Sept. 13, 1927. 1,642,337

O. H. GRAY ET AL

ORE SAMPLING MACHINE

Filed April 9, 1924 2 Sheets-Sheet 1

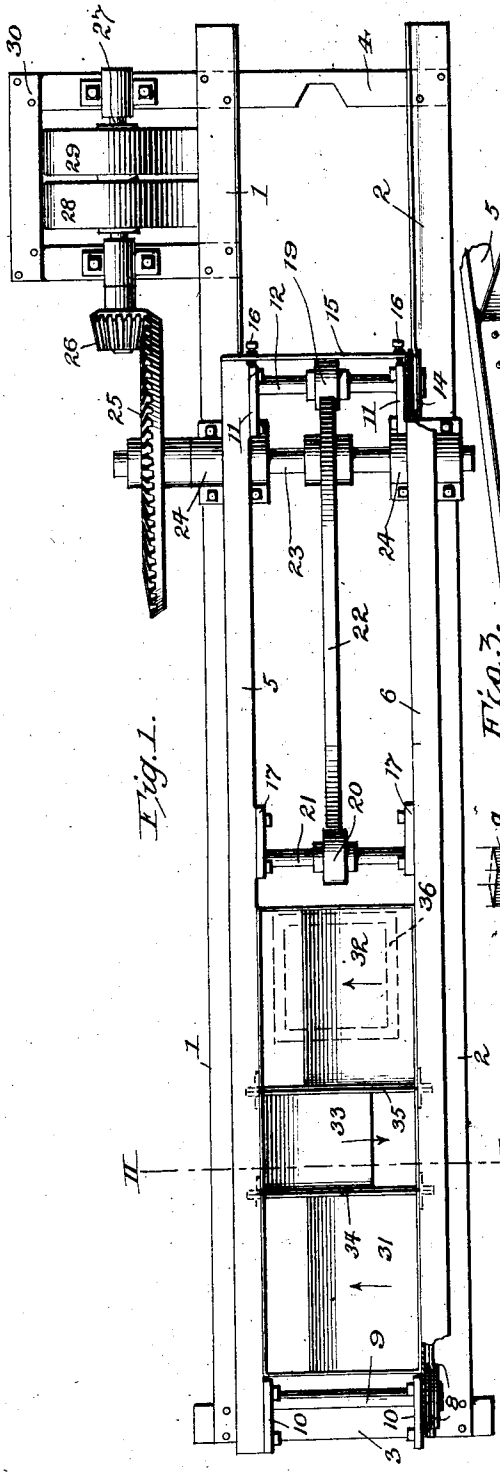


Fig. 1.

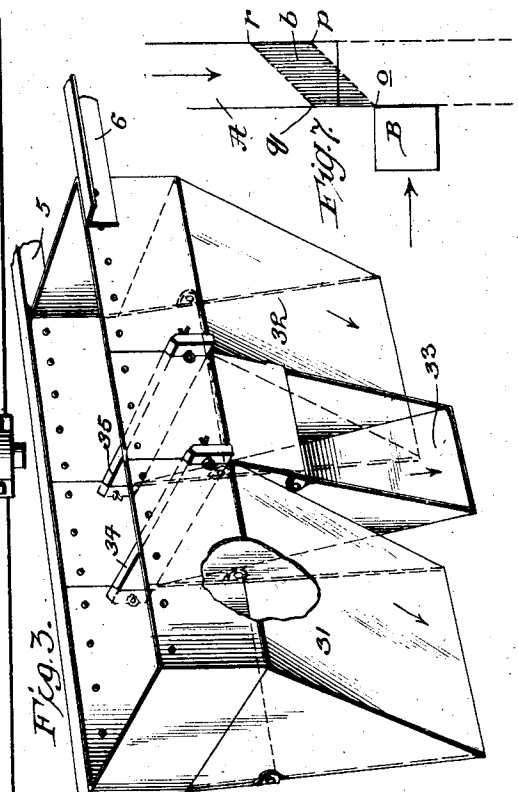


Fig. 3.

Fig. 7.

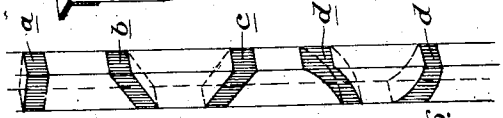


Fig. 6.

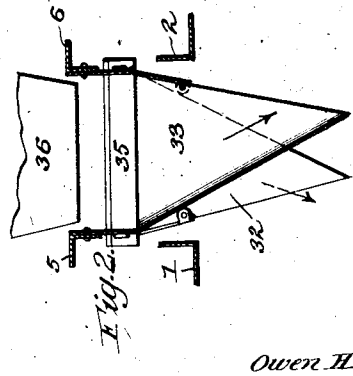


Fig. 2.

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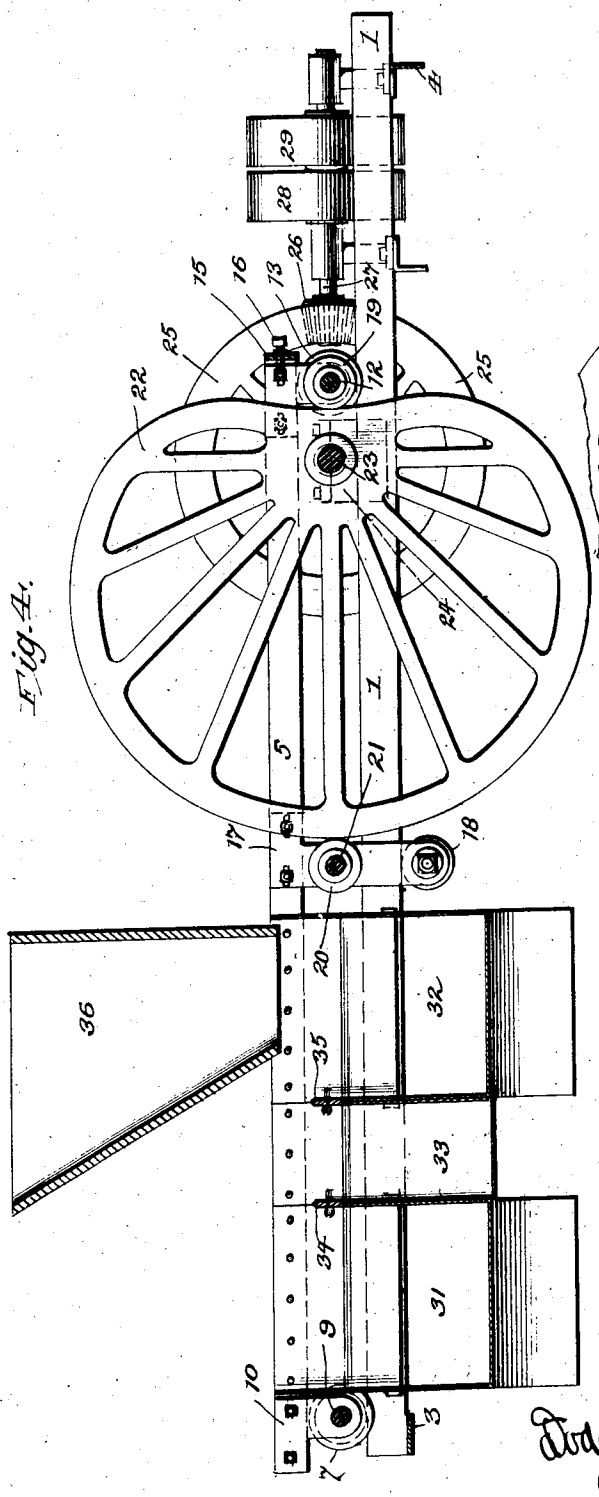


Fig. 4.

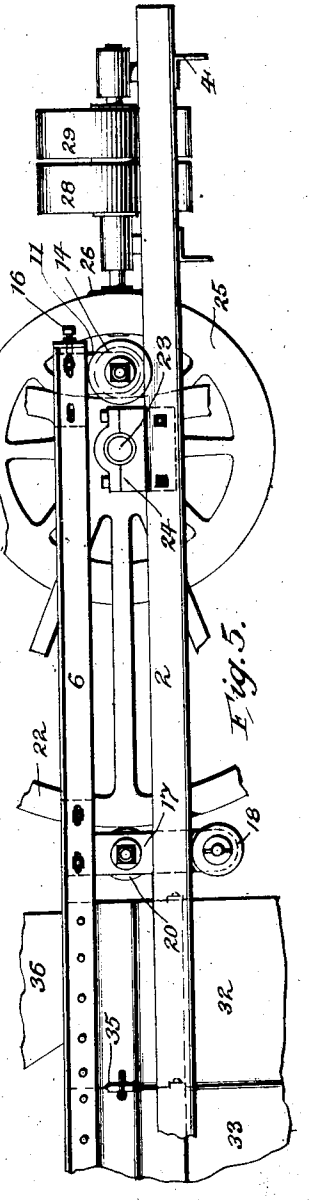


Fig. 5.

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UNITED STATES PATENT OFFICE.

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ORE-SAMPLING MACHINE.

Application filed April 9, 1924. Serial No. 705,270.

This invention pertains to ore sampling machines, and has for its main object the production of a machine through the use of which a true sample of the ore will be obtained. The machine, due to its construction and operation, does away with any selective action and this regardless of the rate of flow of the ore stream and the separation of the fines from the coarser particles, as sometimes obtains in the flow of the ore stream.

One embodiment of the invention is illustrated in the annexed drawings wherein:

Fig. 1 is a top plan view of the machine;

Fig. 2 a transverse vertical sectional view on the line II—II of Fig. 1;

Fig. 3 a perspective view of the sample and rejects chutes;

Fig. 4 a longitudinal sectional view of the machine;

Fig. 5 a side elevation of a portion of the machine;

Fig. 6 a diagram illustrating various methods of sampling; and

Fig. 7 a diagrammatic view illustrating the method employed by us to effect a true sampling operation.

Various machines have heretofore been proposed for sampling ores. In one plan a small part of the ore has been divided or cut continuously out of a falling stream of ore by means of narrow spouts or dividing-flanges. We have found this plan unreliable and unsatisfactory, for the reason that the falling stream of ore, in either an inclined or vertical spout, is never entirely uniform in all its parts, there being a constant tendency to the greater proportion of coarse rapidly-traveling particles in the center of the stream and an excess of the finer slower-moving particles on the sides, and thus it follows that no part of the stream would exactly represent an average of the whole.

In another plan, traveling or revolving buckets or spouts are used to secure a sample, and in this plan the dividing edges of the buckets or spouts soon become covered by chips, bark, sack-strings and drill-rags, that render the division of the stream inaccurate. In addition to this, where buckets are used, the coarse particles rebound from the bottom and find their way into the wrong division. In the traveling or horizontal revolving buckets or spouts the finer particles of ore continue to drop from the spouts during the entire revolution and have to be gathered into a long funnel-shaped receptacle, thereby necessitating a great amount of vertical height in the apparatus, and rendering it almost impossible to clean the apparatus after a lot of ore has been run through.

A third plan has employed a vibrating spout by which the entire stream of ore is deflected alternately to the right and to the left. In this class of apparatus, the dividing edge of the spout does not cross the falling stream instantaneously, but consumes an appreciable portion of time, during which the ore has descended a considerable distance into the spout, thus rendering the sample section taken out of the falling stream a rhomboid or frustum of a wedge, the base of which is taken from the side of the stream toward which the rejected ore is being deflected, and because of this operation it follows that unless both sides of the stream of ore are exactly alike the sample taken will not be an accurate or average representation of the entire lot.

A still further plan has been proposed, wherein there is present a swinging or vibrating spout having a number of compartments, the central one of which discharges in a direction opposite from those of the other, and is designed to remove the sample. In connection with this form of apparatus, which swings through the ore stream in the arc of a circle, the driving mechanism employed has been such, so far as we are aware, as to cause a variation in the speed of travel of the sampling compartment through the descending ore stream, with the consequent effect that the section cut from the stream is not of equal dimensions throughout; consequently, the sample is not a true sample of the stream.

With our invention, the difficulties above mentioned are eliminated and sample sections of the same dimensions throughout are removed from the ore stream, with the consequence that a true sample of the ore is had, irrespective of the fact that the ore as such may be traveling down along one side of the stream, or, in other words, localized in some portion of the stream, due to one condition or another.

Referring now to Figs. 1 to 5 inclusive:—

The supporting frame or bed of the machine is formed of the side rails 1 and 2 formed of L-shaped angle irons, the upper edges of the upstanding portions whereof form in effect tracks or ways upon which

the truck, hereinafter set forth is mounted for reciprocation.

The rails are held in spaced parallel relation by cross bars 3 and 4 and the frame as a whole may be supported upon suitable legs or supports, not shown. Mounted for reciprocation on the frame is a truck comprising two interconnected side bars 5 and 6 supported at their outer end by grooved rollers 7 and 8 carried by an axle 9 mounted in brackets 10. The frame at its opposite or inner end has secured to it a second pair of brackets 11, said brackets being mounted for adjustment longitudinally of the side bars and carrying an axle or shaft 12 upon which is mounted a pair of grooved rollers 13 and 14.

The brackets 11, as will be best seen upon reference to Figs. 1 and 4, are solid in their upper portion and held to the bars 5 and 6 by suitable bolts. A cross bar 15 is secured to the inner ends of the side bars 5 and 6 and adjusting screws 16 mounted in said bar bear against the brackets and serve to move the brackets inwardly. A third pair of brackets, as 17, is secured to the respective bars 5 and 6, said brackets extending downwardly beneath the tracks or ways 1 and 2, and each bracket is provided at its lower end with a roller 18 which bears against the underface of the rail and prevents the carriage as a whole from jumping up, or, in other words, said rolls serve to hold the carriage to its proper position with reference to the rails.

Mounted upon the shaft 12 is a roller 19 and a similar roller 20 is mounted upon a shaft 21 secured in the brackets 17. These rollers are adapted to co-operate with a cam 22, said cam being secured to shaft 23 mounted in suitable fixed bearings 24 secured to the rails 1 and 2. Continuous rotary motion is imparted to the cam through the shaft 23, the shaft being driven from any suitable source, as for instance, through a beveled gear 25 and a driving pinion 26, the latter being secured to a shaft 27 carrying fast and loose pulleys 28 and 29. The shaft 27 is shown in the present case as mounted upon a fixed frame denoted generally by 30, which extends outwardly to one side of the bed or frame of the machine.

The rollers 19 and 20 are designed to be held in close contact with the cam 22, and this may be effected through the adjustment of the brackets 11 or 17, or both.

Secured to and carried by the outer portion of the reciprocating frame, or more specifically, to the side bars 5 and 6 thereof, is a series of chutes, namely, two rejects chutes 31 and 32, and an intermediate sample chute 33. As will be best seen upon reference to Figs. 1 and 3, the rejects chutes are of larger capacity than the intermediate sample chute 33, and such rejects chutes discharge to one side of the medial line of the machine, while the sample chute discharges to the reverse side. This is indicated by the arrows in Figs. 1 and 2. The line of demarcation between the upper portion of the sample chute and the adjacent rejects chutes is defined in the present instance by transversely-extending cross bars 34 and 35, the upper edges of which are preferably beveled, so that no material may collect thereon. It is of course conceivable, in the broader aspect of the invention, that a different arrangement may be provided in so far as the chute construction is concerned, but we have found that the present arrangement enables us to readily cut out samples of the ore from the stream, and obtain an accurate and effective sampling result.

In the operation of the machine, motion being imparted to the shaft 23, the carriage is reciprocated, and such reciprocation causes the chutes to pass successively beneath the downgoing stream of material to be sampled, which is delivered above the chutes through a hopper or way 36, as indicated in Fig. 4. The cam 22 is so designed that, in making one complete revolution, the chutes are passed through the ore stream twice, one each way, and the sample chute 33 is passed through the ore stream at a uniform rate of speed; the slowing down due to the reversing of the direction of travel of the carriage comes at a time when the rejects chutes are under the ore stream. The consequence of this action is, that the sample opening or sample chute is passed first in one direction and then in the reverse direction at a uniform rate of speed, at right angles to the falling ore, thereby tending to compensate for any selective action of the ore that might take place if the opening or chute passed only in one direction. The ore thus cut out is a true and correct sample of the ore stream, regardless of the rate of flow of the ore, or whether there is some separation of the coarse and fines as the ore comes through the hopper 36.

In Fig. 6 we have illustrated diagrammatically a process of sampling a stream of ore. The column-like figure is intended to represent the stream of ore falling from a rectangular chute. As will be appreciated, no stream of ore such as this can possibly be uniform throughout its cross section; that is to say, 90 per cent of the ore may be on one side of the center and only 10 per cent on the other side,—or most of the coarse particles may be on one side of the stream, and most of the fine particles on the other. Most of the mineral values may be in the fines, or close to the inner surface of the stream, and very little anywhere else. It will thus be seen that if we wish to take, say, one-fifth of all of the ore falling in this stream, and have this one-fifth an accurate

sample of the entire stream, it is necessary to cut out sections of the stream which shall extend entirely across the same. If it were possible to have a rectangular pocket or cup passed instantly through the stream, sections such as *a* might be cut out. It is also obvious that if these sections were taken sufficiently close together, they would be an absolutely correct sample of the entire stream, and if the vertical depth of each section were equal to one-fifth of the vertical depth of the stream between sections, the volume of the sample obtained would be one-fifth the volume of the entire stream. It is obviously impossible to make any device which will cut through an ore stream instantly, and it is therefore impossible to cut out sections similar to the section *a*, which has its upper and lower surfaces perpendicular to the axis of the stream.

A correct sample may be obtained from a section such as *b* or *c* cut entirely across the stream but with the top and bottom surfaces of the prism passing diagonally through the stream, provided the top of each prism lies in a plane parallel with the bottom of the prism, so that the depth of the sample section or prism, measured parallel to the axis of the ore stream, is the same at all points of the section. Now it is obvious that sections with a plane surface can be cut only by a spout, chute, or other device moving in a straight line across the path of the stream at a uniform rate of speed. If the path of travel of the chute be not in a straight line, the surfaces of the sections will be curved, and if the velocity of travel across this stream be not exactly uniform, the bottom surface of the sample section will be curved, and not parallel to the top surface. The figure *b* in Fig. 6 illustrates the sample section cut from a falling stream of ore by means of a chute traveling at right angles to the axis of the stream at a uniform velocity, and with the distance between the edges of the chute equal to the width of the ore stream, as illustrated diagrammatically in Fig. 7. In this figure, A is the spout from which the ore is falling and B is the sample chute of the sampling machine. If B has uniform velocity equal to that of the falling ore, it is obvious that the section of the stream, indicated by *o—p—q—r*, will be cut out, and that the bottom *o—p* will be exactly parallel to the top *q—r*, and that both the top and the bottom will make an angle of 45 degrees with the axis of the stream. If the chute B travels at a uniform velocity which is less than that of the falling stream, the lines *o—p* and *q—r* will be steeper than 45 degrees, but they will be parallel to each other, no matter what their angle of slope, so long as B moves at a uniform velocity while passing through the stream, and therefore these sections will give an absolutely correct sample of the entire stream.

Where one employs a swinging sample chute which swings in the arc of a circle, it is clear that unless such chute is moved at a uniform rate of speed, while the sample is being taken from the stream, sections similar to *d* will be cut from the ore stream, neither of which alone is anywhere near a correct sample, because the top of each section is neither straight nor parallel to the bottom. The two sections taken together tend to compensate for the errors in each other, but the compensation can never be complete.

From the foregoing, it will be evident that it is essential to move the sample chute through the stream at a uniform speed at all points in its travel. It is also advantageous to move the sample chute back and forth in a straight line. The reciprocating motion gives certain mechanical advantages, such as tending to free the cutting edges from sticks and strings,—it makes it posible to employ less head room than where an oscillating or swinging chute is employed, and tends to compensate for any selective action of the ore which there might be if the sample chute always passed in the same direction through the ore stream.

What is claimed is:

In an ore sampling machine, the combination of a suitable base provided with tracks, a truck or carriage mounted for reciprocation on said tracks, a plurality of chutes secured to and movable with the carriage, one of said chutes being relatively small and discharging in a direction away from the direction of discharge of the other chutes, and a cam co-operating with the carriage to impart reciprocating motion thereto, said cam being so formed and proportioned as to effect a uniform rate of movement of the carriage as the smaller chute is passing through the stream of ore to be sampled.

In testimony whereof we have signed our names to this specification.

OWEN H. GRAY.
CHAS. E. MURDOCK.