Feb. 25, 1936.

G. H. BEERS

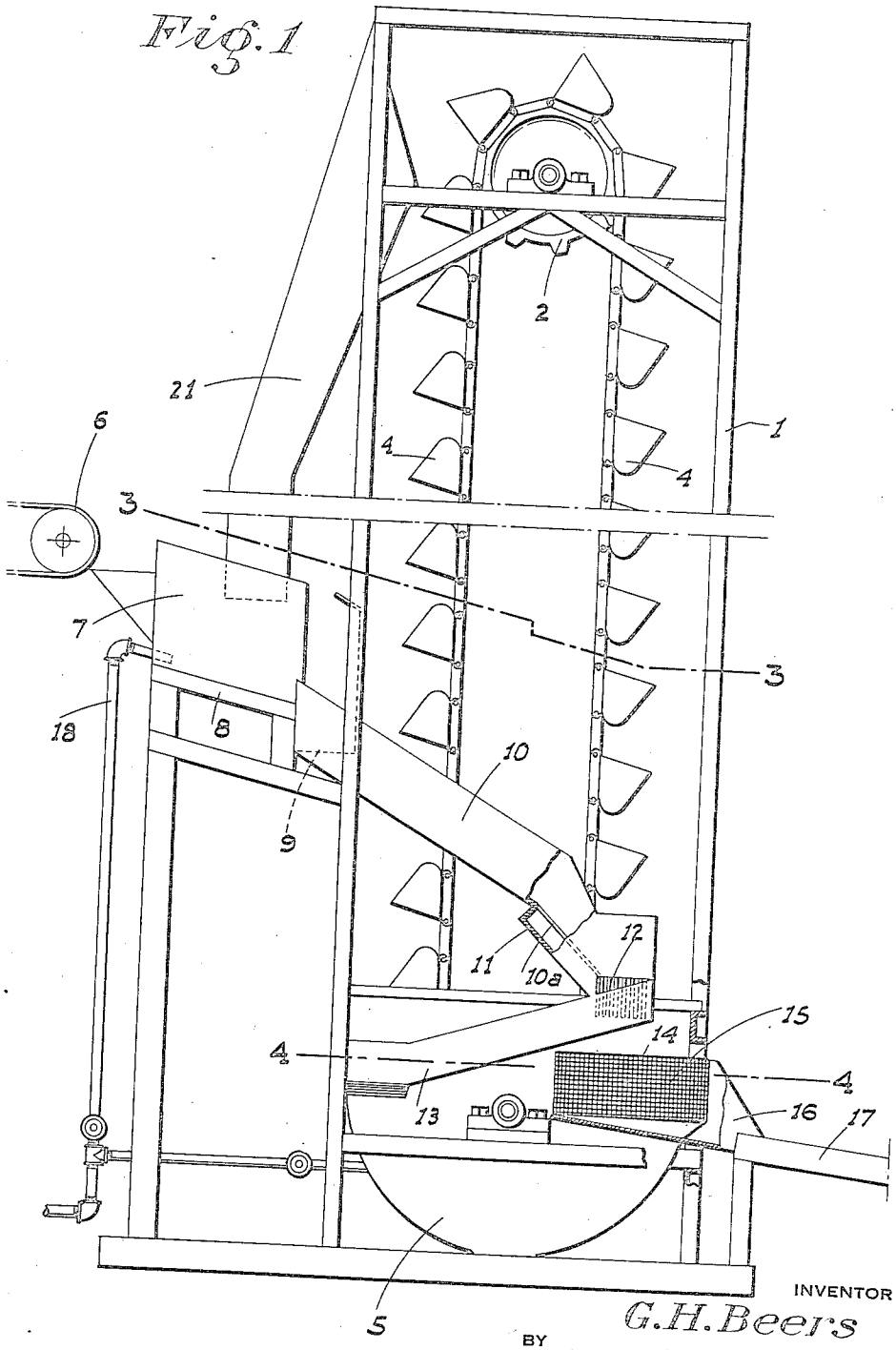
2,032,247

ORE CRUSHING MILL

Filed Oct. 30, 1934

2 Sheets-Sheet 1

Fig. 1



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Fig. 2

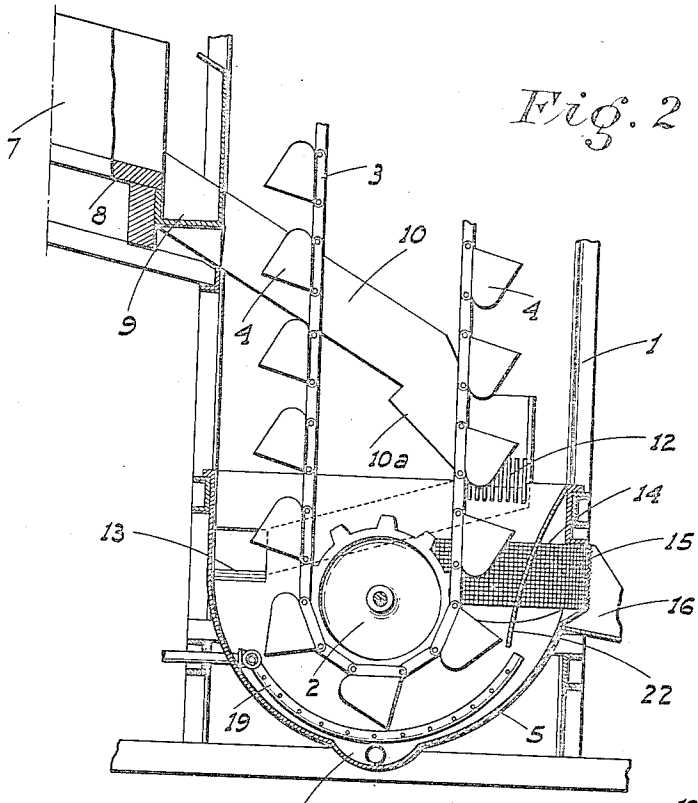


Fig. 3

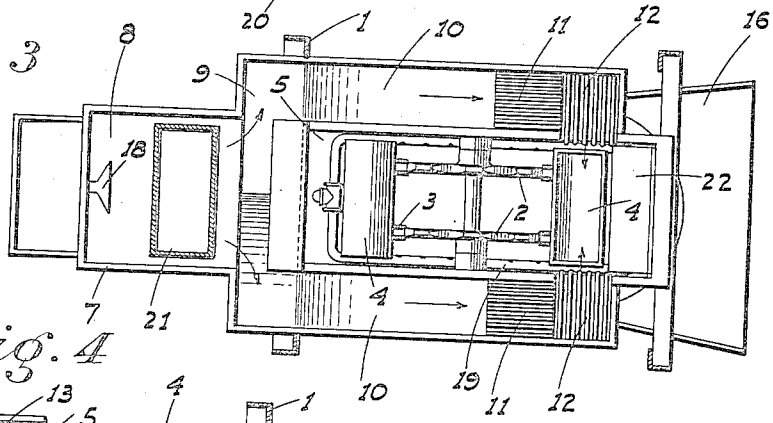
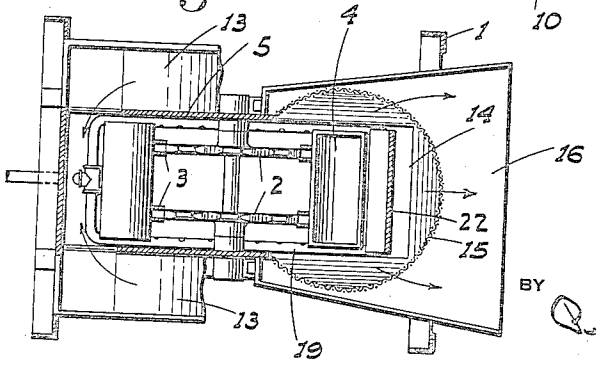


Fig. 4



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ORE CRUSHING MILL

George H. Beers, Wabuska, Nev.

Application October 30, 1934, Serial No. 750,647

6 Claims. (Cl. 83—46)

This invention relates to ore crushing and value recovering mills. My principal object is to provide a machine of this character which will operate by the principles of impact and attrition, arranged to continuously circulate and crush and recrush the ore, subject the crushed ore to an agitating action in water so as to cause any heavy values freed from the ore to collect in a catch receptacle in the bottom of the mill, and to ultimately discharge the crushed material as a whole from the machine so that said material may be fed to a concentrator.

The advantages of my improved mill over the structures for the purpose now on the market are cheaper construction cost per ton capacity, cheaper operating cost per ton, since it requires less horse power than any present mill; a smaller gross and unit weight, thus making a transshipment to remote places easier and cheaper; less wear and tear on the machine per ton crushed; and cheaper and easier replacement of parts than is the case with the present mills.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a side elevation of my improved mill partly broken out.

Figure 2 is a sectional elevation of the lower portion of the mill.

Figure 3 is a sectional plan of the line 3—3 of Figure 1.

Figure 4 is a similar view on the line 4—4 of Figure 1.

Referring now more particularly to the characters of reference on the drawings, the numeral 1 denotes a vertical tower-like frame of considerable height (approximately 25 feet or more) on and adjacent the top and bottom of which are mounted pairs of sprocket wheels 2. Endless chains 3 pass about these sprocket wheels, said chains carrying buckets 4 which face upwardly along one run of the chains, which is on the front side of the machine. Either pair of sprockets, preferably the upper one, is driven by any suitable power means so that the upwardly facing row of buckets travels upwardly. The lower sprockets are disposed in a sump 5 so that the buckets successively pass through the sump with the driving of the sprockets. Said sump is of larger radius than the arc of the buckets but its bottom wall substantially follows such arc.

The material to be crushed or broken up and concentrated is disposed in the buckets and sump from a feed conveyor 6 of suitable character disposed at the back of the mill. This conveyor discharges into a hopper 7, the bottom of which is formed of heavy sloping breaker plates 8. The hopper is disposed a short distance above the sump but a considerable distance below the topmost sprocket wheels. From this hopper the material passes into a chute 9 which extends transversely of the structure behind the back row of buckets, which chute in turn discharges into a pair of downwardly and forwardly sloping chutes 10. These chutes are disposed outwardly of but adjacent the sump and terminate adjacent the front row of buckets in grizzlies and grates 11. These grizzlies in turn discharge onto other grizzlies 12 which extend at right angles to the chute 10 and with a downward slope toward the forward row of buckets with which they are alined; said grizzlies terminating adjacent the ends of the buckets, as shown in Figure 3.

Directly below the chutes 10 and sloping downwardly toward the rear on the outside of the sump are other chutes 13, positioned to receive the material falling between the bars of the grizzlies 12 as well as that falling through the bars of the grizzlies 11. Positive guiding of the last named material into the chutes 13 is assured by auxiliary chutes 10a under the grizzlies 11, as in Figure 1, and communicating with the chutes 13. The material in the chutes 13 passes through the side walls of the sump into the same adjacent its back end.

The front end and the adjacent portions of the side walls of the sump upwardly from a level adjacent the center of the lower sprocket wheels is provided with a preferably rectangular vertical opening 14 covered by a suitable screening 15. The material and water flowing through the screening is received on an apron 16 which delivers to an amalgamating table 17 or other suitable and conventional form of concentrating device.

Water to mix with and flush the material along the chutes as well as maintaining a supply in the sump is fed through a pipe 18 which discharges into the hopper 7 near the bottom and at the back. Other spray pipes 19 may be disposed in the sump so as to extend circumferentially about the same in the sides and adjacent the bottom, the spray openings of these pipes being arranged to discharge toward the center of the sump so as to keep the water and material agitated. These spray pipes however may be omitted if desired.

A trough or depression 20 to receive concen-

trates settling to the bottom is formed in the bottom of the sump at its lowest point so as to provide a clean-up receptacle.

In operation the ore moving down and being flushed along the chutes 10 by the water finally all passes onto the grizzlies 11 and 12 in succession, the finer particles of the ore dropping into the chutes 13 as previously stated, while the large lumps temporarily remain on the grizzlies. Such large lumps drop into the upwardly moving buckets instead of falling into the sump and of course are conveyed to and about the top-most sprocket wheels 2. The buckets then of course become inverted and the lumps fall out due to the action of gravity and into a chute 21 positioned to receive them and whose lower end overhangs the breaker plates 8 of the hopper 7. As previously stated, these plates are a considerable distance below the point of dropping of the lumps so that said lumps fall with a considerable velocity which is not interrupted by the chute and will therefore be crushed or broken by impact with the breaker plates. The broken pieces again pass into the chutes 10 and onto the grizzlies as before and new pieces still too large to pass through the grizzlies are again received in the buckets, elevated and subjected to a further breaking action. This continues indefinitely or until all the material has been broken up to the required fineness, either by the force of impact or by attrition.

As the buckets move through the water in the sump they agitate the water and of course the material therein and tend to raise the latter to the surface of the water, which is maintained at a level adjacent the top of the screen and which is of course constantly flowing through the screen and onto the apron 16. With this constantly flowing water therefore this final agitated and semi-suspended material will pass through the screen onto the apron 16 and thence to the concentrating table. A shield or baffle plate 22 depends into the sump between the screen and the upward row of buckets to prevent an unduly free discharge of the material through the screen, which might otherwise be had on account of the agitating and water propelling action of the moving buckets.

With the use of this apparatus therefore a given quantity of ore will be broken up or crushed, agitated and the valuable content segregated and saved with a continuous operation and without any manual attention being necessary.

It should be noted that while in the above specifications as well as in the claims I have specifically used the word "chains" to denote the members on which the buckets are mounted, it is to be understood that this word is intended to include any endless flexible element such as a belt, cable or the like which would be suitable for the purpose.

From the foregoing description it will be readily seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention what I claim as new and useful and desire to secure by Letters Patent is:

1. An ore treating mill comprising a vertically disposed endless driven chain, buckets on said chain, the buckets on the upwardly moving run of the chain facing upwardly, means to convey ore to be treated toward the upwardly moving buckets and including an initial intake hopper disposed a considerable distance below the upper end of the chain and means to separate the heavy and small particles of ore from the large lumps and deliver the latter to the buckets from opposite sides of the buckets, a water-retaining sump through which the lowermost buckets pass and into the rear portion of which said small particles are delivered by the conveying means, and means to redeliver the lumps in the buckets to the hopper and arranged so that such lumps tend to break up as they are received in the hopper, the sump having a vertical screened opening in front of the upwardly moving row of buckets, and a shield plate depending into the sump between the opening and the adjacent buckets.

2. An ore treating mill comprising a vertically disposed driven endless chain, upwardly and downwardly movable buckets secured to and extended outwardly from said chain, the upwardly movable buckets being open at their upper ends, an ore receiving hopper arranged rearwardly of and having breaker plates therein positioned a substantial distance below the top of the chain, ore conductors inclined downwardly with respect to and having their rear ends communicating with the hopper, said conductors being arranged on opposite sides of the buckets on said chain and having their forward ends provided with means for separating the ore into small and large particles and for discharging the small particles downwardly therefrom and the large particles into the upwardly movable buckets from each side of the latter, an upstanding chute extending upwardly from the hopper, arranged rearwardly and spaced throughout from said chain, said hopper extending above the chain and having an open upper end opposing the buckets at the upper end of the chain for receiving at its upper end the large particles of ore from the upwardly movable buckets for directing said large particles of ore on the gavitation of the latter towards the breaker plates in the hopper, a water receiving sump below the chain and through which the buckets travel for agitating the contents of the sump, and means extending rearwardly from the wall of said conductors for receiving and conveying the separated small particles of ore into the rear of the sump.

3. An ore treating mill comprising a vertically disposed driven endless chain, upwardly and downwardly movable buckets secured to and extended outwardly from said chain, the upwardly movable buckets being open at their upper ends, an ore receiving hopper arranged rearwardly of and having breaker plates therein positioned a substantial distance below the top of the chain, ore conductors inclined downwardly with respect to and having their rear ends communicating with the hopper, said conductors being arranged on opposite sides of the buckets on said chain and having their forward ends provided with means for separating the ore into small and large particles and for discharging the small particles downwardly therefrom and the large particles into the upwardly movable buckets from each side of the latter, an upstanding chute extending upwardly from the hopper and receiving at its upper end the large particles of ore from the upwardly movable buckets for directing said large particles of ore on the gravitation of the latter towards the breaker plates in the hopper, a water receiving sump below the chain and through which the

buckets travel for agitating the contents of the sump, means for receiving and conveying the separated small particles of ore into the rear of the sump, an apron arranged below the upper portion and extended laterally and forwardly from the sump for conducting the treated material discharged from the sump to a concentrating device, the upper portion of the sides and front of the sump being formed with an outlet opening for discharging the treated material and water from the sump upon the apron, and a screen opposing said outlet opening for filtering the discharge from the sump on its passage to the apron.

4. An ore treating mill comprising a vertically disposed driven endless chain, upwardly and downwardly movable buckets secured to and extended outwardly from said chain, the upwardly movable buckets being open at their upper ends, an ore receiving hopper arranged rearwardly of and having breaker plates therein positioned a substantial distance below the top of the chain, ore conductors inclined downwardly with respect to and having their rear ends communicating with the hopper, said conductors being arranged on opposite sides of the buckets on said chain and having their forward ends provided with means for separating the ore into small and large particles and for discharging the small particles downwardly therefrom and the large particles into the upwardly movable buckets from each side of the latter, an upstanding chute extending upwardly from the hopper and receiving at its upper end the large particles of ore from the upwardly movable buckets for directing said large particles of ore on the gravitation of the latter towards the breaker plates in the hopper, a water receiving sump below the chain and through which the buckets travel for agitating the contents of the sump, means for receiving and conveying the separated small particles of ore into the rear of the sump, and said sump having a screened discharge opening at the upper portion of its front.

5. An ore treating mill comprising a vertically disposed driven endless chain, upwardly and downwardly movable buckets secured to and extended outwardly from said chain, the upwardly movable buckets being open at their upper ends, an ore receiving hopper arranged rearwardly of and having breaker plates therein positioned a substantial distance below the top of the chain, ore conductors inclined downwardly with respect to and having their rear ends communicating with the hopper, said conductors being arranged on opposite sides of the buckets on said chain and having their forward ends provided with means for separating the ore into small and large particles and for discharging the small particles downwardly therefrom and the large particles into the upwardly movable buckets from each side of the latter, an upstanding chute extending upwardly from the hopper and receiving at its upper end the large particles of ore from the upwardly movable buckets for directing said large particles of ore on the gravitation of the latter towards the breaker plates in the hopper, a water receiving sump below the chain and through which the buckets travel for agitating the contents of the sump, means for receiving and conveying the separated small particles of ore into the rear of the sump, said sump having a screened discharge opening at the upper portion of its front, and a central depression for receiving precipitated concentrates.

6. An ore treating mill comprising a vertically disposed endless driven chain, buckets on said chain, the buckets on the upwardly moving run of the chain facing upwardly, means to convey ore to be treated toward the upwardly moving buckets and including an initial intake hopper at its rear disposed a considerable distance below the upper end of the chain and means at its front adjacent opposite sides of the upwardly movable buckets to separate the heavy and small particles of ore from the large lumps and deliver the latter into the upwardly movable buckets from the said opposite sides, a water retaining sump through which the lowermost buckets pass and in which said small particles are delivered by the conveying means, means extending upwardly from the hopper to a point adjacent the upper end of the chain for directing the large lumps from the upwardly moving buckets and upon the gravitation of the lumps into the hopper whereby the lumps will be disintegrated by force of contact therewith and with the hopper, and a screened opening in one side of the sump to pass water and small particles of ore agitated by the movement of the buckets through the water, and an apron to catch such water and particles after passing through the opening.

GEORGE H. BEERS.