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(54) **Mixing apparatus for improving the treatment of fibre suspension.**

(57) The present invention relates to a mixing apparatus for improving the treatment of fibre suspension. The apparatus comprises a housing (13) for the fibre suspension flow having a mixing chamber with an inlet opening (14), an outlet opening (16), and a fluidizing rotor (22) arranged in the mixing chamber.

The fluidizing rotor (22) is formed of a shaft (21) extending through the housing (13) substantially at a right angle to the fibre suspension flow therethrough and finger-like fluidizing members (26) attached to the end (25) of said shaft (21) in the housing (13).

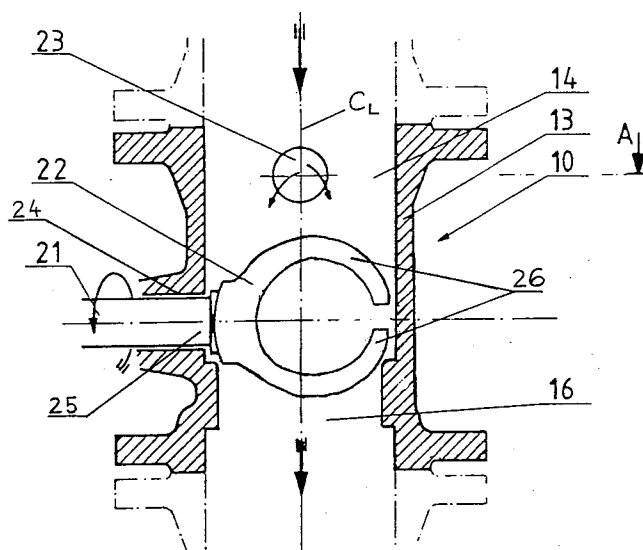


Fig 2

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The present invention relates to a mixing apparatus for improving the treatment of fibre suspension. The apparatus according to the invention are particularly suitable to be used for mixing chemicals into high consistency pulp in the pulp and paper industry.

Treating of high consistency pulp by means of making it flowable like water began in the late seventies when the so called fluidization was observed. The first commercial devices utilizing this phenomenon were centrifugal pumps. These new type of high consistency pumps have become more popular in mills, and such a pump is described, for instance, in US-A-4 435 122. High consistency pulp is fluidized in the pump, in other words changed into a flowing state just before the pulp reaches the range of the pump impeller. High consistency pulp (consistency, 8-20%) is a very stiff material in its nature; depending on the consistency, it may be so stiff that one can stand on the pulp with ordinary shoes and not sink into the pulp. The reason for this is that fibres having a size of a few millimetres form a strong three-dimensional fibre network. High consistency pulp may, however, be changed into a flowing state by breaking the fibre network by means of introducing shear forces into the suspension. This is called fluidization of high consistency pulp. Normally, fluidization is effected by some kind of powerful rotor. For example, in high consistency pumps the rotor effects the fluidization in the suction duct of the pump. In commercial centrifugal pumps, the rotor is attached to the centrifugal impeller and extends centrally and axially in the inlet channel of the pump. Fluidization is a reversible process, and as soon as the rotor stops or the pulp is no longer in the range of the rotor, the fibre network is again formed and the suspension again becomes solid material.

In pulp mills it is often necessary to mix chemicals into the pulp, for example in bleaching. This can be effected either in a fluidizing high consistency pump or in a separate mixer, cf. FI patent 77 905 (FI patent application 850854). When chemicals are mixed in a fluidizing high consistency pump, they are added either before the pump, for instance into the inlet channel thereof, or at the outer rim of the impeller. If this is done, a separate mixer is not necessary, but the same device serves both as a mixer and a pump.

Often a pump cannot be used as a mixer for several reasons. Such can be, for example, material problems or the fact that the amount or the quality of chemicals are such that the chemicals cannot be added into the pump. For instance, the chemicals may be highly corrosive. Therefore, one has to use a separate mixer. There are also applications in which part of the chemicals can be introduced into the pump and the rest into the

mixer, or all chemicals into the mixer, depending on the situation. For instance, gaseous chemicals require a certain type of design so that gas cannot separate from the fiber suspension. In other words, if large amounts of gaseous chemicals are mixed into a fiber suspension by means of a centrifugal pump, the gas tends to separate in large gas bubbles whereby the resulting mixture of gas and fiber suspension is no longer homogenous. A further result of this kind of a mixing is non-uniform bleaching and a decrease in the quality of the pulp.

An example of a fluidizing mixer is described, for example, in FI-patent publication 68688. The mixer comprises a substantially cylindrical rotor which has protrusions on its surface, a housing with an inlet opening and an outlet opening and protrusions on the inner surface thereof, and a feed duct for chemicals opening into the mixing zone between the rotor and the housing. Said mixer, although very practical and reliable, has some disadvantages. Firstly, it causes a significant pressure loss even when rotating as the flow area between the rotor and its housing is minimal. If the rotor, for some reason, is stopped or stops, the flow through the mixer will be cut off immediately. And secondly, since the actual cross-sectional flow area changes so rapidly, especially in connection with the embodiments of Figs. 1 and 2 shown in the publication FI 68688, the gas, if the chemical to be mixed is gas, tends to separate very easily from the pulp at the trailing side of the rotor.

The object of the present invention is to create a mixer having low resistance to flow even if the rotor is stopped.

This object is solved by the apparatus in accordance with the invention defined in claim 1. Advantageous embodiments are defined in the dependent claims.

The present invention discloses an apparatus for mixing chemicals into a fibre suspension flow. The apparatus comprises a housing having a mixing chamber with an inlet opening, an outlet opening, and a fluidizing rotor. The present invention is characterized in that said fluidizing rotor is formed of a shaft and finger-like fluidizing members attached to one end of said shaft.

Advantages of the present invention are discussed below with respect to the prior art.

- The fluidizing rotor allows the pulp flow through the mixer though the mixer would be, for some reason, inoperative or stopped.
- The total pressure loss is diminished.
- It is possible to raise the consistency level of the mixture up to a consistency of 25-30%. This is impossible with the earlier known devices.

The arrangement utilizing the invention enables mixing of chemicals without the pump being the

only place where such can be added. In many cases in bleaching processes, all the chemicals can be added in the mixer. Thus, the arrangement according to the prior art in which a mixer described in FI 68688 could well be used is essentially simplified, since the pump can be manufactured of cheaper material as the chemicals are added into the suspension after the pump.

The apparatus according to the present invention is described in detail below by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a schematic illustration of a mixing arrangement in accordance with the prior art.

Fig. 2 is a sectional side view of a preferred embodiment of a mixer according to the present invention.

Fig. 3 is a fragmentary detail of a mixer according to Fig. 2 viewed from the incoming direction.

Fig. 1 shows a schematical arrangement, for example, for mixing bleaching chemicals into a fiber suspension. The arrangement is basically the same as described in the Finnish patent 77 905 (FI patent application 850854). The arrangement comprises a pulp tank 3, a pump 2, a level control valve 1 used for adjusting the amount of pulp discharged from the tank 3 and a mixer 7 following the valve 1 in the direction of pulp flow, which mixer can be similar to, for example, the fluidizing mixer shown in the Finnish patent specification 68688. Drawbacks of the arrangement are a considerable overall loss of pressure of the devices especially with high consistency pulps and the costs of apparatus made of specific materials.

According to Fig. 2 and 3 the apparatus 10 in accordance with the present invention is composed of a housing 13 with a so called mixing chamber having an inlet opening 14 and an outlet opening 16. The housing is provided with yet another opening 24 for a shaft 21. The shaft 21 is positioned substantially at a right angle to the centerline C_L of the apparatus 10 i.e. the line running from the center of the inlet opening 14 to the center of the outlet opening 16, which is in the direction of pulp flow through the housing 13. The shaft 21 has two ends, the first end being coupled to drive means (not shown) and the second end 25 extending into the housing 13 substantially flush with the wall of the mixing chamber. A fluidizing rotor 22 is attached to said second end 25 of shaft 21 such that it extends inside the housing 13. The fluidizing rotor 22 is formed with at least two finger-shaped members 26 extending towards the wall of the mixing chamber opposite to the shaft opening 24. The members 26 are located spaced from their rotational axis such that they leave the center of the fluidizing rotor 22 open. The purpose of the opening center is to ensure the pulp can flow

through the apparatus even when the fluidizing rotor 22 is stopped. The mixer housing 13 can also be provided with an opening 23 for introducing chemicals into the mixer. Said opening 23 is located either upstream of the fluidizing rotor 22 in the inlet opening area 14 or in the mixing chamber. Naturally, the chemicals may be introduced into the mixing chamber with the pulp flow.

The above described arrangement according to the present invention makes it possible to provide a mixer having a low resistance to flow even if the rotor is stopped by arranging the center of the fluidizing rotor open and by arranging the shaft of the rotor substantially at a right angle to the axis of the apparatus and the direction of flow.

It is also clear that the material being mixed does not need to be high consistency pulp, but the mixing is applicable also to dilute pulps or mere fluids. Similarly, the substances of chemicals to be mixed can be either gaseous, liquids or solids.

Claims

1. Apparatus for mixing chemicals into a fibre suspension flow, which apparatus comprises a housing (13) for the fibre suspension flow having a mixing chamber with an inlet opening (14), an outlet opening (16), and a fluidizing rotor (22) arranged in the mixing chamber, **characterized** in that said fluidizing rotor (22) is formed of a shaft (21) extending through the housing (13) substantially at a right angle to the fibre suspension flow therethrough and finger-like fluidizing members (26) attached to the end (25) of said shaft (21) in the housing (13).
2. Apparatus according to claim 1 **characterized** in that the center of the fluidizing rotor (22) between the fluidizing members (26) is open.
3. Apparatus according to claim 1, **characterized** in that the shape of the cross-section of the envelope surface of the fluidizing rotor (22) substantially corresponds to the shape of the cross-section of the mixing chamber.
4. Apparatus according to claim 1, **characterized** in that an opening (23) is arranged in the housing (13) for the introduction of chemicals therein.
5. Apparatus according to claim 4, **characterized** in that the opening (23) for chemicals is arranged upstream of the fluidizing members (26).

6. Apparatus according to claim 4, **characterized** in that the opening (23) for chemicals is arranged in the fluidization zone.
7. Apparatus according to claim 1, **characterized** in that the fluidizing members (26) are arranged such that they are spaced from their rotational axis. 5
8. Apparatus according to claim 6, **characterized** in that the fluidizing members (26) are arranged substantially at a right angle to the flow direction of the fibre suspension. 10

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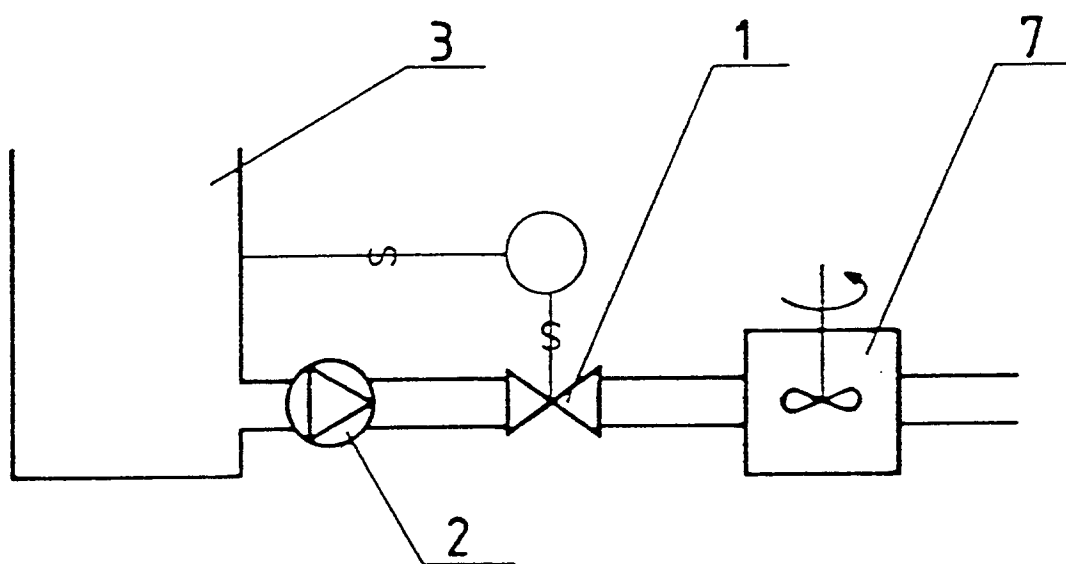


Fig 1

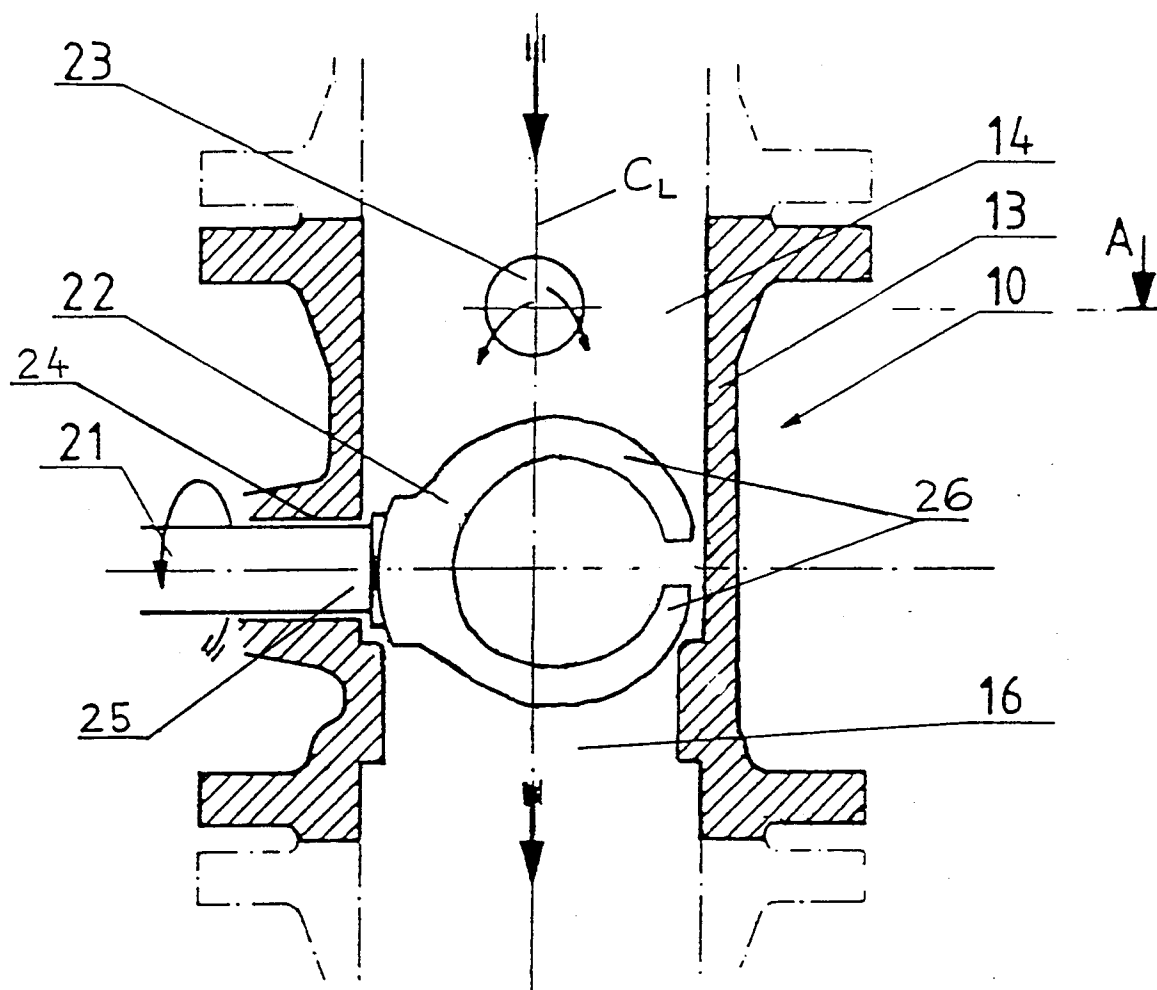


Fig 2

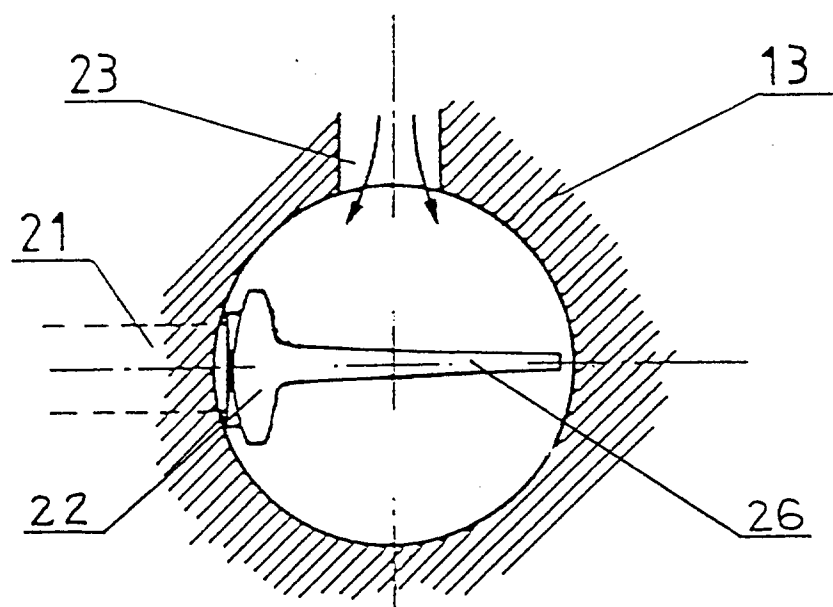


Fig 3