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54 Spiral separator incorporating a fluid deflector.

57 The invention relates to spiral separators having at least one helical trough for receiving a pulp stream at its upper end. It provides a method and apparatus for deflecting a portion of the low solids, high velocity stream component from the outer periphery of the pulp stream back across the stream towards the inner periphery. The apparatus includes an adjustable deflector having a contoured undersurface for deflecting the stream in a fan-like spray.

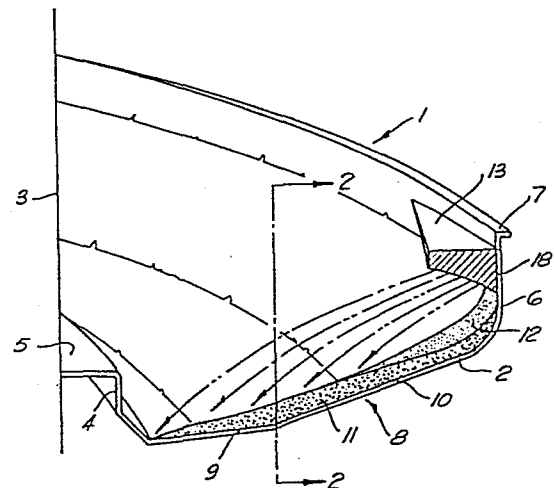


FIG 1

SPIRAL SEPARATOR INCORPORATING A FLUID DEFLECTOR

This invention relates to an improved spiral separator and to a method of spiral separation which is of particular use in the separation of minerals.

Spiral separators are extensively used for the wet gravity separation of solids according to their specific gravity, for example for separating various kinds of mineral sands from silica sands.

Separators of the kind under discussion are shown, for example, in our Australian Patent Application 82717/82. Such
10 separators commonly comprise a vertical column about which there are supported one or more helical troughs. In operation, a "pulp" or slurry of the materials to be separated and water is introduced to the upper end of a trough and as the pulp descends the helix, centrifugal forces act on the less dense particles in a radially outwards direction while the more dense particles segregate to the bottom of the flow and after slowing through close approach to the working surface of the trough gravitate towards the vertical column.

20 During operation of a spiral separator there is a general migration of water from the inner portion or smaller radius of the flow to the outer portion of the flow. However, particularly when there are high proportions of high specific gravity particles present in the pulp, the total water supply at the inner portion can be used up before segregation is completed. As this takes place there is an accumulation of particles at the inner portion which, while it does not prevent the stream from continuing to move,

changes the effective shape of the volute cross section and separation proceeds no further.

According to one aspect of the invention there is provided a spiral separator including at least one helical trough having a trough floor extending between an inner periphery and an outer periphery, said trough being adapted to receive a pulp stream of water and particles at its upper end and to separate particles of different densities as the stream moves downwardly along said trough, said separator
10 being characterised by the inclusion of at least one deflector located adjacent said outer periphery for deflecting a portion of the low solids high velocity stream component from the outer periphery of the pulp stream back across said stream towards said inner periphery.

According to another aspect of the invention there is provided a method for rediluting a pulp stream flowing downwardly along the helical trough of a spiral separator comprising the deflection of a portion of the low solids high velocity stream component from the outer periphery of said
20 pulp stream back across said stream towards its inner periphery.

Preferably, an adjustable deflector is located on an outer wall of the helical trough to deflect the stream component in a fan-like spray. This is not the same mechanism as a normal wash water supply which is deliberately applied as a small radial outflow across the segregated

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stream.

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a sectional perspective view of part of a spiral separator looking upstream and showing one embodiment of the rediluting method and apparatus in use.

Figure 2 is a radial section view taken on line 2-2 of Figure 1.

10 Figure 3 is an incomplete section through a helical trough looking downstream in a tangential direction and showing another embodiment of the invention.

Figure 4 is a plan view taken on line 4-4 of Figure 3.

Figure 5 is a radial sectional view taken on line 5-5 of Figure 3.

Figure 6 is a section taken on line 6-6 of Figure 5.

As shown in Figure 1 the spiral separator 1 includes helical trough 2 supported from a vertical column 3.

20 The helical trough in cross-section comprises an upright inner wall 4, a support web 5 whereby the lip of the inner wall 4 is connected with column 1, an upright outer wall 6 terminating in a lip 7 and a trough floor 8 extending between the inner wall and the outer wall. The trough working surface comprises an inner portion 9 and an outer portion 10 inclined at a greater angle to the helix radial direction and thus slopes more steeply upwardly and outwardly.

The profile of the bottom of the trough is such that the

mass of water in the slurry moves radially outward and upward. This causes thinning of the water layer at the inner portion 11 of the flow and a water build-up at the low solids, high velocity stream at the flow periphery 12.

In accordance with the invention, a deflector 13 is attached to the outer wall 6 to deflect a portion of the water from the flow periphery 12 into the inner portion 11 to reinstate the water quantities necessary to permit the designed separation mechanism to proceed.

0 As shown in Figure 2 the deflector 13 is adjustable by rotation about a radial axis 14 and has an under-surface 15 suitably contoured to deflect the water in a fan-like spray 16 across the trough. The undersurface 15 is arcuate in contour when viewed in both radial and tangential directions with respect to the trough. The deflector preferably permits the stream to be rediluted to a considerable depth and across a broad band at the inner portion of the trough floor. The sharpened leading end 17 of the deflector points upstream and the degree of redilution may be controlled by rotation of the
10 deflector about the axis 14. The outer surface 28 of the deflector is contoured generally to conform to the trough wall 6 and to permit rotation of the deflector over the range required. The axis 14 may be spaced at any desired distance from the leading end 17 of the deflector depending upon the amount of deflection required.

A second embodiment of the invention is shown in Figures 3 to 6 where corresponding features have been given corresponding reference numerals for ease of description. In

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this embodiment the helical trough descends in a left-hand spiral rather than the right-hand spiral of the first embodiment.

In this embodiment the flow is deflected predominantly from the inwardly directed concave surface 15 which extends from the leading end 17 where it is tangential to the stream to a trailing end 18 where it is directed radially inwardly. However, in this embodiment the flow can also be deflected from the upper surface 19 in a fan-like spray from its
10 trailing end 20. In other embodiments the flow can be deflected entirely from the upper surface.

The deflector of the second embodiment may also be adjustable as previously described but is illustrated in a fixed position on the trough wall, just beneath a flexible edge cover 21 with its lower surface 22 spaced above the trough floor to allow solids to pass under the deflector. The tapered configuration of the deflector with its sharpened leading end provides no abrupt edge which would otherwise tend to collect rubbish.

20 Although the invention has been described with reference to a specific example, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

CLAIMS

1. A spiral separator including at least one helical trough having a trough floor extending between an inner periphery and an outer periphery, said trough being adapted to receive a pulp stream of water and particles at its upper end and to separate particles of different densities as the stream moves downwardly along said trough, said separator being characterised by the inclusion of at least one deflector located adjacent said outer periphery for deflecting a portion of the low solids high velocity stream component from the outer periphery of the pulp stream back across said stream towards said inner periphery.

2. A spiral separator according to claim 1 wherein said outer periphery is defined by an outer wall and said deflector is located on said wall.

3. A spiral separator according to claim 2 wherein said deflector has an outer surface contoured to conform to said outer wall.

4. A spiral separator according to claim 1 wherein said deflector is adjustable to vary the amount of stream deflected.

5. A spiral separator according to claim 4 wherein said deflector is mounted for rotation about an axis extending radially with respect to said trough, thereby to vary the amount of stream deflected.

6. A spiral separator according to claim 1 wherein said deflector has a contoured undersurface adapted to deflect said stream in a fan-like spray.

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7. A spiral separator according to claim 6 wherein said undersurface is arcuate in contour when viewed in both radial and tangential directions with respect to said trough.

8. A spiral separator according to claim 7 wherein said deflector has a sharpened leading end pointing upstream.

9. A spiral separator according to claim 1 wherein said trough floor slopes more steeply closer to said outer periphery.

10. A spiral separator according to claim 9 wherein said
10 trough floor includes an inner portion adjacent said inner periphery and a more steeply inclined outer portion between said inner portion and said outer periphery.

11. A spiral separator according to claim 10 wherein said deflector is able to deflect said stream component substantially to said inner portion to redilute the pulp stream to a substantial depth across said inner portion.

12. A spiral separator according to claim 1 wherein said deflector has a contoured upper surface adapted to deflect said stream in a fan-like spray.

20 13. A spiral separator according to claim 12 wherein said deflector also includes an inwardly directed contoured surface adapted to deflect said stream in a fan-like spray.

14. A spiral separator according to claim 12 wherein said inwardly directed surface extends from a leading end where it is tangential to the stream to a trailing edge where it is directed radially inwards.

15. A spiral separator according to claim 14 wherein said inwardly directed surface is concave.

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16. A spiral separator according to claim 12 wherein said deflector has a sharpened leading end pointing upstream.

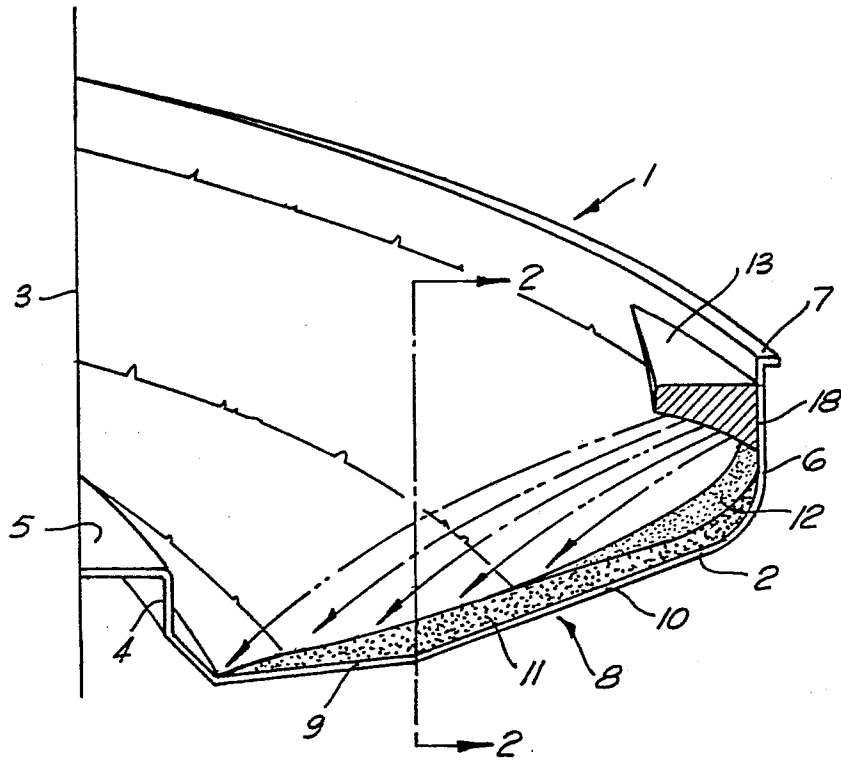
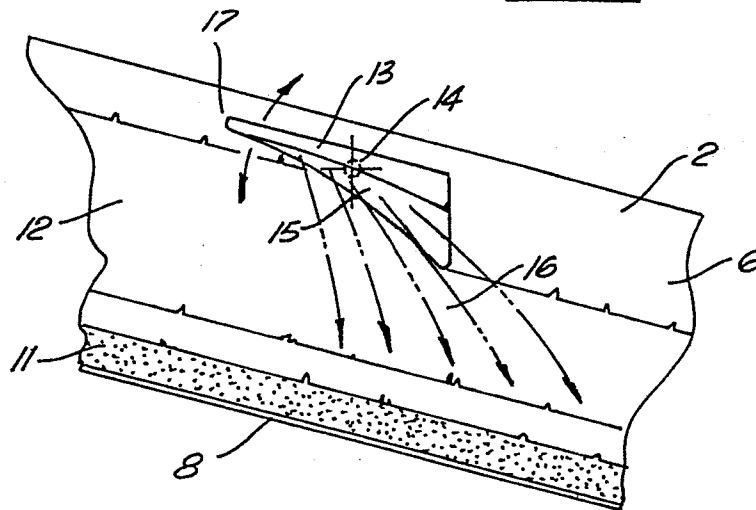
17. A spiral separator according to claim 6 wherein said undersurface is concave.

18. A spiral separator according to claim 17 wherein said undersurface extends from a leading end where it is tangential to the stream to a trailing edge where it is directed radially inwards.

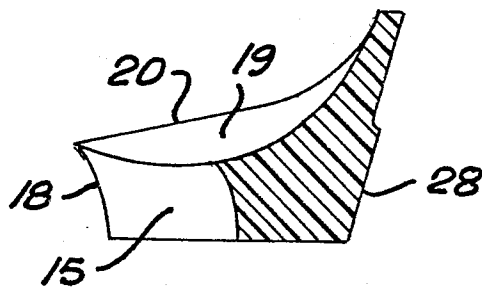
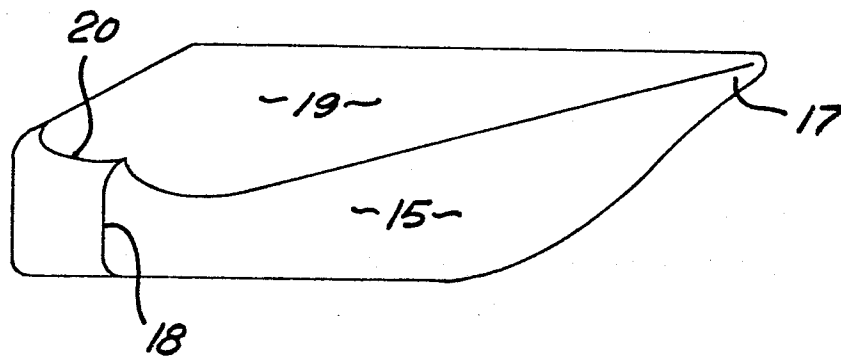
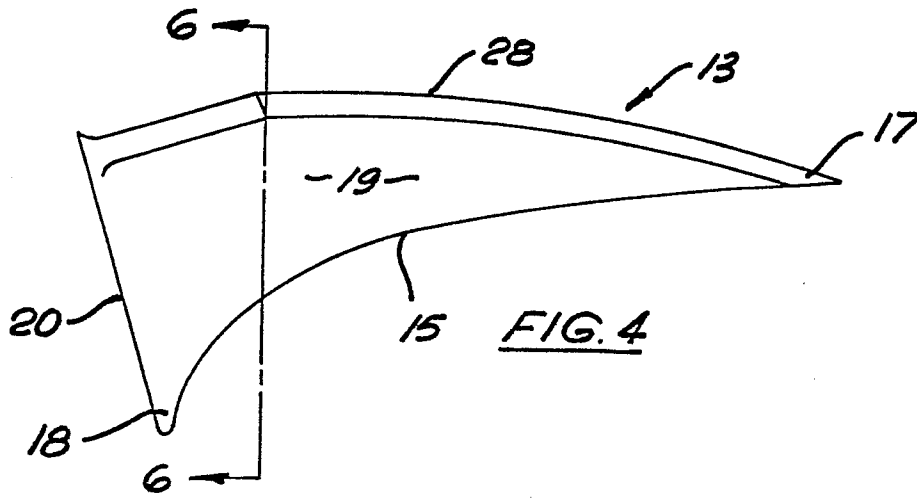
10 19. A method for rediluting a pulp stream flowing downwardly along the helical trough of a spiral separator comprising the deflection of a portion of the low solids high velocity stream component from the outer periphery of the pulp stream back across said stream towards its inner periphery.

20. A method according to claim 12 wherein a substantial portion of said stream component is deflected towards said inner periphery in a fan-like spray to redilute said pulp stream to a substantial depth.

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FIG 1FIG. 2

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
X	CA-A- 961 005 (FULLER) * Page 1, lines 11-21; page 3, lines 19-31; page 4, lines 1-19; page 5, lines 1-12; figure 1 *	1,2,6,9,17,19,20	B 03 B 5/62
X	GB-A- 586 777 (B. HUMPHREYS) * Page 1, lines 16-34; page 2, lines 104-115; page 3, lines 92-130; figure 2 *	1,4,9,19	
A	WO-A-8 203 187 (MINERAL DEPOSITS) * Page 6, line 17 - page 8, line 7; figures 1-2A *	9,10	
A	US-A-3 753 491 (H. VOLLMER)		TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
A	DE-A-2 243 853 (HUMPHREYS)		B 03 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23-07-1984	Examiner LAVAL J.C.A
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	