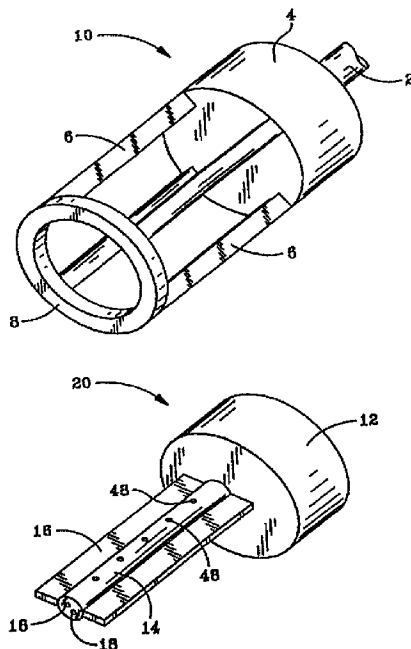




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(51) Int.Cl.⁶ B01F 7/32
(54) **MELANGEUR A HAUTES TURBULENCES**
(54) **HIGH TURBULENCE MIXER**



(57) Cette invention concerne un mélangeur qui comprend un rotor à aubes et cage creuse rotative, lequel est combiné à un stator décalé qui comporte au moins une lame. Cette invention concerne également un appareil destiné au mélange de pâte intermédiaire, lequel comprend une section entrée globalement cylindrique, ainsi qu'une zone de mélange située à proximité de la section entrée. La zone de mélange fait appel au rotor à aubes et cage creuse rotative, lequel est utilisé en combinaison avec le stator décalé et comportant au moins une lame. Cet appareil comprend également une section sortie située à proximité de la zone de mélange. Cet appareil peut en outre être équipé d'un système d'addition de produit chimique, lequel système peut se trouver à l'intérieur de la section entrée ou, encore, consister en un orifice sur la tige du stator.

(57) This invention describes a mixer which includes a rotatable hollow cage vaned rotor in combination with an offset stator having at least one foil on the stator. Also described is an apparatus for medium pulp mixing which includes an essentially cylindrical entry section, a mixing zone adjacent to the entry section, the mixing zone utilizing the rotatable hollow cage vaned rotor in combination with an offset stator having at least one foil on the stator and an exit section adjacent to the mixing section. The apparatus may include a chemical addition component, the location of which can either be within the entry section or an orifice on the stator tongue.

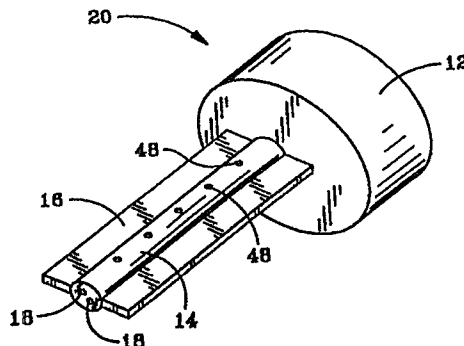
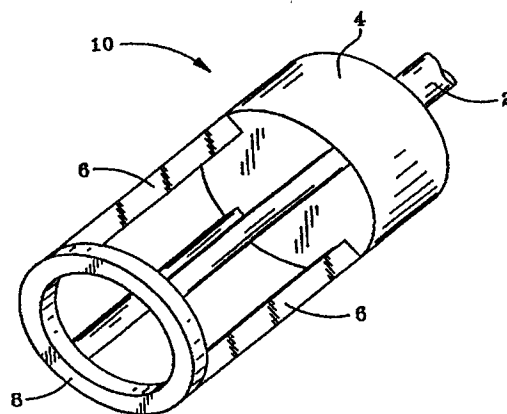
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(21) International Application Number: PCT/US96/08551 (22) International Filing Date: 3 June 1996 (03.06.96) (71) Applicant (for all designated States except US): BELOIT TECHNOLOGIES, INC. [US/US]; Suite 3001, 3513 Concord Pike, Wilmington, DE 19803 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): GALLAGHER, Brian, J. [CA/US]; 71 Naticook Avenue, Litchfield, NH 03052 (US). ROGERS, John, L. [BR/BR]; 4 Rua Princesa, Isabel 246 Apartment 34, CEP-04601 Sao Paulo, SP (BR). (74) Agents: WATKINS, Mark, A. et al.; Oldham & Oldham Co., LPA, 1225 West Market Street, Akron, OH 44313-7188 (US).		(81) Designated States: BR, CA, CN, FI, JP, RU, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: HIGH TURBULENCE MIXER**(57) Abstract**

This invention describes a mixer which includes a rotatable hollow cage vaned rotor in combination with an offset stator having at least one foil on the stator. Also described is an apparatus for medium pulp mixing which includes an essentially cylindrical entry section, a mixing zone adjacent to the entry section, the mixing zone utilizing the rotatable hollow cage vaned rotor in combination with an offset stator having at least one foil on the stator and an exit section adjacent to the mixing section. The apparatus may include a chemical addition component, the location of which can either be within the entry section or an orifice on the stator tongue.



High Turbulence Mixer

Technical Field

The invention described herein pertains to pulp processing equipment, and more particularly to an apparatus and method for mixing low or medium consistency pulp with at least one chemical reagent.

Background of the Invention

In a bleach plant, pulp is subjected to the addition of chemical reagents, some gaseous form and others already in solution. For a general discussion of an ozone bleaching method and equipment used in such a method, refer to International Publication No. WO 94/29514. Low consistency mixing is normally carried out at 3-5% consistency and medium consistency is carried out at 9-18% consistency. Consistency is defined as the percentage by weight of cellulose fiber in a mixture of fiber and liquor. For economic considerations, it is important to perform the bleaching process at as high a consistency as feasible. However, when bleaching cellulose and other materials at high pulp concentration, it is difficult to achieve a rapid and homogeneous mixing of the chemicals into the material being treated. Difficulty is usually encountered when consistencies of 10% or greater are used and in practice, it has been shown to be almost impossible to mix chemicals effectively at concentrations above 18%.

The prior art teaches that effective chemical mixing is difficult to achieve economically. Thus, there exists a need for a more efficient configuration for the addition and mixing of chemicals into a pulp bleaching process streams.

Summary of the Invention

In accordance with the present invention, there is provided a simple, inexpensive mixer for pulp plant bleaching operations which promotes uniform distribution of the bleaching chemicals so that the residence time in the bleaching tower is maximized.

It is an object of this invention to provide a high turbulence mixer which uses a vaned hollow cage rotor in combination with a tongued stator.

It is another object of this invention to provide a high turbulence mixer in which a vaned hollow cage rotor and a tongued stator both rotate to maximize
5 mixing.

It is still another object of this invention to provide a unit which is an in-line device which can be retrofitted without major piping modifications to the existing plant.

It is yet another object of this invention to provide a unit which is an in-
10 line device which consumes as little power as necessary and operates over a wide range of consistency and tonnages.

These and other objects of this invention will be evident when viewed in light of the drawings, detailed description, and appended claims.

15 *Brief Description of the Drawings*

The invention may take physical form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in the specification and illustrated in the accompanying drawings which form a part hereof, and wherein:

20 Fig. 1 is a perspective view of a hollow cage rotor showing four vanes;

Fig. 2 is a perspective view of a tongued adjustable stator;

Fig. 3 is a side view in partial cross-section showing the hollow cage rotor and stator inline of a mixer wherein the inlet and exit sections are in essentially linear alignment;

25 Fig. 4 is a side view in partial cross-section showing the hollow cage rotor and stator inline of a mixer wherein the inlet and exit sections are not in linear alignment; and

Fig. 5 is a cross-sectional view shown in partial cross-section along line 4-4 of Fig. 4.

Detailed Description of the Invention

5 Referring now to the drawings wherein the showings are for purposes of illustrating the preferred embodiment of the invention only and not for purposes of limiting the same, the Figures show a high turbulence mixer for pulp which uses a hollow cage vaned rotor in combination with a tongued stator.

The mixer 50 of the invention comprises the combination of a hollow cage
10 rotor 10 in association with a tongued adjustable stator 20. As shown in Fig. 1, the hollow cage rotor comprises a variable number of vanes 6 (ranging from at least 2 to 12 in number), the vanes physically connected to a rotor base 8 and a rotor boss 4 at opposed ends of the vanes. A rotating shaft 2 is typically affixed to rotor boss 4 centered about the axis of rotation of the rotor. The rotor may be
15 pulley or direct-driven depending upon the application. The number of vanes is generally dependent upon mixer size, piping capacity and pulp consistency. The vanes serve to maintain the coaxial relationship of the rotor boss and rotor base and can have many different geometries. The vanes can be perpendicular to the bottom surface of the rotor boss with the longitudinal axis of any one vane in
20 parallel alignment with the longitudinal axis of the rotating shaft, or skewed or even spiraled wherein the vanes are usually equally spaced about the circumference of the rotor boss but for which an axis drawn between the attachment points of the vane to the rotor boss and rotor base would not result in a parallel alignment with the longitudinal axis of the rotating shaft.

25 In general, the diameter of the rotor base 8 is essentially the same as that of the rotor boss 4. However, in certain specialized instances, the diameter of the rotor base may be larger or smaller than the rotor boss. When in this configuration, the vanes may once again, either be in essentially a straight line

configuration emanating from the bottom surface of the rotor boss and terminating at the rotor base, or in a skewed or even spiral configuration.

As seen in Fig. 2, the stator 20 comprises a tongue 14, which fits inside the rotor cage. The stator can be concentric or off-set depending upon the application. The tongue of the stator in a preferred embodiment, has at least one tongue foil 16 about the periphery of the tongue. The arrangement of the foils can be normal to the surface of the tongue as shown, or the tongue foils can be in a spiral configuration about the stator tongue. While not shown in Fig. 2, it is possible for the stator to also have a rotation shaft in a manner similar to that shown in Fig. 1 for the rotor.

As best shown in Fig. 3, in one embodiment, the high turbulence mixer is positioned in a transverse direction to the inline pulp/liquor stream 22. The flanged piping 26 has an entry section 40, a mixing zone 42 and an exit section 44. Pulp/liquor 22 is received into the entry section 40 and bleaching chemicals are added through chemical entry nozzle 28, optionally fitted with a directional flap 52 for use in channeling the flow of the chemicals into the pulp stream.

Subsequent to the entry section 40 is mixing zone 42 wherein a tongued stator 20 is positioned inside of rotating hollow cage rotor 10. The mixture of pulp and liquor is subjected to intense turbulence and shear forces in mixing zone 42. In a preferred embodiment, the stator tongue 14 is concentric or off-set of the longitudinal axis 34 of the hollow cage rotor shaft 2. As shown in Fig. 3, hollow cage rotor rotates about the tongued stator creating two mixing intensities in the same device, i.e., on the outlet side, higher shear forces will be generated due to the smaller gap between the rotor and the stator, while on the inlet side, a milder turbulence will be generated due to the wider gap. It is imperative that the chemical be well mixed with the pulp prior to discharge stream 46 in exit section 44.

While the stator has been described as non-rotating, there is no need to limit it to such. In an alternative embodiment, both the hollow cage rotor and tongued stator rotate. In one aspect of this embodiment, the rotation of the hollow cage rotor is opposite to that of the tongued stator.

Alternative configurations for the mixer 50 are also envisioned. As shown in Fig. 4, the exit section 44 need not be oriented in longitudinal alignment with the entry section 40. It is also within the scope of this invention to have the chemical addition occur at a point other than that identified previously as chemical entry nozzle 28. In some instances, it may be desirable to add the chemicals into the turbulence created at the rotor/stator interface. This type of configuration is shown in Fig. 3 where the chemical addition occurs through orifices 48 positioned either along the longitudinal axis of stator tongue 14 or through orifices 18, as shown in Fig. 2, on the tongue.

Fig. 5 shows a cross-section of Fig. 4 taken along line A-A. The offset 36 of the tongue 14 in comparison to the longitudinal axis 34 of the stator is evident. The distance between the tongue of the stator and the inside of the rotor vanes 6 can be adjusted to suite the target application.

The invention has been described with reference to preferred and alternate embodiments. Obviously, modifications and alterations will occur to others upon the reading and understanding of the specification. It is intended to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

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What is claimed is:

1. A high turbulence mixer (50) for pulp, comprising: a rotatable hollow cage rotor (10), the rotor having an essentially cylindrical rotor boss (4) having opposed surfaces, a rotor shaft (2) attached along a longitudinal axis of the rotor on one surface of the boss and at least two vanes (6) having opposed ends, one vane end of each vane communicating with the second surface of the boss, the other vane end of each vane communicating with a rotor base (8); and a stator (20) having an essentially cylindrical stator boss (12) having opposed surfaces and a tongue (14) attached to one surface of the stator boss characterized in that:

the tongue of the stator is positioned inside the hollow rotor cage such that the rotor boss of the cage rotor is in opposed directional relationship with the stator boss of the stator.

2. The mixer of claim 1 wherein the stator further comprises at least one foil (16) about a periphery of at least a portion of a length of the tongue.

3. The mixer of claim 2 wherein the stator further comprises at least two foils about a periphery of at least a portion of the length of the tongue.

4. The mixer of claim 2 wherein a longitudinal axis of the foil is parallel with a longitudinal axis of the tongue.

5. The mixer of claim 2 wherein the foil spirals about at least a portion of the length of the tongue.

6. The mixer of claim 2 wherein the stator further comprises a stator shaft attached along the longitudinal axis of the stator boss.

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7. The mixer of claim 6 wherein the stator rotates within the hollow cage rotor.
8. The mixer of claim 7 wherein the stator rotates in an opposite direction to a rotation of the hollow cage rotor.
9. The mixer of claim 1 wherein the stator has at least one orifice (48) on the tongue whereby at least one chemical reagent is added through the orifice.
10. The mixer of claim 1 wherein a longitudinal axis of the vane is collinear with and parallel to the longitudinal axis of the rotor.
11. The mixer of claim 1 further characterized in that it comprises:
 - (a) an essentially cylindrical entry section (40);
 - (b) a mixing zone (42) adjacent to the entry section; and
 - (c) an exit section (44) adjacent to the mixing section.

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12. The mixer of claim 11 wherein the entry section further comprises a chemical addition means.

13. The mixer of claim 11 wherein the mixing section further comprises a chemical addition means.

14. The mixer of claim 13 wherein the chemical addition means is at least one orifice (48) on the stator tongue.

15. The mixer of claim 11 wherein the exit and entry sections are essentially collinear.

16. The mixer of claim 11 wherein the exit and entry sections are in a nonlinear arrangement.

17. The mixer of claim 11 wherein the stator further comprises at least one foil about a periphery of at least a portion of a length of the tongue.

18. The mixer of claim 17 wherein the stator further comprises a stator shaft attached along the longitudinal axis of the stator boss.

19. The mixer of claim 18 wherein the stator rotates within the hollow cage rotor.

20. The mixer of claim 19 wherein the stator rotates in an opposite direction to a rotation of the hollow cage rotor.

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21. The mixer of claim 11 wherein a longitudinal axis of the vane is collinear with and parallel to the longitudinal axis of the rotor.
22. The mixer of claim 1 wherein the stator axis is concentric with respect to the axis of the cage rotor.
23. The mixer of claim 1 where the stator axis is off-set with respect to the axis of the cage rotor.
24. The mixer of claim 11 wherein the stator axis is concentric with respect to the axis of the cage rotor.
25. The mixer of claim 11 where the stator axis is off-set with respect to the axis of the cage rotor.

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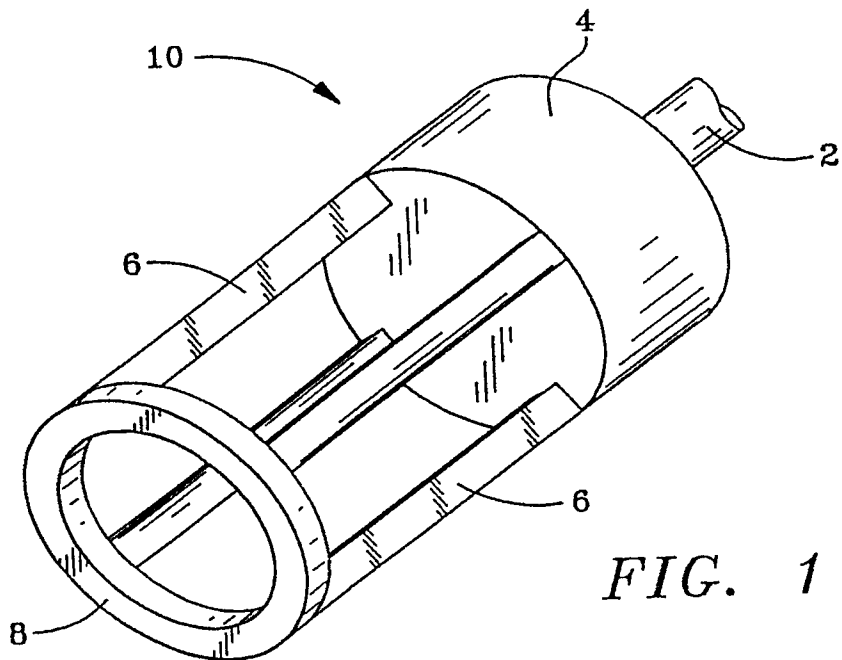


FIG. 1

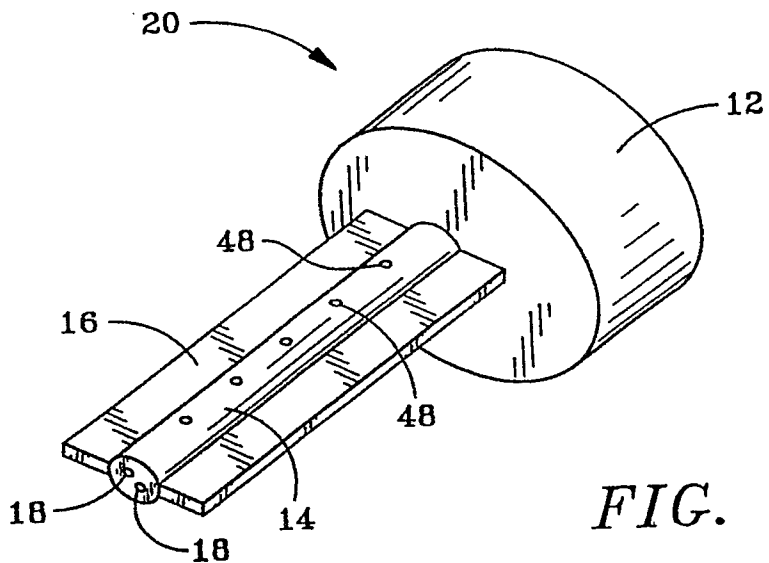


FIG. 2

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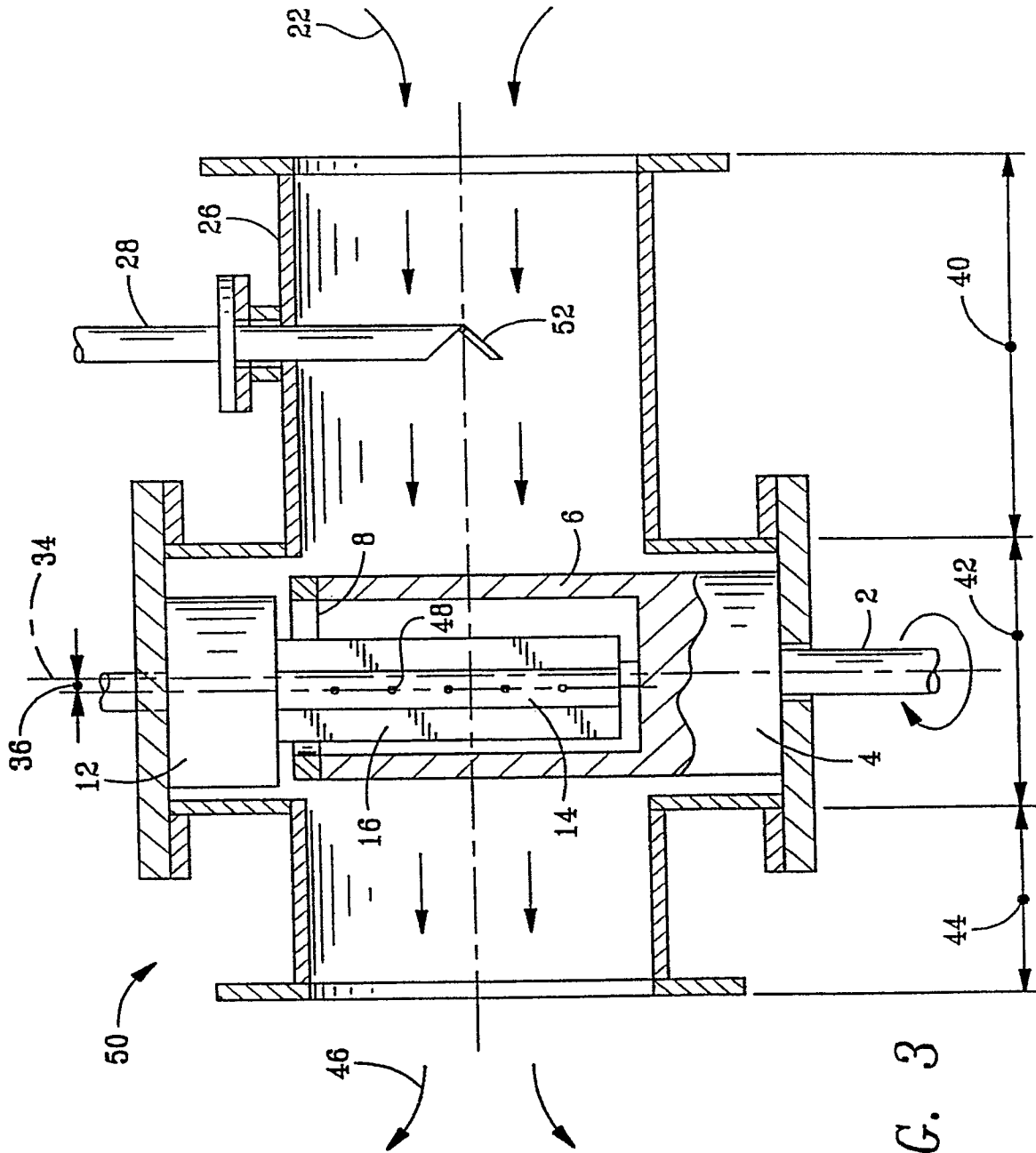


FIG. 3

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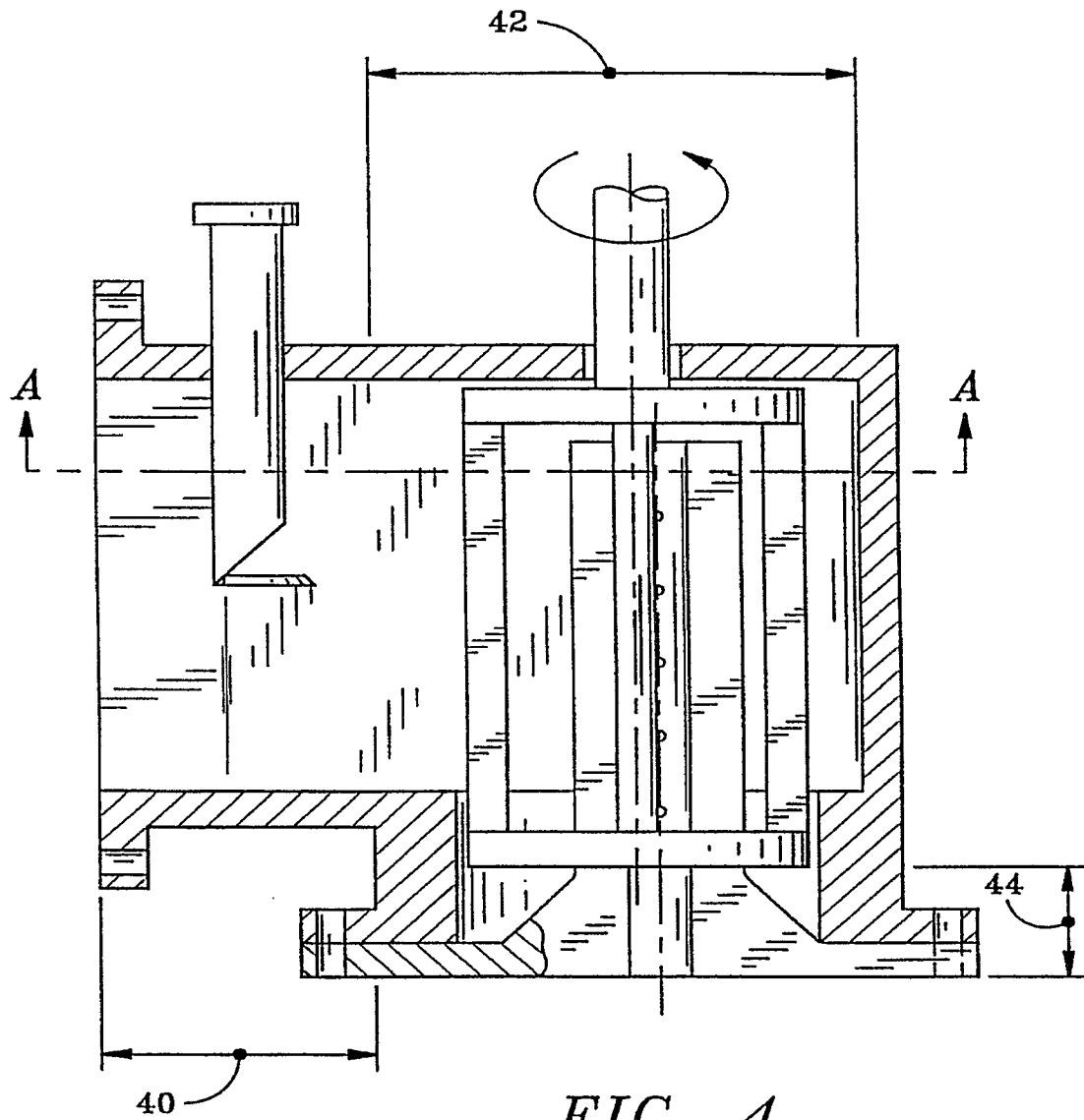
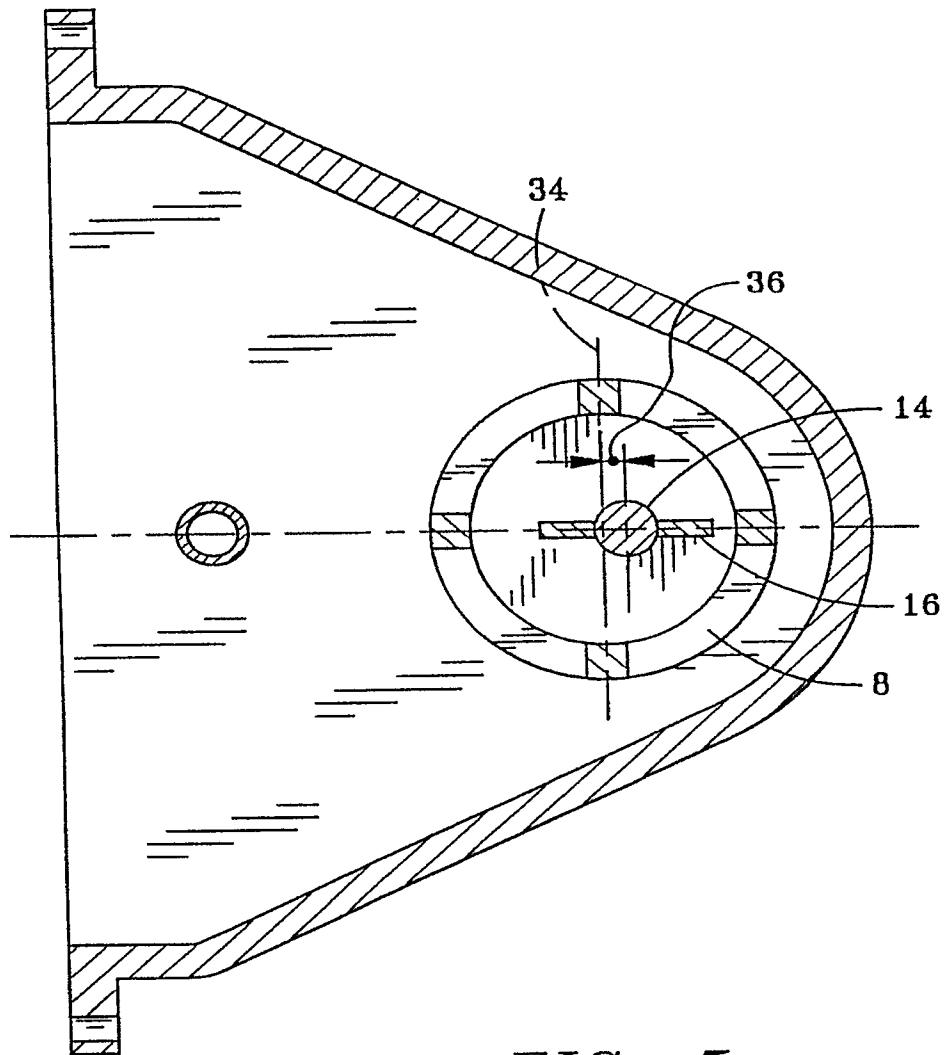


FIG. 4

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*FIG. 5*

