Jan. 27, 1931. W. C. MENZIES 1,790,107

COAL WASHING APPARATUS

Filed Feb. 26, 1927

Fig. 1.

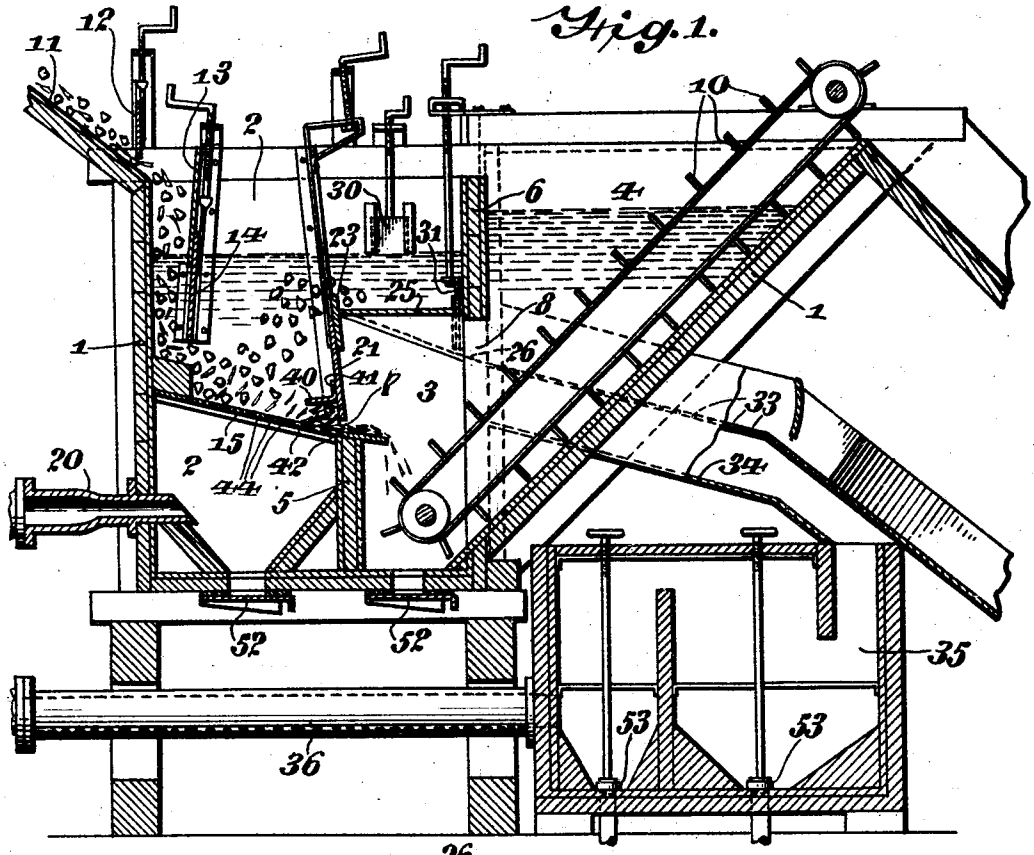


Fig. 2.

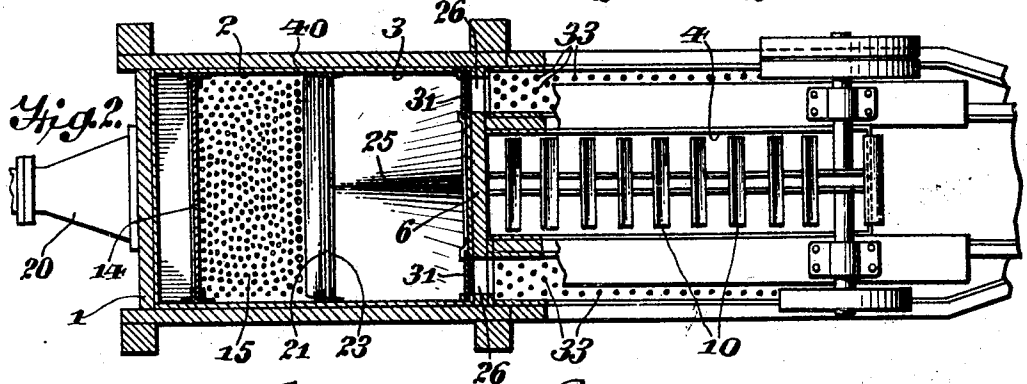


Fig. 3.

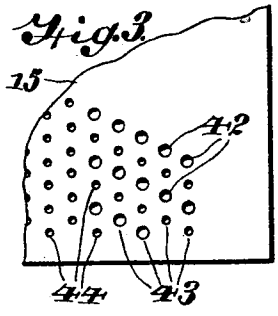
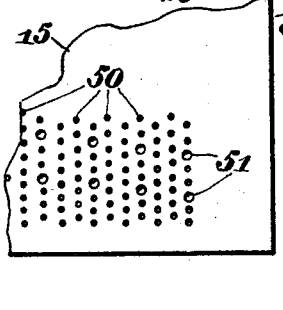


Fig. 4.



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UNITED STATES PATENT OFFICE

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COAL-WASHING APPARATUS

Application filed February 26, 1927. Serial No. 171,118.

My invention relates to coal washing apparatus and has for its object generally to provide novel means for increasing the efficiency of such apparatus in operation.

It also has for its object to provide novel means located above and adjacent to the slate discharge opening which aids in regulating the discharge of such refuse and which coacts with the upwardly moving body of water within the tank of the apparatus in a way to effect a more efficient separation of the coal from the refuse at that particular point in the apparatus and of the operation.

Another object of the invention is to provide means which operates to control the discharge of refuse from the coal after it has been separated therefrom whereby the screen plate, onto which the mixture of coal and refuse is delivered to be washed, may be supported at a greater inclination than heretofore has been practicable.

A further object of the invention is to provide a screen bottom of such character that the clogging of the holes therethrough with mud or other clogging material is prevented.

A still further object of the invention is to provide means for controlling the delivery of the coal to be washed to the apparatus whereby the efficiency and the speed of the washing operation are increased.

To these and other ends the invention comprehends the construction and arrangement of parts as hereinafter described in detail, pointed out in the claims, and as illustrated in the drawing in which a coal washing apparatus containing the improvements constituting the invention is depicted. However, it will be understood that the invention is susceptible of embodiment in other forms of construction than that shown and that changes in the details of construction may be made within the scope of the claims without departing from the said invention or its principle of operation.

In the drawing,—

Fig. 1 is a view in longitudinal section of a coal washing apparatus containing improvements constituting the invention;

Fig. 2 is a view, partly in horizontal section and partly in top plan;

Fig. 3 is a top plan view of a fragmentary portion of a screen plate provided with holes therethrough in accordance with the invention; and

Fig. 4 is a similar view showing a fragmentary portion of a screen of slightly different construction.

In the drawings I have shown a tank designated as a whole by the numeral 1, which tank is divided into compartments 2, 3 and 4 by means of partition walls 5 and 6. All of these compartments are in communication through openings 7 and 8, the former constituting the discharge opening for the passage of slate and other impurities from the compartment 2 into the compartment 3, from which it is removed by the endless conveyor 10 in well known manner.

The coal to be washed and separated from the refuse matter, including slate, rock, sulphur compounds and the like, is delivered into the compartment 2 from a chute 11. The delivery of the mixture of coal and refuse from the chute is controlled by an adjustable gate 12. The adjustments of the gate may be effected in any preferred known manner. The coal descends into the compartment 2 through a passage way formed between the rear wall of the tank 1 and a spaced plate 13 upon the lower end of which is mounted an adjustable gate or baffle plate 14. The coal with its refuse is delivered onto the screen plate 15. By adjustment of the gates 12 and 14 the material to be treated may be delivered at a rate to correspond with the capacity of the apparatus.

Water, preferably under constant pressure, is delivered from a pipe 20 into the lower part of the compartment 2 underneath the

screen 15 which is inclined from the rear toward the front or delivery end of the apparatus as is clearly shown in Fig. 1.

The vertical width or height of the opening 7 may be varied by adjusting the gate 21. The adjustment of the said gate may be effected in any preferred known manner. The water flowing upwardly from the lower part of the compartment 2 through the screen plate 15 strikes the mixture of coal and refuse material, and the former being of less specific gravity than the latter, is caused to move upwardly, while the refuse being of greater specific gravity, moves downwardly along the said plate and is discharged through the opening 7. The coal is carried upwardly and forwardly over the upper edge of the plate 23 onto a transversely extending plate comprising a ridge or elevated portion 25 at its center, the apex of which is located at approximately the medial line of the structure. The opposite sides of the ridge slope in opposite directions so that the coal which falls thereon is caused to move laterally in opposite directions into position to pass outwardly through the openings 26 at the opposite sides of the portion of the compartment 3 above the transversely extending plate comprising the ridge 25 previously referred to. In order to control the height of the water in the compartments 2 and 3 I have provided an opening controlled by a gate 30 as shown in Fig. 1. The coal discharge openings 26 are adapted to be controlled by means of adjustable gates 31. The coal, after it passes through these gates, travels along chutes in known manner, the bottoms of which are perforated as indicated at 33 so that the water which flows out through the discharge openings 26 escapes therethrough onto a plate 34, from which it flows into a tank 35 from which it is withdrawn by means of a pump (not shown) through a pipe 36 and returned through a pipe 20 to the lower portion of the compartment 2.

For the purpose of effecting a more efficient separation of the coal and the refuse which may be present therein I have provided a plate 40 which is secured by means of a flange 41 to the adjustable gate 21 a short distance above the lower edge thereof. The gate 21 is inclined slightly in the direction as indicated in Fig. 1 of the drawing, and in the construction shown the plate 40 extends at right angles thereto towards the rear in a downwardly inclined direction. The angle of such inclination depends upon the angle made by the gate 21 with a vertical plane. The plate 40 preferably is unperforated, although it may be perforated if desired. It extends over the lower portion of the screen plate 15 and together with the lower edge portion of the gate 21 co-operates with the said plate to form what may be described as a partially closed chamber in front of the lower edge portion of the gate 21 within which the refuse is adapted to collect to a greater or less extent.

To effect a more efficient separation of the coal from the refuse I prefer that alternate openings 42 in the rows of openings 43 which are located below the plate 40 shall be considerably enlarged so that the water may flow freely and with greater volume and force therethrough. In the plate as shown in Fig. 3, even the smaller openings 44 are of somewhat larger size than is usually employed in order that the clogging of the said openings or holes is less likely to occur. The presence of the larger openings 42 previously referred to permits the water to flow in greater volume and force through the lower portion of the screen where the quantity of refuse content is greater, in consequence of which there is a greater resistance to the flow of water upwardly through the screen. The increased volume and force of the flow of water upwardly through the lower portion of the screen causes any coal which may have found its way into the space underneath the plate 40 to travel upwardly into the portion of the tank 2 above the screen plate 15 and the plate 40. Also the freer flow of the water through the lower portion of the plate as described, as well as through other portions thereof due to slightly enlarged holes 42, effects greater agitation or movement of the relatively heavy refuse portion of the mass being treated, in consequence of which the coal is more thoroughly separated and removed therefrom.

In the beginning of the operation, if the gate 21 be closed or practically closed so as to prevent the discharge of refuse matter therefrom a portion thereof will bank up underneath the plate 40 so that when the said gate is opened refuse alone will be discharged without the admixture of any coal therewith.

In Fig. 4 I have shown a slightly modified construction of the screen plate in which the openings 50 are smaller than the corresponding openings 44 in the plate shown in Fig. 3. For the purpose of compensating for the smaller openings 50, I have provided in the first, fourth, seventh and tenth rows larger openings 51 at intervals as shown. The presence of these openings permits an acceleration of the upward flow of water through the screen plate to thereby effect complete and efficient separation of the coal from its impurities.

Valves 52 and 53 are provided for removing slush from the compartments 2 and 3 of the tank 1 and from the tank 35 respectively.

It has been found that by adjusting the gate 12 so as to regulate the delivery of coal with its admixture of refuse matter to the compartment 2 in quantity corresponding to the capacity of the apparatus, more efficient and more rapid separation may be effected.

It also has been found that without the presence of the adjustable control gate 12 the space between the rear wall of the tank 1 and the plates 13 and 14 becomes filled with material which does not discharge evenly underneath the lower edge of the plate 14. In such case it will happen sometimes that the quantity of material delivered through the passage way underneath the lower edge of the plate 14 is less than the capacity of the tank, while at other times the quantity is greater than can be handled efficiently by the said apparatus. The result of this is that in the latter case complete separation may not be effected resulting in a loss of coal; that is, resulting in the passage of coal through the refuse discharge opening 7 instead of upwardly through the compartment 2 and out through the discharge openings 26.

It will be seen that by my invention I have provided a construction of apparatus comprising a plurality of elements which are so correlated as to bring about a more efficient operation of the apparatus not only as to the speed with which separation of the coal and refuse matter is effected but also as to the completeness and thoroughness of such separation.

Although I have described the invention as being of especial utility in the washing of coal and the separation thereof from refuse, it is to be understood that the invention also is capable of being used for effecting the separation of any relatively heavy mineral of value from its ore, such as gold, etc.

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

1. An apparatus of the character described comprising a tank having a partition wall extending transversely thereof and dividing the tank into rear and front compartments, which partition wall is provided with a refuse opening therethrough, a perforated screen plate extending across the rear compartment which screen plate is inclined from the rear toward the bottom of the said refuse discharge opening, an adjustable plate for varying the height of the opening through said partition wall, an angle member secured by one of its flanges to the said adjustable plate, the other of said flanges extending rearwardly into and partially across the rear compartment and being inclined downwardly and occupying a position above the lower edge portion of the said screen plate, certain of the perforations in said screen plate underneath the last named flange being larger than the other perforations through said plate, and means for regulating the delivery of coal to be washed to the said rear compartment to correspond with the capacity of the said apparatus.

2. An apparatus of the character described comprising a tank having a partition wall extending transversely thereof and dividing the same into front and rear compartments, said partition wall having a refuse discharge opening therein, a perforated screen plate extending across the said rear compartment, which plate is inclined downwardly toward the lower edge of the said opening, the perforations in said plate being arranged in rows and the perforations of the respective rows located in the lower edge portion of the said plate being alternately relatively large and relatively small, means for delivering coal to be washed to the said rear compartment, means for regulating the delivery of the said coal, and means for discharging water under constant pressure into the lower portion of the said rear compartment, which water flows upwardly through the said compartment and through the said screen.

3. An apparatus of the character described comprising a tank, a partition wall dividing the said tank into rear and front compartments, which partition wall is provided with a refuse discharge opening, the portion of the wall above the said opening being adjustable so that the height of the said opening may be varied, a perforated screen extending across the said rear compartment and inclined from its rear edge toward the lower edge of the said refuse discharge opening, the perforations through the lower portion of the said screen adjacent the said refuse-discharge opening being of different sizes, one set being relatively small and the other set relatively large, a plate secured to the said adjustable wall portion and extending rearwardly therefrom into the said compartment and over the lower edge portion of the said screen, the said plate cooperating with the lower portion of the said adjustable plate and the said screen to form a partially closed chamber, means for delivering coal to be washed to the said rear compartment, means for regulating the discharge of coal into said compartment and means for delivering water under constant pressure to the lower part of the said rear compartment which flows upwardly through the said screen, and constitutes a moving column of water by which the bed of coal and impurities which overlies the said screen is freely supported to effect separation of the coal from refuse matter.

4. Apparatus for separating the relatively heavy constituents from minerals comprising a tank having a screen plate mounted therein, means whereby a bed of said heavy constituents is caused to accumulate on said plate, certain portions of which are thicker than other portions thereof, means for discharging water through said screen plate under substantially constant pressure, said screen plate being provided with means whereby the flow of water therethrough is greater in the region of the thicker portions of said bed of heavy constituents than through the other portions thereof, and

means for controlling the delivery of mineral to said apparatus to correspond to the capacity thereof.

5. Apparatus for separating the relatively heavy constituents from minerals comprising a tank having an inclined screen plate mounted therein, means for discharging water through said screen plate under substantially constant pressure, said screen plate being provided with means whereby the flow of water therethrough is greater at its lower end portion than at the upper end portion thereof, and means for controlling the delivery of mineral to said apparatus to correspond to the capacity thereof.

6. Apparatus for separating the relatively heavy constituents from minerals comprising a tank having a screen plate mounted therein, means for discharging water through openings of different sizes formed in said screen plate under substantially constant pressure, means for causing a bed of said heavy constituents to accumulate on said screen plate, portions of which are thicker than other portions thereof, the said openings being relatively larger in the region of said thicker portions of said bed of heavy constituents than in the remaining portions thereof, and means for controlling the delivery of mineral to said apparatus to correspond to the capacity thereof.

7. Apparatus for separating the heavy constituents from minerals comprising a tank having a screen plate mounted therein, means cooperating with said screen plate for causing a bed of said heavy constituents to accumulate thereon, means for forcing water through perforations formed in said screen plate under substantially constant pressure, the said perforations being arranged in rows and the perforations of the respective rows located in the lower end portion of the said plate being alternately relatively large and relatively small, and means for controlling the delivery of mineral to said apparatus to correspond to the capacity thereof.

8. Apparatus for separating the relatively heavy constituents from minerals comprising a tank having a plurality of compartments therein separated by a partition wall, a screen plate mounted in one of said compartments adapted to convey said heavy constituents to an opening formed in said wall, an adjustable plate for varying the height of said opening having a baffle secured thereto extending rearwardly therefrom above the lower portion of the said screen plate, the said lower portion of said screen plate being provided with a plurality of perforations which are relatively large as compared with the perforations in the upper portion of the said plate, and means for discharging water through said screen plate under substantially constant pressure.

9. Apparatus for separating the relatively heavy constituents from minerals comprising a tank having a plurality of compartments therein separated by a partition wall, a screen plate mounted in one of said compartments adapted to convey said heavy constituents to the other of said compartments through an opening in the said wall, an adjustable plate for varying the height of the said opening having a baffle secured thereto extending rearwardly therefrom above the lower portion of the said screen plate, the said lower portion of said screen plate being provided with a plurality of perforations arranged in rows, the perforations of the respective rows being alternately relatively large and relatively small, and means for controlling the delivery of mineral to said apparatus to correspond to the capacity thereof.

10. Apparatus for separating the relatively heavy constituents from minerals comprising a tank having a plurality of compartments therein separated by a partition wall, an inclined screen plate extending across one of the said compartments and adapted to convey refuse matter to an opening formed in said partition wall, an adjustable plate for varying the height of said opening having a baffle secured thereto extending rearwardly therefrom above the lower portion of the said screen plate, and means for controlling the feed of the material to be treated to the said screen plate.

11. Apparatus for separating the relatively heavy constituents from minerals comprising a tank having a plurality of compartments therein separated by a partition wall, a screen plate mounted in one of said compartments adapted to convey said heavy constituents to an opening formed in said partition wall, an adjustable plate for varying the height of said opening having a baffle secured thereto extending rearwardly therefrom, said screen plate having a plurality of perforations therethrough, the perforations near the lower end portion of said plate being relatively large with respect to those in the upper end portion thereof, and means for controlling the feed of material to be treated to the said screen plate.

12. Apparatus for treating coal to separate therefrom impurities of higher specific gravity than the coal, comprising a tank having a transverse partition wall dividing the said tank into compartments, the said partition wall having an opening therethrough for the discharge of impurities separated from the coal, a perforated screen plate extending across one of said compartments and having its inner edge portion projected through the opening in said transverse partition wall, means for controlling the delivery of coal and impurities onto the said screen plate, means for supplying water under constant pressure to the said compartment underneath the said screen plate, the

said water flowing upwardly through the said screen plate and operating to separate the impurities from the coal, the said impurities being discharged through the opening through the said transverse partition wall, and means whereby the volume and force of the flow of water upwardly through the said screen plate in adjoining relation to the said opening through which the impurities are discharged is greater than at other portions of the screen plate.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 20th day of January, A. D. 1927.

WILLIAM C. MENZIES.