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CRUSHER

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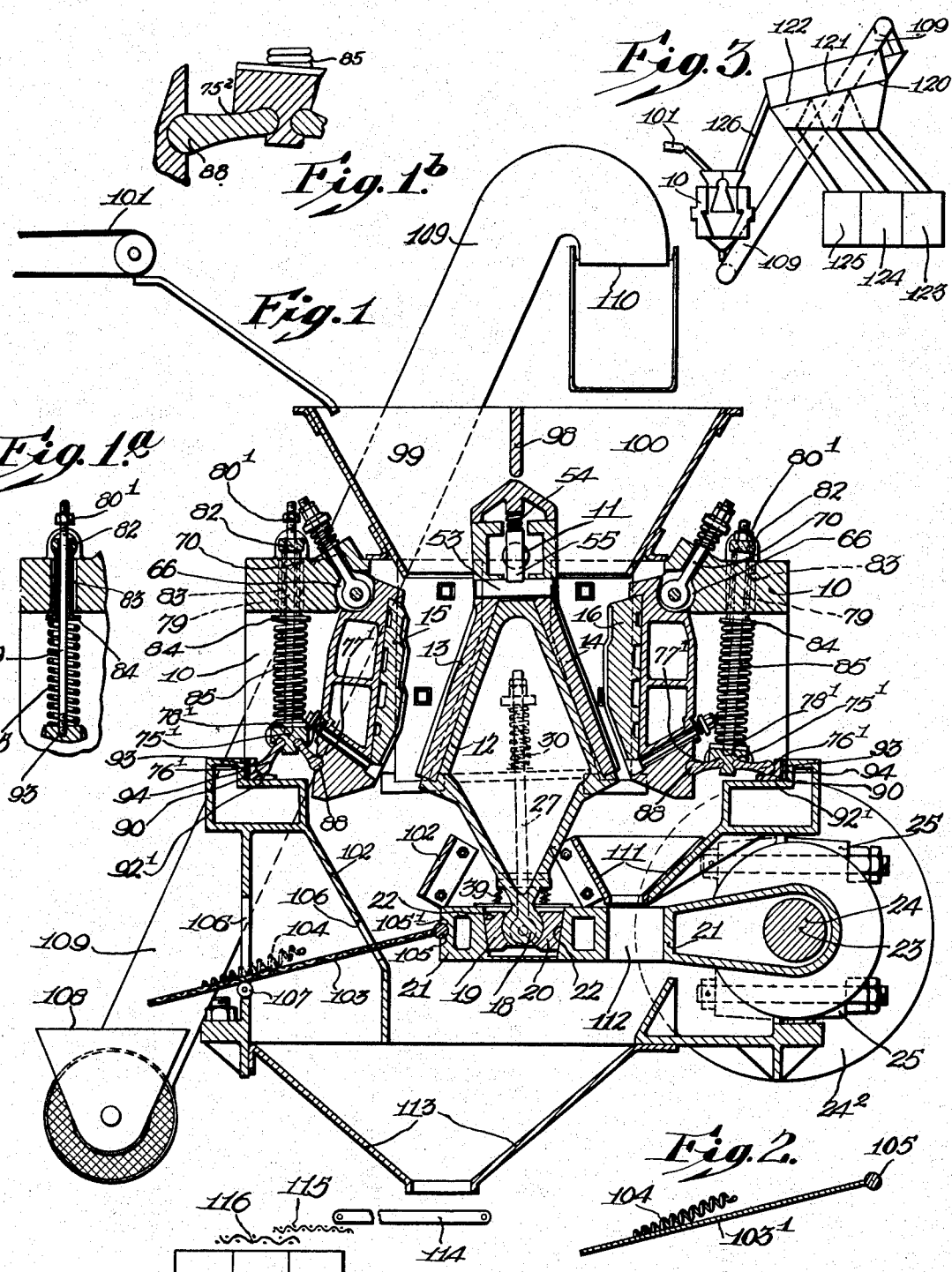


Fig. 1b

Fig. 3.

Fig. 1

Fig. 1a

Fig. 2.

Witnesses:
Elmer W. Hackett
Walter Thom.

Inventor
Edward T. Peterson
by Wm. Steell Jackson and Son
Attorneys.

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CRUSHER

Edward T. Peterson, Pennside, Reading, Pa., assignor to Birdsboro Steel Foundry and Machine Company, Birdsboro, Pa., a corporation of Pennsylvania

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1 Claim. (Cl. 83—53)

The present invention relates to the structure of, and method of using, double-acting stone crushers. These are the type of crusher in which a rocker operates between normally stationary anvils, crushing against one anvil while receding from the other and against the other anvil while receding from the first, each crushing stroke of one side being the retracting or feed stroke of the other and vice versa.

A purpose of the invention is to feed one side of a double-acting crusher with the more coarsely crushed rock from the other side thereof.

A further purpose is to feed the same rock as a continuing process through first one side and then the other side of a double-acting crusher.

A further purpose is to desirably reduce the proportion of fines and secure greater uniformity in the crushed product from a double-acting stone crusher by increasing and diminishing the respective spacings between the cooperating jaws on the different sides of the crusher, continuously feeding all of the uncrushed rock into the side having the greater spacing and a coarser portion of the product from the first side to the side having the lesser spacing.

A further purpose is to operate the two sides of a double-acting crusher in series as distinguished from in parallel, and to secure approximately the same loads on the two sides of the crusher by relative adjustments in the settings of the crusher elements on the respective sides.

A further purpose is to improve the toggle support of a crusher anvil.

Further purposes will appear in the specification and in the claim.

I have elected to show one only of the different forms of my invention, selecting a form however that is practical and efficient in operation and which well illustrates the principles involved.

Figure 1 is a partially schematic vertical section illustrating assembled structure embodying a desirable form of my invention. The left anvil in Figure 1 is shown in the position which it would assume in case an uncrushable object entered the left side of the crusher. In Figure 1 the crusher structure may for some features of the invention desirably be in general accord with that disclosed and claimed in my copending application, Serial No. 630,490, filed August 26, 1932, for a "Crusher" which application became Patent No. 2,009,186, issued July 23, 1935, and has therefore been illustrated in general accord therewith, but in its broader features the illustrated crusher is intended for any double-acting crusher that may be applicable to the invention.

Figure 1*a* is a fragmentary section parallel to the section in Figure 1.

Figure 1*b* is an enlarged fragment of Figure 1.

Figure 2 is a section of a modification of Figure 1.

Figure 3 is a diagrammatic reduced scale elevation of a variation of Figure 1.

Describing in illustration and not in limitation and referring to the drawing:

In the illustrated embodiment of the invention a supporting shell and frame structure **10**, carries pivotally at **11** a main rocker **12** which presents its preferably downwardly diverging opposite faces **13** and **14** to operate as the movable crushing jaws with normally stationary anvil members **15** and **16** respectively. The rocker faces **13** and **14** are held in place by rods **53** and **55** positioned by springs **54**.

Stone or the like is crushed between each anvil **15** or **16** and the adjacent face **13** or **14** of the rocker, the crushing stroke toward one anvil being the retracting stroke from the other and vice versa.

The main rocker **12** is thus double-acting in its crushing operations, each rocking movement in one direction crushing on one side and retracting on the other and being succeeded by a rocking movement in the other direction that retracts on the first side and crushes on the second.

The rocker extends and converges downwardly from the lower edges of the crushing faces **13** and **14** to a transverse knee or head **18** which presents pivot surfaces to shoes **19** and **20** that connect the head **18** with the outer end of a link **21**, the shoes and intermediate head fitting between opposite sides of a downwardly tapering opening **22** in the outer end of the link.

The link or eccentric rod **21** is resiliently urged upwardly at one end by springs **30** acting on rods **27**. The head and shoe joint between the rocker and the link is covered at **39**. The link **21** is longitudinally reciprocated by an eccentric **23** upon a main drive shaft **24** which is supported in pillow block bearings **25** and carries a pulley **24²**.

The anvil members **15** and **16** are normally rigidly and adjustably supported in positions for best cooperation with the wear faces **13** and **14** of the rocker preferably in a manner permitting sudden temporary yielding to high pressures such as would arise, for example, if a metal nut or any other uncrushable object were inadvertently fed into the crusher.

As illustrated, each anvil **15** or **16** is supported

at the top and rear from moving upwardly and rearwardly by a knee and socket joint at 66 with the frame structure of the machine, spring-supported eye bolts 70 holding the anvils from moving downward at the joint 66.

The anvils are suitably supported from moving rearwardly at the bottom by toggle mechanism between the back of each anvil near the bottom thereof and a stationary bearing supported by the frame structure.

Each toggle is normally a little off dead center with the central members of the toggles strongly pressed resiliently toward their dead center positions, whereby the crushing force applied to the front of either anvil if sufficient to cause any bending of its toggle must overcome an adjustably heavy retraction of a spring tending to straighten the toggle.

Until the force on the spring is relatively great, the toggle will maintain its position, but as soon as the spring begins to yield, further yielding will be quick and easy, as the proportion of the total force transmitted to the spring rapidly increases as the toggle bends, so that there is no yielding of the toggle unless or until the pressure upon the front of the anvil is to a predetermined extent above normal, when the toggle snaps into release to automatically reset under the action of the spring as soon as the rocker retracts, permitting the uncrushable object to pass downward from between the jaws.

As shown each toggle comprises an intermediate head 75′ and toggle arms 76′ and 77′ along opposite sides of the head and respectively engaging at their other ends the back of the anvil and a stationary bearing. The ends of the toggle arms form convex rib-like pivots, as shown at 88, for example. The head 75′ is provided with flat seats 78′ at intervals along its upper side and is vertically bored and threaded at the middle of each seat to attach the lower ends of bolts 79.

The bolts 79 are adjustably fastened at their upper ends at 80′ to a horizontal rocker pivotally mounted at 82 in frame structure. They pass down through openings 83 in the frame structure and are surrounded by flanged sleeves 84. The flanges of the sleeves 84 receive the upper ends of springs 85 which surround the bolts 79 and are compressed between the flanges on the sleeves 84 and the seat portions 78′ of the head member 75′, the springs tending to straighten the toggles.

The adjusting nuts at 80′ at the upper ends of the bolts 79 limit the downward movement of the toggle, to an extent that is adjustably close to but somewhat above dead center, since the bolts 79 are rigid with respect to the head 75′. Also, the under side of the head 75′ is preferably so shaped that the toggle cannot fully straighten, due to the contact of the head 75′ against the toggle arms, as shown at 75^2 at the right of Figure 1.

It will be understood that the adjustment of the nuts 80′ may be such that the shoulder portions at 75^2 of the heads 75′ are normally high enough to be always out of engagement with the toggle arms 76′ and 77′.

In practice the proper ranges of adjustment of the nuts 80′ are usually fairly short and the reason for an adaptation of the heads 75′ and the toggle arms to effect partial locking engagements at the shoulders 75^2 is to avoid danger of an operator inadvertently setting the toggle arms too straight. In such event the toggle would be so close to dead center as to fail to function in the intended way. There would then be every likelihood of serious breakage to the crusher if an uncrushable object should come between the jaws. The low positions of the heads 75′ may thus be determined by the settings of the nuts 80′ and these settings are, for safety of the machine, never higher than that for engagement of the shoulder 75^2 against the toggle arms.

The toggle arms 76′ and 77′ are shown alike and of rail section, each presenting an enlargement at one end to a socket in one side of the head 75′ along substantially the length thereof and at the other end presenting an enlargement to a socket on the back of the anvil or to a stationary concave adjustable bearing 90.

The concave stationary bearing 90 supports the bottom of the anvil from yielding rearwardly and may comprise an angle member having a flat base seated along a horizontal surface 92′ and a vertical back adjustably spaced from a riser portion 93 by suitable shims 94 between the bearing and riser.

It will be evident that the rib and socket joints at the ends of the toggle arms are very desirable.

A division wall 98 suitably directly above the rocker axis, separates the hopper into effectively two hoppers 99 and 100, one for each side of the crusher. Raw charge material, which is usually uncrushed stone, is delivered suitably by a conveyor 101 and as a continuing process into one side of the hopper as into the division 99, the corresponding side of the crusher having been adjusted at the shims 94 for relatively very coarse grinding.

The more coarse portion of the product from the first side of the double-acting crusher is delivered continuously into the other side of the crusher and the final product, of which all will have passed through the first side and a coarser portion from the first side passed through the second side, may be graded as to coarseness in any suitable or usual way.

The coarser and finer portions of the product from the first side may be separated by screening, locating the screen or screens either within or outside of the frame structure of the crusher, and sending all or only the coarser part of the product from the first side to the second side.

In Figure 1 the uncrushed material delivered to the hopper 99 passes downward between the cooperating jaws of the left side of the crusher, being guided by baffles 102 to the upper side of a screen 103.

As illustrated, the screen 103 is reciprocated by cooperating actions of the link 21 and one or more springs 104, the upper and receiving end 105 of the sloping screen resting in and being supported by a horizontal groove seat 105′ presented by the end of the link 21, the screen suitably sloping downward through openings 106 of the frame structure, where it may slide back and forth on side supports at 107 and be resiliently held rearwardly to continuously contact with the link 21 by the spring or springs 104.

The screen 103 at its lower edge delivers to the inlet 108 of a continuous conveyor 109 which, while intended to be illustrated as a link conveyor, may be of any suitable type adapted to continuously deliver the coarsely crushed stone from the screen to the hopper division 100, feeding the second side of the double-acting crusher. The delivery spout of the conveyor 109 is indicated at 110. The second side of the crusher is set to produce a finer product than the first side,

as by inserting more shims 94 on the second side.

The crushed product from the second side of the crusher passes downward under the guidance of cross plates 111 through a vertical opening 112 of the link into a receptacle 113 that also receives that portion of the crushed product from the first side that passes through the screen 103.

A conveyor 114 may deliver the crushed product from the receptacle 113 to sizing mechanism, illustrated as screens 115 and 116 of successively coarser mesh, and compartments 117, 118 and 119 to respectively receive the more fine particles which pass through the screen 115, the somewhat coarse particles which pass through the screen 116 and the particles too large to pass through the mesh of either screen.

It will be understood that when uncrushed rock passes through a crusher, the crushed product comprises pieces of widely variant sizes.

Even when the cooperating jaws of the crusher are so widely spaced as to pass relatively large pieces, the crushed product will usually contain a considerable proportion of relatively small particles, the pieces being of sizes ranging from that of mere dust to the maximum size that will pass the crusher.

Frequently in practice desired characteristics are close uniformity of size, absence or low proportion of fines and effective use of the power delivered to the crusher, and my method of operation gives advantageous results from all of these standpoints.

The wider setting between the cooperating jaws on the first side of the crusher results in a relatively easy direct delivery (through the screen 103) of a considerable portion of the product from the first side and this portion, passing the screen 103, preferably does not go at all to the second side of the crusher. Were the material passing through the screen 103 to pass with the coarser material from the first side of the crusher through the second side of the crusher, it would be crushed to an undesirable fineness, and while still in the crusher would have deleterious packing action around still uncrushed pieces, making more difficult the crushing of these yet uncrushed pieces. This no doubt explains one of the reasons for the advantageous results obtained.

Nevertheless, if it be desired to send all the charge from the first side of the crusher through the second side, this may be accomplished by substituting the baffle 103′ (Figure 2) for the screen 103. Thus the coarser part of the charge which goes through the second side of the crusher may or may not be accompanied by finer material.

While in Figure 1 the screen is shown immediately below the rocker of the crusher, it is not intended to indicate that this arrangement will necessarily be that adopted in practice. In Figure 3, I show a crusher similar to Figure 1, supplied from a conveyor 101 with material to be crushed on its coarse side, and discharging from its coarse side into a conveyor 109. From the conveyor 109 the material travels over successive screens 120, 121 and 122 of variant sizes, that material passing through the screens entering bins 123, 124 and 125, respectively. Material too coarse for any of the screens 120, 121 and 122 is taken by the chute 126 to the finer side of the crusher, from which it goes to the conveyor 109, to be regraded by the screens 120, 121 and 122, and, if still too large to pass through the largest of said screens, returned to the finer side of the crusher.

Thus it will be evident that, in the form of Figure 3, the material, after passing through the coarser side of the crusher, is graded before the coarser portion of the material goes to the finer side of the crusher.

I find it desirable to make the adjustments between the two sides of the crusher such that the work of the crushing stroke on either side will be substantially the same as that on the other side.

Usually this entails a relatively coarse setting on one side and a setting on the other side somewhat finer than would be needed if the two sides of the crusher were to be operated in parallel. It will be understood that the relative work performed upon the two sides of the crusher may be adjusted by adding or removing shims at 94 on either side.

It will be also understood that the different crushing duties on the two sides of the machine make it desirable to give the cooperating crushing jaws of one side suitably different characteristics from the cooperating jaws of the other side. Thus, for example, usually both the relative spacing and upward spread of the cooperating jaws of the first side will be greater than on the second side.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such in so far as they fall within the reasonable spirit and scope of my invention.

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

A double-acting crusher comprising a frame, opposed substantially vertical stationary jaws adjustably mounted in said frame, pivots in said frame above said jaws and located in a line nearer one of said jaws than the other, a rocking crusher member supported by said pivots and extending between said jaws, jaw faces on the rocking member opposed to the stationary jaws, the spacing between one stationary jaw and its cooperating movable jaw being greater for coarse crushing than the spacing between the other stationary jaw and its cooperating movable jaw for fine crushing, means to rock said rocking member, a screen located beneath the cooperating jaws which are spaced apart the greater distance, means for receiving the material too large to pass the screen and mounted to carry such material and discharge it between the jaws spaced apart the lesser distance and means for adjusting said stationary jaws so that the work required to operate the crusher on the coarse side is substantially equal to that required to operate the crusher on the fine side.

EDWARD T. PETERSON.