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AGITATOR FOR PULP STOCK TANKS

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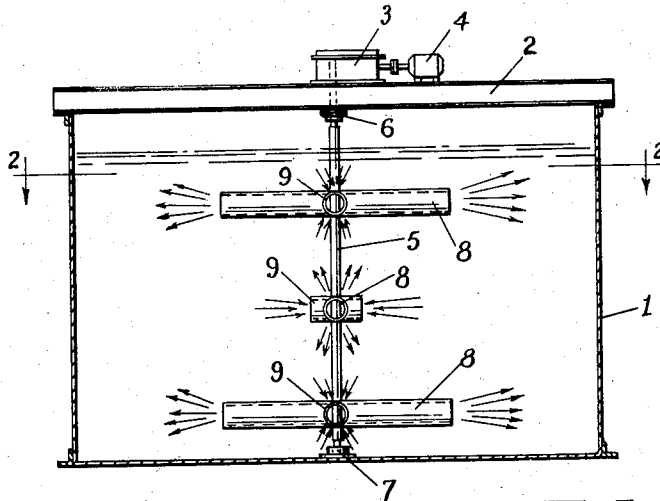


Fig. 1

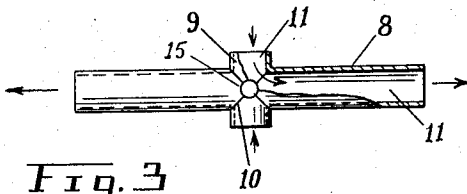


Fig. 3

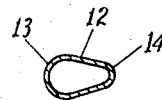


Fig. 4

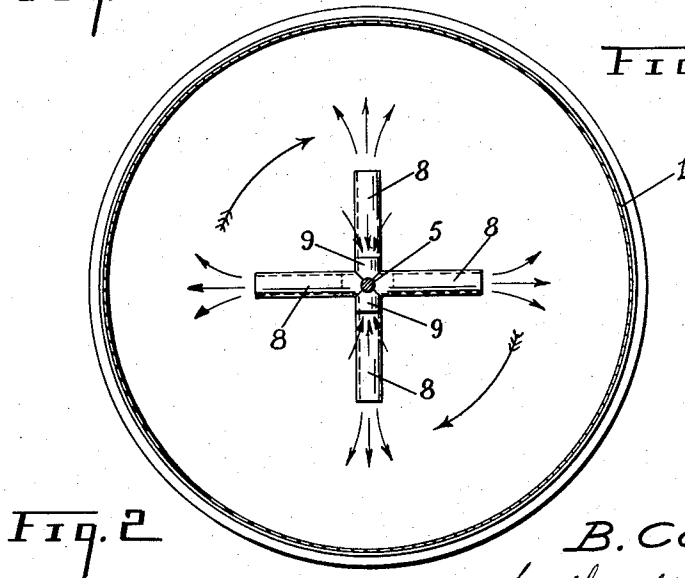


Fig. 2

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AGITATOR FOR PULP STOCK TANKS

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2 Claims. (Cl. 259-96)

This invention relates to agitators for pulp stock tanks and more particularly to the means whereby a more efficient circulation and mixing of the pulp stock is obtained at a low speed of rotation of the agitator with a considerable reduction in the power consumption.

The invention consists essentially in the use of a series of pairs of crossed tubes mounted one above the other on a drive shaft centered in a pulp stock tank. The crossed tubes comprise one long tube and one short tube, the tubes being open ended and communicating with each other about the drive shaft on which they are mounted so that when the assembly is rotated a flow of pulp stock from the central area of the tank will be induced by centrifugal force to flow into the open ends of the shorter tube and thence through the longer tube to be expelled into the outer circumferential area of the tank. The number of crossed tube assemblies depend upon the height of the stock tank and each assembly is off-set axially with respect to each other to give the maximum of agitation and circulation of the stock.

The object of the invention is to provide an agitator for pulp stock tanks which will give a maximum of circulation of the stock with a minimum of power consumption.

A further object of the invention is to provide an agitator for pulp stock tanks which will produce maximum efficiency of stock circulation at low speed of rotation.

A further object of the invention is to provide an agitator for pulp stock which will produce a maximum of blending of the stock without flocculation of the pulp.

A further object of the invention is to provide an agitator for pulp stock wherein a maximum of the input power is utilized for the circulation of the pulp stock and only a small fraction of the power is required to initiate and maintain the agitator drive.

In the drawings which illustrate embodiments of the invention:

Fig. 1 is a vertical sectional view of a pulp stock tank showing the pulp agitator installed and showing the direction of flow of the pulp stock.

Fig. 2 is a plan view of the pulp stock tank taken on the line 2-2 of Fig. 1 and showing the direction of rotation of the agitator and the direction of flow of the pulp stock.

Fig. 3 is a plan view of one of the agitator tubes.

Fig. 4 is a cross section of a modified form of section of agitator tube.

Referring to the drawings the pulp stock tank 1 is circular in shape and has mounted across its top the drive supporting framework 2. Supported on the framework 2 is a reduction gear box 3, driven by the motor 4. The drive shaft 5 is coupled to the output side of the gear box 3 at 6 while its lower end is supported in the foot bearing 7.

The stock agitator is composed of a series of open ended tubes supported on the shaft 5 at various levels inside the tank 1. These open ended tubes are in the form of a cross as shown in detail in Fig. 3 of the draw-

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ings and comprise a long tube 8 and a short tube 9 mitred and joined together at 10 to form the agitator arms and are secured together by welding or other suitable means to form the communicating cross passages 11. The agitator arms formed by the cross tubes 8 and 9 are provided with the bore 15 through which the shaft 5 is passed and the arms are secured to the shaft 5 at vertically spaced intervals. The number of agitator arms fitted will depend on the height of the stock tank 1. The spacing of the agitator arms on the shaft 5 being such that a maximum of stock circulation will be induced through the tubes 8 and 9 without danger of flocculation of the stock fibres.

The agitators are preferably assembled on the shaft 5 by welding and are offset axially from each other as shown in Fig. 2 of the drawings. However it is understood that they need not be offset at an angle of 90° but could be set at any other angle to suit specific conditions such as when more than three agitators are mounted on the shaft 5.

In Fig. 4 of the drawings a modified form of tube section is shown. In this case the tube 12 has a large radius leading edge at 13 and a small radius trailing edge at 14. By using a tube having a streamlined section as shown the paddle action of the tube as it rotates in the pulp stock is greatly reduced which, in turn, reduces hydraulic drag making for lower power consumption.

In the operation of a pulp agitator as above described, the procedure is as follows:

When the agitator is at rest the interior of the pipes 8 and 9 are flooded with pulp stock. As the agitator is rotated, it rotates at a higher rate of speed than that of the liquid within the tank. This is due to the fact that the agitator has a comparatively small sectional area with respect to the large frictional area of the tank. Thus the liquid confined within the outer ends of the long tube has a greater centrifugal force than the liquid in the tank immediately surrounding this portion of the long tube and consequently there is a tendency for the liquid to move outwardly of the long tubes into the tank. It can be seen that this creates a hydraulic pressure differential between the openings into the outer ends of the short tube and the long tube and consequently a continuous pumping action is set up whereby the stock is drawn from the area adjacent the openings into the short tube and is passed out to the outer area of the tank. It is essential that a short tube be provided in order that the pressure differential referred to above be created and the stock inlet openings must be disposed in an area spaced from the shaft where the liquid is not affected to a substantial degree by rotation of the shaft and central portion of the long tube.

By the use of relatively large diameter tubes rotating at low speed, large volumes of pulp stock are moved from the centre to the outside area of the tank without creating unnecessary internal surface friction in the tube, as at the low speed of rotation, 20 to 30 R. P. M., the flow of stock through the tube is only in the neighbourhood of four to six feet per second. Further, by moving a large volume of stock slowly there is no appreciable difference in stock level between the centre and outer edges of the tank while a complete turnover of the stock in the tank can be accomplished every five or ten minutes. The low speed of operation also has the effect of keeping down the velocity head imparted to the stock, or the kinetic energy absorbed by pumping.

The relatively large diameter of the tubes 8 and 9 allow for free flow of the stock therethrough without fear of the tubes becoming plugged with stock as is very often the case where relatively small diameter tubes rotating at high speed are used.

The diameter of the tubes 8 and 9, while relatively large in themselves are of small sectional area with respect to the size of the tank 1 within which they rotate.

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Due to the small sectional area of the tubes and the large friction surface of the containing tank, the tubes rotate at a higher speed than the liquid in the tank. This difference in speed allows a greater centrifugal pressure to be built up in the tubes than outside the tubes, and radial flow of stock through the tubes from the centre of the tank, occurs.

What I claim is:

1. In an agitator for pulp stock tanks, in combination, a tank containing the stock to be agitated, a shaft centrally mounted in said tank, means to rotate said shaft at a slow speed, and agitating means mounted on said shaft, said agitating means comprising a pair of open ended tubes connected together in the form of a cross, said pair including a long tube and a short tube, the passageways in said tubes being intercommunicating, stock inlet means comprising the openings in the ends of said short tube and stock outlet means comprising the openings in the ends of said long tube, said stock inlet

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openings being disposed along an axis at substantially right angles with respect to the axis of the shaft, the said tubes having a small sectional area with respect to the large frictional area of the said tank, permitting the tubes to rotate at a higher speed than the liquid contained within the said tank and a build-up of greater centrifugal pressure in the tubes than outside, inducing a radial flow of liquid through said tubes.

2. In an agitator according to claim 1 wherein a series of said agitator means is mounted at vertically spaced intervals on said shaft.

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