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(54) **Method and arrangement for treating surfaces**

(57) The invention relates to a method and an arrangement for treating surfaces, like for example the cleaning, disinfecting, degreasing and conservation, in the process of which a liquid with a predefined liquid

pressure and a gas with a predefined gas pressure are mixed in a mixing head and in which the mixture is subsequently fed through a tubular channel (12) comprising a venturi (17) and sprayed onto the surface to be treated.

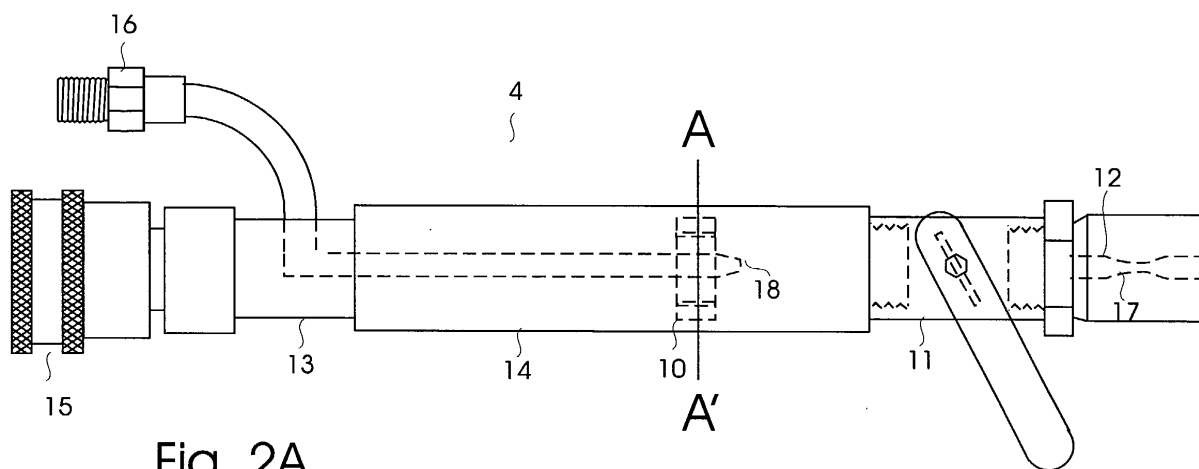
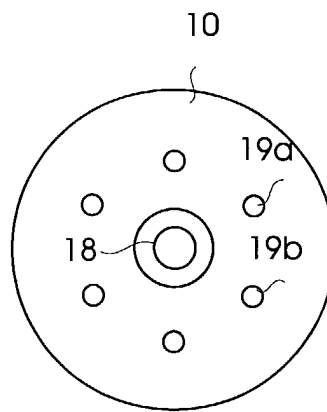


Fig. 2A

Fig. 2B



Description

[0001] The invention relates to a method for treating surfaces, like for example cleaning, disinfecting, degreasing and conservation, according to which a liquid having a predefined liquid pressure and a gas having a predefined gas pressure are mixed in a mixing head, which mixture is subsequently sprayed onto the surface to be treated.

[0002] A method of this kind is known from for example the patent application EP-A-0 934 129. According to the known method, water is supplied to the mixing head via a central boring and compressed air is supplied to a second boring, positioned coaxial round the central boring, as a result of which the compressed air sort of drags along the water and adds an extra impulse to the water. Both borings end in the open air, which implies that the pressure of the gas in the mixture will be reduced in an undefined manner to the atmospheric pressure. In this process, energy will be lost that might have been used for adding an additional impulse to the water. The method according to the invention substantially obviates this drawback and is characterised in that the gas/liquid mixture, prepared in the mixing head, is previously led through a tube, comprising a venturi. In the venturi, the overpressure in the mixture is gradually reduced to atmospheric pressure, as known in the art, in the process of which the speed of the mixture will increase. The result is that the method according to the invention has a larger cleaning power. This saves time, but also less liquid can be used, which is important because used liquid must normally be cleaned or disposed of in an acceptable manner.

[0003] An important additional advantage is that with the aid of the venturi one may give the jet, obtained according to the method, a desired shape. This is possible, as known as such in the art, by giving the venturi a predefined shape. For a venturi having a radial symmetry for example, a conical shaped jet will be produced, while a more elliptically shaped or slot-shaped venturi will produce a fan-shaped jet. Especially the fan-shaped jet turns out to be very effective for cleaning surfaces; because of the high speed of the liquid droplets, the fan-shaped jet cuts free the dirt so to speak off the surface over a large width.

[0004] A favourable realisation of the inventive method is characterised in that as liquid water, provided with previously determined additives is used and that as a gas compressed air is used. The additives may be detergents when rooms in the food industry or abattoirs must be cleaned, or disinfectants if the disinfection of for example stables or sheds or vehicles is necessary or even grit, when a surface must be blasted.

[0005] A further favourable realisation is characterised in that the liquid and the gas are prepared and pressurised in a mobile unit and are supplied to a mixing head implemented as a hand-held spray-gun, in which the liquid and the gas are mixed and led through the

venturi. The addition of a venturi enables one to perform the cleaning with a relatively small quantity of cleaning liquid and this in turn enables one to accommodate all necessary components in a mobile unit. Also the fact that a hand-held spray gun can be used is a direct consequence of the addition of a venturi. As only a small quantity of water is used, the reaction forces on the spray gun will be small, which means that an operator may operate the spray gun for a prolonged time without a risk that RSI related symptoms might develop. A further advantage of a mobile unit is that the utilisation of the method does not require special investments, which does make the method very accessible.

[0006] The invention also relates to an arrangement for treating surfaces, like for example cleaning, disinfecting, degreasing and conservation, comprising a spray head provided with connections to which a liquid having a predefined liquid pressure and a gas having a predefined gas pressure can be supplied, and a mixing head, situated in the spray head, with which the liquid and the gas can be mixed thoroughly, and a nozzle via which the mixed product can be delivered. The inventive arrangement is characterised in that between the mixing head and the nozzle a tubular channel is fitted, comprising a venturi. In the venturi, the overpressure in the mixture is gradually reduced to the atmospheric pressure, as known in the art, in the process of which the speed of the mixture will increase. The result is that the arrangement according to the invention can realise a larger cleaning power.

[0007] It is well known that the venturi will perform best when the mixture supplied to it has an at least substantially laminar flow pattern and as a consequence does show little turbulence. This can be accomplished easily, by giving the tubular channel a sufficient length. A favourable embodiment of the inventive arrangement is thereto characterised in that a length of the tubular channel measures at least five times the inner diameter of the tubular channel.

[0008] A further favourable embodiment of the inventive arrangement is characterised in that the venturi comprises a constriction, obtained by pressing the tubular channel together in one direction. A constriction of this kind can be introduced in a simple and reproducible manner, while a venturi of this type will produce a fan-shaped jet, with which a large surface may be cleaned in a single continuous movement.

[0009] A further favourable embodiment of the inventive arrangement is characterised in that the spray head is housed in a hand-held spray gun, provided with two hose connections. Because the arrangement uses such a small amount of water, the forces on the spray head are modest, which in turn makes this design feasible.

[0010] In the known arrangement, the compressed air is supplied in the mixing head round a central boring, via which water is supplied. The compressed air surrounds so to speak the water jet and more or less drags it along. In the arrangement according to the invention,

the aim of the mixing head is on the other hand to realise thorough mixture of the liquid and the gas. It is thereto characterised in that the mixing head comprises a central boring, for the supply of gas, and a number of peripheral borings, situated round the central boring, for the supply of liquid.

[0011] The invention also relates to a system for the treatment of surfaces, like for example cleaning, disinfecting, degreasing and conservation, comprising an arrangement as described here, for which the system moreover comprises a mobile unit, provided with a pump unit for the liquid, a gas bottle and/or a compressor for the gas.

[0012] A very favourable embodiment of the inventive system is characterised in that the mobile unit moreover comprises at least one supply vessel for an additive, like for example a detergent, and a dosage device with an injector for adding the additive to the liquid. It is possible then for example to prefoam a surface to be cleaned by spraying water with a detergent and then, after some reaction time, to clean the surface with water. In a final treatment, a disinfectant can be added to the water.

[0013] When the inventive arrangement is always used on a given location, and compressed air and water are available with a sufficiently high pressure, then a stationary arrangement can be implemented of course.

[0014] The invention will now be explained in more detail with a reference to the following figures, in which:

- Fig. 1 schematically represents a possible embodiment of the system;
- Fig. 2A represents more in detail a possible embodiment of the spray head;
- Fig. 2B represents in a cross-section according to the line AA' in Fig. 2A the mixing head;
- Fig. 3 represents an alternative embodiment of the spray head;
- Fig. 4A represents the venturi tube, before the constriction has been introduced;
- Fig. 4B represents the venturi tube, after the constriction has been introduced;
- Fig. 4C represents the venturi tube after a protective cover has been mounted;
- Fig. 5 represents in a block schematic diagram a possible embodiment of the mobile unit.

[0015] Fig. 1 schematically represents a possible embodiment of the system, comprising a mobile unit 1, in which a compressor 2 is placed which supplies compressed air via a hose 3 to a spray head 4, and a pump 5, which supplies water, from a supply vessel 6 or via a coupling from the water supply system, to spray head 4 via a hose 7, and in which moreover three containers 8a,8b,8c are placed, in which additives are stored that may be added to the water with the aid of valves, injectors and/or dosage devices, as such well known in the art, which can be controlled with the aid of a control panel 9. Spray head 4 contains a mixing head 10, in which

the water and the compressed air are mixed thoroughly. This mixture leaves spray head 4 via a valve 11 and a tube 12 which is provided with a venturi so as to form a cone-shaped or fan-shaped jet which contains relatively little water but which nevertheless has an exceptionally strong cleaning effect.

[0016] Fig. 2A represents more in detail a possible embodiment of the spray head 4, containing a tubular body 13, provided with a synthetic insulation layer 14, which is on a first side provided with a standard water hose connection 15 and a connection 16 for hose 3, via which compressed air is supplied. Water and compressed air are mixed in mixing head 10, here consisting of a metal disk through which via a central opening the air is admitted and via a number of coaxial arranged openings the water is added. This type of mixing causes much turbulence, necessary for obtaining a very thorough mixture. Subsequently the mixture is conducted to a valve 11, which is screwed onto tubular body 13, and to a tube 12, screwed onto valve 11, which is provided with a venturi 17. In tube 12, the turbulent water/air mixture is forced into a more laminar flow and in venturi 17 the mixture may expand in a controlled manner, in the process of which the speed of the mixture significantly increases. If desired, valve 11 may be replaced by for example electrically controlled valves, situated near the connections 15,16 or in mobile unit 1.

[0017] Spray head 4 is completely manufactured of stainless steel, with the exception of insulation layer 14, and is therefore well suited for spraying all possible types of other media. Compressed air may for example be replaced by steam when for example chewing gum must be removed or the water may be replaced by a solvent when a surface must be degreased.

[0018] Fig. 2B represents in a cross-section according to the line AA' in Fig. 2A the mixing head 10, consisting of a metal disk provided with a central opening 18 via which the air is admitted and via a number of coaxial arranged openings 19a,19b,... via which the water is admixed. In the embodiment shown here, mixing head 10 is provided with six peripheral openings, but this number may be chosen larger if more liquid is to be added to the mixture. The diameter of the peripheral openings is for example 1 millimetre and the diameter of the central opening for example 3 millimetre.

[0019] It is possible to supply water via central opening 18 and to supply compressed air via peripheral openings 19a,19b,... Experimentally it has been determined that this leads to less favourable results.

[0020] Fig. 3 represents an alternative embodiment of the spray head, comprising a tubular body 13, provided with a synthetic insulation layer 14, which is on one side provided with a standard pistol grip 20, connected to hose 7, via which water can be supplied and with a connection 16 for hose 3, via which compressed air can be supplied. Water and compressed air are mixed in mixing head 10, here consisting of a metal disk provided with a central opening 18 via which the air is admitted and

via a number of coaxial arranged openings 19a,19b,... via which the water is admixed. Subsequently the mixture is conducted to a tube 12, screwed onto a tubular body 13, which tube 12 is provided with a venturi 17. In tube 12, the turbulent water/air mixture is forced into a more laminar flow and in venturi 17 the mixture may expand in a controlled manner, in the process of which the speed of the mixture significantly increases. The spray head can be operated via pistol grip 20, via which water is supplied to mixing head 10. In mobile unit 1, a pressure drop or a flow will be detected and a valve will be opened which admits compressed air to flow via hose 3 and connection 16 to mixing head 10.

[0021] Fig. 4A represents a possible embodiment of the venturi tube 12, before the constriction has been introduced. Venturi tube 12 is made of stainless steel, has a length of for example 30 millimetre, an inner diameter of 5 millimetre and it is integrated with a nut 21 and a threaded end 22, in such a manner that it can easily be replaced when a liquid/gas mixture jet with a different type of cone-beam or fan-beam is desired.

[0022] Fig. 4B represents the venturi tube 12, after the constriction 17 has been introduced with the aid of two clamping blocks 23a,23b in a press that is not shown here. Constriction 17 is slit-shaped here, with a width of the slit of for example 1.5 millimetre. In this way, a fan-beamed jet can be obtained having a beam width of about 10x45 degrees. It is also possible to carry out the clamping process while venturi tube 12 is rotated round its longitudinal axis. A constriction having a radial symmetry can thus be obtained with an inner diameter of for example 2.5 millimetre. In this way, cone-shaped jet can be obtained having a beam width of about 20 degrees. Fig. 4C represents the venturi tube after a protective cover 24 has been mounted.

[0023] Fig. 5 represents in a block schematic diagram a possible embodiment of the mobile unit 1, with compressor 2, which supplies compressed air via a hose reel 25 and hose 3, a pump 5 which supplies water via hose reel 25 and hose 7, and three containers 8a,8b,8c in which additives are stored. With the aid of three-way valves 26a,26b,26c, the water is supplied to one of the three dosage devices 27a,27b,27c, well known in the art, and with the valves 28a,28b,28c one of the containers 8a,8b,8c is connected at the same time to the corresponding dosage device, so that the desired additive is indeed added. Moreover, three one way valves 29a, 29b,29c are provided, which prevent compressed air from leaking towards the dosage devices when valve 11 of spray head 4 is closed. This is necessary, as the pressure of the compressed air is always chosen higher than the water pressure. The water pressure is for example 2-10 bar, while the pressure of the compressed air amounts to 6-15 bar.

[0024] The system can be used for cleaning surfaces, but it may also be used for spraying plant-protecting means, for disinfecting cattle, in a car wash and for cleaning frontages and sewers.

Claims

1. Method for treating surfaces, like for example cleaning, disinfecting, degreasing and conservation, according to which a liquid having a predefined liquid pressure and a gas having a predefined gas pressure are mixed in a mixing head, which mixture is subsequently sprayed onto the surface to be treated, **characterised in that** the gas/liquid mixture, prepared in the mixing head, is previously led through a tube, comprising a venturi.
2. Method according to claim 1, **characterised in that** as a liquid water, provided with previously determined additives is used and that as a gas compressed air is used.
3. Method according to claim 1 of 2, **characterised in that** the liquid and the gas are prepared and pressurised in a mobile unit and are supplied to a mixing head implemented as a handheld spray-gun, in which the liquid and the gas are mixed and led through the venturi.
4. Arrangement for treating surfaces, like for example cleaning, disinfecting, degreasing and conservation, comprising a spray head provided with connections to which a liquid having a predefined liquid pressure and a gas having a predefined gas pressure can be supplied, and a mixing head, situated in the spray head, with which the liquid and the gas can be mixed thoroughly, and a nozzle via which the mixed product can be delivered, **characterised in that** between the mixing head and the nozzle a tubular channel is fitted, comprising a venturi.
5. Arrangement according to claim 4, **characterised in that** a length of the tubular channel measures at least five times the inner diameter of the tubular channel.
6. Arrangement according to claim 4 of 5, **characterised in that** the venturi comprises a constriction, obtained by pressing the tubular channel together in one direction.
7. Arrangement according to one of the claims 4 to 6, **characterised in that** the spray head is housed in a handheld spray gun, provided with two hose connections.
8. Arrangement according to one of the claims 4 to 7, **characterised in that** the mixing head comprises a central boring, for the supply of gas, and a number of peripheral borings, situated round the central boring, for the supply of liquid.
9. System for the treatment of surfaces, like for exam-

ple cleaning, disinfecting, degreasing and conservation, comprising an arrangement according to one of the claims 4 to 8, for which the system moreover comprises a mobile unit, provided with a pump unit for the liquid, a gas bottle and/or a compressor for the gas. 5

10. System according to claim 9, **characterised in that** the mobile unit moreover comprises at least one supply vessel for an additive, like for example a detergent, and a dosage device with an injector for adding the additive to the liquid. 10

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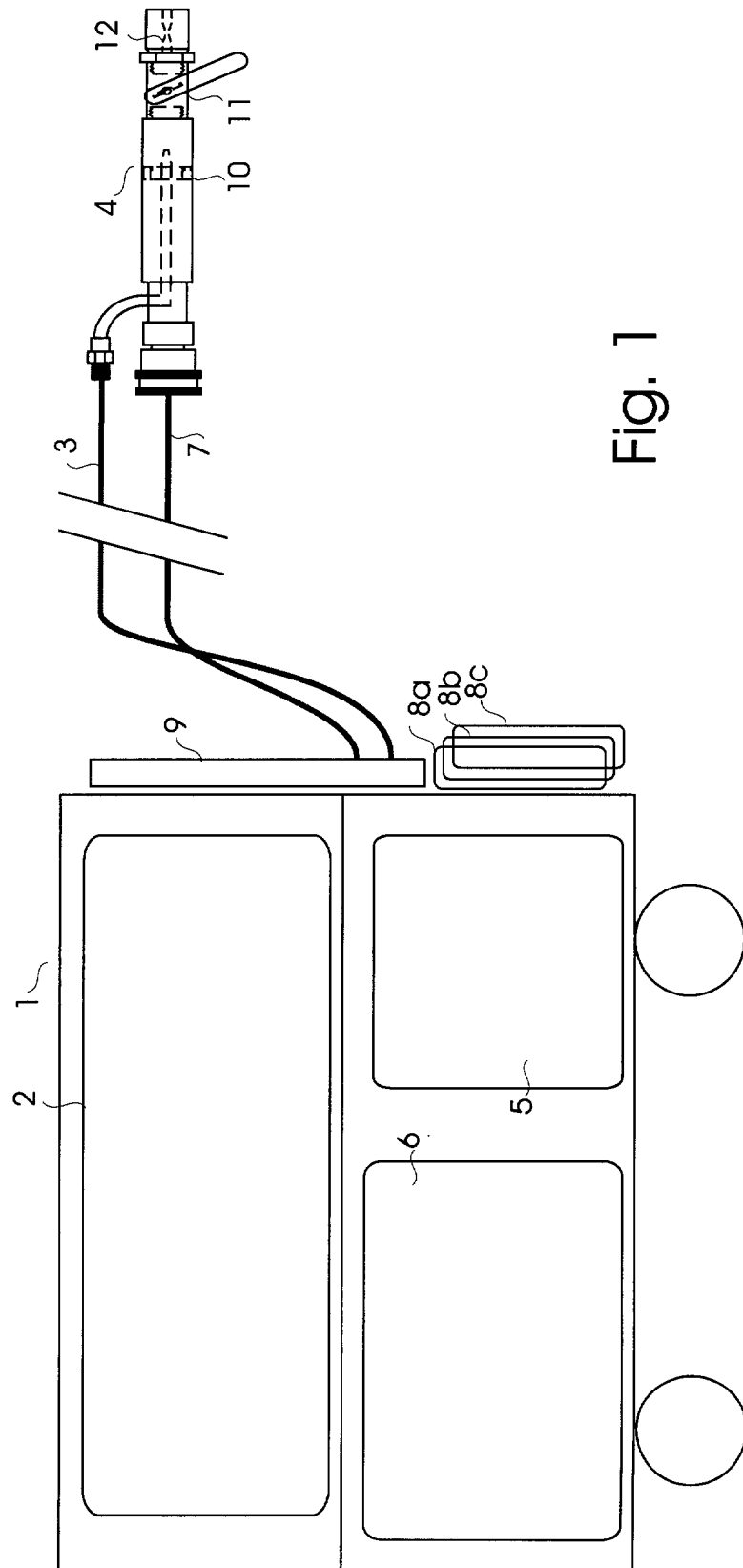


Fig. 1

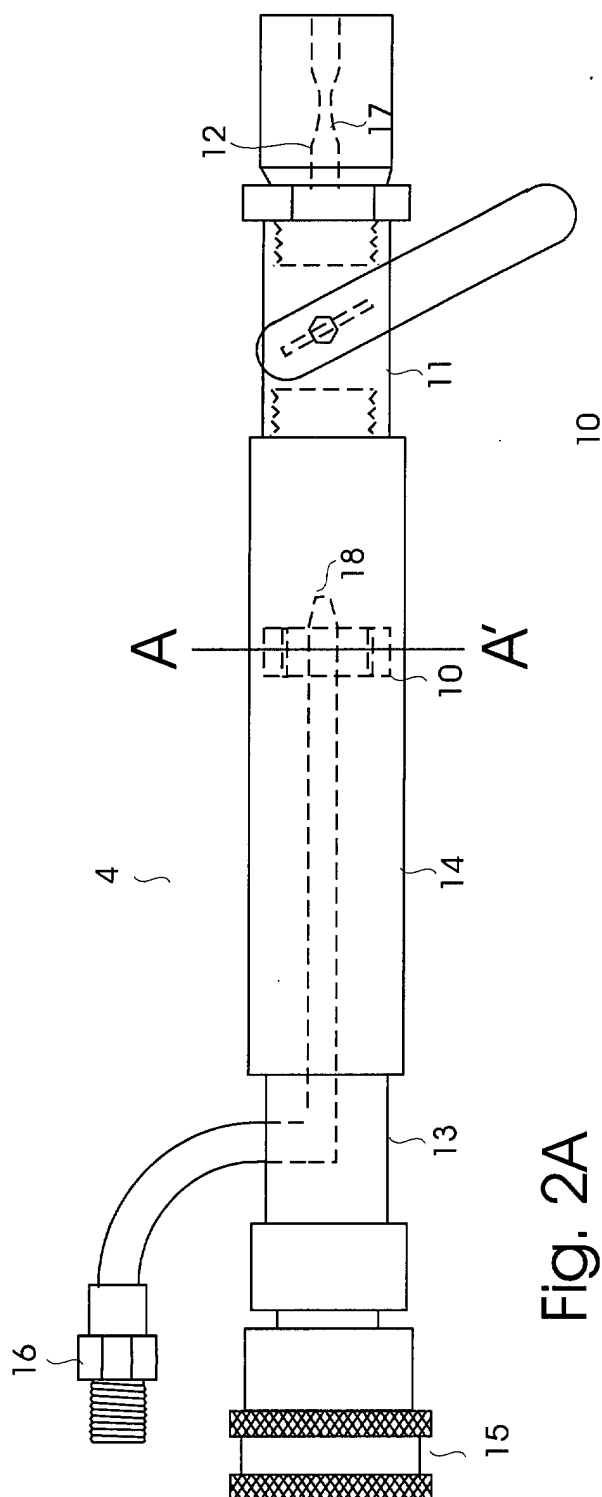


Fig. 2A

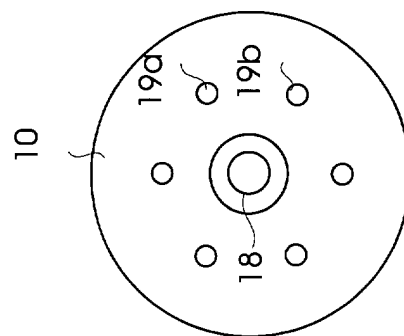


Fig. 2B

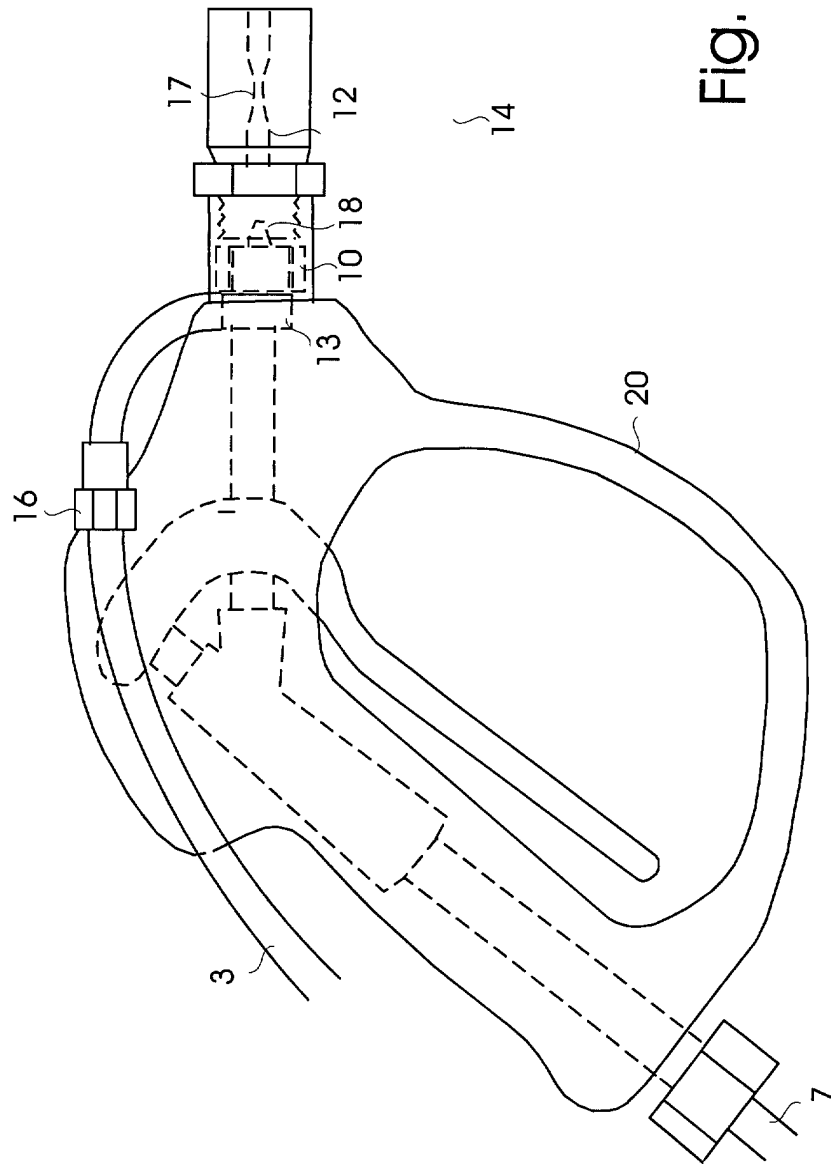


Fig. 3

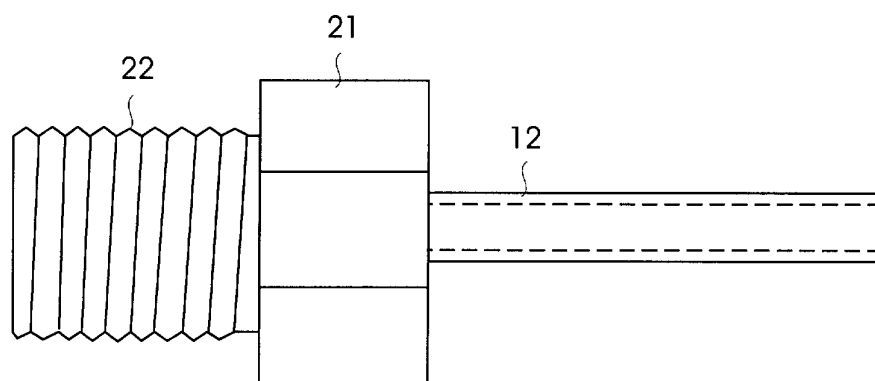


Fig. 4A

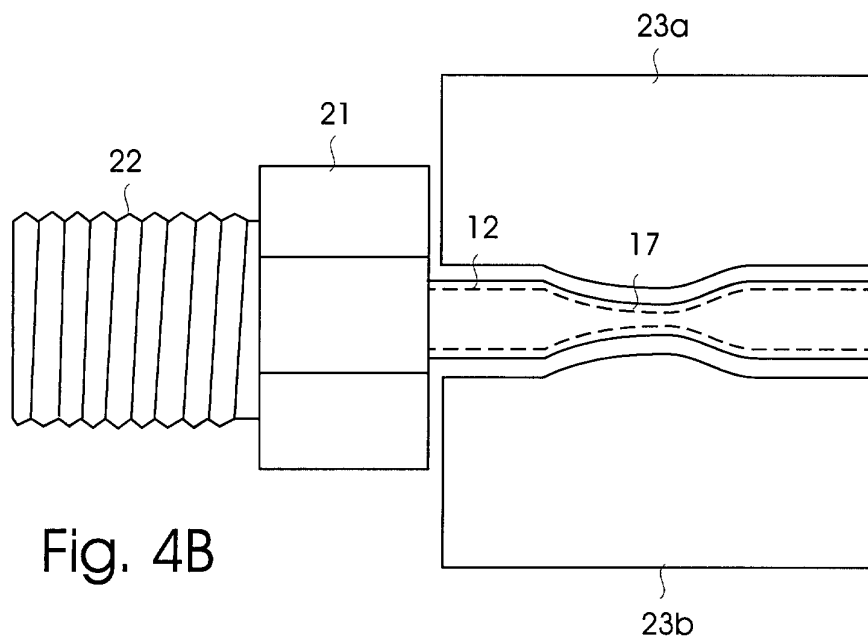


Fig. 4B

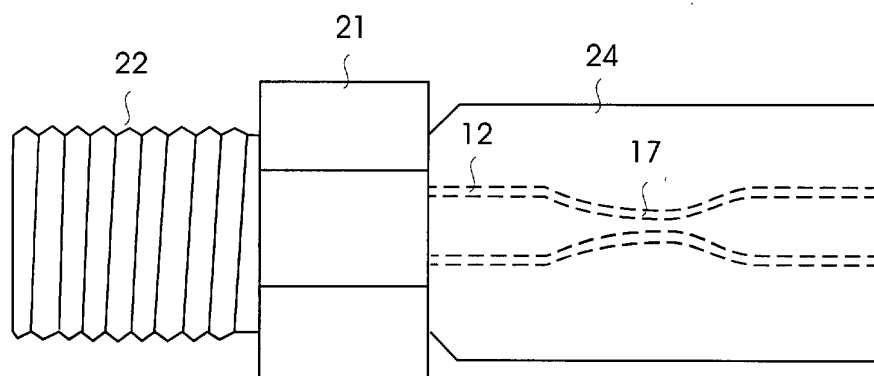


Fig. 4C

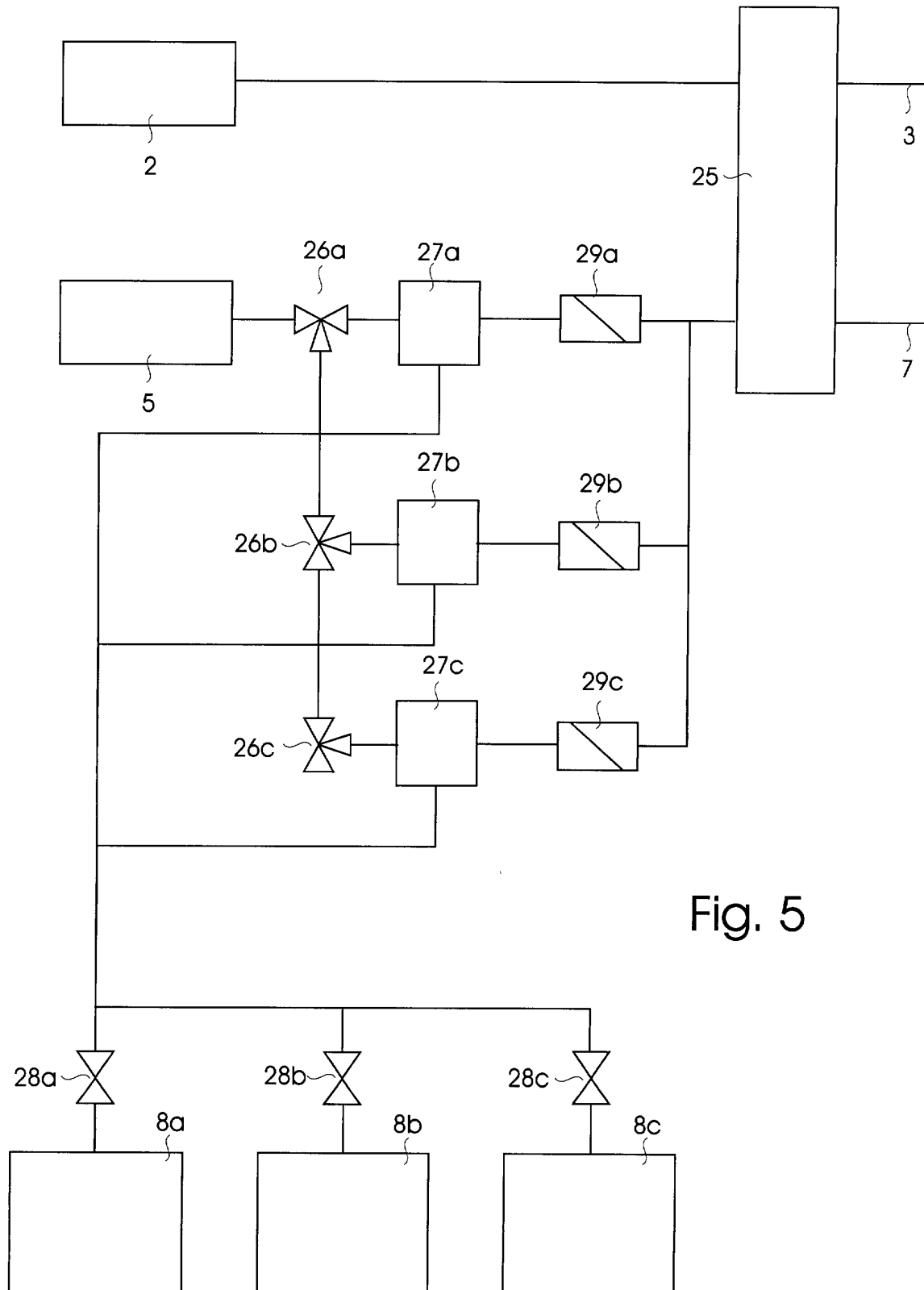


Fig. 5



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 9399

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