March 20, 1945. A. C. DURDIN, JR 2,371,681

CENTRIFUGAL CUTTING PUMP

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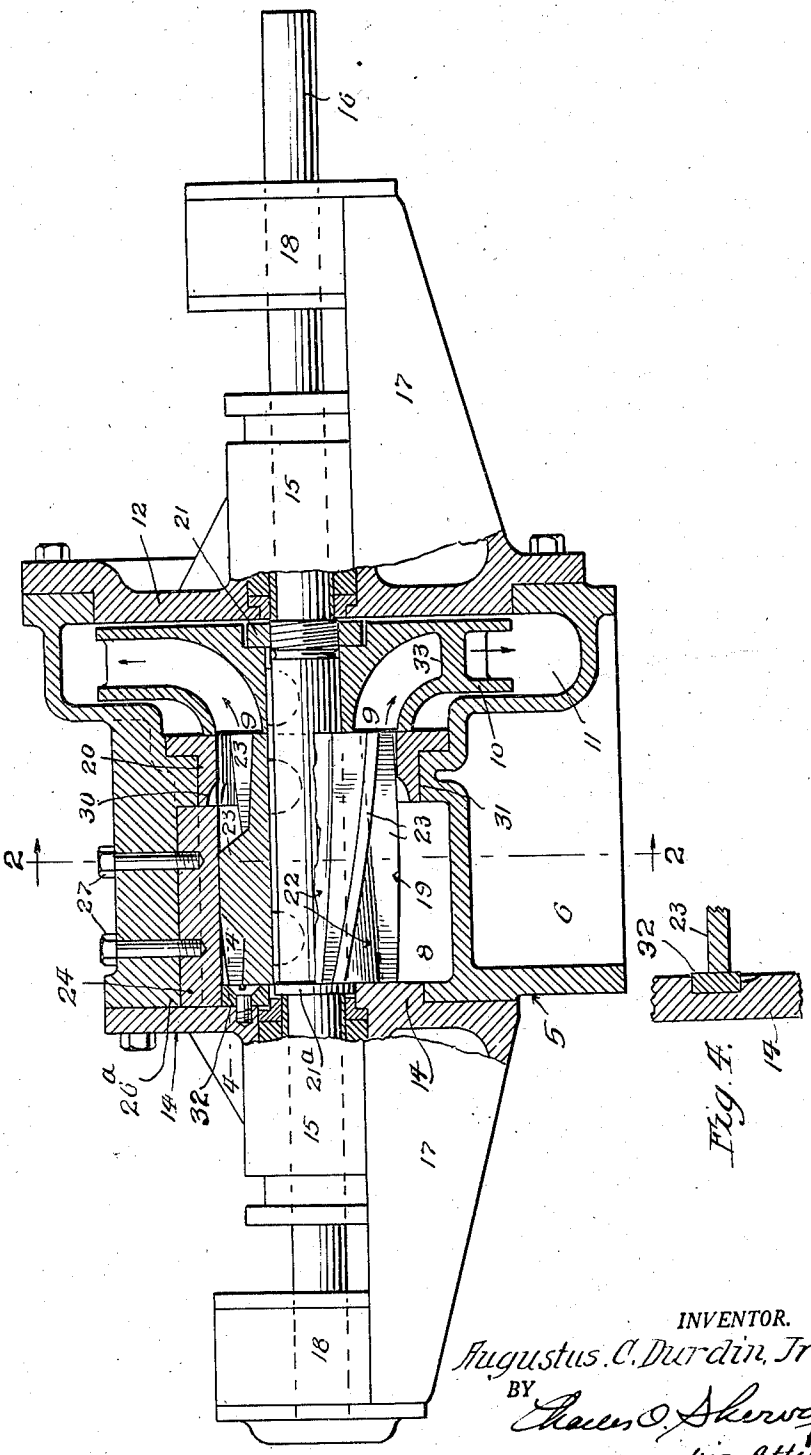

Fig. 1.

Fig. 4.

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Fig. 3.

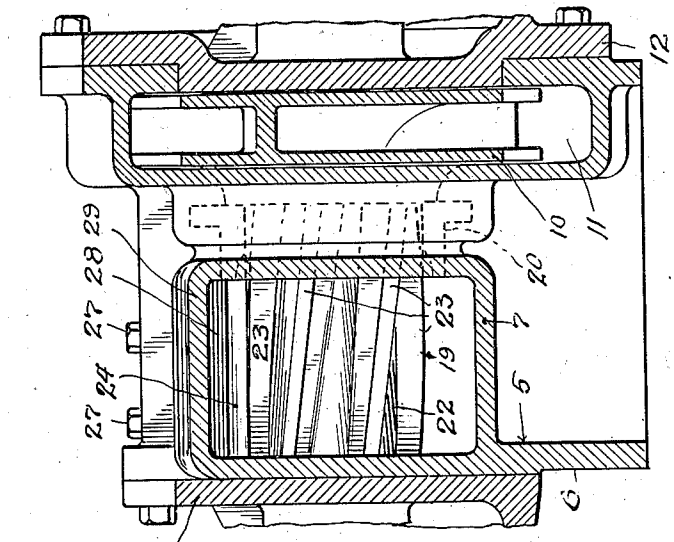
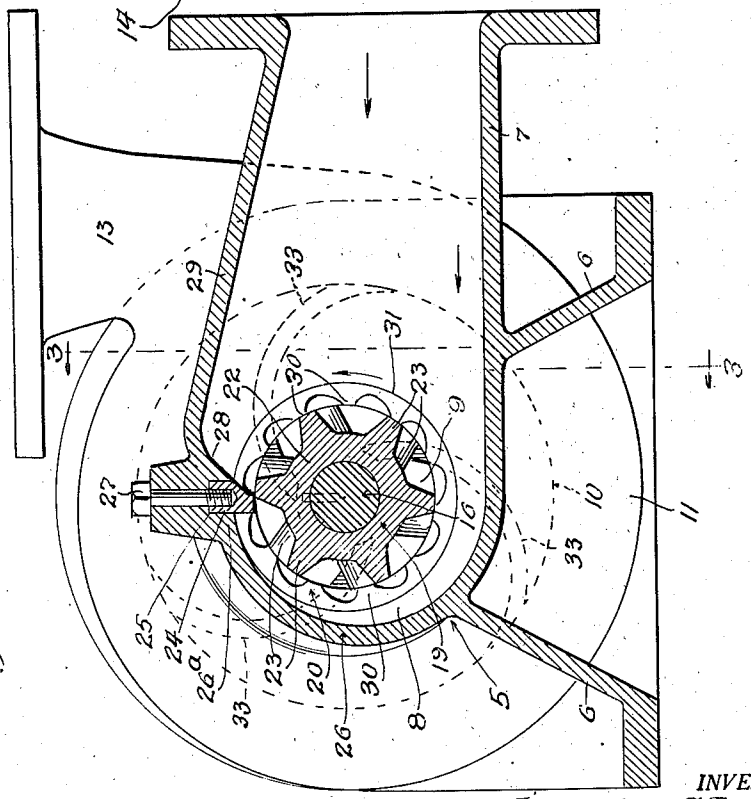


Fig. 2.



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CENTRIFUGAL CUTTING PUMP

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Application January 18, 1943, Serial No. 472,690

5 Claims. (Cl. 103—111)

This invention relates to centrifugal cutting pumps. Pumps of this character are usually used for pumping liquids containing solids and semi-solids, such as sludge, and one object of this invention is to increase the efficiency of such pumps and to more effectively reduce the solids into small pieces so that they may readily pass with the flow of liquids through the pump and be pumped to some other station for further treatment. Another object is to prevent clogging and to prevent winding of stringy material around rotating elements of the pump.

Other objects and advantages will appear in the course of this specification and with said objects and advantages in view this invention consists in the several novel features hereinafter fully set forth and claimed.

One embodiment of the invention is clearly illustrated in the accompanying drawings, in which:

Fig. 1 is a view, partly in side elevation and partly in central, vertical, longitudinal section of a centrifugal cutting pump embodying the invention.

Fig. 2 is a vertical cross section thereof taken on the line 2—2 of Fig. 1.

Fig. 3 is a vertical longitudinal section taken on the line 3—3 of Fig. 2.

Fig. 4 is a detail cross section of a certain cutting blade taken on the line 4—4 of Fig. 1.

Referring to said drawings, which are merely illustrative of the invention, the reference character 5 designates the main member of the pump casing, usually cast with a base 6, a suction inlet 7, which terminates in an inlet chamber 8 that leads to the eye 9 of the pump impeller 10, which is contained in a volute chamber 11, the walls of which may be cast integral with the other walls of the pump casing. One side of the volute chamber is closed by a head 12 bolted to the wall of the volute chamber. The latter terminates in a discharged outlet 13.

The outer side wall of the inlet chamber 8 has an opening which is closed by a head 14, bolted to said wall of the inlet chamber. The heads 12, 14 are cast with stuffing boxes 15 for the pump shaft 16, and with bearing brackets 17 that include bearing boxes 18 in which the pump shaft is journalled. The pump shaft extends through the inlet chamber and the volute chamber, and keyed or otherwise secured upon the shaft in the inlet chamber is a rotating cutting member 19 which extends from the outer side wall of the inlet chamber, through a cutting ring 20, to the eye of the impeller. The latter is keyed upon the shaft and is held in contact with the cutting member 19 by a nut 21 threaded upon the shaft. The cutting member bears against the flange 21*a* on the shaft.

The body 22 of the cutting element is tapered and tapers toward the impeller. It is cast or otherwise provided with cutting blades 23 disposed helically about the tapered body. The cutting blades 23 co-operate with a stationary cutting bar 24 which extends parallel with the axis of the rotating cutting member and is seated in a recess 25 formed on the inner face of the part 26*a* of the wall 26 of the inlet chamber. The cutting bar is rigidly secured in place by bolts 27 that extend through said part 26*a* of the wall of the inlet chamber. The cutting face of the cutting bar is disposed in close proximity to the cutting faces of the cutting blades, to provide a shearing action on material caught between the blades of the rotating cutting member and the cutting bar. One side of the cutting bar is shown as sloping toward the rotative cutting element with the part 28 of the suction inlet wall 29 sloping along the same plane and disposed flush with said sloping face of the cutting bar. The rotating cutting member directs liquids along said sloping faces and sets up turbulence whereby material caught on the cutting bar is washed therefrom, enabling it to pass with the flowing stream to the eye of the impeller.

The cutting ring 20 is notched to provide a multiplicity of cutting teeth 30 on its internal side which teeth co-operate with the blades of the rotating cutting member to comminute or reduce any material that may project beyond the cutting faces of the blades. The cutting ring is shown as flanged and is rigidly seated in a bored part 31 of the wall of the inlet chamber.

To prevent pieces of material from lodging between the end of the rotating cutting member and adjacent side wall of the inlet chamber, a cutting blade 32 is provided, which is seated in a recess formed in the side wall of the inlet chamber, and secured therein by a screw or otherwise. The cutting blade 22 co-operates with the rotating cutting member to shear off any material that might enter between the side wall and rotating cutting member.

The impeller may be provided with any desirable number of impeller blades 33 but the rotating cutting member is formed with a greater number of cutting blades than the number of impeller blades, certain of the cutting blades joining or abutting against the impeller blades and the

other cutting blades terminating at the spaces between the impeller blades.

By having a relatively large number of cutting blades, the solids are reduced more thoroughly and the cut up mass is distributed in the channels between the impeller blades, thereby preventing clogging of the impeller.

The bottoms of the notches between the teeth 30 of the cutting ring slope away from the edge of the cutting ring toward the inner face thereof to enable material which is cut off by the teeth to freely pass into the channels between the cutting blades of the rotating cutting member.

Power from any suitable source may be applied to the pump shaft. In operation liquids containing solids and semi-solids flow in through the suction inlet and enter the inlet chamber, passing through the channels between the blades of the rotating cutting member to the eye of the impeller, from which they are discharged by the impeller into the volute chamber and thence discharged through the discharge outlet.

Solid and semi-solid materials carried around by the rotating cutting member and caught between the blades thereof and the stationary cutting bar are sheared off, and the pieces which lodge on the sloping face of the stationary cutting bar are washed from the same and pass with the liquids to the eye of the impeller and are distributed between the impeller blades. Pieces caught between the cutting blades and the teeth of the cutting ring are further reduced and pass with the flowing stream to the eye of the impeller.

I claim as new and desire to secure by Letters Patent:

1. In a centrifugal cutting pump the combination with a pump casing having a suction inlet, an inlet chamber formed with a top wall which inclines upwardly from the suction inlet and terminates in a downwardly inclined wall at the inlet chamber, a volute chamber and a discharge outlet, of a shaft mounted to rotate in said casing, a rotating cutting member mounted on said shaft in said inlet chamber, said rotating cutting member having a plurality of cutting blades disposed helically about the body thereof, a stationary cutting bar having one face flush with the inclined terminal end of said top wall and mounted in the inlet chamber and co-operating with said rotating cutting member to reduce solids, and a separately formed impeller mounted on said shaft in the volute chamber with its eye communicating with the channels between the blades of the rotary cutting member, said impeller having impeller blades, the inner ends of which join with adjacent ends of some of the cutting blades, other cutting blades terminating at the spaces between the impeller blades.

2. In a centrifugal cutting pump the combination with a pump casing having a suction inlet, an inlet chamber formed with a top wall which inclines upwardly from the suction inlet and terminates in a downwardly inclined wall at the inlet chamber, a volute chamber and a discharge outlet, of a shaft mounted to rotate in said casing, a rotating cutting member mounted on said shaft in said inlet chamber, said rotating cutting member having a plurality of cutting blades disposed helically about the body thereof, a stationary cutting bar having one face flush with the inclined terminal end of said top wall and mounted in the inlet chamber and co-operating with said rotating cutting member to reduce solids, and a separately formed impeller mounted on said shaft in the volute chamber with its eye communicating with the channels between the blades of the rotary cutting member, said impeller having a lesser number of impeller blades than the number of cutting blades of the rotating cutting member.

3. In a centrifugal cutting pump the combination with a pump casing having a suction inlet, an inlet chamber formed with a top wall which inclines upwardly from the suction inlet and terminates in a downwardly inclined wall at the inlet chamber, a volute chamber and a discharge outlet, of a shaft mounted to rotate in said casing, a rotating cutting member mounted on said shaft in the inlet chamber, said rotating cutting member having cutting blades disposed helically about the body of the rotating cutting member, with channels between the blades, a stationary cutting bar disposed above the rotating cutting member and paralleling the axis of the same and secured to the top wall of the inlet chamber in shearing relation with respect to the cutting blades, one face of said top wall of the inlet chamber being flush with an inclined side face of the cutting bar and inclining upwardly toward the suction inlet, and an impeller mounted on said shaft with its eye opening to said channels.

4. In a centrifugal cutting pump the combination with a pump casing having a suction inlet, an inlet chamber formed with a top wall which inclines upwardly from the suction inlet and terminates in a downwardly inclined wall at the inlet chamber, a volute chamber and a discharge opening, of a shaft mounted to rotate in said casing, a rotating cutting member mounted on said shaft in said inlet chamber, said rotating cutting member having cutting blades disposed helically about the body of the rotating cutting member with channels between the blades, a stationary cutting bar disposed above the rotary cutting member and paralleling the axis of the same and secured to a wall of the inlet chamber in shearing relation with respect to said cutting blades, one side face of said cutting bar sloping toward the rotating cutting member and the adjacent part of the top wall of the inlet chamber sloping to said sloping side of the stationary cutting bar and being flush therewith, and an impeller mounted on said shaft in the volute chamber with the eye thereof in communication with the channels of the rotating cutting member.

5. In a centrifugal cutting pump the combination with a pump casing having an inlet chamber, of a shaft mounted to rotate in said casing, a rotating cutting member mounted on said shaft in said inlet chamber, said cutting member having cutting blades disposed helically about the body thereof, a cutting ring mounted in said casing at one side of the inlet chamber and being formed with cutting teeth on its internal face co-operating with the cutting blades to reduce solids, and an impeller mounted on said shaft, in the casing, with its eye in communication with the space between the internal face of the cutting ring and the body of the rotating cutting member.

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