# United States Patent [19]

**Guillaud**

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[54] **PROCESS FOR MIXING TWO OR MORE LIQUID OR PASTRY PRODUCTS UNDER HIGH PRESSURE AND MIXING HEAD THEREFOR**


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[51] **Int. Cl.** ..... **B01f 5/10;** B01f 15/02

[58] **Field of Search** ..... 259/4, 18, 36, 5, 6, 7, 259/8; 23/252



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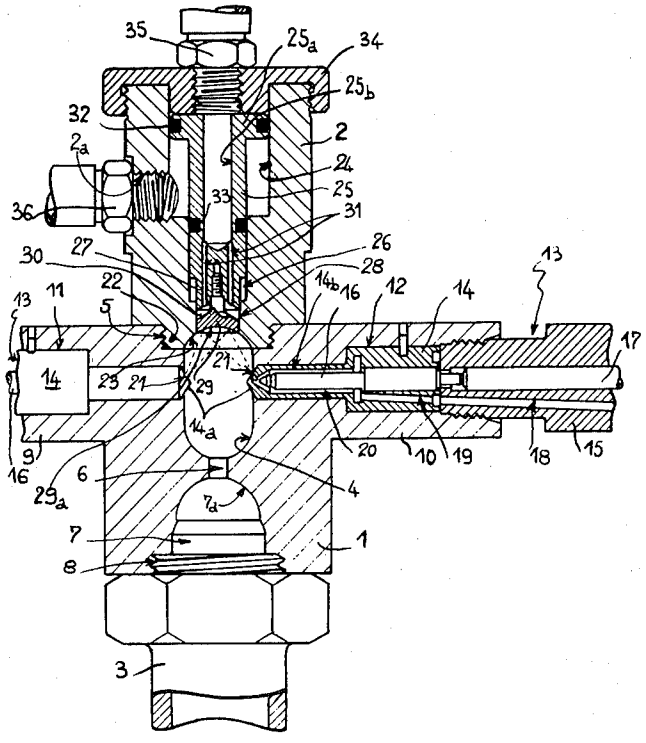
[57] **ABSTRACT**

Mixing process for at least two liquid or pastry products, characterized in that it consists in casting these products under pressure obliquely towards the same point on a surface so as to obtain a homogenous mixture which is then sent in the direction of a convergent-divergent nozzle which assures compression, followed by expansion of said mixture.


**6 Claims, 2 Drawing Figures**



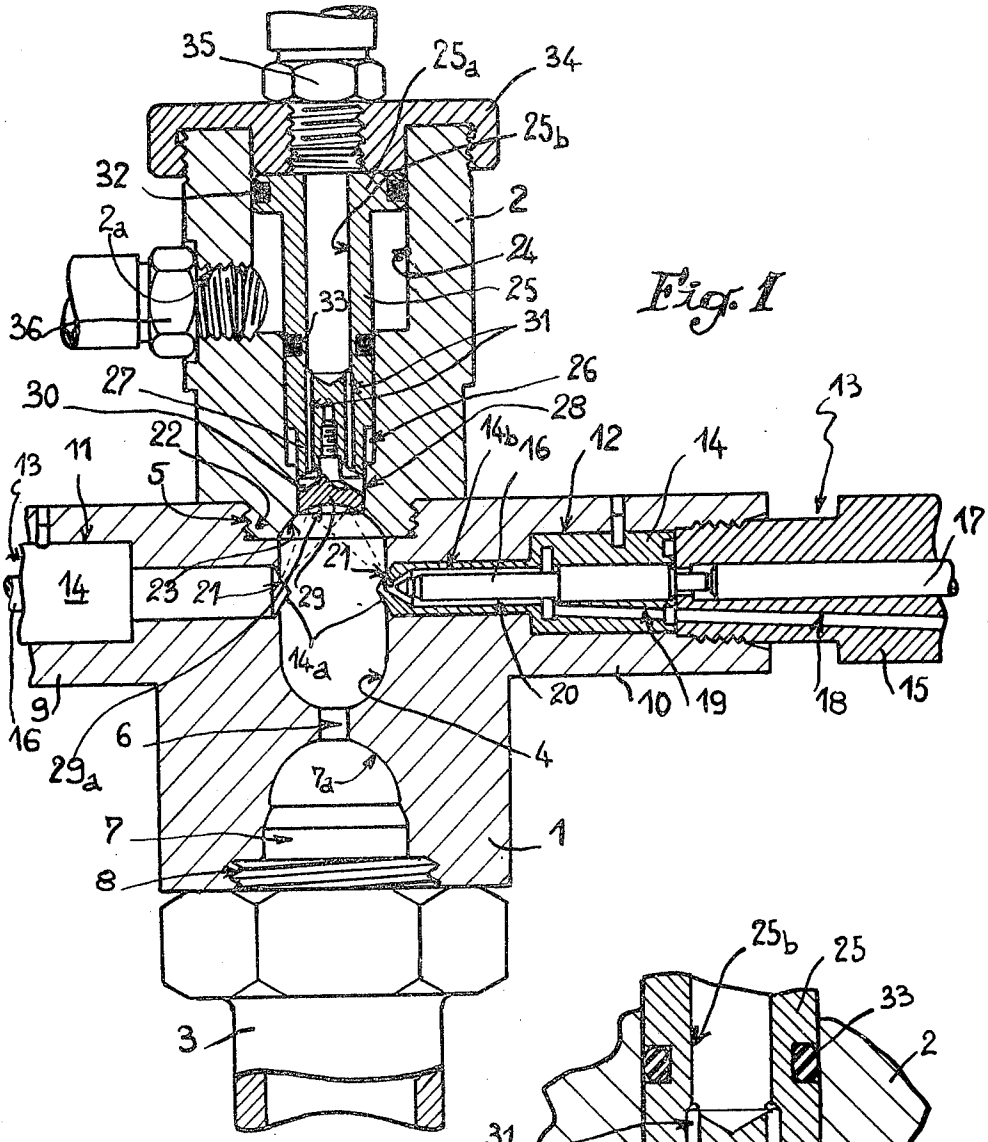

35
25a
34
25b
32
2
2a
24
25
36
33
31
26
30
27
28
22
14b
16
12
14
13
11
5
17
21
14
23
21
29
14a
9
20
10
19
18
15
16
29a
6
4
7a
7
1
8
3

Fig. 1

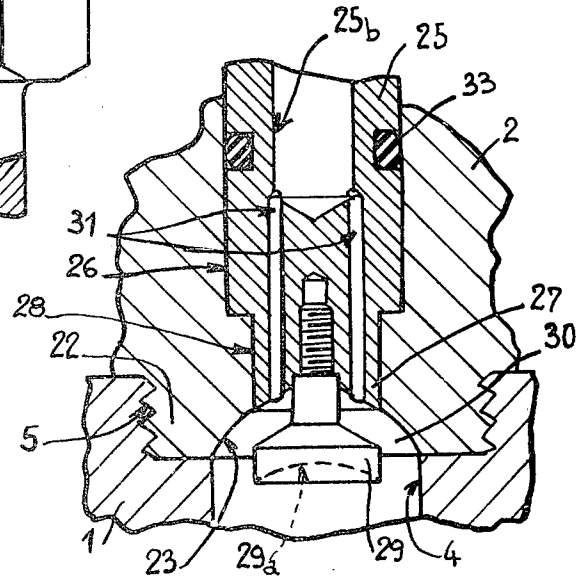

25b
25
33
2
31
26
27
28
30
22
5
1
23
29a
29
4

Fig. 2

# PROCESS FOR MIXING TWO OR MORE LIQUID OR PASTRY PRODUCTS UNDER HIGH PRESSURE AND MIXING HEAD THEREFOR

## DESCRIPTION OF THE INVENTION

The present invention concerns mixing at least two liquid or pasty products under high pressure and also mixing heads for accomplishing this purpose.

The improvements which constitute the subject of the present invention have the goal of creating a mixing head which can respond quite well to various requirements of the technique of high pressure mixing. In effect, and in contrast to the principle of high pressure mixing without an agitator, the so-called "countercurrent method" where the number of products which can be mixed is by definition only two, one of the advantages of the present invention is the fact that a number of liquid or pasty products greater than two can be mixed at the level of the mixing head. Thus, one has immediately the possibility of varying the output or the proportion of the mixed products in a moulding machine for polyurethane between two successive mouldings without having to empty the circuit containing the mixture of the mentioned products which were previously measured in a different proportion.

The process of the invention is characterized in that it consists in projecting these products under pressure obliquely towards the same point on a surface so as to obtain a homogenous mixture which is then sent in the direction of a converging-diverging nozzle which assures compression, followed by expansion of the mixture.

The mixing head of the invention is characterized in that one of its ends is constructed in the shape of a spherical dome onto the center of which the products are projected; its opposing end, which is also spherical, comprises a central channel which runs into a discharge chamber of greater diameter.

According to a preferred mode of operation, the center of the spherical dome is provided with a valve which is likewise spherical and which is normally closed. The valve is opened in the direction of the interior in order to let pass a liquid under pressure to clean the cavity.

The drawing, which is given for the sake of example, explains the invention better, the characteristics which it has and the advantages of which it permits:

FIG. **1** is a longitudinal section of a mixing head according to the invention.

FIG. **2** is a partial view of FIG. **1** on a larger scale, whereby the valve is open.

The mixing head shown in FIG. **1** comprises essentially a body **1**, a cap **2** and a discharge tube **3**.

The body **1** has a generally cylindrical form and has a central cavity **4**, which in cross-section has a circular shape and of which the upper outlet is provided with a threaded piece **5**. The bottom of cavity **4** has a concavely spherical shape and is pierced in its center by a channel **6** connecting cavity **4** to a cylindrical chamber **7** opening downwards. The upper end **7***a* of chamber **7** is preferably spherical in shape. Channel **6** is of a very short length. It is obvious that the bottom of cavity **4**, the channel **6** and the upper part of chamber **7** constitute a convergent-divergent nozzle.

The outlet of chamber **7** comprises a threaded part **8** of a greater diameter, into which is screwed the discharge tube **3**.



Two radial bosses **9** and **10** are provided on the periphery of body **1** at the level of cavity **4**. Each boss includes an axial bore **11**, or **12**, with two diameters into which a needle injector **14** of a known type is inserted.

Each injector comprises a body **14**, the conical end **14***a* of which extends slightly into the cavity **4**, an injector holder **15**, and a needle **16** which supports a pushrod **17** springingly thrust back in the direction of the geometric axis of the body **1** by means which are not represented.

The injector holder comprises an oblique perforation **18** ending in a hole **19** of the body of the injector **14** in such a way so as to allow a liquid to pass into an annular space **20** situated between the needle **16** and the axial bore **14***b* of body **14**. This body terminates in a cone and jets **21** are provided in the end of the body to establish a connection between space **20** and the cavity **4**. These jets have a geometrical axis which is oriented upwards in a direction which will be defined more precisely later on.

Cap **2** is made in the shape of a cylinder of which the lower end has a threaded tip **22** which screws into piece **5** of body **1**. The cap has a central perforation with several diameters which opens downwards into a spherical hollow **23**. This perforation has a first bore **24** of large diameter into which the head **25***a* of a piston **25** can be placed. The piston rod cooperates with a second bore **26** of a smaller diameter than bore **24** and which follows it downwards. The rod of piston **25** terminates in a projection **27** of smaller diameter which cooperates with the low part **28** of the central perforation.

Piston **25** terminates in a valve **29** of which the head is removed from the end of the tail of the piston in such a way that a space **30** separates the two elements. This valve has on its extreme face a spherical depression **29***a* of the same radius as that of the hollow **23**. Piston **25** has a central hole **25***b* ending in space **30** through the channels **31** with a small diameter. O-rings **32** and **33** are placed respectively about the head and the rod of piston **25**.

The upper part of bore **24** is closed by a screw plug **34** with a central bore in which a coupling **35** is located. Note that cap **2** has a threaded radial hole **2***a* in which a coupling **36** is screwed and which empties under the head **25***a* of piston **25**.

During operation a liquid under pressure is sent into each injector. Thanks to the special orientation of jets **21**, the liquid is projected in the direction of the center of the valve **29**. The intimate mixture of the liquids thus takes place at the level of this valve and the final product is sent downwards. The pressure in cavity **4** as well as the convergent-divergent shape of its bottom force this product to traverse channel **6**, with the result that it is compressed at this level; then it expands as it penetrates into chamber **7**. Thus, it enters under a very low pressure into the discharge tube **3**.

When the operation of mixing and of discharging is stopped, it is necessary to rinse cavity **4**. In order to do this, compressed air is put in through coupling **35**, which air causes the piston **25** to descend in such a manner that valve **29** moves downward and comes into the interior of the cavity **4** (FIG. **2**). At this moment the air which was entrapped in space **30** escapes in the direction of the recited cavity and cleans it.

Of course, the compressed air can be replaced by any other fluid or gas under pressure.

When the head has been well cleaned, air is let under the head of piston **25** through coupling **36.** The difference in pressure causes the piston to rise, thus assuming its work position shown in FIG. **1,** whereby valve **29** closes sealingly tight.

In the case in which it is desired that air be incorporated into the mixture of the components, holes can be pierced with advantage at the level of channel **6** in a plane perpendicular to the axis of this channel, the axis of these holes forming an angle less than 90° with the tangent of said channel. This is done in such a way that a whirling movement is created.

I claim:

**1.** A head for mixing multiple liquid products introduced thereinto under pressure, comprising:

a body including therein a cavity having a central portion and having respective first and second concavely shaped end portions separated from each other along the axis of the cavity by said central portion, and said body further having a chamber located adjacent to said first end portion and communicating with said first end portion by a channel located on said axis and said second end portion having an opening therethrough.

a cap removably closing said second end portion;

injector means extending from outside the head into the central portion of the cavity, the injector means being supplied with said liquid products under pressure and having jet openings extending into the cavity and directed to project said products onto the concavely shaped second end portion; and

a discharge tube extending from the chamber to discharge the mixed products.

**2.** A mixing head as set forth in claim **1,** wherein said channel and said chamber are mutually proportioned to comprise a convergent-divergent nozzle for the discharged products.

**3.** A mixing head as set forth in claim **2,** wherein said injector means comprises a separate injector for each of said multiple liquid products, said injectors extending into said cavity in spaced relationship around the central portion thereof, and said injectors having their jet openings directed obliquely toward the center of said second end portion.

**4.** A mixing head as set forth in claim **1,** said removable cap having an inner end having an openable flushing valve therein, and the valve when closed having a surface following the contour of said second concave end of the cavity.

**5.** A mixing head as set forth in claim **4,** said cap having a central bore therethrough extending in the direction of said axis, a ram in said bore selectively operable to reciprocate in the bore, and the ram being coupled to operate the valve to close it and thereby locate its surface to complete the contour of the second concave end of the cavity and to open it by moving the valve into the cavity, and means for passing flushing fluid through the valve when opened into the cavity.

**6.** A mixing head as set forth in claim **1,** wherein said axis is substantially vertical and said second end portion is located above the first end portion and chamber, and said jet openings are directed upwardly toward said second end portion.

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