J. L. HILLER.

CRUSHING AND PULVERIZING MACHINE.

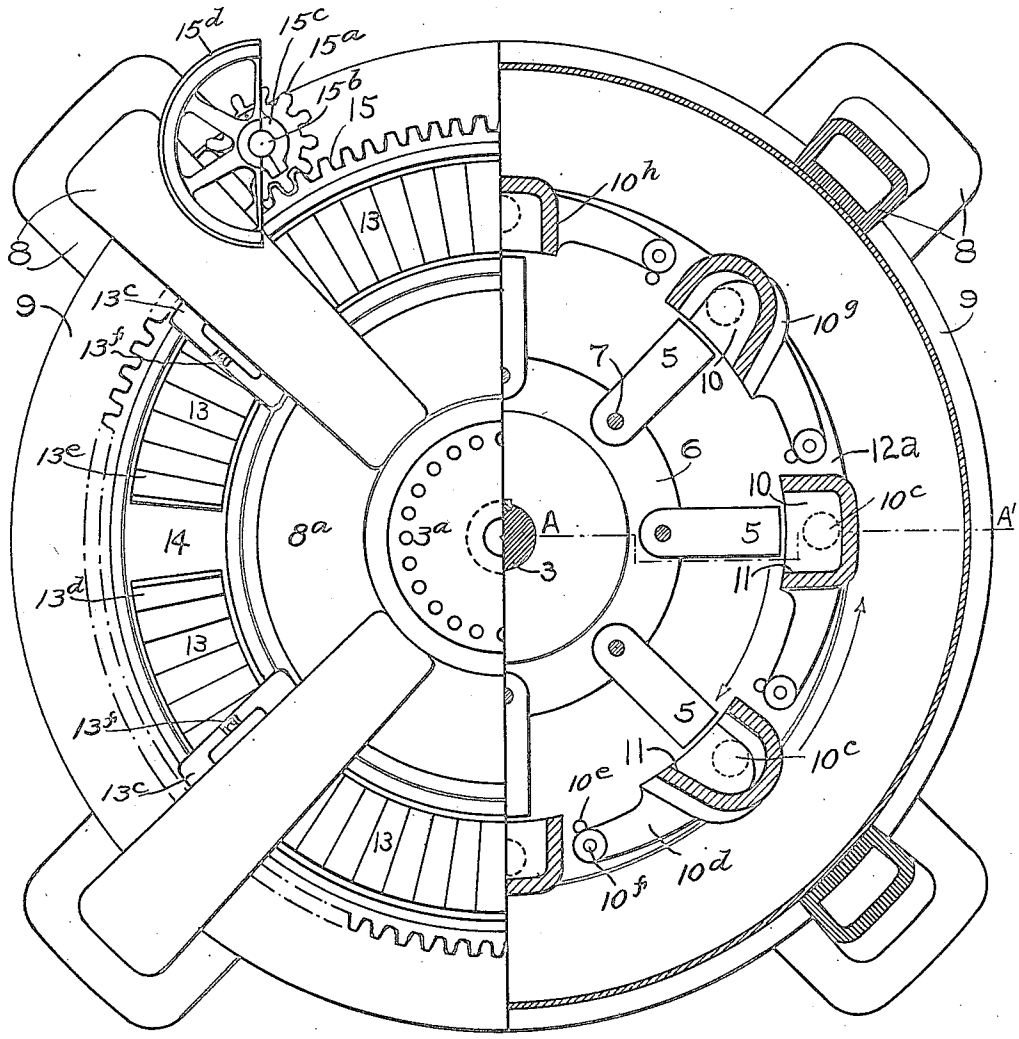
APPLICATION FILED FEB. 25, 1919.

1,436,101.

Patented Nov. 21, 1922.

2 SHEETS—SHEET 1.

FIG. 1.



WITNESS:

Florence L. Hiller

Hannah Markowitz

INVENTOR.

JOSEPH L. HILLER.

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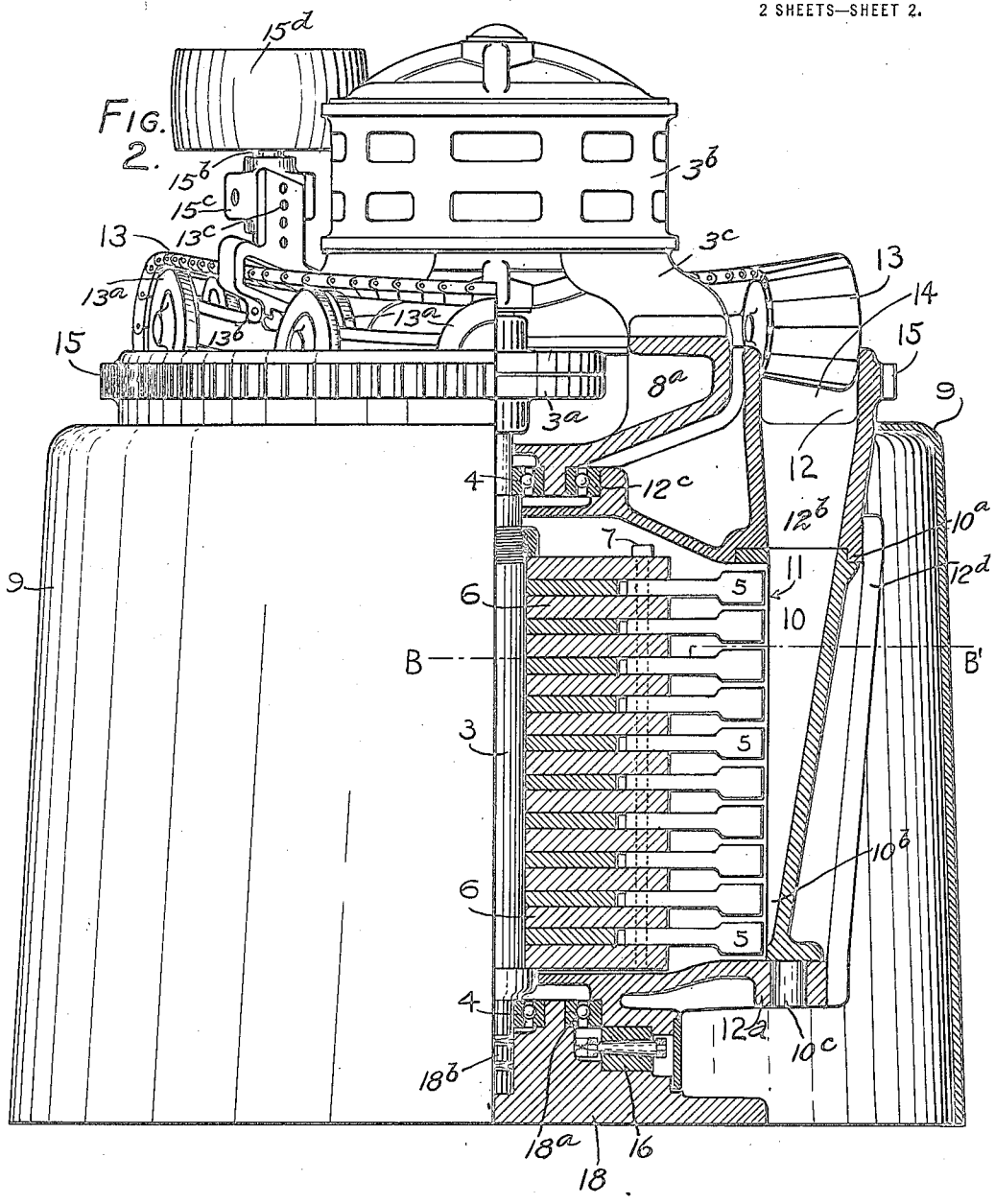
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FIG. 2.



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UNITED STATES PATENT OFFICE.

JOSEPH L. HILLER, OF MATTAPOISETT, MASSACHUSETTS.

CRUSHING AND PULVERIZING MACHINE.

Application filed February 25, 1919. Serial No. 279,144.

To all whom it may concern:

Be it known that I, JOSEPH L. HILLER, a citizen of the United States, residing at Mattapoisett, in the county of Plymouth and State of Massachusetts, have invented certain new and useful Improvements in Crushing and Pulverizing Machines, of which the following is a specification.

This invention relates to crushers and pulverizers, particularly those adapted for secondary reduction and for handling those materials which are of a size comparable with the products of primary crushing machines.

The object of the invention is to produce a machine in which the material to be crushed or pulverized is subject to closer control than in the normal machine and by means of this control to better regulate the product; to provide for an increased co-operation of the active parts; to simplify the apparatus and by dispensing with delicate members to produce a machine which, for a given capacity, shall be of lower cost, shall require less power to operate, shall permit of more rugged design, shall be simple to maintain in efficient operation and in which the cost of crushing and pulverizing shall be materially reduced.

As an illustration, typical of the difficulties which I have sought to overcome, I may cite the familiar hinged hammer crusher or pulverizer, in which a number of rotary beaters are arranged on a horizontal rotor operating in a practically closed chamber except for a feed opening, located above the axis of the rotor, the machine being normally built with a screen member closing the lower part of said chamber and co-operating with the rotor in crushing material. The action varies slightly, dependent upon the direction of travel of the rotor. It will be understood that the impact of the rotor beaters will be proportional to the resistance met with, and the resistance of small pieces of material, unrestrained except for the action of gravity will be small. Following the initial impact of material and rotor, there will be a grinding action which to some extent effects a reduction of the material but with a relatively high expenditure of power in overcoming the frictional resistance of the material as it is forced over the chamber surface and inefficiently worn away, in contrast to the effective crushing by impact.

I am aware that the vertical rotors in crushing machines are not new and that in various types of crushers, especially those employing rolling crushing members, that the material to be crushed has been held on rotary members but in machines differing from my invention.

In the feature of the control of the resistance offered by the material to the impact of the rotor resides an important element of my invention. I am able to adjust, at will, the resistance of the material to the impact of the rotor, and by this control of the work done on the material, I am able to control the sizing of the product.

Following my invention, it is possible to employ a considerable number of feeding ports, each of which has approximately the same impact crushing capacity as has the single feeding port of an old style machine with similar rotor, and with my machine all of the material is under perfect control as to speed of feed and independently as to resistance to impact by the rotor.

I attain the objects of my invention as herein described, or shown in the drawings.

Referring to the illustrations, Fig. 1 represents a plan view, partially in section, of a machine constructed in accordance with my invention, and showing a rotor, which may be made in accordance with the design of any of the impact type rotors, the material holding members and crushing parts, together with the annular feeding trough, with means for rotating it, the casing, and outside framework, and attached thereto the forcing feeders.

Fig. 2 is an elevation, also partly in section, illustrating the mechanism for feeding the material to the machine, the framework 8 of Fig. 1 being omitted and a motor, for driving rotor, being shown.

In detail, the various members being indicated by reference numerals of like character in the several views, the principal elements are as follows:

The rotor shaft may be located by reference numeral 3. The upper end of shaft 3, is shown connected, by means of a coupling 3^a, to the driving motor 3^b, which, by legs 3^c, rests on the upper stationary member 8^a. Although the machine is well adapted for such a motor drive, it is obvious that other driving means might be substituted without affecting the favorable results obtained by the use of this machine. The bearings for

the shaft are numbered 4. The rotor beaters 5 are carried by members 6 by means of rods 7. The rotor shaft bearings marked 4, are supported on a base plate 18 and an upper member 8^a, which in turn is mounted on framework 8 and to which is attached the outer casing 9. The rotatable trough 12 is connected by stays 12^d, and by the series of feed holding sections 10, with the lower rotatable member 12^a, which is shown carried on roller bearing 16, and ball bearing 18^a, and together these rotatable members constitute a cage. This cage may be rotated by means of the gear 15, pinion 15^a, shaft 15^b, held in bearing 15^c, and driven by pulley 15^d. The pulley 15^d is preferably driven by a belt from a variable speed countershaft not shown. The feed holding sections, or ports 10, have anvil blocks marked 11 against which the material is supported while being crushed by the rotor. The port wall 10^h is shown vertical and the port wall 10^g, inclined as variations which affect the freedom of feeding of material through the feed holding member 10. The several pendent feeding branches 12^b connecting with the ports 10, are a part of and take their supply of material to be crushed from the open, annular trough or feed ring 12, which rotates under the two forcing feeders 13. The ports or feed holding sections 10, are preferably tapered being large at the intake end joining branches 12^b, and narrowing to end marked 10^b, so that material to be pulverized will be carried towards the rotor as it passes along the feed holding section 10 by gravity or by a mechanically forced feed. Each port 10, therefore, is always, through its connecting feeding branch 12^b, in direct connection with the annular feed ring 12 by means of which material may be continuously supplied.

Each feed holding section 10, is pivoted both to feed ring 12, at 10^a, and to supporting member 12^a, at 10^c, and may have a lever or arm 10^d as shown in Fig. 1 by which it may be swiveled and held in position as by a pin 10^f, inserted in any one of a series of holes 10^e, as shown, or a screw adjustment may be used, to vary the relation of edge 11 to the rotor. At points 14, between the ends 13^d and 13^e of the forcing feeders 13, the material to be crushed may be delivered directly from an overhead bin, or otherwise fed to the machine. Each forcing feeder 13, consists of an endless belt supported on idlers 13^a which, in turn, are carried by a skeleton 13^b, which is secured to the main supporting framework 8 by bolts 13^f, shown in the left quadrant of Fig. 1. A hinged portion 13^c, attached to the skeleton 13^b, as shown in Fig. 2 is provided with a series of holes to facilitate its adjustment, which affects the quantity of feed. In operative adjustment one end 13^d, of the feeder 13, which is adjacent to feeding point 14 is higher than its opposite end 13^e. Thus material deposited in the annular trough 12, at the feeding point 14, in rotating with the annular trough, is carried under the elevated end 13^d of the belt, and continuing is pressed down in the trough 12 and out through the feeding branches 12^b and into the crushing ports 10, as it rotates towards the lowered end 13^e of the feeder. The inclined endless feeding belt, as shown in the drawings, would not begin to operate until material were deposited in the trough 12, following which rotation of the trough carrying the material would, through the medium of the material contacting on the under side of the endless feeding belt, drive it. Other driving means might be employed for the endless feeding belt or in place of the endless feeding belt, a stationary inclined shoe could be used, under which some materials would slide, but the friction between the rotating material and the stationary shoe might be objectionable.

From the foregoing description of the structure, it will be understood that the feed ring 12 and the frame 12^a, rotate in unison and carry by pivotal attachment the circularly disposed feeding port sections 10 around the rotor at such rate of speed as may be desired in order to hold the material in the feeding port sections 10, with such degree of centrifugal force as will best suit the proper co-operation with the rotor in meeting the crushing requirements. The gear 15 normally rotates the feed ring 12 and with it the feeding port sections 10, in the opposite direction from that taken by the rotor, but may rotate in the same direction, but at relatively slow speed, or the feeding port sections may be stationary. In operation, the rotative speed of the cage, if sufficient to develop a centrifugal force in excess of the force of gravity, places the material to be crushed, under perfect control. In the preferred method of operating, the rotative speed of the material augments the speed of the rotor and thus increases the force of the blows as the rotor strikes against the material carried by the feeding sections, or ports.

If fine crushing is desired, the feeding branches, or ports 10, will be adjusted so as to bring the anvil blocks 11 adjacent to the path of the beaters 5. A further adjustment may be made by increasing the speed of the cage, carried on frame 12^a, which has the effect of more firmly holding the material in the feeding sections, or ports 10. Coupled with the last adjustment, an adjustment should be made in the forcing feeders 13, by adjusting their angle so that a smaller feed per revolution will be forced into the feed ring, unless it is desired to operate the machine at higher capacity. By reducing

the angle, and thereby the feed, of the forcing feeders 13, the fineness of the product may be increased as desired.

From the foregoing description, it will be seen that the machine provides a positive adjustment of the amount of material delivered through the feed ring, the amount being regulated by adjusting the angle of the forcing feeders 13. Again, the quantity of material fed to the machine will be controlled by the speed of rotation of the cage members 12, 12ª and 10, if, with such changes of speed, there is no adjustment of the feeders 13. It is thus seen that we have two independent methods of positively controlling the quantity of material fed to the machine.

We may control the size of the product in three ways. First, by an adjustment of the feed holding sections, or ports 10, to bring the anvil blocks 11 closer to the rotor for fine crushing and farther away from the rotor for coarse crushing, or second, by increasing the speed of rotation of the feeding members without increasing the amount of material fed we may secure finer crushing and conversely, by decreasing the speed of rotation of the feeding members without changing the quantity of material fed to these members, we will secure coarser crushing, and third, without changing either the position of the anvil block 11 and without changing the speed of rotation of the feeding members, we may, by decreasing the angle of the forcing feeders 13, secure finer crushing or by increasing the angle of the forcing feeders and thereby feeding more heavily, we will secure coarser crushing.

Having provided, by my invention, for the accurate control of the material as it is presented to the rotor, it is unnecessary to provide screen plates with this machine, for the rotation of the feed holding sections, or ports, develops sufficient centrifugal force to hold the material in these sections, or ports, and makes it possible for the rotor to accurately slice off the material, and thereby to secure an evenness in the size of product unattainable in the old style crushers. In machines, of the impact rotor type, which employ screens it is found that these members are annoying not only because of their short life, but because of the lack of reliability which their delicacy entails and the disastrous results which may accompany the breaking of such screens, if the accident is not observed and repairs promptly made.

It is to be noted that, in the embodiment of this invention, there are no weak or fragile members, that inefficient grinding is avoided, that I have perfect control of the feeding of the material as regards quantity, that I can accurately govern the resistance to the impact of the rotor, that the size of the crushing is controllable at will and that because of my ability to properly hold the material in position to be most effectively acted upon by the rotor through my ability to control the centrifugal force employed for this purpose, I am able to multiply the feeding ports and increase the capacity of the machine. This multiplied capacity of the machine materially reduces the cost of a machine for a specified production, saves in space required for the crushing operation and by utilizing, for effective additional crushing, the power which is so wasted in the machines of the prior art, there is a great economy in power consumption.

It is evident that, without departing from the spirit of my invention, certain variations in structure may be made such as the feeding arrangement, in introducing screens, or solid members, between the feeding ports, and in drawing off the finished material with currents of air instead of letting it settle by gravity. The rotor may also be so shaped, as, in rotation, to generate a frusto-conical or other surface and the feeding ports may be suited to such other form of rotor.

What I claim is:

1. In a crushing or pulverizing machine, a rotor, a plurality of members adapted to revolve around said rotor, independent of said rotor and feed material to said rotor, for the purpose of crushing such material.

2. A crushing or pulverizing machine consisting of a vertically supported rotor, a series of spaced feed holding members arranged circumferentially around said rotor and adapted to hold the material while being pulverized by contact with said rotor, means for feeding said holding members with said material and driving means for both the rotor and the material holding members.

3. A crushing machine comprising a rotor having coacting crushing portions, a member, adapted for positively rotating material to be crushed or pulverized, said member being revoluble circumferentially outside of the crushing portions of said rotor and means for feeding said member with said material.

4. The combination in a pulverizing device of a pulverizing rotor, with a rotatable feed ring having spaced feed holding sections thereon open to said rotor, and means for feeding material from said feed ring to said sections.

5. A crushing machine consisting of a frame, a rotor supported on said frame, a series of material holding and feeding members adapted to feed material longitudinally of the rotor and revoluble outside of and about said rotor.

6. A crushing machine consisting of a rotor, a series of holding and feeding members, located outside of and revoluble about said

rotor, each of said holding and feeding members arranged with that portion of its surface adapted to hold material against the action of centrifugal force, and being tapered in such a manner that as material to be crushed is fed into said holding members, it will approach the surface described by the rotation of the rotor, said members being properly mounted in a frame.

7. In a crushing machine, the combination of a rotor, a receptacle located circumferentially outside the active crushing portion of said rotor for holding material to be crushed and having a wedge shaped opening for the reception of said material, said holding member being located outside of and adapted to rotate about said rotor and means for forcing material along said wedged shaped opening.

8. A crushing machine comprising a rotor, a series of members located outside of and rotatable about said rotor, said members being adapted to receive wedge shaped bodies of material to be crushed, and with spaces between said members, for the exit of crushed or pulverized material.

9. A crushing machine consisting of a properly supported rotor, a member adapted to receive, hold and feed to the rotor material to be crushed, said holding member located outside of and being rotatable about said rotor and adapted to swing to permit of varying the distance between an edge of said member and the surface described by the rotor.

10. A crushing machine comprising a suitably mounted rotor and a series of material holding members rotatable about said rotor, each of said members being adjustable to vary the distance between said members and the rotor.

11. A crushing machine consisting of a suitably mounted rotor, a series of material holding members revoluble about the active crushing portion of said rotor and adapted to present material to said rotor, an annular trough adapted to receive material and to distribute said material to the several holding members.

12. In a crushing machine, a combination of a suitably mounted rotor, a series of rotatable material holding members adapted to receive material and to present it to said rotor and means outside said rotor adapted to force material into said holding members.

13. In a crushing machine, the combination of a beater rotor, a wall outside of and revoluble about said rotor adapted to positively carry, support and present material to said rotor for crushing action thereby.

14. In a crushing machine the combination of a rotor and a series of separate and spaced apart feeding and holding members arranged circumferentially about and open to said rotor, and adapted to co-operate.

15. In a crushing machine the combination of a rotor and a plurality of hollow feeding and holding members circumferentially disposed about said rotor and adapted to permit crushed material to escape between said feeding and holding members, said feeding members being open to said rotor.

In testimony whereof I have affixed my signature in the presence of two witnesses.

JOSEPH L. HILLER.

Witnesses:
GEO. A. WILLMANUS,
HANNAH MARKOWITZ.