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CA 2425840 C 2010/07/06

(11)(21) **2 425 840**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(22) Date de dépôt/Filing Date: 2003/04/17

(41) Mise à la disp. pub./Open to Public Insp.: 2004/10/17

(45) Date de délivrance/Issue Date: 2010/07/06

(51) Cl.Int./Int.Cl. *B01D 19/02* (2006.01), *B01D 19/00* (2006.01), *C10C 3/00* (2006.01)

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(54) Titre : METHODE ET SYSTEME DE DESAERATION DE MOUSSE DE BITUME
(54) Title: METHOD AND SYSTEM FOR DEAERATING A BITUMEN FROTH

(57) Abrégé/Abstract:
A bitumen froth is deaerated by passing the froth through a screen to reduce the air content of the froth. The screen is preferably configured as a conveyor belt which is rotated slowly underneath a froth supply unit and the sieve opening is preferably selected such that necking of the froth that drips out of the sieve openings occurs and the surface area of the froth is increased whereby air escape from the froth is enhanced.

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A B S T R A C T

METHOD AND SYSTEM FOR DEAERATING A BITUMEN FROTH

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(Fig.2)

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METHOD AND SYSTEM FOR DEAERATING A BITUMEN FROTH

FIELD OF THE INVENTION

The invention relates to a method and system for deaerating a bitumen froth.

It is known that bitumen froth produced from an oil sand deposit can be difficult to pump using centrifugal pumps due to its high viscosity and degree of aeration.

Various deaeration systems are disclosed in the prior art for the purpose of making bitumen froth more easily pumpable.

Canadian patent 1072474 discloses a system in which froth streams are fed by gravity to deaerator columns wherein the streams are heated and deaerated with steam to produce a pumpable micture of bitumen, water and solids.

Canadian patent 1071130 discloses the recovery of bitumen froth in overflow launders disposed on the upper edge of an extraction cell. The recovered froth flows from the launders, by gravity, into a lower collection vessel. Deaeration is accomplished by adding steam injection means to the launder so that the bitumen froth can be heated and deaerated while being transferred from the separation zone to the collection zone.

Canadian patent 1137906 discloses the use of chemical defoaming agents so that a froth deaerates in a separation cell and becomes pumpable without further treatment.

API document No. 4270069 describes a tubular vertical deaeration tower wherein a froth is caused to cascade downward over a series of cones, flowing against the upward

flow of steam. Such deaeration towers are commonly used in present day oil sands extraction plants. The froth entering the deaeration tower typically contains about 20% by volume of air and may be at a temperature of about 40 degrees Celsius. The froth needs to be deaerated such that the air content is reduced by about 20% by volume of air before it can be easily pumped using conventional centrifugal pumps. The deaeration tower typically contains a series of cones, a distributor plate, internals and steam injection means and optionally a froth recycle loop to assist in process control. Typically the deaerated froth stream from the deaeration tower will have a temperature of about 65 degrees Celsius, which needs to be reduced to about 48 degrees Celsius before the downstream solvent recovery of the bitumen can be attempted.

Accordingly, all of the above prior art systems to deaerate bitumen froth involve the use of costly equipment and the costly addition of either heat and/or chemicals.

Canadian patent application number 2,263,858 advocates overcoming these disadvantages by using mechanical deaeration whereby the froth is sheared with an impeller or a recirculating pump. This approach entails costly mechanical equipment that is difficult to maintain in operation.

An object of the present invention is to reduce the cost of deaeration of bitumen froths and to provide a bitumen froth deaeration method and system which also protect downstream centrifugal pumps and/or other bitumen processing equipment from damage by coarse solids.

SUMMARY OF THE INVENTION

The bitumen froth deaeration method according to the invention comprises passing the froth through a screen to reduce the air content of the froth.

The sieve opening size is determined by the required throughput, froth temperature and area of the screen. Preferably, the sieve opening size of the screen is selected such that the surface area of the bitumen froth is expanded and air escapes from the bitumen froth and is at least 2 mm, more particularly at least 6mm, across.

The screen may be continuously or intermittently moved relative to a froth supply unit, for example by configuring the screen as a permeable conveyor belt, which is continuously translated underneath the froth supply unit.

Suitably, the froth supply unit is arranged downstream of a primary bitumen enriched froth exhaust conduit of a gravity froth separation vessel in which a froth formed by injecting air into a slurry of oil sand and water is separated by gravity separation into a bitumen enriched primary froth stream and a water and sand enriched secondary froth stream.

The oil sand may be mined from an oil sand deposit and subsequently crushed and mixed with hot water and transported from the mining site to the froth separation vessel through a pipeline in which the slurry of hot water and oil sand is conditioned and air is injected into the slurry to create a froth which is fed into the gravity froth separation vessel.

The bitumen froth separation system according to the invention comprises a screen through which in use a

bitumen froth is induced to flow and the air content of the froth is reduced. Preferably, the screen has a sieve opening size of at least six mm across and the screen is configured as a permeable conveyor belt which is in use slowly rotated and thereby translated underneath a froth supply unit. The conveyor belt may be provided with a scraper and/or spray cleaning unit for removing any bitumen froth from the screen during each rotation cycle.

These and other features, objects and advantages of the method and system according to the invention are detailed in the appended claims, abstract and detailed description with reference to the accompanying drawings.

DESCRIPTION OF PREFERRED EMBODIMENTS

The method and system according to the invention will be described in more detail and by way of example with reference to the accompanying drawings in which:

Fig.1 shows a schematic overview of an oil sand processing plant, which comprises a deaeration screen according to the present invention;

Fig. 2 shows at a larger scale the deaeration screen of Fig.2; and

Fig.3 shows at a further enlarged scale a screen opening of the screen of Fig.1 and 2 in which froth necking occurs.

Referring to Fig.1 there is shown a schematic overview of an oil sand processing plant in which mined oil sand is fed from an oil sand truck 1 to a semi-mobile crusher 2 and then transported by a conveyor belt 3 to a rotary breaker 4 in which the crushed oil sand is mixed with

hot water 5 and oversized lumps are separated and supplied to a reject disposal 6.

The remaining oil sand and water slurry is then pumped through a pipeline 7 in which the oil sand slurry is conditioned and aerated by an air injection unit 8.

The aearated slurry flows from the pipeline 7 into a primary froth separation vessel 9 in which a primary low density bitumen enriched froth is separated from a secondary high density sand and water enriched froth. The secondary high density sand and water enriched froth is removed from the separation vessel 9 via one or more lower exhaust conduits and further processed in a series of flotation cells 10 and a hydrocyclone 11 and pumped into a tailings settling pond 12 and a water treatment and/or recycling unit 13.

The primary bitumen enriched froth is discharged from the primary froth separation vessel 9 via an upper exhaust conduit 14 and fed to a froth supply unit 15, which is arranged above a froth deaeration screen 16 according to the invention.

Fig.2 shows in greater detail that the screen 16 is configured as a conveyor belt, which rotates about a series of rollers 17 around a collector trough 18. The froth supply unit 15 distributes the froth across the substantially horizontal upper surface of the screen 16. Fig.3 shows in greater detail how froth necking occurs as the froth passes through the screen 16.

When field tested elongated streams of bitumen 20 were observed to be forming under the wire mesh of the rotating screen 16 according to the invention.

The elongated streams of bitumen 20 were either removed by scrapers 19 and/or pulled away by their own weight.

Testing of screens was conducted to verify that they would function to deaerate oil sands froth in addition to removing solids. Froth was aerated so that it contained over 60% air. A series of tests was conducted in which aerated froth, at temperatures of 25° Celsius and 40° Celsius, was strained through screens having different mesh sizes. The amount of resulting deaeration is shown in the following table.

Results:

	Air Reduction with Time only	Air Reduction over an Inclined Plate	Air Reduction - 6 mm Sieve	Air Reduction - 2.5 mm Sieve
	2.3%	7.2%	20.2%	36.4%
	2.9%	4.2%	8.7%	22.4%
	3.4%	3.5%	12.4%	29.6%
Average:	2.9%	4.5%	13.8%	29.7%

As can be seen, the amount of deaeration when using the sieve having an opening size of six mm was on average a 13.8% reduction) and when using the screen having a sieve opening size of 2.5 mm was on average a 30% reduction).

As can be seen from these test results, a linear screen 16 can be used to not only remove debris from oil sands froth but to also replace costly conventional deaeration means.

It is believed that the screen achieves deaeration by expanding the surface area of the bitumen to allow air to escape from the bitumen more easily. It is recognized that steam can be added to assist in deaeration, however it is not essential to do so. The objective is to conduct the deaeration using the screen in a manner which does not cause the raising of the temperature of the bitumen.

As illustrated in Fig. 1 the deaerated bitumen froth can be easily pumped from the deaerated froth collection trough 18 by a conventional centrifugal pump 21 into a bitumen storage tank 22.

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CLAIMS:

1. A method for deaerating a bitumen froth, the method comprising passing the froth through a screen to reduce the air content of the froth.

2. The method of claim 1, wherein the sieve opening size of the screen is selected such that the surface area of the bitumen froth is expanded and air escapes from the bitumen froth.

3. The method of claim 1 or 2, wherein the sieve opening size of the screen is at least 2 mm.

4. The method of claim 3, wherein the sieve opening size is at least 6 mm.

5. The method of any one of claims 1-4, wherein the screen is continuously or intermittently moved relative to a froth supply unit.

6. The method of claim 5, wherein the screen is formed by a permeable conveyor belt, which is continuously translated underneath the froth supply unit.

7. The method of claim 5 or 6, wherein the froth supply unit is arranged downstream of a primary bitumen enriched froth exhaust conduit of a gravity froth separation vessel in which a froth formed by injecting air into a slurry of oil sand and water is separated by gravity separation into a bitumen enriched primary froth stream and a water and sand enriched secondary froth stream.

8. The method of claim 7, wherein the oil sand is mined from an oil sand deposit and subsequently crushed and mixed with hot water and transported from the mining site to the froth separation vessel through a pipeline in which the

slurry of hot water and oil sand is conditioned and air is injected into the slurry to create a froth which is fed into the gravity froth separation vessel.

9. A bitumen froth separation system, the system comprising a screen through which in use a bitumen froth is induced to flow and the air content of the froth is reduced.

10. The system of claim 9, wherein the screen has a sieve opening size of at least 2 mm.

11. The system of claim 10, wherein the screen has a sieve opening size of at lest 6 mm.

12. The system of claim 10, wherein the screen is formed by a permeable conveyor belt, which is in use translated underneath a froth supply unit.

13. The system of claim 12, wherein the conveyor belt is provided with a scraper and/or spray cleaning unit for removing any bitumen froth from the screen during each rotation cycle of the conveyor belt.

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PATENT AGENTS

Application number / numéro de demande: 2425840

Figures: 1, 2, 3

Pages:

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