

Aug. 27, 1935.

A. L. RUNYAN

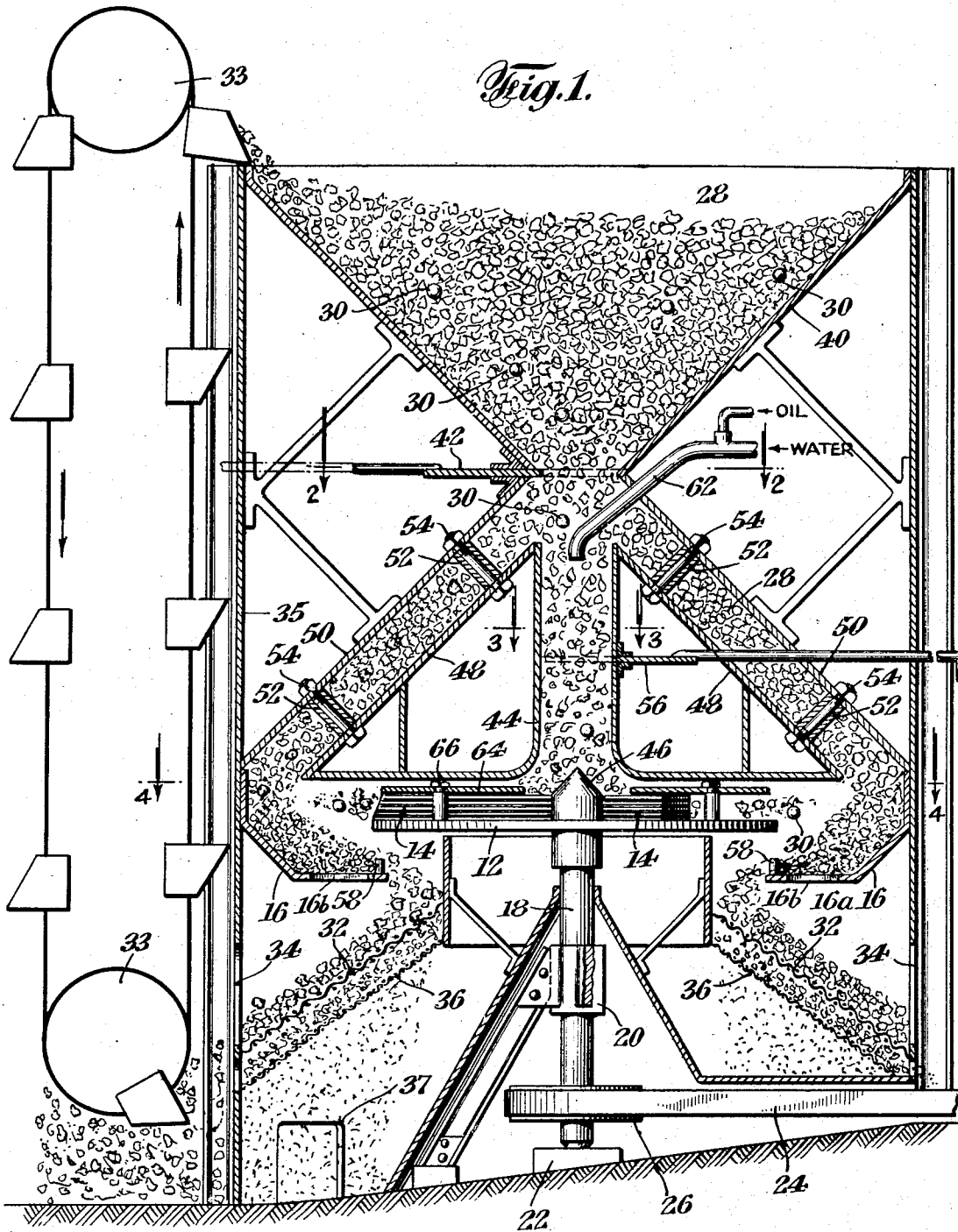
2,012,694

CRUSHER AND PULVERIZER

Filed July 8, 1933

2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

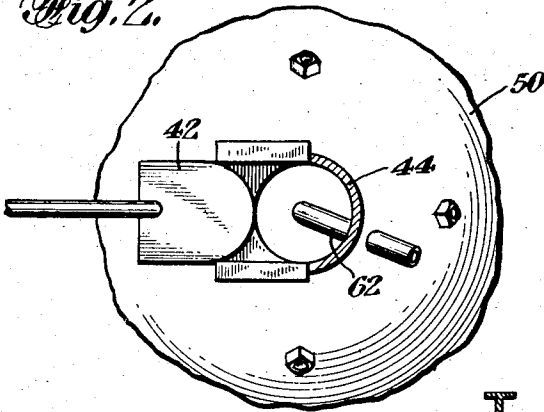


Fig. 3.

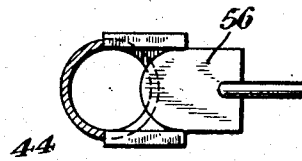


Fig. 4.

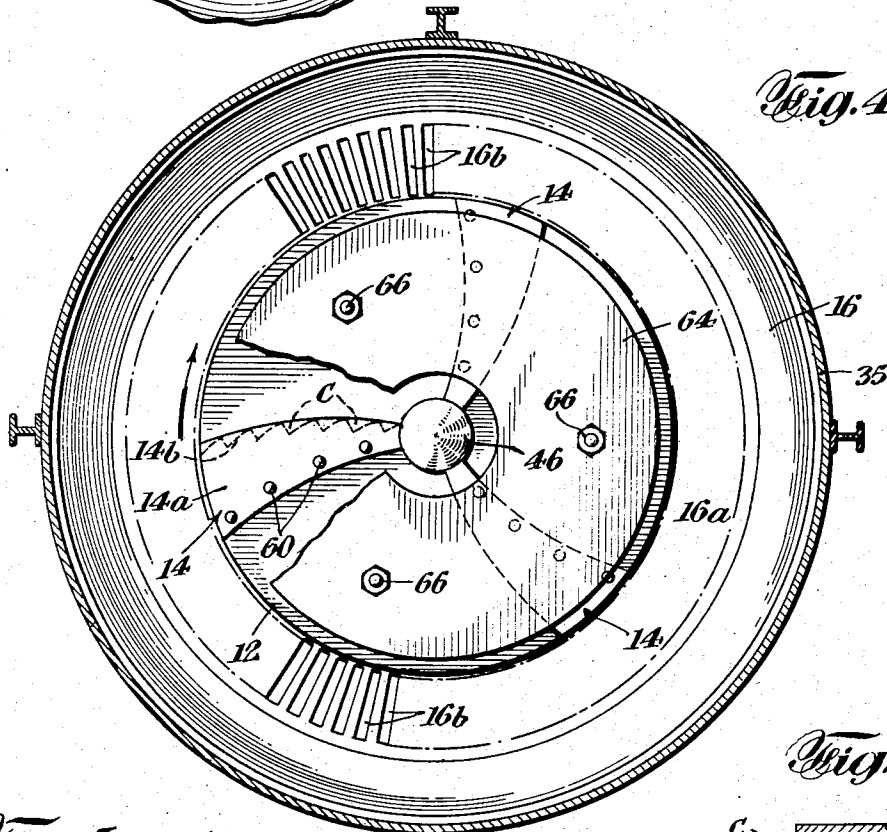


Fig. 5.

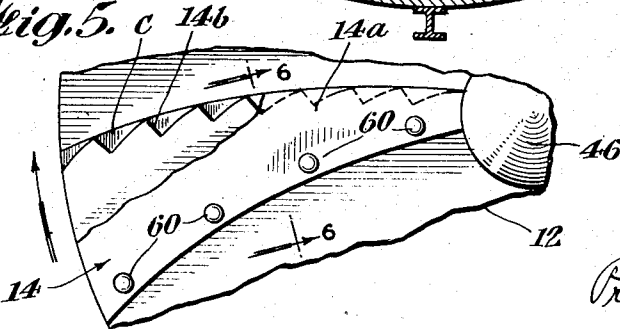
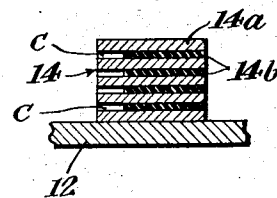


Fig. 6.



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CRUSHER AND PULVERIZER

Arthur L. Runyan, New York, N. Y., assignor to
Edward Harding, trustee, New York, N. Y.

Application July 8, 1933, Serial No. 679,457

4 Claims. (Cl. 83—46)

My present invention relates to improvements in crushers and pulverizers for breaking up and comminuting ores, coal, rocks and other adapted material.

5 The machine propels, throws or hurls portions of the material to be crushed (which may include suitable non-crushable projectiles) against other portions of the same material, as distinguished from prior machines wherein the anvil or target for the material to be crushed is a part or parts of the machine itself which soon become worn out and must be replaced, the machine meanwhile being rendered idle.

10 Another of my objects is to reduce the wear on the propelling or throwing element by the propelled material.

15 These and other objects and advantages will appear from the following description in connection with the drawings which show diagrammatically one preferred form or embodiment of the invention which is to be taken as simply illustrative of the invention and not as limiting the invention thereto.

In the drawings:

20 Fig. 1 is a diagrammatic elevational and vertical sectional view of a crushing and pulverizing machine within my invention.

Fig. 2 is a combined plan and horizontal sectional view on the line 2—2 in Fig. 1.

25 Figs. 3 and 4 are similar views to Fig. 2 but taken respectively on the lines 3—3 and 4—4 in Fig. 1.

Fig. 5 is a plan view of a fragment of the throwing wheel or disc enlarged as compared with Fig. 4 and with one of its vanes partly broken away to show its underlying or interior structure; and

30 Fig. 6 is a transverse section through the vane and disc on the line 6—6 in Fig. 5 looking in the direction of the arrows.

35 Describing now the illustrative embodiment of the invention: A disc 12 equipped on its top face with a radial vane or vanes 14 is rotatable at centrifugal speed to propel, throw or hurl portions of the ore, etc. against other portions thereof with crushing velocity and force. In other words, the ore is both the projectile and the target. The annular receptacle 16 which circumferentially surrounds the disc 12, suitably spaced from the periphery thereof, contains the target ore. It will be noted that this annular receptacle is open towards the disc so as to expose the contained ore as a target for the material centrifugally thrown from the disc.

40 The disc is fixed on the upper end of the shaft

18 which turns in any suitable bearing 20 and rests at its lower end, which may be coned, in a suitable bearing recess in the top of a stationary support or block 22. A belt 24 and pulley 26 are shown for rotating the described shaft and disc at the requisite speed.

45 The projectile and target material need not consist wholly of ore, coal, rocks, indicated in the drawings by the general designating numeral 28, but may advantageously comprise (especially as to the projectile portions thereof) metal balls 30 or other suitable shapes of metal or the like adapted to make efficient projectiles for expediting the crushing of the material.

50 The crushings drop from the aforesaid receptacle 16 upon conical screens, namely an upper coarse screen 32 which delivers or is intended to deliver all the material which is too coarse to pass through it to a conveyor 33 through the circular series of openings 34 in the enclosure 35 for a return passage or passages through the machine until sufficiently reduced and pulverized to pass through the lower suitably fine mesh screen 36. These fines are received into the space under the screens and are removed through a suitable opening or openings 37 in the wall of the stationary cylindrical casing or enclosure 35.

55 This enclosure 35 is bottomed or supported on a suitable foundation, and in turn operatively supports within it by means of brackets and struts, etc., as indicated, the described rotary disk, target-ore receiver and the screens and other devices next to be described.

The projectile and target materials preferably will be fed automatically to the centrifugal disc 12 and to the receptacle 16. For this purpose, a conical hopper 40 is shown supported in the upper portion of the enclosure 35 and is or may be the common receptacle or hopper for all of the material.

60 A slidable gate 42 (compare Figs. 1 and 2) controls the rate of delivery of the material from the hopper outlet. A tubular chute 44 is located vertically under the outlet from the hopper and over the intake or center portion of the centrifugal disc 12. This disc may be provided with a relatively small conical projection 46 axially coincident with the disc adapted to divide and spread the material more or less evenly as it falls from the chute 44 on the intake center portion of the disc.

65 The chute for the target material is shown as consisting of two concentric spaced-apart cones 48 and 50 held together by the spacing

sleeves 52 and uniting bolts 54. These cones are suitably supported from the enclosure 35 and form a conical chute leading from the outlet of the hopper 40 to the receptacle 16 for the target material.

A handle-operated slidable gate 56 in connection with the vertical chute 44 controls the rate of delivery of the material to the centrifugal disc, which in the ordinary operation of the machine will be substantially continuous.

The rate of delivery by the conical chute 48-50 to the receptacle 16 will or may be slower than the rate of delivery from the vertical chute 44 to the centrifugal disc. Thus in the particular illustrated machine, the adaptation of the receptacle 16 to the conical chute is intended to cause the material in said chute to be upheld by the material in the receptacle and the feed to be temporarily interrupted as soon as the receptacle is full. A circular row of closely spaced pins 58 at the otherwise unguarded inner periphery of the bottom 16a of the receptacle assists in retaining the ore, etc. in the receptacle as a target for the centrifugated material. As the crushing operation proceeds, the crushings both fall and are driven out of the receptacle and their place is automatically filled by fresh ore from the conical chute 48-50 as long as the machine is in operation.

Each vane 14 of the centrifugal disc in the particular embodiment shown consists of a plurality of laminations or plates 14a, which may be made of metal, and a plurality of serrated edged plates 14b, preferably made of rubber, said metal and rubber plates or laminations being alternately interleaved and stacked as shown, and secured by bolts 60 or other suitable means to the disc. Compare Figs. 5 and 6.

Liquid such as water or a mixture of water and oil is delivered by the pipe 62 at a controllable rate into the vertical chute 44 so that said liquid is centrifugated along with the ore by the disc 12.

Due to the rotation of the disc 12, the solid material to some extent and the liquid to a greater extent piles up against the active or advancing faces of the vanes 14 so that the solid materials and liquid are whirled at the rotary speed of the disc and at the same time are thrown radially outwardly by centrifugal action towards and off the periphery of the disc. During this outward motion, the solid material and the liquid piled up against the active faces of the vanes slide at high speed and pressure lengthwise thereof.

The liquid serves to reduce very materially the frictional wear of the solid material against the active edges of the metal laminations 14a. In the first place it constantly lubricates the edges of the metal laminations. In the second place, the liquid enters and fills the cells C in the active faces of the vanes consisting of the spaces between the serrations of the rubber laminations 14b thereof. The liquid due to centrifugal action is continuously forcibly propelled along the active faces of the vanes, and passes successively into cells more and more distant from the center of rotation until thrown off the disk. In so doing, the far walls of the cells, viz. their walls furthest from the center of rotation direct the liquid or cause it to bear against the solid material piled up against the active faces of the vanes, thereby exerting a counter-pressure against said solid material which substantially reduces the frictional wear of the vanes. For this purpose the aforesaid far walls of the cells are inclined as

shown in Fig. 5, or are otherwise suitably disposed to function as explained.

When ultimately the active faces of the vanes have become so worn as to obliterate or render ineffective the aforesaid action of the cells, the laminated structure of the vanes makes it readily possible to repair them by merely replacing the worn rubber layers 14b with new serrated edged rubber layers. For this and other reasons I prefer the described built up laminated vane construction, but of course, vanes with cellular faces within my invention can be made in other ways and with other shapes and arrangements of cells which will nevertheless function to lessen very materially the frictional pressure and consequent wear of the ore on the vanes.

The centrifugated liquid also serves to wash the fines from the target receptacle 16 and to mix oil with any metallic values requiring oil recovery treatment and to carry same down through the screens for appropriate subsequent treatment and recovery.

Another preferred feature of the centrifugal disc construction consists of an annular plate 64 (compare Figs. 1, 4 and 5) which rests on the vanes and is secured by the bolts 66 to the centrifugal disc. In other words, the centrifugal element in the form shown comprises upper and lower plates fastened together, the vanes being located between them. The open center of the upper plate permits the ore and liquid to drop from the vertical chute 44 upon the center portion of the centrifugal disc 12 which is the referred to lower plate of the construction. The upper plate 64 prevents the ore and liquid from jumping the vanes.

The foregoing description makes the operation of the machine clear and self-evident without restating it.

It will be understood that modifications and changes, including omissions, substitutions and additions of elements, may be made in the foregoing without departing from the scope and spirit of my invention.

What I claim is:

1. In a crushing and pulverizing machine, the combination of a rotary centrifugal throw member operating in a horizontal plane and which is peripherally open for direct, radially outward delivery of the thrown material, a chute delivering material to the intake of said throw member, an annular receiver in surrounding spaced relation to the open periphery of the throw member, said receiver having a bottom but being open at the top and being closed on its outer side but being open-sided towards the throw member so as to expose the material as a substantially continuous target surrounding the throw member and permit the crushings to fall from the receiver, and a chute which is annular in horizontal section arranged to deliver material to the annular receiver through the open top thereof.

2. The combination as claimed in claim 1 further characterized by the annular sectioned chute being conical with an inlet opening at its apex which is at the top of the chute, and a hopper for delivering material into the inlet at the apex of the conical annular cross sectioned chute and into the upper end of the gravity chute to the throw member.

3. A rotary centrifugal throw member, and means for delivering solid material and a liquid to said member at its center of rotation, said member comprising, a bottom part for supporting the solid material and the liquid to be thrown

and a side part having longitudinal ribs against which the solid material bears and along which it slides while being thrown, the bottom of the spaces between the ribs comprising a series of peaks and valleys, whereby the valleys will receive the centrifuged liquid and the slopes of the peaks will direct it against the solid material in opposition to the pressure thereof against the ribs of the side part.

4. A rotary centrifugal throwing member as claimed in claim 3 further characterized by the side part being built up out of laminations, some smooth edged to form the ribs against which the solid material slides, and the intermediate laminations being serrated to form the liquid receiving and directing valleys and peaks.

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