July 14, 1936. E. L. BALL 2,047,171

PERCUSSION ORE MILL

Filed March 5, 1934

Fig. 1

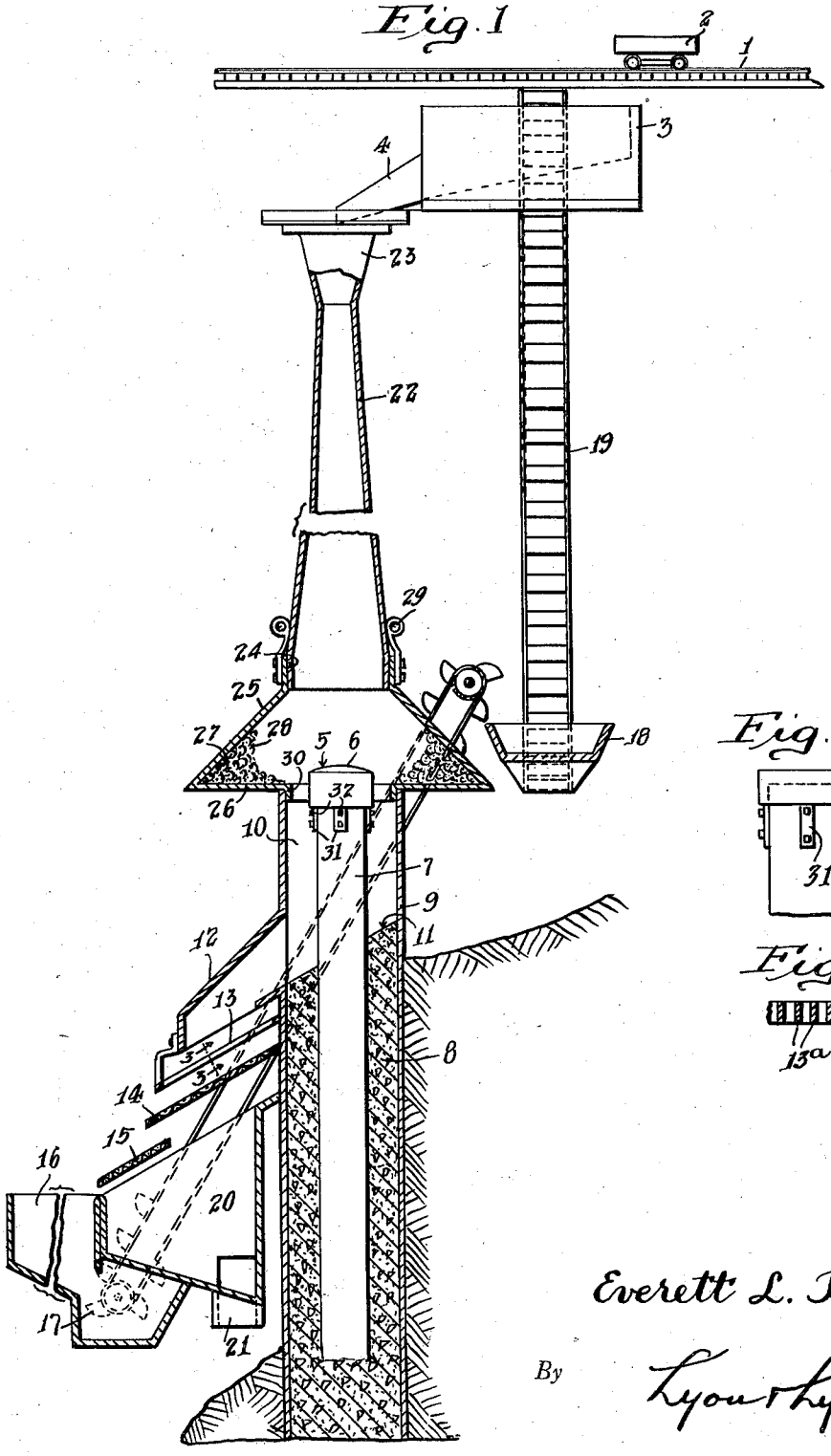


Fig. 2

Fig. 3

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PERCUSSION ORE MILL

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5 Claims. (Cl. 83—46)

This invention relates to a percussion mill for breaking ore, or other material. It is the present practice to break ore by means of rotary breakers which consume considerable power and are subjected to considerable wear and tear on account of the nature of the breaking operation.

The general object of this invention is to provide a percussion mill of improved construction in the operation of which the ore is dropped from an elevated point onto a hard anvil to break the ore.

One of the objects of the invention is to provide means for retaining the pieces of ore that fly from the anvil and to provide means for protecting the parts of the apparatus from injury from such flying pieces.

A further object of the invention is to provide improved means for collecting the broken ore, for screening the same, and for continuously returning the same to the elevated point from which the ore is dropped again onto the anvil.

A further object of the invention is to provide a general arrangement for the material which will avoid the necessity for raising the run-of-the-mine ore for dropping the same onto the anvil.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combinations of parts to be described hereinafter, all of which contribute to produce an efficient percussion ore mill.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawing:

Figure 1 is a vertical section through a mill embodying my invention, certain parts being broken away and other parts being shown in elevation.

Fig. 2 is a fragmentary side elevation illustrating another embodiment of the anvil.

Fig. 3 is a cross section taken on the line III—III of Fig. 1, upon an enlarged scale, and illustrating the construction of a "grissly" or bar screen which is employed in the mill.

Before proceeding to a more detailed description of the mill, it should be stated that the mill is preferably located so that its upper end is disposed below the level of the ore taken from the mine at a considerable height, for example 75 feet, and below this point an anvil is provided upon which the ore is dropped.

The percussion of the ore upon the anvil breaks it up into small pieces. When the lumps of ore taken from the mine strike the anvil, there is considerable energy developed by the percussion and pieces of broken ore fly in all directions radially from the anvil. In accordance with my invention I provide a bank of broken ore surrounding the anvil, and this bank of ore forms a cushion to receive the flying pieces and constitutes a protection. In the preferred form of the invention this surrounding cushion is preferably developed by the operation of the mill, within a casing which surrounds the anvil and which presents an annular pocket in which the broken ore collects. This ore cushion arrests the movement of heavier pieces flying off from the anvil at a low elevation. Above the level of the bank the casing forms means for arresting the flight of the smaller pieces of ore, which fly in a general upward direction. Around the anvil an opening is formed in the mill through which the broken ore passes downwardly to a receiver from which the ore passes outwardly to be screened. The ore that passes through the screen will be sufficiently small in size for treatment to extract the values from the same. The tailings from the screening means are returned to the elevated point and drop again onto the anvil.

There is danger that the annular opening around the anvil, through which the broken pieces pass downwardly, will clog, and for this reason I prefer to construct the casing so that it can be raised so as to expose the anvil and the opening so that the same can be cleared of any obstructions when necessary.

Referring more particularly to the parts, 1 indicates a track on which small side-dumping cars, such as the car 2, are employed to carry the ore out of the mine and dump the same laterally from the car into an elevated hopper 3 from which the ore passes out through a spout 4 to a point directly over the anvil 5. This anvil is preferably in the form of a heavy cap of hardened steel or similar material which will withstand the impact of the heavy mass of ore falling upon it.

As illustrated in Fig. 1, the anvil 5 has a crowned upper face 6. If desired, this face may be of conical form with a point on its axis, or, if desired, this face may be flat, as illustrated in Fig. 2. The anvil is supported on an upwardly extending post or heavy tube 7, which is planted in a foundation of concrete 8. This concrete is placed within a tubular receiver 9 and extends upwardly and cooperates with the anvil which is centrally placed in it, to form an annular open-

ing 10 around the anvil, from which the broken ore descends.

The concrete 8 has an inclined upper face 11 that directs the broken ore off to one side and through a spout 12, from which point the ore falls onto screening means of any suitable construction. In the present instance, the screening means includes an inclined "grissly" 13 below which one or more screens 14 and 15 may be placed, of progressively finer mesh. The tailings from the lower screen 15 fall into a hopper 16 from which the tailings are picked up on a conveyor 17 for carrying the broken tailings back to the hopper 3 to drop this ore again onto the anvil. The conveyor means may be of any desired construction and may consist of a single flight, if desired, but in the present instance the conveyor includes two flights; that is to say, the conveyor 17 delivers to an elevated hopper 18 from which the broken ore is carried on a second conveyor 19 that delivers into the hopper 3.

The "grissly" is preferably a grid formed of parallel bars 13a disposed in a vertical plane and preferably inclined (see Fig. 1). The screen 14 should be of coarser mesh than the screen 15. The material that passes through these screens is collected in a hopper 20, having a delivery spout 21 from which the screened material can be taken for further treatment to separate the values from the crushed or broken ore.

The mill preferably includes guiding means for guiding the falling ore passing down from the elevated point at the spout 4. This means is preferably in the form of a tube 22 which may have a funnel-shaped receiving mouth 23 at its upper end. This tube is preferably tapered and enlarges toward its lower end, which extends into a sleeve 24 formed on the upper end of a casing 25. This casing 25 is preferably in the form of a substantially conical shell having a substantially horizontal bottom 26 forming a ledge on which broken ore can rest. Between this bottom and the conical side wall of the casing an annular pocket 27 is formed to catch broken material 28 that flies off of the anvil. This broken material 28 operates as a cushion to protect the lower portion of the casing from any injury by the flying pieces of ore. The upper portion of the casing will not be injured because the pieces flying upwardly will be relatively light.

In order to give access to the opening 10 for repairing or replacing the anvil, and in order to permit the annular opening 10 to be cleared of obstructions in case it should become obstructed by broken ore, I prefer to provide the upper end of the casing with hooks or eyes 29 which can be attached to a grapple or hooks on a hoist. This enables the casing to be pulled upwardly a considerable distance above the upper end of the tubular receiver 9.

The bottom 26 of the casing 25 may be provided with a downwardly projecting flange 30 to engage the upper end of the tubular guide 9 for centering the casing on the receiver 9.

The anvil is preferably constructed so that it is detachably secured to the upper end of the post or tube member 7. This may be accomplished by providing metal straps 31 that extend down from the lower end of the cap and which receive removable bolts 32.

By having the mouth 23 of the mill disposed just below the level of the track 1, an economy is effected by reason of the fact that it becomes unnecessary to raise the broken ore to the high level of the mouth 23. The guide tube 22 is supported by any suitable means (not illustrated) independent of the casing 25.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

I claim:

1. A percussion mill for breaking ore, having a fixed anvil, a tubular guide surrounding the anvil and cooperating with the anvil to form an annular opening around the anvil, means for dropping chunks of ore from an elevated point onto the anvil, so that the same fall solely by gravity onto the anvil, a casing surrounding the anvil and having an annular ledge located at a distance from the anvil, with an annular pocket for catching material that splashes from the anvil, so as to form a bank of broken material surrounding the anvil and protecting the casing from material flying from the anvil.

2. A percussion mill for breaking ore, having a fixed anvil, a tubular guide surrounding the anvil and cooperating with the anvil to form an annular opening around the anvil, a post within the guide, concrete embedding the post and having an inclined upper face, means for dropping ore from an elevated point onto the anvil, so that the ore falls solely by gravity, a casing surrounding the anvil and having an annular ledge removed from the anvil, with an annular pocket for catching material that splashes from the anvil, so as to hold the broken material in a bank surrounding the anvil and protecting the casing from material flying from the anvil, and screening means receiving the broken material gravitating down the inclined upper face of the concrete, for screening the broken ore that passes down through said annular opening.

3. A percussion mill for breaking ore, having a fixed anvil, a tubular guide surrounding the anvil and cooperating with the anvil to form an annular opening around the anvil, means for dropping ore from an elevated point onto the anvil, a casing surrounding the anvil and having a substantially horizontal ledge at a distance from the edge of the anvil, with an annular pocket over the ledge for catching material that splashes from the anvil, so as to form a bank of broken material surrounding the anvil and protecting the casing from material flying from the anvil, said casing having means for mounting the same to permit the casing to be raised to expose the anvil.

4. A percussion mill for breaking ore, having a fixed anvil of block form, means for dropping lumps of ore from a height so that they fall solely by gravity onto the anvil, thereby shattering the lumps of ore and violently projecting flying fragments of the ore in a general radial direction from the anvil, a shelf in the form of a substantially horizontal annular plate surrounding the anvil with its inner edge removed from the anvil so as to form a space through which broken fragments of ore may pass down, and a wall at the back of said shelf cooperating with the shelf to retain a quantity of the broken ore and thereby form a bank of broken ore to receive the impact of the flying fragments and protect the said wall from further impact.

5. A percussion mill for breaking ore, having a fixed anvil of block form, means for dropping lumps of ore from a height so that they fall solely by gravity onto the anvil, thereby shat-

tering the lumps of ore and violently projecting flying fragments of the ore in a general radial direction from the anvil, a shelf in the form of a substantially horizontal annular plate surrounding the anvil with its inner edge removed from the anvil so as to form a space through which broken fragments of ore may pass down, a wall at the back of said shelf cooperating with the shelf to retain a quantity of the broken ore and thereby form a bank of broken ore to receive the impact of the flying fragments and protect the said wall from further impact, and means for guiding said shelf to enable the same to be raised to a point above the level of the anvil to enlarge the opening around the anvil and clear the same of ore fragments obstructing the same.

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