United States Patent

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[54] **PNEUMATIC PULSATION FOR IMPARTING VIBRATORY MOTION TO A LIQUID IN A CONTAINER**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **259/1**
[51] **Int. Cl.** **B01f 11/00**
[50] **Field of Search** 259/1; 103/223; 60/62.5, 62.6; 15/404; 137/625.21, 625.22, 624.11, 624.13, 625.15, 625.16; 91/460, 280

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ABSTRACT: A pneumatic pulsator for imparting vibratory motion to a liquid in a container comprises a body with an inlet port connected to a compressed air supply line and an outlet port connected with the atmosphere, the body containing a rotary valve with at least one channel connected to a pulsation chamber for alternately placing the same in communication with the compressed air supply line and the atmosphere, the pulsation chamber being in turn connected to the container to produce pulsation of the liquid therein. Between the valve and the body is a stationary liner made from a wear-resistant material having inlet and outlet apertures in communication with the ports in the body, the liner being spaced with a permanent gap from the valve.

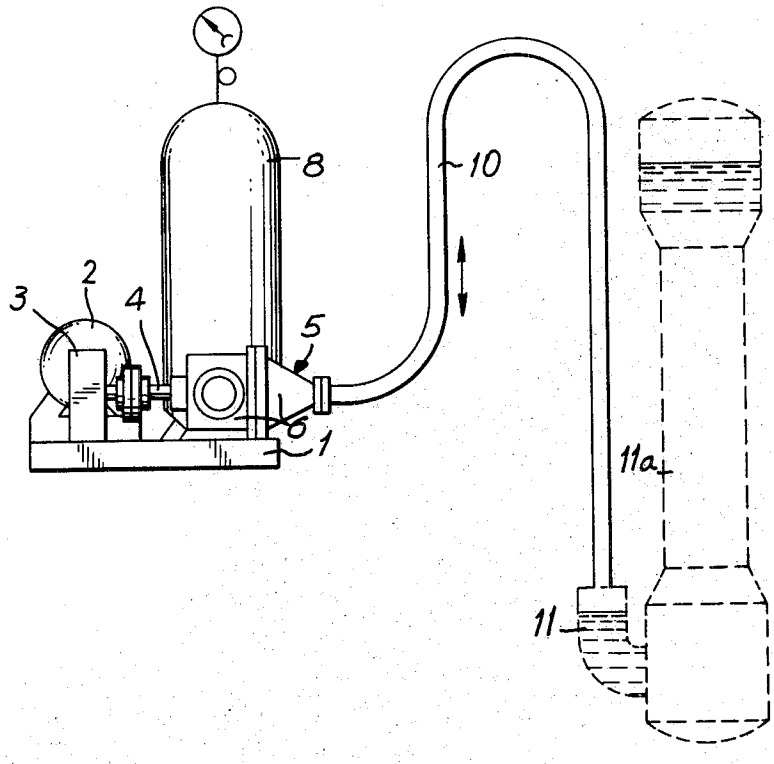


FIG. 1

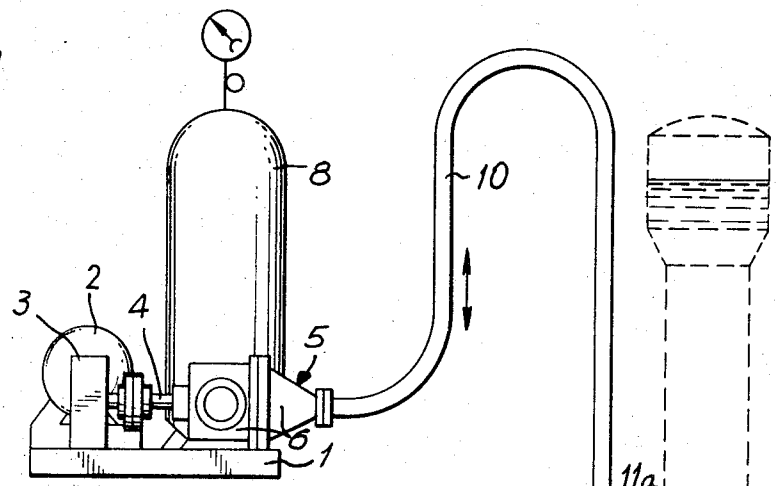


FIG. 2

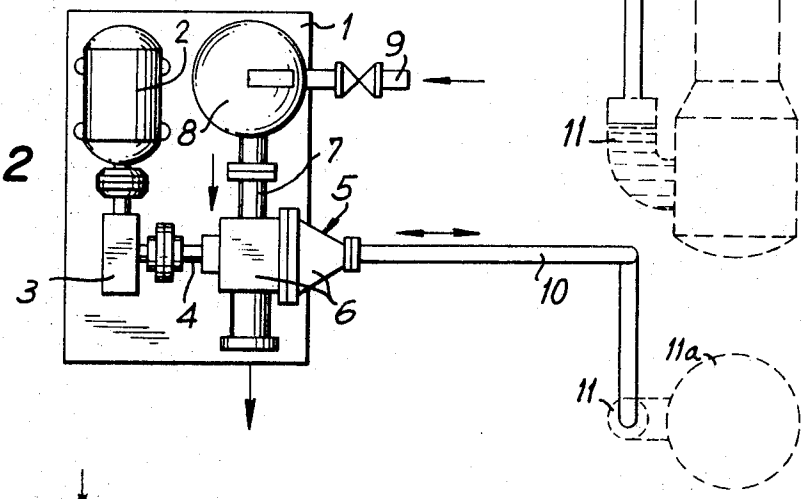
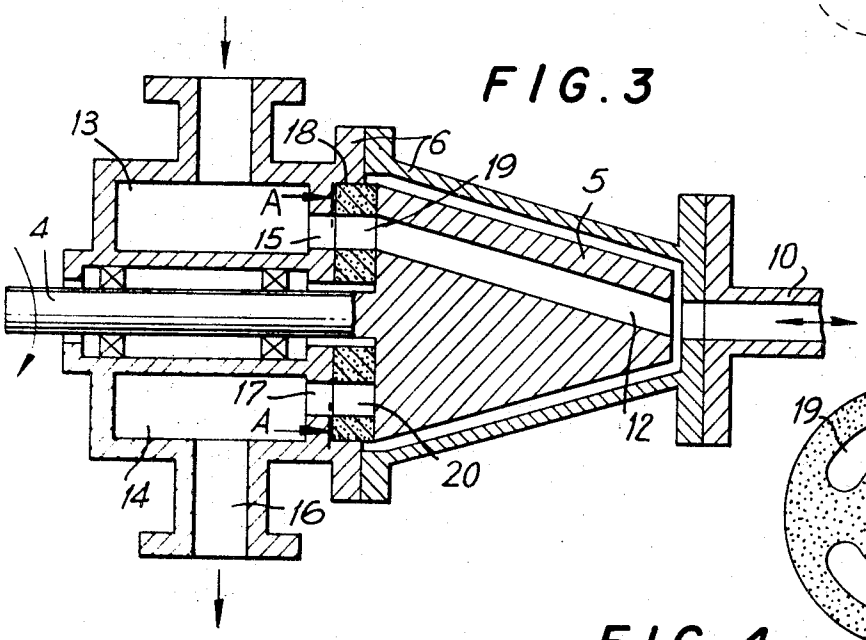


FIG. 3



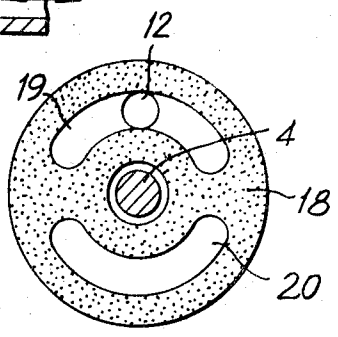


FIG. 4

PNEUMATIC PULSATION FOR IMPARTING VIBRATORY MOTION TO A LIQUID IN A CONTAINER

The present invention relates to pneumatic pulsators employed for imparting vibratory motion to a liquid in a container, mostly in chemical apparatus such as columns, reaction vessels, mixers-settlers, etc.

Vibratory motion of the liquid is required to intensify the processes proceeding in the apparatus and is created by means of a pulsator which alternately supplies compressed air into the pulsation chamber of the apparatus and discharges it, said chamber communicating with the liquid container through a hole located below the liquid level.

The volume of the liquid acquiring vibratory motion may vary from 0.1 to 100 cu. m. and the amount of air supplied into the container within one working cycle may vary from 0.1 to 2 cu. m. at a pressure of 0.1 to 3 atm.

The pulsators known in the art have an adjustable speed drive for rotating the slide valve located in the body; this slide valve communicates the pulsation chamber of the apparatus alternately with the compressed air line and the atmosphere which makes the liquid in the container vibrate.

As a rule, the slide valve is a cylindrical or conical member with at least one through channel, the body accommodating said slide valve communicating through a pipe with the container of the apparatus and having an inlet port and an outlet port communicating, respectively, with the compressed line and the atmosphere.

In the course of operation, the pulsator slide valve becomes worn rather rapidly, which results in compressed air losses; this, in turn, impairs the economy of the process and the steadiness of pulsation. Replacement of a worn slide valve becomes especially difficult when the handled liquids are toxic or radioactive.

An object of the invention resides in providing a pneumatic pulsator whose slide valve is less subject to wear in operation.

Proposed herein is a pneumatic pulsator for imparting vibratory motion to a liquid in a container which incorporates a rotatable slide valve with at least one channel, said valve being located in a body with an inlet port and an outlet port and communicating the liquid container alternately with the compressed air line and the atmosphere. In accordance with the invention, installed between the body at the side of its ports, and the slide valve is a stationary liner made from a wear-resistant material and provided with inlet and outlet holes which coincide with the corresponding ports in the body.

The liner installed between the body and slide valve reduces the wear of the latter because, as the slide valve rotates, the liner itself becomes worn partly which creates a certain clearance between it and the slide valve; as a result, further friction ceases and so does the wear of the slide valve and the liner.

Now the invention will be described by way of example with reference to the appended drawings in which:

FIG. 1 is a diagrammatic illustration of a pneumatic pulsator according to the invention, and a container connected thereto;

FIG. 2 is a top view thereof;

FIG. 3 is a sectional view of a slide valve of a pneumatic pulsator according to the invention; and

FIG. 4 is a section taken on line AA in FIG. 3 with a conventionally shown slide valve channel inlet hole.

As shown in FIGS. 1 and 2, the pneumatic pulsator has a frame 1 for the joint installation of a motor 2 and a reduction unit 3 whose output shaft 4 is connected with the slide valve 5 housed in the body 6. The body 6 is connected by a pipe connection 7 to a receiver 8 which communicates with the compressed air line 9 and, through a pipe 10, with the pulsation chamber 11 of the liquid container 11*a*.

The slide valve 5 (FIG. 3) connected to the output shaft 4 of the reduction unit 3 is a conical member with at least one through channel 12 arranged at an acute angle to the axis of the slide valve 5 so that its outlet end is in constant communication with the pipe 10.

The body 6 has two chambers 13 and 14, the first being in communication with the inlet port 15 and compressed air line 9, the second being in communication with the atmosphere through the hole 16 and with the outlet port 17 in the body 6. Being rotated by the motor 2 via the reduction unit 3, the slide valve 5 provides communication between the container 11*a* alternately with the compressed air line 9 through the chamber 13 and with the atmosphere through the chamber 14 which results in vibration of the liquid in container 11*a*.

It should be emphasized, that in spite of the fact that the pulsation chamber 11 is periodically subjected to overpressure, the liquid in the container 11 is usually at atmospheric pressure; this improves considerably the dependability of such apparatus and simplifies their design. However, in a general case, the pressure in the apparatus depends on the operating conditions and may be other than atmospheric.

INstalled between the body 6 at the side of its ports 15 and 17 and the slide valve 5 is a stationary liner 18 made from a wear-resistant material such as graphite or Teflon (polymer of tetrafluoroethylene) and provided with inlet and outlet holes 19 and 20 (FIGS. 2 and 4) which usually are similar in cross section with the ports 15 and 17 in the body 6.

The number of ports in the body 6 and of holes in the liner 18 may vary with the required relation between the durations of the air supply and discharge cycles, the frequency of vibrations and other pertinent factors.

There should be a certain clearance between the liner 18 installed in the body 6 and the slide valve 5. For example, this clearance can be obtained by preliminary lapping of the slide valve 5 to the liner 18. Then, rotation of the slide valve will wear the liner 18 to a certain extent, after which there will appear a clearance between the liner and the slide valve and further friction will be discontinued.

This factor precludes further wear of the slide valve.

Investigations conducted with an experimental model of the pneumatic pulsator proposed herein have proved the reliability of the slide valve which has worked successfully without servicing for a long period of time.

The invention is not confined to the example disclosed above and may be modified without departing from the spirit and the scope of the invention.

We claim:

1. A pneumatic pulsator for imparting vibratory motion to a liquid in a container, by means of compressed air, said pulsator comprising: a compressed air supply source; a receiver communicating with said compressed air supply source; a pulsation chamber having a lower portion connected to the container with the liquid; valve means communicating with the upper portion of said pulsation chamber and with said receiver for providing alternating communication of said pulsation chamber with said receiver and with atmosphere; and drive means for said valve means.

2. A valve in a pulsator for imparting vibratory motion to liquid in a container by means of compressed air, said apparatus comprising: a body with inlet and outlet openings; partition means in said body dividing the bodies into inlet and outlet chambers having a common flat wall and communicating respectively with said inlet and outlet openings; said flat wall having inlet and outlet ports respectively opening into said inlet and outlet chambers; a rotor in said body and having a flat surface perpendicular to the axis of its rotation and parallel to said flat wall, said flat surface facing the flat wall; said rotor having a rectilinear channel inclined at an acute angle with respect to the axis of rotation of said rotor, one end of said channel facing said flat surface of said rotor while the other end of said channel is on the axis of rotation of said rotor, said rotor and said channel being arranged with respect to the inlet and outlet ports such that said channel communicates alternatively with said ports as the rotor rotates; a flange on said body having a hole, said flange being adapted for connection with a pipe leading to a pulsation chamber, said hole in said flange being in registry with said other end of said channel and a liner secured to said flat wall of said body and having apertures which coincide with said inlet and outlet ports while

between said liner and said flat surface of the rotor there is a constant gap.

3. A slide valve as claimed in claim 2 wherein said apertures in said liner are elongated.

4. A slide valve as claimed in claim 3 wherein said liner is made of a wear-resistant low friction material.