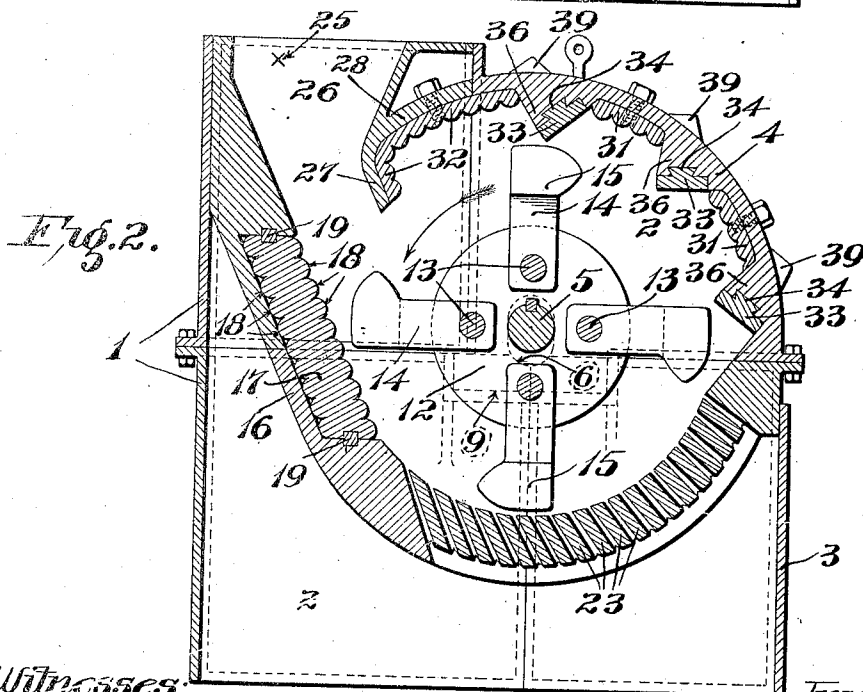
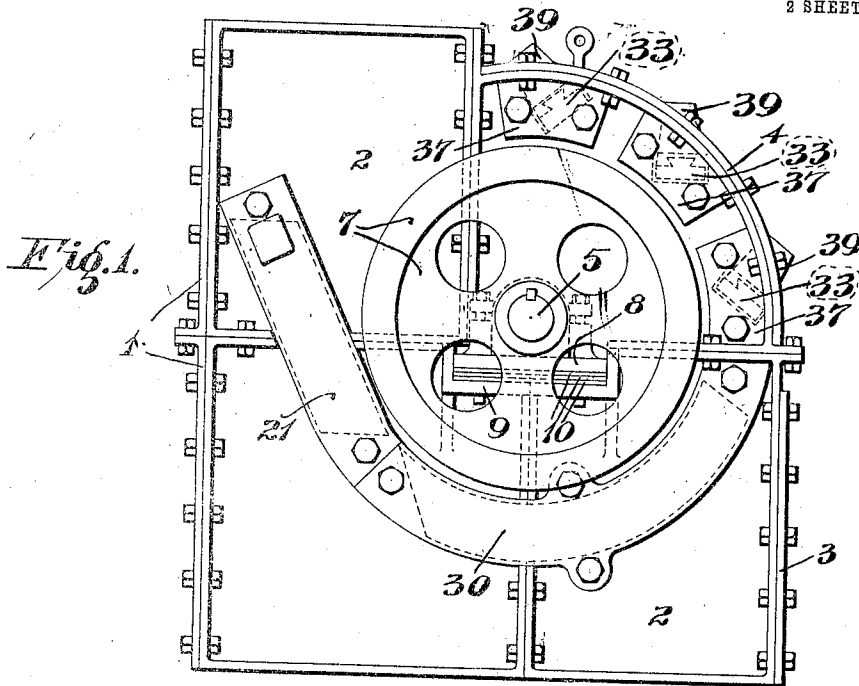


F. L. BUCHANAN.
CRUSHER AND PULVERIZER.
APPLICATION FILED SEPT. 4, 1909.

981,477.

Patented May 9, 1911.

2 SHEETS-SHEET 1.



Witnesses:

Edgar T. Farmer,

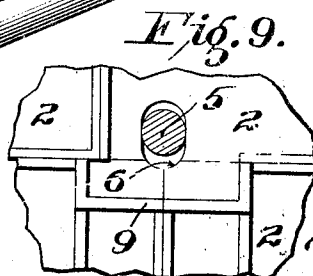
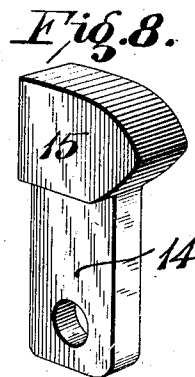
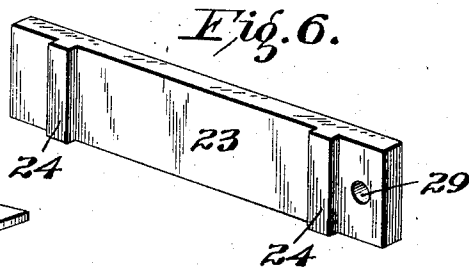
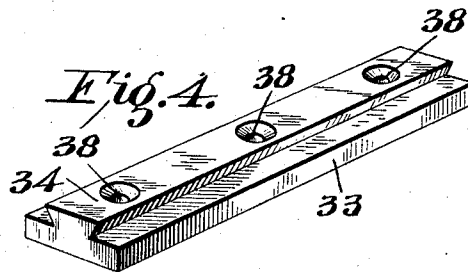
G. A. Pennington

Inventor.

Frank L. Buchanan,
By *Carroll Davis*,
Attys

991,477.

2 SHEETS--SHEET 2.



G. A. Pennington

By Court &
attys.

UNITED STATES PATENT OFFICE.

FRANK L. BUCHANAN, OF ST. LOUIS, MISSOURI, ASSIGNOR TO FRANK L. BUCHANAN MINING MACHINERY MANUFACTURING COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

CRUSHER AND PULVERIZER.

991,477.

Specification of Letters Patent.

Patented May 9, 1911.

Application filed September 4, 1909. Serial No. 516,221.

To all whom it may concern:

Be it known that I, FRANK L. BUCHANAN, a citizen of the United States, and a resident of the city of St. Louis and State of Missouri, have invented a new and useful Improvement in Crushers and Pulverizers, of which the following is a specification.

This invention relates to machines for crushing and pulverizing ores, stone, shale, fire clay, mineral paints and other materials.

It has for its principal objects to secure a perfect crushing and pulverizing action; to minimize wear upon the parts; to avoid forcing the material out of the feed opening; to avoid clogging or choking the screening cage; to make the wearing parts interchangeable and reversible; and to improve generally upon machines of like character.

The invention consists in the parts and in the arrangements and combinations of parts hereinafter described and claimed.

In the accompanying drawings which form part of this specification, and wherein like symbols refer to like parts wherever they occur, Figure 1 is a side elevation of crushing and pulverizing machine embodying my invention; Fig. 2 is a vertical section of the same; Fig. 3 is a fragmentary section showing the manner of securing the secondary breaker plates in reversed position; Fig. 4 is a perspective view of a secondary breaker plate detached; Fig. 5 is a perspective view of one of the liners or shims for adjusting the bearings for the hammer shaft; Fig. 6 is a perspective view of one of the cage bars; Fig. 7 is a perspective view of the initial breaker plate and one of the securing keys therefor; Fig. 8 is a perspective view of one of the hammers; and, Fig. 9 is a fragmentary view showing the slot in the side plate of the machine for permitting the hammer shaft to be adjusted vertically.

The machine as illustrated in the drawing comprises a sectional shell or casing. The front wall 1 preferably comprises two plates; the side walls 2 comprise four plates each; the rear wall 3 comprises one plate; and the top or cover 4 comprises one plate. The four plates on each side and two front plates are preferably flanged at their meeting edges and bolted or riveted together; and the plates of the front and rear walls and the top are secured to the adjacent side plates. The arcuate top or cover plate 4 is

curved substantially concentrically with respect to the axis of the horizontal rotatory hammer shaft 5. The ends of the hammer shaft 5 extend through vertical slots 6 in the opposite side walls 2 to the outside of the machine. On one end of the shaft is secured a fly-wheel 7 and on the opposite end may be secured a pulley (not shown) for a driving belt or any other suitable driving device may be employed. The hammer shaft 5 is journaled in bearings 8 which are mounted on shelves or brackets 9 projecting laterally from the outer faces of the side walls 2. The bearings 8 may be readily adjusted vertically by using liners or shims 10 between the same and the top of the shelves. The shims 10 are preferably rectangular plates which are slotted transversely from one side near each end as at 11 so as to be readily inserted and withdrawn without removing the bolts which secure the bearing to the shelf.

On the hammer shaft 5, between the side walls 2 are secured a series of disks 12. These disks are spaced apart and they are provided with alining openings through which pivot rods 13 for the hammers 14 are passed. The hammers 14 are provided with widened head portions 15 which are offset on one side only and they are preferably arranged in two crossed diametrical pairs between each of the disks, extending at right angles to each other, and the heads of one pair of hammers being offset from the side opposite to those of the other pair. The disks and hammers are preferably so proportioned in thickness and number that there is a space equal substantially to the thickness of a hammer shank between the endmost disks and the adjacent side walls of the casing. Only one pair of hammers are mounted in each of said end spaces, said opposite end pairs being arranged at right angles to each other and having their offset hammer head portions projected inwardly. The distance the offset head portions of the hammers project from the face of the shank is a little over one half the thickness of a disk, and by reversely projecting and staggering the offsets of the heads of one crossed pair with those of the other, the ends of the hammers travel in overlapping paths. Therefore, the entire width of the machine is covered by the rotating hammers.

In the front portion of the machine is an inclined dead plate or heavy casting 16 which is recessed to receive a removable initial breaker plate or block 17. This block 17 is preferably formed with corrugations or ribs 18 on its opposite faces and made reversible. It is preferably held in the recess or seat in the dead plate 16 by the elongated keys 19 which are slidably fitted in grooves 20 in the ends of the block and registering grooves or keyways in the dead plate. The block is preferably inserted edgewise through an elongated opening in one of the side walls 2 and held against accidental removal by a cover plate 21 which also prevents the keys 19 from working out. The keys may be provided with hooked ends 22 as shown or otherwise arranged to be readily withdrawn from between the dead plate and removable breaker plate.

In the lower portion of the machine is a semi-circular grinding and sifting cage comprising a series of grate bars 23. The bars are spaced apart a distance from each other which is determined according to the fineness to which it is desired to reduce the material. The bars are of flat angular section and preferably of the same thickness throughout excepting for spacing lugs or ribs 24 which are located near the ends of each of the bars on one face thereof. These bars are set radially from or about a transverse line indicated by the cross mark 25 at a point near the mouth of the feed hopper 26 and adjacent to the front wall of the machine. By this arrangement, the openings between the bars are substantially in line with the direction of the blast created by the rapidly revolving hammers. Therefore, the pulverized material will be quickly forced through the cage.

Extending across the machine at the bottom of the hopper is a lip 27 which is substantially parallel with the inclined dead plate 16. This lip extends some distance from the curved top portion 28 and its edge terminates close to the path of the ends of the rotating hammers. By this arrangement, the rapidly rotating hammers create a suction through the hopper which prevents the fine material or dust from being forced back and out through the hopper, and as the above described arrangement of cage bars prevents the spaces between the bars from becoming choked or clogged up, the machine will be quickly cleared of the pulverized or fine material through the grate or cage.

When the grinding edges of the cage bars become worn the bars can be taken out and reversed. To facilitate the ready removal and replacing of the grate bars 23, an arcuate slot is provided in one of the side walls 2 through which the bars are passed. The bars are supported on curved ribs or flanges

28 on the inner faces of the side walls 2. These ribs are provided with seats or notches in which the end portions of the lower edges of the bars rest. The end portions of the bars adjacent to the slotted side plate are provided with transverse perforations 29 whereby the bars can be readily withdrawn endwise from the machine through the slot. The slot is closed by a cover plate 30 which holds the bars in place.

The curved top or cover 4 of the machine is preferably provided with a renewable lining comprising corrugated or ribbed plates 31; and a similar lining or plate 32 is provided on the portion 28 and lip 27.

A series of secondary breaker plates 33 are mounted transversely on the inner side of the cover member 8. These secondary breaker plates are preferably made to be interchangeable and reversible. They are each provided on one side with a longitudinal rib 34 whose sides are undercut so as to fit in a counterpart groove 35 in one side of transverse triangular ribs 36 on the inner face of the cover. The breaker plates are inserted through openings in the side plate 2 which are closed by cover plates 37. The breaker plates are provided with perforations 38 which are arranged to register with alining holes extending through the ribs 36 and bosses or lugs 39 on the outer side of the cover 4. The plates may be withdrawn from the grooves 35 and turned end for end when the projecting corner becomes worn away; and when the second corner is worn away, the plates can be withdrawn and reversed so that the ribbed portion 34 is exposed to the action of the material. When the plates are turned to present the ribbed side, bolts 40 are inserted through the perforations therein and through the holes in the ribs 36 and lugs 39. The heads of the bolts 40 are countersunk into the rib of the breaker plate and nuts 41 or other suitable securing devices are provided on the outer ends of the bolts.

In the operation of the machine, ore, rock, shale or other material in lumps is fed into the machine through the feed hopper. The rapidly rotating hammers first strike the material upon the initial breaker plate. The material is broken and crushed and carried down and over the grate bars and ground against edges thereof, the very fine particles being forced out through the spaces between the bars. Practically all of the material not broken or crushed on the initial breaker plate and afterward ground and sifted through the cage at the bottom, will be thrown against the secondary breaker plates and finally crushed before it again reaches the initial breaker plate. So, too, by arranging the grate bars as shown and described, the machine is quickly cleared of the finely crushed and pulverized material. There-

fore, the capacity of the machine is greatly increased as the number of revolutions of the hammers to crush and pulverize a given quantity of material is minimized and the tendency of the sifting cage to clog or choke up is overcome due to the direct sweep of the air blast created by the rotating hammers.

Obviously, the device admits of considerable modification without departing from my invention. Therefore, I do not wish to be limited to the specific construction and arrangement shown.

What I claim as my invention and desire to secure by Letters Patent is:

1. A crusher and pulverizer comprising a casing having a feed opening in its upper forward portion, a rotatable hammer shaft extending transversely through the casing and having a series of hammer supports thereon, a series of hammers pivotally mounted on said hammer supports, an inclined breaker plate arranged below the feed opening with its working face in proximity to the path of the ends of the rotating hammers, an arcuate grinding and sifting cage located below said hammer supports with its working side in proximity to the path of the ends of the rotating hammers, an arcuate cover on the casing, a series of triangular ribs extending transversely across the inner face of the arcuate cover and spaced apart, and a breaker plate detachably secured on the side of each of said triangular ribs opposed to the direction of rotation of the hammers, and the projecting corners of said plates being located in proximity to the path of the ends of the rotating hammers.

2. A crusher and pulverizer comprising a casing having a feed opening in its upper forward portion, a rotatable hammer shaft extending transversely through the casing and having a series of hammer supports thereon, a series of hammers pivotally mounted on said hammer supports and arranged in crossed diametrical pairs between said supports, the head of each of said hammers being offset on one side only and the heads of one diametrical pair being offset to the side opposite to that which the heads of the adjacent crossed pair project, whereby the ends of the hammer heads travel in overlapping paths, an inclined breaker plate located below the feed opening with its working face in proximity to the path of the ends of the rotating hammers, an arcuate grinding and sifting cage located below said hammer supports with its working side in proximity to the path of the ends of the rotating hammers, an arcuate cover on the casing, a series of transversely arranged triangular ridges on the inner side of said arcuate cover, said ridges being spaced apart, and a breaker plate mounted on the side of each

of said ridges opposed to the direction of rotation of said hammers, the projecting corners of said last mentioned breaker plates being located in proximity to the path of the ends of the rotating hammers.

3. A crusher and pulverizer comprising a casing having a feed opening in its upper forward portion, a rotatable hammer shaft extending transversely through the casing and having a series of hammer supports thereon, a series of hammers pivotally mounted on said hammer supports, an inclined initial breaker plate mounted below said feed opening with its working face in proximity to the path of the ends of the rotating hammers, an arcuate cover on the casing, a series of transversely arranged triangular ridges on the inner side of said arcuate cover, said ridges being spaced apart, and a secondary breaker plate detachably and reversibly mounted on the working side of each of said triangular ridges opposed to the direction of rotation of said hammers, the projecting edges of said last mentioned breaker plates being located in proximity to the path of the ends of the rotating hammers.

4. A crusher and pulverizer comprising a casing, a feed hopper located in the upper forward portion of the casing, a rotatable hammer shaft extending transversely through the casing and having a series of hammer supports thereon, a series of hammers pivotally mounted on said hammer supports, an inclined breaker plate located below said feed hopper with its working face in proximity to the path of the ends of the rotating hammers, and an arcuate grinding and sifting cage adjoining the inclined breaker plate and located below the hammer supports with its working side in proximity to the path of the ends of the rotating hammers, said cage comprising a series of transverse grate bars of flat angular section and said bars being set edgewise radially from a transverse line near the mouth of the hopper and front wall of the casing so that the bars adjacent to the breaker plate are substantially in parallel relation therewith.

5. A crusher and pulverizer comprising a casing, a feed hopper located in the upper forward portion of the casing, a rotatable hammer shaft extending transversely through the casing and having a series of hammer supports thereon, a series of hammers pivotally mounted on said hammer supports, an inclined breaker plate located below said feed hopper with its working face in proximity to the path of the ends of the rotating hammers, and an arcuate grinding and sifting cage adjoining the inclined breaker plate and located below the hammer supports with its working side in proximity to the path of the ends of the rotating hammers, said cage comprising a se-

ries of reversible transverse grate bars of flat angular section and said bars being set edgewise radially from a transverse line near the mouth of the hopper and front wall of the casing so that the bars adjacent to the breaker plate are substantially in parallel relation therewith.

6. A crusher and pulverizer comprising a casing, a feed hopper located in the upper forward portion of the casing, a rotatable hammer shaft extending transversely through the casing and having a series of hammer supports thereon, a series of hammers pivotally mounted on said hammer supports, an inclined initial breaker plate located below said hopper with its working face in proximity to the path of the ends of the rotating hammers, an arcuate grinding and sifting cage located below the hammer supports with its working side in proximity

to the path of the ends of the rotating hammers, said cage comprising a series of transverse grate bars of flat angular section and said bars being set radially from a transverse line near the mouth of the hopper and front wall of the casing so that the bars adjacent to the initial breaker plate are substantially in parallel relation therewith, an arcuate cover on the casing, and a series of transverse secondary breaker plates mounted on the inner side of said arcuate cover with one edge portion in proximity to the path of the ends of the rotating hammers.

Signed at St. Louis, Missouri, this 31st day of August, 1909.

FRANK L. BUCHANAN.

Witnesses:

G. A. PENNINGTON,
J. B. MEGOWN.