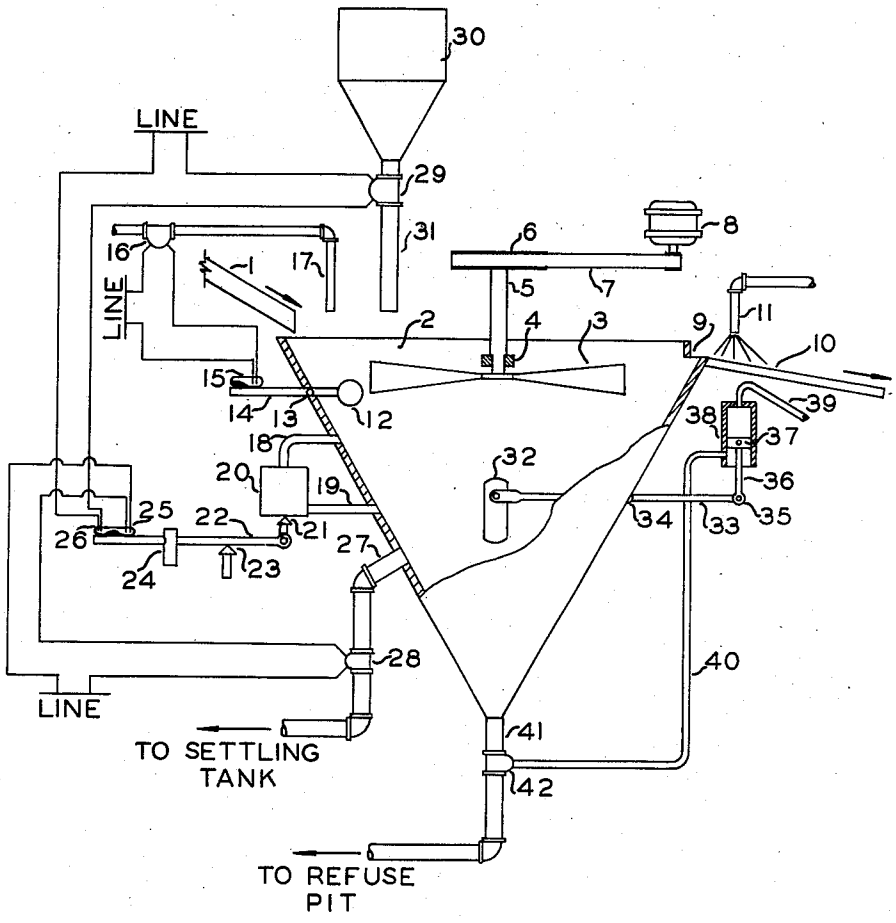
June 25, 1940. W. M. CROSS, JR 2,205,942

METHOD OF WASHING COAL

Filed Dec. 23, 1935



Walter M. Cross Jr.

INVENTOR

Patented June 25, 1940 2,205,942

UNITED STATES PATENT OFFICE

2,205,942

METHOD OF WASHING COAL

Walter M. Cross, Jr., Kansas City, Mo.

Application December 23, 1935, Serial No. 55,807

4 Claims. (Cl. 209—173)

This invention relates to an improvement in the art of coal washing.

On object of my invention is the utilization of a colloidal clay, such as Wyoming bentonite, which is of such high colloidal efficiency that it is capable of forming a highly viscous and substantially stable aqueous solution when it alone is combined with many times its weight of water for washing coal and separating the impurities therefrom by virtue of the viscosity of said solution, which maintains the pure coal in suspension, while the impurities settle out.

Another object of my invention is to teach a method of floating coal to segregate it from the refuse primarily by the viscosity of the washing medium attained by addition of Wyoming-type bentonite to the water of the washing medium instead of the specific gravity thereof, but I may also add a weighting agent to increase the specific gravity of the washing medium, and said weighting medium will be held in suspension by the Wyoming bentonite.

These objects are accomplished by providing a method of washing coal which provides for new types of washing medium, the viscosity of which is depended upon to separate the coal from the refuse instead of the specific gravity of the said medium. The following description shows in detail one form of apparatus that may be used to accomplish my results.

The drawing is a partially cut-away side elevation of a coal washer.

In the drawing, 1 is the coal intake chute; 2 is the washing receptacle; 3 is the paddle wheel agitator located in the washing receptacle; 4 is the bearing for the paddle wheel shaft; 5 is the paddle wheel shaft; 6 is a pulley fixed to the paddle wheel shaft and is driven by belt 7 which in turn is driven by power source 8; 9 is the discharge lip of the washing receptable; 10 is the spraying and dewatering screen; 11 is the water spray line for washing off the solid matter which has been left on the coal by the washing medium; 12 is the bulb of a float control, the arm 14 of which pivots vertically around bearing 13; 15 is a mercury electric switch which closes a circuit when the mercury has flowed to the end of the bulb containing the electric terminals in such manner as to cover both terminals; 16 is an electric valve for fluid; 17 is a fluid line so located as to empty fluid into receptacle 2 when valve 16 is open; 18 and 19 are flexible tubes which allow the washing medium contained in receptacle 2 to flow through weighing box 20; 21 is a knife edge supporting weighing box 20; 22 is the beam of a scale mechanism supported on fulcrum 23; 24 is a weight movable on beam 22; 25 and 26 are separate sets of electric terminals in a mercury electric switch bulb; 27 is the discharge line for the washing medium; 28 is an electric valve located in line 27; 29 is an electric valve located in discharge pipe 31 of hopper 30; 32 is a float suitably supported by a horizontal bearing in arm 33 which arm pivots vertically about bearing 34; 38 is a cylinder in which piston 37 is moved vertically in such a manner as to give arm 33 a vertically reciprocating motion through bearing 35; 39 is an air supply line into cylinder 38; 40 is a pipe connection between cylinder 38 and air operated valve 42 which is located in refuse discharge line 41.

The description of an embodiment of the operation of this method of coal washing follows. Coal to be washed is charged into cone 2 through chute 1 after cone 2 has been filled nearly to the level of lip 9 with a washing medium which is made up in one of the following ways. First the washing receptable is filled nearly to the level of discharge lip 9 with water. While paddle wheel 3 is rotating, a gelling material namely, bentonite, is slowly added. The most efficient substance to use is a clay known as bentonite, of the Wyoming variety. This clay has the characteristic of forming a gel with from fifteen to twenty-five times its weight of water, and the clay may be chemically treated to be even more efficient in gelling power. The gel is most easily formed when the bentonite is of such fineness that it will pass a screen, having 200 meshes to the inch. The gel formed by treated bentonite gives a washing medium having a viscosity of any desired amount up to 180 centipoises with only 5.5 percent, by weight, of solids concentration. Such a gel is thixotropic in character. If a gelling agent such as Wyoming bentonite is used, the amount of clay placed in the water may range from ¼ of 1 percent to 15 percent, by weight, of the water present.

Where there is not an appreciable amount of fire clay brought into the washing medium by the coal, the viscosity of the gelled washing medium alone or in conjunction with the upward component given the washing medium in receptacle 2 will be sufficient to properly float the coal from the washer.

As the coal is floated in the washing medium contained in receptacle 2 there are separated from it foreign materials such as fire clay, pyrites and shale. These materials, particularly the last

two, sink to the bottom of the washing receptacle and the cleaned coal floats off through discharge lip 9. A sharp spray of water is played upon the coal as it passes on to screen 10 and then vibration of screen 10, subsequently passed, dewaters the coal. From screen 10 the coal goes to further processing means or is loaded out as the case may be.

Float 32 is given a continual reciprocating motion vertically by arm 33 which pivots around horizontal bearing 34. Through line 39, intermittent air impulses continually force piston 37 downwardly. This mechanism is so designed that the weight of float 32 tends to keep piston 37 toward the top of cylinder 38. The action of piston 37 through piston rod 36 on arm 33 is to give float 32 a constant vertical reciprocating motion. Air line 40 enters cylinder 38 at a point which is just above the top of piston 37 when it is at the bottom of this cylinder. Piston 37 does not make the full vertical traverse of the cylinder at each air impulse through line 39 but travels only a short distance downwardly. As refuse builds up in the bottom of receptacle 2, float 32 assumes a higher mean level with respect to the bottom of the receptacle, since it is constantly jigging up and down and at the bottom of each stroke rests on the refuse in the bottom of the receptable. As the level of the refuse becomes higher, piston 37 attains a lower mean level with reference to the bottom of cylinder 38 until the air from line 39 passes through cylinder 38 into line 40 and passes thence to valve 42. Valve 42 is opened by the air pressure thus resulting and the refuse in receptacle 2 is discharged through line 41 to a refuse pit, from which some light mud may be reclaimed.

As washing continues, it may be desirable when using a weighting agent to maintain the specific gravity of the washing medium relative to the viscosity within certain limits. To accomplish this the washing medium is continually circulated through lines 18 and 19 into weighing box 20 which is thus kept full. If the specific gravity of the washing medium become greater than the desired value, box 20 will increase in weight and will depress knife edge 21. This causes beam 22 to turn on knife edge 23, raising the end of the beam where is located the mercury electric switch. This tipping of arm 22 causes the mercury in the switch to flow so as to cover electric terminals 25, thus closing an electric circuit which causes valve 28 to open and allows the washing medium to flow from receptacle 2 through line 27 to the settling tank. When the specific gravity of the washing medium falls to the desired value, box 20 will decrease in weight and will turn beam 22 about knife edge 23 so that the mercury in the mercury electric switch uncovers terminals 25 which action closes valve 28. It is sometimes desirable to combine lines 27 and 41 and to discharge to a single pit or tank, either when the refuse level in receptacle 2 rises to a predetermined height or when the specific gravity of the washing medium reaches a predetermined maximum. At the same time, since the level of the washing medium in receptacle 2 is becoming lower, float bulb 12 will also become lower and cause the mercury in switch 15 to cover the terminals therein. These terminals close an electric circuit which opens valve 16 allowing washing medium which has been cleared in the settling tank, or water, as may be desired, to flow into receptacle 2 until the level of the medium in the receptacle is high enough to break the contact in switch 15 which thus closes valve 16.

If the specific gravity in receptacle 2 falls below the desired value, the weight of box 20 decreases. This allows arm 22 to tip on knife edge 23 in such a manner as to run the mercury in the mercury electric switch attached to said arm 22 to flow over terminals 26 which closes an electric circuit to valve 29. With valve 29 open, additional solid matter is allowed to flow into receptacle 2 through pipe 31 until the weight of box 20 has increased sufficiently to break the contact on terminals 26 when valve 29 closes. In this manner the specific gravity of the washing medium is kept within the desired limits relative the viscosity.

Further advantages of this invention by adding a gelling material having the properties of Wyoming bentonite are that the fire clay washed from the coal can be supported in greater quantities in the washing medium, thus more efficiently supporting the coal therein and also preventing the fire clay from settling in a hard mass in the bottom of the washing receptacle which causes a shut-down and requires constant cleaning.

It is apparent that various changes may be made in this invention within the scope of the appended claims.

What is claimed is:

1. The method of washing coal which comprises introducing raw coal into an aqueous medium consisting of water and Wyoming bentonite and having a specific gravity less than that of coal and having a viscosity which substantially floats the coal alone and creating a circulating movement in the aqueous medium to an extent such that the coal is held in suspension while the impurities associated with the coal sink to the bottom of the aqueous medium.

2. The process as set forth claim 1 in which the circulating movement in the aqueous medium is effected by agitation.

3. The process as set forth in claim 1 in which the amount of Wyoming bentonite is from ¼ to 15%.

4. The process as set forth in claim 1 in which the aqueous medium is prepared by adding a Wyoming bentonite having a fineness such that it will all pass through a 200 mesh screen, to water, the amount of bentonite being from ¼ to 15%.

WALTER M. CROSS, JR.