J. WILLNERS.

CRUSHING MACHINE.

APPLICATION FILED AUG. 31, 1911.

1,025,895.

Patented May 7, 1912.

3 SHEETS—SHEET 1.

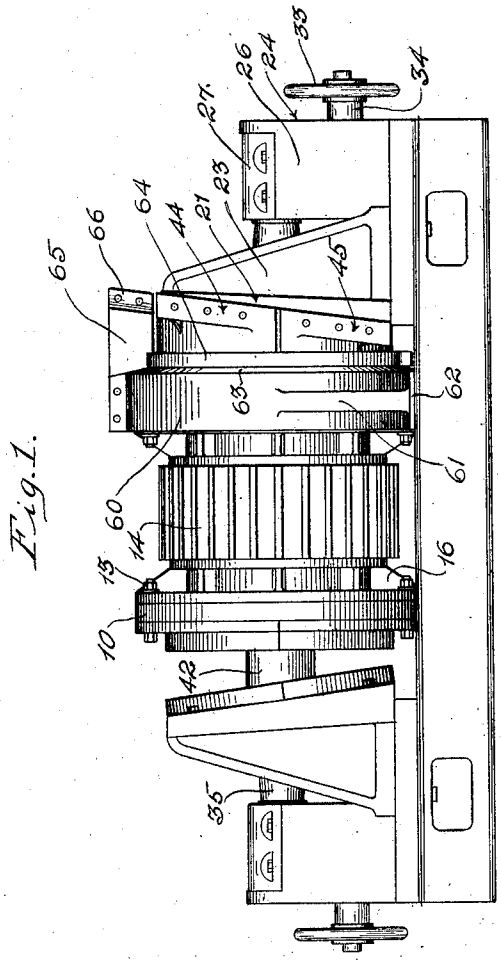

Fig. 1.

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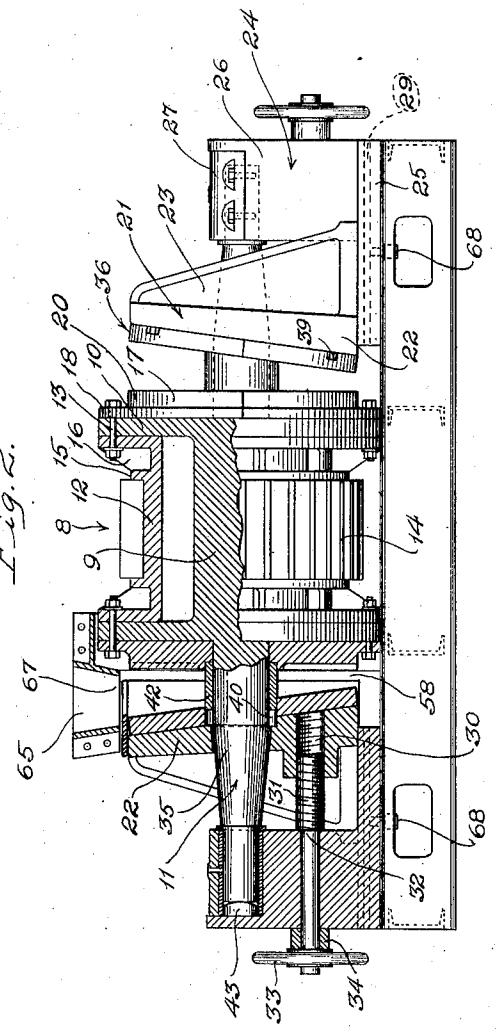
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 4.

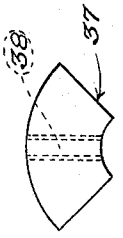


Fig. 5.

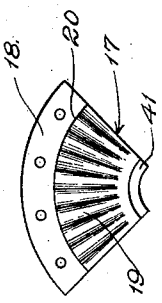


Fig. 3.

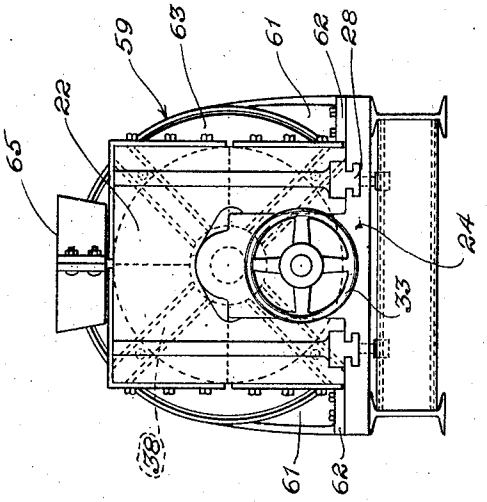


Fig. 6.

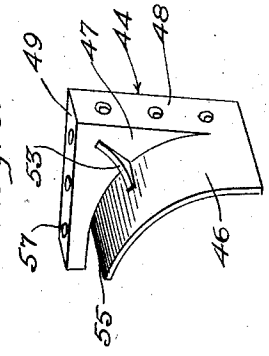
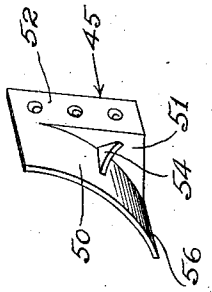


Fig. 7.



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UNITED STATES PATENT OFFICE.

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CRUSHING-MACHINE.

1,025,895. Specification of Letters Patent. Patented May 7, 1912.

Application filed August 31, 1911. Serial No. 647,079.

To all whom it may concern:

Be it known that I, JOHN WILLNERS, having declared my intention of becoming a citizen of the United States, residing at Chicago Heights, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Crushing-Machines, of which the following is a specification.

This invention relates to a crusher especially adapted for crushing rock, ore, and other similar material.

The general principle of construction of the machine of the present invention comprises the use of a stationary member and a rotating co-acting member adjacent the same, the crushing faces of the two members lying at an angle to each other so that as the crushing member rotates, the rock or other similar material will be carried down into a space of uniformly diminishing breadth, thus gradually breaking up the larger pieces of material until they are of a size to fall through a comparatively small opening in the bottom portion of the machine.

It will be understood that in any form of crusher an extremely large force is exerted between the co-acting jaws. In designing a rotary crusher, a serious problem is the arranging of the parts in such way as to take up the forces exerted on the rotating member. It would be difficult and expensive to design a thrust bearing capable of taking up these forces in a satisfactory manner.

One of the objects of this present invention is to provide a rotary crusher of such construction that the forces on the rotating member can be neutralized, as it were, with the result that the only end thrust which must be taken up by the shaft is any momentary difference in the thrusts which are exerted in opposite directions. In this way the size of the bearings can be greatly reduced and their arrangement correspondingly simplified, thus enabling me to produce a machine of smaller size and weight than would otherwise be necessary, and at a smaller cost.

Another object of the present invention is to make the working surfaces of the elements removable so that they can be changed from time to time as they wear in service. The members which are actually subjected to wear are thus replaceable and are supported by other members of sufficient size and strength to withstand the enormous forces necessary. In this manner it is possible to provide a machine in which the wearing portions may be almost completely used up, and their thickness greatly diminished in service, without weakening the machine to any appreciable extent. In this way also renewals can be made from time to time, and, therefore, the machine can be kept in the best possible operative condition.

Another object of the invention is to provide a structure in which the distance between the co-acting jaws can be enlarged or reduced to the desired amount, thereby regulating the size of rocks which can be handled, and also regulating the size of the pieces into which the rocks are broken. It is intended to so relate the parts that this adjustment of size can be made in a very simple and effective manner, and without the necessity of disassembling the machines in any respect. At the same time, means are provided for properly inclosing the working jaws at all times, regardless of their adjustment with respect to each other, so as to insure a proper movement of the rock or other material from the intake hopper to the discharge, and so as to prevent partly broken pieces of material from being thrown about.

Other objects and uses will appear from a detailed description of the invention, which consists in the features of construction and combination of parts hereinafter described and claimed.

Figure 1 shows a side view of the machine having the inclosing casing removed from one pair of the jaws; Fig. 2 shows a side view partly in elevation and partly in section having the inclosing casing removed from one pair of jaws; Fig. 3 shows an end view of the completed machine; Fig. 4 shows a face view of one of the stationary jaw plates; Fig. 5 shows a face view of one of the rotating jaw plates; Fig. 6 shows a perspective of one of the upper sections which is attached to the bracket; and Fig. 7 shows a perspective of one of the lower inclosing plates which is also attached to the bracket.

In the embodiment of my invention, I provide a rotating element, on each end of which I mount a crushing member. Adjacent each end of the rotating member I place a stationary member which carries a

crushing member to co-act with the corresponding face of the stationary member. Means are then provided for guiding the rock or other material down between the pairs of crushing members thus established, and the end thrusts on the rotating member are thereby balanced.

Referring now to the drawings, the rotating member 8 comprises a drum 9 provided with end flanges 10 and mounted on or attached to a shaft 11. In the present instance, the drum, end flanges and shaft are formed from a single piece of material, but it will be understood that this is simply done for convenience, and that any other equivalent form of construction might be substituted. A toothed rim 12, preferably in the form of a number of sections, is mounted between the end flanges and may be bolted to them by bolts 13. Any suitable form of pinion or other drive may be used to engage the teeth 14 of the drum to drive the same. In the particular construction illustrated, the teeth are formed separately from the drum and are mounted between flanges 15 of the rim 12. These flanges and the entire rim are reinforced by a plurality of webs 16 which may be evenly spaced around the periphery of the rim.

On each of the flanges of the rotating member, I mount a circular removable wearing member. The same preferably comprises four quadrant sections 17 such as shown in Fig. 5. The outer portion of each of these comprises a flange 18 through which pass the bolts 13. The central portion 19 of each of these quadrants is preferably corrugated in order to increase its efficiency, as will presently appear. It will be understood that when four sections are mounted on each end of the drum a complete circular wearing face is presented, the same being corrugated radially in its middle portion. As is well shown in Figs. 1 and 2, the corrugated portion of this wearing surface projects out beyond the flange 18 to provide a circular shoulder 20.

Adjacent each end of the rotating member I mount an adjustable bracket 21. The same comprises a substantially rectangular body portion 22 of considerable thickness, reinforced near each side by a vertical web 23.

A bearing member 24 is provided at each end of the crusher. The same comprises a bed 25 from the middle end portion of which projects a block 26. The corresponding end of the shaft is journaled in the upper end of this block, a removable cap 27 being provided for giving access to the interior of the journal. The lower end of each of the webs 23 is provided with a tongue 28 which engages a corresponding groove 29 in the bed 25.

It will be seen from the above construction that the bracket 21 can be moved back and forth toward or away from the corresponding face of the rotating member. In order to accomplish this result, I provide a threaded hole 30 in the central lower portion of the bracket and engage a threaded shaft 31 therewith. This shaft passes through the bearing block 26 and is shouldered at the point 32 in order to provide an end thrust for moving the bracket in one direction. A hand wheel 33 is mounted on the outside end of the shaft, a block 34 spacing the same away from the journal block and providing an end thrust for pulling the bracket away from the rotating member when the shaft is turned in the proper direction. The portion 35 of each end of the shaft is preferably tapered as shown.

It will be understood that a hole is provided in each bracket, the tapered portion of the shaft passing through this hole, so that the bracket surrounds the shaft in this portion. A wearing member 36 is mounted on the inner face of each bracket, the same preferably comprises four quadrant sections 37 of the form shown in Fig. 4. Each of these sections is provided with a radial tongue 38 which engages a corresponding groove in the face of the bracket. The four sections are slipped into their respective grooves until they meet to provide a circular wearing surface and then they are severally locked in such position by means of tap bolts 39. It will be understood that a certain amount of space or clearance must be left between the tapered portion of the shaft and the hole of the corresponding bracket. The amount of this clearance will depend upon the exact position of the bracket toward or away from the rotating member. Under any circumstances, means should be provided for preventing small portions of rock or other material from gaining access to such clearance. For this purpose the inner radius of the wearing sections 37 is such as to provide a clearance 40 between them and the shaft. Reference particularly to Fig. 5 will show the fact that the sections 17 of the rotating member are shouldered at 41 on their inner portions. A sleeve 42 surrounds the shaft in the portion between the stationary and rotating members, and sets back into the recess 41. This sleeve is of such length, and the recess 40 is of such depth that the sleeve and the wearing sections 37 will telescope as the bracket is moved back and forth, so that the recess 40 will be closed at all times. The sleeve also prevents wear on the shaft.

Although the forces on the two ends of the rotating member will ordinarily balance, still I have provided a thrust block 43 in each bearing for taking any small amount of unbalance which might occur, and for

keeping the rotating member always properly centered in the machine. It will be understood that the wearing surfaces of the rotating member are corrugated while those of the stationary members or brackets are not necessarily so. However, by setting the wearing surfaces substantially as shown so that the distance between them is smaller in their lower than in their upper portions, the rock and other material will naturally gravitate down between the crushing surfaces and will naturally be carried down by engaging with the corrugations of the rotating member. It will also be understood that the wear on the surfaces of the rotating member will be substantially uniform throughout their entire periphery. This is not necessarily so, however, in the case of the stationary surfaces. Should they wear more rapidly in one portion than in another, the different sections may be readjusted with respect to each other after a time in order to compensate for such wear, and insure that all of the sections will be used up to their fullest extent in the end. For example, if it should be found that the lower sections would wear more completely than the upper sections, then the new quadrants might first be inserted in the upper grooves and afterward be transferred to the lower grooves when the lower sections had worn out and then a new set of sections would be inserted in the upper grooves.

As before stated, means must be provided for retaining the rock or other material between the crushing surfaces and for preventing it from being thrown about. In order to accomplish this end, I have shown the following construction. Two quadrant sections 44 are mounted on the upper portion of each bracket, and two quadrant sections 45 on the lower portion of the same. Each of the sections 44 comprises a flange 46 of a size to fit easily around the periphery of the corresponding quadrant section 37. This flange is carried by a body portion 47 having an inturned flange 48 which may be bolted to the side of the bracket, and having a flange 49 which seats on the upper face of the bracket and may be likewise secured to the same. Each section 45 comprises a circular flange 50 attached to a flat portion 51 having a flange 52 which can also be attached to the side of the bracket. A web 53 re-inforces each of the upper sections, and a web 54 re-inforces each of the lower sections. It will be understood that the two sections 44 and the sections 45 co-act together to practically encircle the periphery of the wearing surface on the bracket. However, the upper edge 55 of each section 44 and the lower edge 56 of each section 45, is formed far enough to provide a space between the flanges of the upper sections and a corresponding space between the flanges of the lower sections. The flanges 49 of the upper sections are carried out in their end portions 57 a sufficient distance so that such portions will meet to inclose the outside of the hole through which the material is passed into the space between the jaws.

The flanges 46 and 50 of the upper and lower sections project out a sufficient distance from each bracket to overlie the periphery of the wearing surface at the corresponding end of the rotating member, when the bracket is moved up into its position closest to the rotating member. As the bracket is moved back to increase the space between the jaws, the amount of such overlying will decrease until finally a space will be left between the edge of the flanges and the wearing surface of the rotating member, as is well shown in the left-hand portion of Fig. 2. Such space is there designated by the numeral 58. In order to inclose this space, I have provided a stationary guard which surrounds the rotating member, and overlies the flanges which are carried by the bracket. As shown in the several figures and particularly in Figs. 1 and 3, this stationary guard is made in two similar sections 59. Each of these comprises a rim 60 of suitable diameter to overlie the corresponding flange 10 of the rotating member, the rim portion of each section being supported by a web 61, the lower end 62 of which can be bolted to the base. This rim is inturned in its portion 63 and carries a flange 64 which overlies and fits loosely on the flanges which are carried by the bracket.

The upper co-acting ends of the rims 60 carry the halves of a hopper 65, the outer end of which is joined together by bolted flanges 66. As is shown in Fig. 2, the upper ends 67 of the flanges 64 are cut back a sufficient distance to provide a space which co-acts with the space between the two sections on the bracket, so that rock or other similar material can drop immediately from the hopper down between the jaws. Referring still to Fig. 2 it will be seen that the hopper is of such size that the bracket may be moved out to its maximum distance and rock will still be delivered to practically the entire space between the upper portions of the jaws. After each bracket has been adjusted into any given position it may be locked by means of a pair of tap bolts 68 which extend up into the grooves 29 and engage the tongues on the lower ends of the flanges of the bracket. In this way the threaded shaft is relieved of the major portion of the thrusts, and the wear on it is thus reduced.

I wish particularly to emphasize the fact that by means of the double end construction herein shown and described, the end thrust on the rotating member is counter-

balanced, thus reducing the wear in the journal boxes, and making it possible to secure the necessary strength and rigidity of construction with a much smaller machine than otherwise. I would also call attention to the fact that by simply moving the brackets back and forth, the size of the resulting product can be closely regulated, the end thrust on the shaft being still counterbalanced. In this way both ends of the machine can be adjusted to deliver product of the same size, or they may be adjusted to deliver two different sizes of product simultaneously. For example, one end might be taking large blocks of rock and crushing the same into smaller pieces, while the other end of the machine might take these smaller pieces and crush them into still finer portions. These two processes could be going on simultaneously, the end thrust remaining counterbalanced all the while.

It will be understood that I am not restricted to the particular construction herein shown and described except as I may limit myself by the claims, but that I include within the scope of my invention all forms of equivalent construction for accomplishing substantially the same result in substantially the same manner.

I claim:

1. In a crushing machine, the combination of a rotatable drum having a crushing element on each end thereof lying at substantially right angles to the axis of rotation of said drum, and a stationary crushing element adjacent each end of the said drum and having the plane of its face lying at an angle to the plane of the crushing element of the adjacent end of the drum and extending from top to bottom of the drum, and means for directly driving the said drum, substantially as described.

2. In a crushing machine, the combination of a rotatable drum having a crushing element on each end thereof lying in a plane at substantially right angles to the axis of rotation of said drum, and a stationary crushing element adjacent each end of the said drum and having the plane of its face lying at an angle to the plane of the crushing element of the adjacent end of the drum and extending from top to bottom of the drum, substantially as described.

3. In a crushing machine, the combination of a rotatable drum having the end faces thereof lying at substantially right angles to the axis of rotation of said drum, a corrugated crushing element on each end of said drum and having the corrugations thereof lying in a plane substantially at right angles to the axis of rotation of the drum, a stationary member mounted adjacent each end of said drum, and an uncorrugated crushing element carried by each stationary member adjacent the corresponding crushing element of the drum and having the plane thereof lying at an angle to the plane of the corrugations of the adjacent end of the drum and extending from top to bottom of the drum, substantially as described.

4. In a crushing machine, the combination of a rotatable drum having the end faces thereof lying at substantially right angles to the axis of rotation of the said drum, a crushing element carried by each end of the drum and having the crushing face thereof also lying in a plane substantially at right angles to the axis of rotation of the drum, a bracket member adjustably mounted adjacent each end of the drum, and a crushing element carried by each bracket member adjacent the corresponding crushing element of the drum, and having its crushing face lying in a plane at an angle to the plane of the crushing face of the adjacent end of the drum and extending from top to bottom of the drum, substantially as described.

5. In a crushing machine, the combination of a rotatable drum, a crushing member carried by each end of the same and having its crushing face lying in a plane at substantially right angles to the axis of rotation of the drum, a stationary bracket mounted adjacent each end of the drum and having a substantially plane surface lying at an angle to the plane of the crushing member on the adjacent end of the drum, and a crushing element secured to each stationary member on the plane surface thereof and extending from top to bottom of the drum, substantially as described.

6. In a crushing machine, the combination of a rotatable drum, a crushing element carried by each end thereof and lying at substantially right angles to the axis of rotation of the drum, a bracket adjustably mounted adjacent each end of the drum, a crushing element carried by each bracket adjacent the corresponding element of the drum, and lying in a plane at an acute angle to the axis of rotation of the drum, a stationary hood member encircling each end of the drum and having an outwardly projecting flange, a hopper carried by each stationary hood member in the upper portion of the same, and a flange carried by each bracket and telescoping with the flange of the corresponding stationary hood member, substantially as described.

7. In a crushing machine, the combination of a drum having a crushing surface on each end thereof, a mounting in which the drum is free to rotate, the said crushing surfaces lying in planes at substantially right angles to the axis of rotation of the drum, and a stationary member adjacent each end of the drum and having a crushing face in

co-active relationship to the crushing surface of the adjacent end of the drum, and extending substantially from top to bottom of the diameter of the drum and lying at an angle to the plane of the crushing element of the adjacent end of the drum, whereby a crushing space is provided of constantly diminishing width from top to bottom, substantially as described.

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