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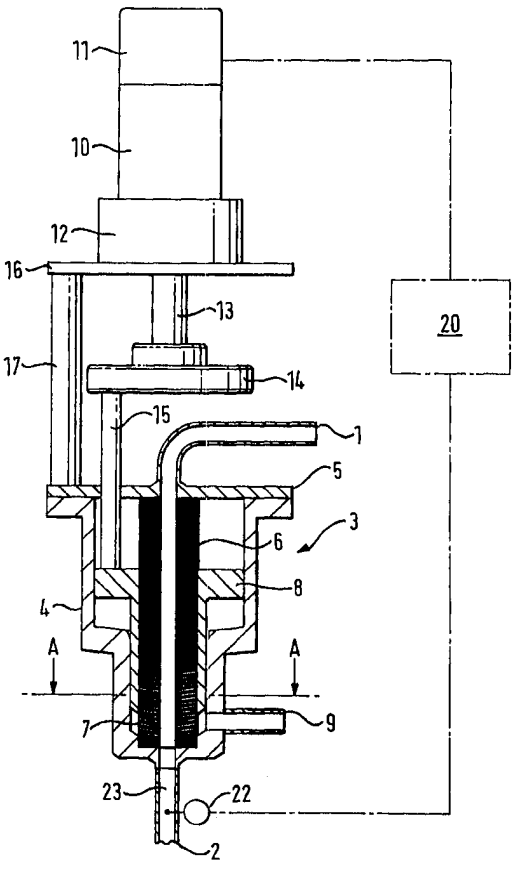
(57) Abstract

The invention relates to a device consisting of a conduit (1) for the inlet of the liquid, of a steam inlet (9) and of a closed housing (4) which contains part of the conduit, this part of the conduit being formed by a pipe (6) having various bores (7), and the said device additionally having a regulating slide between the housing and the outer wall of the pipe, the pipe, the housing and the regulating slide being coaxial and the steam inlet entering from the housing and in the vicinity of the bores of the pipe.



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Method and device for the heating, pasteurization and sterilization of liquids

The invention relates to a method for the heating, pasteurization or sterilization of liquids by direct convergence with steam. The invention relates, furthermore, to the device for carrying out the method.

It is already known for the pasteurization or sterilization of milk to be carried out by direct convergence with steam. DE-B-1 164 024 relates to such a method. The disadvantage of this method is that high shearing forces occur in the region in which the milk and steam are mixed, and it is impossible to heat a lumpy product because the lumps would be subjected to very high stress. The conduits have narrow passages in this steam injector, thus giving rise to high accelerations, which makes such a device additionally unsuitable for lumpy products.

The object on which the invention is based is to have a method in which it is possible to heat all types of liquids with high flexibility as regards the heating temperature and the nature of the product.

The invention relates to a method for the heating, pasteurization or sterilization of liquids by direct convergence with steam, the steam being injected in small jets from the radius towards the centre of the liquid stream and the number of these jets being variable.

The injection of the steam in the form of small jets allows a very good distribution of the steam in the liquid, thus leading to regular temperature distribution and a short condensation time. The variability of the number of jets allows the method to have good flexibility as regards the temperature of the liquid obtained.

The number of jets is not critical. It is preferably between 10 and 500. A temperature difference of 10 to 120°C may be achieved by means of such a range. Both heating and pasteurization or sterilization of a liquid may therefore come under consideration.

The jets of steam are critical as regards their arrangement. The arrangement of the jets extends spirally in relation to the axis of the liquid stream.

The liquid which may be treated according to the invention is absolutely uncritical. Liquid both with lumps and without lumps may be heated. There are also no restrictions as regards the viscosity of the liquid. Products with high viscosities may be heated in exactly the same way as pure low-viscosity liquids. The liquid is selected, for example, from the group comprising milk, sauces, sauces with lumps, cereal mash.

The number and size of the jets may be adapted to the steam quantity to be injected: the larger the steam quantity, the larger the jets.

There is likewise no criticality as regards the steam. A conventional steam supply may be adopted. According to the invention, the work is preferably carried out with steam at a temperature of between 150 and 180°C and at a pressure of between 5 and 10 bar.

The liquid velocity may be very low and very high, without adverse effects on functioning.

The invention relates, furthermore, to a device for carrying out the abovementioned method, consisting of a conduit for the inlet of the liquid, of a steam inlet and of a closed housing which contains part of the conduit, this part of the conduit being formed by a pipe having various bores, the said device additionally having a regulating slide between the housing and the outer wall of the pipe, the pipe, the housing and the regulating slide being coaxial and the steam inlet entering from the housing and in the vicinity of the bores of the pipe.

By means of this device, the liquid flows through the pipe without obstructions and there is virtually no pressure loss.

The regulating slide makes it possible to open and close the bores. The device runs at a very low noise level, without vibration or cavitation, and regular temperature distribution and rapid steam condensation, even in a viscous product, are achieved.

In the case of treatment of a liquid having lumps, these lumps are heated carefully. No pressure loss occurs on the product side. The device according to the invention is virtually independent of viscosity and output.

The pipe in the device has between 10 and 500 bores. The diameter of these bores depends on the diameter of the conduit for the inlet of the liquid: the diameter of the bores is normally between 0.5 and 4 mm. Complete opening of the bores makes it possible to heat a liquid to approximately 170°C, this corresponding to the maximum available steam pressure.

The bores are not distributed arbitrarily: they are arranged spirally, as seen from the inner wall of the pipe. The angle of the helix may be selected as desired and according to the number of holes and the overall height.

The pipe has no metallic surfaces: the risk of some of the product being burnt onto these surfaces is prevented. The pipe is manufactured from a material having poor conductivity, such as, for example, polytetrafluoroethylene, ceramic, carbon fibre or carbon fibre/epoxy.

Continuous adaptation of the free nozzle bores is possible by means of a motor drive which actuates the closing and the opening of the regulating slide. In this case, the device comprises a control which contains a sensor at the outlet of the liquid, the said sensor measuring an actual-value temperature and emitting a signal, and, if a temperature deviation from the desired value occurs, the control transmits accordingly to the motor a further signal for the actuation of the regulating slide.

The device is described in more detail in conjunction with the drawings in which

Figure 1 shows a diagrammatic illustration of the device according to the invention in part section, and

Figure 2 shows a section along the line A-A of Figure 1 with only the pipe.

Figure 1 shows, for the liquid, an inlet pipe (1) and an outlet pipe (2) and, between them, the device (3) according to the invention.

This device consists of the following parts:

- a housing (4) with a cover (5),
- a pipe (6) with bores (7),
- a regulating slide (8) and
- a steam inlet (9).

The regulating slide (8) can be moved by means of a motor with gear (10), the said motor having an electrical connection (11) and a coupling (12). The spindle (13) moves the flange (14) which, in conjunction with the guide rods (15), moves the regulating slide (8) upwards or downwards.

A fixed bearing flange (16) having the spacer rods (17) defines the stroke length of the flange (14). If this stroke length is to be varied, the length of the spacer rods may be increased or reduced accordingly.

The device functions as follows:

the liquid comes along the axis (23) through the conduit (1) into the device (3). The steam enters the device through the conduit (9). The regulating slide is located at a specific height and leaves a particular number of bores (7) in the pipe (6) open. Depending on the desired final temperature of the liquid, action may be taken via the steam temperature, via the steam pressure and via the number of open bores. The pipe (6) in the figure has 150 bores with a diameter of 1 mm.

The height of the regulating slide may be influenced manually by putting the motor (10) into operation when a specific change in the final temperature of the product is required.

It is also possible to have automatic control. In this case, a sensor (22) is placed on the outlet line (2) of the liquid. The sensor measures an actual-value temperature and emits a signal. If this actual value deviates from the desired-value temperature, the control (20) transmits to the motor (10) a further signal for the actuation of the regulating slide (8).

As already mentioned above, it is advantageous, according to the invention, to have a device available which makes it possible to heat liquids having lumps. A further advantage is that there is no longer any need for a steam-regulating valve. Steam regulation and steam injection take place together by virtue of the variability of the number of open bores. The device according to the invention can be produced at a price equal to or more favourable than that of traditional injectors with an additional steam-regulating valve.

Claims

1. Method for the heating, pasteurization or sterilization of liquids by direct convergence with steam, characterized in that the steam is injected in small jets from the radius towards the centre of the liquid stream, and in that the number of these jets is variable.

2. Method according to Claim 1, characterized in that the number of jets is variable between 10 and 500.

3. Method according to Claim 1 or 2, characterized in that the arrangement of the jets extends spirally in relation to the axis of the liquid stream.

4. Method according to Claims 1 to 3, characterized in that the steam is supplied at a temperature of between 150 and 180°C and at a pressure of between 5 and 10 bar.

5. Method according to Claims 1 to 4, characterized in that the liquid is selected from the group comprising milk, sauces, sauces with lumps, cereal mash.

6. Device for carrying out the method according to Claims 1 to 5, consisting of a conduit for the inlet of the liquid, of a steam inlet and of a closed housing which contains part of the conduit, characterized in that this part of the conduit is formed by a pipe having various bores, and in that the said device additionally has a regulating slide between the housing and the outer wall of the pipe, the pipe, the housing and the regulating slide being coaxial and the steam inlet entering from the housing and in the vicinity of the bores of the pipe.

7. Device according to Claim 6, characterized in that the regulating slide makes it possible to open and close the bores.

8. Device according to Claims 6 or 7, characterized in that the pipe has between 10 and 500 bores.

9. Device according to Claims 6 to 8, characterized in that the pipe is manufactured from a material having poor heat conductivity.

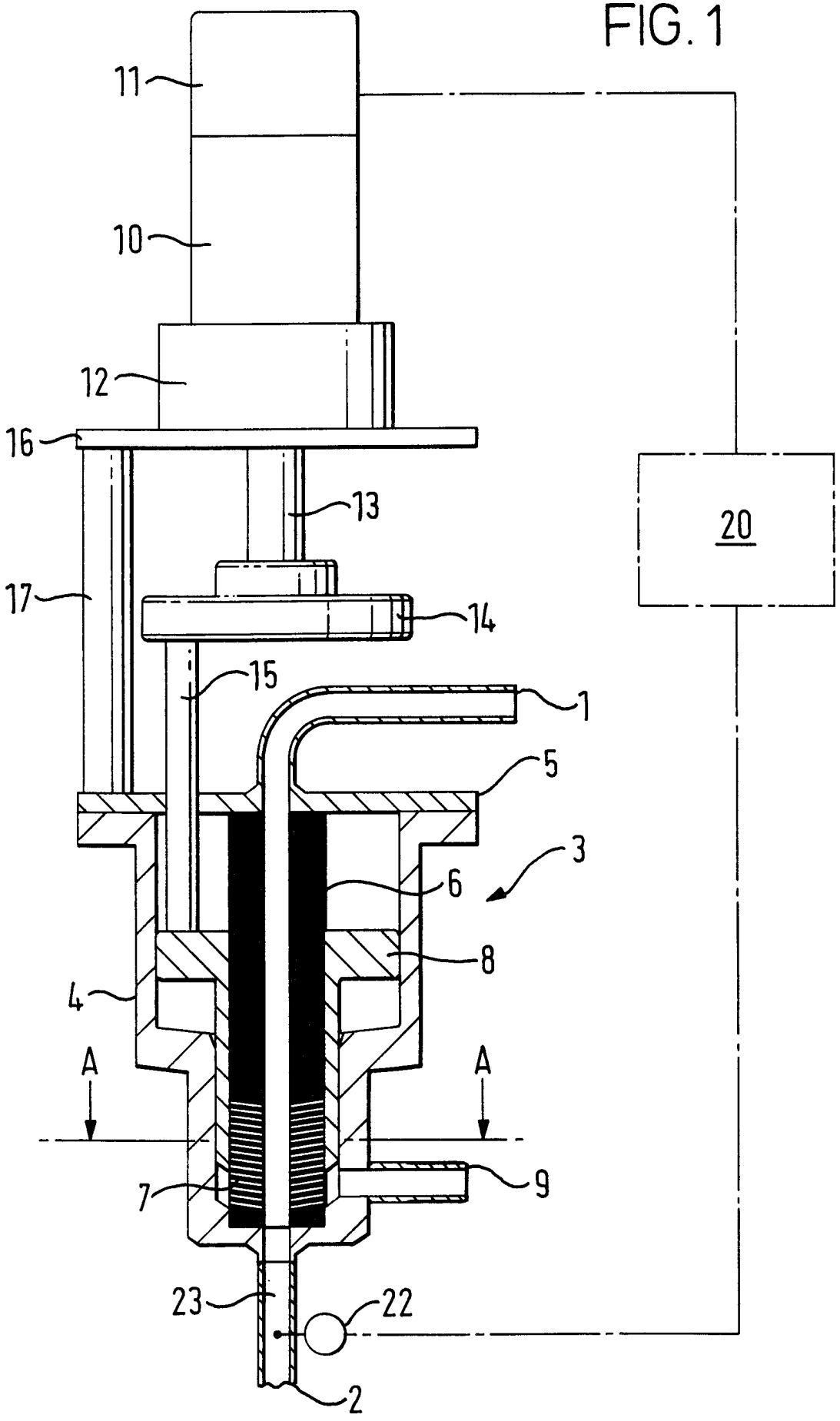
10. Device according to Claims 6 to 9, characterized in that the bores in the inner wall of the pipe are

arranged spirally.

11. Device according to Claims 6 to 10, characterized in that it has a motor for closing and opening the regulating slide.

12. Device according to Claims 6 to 11, characterized in that it comprises a control which contains a sensor at the outlet of the liquid, the said sensor measuring an actual-value temperature and emitting a signal, and in that, if a temperature deviation from the desired value occurs, the control transmits to the motor a further signal for the actuation of the regulating slide.

FIG. 1



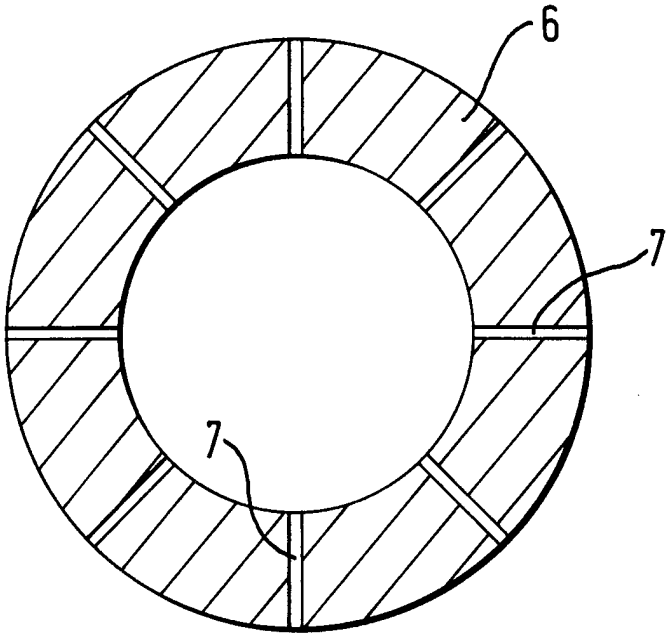


FIG. 2

INTERNATIONAL SEARCH REPORT

Intern ial Application No
PCT/EP 97/05704

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A23L3/22 A23C3/037 B01F5/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A23C B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 3 219 483 A (HANNO GOOS ET AL.) 23 November 1965 see column 3, line 40 - column 4, line 48; figures 5,6 see column 4, line 67 - column 5, line 25	1,2,5-8, 11,12 9
Y	US 4 160 002 A (V. J. JANOVTCHIK) 3 July 1979 see column 2, line 32 - column 3, line 24; claims	9
X	BE 558 477 A (SEPARATOR) 15 July 1957 see page 7, line 27 - page 8, line 10; claims 1,3,4; figures 4-6 see page 2, line 11 - line 20	1-5

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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26 January 1998	04/02/1998

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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X	FR 1 230 497 A (SEPARATOR) 15 September 1960 see page 3, column 1, line 41 - column 2, line 14; figures	1,5
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Information on patent family members

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