C. O. HASKELL.

ORE CRUSHER AND CONCENTRATOR.

APPLICATION FILED DEC. 28, 1914.

1,200,104.

Patented Oct. 3, 1916.

3 SHEETS—SHEET 1.

Fig. 1.

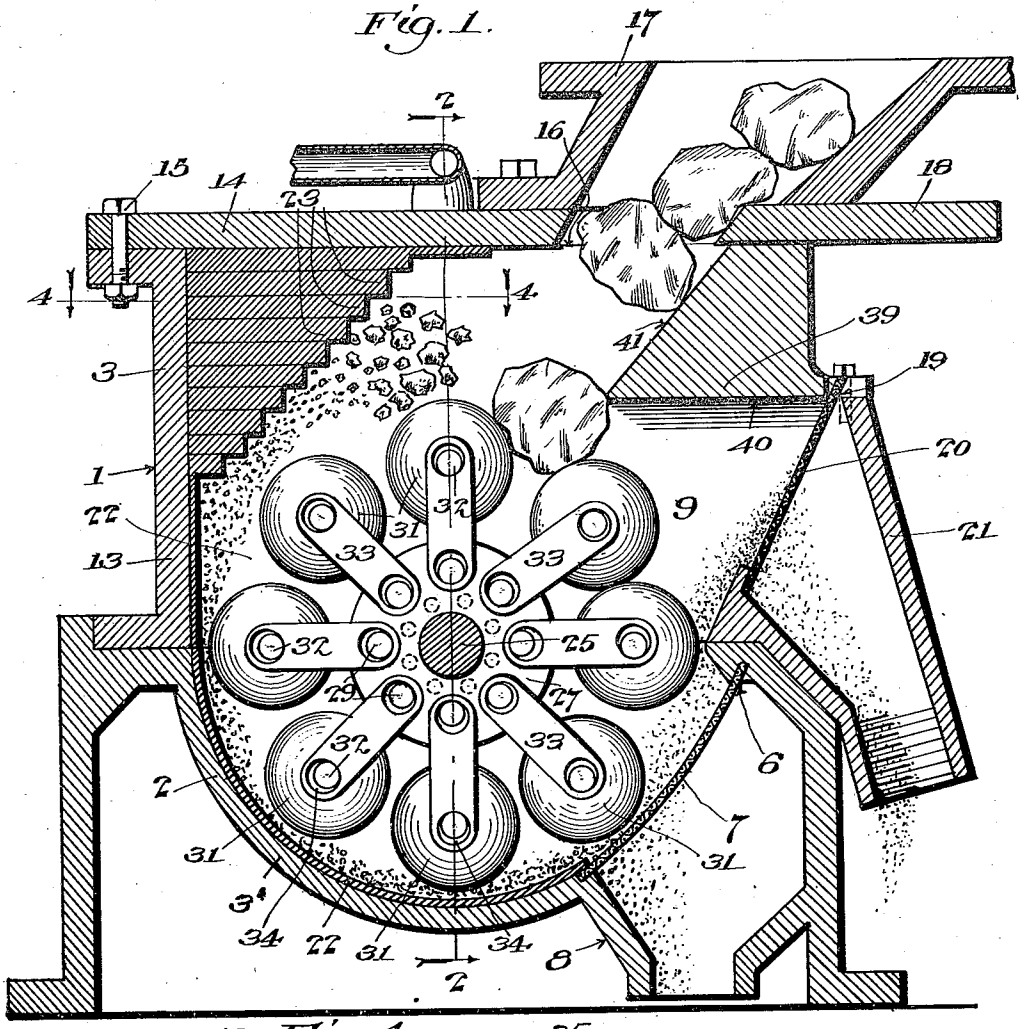
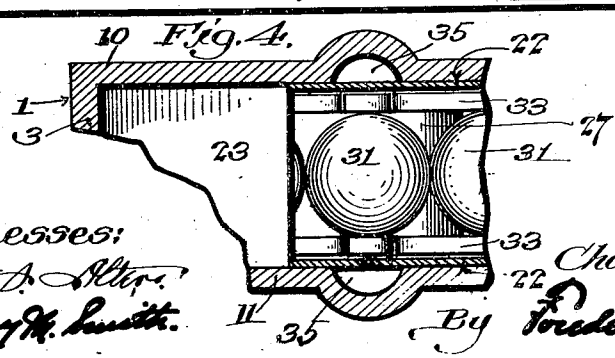


Fig. 4.



Witnesses:

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3 SHEETS—SHEET 2.

Fig. 2.

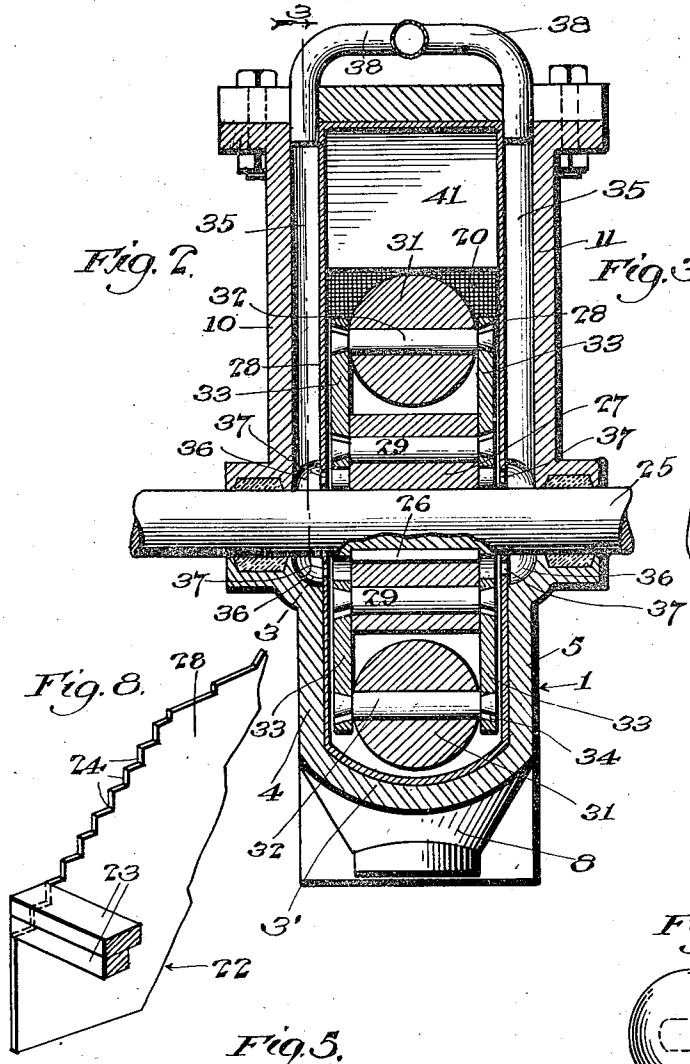


Fig. 3.

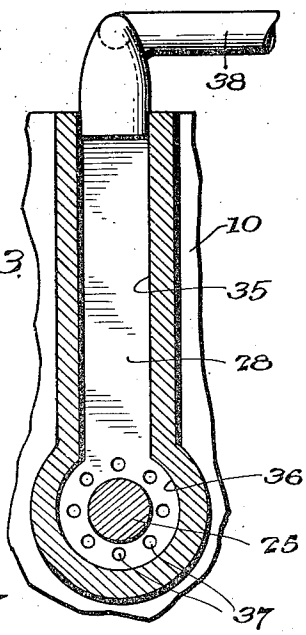


Fig. 8.

Fig. 6.

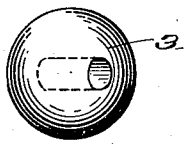


Fig. 5.

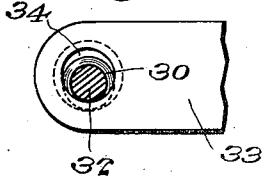
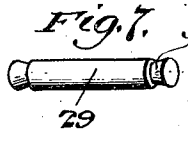


Fig. 7.



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1,200,104.

Patented Oct. 3, 1916.

3 SHEETS—SHEET 3.

Fig. 9.

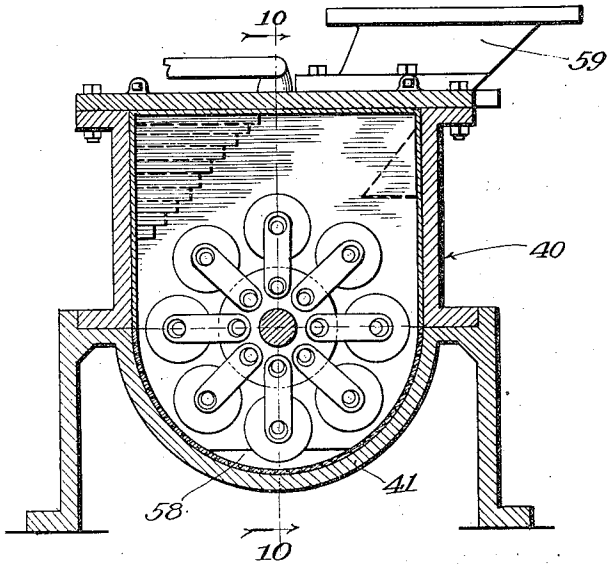
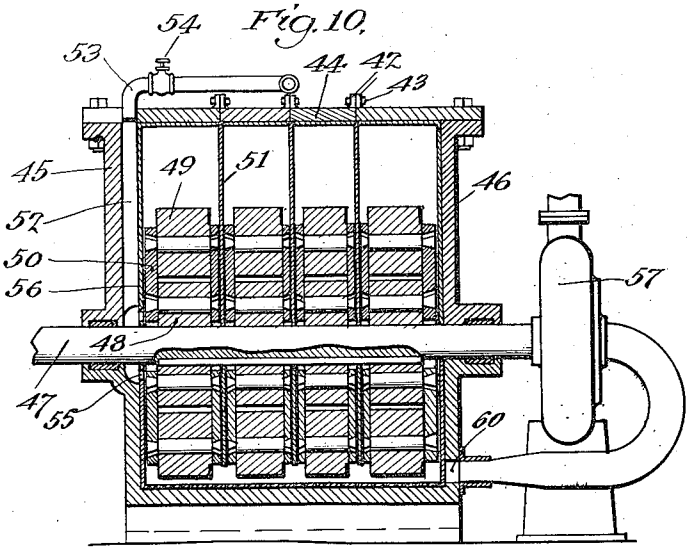


Fig. 10.



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UNITED STATES PATENT OFFICE.

CHARLES O. HASKELL, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO CENTRIFUGAL MACHINERY COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

ORE CRUSHER AND CONCENTRATOR.

1,200,104. Specification of Letters Patent. Patented Oct. 3, 1916.

Application filed December 28, 1914. Serial No. 879,289.

To all whom it may concern:

Be it known that I, CHARLES O. HASKELL, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Ore Crusher and Concentrator, of which the following is a specification.

This invention relates to crushing, pulverizing and concentrating machines, and more particularly to a machine of this nature especially adapted for handling ore in such fashion that it will be crushed, pulverized and separated, the concentrates being discharged at one point and the tailings at another point.

One of the objects of the invention is to provide a strong, substantial and very efficient and practical crushing and concentrating machine which will readily handle ore in any form, and which will crush, pulverize and separate the ore so that the concentrates may be discharged through one opening and the tailings and dust through another opening.

A further object of the invention is to provide a machine of this nature which makes use of an air current to carry off the dust with the tailings through one discharge opening and to also prevent grit and dust collecting on the axles of the grinding mechanism.

A further object of the invention is to provide a machine in which many of the parts are both reversible and interchangeable, and a machine which may be easily assembled, and in which worn parts may be easily renewed.

With these and other objects in view, the invention consists in certain novel features of construction, combination and arrangement of parts as will be hereinafter fully described, illustrated and claimed.

Figure 1 is a vertical sectional view through the machine. Fig. 2 is a section on the plane of line 2—2 of Fig. 1. Fig. 3 is a vertical section on the plane of line 3—3 of Fig. 2, showing one of the air passages formed in the casing wall. Fig. 4 is a fragmentary horizontal sectional view taken on the plane of line 4—4 of Fig. 2. Fig. 5 is a detail view showing an axle and an arm of the machine. Fig. 6 is a detail view of one of the hammers. Fig. 7 is a perspective view of one of the axles on which the hammers are mounted. Fig. 8 is a perspective view showing a portion of the casing lining and a portion of two of the plate abutments. Fig. 9 is a transverse sectional view through a slightly modified form of my crushing machine. Fig. 10 is a longitudinal sectional view on the plane of line 10—10 of Fig. 9.

In general, the crushing, pulverizing and concentrating machine forming the subject matter of the present application comprises a casing having a concave grinding surface, discharge openings and abutments; grinding mechanism operable within said casing; and means for setting up an air current which will carry off the dust from the interior of the casing and prevent dirt and dust settling on the axles of the grinding mechanism.

Referring in detail to the drawings by numerals, 1 designates as an entirety the casing of the machine, and this casing is preferably formed of a lower section 2 and an upper section 3. The lower or base section is preferably a casting and is formed with a curved lower wall 3′ having a concave inner face and side walls 4, 5. The wall 3′ is cut away adjacent one end to form a discharge opening 6, and this opening is covered by a screen 7. A spout or hood 8 is formed externally of the casing about the opening 7, and is designed to be connected to a closed tank, not shown, when the machine is in operation. It is through this spout that concentrates are discharged, as will be hereinafter explained.

The upper section 2 rests upon the lower section and completes the crushing and pulverizing chamber 9. This upper section is formed with side walls 10 and 11, the latter being removable, and an end wall 13. The top of the casing is closed by a wall 14 secured in position by suitable fasteners such as the bolts 15, and this wall is formed with an opening 16 above which is mounted a hopper 17, and a gate 18 is provided to regulate the size of the passage connecting the hopper with the interior of the casing. The side of the casing 1 opposite the wall 3 is cut away to form an opening 19 through which the dust and tailings are discharged. This opening is covered by a screen 20 and is surrounded by a discharge spout 21, which is designed to be connected to an open tank, not shown. The interior walls of the casing

1 are covered by a lining 22 formed in two sections, as shown, for the purpose of facilitating insertion and removal, and this lining serves to support a plurality of plate abutments 23. As clearly shown in Figs. 1 and 8, the sides of the lining are cut away in step formation to provide shoulders 24, and the shoulders support the plate abutments 23. Referring to Fig. 1, it will be seen that each abutment is somewhat wider than the next lower one, and therefore when the abutments become worn, they may be removed and fitted in a lower position, and thus used again. This is one of the important features of my invention, since it makes for economy and practicability. The arrangement whereby each abutment is smaller than the one next higher makes it unnecessary to provide bolts or other fastening means, and therefore the machine may be very quickly assembled in so far as this particular feature is concerned.

A shaft 25 extends transversely through the crushing chamber 9, and has rigidly secured thereto by means of a key 26, a circular hub 27 of less width than the distance between the side walls 28 of the lining 22. The hub carries a plurality of axles 29 which extend transversely therethrough, which are arranged in a circle concentric with the shaft 25, and which extend a slight distance beyond the side faces of the hub. The terminal portions of the axles are tapered inwardly from their ends, as indicated by the numeral 30, and is clearly shown in Fig. 7. A plurality of spherical hammers 31 having axles 32 similar in all respects to the axles 29 are provided, and these last mentioned axles are connected to the axles 29 by means of arms 33 which have circular openings 34 adjacent their terminals to receive the inwardly tapered end portions of the axles. The openings in the arms are tapered inwardly, as best shown in Fig. 2, but the smallest diameter of these openings is greater than the largest diameter of the axles, so that the arms may be easily slipped over the ends of the axles. The arms are held in position by means of the side walls 28 of the lining, as will be readily understood by reference to Fig. 2 of the drawings.

It is noted that the spacings of the abutments 23 from the circular plane in which the hammers 31 rotate are gradually reduced downward. The advantage of this is that the ore will be broken into more minute fragments at the lower abutments than at the higher abutments so as to insure against relatively large pieces of the ore getting between the lining 22 and hammers.

In order to prevent dust and grit collecting on the central axles and to provide a means for carrying off the dust and tailings through the spout 21, I introduce into the crushing chamber a blast of air. This is done by forming in the side walls 10 and 11 of the upper casing section, the circular passages 35, said passages being created by offsetting the walls as best shown in Fig. 4. The lower ends of the passages are circularly enlarged as at 36, and the lining is formed with an annular series of openings 37 around the hub and opposed to each of said circularly enlarged portions 36. Pipes 38 are connected at their upper ends to the air passages 35, and when air is forced into these pipes, it passes through the passages 35 into the enlarged portions 36 thereof and then through the openings 37 into the crushing chamber 9 immediately around the hub, and from this point the air radiates outwardly between the arms 33, and carries away from the hub all dust and dirt which would tend to collect thereon and cause excessive wear on the axles and arms. This air may be forced into the casing 9 or the suction which is set up by the rapid rotation of the hub and grinding mechanism may be depended upon to draw in a sufficient quantity of air for the purpose indicated. The upper section of the casing 1 is provided with an abutment 39 above the opening 19. This abutment has a horizontal lower face 40 which extends a considerable distance toward the vertical center line of the crushing chamber, and is provided with an upwardly and outwardly inclined face 41, which extends toward the feed opening 16. The abutment prevents the air which is drawn into the casing passing upwardly out of the opening 16, and serves to direct said air into the discharge spout 21. The current of air will serve to carry the dust out of this discharge spout and will also assist in drawing the tailings through the discharge spot 21.

The ore as it is fed into the crushing chamber through the opening 16 comes in contact with the rapidly revolving spherical hammers 31 and is thrown against the plate abutments 23 and broken into smaller pieces. From the abutments 23 the partly crushed ore travels downwardly along the concave grinding surface and is crushed and pulverized by the action of the hammers, and also by the attrition which is caused. When a heavy lump of ore strikes the hammers at its point of entrance into the crushing chamber, it forces the hammer immediately under it backwardly against the next following hammer, and then the combined weight and force of these two hammers act to throw the ore with increased power against the abutments 23. The hammers are very heavy and usually act to crush the ore before it strikes the abutments 23. It will be noted that these hammers are free to revolve, and that they also have a movement longitudinally of the arms by which they are carried, and this

is very important because it some times happens that a large lump of ore will pass down onto the concave grinding surface, and the hammer must move inwardly in passing over this piece of ore, for otherwise the machine will be strained. The arms themselves have a slight longitudinal movement, and this also reduces the strain and jar upon the crushing mechanism. When the crushed and pulverized ore reaches the screen 7 the heavy concentrates will drop through, but the tailings and the dust will be carried on upwardly by the current of air which enters through the openings 37, and will pass through the screen 20. The spout 8 is connected to a closed tank, therefore there is no air current to draw the tailings and dust through this spout, but the spout 21 is connected to an open tank and hence the air current is not broken or destroyed.

It will be noted that the arms are both interchangeable and reversible, and also that the axles are interchangeable and reversible. This features is of advantage since it is possible by changing and reversing the parts to have them all wear alike, and as it also reduces the number of different formations which must be made when the machine is being manufactured. In other words, it both increases the life of the machine and reduces the cost of manufacture.

In Figs. 9 and 10 I have shown a modified form of crusher and pulverizer wherein the screens 7 and 20 have been dispensed with. In these figures, 40 designates as an entirety the casing which is preferably formed with a base 41 here shown as a single member which member is in sections so as to be more easily and conveniently handled. The upper portion of the casing is formed by a plurality of sections 42 secured together by bolts 43 passing through ears 44. The end walls of the casing are designated by the numerals 45 and 46. A shaft 47 extends longitudinally through the casing and carries a plurality of hubs 48 to which are secured a plurality of cylindrical hammers 49 by means of arms 50. The hammers 49 are connected to the hubs in the same fashion as the hammers 31 are connected to their hubs. The casing is divided into a plurality of compartments by the partitions 51 and one hub and set of hammers is arranged to rotate in each of the compartments. The end wall 45 is formed with an air passage 52 in communication at its upper end with a supply pipe 53, the passage through which is controlled by a stop cock 54. Air is forced through the passage 52 into the interior of the casing through the openings 55 in the lining 56 and a suction pump 57 is provided for the purpose of drawing the air through the casing. The partitions stop short of the bottom of the casing leaving a passage 58 best shown in Fig. 9 through which the pulverized ore is sucked. The speed at which the material passes through the crusher may be regulated by means of the stop cock 54 which controls the flow of air into the casing. This form of pulverizer and crusher may be adjusted to divide the ore into very fine particles and the degree of fineness may be varied by regulating the force of the suction set up within the casing.

Ore is fed into the machine through the hopper 59 and is fed by the first annular series of hammers 49 and the size of the lumps reduced somewhat. Then the ore passes into the next compartment and is further crushed by the second annular series of hammers, and this process is repeated until the last compartment is reached and from here ore is sucked out through the discharge opening 60. The pump will operate to draw water through the machine as well as air.

What I claim is:

1. In a crushing machine, a casing, crushing mechanism operable within said casing, the casing being formed with air channels in its walls, said channels opening upon the interior of the casing adjacent the center thereof, and means for introducing air into the outer ends of the channels.

2. In a crushing machine, a casing, crushing mechanism operable within said casing, a channel formed in one side wall of the casing and opening at its inner end upon the interior of the casing near the center line of the crushing mechanism, a lining within the casing, said lining being perforated opposite the inner end of the channel to establish communication between said channel and the interior of the casing, and means whereby air may be forced into the outer end of the channel.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 18th day of December, 1914.

CHARLES O. HASKELL.

In presence of—

LORA M. BOWERS,

ANNA F. SCHMIDTBAUER.