March 7, 1950 D. H. YOUNG 2,500,109

TOGGLE MEANS FOR JAW CRUSHERS

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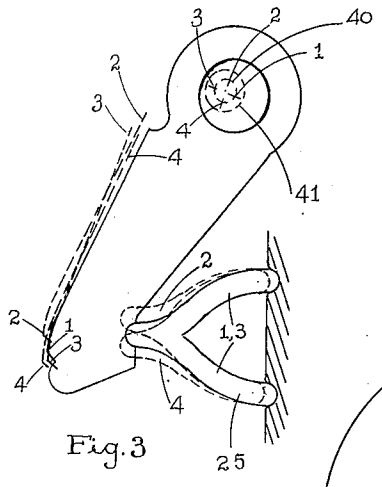


Fig. 3

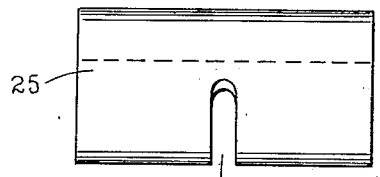


Fig. 2

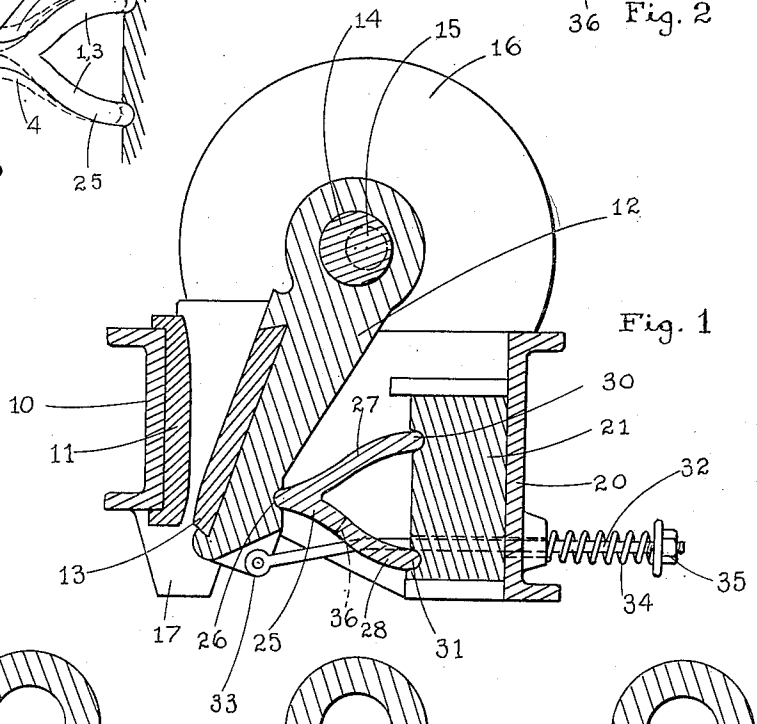


Fig. 1

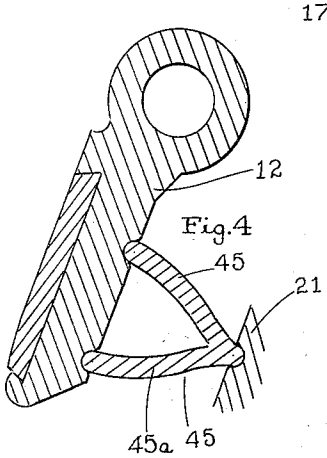


Fig. 4

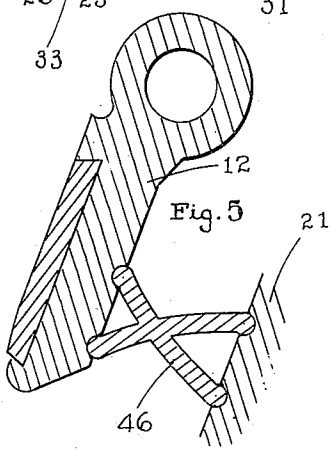


Fig. 5

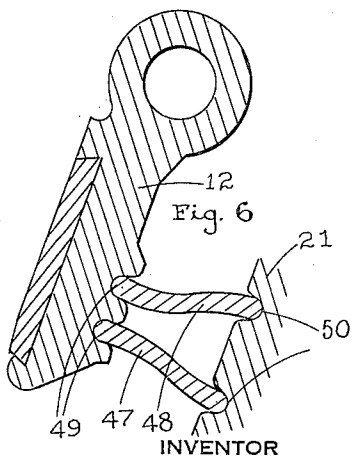


Fig. 6

Witness

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TOGGLE MEANS FOR JAW CRUSHERS

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3 Claims. (Cl. 241—217)

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This invention is concerned with improvements in jaw crushers employed for breaking stone, ore or similar materials. A heretofore common form of machine for such purposes, such as is illustrated in general by the United States Patent to Mitchell No. 947,667 of January 25, 1910, embodies a pair of opposed jaws inclined relative to each other in the form of a chute, one of the jaws being movable and supported and operated by an eccentric adjacent to the upper end and a toggle plate adjacent the lower end. Rotation of the eccentric produces a compound motion including successive crushing impulses at the upper and lower portions of the movable jaw, the number of impulses at the bottom being equal to the number of impulses at the top.

This action in the prior devices results in breaking a greater weight of material near the upper ends of the jaws than can be further broken into the smaller pieces near the lower ends in the same period. This results further in the retention of material above the lower ends of the jaws which is too large to pass when the jaws open, which in turn retards and prevents the suitably smaller material thereabove from being discharged. As a consequence, the output of the crusher is limited by the amount of material which can be broken near and discharged between the lower ends of the jaws. Also, material of a size suitable to be discharged but which is retained by the interference of larger material will be subjected to further breaking or attrition, producing an unwanted quantity of fine material and dust. Considerable work is expended, therefore, in producing a quantity of non-useful material.

The present invention serves to remedy these undesirable characteristics by a simple inexpensive arrangement capable of delivering a greater number of crushing impulses at the lower end than are delivered at the upper end of the same jaw means in the same period. Specifically, the invention provides an improved form of toggle having a plurality of pivotal bearings with corresponding effective lever arms which, in the rocking motion of the toggle, alternately come into play, each imparting a forward impulse to the movable jaw during each cycle. The net effect is a plurality of intermittent impulses at the lower end of the jaws for each impulse at the upper end. As a result, the lower end has a capacity for handling the material and performing useful work comparable to that at the upper end, and clogging is eliminated or substantially reduced. The machine as a whole is

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capable of delivering a greater amount of the desired size of broken material and with a reduced proportion of unwanted fines and dust.

The invention accordingly comprises the features of construction, combination of elements and an arrangement of toggle means which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a cross-sectional view through a jaw crusher embodying the features of the invention;

Fig. 2 is a bottom plan view of the particular toggle means employed in Fig. 1;

Fig. 3 is a diagrammatic view showing the successive positions of the movable jaw in a complete cycle;

Fig. 4 is a fragmentary cross-sectional view similar to that of Fig. 1 but showing the toggle of Fig. 1 reversed as to position;

Fig. 5 is a view similar to Fig. 4 but showing a modified form of toggle means; and

Fig. 6 is a view likewise similar to Fig. 4 but showing a still different type of toggle means.

Only so much of the machine is shown in Fig. 1 as is necessary for an understanding of the principles of the invention, the machine in general being of a common well known type such as disclosed by the above-noted patent, No. 947,667. It may be briefly explained here, however, that the machines of such character embody a stationary jaw and a movable jaw inclined with respect to the stationary jaw so as to form a chute, with the space between the jaws gradually decreasing toward the bottom. The upper end of the jaw is mounted on a power driven crank, the lower part of the movable jaw being held against a rockable toggle plate.

The cross-sectional view of Fig. 1 shows, in general, such a type of machine and accordingly includes a stationary jaw **10**, which may be provided with a hardened wear plate **11**, and a movable jaw **12**, which likewise may be provided with a hardened wear plate **13**. Either one or both of the two plates may be provided with corrugations or surface configurations in accordance with conventional practice. The upper end of the movable jaw **12** is supported on and operated from a crank means in the form of an eccentric **14** secured on or integral with the rotary drive shaft **15**, the drive shaft being provided

with one or more flywheels 16 and rotated by any suitable source of power. It will be understood that the jaws and the eccentric have a substantial length in the direction of the axis of shaft 15 which may vary dependent upon the desired capacity of the machine. Suitable end plate means are provided, one of which is shown at 17 in Fig. 1, to define a chute substantially closed on four sides. The coarse material to be broken is fed into the top of the chute and progresses downwardly and out the slit at the bottom. The machine includes a back supporting frame part 20 and a reinforcing support plate 21.

As thus far described, the machine is substantially conventional. In accordance with the present invention, however, the machine here illustrated embodies means for imparting a greater number of crushing impulses to the lower portion of the movable jaw 12 than are imparted at the top portion in the same period of time. In the specific form shown in Fig. 1, this comprises a toggle plate means 25 having a forward bearing nose 26, the rear portion being bifurcated to form an upper leg 27 and a lower leg 28, each provided with a bearing nose adapted to be received respectively in the recesses 30 and 31 of the supporting plate 21. The movable jaw 12 is constantly urged into engagement with the toggle plate 25 and it, in turn, against the supporting plate 21 by means of the link 32 pivoted at 33 to the movable jaw and extending back through an opening in the rear wall, being provided exteriorly thereof with a compression spring 34, the force of which may be adjusted by a suitable nut means 35. As shown, one such compression means is employed and it correspondingly occupies a position intermediate of the ends of the toggle plate 25 and, as shown particularly in Fig. 2, a slot 36 is provided to receive the rod 32. As Fig. 2 also shows, the toggle plate has considerable length in the direction of the axis of shaft 15 of the machine, which may be varied but, for purposes of strength and balance, its length preferably aproaches at least the width of the jaw 12. Each of the legs 27 and 28 preferably has a curved configuration in cross-section whereby it may further deflect and break upon excessive compression forces and thereby act as a safety factor. It is to be understood that the complete machine may embody other details of construction and refinements the details of which need not be illustrated here, as, for example, the rear toggle supporting means may be adjustable to vary the opening at the bottom of the chute and accordingly the size of the pieces of the delivered material.

As diagrammatically shown in Fig. 3, the rotation of the eccentric produces a back and forth motion of the movable jaw at the top and also an up and down motion of the jaw which, in turn, causes the nose 26 of the toggle plate 25 to move up and down, rocking the toggle plate as a whole, so that first one leg and then the other thereof becomes the controlling element. In the upward movement the leg 27 assumes a more nearly horizontal position, forcing the jaw to the left, the leg 28 partially withdrawing from its recess in the supporting plate 21, and in the downward movement the toggle is restored to the position shown, which is the furthest retracted position for the jaw 12, and continued downward movement (that is, counter-clockwise rotation of the toggle) causes the leg 27 to withdraw partially from its recess and leg 28 becomes the controlling support, again forcing the jaw outwardly to the left. During a single revolution of shaft 15, the upper portion of jaw 12 has received one crushing impulse, the extreme forward position being shown, approximately at least, in Fig. 1. The lower portion of jaw 12 has received, however, two crushing impulses.

Referring to the details of Fig. 3, the eccentric is there shown in an initial full line position approximately 180° from that in Fig. 1. The path of the center of the crank pin or eccentric is indicated by the smaller or innermost broken line circle 40, and the supporting shaft by the broken line circle 41. The initial full line position is indicated at the respective points on the crank pin circle, at the upper and lower portions of the jaw and at the toggle by the numeral 1. In this position the toggle plate 25 is fully seated on both legs and the top and bottom portions of the jaw are both in their fully retracted positions. Assuming the crank is rotating in a counter-clockwise direction, at the end of 90° the respective parts will be in the dotted line positions indicated by the numeral 2, in which the top portion of the jaw has been advanced to an intermediate forward position and the bottom portion to a fully advanced position. Continuing the rotation for another 90° to the positions indicated by the numeral 3, the top portion of the jaw has been further advanced to its extreme forward position and the bottom portion to its fully retracted position. Upon a still further rotation of 90° to the position indicated by the numeral 4, the top portion of the jaw will be moved back to an intermediate position and the bottom portion to an again fully advanced position. A further rotation of 90° brings the parts back to the initial position 1, as shown in full lines. It will be seen, therefore, that in one complete cycle or rotation of the shaft 15 the top portion of the jaw will have received one forward crushing impulse and the lower portion of the jaw two forward crushing impulses.

To produce the desired operation, the bearing points of the toggle plate seated in the recesses 30 and 31 should be spaced apart by a considerable distance, and their angular positions about bearing point 26 with respect to the jaw 12 should be such that, for example, upon an upward swing from the position shown in Fig. 1 as determined by the eccentric 14 the lower portion of the jaw 12 will be forced out the requisite distance, as distinguished from an arrangement in which the jaw would be caused to move in a path which was practically tangential to an arc having a radius corresponding to leg 27 of the toggle plate. This is also true as to the downward movement on leg 28 of the toggle plate. Also, the two positions of maximum advance to the left should preferably be approximately the same. Similar results can be obtained by employing a toggle plate means having legs of different length provided the angular positions for each and the location of the supports for the respective rear supports are properly chosen.

Various other arrangements of toggle plate means may be employed to achieve the result of producing a greater number of impulses at the bottom than at the top in a given cycle or period of time, and the ratio may be varied from that of 2:1 provided by the particular means shown in Figs. 1 to 3. Fig. 4 shows a toggle plate 45 similar to that of Fig. 1 but with the plate reversed as to position, so that the bifurcated ends engage with the movable jaw 12 instead of with the supporting plate 21. It will be un-

derstood, of course, that the bifurcated or V-shape employed in these two figures may comprise, instead, a substantially triangular shape, and the legs 45*a* and 45*b* may be different as to length to suit the particular position occupied.

A similar result to that above described may be obtained by employing a toggle plate means which is rectangular in cross-section or in the shape of an X, as shown at 46 in Fig. 5. Fig. 6 shows a still further illustrative variation, in which the toggle plate means is composed of two separate plate sections 47 and 48. In this case the recesses 49 and 50 for each side or edge surface of the toggle plate elements should be of sufficient depth to insure that either plate section does not slip out of place when in the rotation of the eccentric one section becomes effective and the other is freed.

It is to be understood that the drawings and the above description are illustrative of the principles of the invention, and that certain changes may be made in the construction and different embodiments of the invention could be made within such principles, and it is intended accordingly that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a jaw crusher, a pair of opposed jaws one of which is movable, said jaws on their opposed front sides being spaced apart and downwardly inclined with respect to each other to form a chute with the space therebetween decreasing in width toward the bottom thereof, crank means operative on the upper portion of said movable jaw about a substantially horizontal axis to cause that jaw to be swung periodically back away and forth toward the other jaw, a toggle means extending substantially parallel to the axis of said crank means and having only a single bearing means on one side thereof extending longitudinally thereof and engaging the back side of and supporting the lower portion of said movable jaw, and a relatively fixed supporting member located rearwardly of and adapted to support said toggle means, said toggle means being provided at the rear side with a plurality of longitudinally extending bearing means laterally spaced a substantial distance from each other and proportioned and arranged with respect to the throw of said crank means and said single bearing means to effect alternate engagement of said supporting member by said spaced bearing means and thereby to impart a plurality of crushing impulses to the lower portion of the movable jaw for each crushing impulse at the upper portion thereof.

2. In a jaw crusher, a pair of opposed jaws one of which is movable, said jaws on their opposed front sides being spaced apart and downwardly inclined with respect to each other to form a chute with the space therebetween decreasing in width toward the bottom thereof, a crank means rotatable about a substantially horizontal fixed axis pivotally supporting the upper portion of said movable jaw, a rigid toggle means extending across the back side of said movable jaw to support the lower portion of the latter and having only a single bearing means on the jaw-contacting side thereof arranged longitudinally substantially along a line substantially parallel to the crank axis and a pair of major longitudinally-extending bearing means on the opposite side thereof appreciably spaced apart in a direction substantially normal to the crank axis with each of the latter bearing means being arranged along a line substantially parallel to the crank axis, means on the back side of said movable jaw providing a bearing surface for the single toggle bearing means, a relatively fixed supporting member located rearwardly of and adapted to be engaged by and support said toggle means the parts being constructed and proportioned with relation to the throw of said crank means to effect alternate engagement of said supporting member by said spaced apart toggle bearing means as said toggle means is rocked with rotation of said crank means.

3. In a jaw crusher, a pair of opposed jaws one of which comprises a movable jaw member, said jaws at their opposed front sides being spaced apart and downwardly inclined with respect to each other to form a chute with the space therebetween decreasing in width toward the bottom thereof, crank means rotatable about a substantially horizontal fixed axis pivotally supporting the upper portion of said movable jaw member, a normally fixed supporting member located rearwardly of said movable jaw member, and an elongated toggle part extending generally parallel to the crank axis interposed between the lower portion of said movable jaw member and said supporting member and adapted to engage both said members, said toggle being substantially triangular in cross section to provide an apex comprising one bearing means adapted to engage one of said members, and having diverging legs to provide a pair of laterally spaced bearing means adapted to engage the other of said members, the legs being constructed and arranged with respect to each other and the associated said members and the throw of said crank means whereby rotation of said crank rocks said toggle and said legs are alternately effective to support and determine the position of the lower part of said movable jaw member and a plurality of crushing impulses are imparted to the lower portion thereof for each crushing impulse at the upper portion thereof.

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