METHOD OF FROTH FLOTATION


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4 Claims. (Cl. 209—166)

This invention relates to a method of use in the recovery of coal from a water borne suspension of coal and dirt such as for example forms the residual product in washing and it is intended especially for use in the treatment of coal to reduce its dirt content.

It is known to recover the coal from such a suspension by means of a froth flotation process by which fine coal may be recovered in the form of a filter cake containing a relatively low percentage of dirt.

According to the present invention, a conditioning agent, for example gas oil or creosote, is introduced to the suspension and thereafter, or it may be simultaneously, a frothing agent, for example cresylic acid, is added thereto. Sufficient air is then introduced to the suspension so treated to form bubbles which unite preferentially with the coal particles and rise to the top of the suspension to form a froth which is skimmed off and thereafter treated in known manner to form a filter cake.

One object of the present invention is to provide a process which can be controlled to suit the quality of the suspension under treatment with a view to obtaining a high coal extraction efficiency.

Another object of the invention is to provide a process whereby, in treating a water borne coal suspension by the froth flotation process, the quantity of conditioning and frothing agents will be substantially reduced below what is now regarded as normal.

To this end the present invention a conditioning agent, a frothing agent and air are introduced into a flow of the suspension a major part of the flow containing said agents and air subjected to a mixing and agitation action, and the total flow is then treated for removal of the froth as formed thereby, a minor part of the flow variable at will being by-passed without mixing and agitation to unite with the mixed and agitated flow prior to the removal of the froth.

The invention will now be described with reference to the annexed drawings in which:

Figure 1 is a diagrammatic view of one form of apparatus usable in carrying out the invention;

Figures 2, 3 and 4 are a side elevation, plan and end elevation respectively of a second form.

Figure 5 is a perspective view of a detail of a third form.

The apparatus shown in Figure 1 comprises a vertical tank a of which the lower part b constitutes a turbulent zone while the upper part c constitutes a quiescent zone. Conducted towards the top and foot of the turbulent zone of the tank are inflow and outflow pipes c1 and d respectively which are connected to a centrifugal pump e driven by a motor f. The flow in each of the outflow pipes c1 and d is controlled by valves v1 and v2 respectively. Said pipes are interconnected by means of a by-pass pipe g the flow in which is controlled by valve v3, whereby the degree of mixing of the suspension and introduced agents can be controlled.

The conditioning agent is introduced through a valve-controlled branch pipe h and the frothing agent through a valve-controlled branch pipe i, said pipes being connected to a pipe j which in turn is connected to the low pressure side of the pump e. The air intended to form the air bubbles is introduced through a further valve-controlled branch pipe k connected to the pipe j.

When the apparatus is in operation the water borne suspension is delivered by means of pump e to the turbulent zone b of the tank, and is circulated therein, the suspension passing back to the pump through the return pipe d for recirculation. The rate of flow through the inflow pipe is maintained at a velocity exceeding the critical Reynolds value. The conditioning agent may be introduced to the pump with or without primary or conditioning air and is thereby dispersed over as large as possible an area of the coal particles.

In like manner, the frothing agent is introduced to the conditioned suspension, or it may be introduced simultaneously with the conditioning agent. Finally air for frothing is introduced in like manner through pipes k and j and forms bubbles in the turbulent zone of the tank. Thereafter more and more of the water borne suspension together with conditioning agent, frothing agent and air are introduced and circulated through the turbulent zone, some of the suspension then rising to the quiescent zone c. Air bubbles with particles of coal adhering thereto rise through the quiescent zone to form a froth on the top from which it is skimmed off through the discharge outlet 1. The introduction of the water borne suspension should be such as will keep the apparatus working to capacity, the water and dirt suspension being withdrawn continuously or periodically from the turbulent zone.

The degree of turbulence, the amount of air introduced, and the stage or stages at which air is introduced, the amount of conditioning agent and the amount of frothing agent are all capable of independent control to suit the suspension being treated and the desired final product.

Further, part of the suspension with either or both of the agents and with or without the air can be by-passed through pipe g to the return flow pipe of the pump without entering the tank and by this means the degree of mixing can be controlled.

In Figures 2–4 where like parts are denoted by like references, the apparatus embodies two tanks a in series, separated by a partition p having at its upper end an adjustable slidable flap q for height variation. Duplicate pumps f, and duplicate systems of piping and valves are provided for each tank. The tailings discharged from the outlet of the left hand tank a is led to the inflow piping d for the right hand pump f for further treatment, while the froth in both tanks rises to the top and is removed by a froth skimmer comprising chains s carrying flights m and driven by rollers r.

The general mode of operation of this apparatus is otherwise similar to that described in connection with Figure 1.

In Figure 4 the inlet pipe c1 has a curved portion within the tank a so that the incoming flow against the sloping bottom b of the tank a.

Figure 5 shows a modified form of tank a which may be used instead of the tank shown in Figure 1. In this form also like references denote like parts, the treated suspension flow entering the tank at the inlet c1 as in the case of Figure 1, the froth leaving at I and the tailings at t after flowing past the adjustable partition p1. In this case however there are no turbulent and quiescent zones in the sense of Figure 1.

In order to give the necessary high degree of mixing and dispersion of air and reagents with the water borne coal suspension, it is essential that the velocity of the water borne suspension flowing through some part of the pumping system should exceed the critical Reynolds value.
The above described method and apparatus may likewise be applied to the treatment of coal to reduce its ash content. When so applied the coal is pulverized and a water borne suspension formed therefrom, this suspension then being treated as above described. By such means a froth formed of coal substantially free of ash is obtained.

We claim:
1. A method for the recovery of coal from a water borne suspension of coal or of coal and dust, wherein a conditioning agent, a frothing agent and air are introduced into a main flow of the suspension, the main flow containing said agents and air is subjected to a mixing and agitating action, and a part only of the main flow is then treated for removal of the froth formed thereby, a part of the aerated and agitated main flow variable at will being by-passed without froth removal to unite with the main flow prior to the mixing and agitating action.
2. A method according to claim 1 wherein the agents and air are introduced into the main flow immediately prior to the mixing and agitating action.

3. A method according to claim 1 wherein a part of the flow is led for froth removal into a quiescent flow zone located above and in communication with a turbulent flow zone, the froth thereby rising to the upper part of the quiescent zone while the tailings discharge is removed from the lower part of the turbulent zone.
4. A method according to claim 3 wherein a part of the flow variable at will is led from the lower part of the turbulent zone into the main flow before mixing and agitating.

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