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(71) Applicant: **Bertoli S.r.l.**  
43040 Vicofertile,  
Parma (IT)

(72) Inventor: **Barusi, Ercole**  
43015 Noceto (Parma) (IT)

(74) Representative: **Gotra, Stefano**  
BUGNION S.p.A.  
Via Vellani Marchi, 20  
41100 Modena (IT)

## (54) An improved positive displacement pump, in particular for food products

(57) The pump is normally used for pumping fluid products containing solid parts, and comprises a piston (1), slideable internally of a chamber (1a), which piston (1) introduces the product into the chamber (1a) by aspirating the product through an inlet mouth (2) and expels the product from the chamber (1a) through an outlet mouth

(4); the chamber (1a) develops along a longitudinal axis; the inlet mouth (2) and the outlet mouth (4) have axes which are perpendicular to the chamber (1a) axis; the piston (1) is arranged coaxially to the chamber (1a) axis at an end of the chamber (1a) and slides between two extreme positions in such a way that it never covers the inlet mouth (2) and the outlet mouth (4) holes.

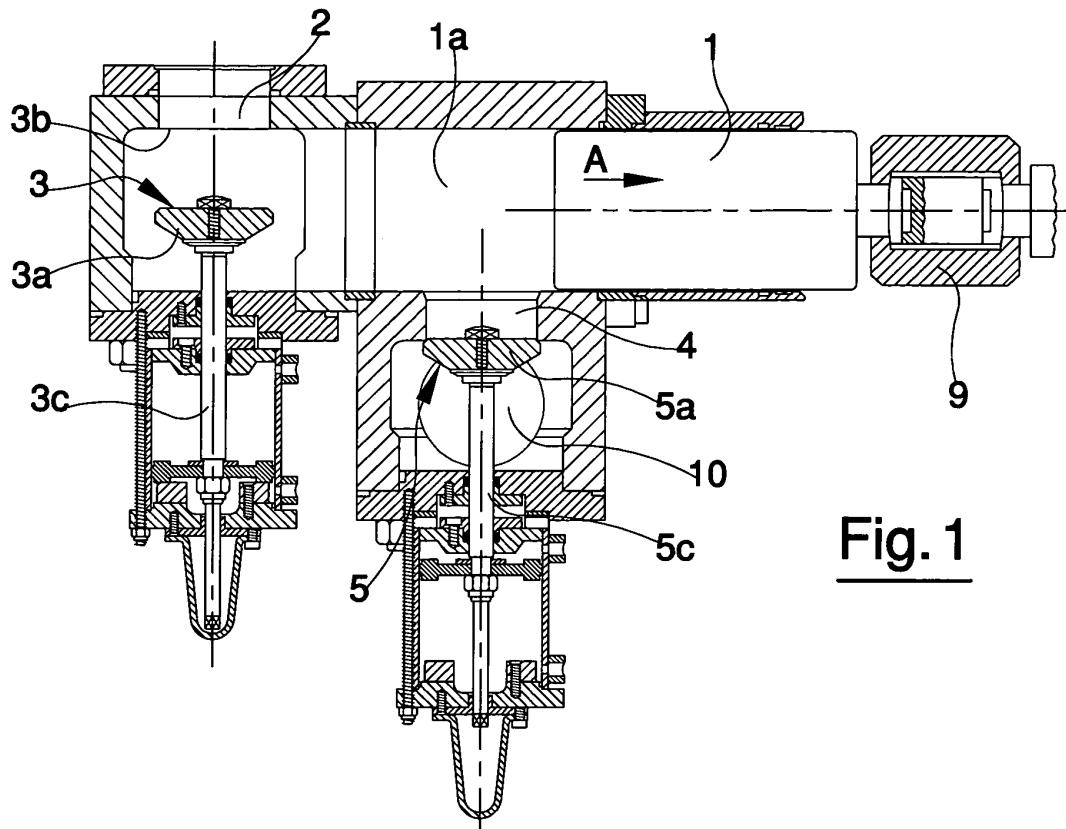


Fig. 1

## Description

**[0001]** In the food industry, pumps for pumping fluid products containing solid parts have been used for a considerable time; these pumps are used, for example, for pumping jams, mustard, tomatoes in pieces immersed in their juice, vegetable soups containing pieces of vegetable matter, and the like. These pumps normally comprise a sliding piston which aspirates the product from an inlet mouth, generally provided with a single-acting globe valve, and pumps it through an outlet mouth, also generally provided with a single-acting globe valve. One of these pumps is illustrated and described, for example, in Italian patent IT 1180935 belonging to the same applicant.

**[0002]** In these pumps, the functioning of which is known and satisfactory, it is important to prevent, or at least minimise, crushing or deterioration of the pieces of product, as well as the trapping and stagnating of the products internally of the pump; this latter aspect is of particular importance inasmuch as since the products are comestible, any stagnating might lead to a deterioration in their physical-chemical properties.

**[0003]** The main aim of the present invention is to provide a geometry in this kind of pump which eliminates or minimises the above-mentioned drawbacks.

**[0004]** An advantage of the invention is that it provides a pump which is easy and rapid to clean and maintain.

**[0005]** These aims and advantages and more besides are all attained by the invention, as it is characterised in the appended claims.

**[0006]** Further characteristics and advantages of the present invention will better emerge from the detailed description that follows, of a preferred embodiment of the invention, illustrated by way of non-limiting example in the accompanying figures of the drawings, in which:

figure 1 is a vertical elevation section of the pump of the invention during an aspiration stage;

figure 2 is a vertical elevation section of the pump during a delivery stage.

**[0007]** The pump of the invention comprises a piston 1 which is slidable internally of a chamber 1a afforded in the body of the pump; as with known-type pumps, the piston slides by connecting, for example by means of a joint 9, an end of the piston 1 to a movement system, not illustrated, which can for example be represented by a con rod powered by a motor.

**[0008]** The chamber 1a affords an inlet mouth 2, provided with a first single-acting valve 3, and an outlet mouth 4 provided with a second single-acting valve 5.

**[0009]** The chamber 1a develops with a longitudinal axis and has a cylindrical shape; the inlet mouth and the outlet mouth have axes which are perpendicular to the axis of the chamber and are arranged on opposite sides of the chamber 1a axis, and are not located side-by-side of one another.

**[0010]** Preferably the inlet and outlet mouths are arranged at a reciprocal distance, calculated according to the axial direction of the chamber 1a, which distance is about the same as the axial run of the piston 1.

**[0011]** The piston is arranged coaxially to the axis of the chamber 1a and is located at an end of the chamber itself; the length of the piston run is such that the piston 1 moves between two extreme positions, i.e., a position which is more internal of the chamber, from which the aspiration stage initiates, and a position more external of the chamber from which the pumping stage starts, so that it never obstructs the inlet and outlet mouths.

**[0012]** In other words the movement of the piston never interests the chamber zone where the fluid inlet and outlet mouths are located.

**[0013]** The first valve 3 and the second valve 5 are globe valves, of known type and used for these pumps. They exhibit an obturator, which rests on a valve seating, and a stem which, as with pumps of known type, is activated not only by the action of the piston but also by double-acting pneumatic cylinders which render the movement of the valve readier and more effective.

**[0014]** The obturator 3a of the first valve is internal of the chamber 1a, the seating 3b of the first valve is afforded on the internal wall of the chamber 1a, and the stem 3c of the valve projects from the chamber 1a from the opposite side to the valve seating 3b. The obturator 5a and the stem 5b of the second valve 5 are external of the chamber 1a, and the seating 5b of the second valve 5 is afforded on the external wall of the chamber 1a.

**[0015]** For reasons which will be better described herein below, the pump is maintained, during its operation, with the axis in a horizontal lie in order to arrange the inlet mouth 2 facing upwards.

**[0016]** With the above-described conformation and arrangement of the pump, the inlet mouth 2 can be connected directly and with no curves to a fluid supply pipe, not shown in the figures. The fluid exiting the pump passes through an outlet pipe, not shown in the figures, which is connected to an opening 10 located downstream of the outlet mouth 4 and in communication with the outlet mouth 4 when the second single-acting valve 5 is open.

**[0017]** In the configuration of figure 1, the piston 1, which moves in the direction indicated by the arrow A, is in an aspirating stage in which it causes the introduction of the product into the chamber 1a. The product is aspirated by the inlet mouth 2 through the first single-acting valve 3, which, due both to the aspiration of the piston and the action of the relative pneumatic cylinder, is in the open position. During this stage the product, also by force of gravity, enters the chamber 1a directly and without encountering any obstacles, causing a mixing of the product which, as will be seen herein below, is already present in the chamber 1a. The mixing action caused by the aspiration of the piston and enhanced by the geometry of the pump and in particular of the chamber 1a, which has no zones which are unreachable by the product being mixed, performs at each work cycle a sort of

complete cleaning of the chamber 1a and prevents stagnation of the product therein.

**[0018]** At the completion of the aspiration stage the chamber 1a is full of product and the piston 1 begins its delivery run, moving in the direction indicated by the arrow B of figure 2; during this delivery stage the first valve 3 is closed, the second valve 5 is open, and the product exits the chamber 1a through the outlet mouth 4 and the second single-acting valve 5. During this stage too the product meets no obstacles and exits freely from the outlet mouth 4; the exiting fluid flow further performs a complete cleaning of the pump zone comprised between the aperture 5b of the second valve 5 and the opening 10 to which the outlet pipe is connected, through which the exiting fluid is sent on to further work stages.

**[0019]** At the end of the delivery stage the chamber 1a is still full of fluid and the pump restarts the aspiration cycle as described above, during which, as previously mentioned, the product in the chamber is mixed up with the new product entering the chamber during the following aspiration stage.

**[0020]** In a complete cycle the pump performs a fluid delivery a volume of which is equal to the straight section of the chamber over the piston run. Note that as the overall volume of the chamber is more than double the volume of the fluid delivery, the product remains inside the chamber for several operating cycles; this however leads to no drawbacks, indeed it constitutes an advantage since, as mentioned previously, it is exactly this presence of fluid in the chamber at the end of the delivery stage which enables a cleaning of all the parts of the chamber to be performed with the fluid.

**[0021]** The geometry of the pump of the invention enables: a considerable ease of passage of the product through the pump, with the obvious advantage of preventing deterioration, in particular, of the solid pieces contained in the product itself; an effective and constant cleaning of the chamber and the various parts of the pump crossed by the product, obtained with the product flow itself, which prevents stagnating of the product internally of the pump; a pump structure which enables easy and rapid maintenance operations, and trouble-free periodic cleaning.

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perpendicular to the chamber (1a) axis ; the piston (1) is arranged coaxially to the chamber (1a) axis at an end of the chamber (1a) and slides between two extreme positions in such a way that it never covers apertures of the inlet mouth (2) and the outlet mouth (4).

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2. The pump of claim 1, **characterised in that** the inlet mouth (2) and the outlet mouth (4) are arranged on opposite sides of the chamber (1a) axis, and do not face one another.

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3. The pump of claim 2, **characterised in that** the first valve (3) and the second valve (5) are globe valves; the first valve (3) exhibits an obturator (3a) which is internal of the chamber (1a), has a seating (3b) afforded on an internal wall of the chamber (1a), and exhibits a stem (3c) which projects from the chamber (1a) on an opposite side from the seating (3b) of the first valve (3); the second valve (5) exhibits an obturator (5a) and a stem (5c) which are external of the chamber (1a), and has a seating (5b) which is afforded on an external wall of the chamber (1a).

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4. The pump of claim 2, **characterised in that** the inlet mouth (2) and the outlet mouth (4) are arranged at a reciprocal distance, which distance is calculated according to an axial direction of the chamber (1a) which is about equal to an axial run of the piston (1).

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5. The pump of claim 2, **characterised in that** during operation the pump is maintained with the axis thereof in a horizontal lie, and the inlet mouth (2) is arranged facing upwards.

## Claims

1. An improved positive displacement pump, in particular for food products, of a type comprising a piston (1), slidable internally of a chamber (1a), which piston (1) introduces the product into the chamber (1a) by aspirating the product through an inlet mouth (2) provided with a first single-acting valve (3), and expels the product from the chamber (1a) through an outlet mouth (4) provided with a second single-acting valve (5), **characterised in that** the chamber (1a) develops along a longitudinal axis; the inlet mouth (2) and the outlet mouth (4) have axes which are

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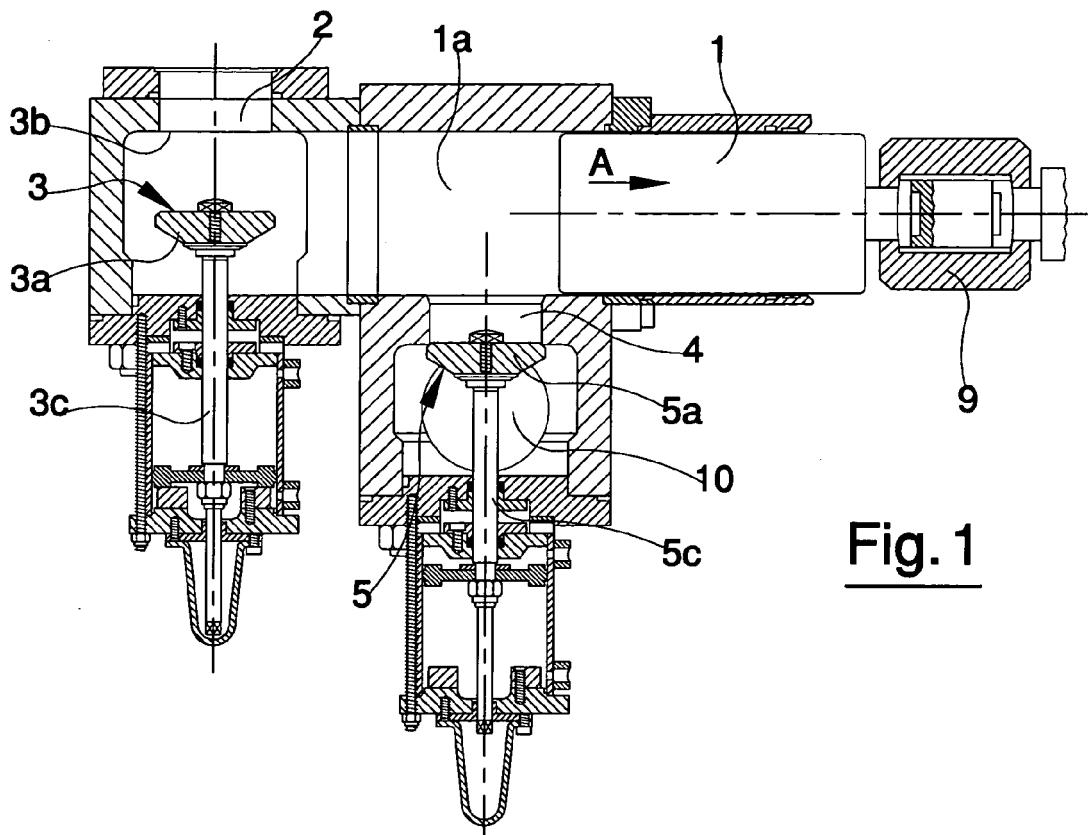


Fig. 1

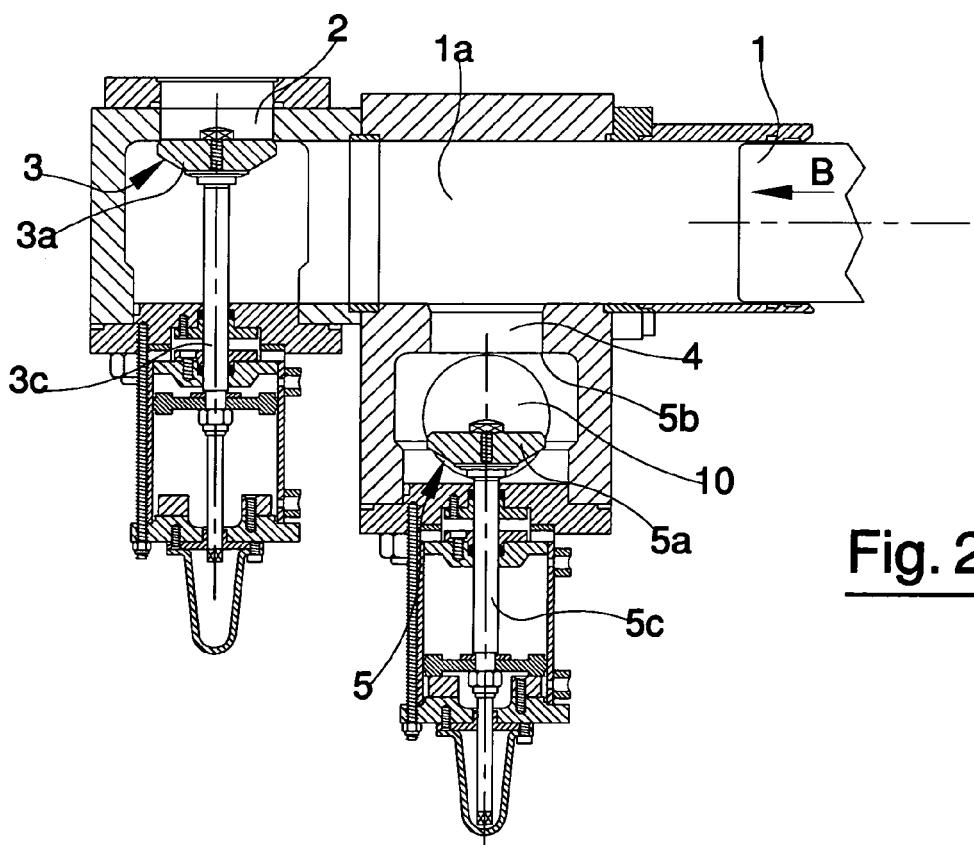


Fig. 2



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
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Y	US 5 252 037 A (ASEPTIC TECHNOLOGY ENGINEERING CO.) 12 October 1993 (1993-10-12) * column 1, line 6 - line 10 * * column 3, line 57 - column 4, line 21 * * figure 1 * -----	2,3	
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The present search report has been drawn up for all claims			
2	Place of search	Date of completion of the search	Examiner
	Munich	14 September 2006	Gnüchtel, Frank
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 06 42 5247

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