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(11) **EP 1 195 190 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.04.2002 Bulletin 2002/15

(51) Int Cl.7: **B01F 5/06**

(21) Application number: **00830652.4**

(22) Date of filing: **05.10.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

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(54) **A homogenization valve**

(57) The invention relates to a homogenization valve comprising an inlet conduit (1) for the product to be homogenized and an outlet zone (5) for the product when homogenized, the inlet conduit (1) being located upstream and the outlet zone (5) being located downstream of the outlet aperture (2) of the valve; the valve comprising a seating (3) and an obturator (4). The seating (3) and obturator (4) of the valve face one another

at an annular surface inside which ends (6a) of conduits (6) open out, each of which conduits (6) is connected to the inlet conduit (1). The outlet aperture (2) of the valve develops both along an external circumference (2a) and an internal circumference (2b) of the annular surface; a cavity (7) is afforded, into which the outlet aperture (2) of the valve opens, which outlet aperture (2) develops along the internal circumference (2b) and is connected to the outlet zone (5) by holes (8).

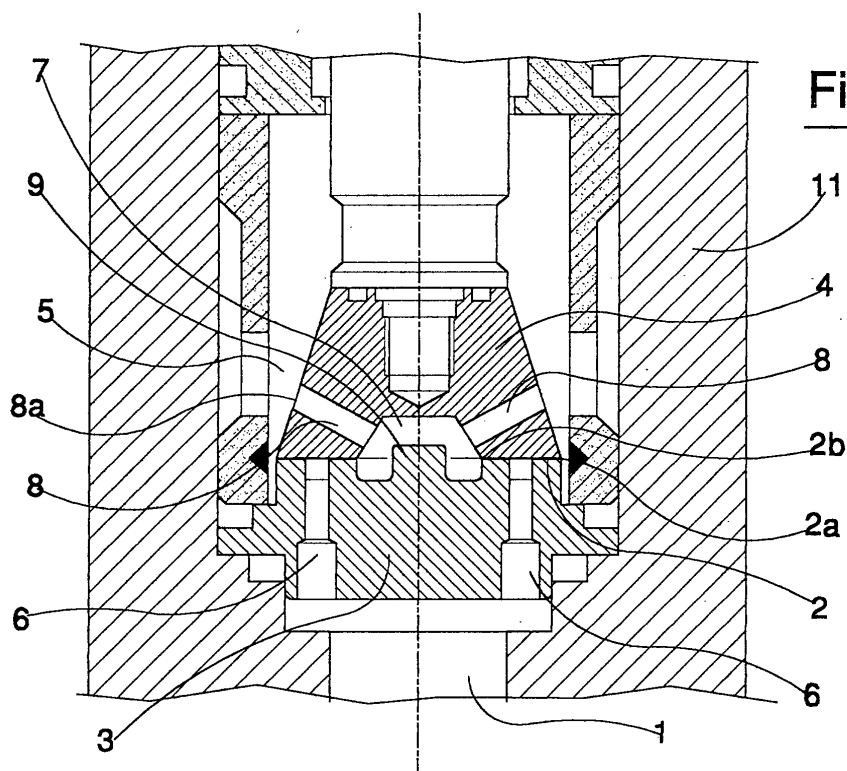


Fig. 2

Description

[0001] The invention relates to a homogenization valve, which can be usefully but not exclusively used for homogenizing milk.

[0002] Homogenizers have been well-known for some time, and are used in homogenizing emulsions and suspensions. Very briefly, they are constituted by a pump which forces the product to be treated to pass through the narrow passage aperture of a homogenization valve. The homogenization operation of a product, for example, milk, consists substantially in the fine subdivision of the fat cells and their homogeneous dispersion throughout the mass of the liquid.

[0003] The obturator of the valve is subject to high pressure, which tends to close the valve and block the passage of the product through the valve itself. Consequently the product at the valve inlet too is subject to a high pressure in order for it to be able to overcome the pressure tending to close the valve.

[0004] As is well-known, the homogenization of the product is a consequence of various causes among which the acceleration and passage of the product through the narrow valve aperture, an impact against a special ring located at the outlet of the valve, bubble cavitation, with a consequent unleashing of high-frequency vibrations and turbulence in the fluid, which is determined at the outlet of the valve due to the rapid drop in pressure and speed the product is subjected to.

[0005] The efficiency of a homogenization valve is conditioned, among other factors, by the geometry of the valve itself, which must enable a sufficient product flow rate as well as high acceleration values and a pressure drop in order for the transiting product to be correctly treated. Also, however, the obturator must not be subjected to excessive forces which might lead to problems involving difficulty of regulation of the valve and possible instability thereof.

[0006] An example of a homogenization valve of known type is represented by the valve illustrated in figure 1. In this valve the product, which enters at I under pressure, is forced to pass through the valve aperture i. e. the annular crown located between the seating S and the obturator O of the valve. The breadth of the valve aperture is extremely small; the product therefore is subjected to strong acceleration and crosses the valve aperture, whereafter there is a brusque pressure change and a high-speed impact against a ring A at the outlet of the valve passage aperture. These are the factors which lead to the homogenization of the product.

[0007] In this type of valve, of relatively simple construction, a design compromise is necessary, with a calculation made according to the product inlet pressure. On the one hand there is the need to have a diameter (and therefore a length of the external circumference, i. e. the outlet passage aperture) which is sufficient to enable a good liquid flow rate, while on the other hand it is necessary to limit both the force which is unleashed

on the valve obturator and the width of the circular crown of the outlet passage aperture. The overall efficiency of the valve is therefore considerably limited.

[0008] To increase the efficiency of the valves, various solutions have been proposed. For example, in the valve taught in US 4352573, there are several outlet passage apertures, placed one above another; in the valve illustrated in EP 0810025, on the other hand, there is an outlet passage aperture of considerable length and small width, obtained with a tangential product inlet and having a valve obturator construction which enables a partial compensation of the forces unleashed thereon. Apart from the greater dimensions with respect to normal valves, these types of valves are constructionally quite complex and present some difficulties in regulation.

[0009] The main aim of the present invention is to make available a homogenization valve which is constructionally quite simple while at the same time offering high operational efficiency.

[0010] An advantage of the present invention is that it provides a valve of about the same size as traditional valves, and which therefore can be used in substitution of these prior-art valves in homogenizers.

[0011] These aims and advantages and more besides are all attained by the present invention, as it is characterised in the appended claims.

[0012] Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of a preferred but non-exclusive embodiment of the invention, illustrated purely by way of a nonlimiting example in the accompanying figures of the drawings, in which:

figure 1 shows a vertical-elevation section of a known-type homogenization valve;
figure 2 is a vertical-elevation section of the homogenization valve of the invention;
figure 3 is an exploded view, with some parts shown in section and with the size of the aperture of the valve shown as bigger than it actually is, of some parts which go together to make the valve of the invention.

[0013] The homogenization valve of the invention, which is used in homogenizers of known type and not illustrated in the figures of the drawings, exhibits an inlet conduit 1 for the product to be homogenized and an outlet zone 5 for the homogenized product, which inlet and outlet are respectively upstream and downstream of the outlet aperture 2 of the valve. The valve comprises a seating 3, fixed in the valve body 11, on which an obturator 4 is forced at a predetermined pressure, so that when the pressurised fluid to be homogenized is pumped through the valve and presses against the obturator, an outlet aperture 2 of the valve is defined. As happens in known-type valves, the distance between the facing surfaces of the seating and the obturator, i.e.

the width of the valve outlet aperture, is determined by the state of equilibrium between the forces acting on the obturator.

[0014] The seating 3 and the obturator 4 of the valve face each other at an annular surface along an external circumference 2a and an internal circumference 2b of which the outlet aperture 2 of the valve develops.

[0015] A plurality of conduits 6 are afforded internally of the seating 3, each of which conduits 6 is connected by an end thereof to the inlet conduit 1 of the fluid to be homogenized. The other ends 6a of the conduits open halfway between the inner and outer circumferences of the annular surface, where the seating 3 and the valve obturator 4 face each other; the ends 6a of the conduits 6 are angularly equidistant.

[0016] The seating 3 and the obturator 4 of the valve also define, internally thereof, a cavity 7 into which the valve outlet aperture 2 (developing along internal circumference 2b of the annular surface) opens; this cavity 7 is connected to the homogenized product outlet zone 5 by means of a plurality of holes 8 which are made in the obturator 4 of the valve. The outlet ends 8a of the holes open on the external lateral surface of the obturator 4 which surface develops along the external circumference of the obturator 4 in a zone which is close to the outlet aperture 2 of the valve.

[0017] A projection 9 is often present internally of the cavity 7 and is solidly connected to the seating 3 of the valve, is located concentrically to the internal circumference 2b and is arranged in such a way as to intersect the plane containing the internal circumference 2b.

[0018] Figure 3 clearly shows that both the seating 3 and the obturator 4 of the valve are solid in rotation and arranged coaxially to each other.

[0019] Apart from a higher efficiency, determined by various factors which will be described herein below, the operation of the homogenization valve is rather similar, generally speaking, to the operation of known-type homogenization valves. Very briefly, the product arriving at the valve inlet at high pressure raises the obturator of the valve, which is also subject to a high pressure which tends to close the valve. The liquid product therefore exits through the narrow valve aperture which is created following the raising of the obturator. As in known valves, the flow rate and efficiency of the valve are influenced by the equilibria of the pressures concerned (product inlet pressure - obturator closure pressure).

[0020] The valve, as mentioned herein above, has the primary advantage of having the same overall external dimensions as a known-type valve, which means that it can be substituted for a traditional valve with no need for structural changes to the homogenizer already fitted with known valves.

[0021] Furthermore, in a direct comparison at equal pressures, the invention offers higher valve flow rate thanks to the special geometry of the valve, which gives a more or less double length of outlet aperture in com-

parison to valves of known type; the width of the outlet aperture, however, is practically halved with respect to the prior art, which leads to an almost-instantaneous pressure drop for the product transiting through the valve, and a considerable bubble cavitation effect in the product exiting from the outlet aperture of the valve. All of these advantages are obtained without having to increase the force transmitted by the inletting product to the obturator (the sum of the areas of conduit 6 ends 6a can be equal to the area of the outlet aperture of a known-type valve).

[0022] An increase in the turbulence in the fluid, and therefore probably the efficiency of the valve, is produced by the contact between the product exiting from the outlet ends 8a of the holes 8 and the product exiting from the valve outlet aperture developing along the external circumference 2a. The projection 9 internal of the cavity 7, which functions as a shock ring for the product exiting from the valve aperture developing along the internal circumference 2b, could be eliminated in order to obtain a reciprocal impact between the product particles exiting from the valve outlet aperture developing along the internal circumference 2b. In some cases these impacts between particles can have a better effect on valve efficiency than those obtained by product impact on the projection 9.

Claims

1. A homogenization valve, comprising: a seating (3) and an obturator (4) having reciprocally facing surfaces which are distanced in order to define a valve outlet aperture (2); an inlet conduit (1) for the product to be homogenized and an outlet zone (5) for the product when homogenized, the inlet conduit (1) being located upstream and the outlet zone (5) being located downstream of the outlet aperture (2) of the valve; **characterised in that:**

the seating (3) and the obturator (4) face one another at an annular surface, into which annular surface ends (6a) of a plurality of conduits (6) open, each of which conduits (6) is connected with the inlet conduit (1);
the outlet aperture (2) of the valve develops along both an external circumference (2a) and an internal circumference (2b) of the annular surface.

2. The valve of claim 1, **characterised in that** the seating (3) and the obturator (4) of the valve together define a cavity (7), into which the outlet aperture (2) developing along the internal circumference (2b) opens: the outlet aperture (2) being connected to the outlet zone (5) for the homogenized product by means of a plurality of holes (8).

3. The valve of claim 2, **characterised in that** the plurality of holes (8) are afforded in the obturator (4) and have outlet holes (8a) which open on a lateral external surface of the obturator (4) in a zone which is close to the valve outlet aperture (2) developing along the external circumference (2a). 5
4. The valve of claim 1, **characterised in that** the plurality of conduits (6) is made in the seating (3) of the valve, and the ends (6a) of the conduits (6) open on a halfway circumference of the annular surface and are reciprocally angularly equidistant. 10
5. The valve of claim 2, **characterised in that** it comprises a projection (9) which is arranged internally of the cavity (7) in a concentric position in relation to the internal circumference (2b) and intersects a plane containing the internal circumference (2b) 15

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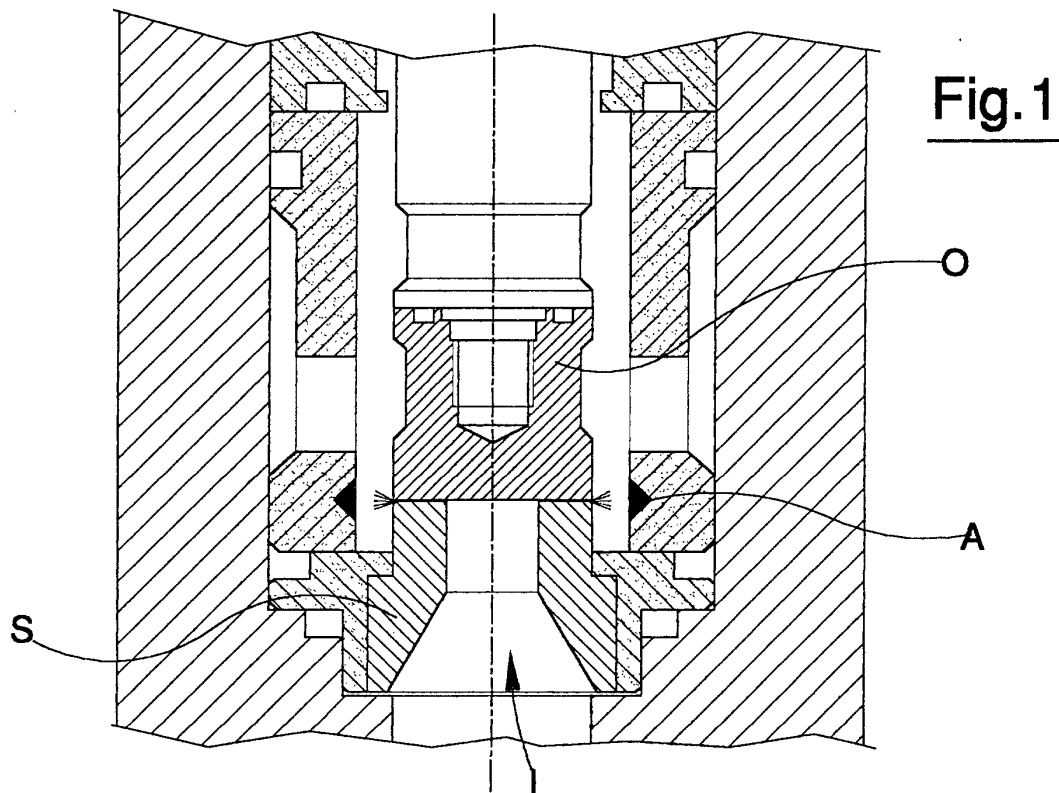
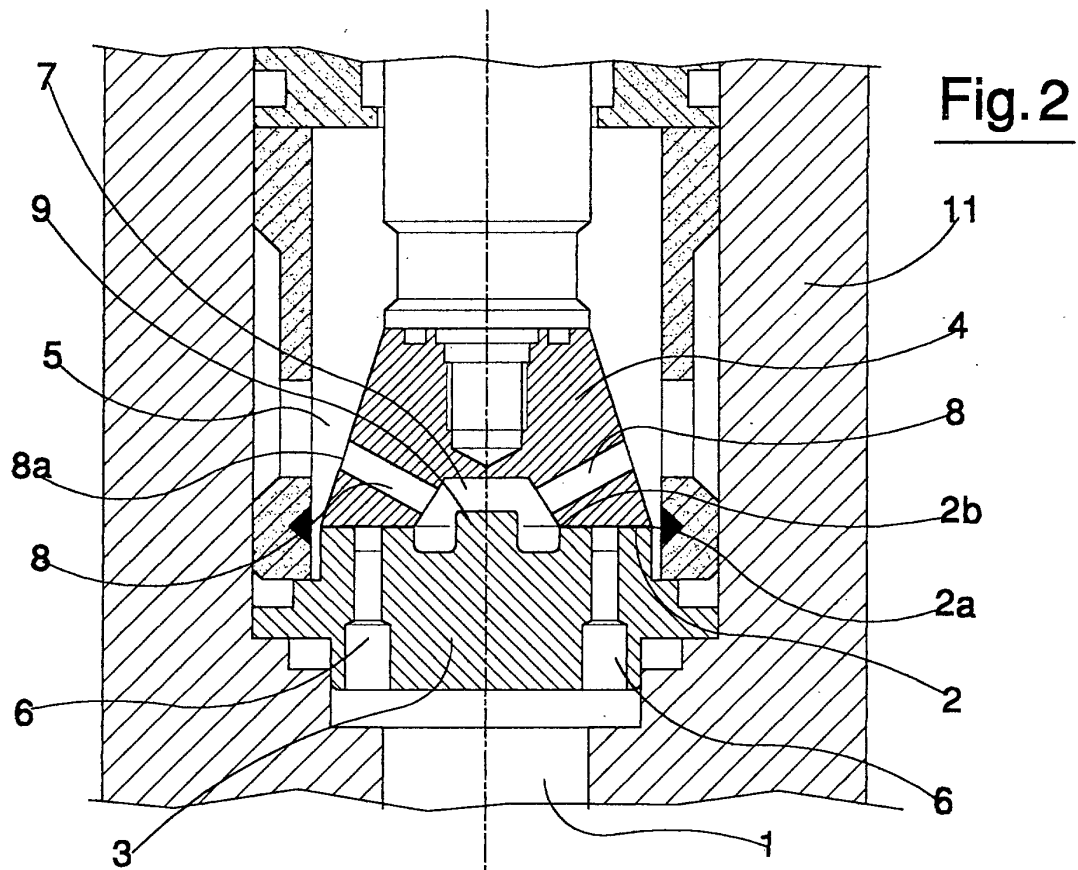
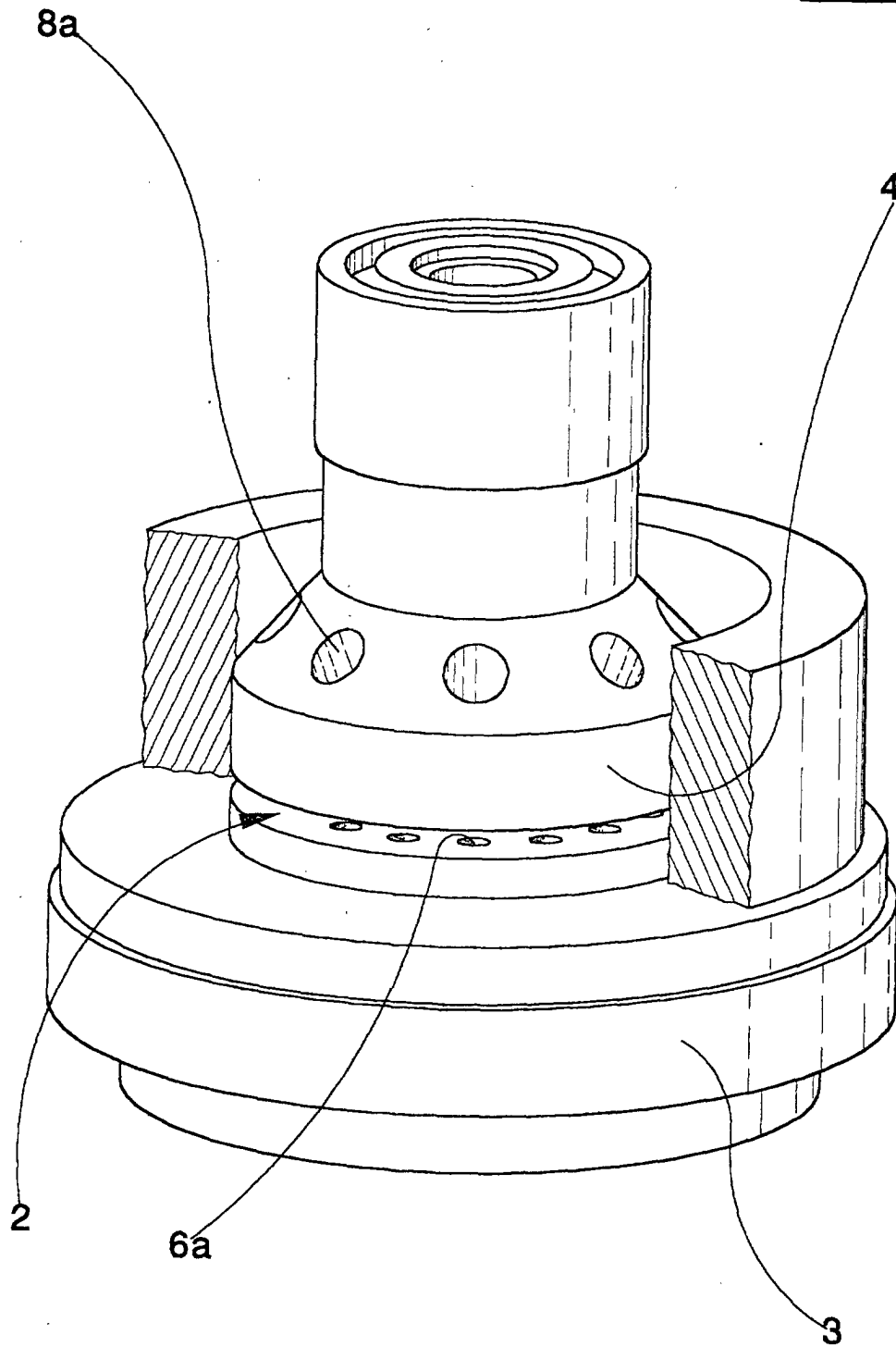


Fig. 3





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EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0652

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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Y	* claims; figures *	5	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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Place of search		Date of completion of the search	Examiner
THE HAGUE		27 February 2001	Belibel, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 B2 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 83 0652

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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