

J. L. HILLER.

MACHINE FOR CRUSHING AND PULVERIZING MATERIAL.

APPLICATION FILED DEC. 31, 1909.

1,051,887.

Patented Feb. 4, 1913.

2 SHEETS—SHEET 1.

Fig 1

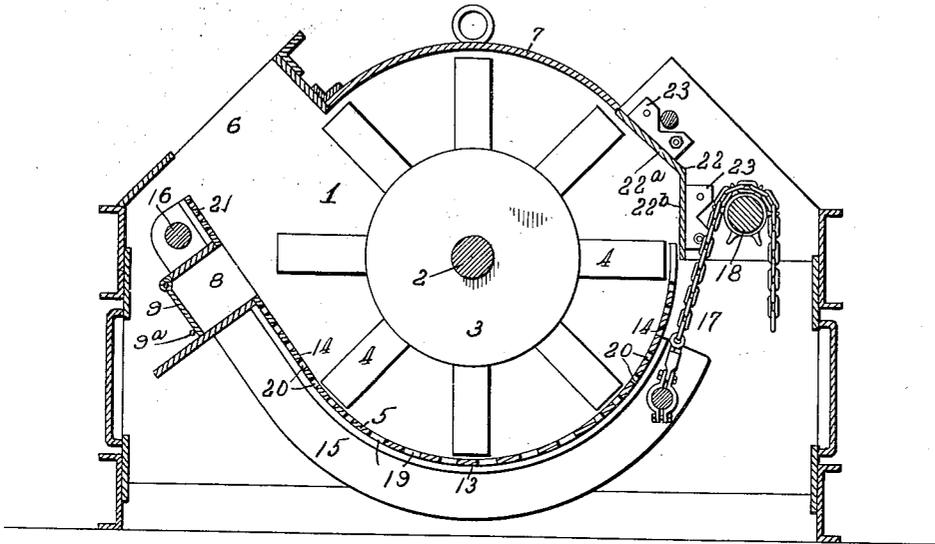


Fig 2

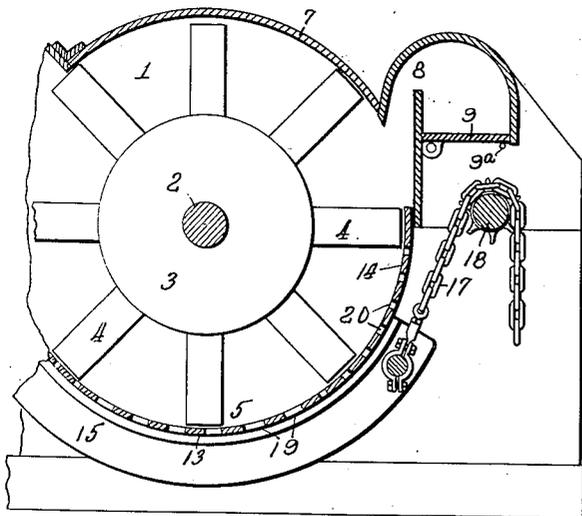


Fig 3

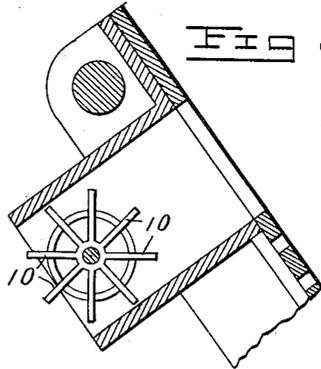
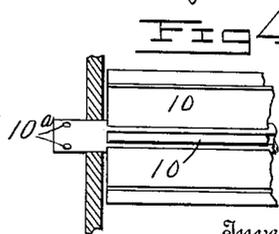


Fig 4



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2 SHEETS—SHEET 2.

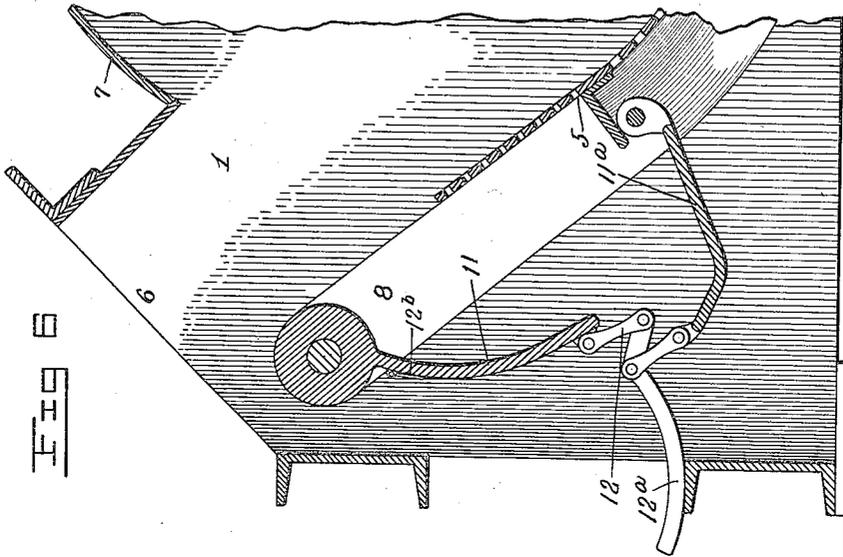


FIG 6

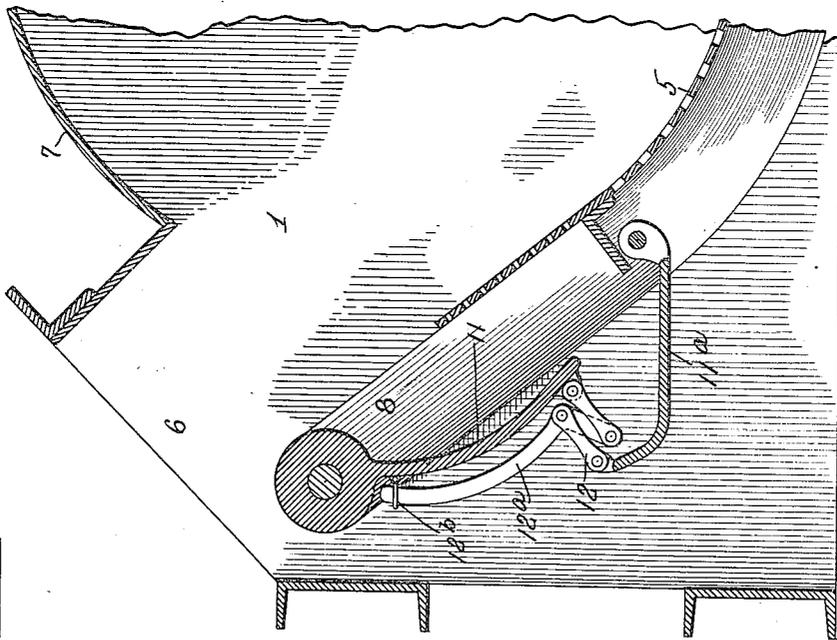


FIG 5

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UNITED STATES PATENT OFFICE.

JOSEPH L. HILLER, OF MATTAPOISETT, MASSACHUSETTS.

MACHINE FOR CRUSHING AND PULVERIZING MATERIAL.

1,051,887.

Specification of Letters Patent.

Patented Feb. 4, 1913.

Application filed December 31, 1909. Serial No. 535,856.

To all whom it may concern:

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

This invention relates to improvements in machines of the pivoted hammer type for crushing or pulverizing material, more particularly, though not exclusively, intended for crushing coal.

The invention has for one of its objects to provide for the discharge from the machine of foreign, uncrushable matter. As illustrative of the value of this part of the invention, in dealing with ordinary run-of-mine coal various metallic objects, such as spikes, fragments of iron, and the like, pass into the machine with the coal, and the presence of these hard substances in the crusher, the elements of which move at a very high speed, is objectionable because of the liability of damage to the machine. Heretofore it has been proposed to make the grinding surface which coöperates with the hammers movable so that it may be lowered sufficiently to enable such foreign substances to be removed, and it has also been proposed to provide such movable grinding-surface adapted to completely dump the contents of the machine and thus relieve it of the presence of such uncrushable matter. These practices, however, have depended mainly upon the vigilance and intelligence of an attendant to whom the only signal of the presence of such foreign uncrushable substance, and the necessity for its removal, has been the audible one of the thumping or pounding of such material in the machine. Should the attendant happen to be absent when such substance enters the machine, or should he not be vigilant and prompt in carrying out the previous practice, danger of damage to the machine or some part thereof is imminent. According to my invention the machine automatically relieves itself of the presence of any such uncrushable matter that may enter with the material to be ground or crushed.

The invention has also for an object the provision of what is known in the art as a pivoted grinding cage or surface, capable of being adjusted relatively to the ends of the hammers to compensate for wear of the

hammers, comprising several fields or sections, the openings for discharging ground or crushed material in said fields or sections being of different size. The value of this portion of the invention consists in this: When the hammers are new their ends move across the grinding surface or cage close to said surface throughout the extent of the latter, because the circle described by the hammer ends is only slightly smaller than the circle of such surface. After the hammers have become worn and shortened so that the circle described by their ends is materially smaller than the circle of the grinding surface or cage, and the latter is adjusted to the hammers, the hammer-ends move close to the intermediate portion of the grinding surface, and at either side of this portion the path of movement of the hammer-ends is farther away from the grinding surface, and the result has been that the material acted on by the hammers in that arc where the latter moves closest to the grinding surface will be swiftly carried over the grinding surface; whereas the material between the hammer-ends and the grinding surface where a greater space intervenes will move less quickly. In these circumstances, it is desirable to have the material-discharge openings or perforations at that part of the cage which, when the hammers are worn and the cage is adjusted, approaches in close proximity to the path of travel of the hammers, and is therefore best adjusted for fine grinding or crushing, and across which the material moves more rapidly, relatively large to facilitate the discharge of material ground to the proper fineness, whereas those parts of the cage over which the material is moving more slowly and which do not sustain the same close relation to the path of movement of the hammers, should be smaller to prevent the passage therethrough of material not sufficiently ground, and to admit of the passage therethrough only material which has been sufficiently ground or pulverized. It may be stated as a rule that the closer the hammers are to the grinding surface the larger may be the openings for a given size of product.

Another object of the invention is to provide for keeping the crushing cylinder a substantially closed one, except for the introduction of material to be crushed and for the exit of crushed material. In some machines as heretofore designed, the grinding-

surface or cage is adjusted to compensate for wear of the hammers, being pivoted at one end and movable at the other end. The range of movement of the free or movable end for such purpose is so little that said end does not very appreciably depart from a straight line, which coincides with the fixed portion of the cylinder-casing.

In practice, when the hammers are new a slight space exists between the end of the grinding-surface or cage and the fixed portion of the casing to afford room for adjustment of the former for the purpose stated. According to the present invention the free end of the grinding-surface or cage laps inside the fixed portion of the casing, so the cylinder is closed at that point in all positions of adjustment of the grinding-surface or cage. This results in the material striking a certain area of the wall of the cylinder which is therefore subject to greater wear than the remaining portions, and to take care of this I provide a reversible wall section.

The invention consists in a machine embodying the features herein described and then pointed out in the claims following the description.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a sectional view of a crushing machine, illustrating the invention. Fig 2 is a similar view showing the pocket to receive foreign material differently located than in Fig. 1. Fig. 3 is a detail illustrating a different form of discharge gate. Fig. 4 is a detail showing one suitable means for rotating the gate illustrated in Fig. 3. Fig. 5 is a detail sectional view illustrating the preferred arrangement of pocket, and Fig. 6 is a similar view showing the pocket open to permit the removal therefrom of material collected therein.

In said drawings, the reference numeral 1 designates the cylinder in which the revolving hammers or beaters move and which constitutes a practically closed chamber except that it has the hereinafter referred to material inlet throat.

2 designates an axle upon which is mounted, as usual, a series of hammer carriers or disks 3, to which are pivotally secured the series of hammers or beaters 4.

5 designates the grinding surface which cooperates with the hammers or beaters for reduction of material introduced into the machine, and 6 designates the inclined inlet throat for the material. The grinding-surface 5 and a cover or top 7 constitute the wall of the substantially cylindrical chamber 1, and the continuity of this wall is interrupted by what I term a pocket 8, extending transversely of the width of chamber 1, the pouch or body of which is located externally of the cylinder and into which

any uncrushable substance introduced into the machine will be thrown by the hammers. This pocket may be located at the inlet throat 6, as shown in Fig. 1, at the far side of said throat with respect to the direction of rotation of the hammers, and with its mouth in a line directly across the field of centrifugal projection exercised by the action of the hammers under the resistant influence of the wall of the chamber until the throat is reached. In the example of my invention illustrated in Fig. 2 of the drawing the mouth of the pocket is located at the far side of and directly across the field of centrifugal projection exercised by the action of the hammers under the resistant influence of the wall of the chamber. That is to say, in each instance illustrated, the mouth of the pocket is located at the far side of and directly across a field of centrifugal projection of the hammers. For example, in the illustration of the invention, Fig. 1 of the drawing, any hard substance which is to be gotten rid of would naturally be projected centrifugally, but this is prevented by the confining wall of the cylinder until it reaches the throat 6, where, being unrestrained, it will enter and traverse a field of centrifugal projection at the far side of and directly across which the pocket is arranged. So also in the illustrative example of the invention shown in Fig. 2 of the drawing, such hard substance will travel in a path concentric to the axis of rotation of the hammers, because of the confining wall of the cylinder, until it reaches the point of interruption of the wall, where it is free to pursue a path of centrifugal projection, at the far side of which is located the mouth of the pocket. In practice if any such substance enters with the material to be crushed or pulverized, it will, by centrifugal action of the hammers or beaters, move along or close to the grinding-surface and upper wall 7 until it reaches the entrance to the pocket when, being unrestrained, it will be thrown, in a line tangential to the movement of the hammers, into the pocket 8. The pocket may fill with crushed material in which event the uncrushable material will strike against and embed itself in such material collected therein.

The pocket is provided with a gate which may be moved to enable the emptying of the pocket and withdrawal of the uncrushable matter deposited therein. This gate may be of any suitable character, such as a pivoted one, 9, shown in Fig. 1, held in closed position in any suitable way, as by means of a cotter pin 9^a, or the gate may be a rotatable one provided with a plurality of arms 19, closing the pocket (as shown in Figs. 2 and 3) and upon rotation of which the material in the pocket is discharged by the arms in which case suitable means are provided

whereby the gate may be rotated to discharge the contents of the pocket, as for example sockets 10^a to receive an operating handle.

5 In Figs. 5 and 6 is illustrated the preferred arrangement of pocket comprising pivoted members 11, 11^a, the free ends of which are connected by a toggle 12 having an operating handle 12^a by which the members 11, 11^a may be manipulated. In Fig. 10 5 the pocket is shown as closed for the collection of uncrushable material, the handle of the toggle being secured to maintain the closed position of the pocket as by means of a ring 12^b. In Fig. 6 the parts are shown when the lever 12^b has been moved to open the pocket to permit an operator to remove the collected uncrushable material therefrom, which may be done at any desired time. In ordinary practice the operation of the machine would be discontinued while the foreign material is being removed, but it may be accomplished while the machine is in operation. The toggle connection 12 may be connected to the pivoted members 11, 11^a, at either side thereof or intermediate the width of the members, and if desired may be duplicated at each side edge of the members, in which event the operating lever may conveniently be in the form of a yoke.

As thus described the machine automatically relieves itself of any foreign uncrushable matter, which may enter with the material to be crushed, by discharging the same into a pocket, from which it may be subsequently removed.

The grinding surface comprises several fields, which may be constituted of several separate sections, as shown, or the structure of the grinding surface may be integral and the fields defined by the size of the openings therein for the discharge of material. For convenience I will refer to such fields as "sections," of which, preferably, there are three, an intermediate section 13 and end sections 14 carried by a frame, consisting of arms 15 pivotally mounted at one end 16 and to the free end of which frame are means such as a chain and winding drum 17, 18, for raising and lowering the same for purposes of adjustment of the grinding surface with relation to the hammers, or for other purpose. The intermediate section 13 of the grinding surface is provided with discharge openings 19 relatively large as compared with the discharge openings 20 in the end sections. This feature of differentiation in the size of the discharge openings of the several sections is important in the respect hereinbefore pointed out, the smaller openings of the end sections preventing passage therethrough of material which has not been crushed or pulverized to the predetermined degree, and the larger openings of the in-

termediate section facilitating the passage therethrough of material sufficiently ground. When the lower wall of the throat 6 is formed by one of the end sections 14, as shown, the pocket 8 may be fashioned as a transverse depression therein, and the perforations 21 at the extremity thereof may be of a correspondingly smaller area, as this field of the perforated cage is designed chiefly to permit the sifting through of material coming to the machine in a state of fineness that needs no further reduction.

For the purpose hereinbefore stated the upper part 7 of the wall of chamber 1, is provided with a section 22 composed of counter-part portions 22^a, 22^b, shown as angularly related, provided with like attaching members 23 adapted to be bolted to the side frames of the machine to hold said section in place. In the use of the machine, referring to Fig. 1, the material propelled by the hammers strikes against the portion 22^a, and this part of the casing is therefore subject to harder usage by the material than the remaining portions of the casing, and it is for this reason that I provide the section with counter-part portions, so that it may be readily reversed to present the surface 22^b in place of the surface 22^a.

Having thus described the invention what is claimed is:—

1. In a crushing machine, the combination of rotating hammers, a cylinder in which the hammers are arranged, which cylinder has an inlet throat and otherwise constitutes a practically closed chamber provided with a grinding surface having passages for the discharge of ground material, and a pocket the body of which is external of the wall of the cylinder and the mouth of which is normally open and communicates with the interior of said cylinder.

2. In a crushing machine, the combination of rotating hammers, a cylinder in which the hammers are arranged, which cylinder has an inlet throat and otherwise constitutes a practically closed chamber provided with a grinding surface having passages for the discharge of ground material, and a pocket the body of which is external of the wall of the cylinder and the mouth of which is normally open and communicates with the interior of said cylinder, said pocket having a gate to facilitate access thereto.

3. In a crushing machine, the combination of rotating hammers, a cylinder in which the hammers are arranged, which cylinder has an inlet throat and otherwise constitutes a practically closed chamber provided with a grinding surface having passages for the discharge of ground material, and a pocket, the body of which is external of the wall of the cylinder, and the mouth of which is normally in open communication with the interior of the cylinder and located

on the far side of a field of centrifugal projection and across the path of centrifugal projection of material projected by the hammers.

5 4. In a crushing machine, the combination of rotating hammers, a cylinder in which the hammers are arranged, which cylinder has an inlet throat and otherwise constitutes a practically closed chamber provided with a
10 throat for the admission of material thereinto, and with a grinding surface having passages for the discharge of ground material, and a pocket located at the far side
15 of said inlet throat with respect to the direction of movement of the hammers, the body of which is external of the wall of the cylinder and the open mouth of which is in communication with the interior of the cylinder.

20 5. In a crushing machine, the combination of rotating hammers, a cylinder in which the hammers are arranged, which cylinder has an inlet throat and otherwise constitutes a practically closed chamber provided with

a grinding surface having passages for the
25 discharge of ground material, a pocket the body of which is external of the wall of the cylinder and the mouth of which communicates with the interior of said cylinder, said
30 pocket provided with a gate comprising movable members, and means for moving said members to afford access to the pocket.

6. In a crushing machine, the combination of rotating hammers, and a cylinder in
35 which the hammers are arranged, said cylinder provided with a grinding surface having passages for the discharge of material therethrough, the passages of the intermediate portion of the grinding surface being
40 of greater area than those of the end portions.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOSEPH L. HILLER.

Witnesses:

S. ELLA MATSON,
F. L. HILLER.