

PATENT SPECIFICATION

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(54) CENTRIFUGAL FROTH PUMP

(71) We, WARMAN EQUIPMENT (INTERNATIONAL) LTD., a Company incorporated in the State of Western Australia, Commonwealth of Australia, of 88 Fisher Street, Belmont 6104, Western Australia, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to centrifugal froth pumps having an impeller at the lower end of a vertical spindle, a casing enveloping said impeller, an intake opening through the upper wall of said casing about said spindle and a feed chamber surrounding said spindle and downwardly communicating with said intake opening.

The principal object of the invention is to provide a pump of the type above described which is adapted to handle frothy fluids such as floatation concentrate slurries which are difficult to pump with conventional centrifugal pumps because of the entrained air.

In accordance with the invention there is provided a centrifugal froth pump comprising an impeller at the lower end of a rotatable vertical spindle, a casing enveloping said impeller, an intake opening through the upper wall of said casing about said spindle, a feed chamber surrounding the spindle and downwardly communicating with said opening in said casing and adapted to receive the pump feed, contain it in vortex motion and transfer it to and through said opening into said casing, and one or more vanes projecting inwardly from the periphery of the opening in the casing towards the spindle and adapted to return to the feed chamber with increased energy a portion of the fluid energised within the casing by the impeller.

The vane or vanes provided in the intake

opening may effectively take a variety of forms but a preferred form which returns fluid to the feed chamber with maximum conservation of energy comprises multiple helical vanes projecting inwardly from the outer wall of the intake opening and leaving a clear annular space between the radially inner ends of the vanes and the spindle for entry of feed to the pump, the handing of said helical vanes being such that fluid rotating within the casing about the vertical axis of the pump in the direction of rotation of the pump impeller may enter between the vanes and return to the feed chamber without alteration in direction of rotation. The proportion of the feed so returned from the pump to the feed chamber may be predetermined by the extent to which the vanned portion occupies the annulus between the spindle and the outer wall of the intake opening and also by the helix angle and thickness of the vanes.

A variety of shapes of feed chamber may be used but a form found to be effective in disentraining air and conserving the energy of the fluid returned from the pump is a frustum of an upwardly divergent cone symmetrical about the pump spindle having its lower end communicating with the intake opening of the pump and its upper end joined to a cylindrical section the vertical dimension of which may vary according to the circumstances of particular usage but is typically approximately half of the vertical dimension of the conical frustum. The included angle of the conical frustum may also vary considerably depending on the requirements of any given application but typically approximates 55°.

While the feed to the feed chamber may be introduced in a number of ways a preferred method is by means of a pipe downwardly sloping at an angle of about 15°

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and tangentially joining the cylindrical section of the feed chamber in such manner that the feed fluid in passing into the feed chamber flows along the wall of the chamber with the same direction of rotation about the pump axis as that of the impeller.

In some applications of the invention it may be necessary to limit the height of the vortexing fluid in the feed chamber and for this purpose one or more helical vanes inwardly projecting from the cylindrical section of the feed chamber may be provided having a handing such that fluid vortexing in the feed chamber and entering the vane or vanes near the top of the cylindrical section is deflected downwardly without change in the direction of its rotation about the pump axis.

A specific form of the invention is illustrated in the accompanying drawings wherein:

Figure 1 is an axial section of a centrifugal pump adapted to function according to the invention.

Figure 2 is a part plan view on the line A-A of Figure 1.

Like parts are illustrated by like characters throughout the specification and drawings.

As shown in the drawings 1 is an impeller enveloped in a casing 3 and mounted on the lower end of a vertical spindle 2 supported and rotated clockwise as viewed in plan by any suitable means not shown in the drawings, said vertical spindle passing through a cylindrical intake opening 4 in the upper wall 5 of the casing 3. A feed chamber 6 surrounding vertical spindle 2 comprises a frustum of an upwardly divergent cone 7 communicating at its lower end with the intake opening 4 and connected at its upper end to a cylindrical section 8.

Feed enters the pump tangentially through downwardly sloping feed pipe 9 joined tangentially to the upper cylindrical section 8 of the feed chamber 6, flows downwardly in clockwise vortex motion through the feed chamber to the intake opening 4 and passes into the pump casing 3 through the clear annular space between the radially inner ends of three left hand helical vanes 10 and the spindle 2. A portion of the fluid energised within the casing 3 by the rotation of the impeller 1 enters the spaces between the vanes 10 and returns upwardly with increased energy in clockwise helical motion to the radially outer region of the conical section 7 of the feed chamber 6 where it transfers energy through a rough and turbulent interface as at 11 to the feed imparting or enhancing a shearing vortex action therein which promotes bubble

aggregation and centrifugal separating movement of the bubbles towards and their disengagement at the surface of the vortex.

To limit the height of the vortexing fluid in the feed chamber six right hand helically shaped vanes 12 are provided projecting radially inwards from the cylindrical portion 8 of the feed chamber and serve to deflect downwardly, without change in its direction of rotation about the pump axis, fluid which might otherwise overflow the feed chamber.

WHAT WE CLAIM IS:—

1. A centrifugal froth pump comprising an impeller at the lower end of a rotatable vertical spindle, a casing enveloping said impeller, an intake opening through the upper wall of said casing about said spindle, a feed chamber surrounding the spindle and downwardly communicating with said opening in said casing and adapted to receive the pump feed, contain it in vortex motion and transfer it to and through said opening into said casing, and one or more vanes projecting inwardly from the periphery of the opening in the casing towards the spindle and adapted to return to the feed chamber with increased energy a portion of the fluid energised within the casing by the impeller.

2. A centrifugal froth pump according to Claim 1 wherein the vane or each vane is of helical form and the handing of the helix is such that fluid is returned to the feed chamber without change in direction of its rotation about the axis of the pump.

3. A centrifugal froth pump according to Claim 1 or Claim 2 wherein the feed chamber is symmetrical about the spindle and is in the form of an upwardly diverging frustum of a cone joined at its upper end to a cylindrical section.

4. A centrifugal froth pump according to Claim 3 wherein a feed pipe joins the cylindrical section of the feed chamber substantially tangentially and discharges thereinto in the direction of rotation of the vortex flow therein.

5. A centrifugal froth pump according to Claim 3 or Claim 4 wherein the feed chamber is provided with one or more vanes projecting inwardly from the wall of the cylindrical section thereof and downwardly sloping in the direction of the vortex flow of the feed therein.

6. A centrifugal froth pump substantially as hereinbefore described with reference to the accompanying drawings.

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