said jaws, and a rupturable connection between one of said jaws and said stub shaft adapted to permit a recession of said jaw in response to a predetermined excess crushing pressure within the crushing cavity, said rupturable connection including split eyes and breaker bolts connecting the opposite parts of said split eyes.

7. In a jaw crusher, a frame, opposed jaws mounted on said frame, one being normally fixed in relation thereto, the other being normally movable, means for moving the normally movable jaw toward and away from the normally fixed jaw, means for defining the axis of movement of said movable jaw and for supporting said fixed jaw, including a shaft, an eye on one of said jaws surrounding said shaft and having a breaker element adapted to rupture in response to a predetermined excess crushing stress and to permit the jaw to recede from said shaft.

OSCAR C. GRUENDER.