United States Patent

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[54] **APPARATUS FOR MIXING SUBSTANCES**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **259/2,** 259/91
[51] **Int. Cl.** **B01f 11/00**
[50] **Field of Search** 259/2, 72, 1, 3, 12, 17, 29, 35, 59, 75, 76, 80, 78, 79, 91, 92, 93, 94

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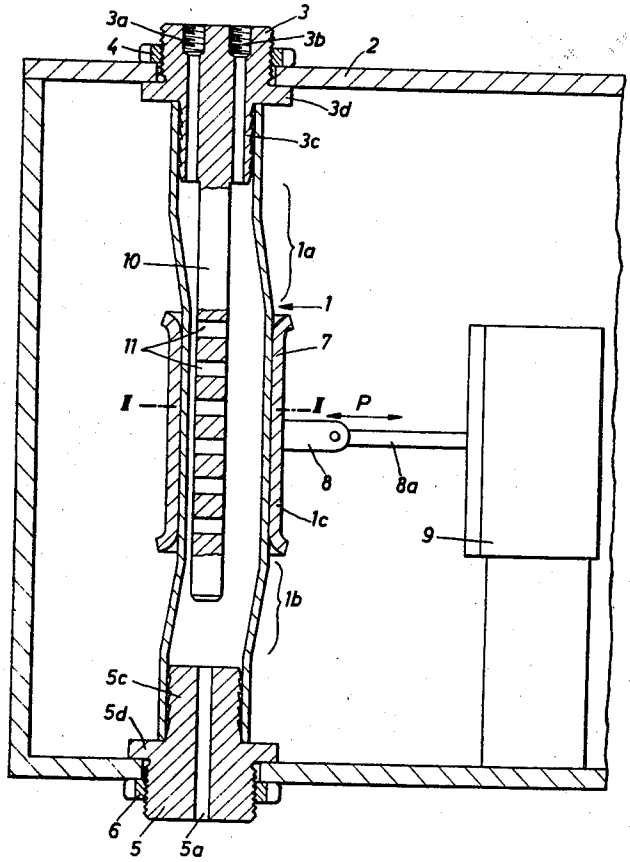
ABSTRACT: There is disclosed an apparatus for mixing substances of which at least one is a liquid, in a closed cylindrical vessel in which a rigid body is disposed extending in the axial direction thereof and filling a portion of the internal cross section of the vessel, wherein at least terminal members positioned adjacent terminal closure members of said vessel are composed of a material readily movable out of the axial direction of said vessel, a portion of said vessel disposed between said terminal members being provided with a reciprocating drive acting transverse of the axial direction thereof.



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SHEET 1 OF 2

Fig.1

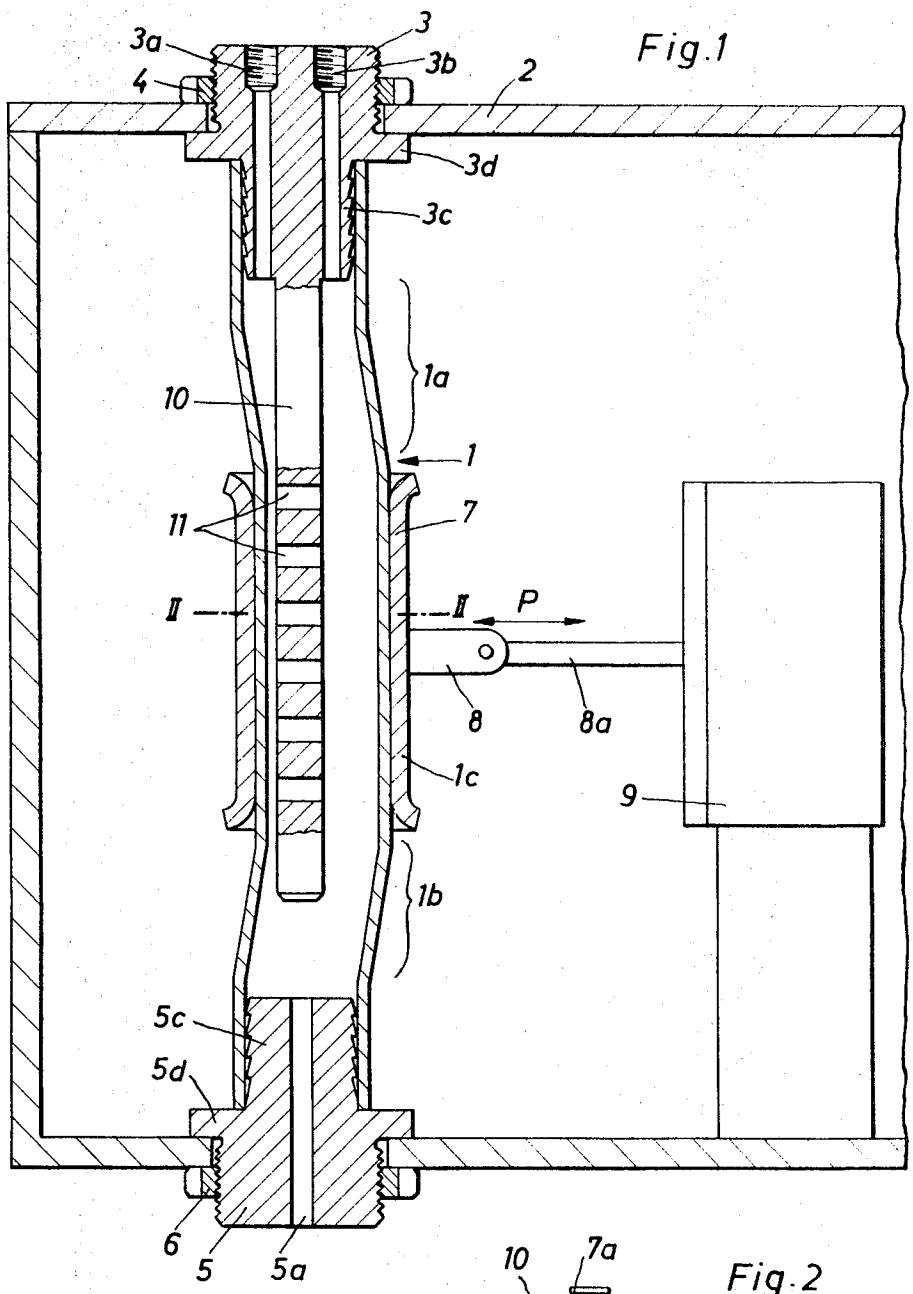

Fig.2

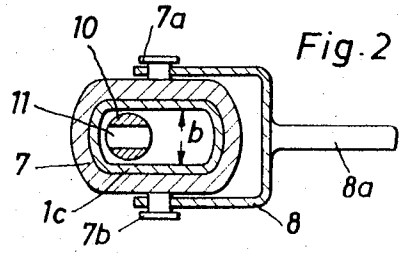

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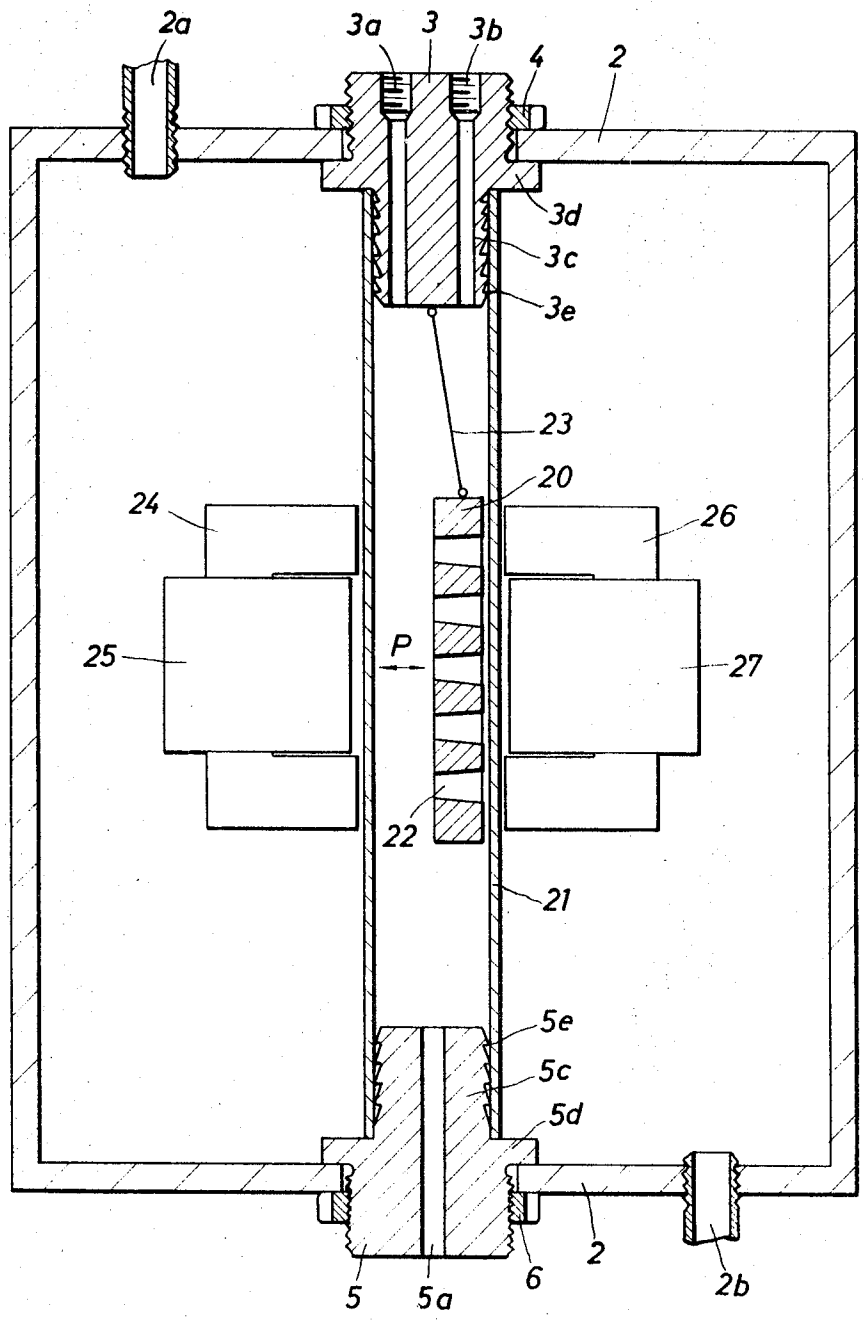
Fig. 3



Inventor:

APPARATUS FOR MIXING SUBSTANCES

This invention relates to an apparatus for mixing substances of which at least one is a liquid, in a closed vessel. It is conventional to provide rotating agitator vanes in a vessel and to extend the shaft or the supporting shank of apertured plates out of the vessel to the outside and to effect a drive from there.

Such arrangements result in difficulties in particular in the event that the vessel is subjected to a higher pressure internally than externally, because then the sealing means through which the shaft or the shank must be passed can become ineffective, in particular in the event one of the substances to be mixed is of a chemically or mechanically aggressive nature.

It is an object of the invention to provide an apparatus including a closed cylindrical mixing vessel for mixing substances of which at least one is a liquid, in which these difficulties cannot occur.

According to a feature of this invention, an apparatus is provided for mixing substances of which at least one is a liquid in a closed cylindrical vessel in which a rigid body is disposed extending in the axial direction thereof of filling a portion of the internal cross section of the vessel, wherein at least terminal members positioned adjacent terminal closure members of said vessel are composed of a material readily movable out of the axial direction of said vessel, a portion of said vessel disposed between said terminal members being provided with a reciprocating drive acting transverse of the axial direction thereof.

This arrangement principally is suited for apparatus having an opening which is provided as an inlet for the substances to be mixed as well as outlet for the mixture. This apparatus is particularly suited for continuous operations, the vessel in this case then preferably being provided in a cylindrical shape at the one end of which, preferably the upper end, separate inlets are provided for the substances to be mixed, whereas an outlet for the mixture is provided at the other end.

The vessel preferably is provided in the form of a tube having a rectangular cross section the width of which is slightly greater than the width of said body in the region in which it surrounds the rigid body.

With the foregoing object in view, together with such additional objects and advantages as may subsequently appear, the invention resides in the parts, and in the construction, combination and arrangements of parts disclosed, by way of example, in the following specification of certain modes of execution of the invention; reference being had to the accompanying drawings which form a part of said specification and in which drawings:

FIG. 1 is a longitudinal sectional view of an apparatus wherein the vessel is moved relate to the rigid body disposed therein;

FIG. 2 is a cross-sectional view on the line II–II of FIG. 1;

FIG. 3 is a longitudinal sectional view of an apparatus wherein the rigid body disposed in the vessel is moved relate to the vessel.

Referring first to FIG. 1, a tube 1 is shown in a machine frame 2 which is here illustrated as a closed casing, said tube being secured by means of two securing nipples 3 and 5 in alignment with one another and having corresponding securing sockets 3*c* and 5*c*, respectively. The nipple 3 is secured to the machine frame 2 by means of a nut 4 opposite to a flange 3*d* of the nipple 3. Similarly, a nut 6 is drawn down opposite to a flange 5*d* of the nipple 5. The nipple 3 is provided with two bores 3*a*, 3*b* serving as inlets for the substances to be mixed, whereas the nipple 5 is provided with a bore 5*a* as an outlet for the mixture. The intermediate portion 1*c* of the tube 1 is surrounded by a metal sleeve 7 which is connected with a linkage 8*a* through a fork 8, said linkage being reciprocated in direction of the arrow P, 5 to 100 times per second by a motor 9 illustrated diagrammatically only, for instance an unbalance motor. This oscillating frequency is correlated in particular to the substances to be mixed and to the mechanical conditions. In the course of such reciprocation, the terminal members 1*a* and 1*b* of the tube 1 are deformed as illustrated in FIG. 1.

A cylindrical body 10 is firmly connected to the nipple 3, said body extending through the portion 1*c* of said tube. It can, as illustrated, be an integral part of the nipple. The body 10 has a plurality of transverse bores 11 in the region of the portion 1*c*.

The tube 1 has a substantially rectangular cross section (see FIG. 2). The internal width *b* of the tube 1 is slightly larger than the diameter of the body 10. When the central tube portion 1*c* reciprocates, the substances fed into the interior of the tube are therefore moved from the one side of the body 10 to the other and then back again; for doing so, these substances are able to move through the transverse bores 11 or through the intermediate space provided between the body 10 and the interior longitudinal wall of the tube portion 1*c* only, from the one side of the body to the other side. As a result thereof, a complete mixing of the substances fed in is accomplished. The size and shape of the transverse bores 11 must be correlated to the substances and the other conditions. It can prove to be desirable to use tapered bores instead of cylindrical bores.

The nipples 3 and 5 are seated in the closed casing 2 which is provided with an inlet and an outlet 2*a* and 2*b*, respectively for a heating agent or a coolant.

It might be desirable depending on circumstances to perform the mixing operation in raising the temperature. In such a case, it is recommended to construct the machine frame 2 as a closed casing which can be filled with a heated fluid, e.g., hot air.

Notwithstanding the illustrated embodiments of the invention and the manner in which such may be used, it is appreciated that changes and modifications will suggest themselves to others skilled in the art both for uses similar to those illustrated as well as for other uses. The invention, therefore, is not to be deemed to be limited to the exact modes of execution above disclosed by way of example, and it will be understood that the invention embraces all such changes and modifications in the parts, and in the construction, combination and arrangement of parts as shall come within the purview of the appended claims.

What I claim is:

1. An apparatus for mixing substances of which at least one is a liquid, in a closed cylindrical vessel in which a rigid body is disposed extending in the axial direction thereof and filling a portion of the internal cross section of the vessel, wherein at least terminal members positioned adjacent terminal closure members of said vessel are composed of a material readily movable out of said axial direction of said vessel, a portion of said vessel disposed between said terminal members being provided with a reciprocating drive acting transverse of the axial direction thereof.

2. An apparatus as set forth in claim 1, wherein a portion of said vessel positioned between said terminal members is surrounded by a rigid sleeve, said sleeve being connected to said drive.

3. An apparatus as set forth in claim 1, wherein a first end of said vessel is provided with an inlet or a plurality of inlets for said substances to be mixed and a second end is provided with an outlet for the substance mixture.

4. An apparatus as set forth in claim 1, wherein the vessel is substantially tubular with a rectangular cross section and said body disposed therein has a width which is slightly smaller than the internal width of said vessel.

5. An apparatus as set forth in claim 1, wherein said body disposed in said vessel is provided with a plurality of transverse bores.