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(54) Title: DEVICE FOR AN INJECTOR

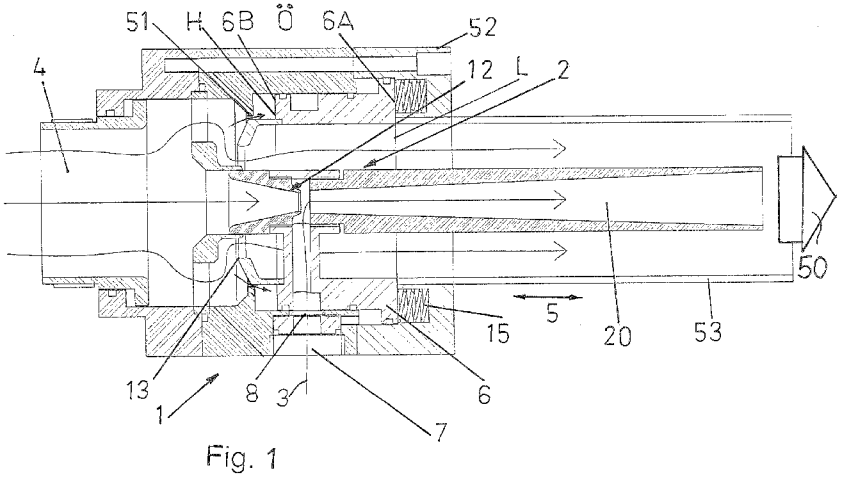



Fig. 1

(57) Abstract: The invention relates to a device (1) for an injector (2) in order to mix foam liquid (3) in water (4), comprising a movable piston, which exhibits two piston faces with separate piston areas, i.e. a pressure drop piston (6) and an inlet (7) leading thereto for foam concentrate (3) to the suction side of the injector (2). Said injector (2) is arranged internally in said movable pressure drop piston (6) in order to adjust varying water flow past said injector (2) and with maintained pressure drop. The pressure drop piston (6) exhibits axial passage for water. A dosing valve (8) to the injector (2) is provided to vary occurring water flow changes in order to keep the premix within the intended wanted limits, so that when the water flow (4) past the injector is low, it is so arranged that smaller quantities of foam concentrate (3) are dosed than when the water flow (4) past the injector (2) is increased.

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# Device for an injector

The present invention relates to a device for an injector in order to mix foam liquid in water, comprising a movable piston, which exhibits two piston faces with separate piston areas, i.e. a pressure drop piston and an inlet leading thereto for foam concentrate to the suction side of the injector.

Injectors are intended to mix foam liquid in water to form a premix, which is used for firefighting purposes. Such known injectors are frequently occurring and are used for stationary as well as portable applications. The so called intermediate injector makes it possible to suck foam liquid in the form of a concentrate from an open vessel and to dose said foam liquid into a pressurized conduit. However, said intermediate injector requires a pressure drop between incoming and outgoing conduit of about 33%, but said injector has a fixed flow.

It is necessary to obtain broader flow ranges, since newer foam liquids are developed.

Previously, there were only foam liquids, which were approved for admixtures of 3% and 6%, but now there are foam liquids, which are approved for 1% and even less. Such an intermediate injector, which is well developed, may dose up to about 10% with an acceptable pressure drop.

Thus, there exist conditions to obtain an injector with variable admixture of foam liquid in water in a pressurized conduit.

The device, which is previously known by US 6,659,187 B1, comprises a separate pilot valve, which

is arranged to control the dosage of foam concentrate in the water. Thereby, the injector (JI) is located at the rear end of the diffusor (CPS). The inlet (FCI) for foam concentrate is located at the rear end of said diffusor. Separate housings (B) are provided to enclose the entire device, and this means that the device becomes enormous and comprises many parts.

The main object of the present invention is, therefore, in the first place to make it possible to obtain flow independent admixture of foam liquid with a constant percentage.

Said object is reached by means of a device according to the present invention, which is mainly characterized in that said injector is arranged internally in said movable pressure drop piston in order to adjust varying water flow past said injector and with maintained pressure drop, that the pressure drop piston exhibits axial passage for water, that a dosing valve to the injector is provided to vary occurring water flow changes in order to keep the premix within the intended wanted limits, so that when the water flow past the injector is low, it is so arranged that smaller quantities of foam concentrate are dosed than when the water flow past the injector is increased, and that said movable pressure drop piston is enclosed by a surrounding housing.

The invention is described below as a preferred embodiment, whereby it is referred to the accompanying drawings, in which

Fig. 1 is a sectional view along a device, which is provided for maximum water flow and maximum admixture of foam liquid,

Fig. 2 illustrates an inlet valve in fully opened position,

Fig. 3 is a sectional view across the device, but adjusted for low water flow and a small amount of admixture of foam, and

Fig. 4 illustrates the inlet valve in said position.

A device 1, which is illustrated as an example in Figs. 1-4 and which is provided at an injector 2 in order to mix foam liquid 3 in water 4 and which comprises a piston, which is movable in axial direction 5 and which exhibits two piston faces with separate piston areas, i.e. a pressure drop piston 6 and an inlet 7 leading thereto for foam concentrate 3, and an injector 2 for water, respectively, has said injector 2 provided internally in said movable pressure drop piston 6. Thereby, it is possible to adjust varying water flow 4 past said injector 2, but with maintained pressure drop. A dosing valve 8 to the injector 2 is provided to vary occurred water flow changes in order to keep the premix of foam 3 within intended wanted limits, so that when the water flow 4 past the injector is low, it is so arranged that less foam concentrate 3 is dosed past the injector.

The present invention, which is illustrated as an example in Figs. 1-4, is based on the idea that the water 4 is passed past the injector 2 with up to ten times the capacity of the injector 2, and in certain application with still more. The demand for pressure drop in the region of 30-40% can be achieved by means of diaphragm faces or pistons and also by means of spring force.

A dosing valve to the injector 2 is required, which can vary with the water flow changes, så that the premix is not varied in percentage more than the standard demands, for example 1%-1,3%. This dosing valve

can be mounted, so that it senses the position of the water regulating function. This means that when the water flow past the injector is low, a small amount of foam concentrate is dosed, and when the water flow is high, the dosage of foam is increased. In the product in question the valve is built-in, so that a part of the piston constitutes one side of the function.

The inlet pressure to the injector 2 is, as is illustrated in Figs. 1-4, arranged to act on the high pressure side H of the pressure drop piston 6, which in its turn is arranged to balance the low pressure side L of the pressure drop piston 6. Thereby, the respective diametrically opposed piston sides 6A, 6B of the pressure drop piston form low pressure side L and high pressure side H, respectively. A passage 13 for maximum water passage 4 is adjustably provided depending on the displacement movement of the pressure drop piston 6 between completely closed and maximally open positions, S and Ö, respectively. A passage 51 for water passage leads to the high pressure side 6B of the pressure drop piston 6. The inlet 7 for foam concentrate 3 debouches across the pressure drop piston 6 into the vacuum chamber 14 of the injector 2 between the nozzle 12 and a diffusor 20 leading therefrom, and a valve 8 for foam concentrate 3 is provided at said inlet 7.

The injector 2 is formed by a nozzle 12, a said vacuum chamber 14 and a diffusor 20.

Said valve 8 for adjusting the foam concentrate 3 is provided to be adjusted by the displacement movement of the pressure drop piston 6.

In shut off position, when the plant is not in operation, the return movement of the pressure drop piston 6 is obtained by means of a number of springs 15,

which are distributed along the low pressure side L of said pressure drop piston. The smart and unique of the present solution is, however, that the main part of the injector 2 is located inside the pressure drop piston 6, which means that only one movable part is required. The product, as it is now described, is independent of the flow, but not of the pressure.

The function of the pressure drop regulator is as follows:

When flow changes are within the scope of approved percentages the pressure drop is maintained, so that the injector generates a negative pressure in the vacuum chamber 14. The negative pressure is generated in that the water flow through the nozzle 12 converts pressure energy into kinetic energy. All pressure energy is converted into kinetic energy if the pressure drop above the injector is more than 33%. The ratio of the pressure at the high pressure side H and low pressure side L of the piston is 1:0,67. The function of the diffusor 20 is to recreate kinetic energy in the vacuum chamber into pressure energy. Depending on the consumption downstreams the piston will adjust itself in a position between minimum and maximum. The foam valve will be located in position in relation to the edge of the piston in order to deliver the correct dosage. This is clear from Figs. 1-4.

For example, if the flow area of the injector is 1:10 and a foam liquid of 1% is used, the injector will dose 10% in the vacuum chamber at maximum flow. This over-enriched premix will meet the water passing and be mixed into a premix of 1%.

According to the illustrated embodiment of the invention a tube 53 extending from the surrounding housing 52 enclosing the different parts is provided,

through which said wanted premix 50 is discharged to the place of consumption. Thus, said movable pressure drop piston 6 is surrounded and enclosed by such a surrounding housing 52.

The invention should have been clear from the above description as far as the nature as well as the function are concerned. However, the invention is of course not limited to the embodiment described above and illustrated in the accompanying drawings. Modifications are possible, especially as far as the nature of the different parts is concerned, or by using equivalent technique, without departing from the scope of the invention as it is defined in the patent claims.

PATENT CLAIMS

1. Device (1) for an injector (2) in order to mix foam liquid (3) in water (4), comprising a movable piston, which exhibits two piston faces with separate piston areas, i.e. a pressure drop piston (6) and an inlet (7) leading thereto for foam concentrate (3) to the suction side of the injector (2), **characterized in** that the main part of said injector (2) is arranged internally in said movable pressure drop piston (6) in order to adjust varying water flow past said injector (2) and with maintained pressure drop, that the pressure drop piston (6) exhibits axial passage for water, that a dosing valve (8; 16) to the injector (2) is provided to vary occurring water flow changes in order to keep the premix (50) within the intended wanted limits, so that when the water flow (4) past the injector is low, it is so arranged that smaller quantities of foam concentrate (3) are dosed than when the water flow (4) past the injector (2) is increased, and that said movable pressure drop piston (6) is enclosed by a surrounding housing (52).

2. Device according to Claim 1, **characterized in** that the inlet pressure to the injector (2) is arranged to act on the high pressure side (H) of the pressure drop piston, which in its turn is arranged to balance the low pressure side (L) of the pressure drop piston (6).

3. Device according to Claim 2, **characterized in** that the respective diametrically opposed piston sides

(L, H) of the pressure drop piston (6) form low pressure side (L) and high pressure side (H), respectively.

4. Device according to anyone of the preceding Claims, **characterized in** that a passage (13) for maximum water passage (4) is adjustably provided depending on the displacement movement of the piston (6) between completely closed and maximally open positions (S and Ö, respectively).

5. Device according to anyone of the preceding Claims, **characterized in** that inlet (7) for foam concentrate (3) debouches across the pressure drop piston (6) into a vacuum chamber (14) between the injector (2) and a diffusor (20) leading therefrom, and that a said valve (8) for foam concentrate (3) is provided at said inlet (7).

6. Device according to Claim 5, **characterized in** that said valve (8) for adjusting foam concentrate (3) is provided to be adjusted by the displacement movement (5) of the pressure drop piston (6).

7. Device according to anyone of the preceding Claims, **characterized in** that in shut off position and when a plant in question is not in operation, the return movement of the pressure drop piston (6) is obtained by means of a number of springs (15), which are distributed along the low pressure side (L) of said pressure drop piston.

8. Device according to anyone of the preceding Claims, **characterized in** that the injector (2) is formed by a nozzle (12), a vacuum chamber (14) and a diffusor (20).

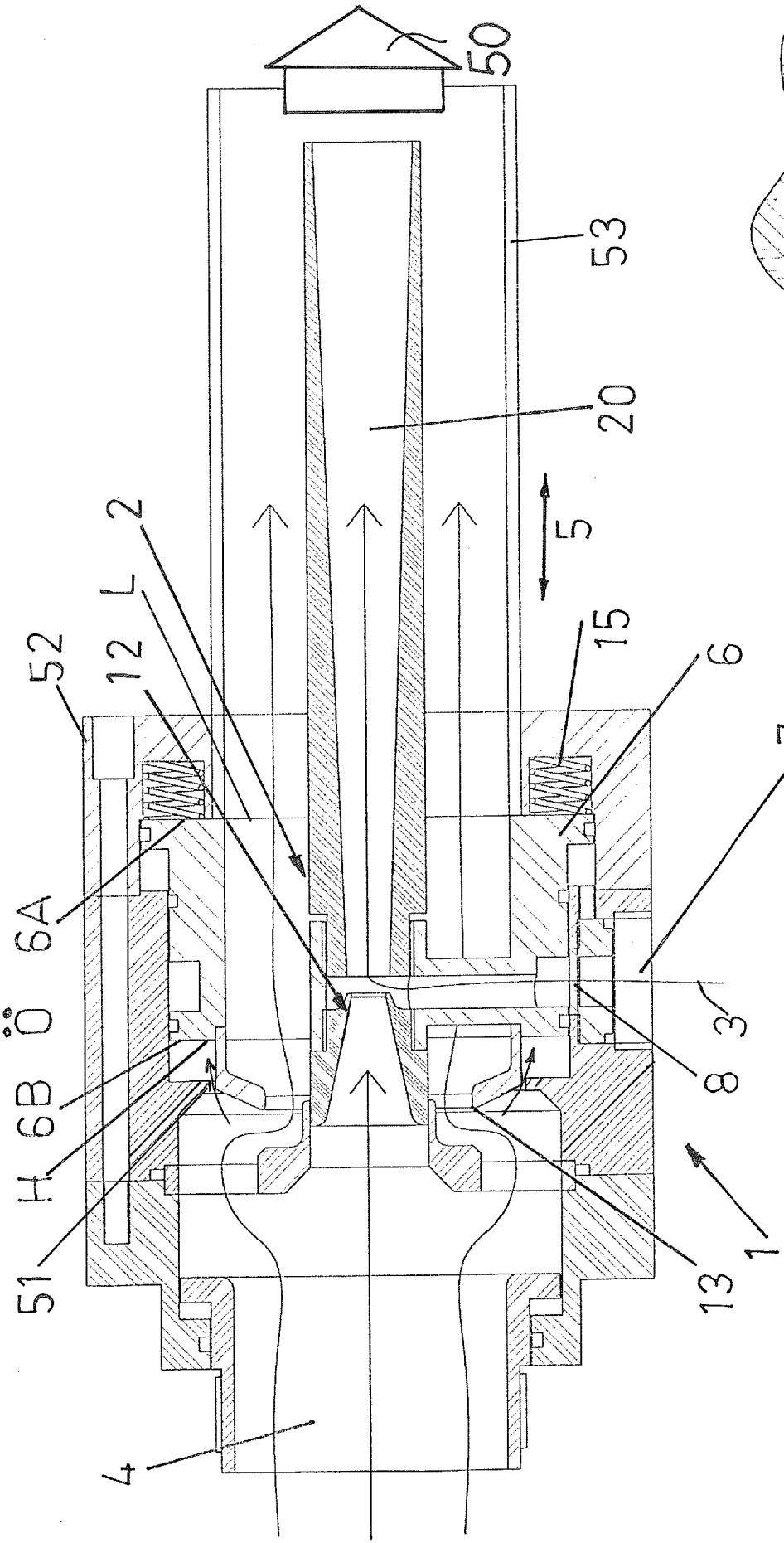



Fig. 1

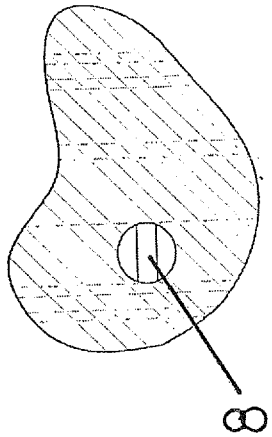



Fig. 2

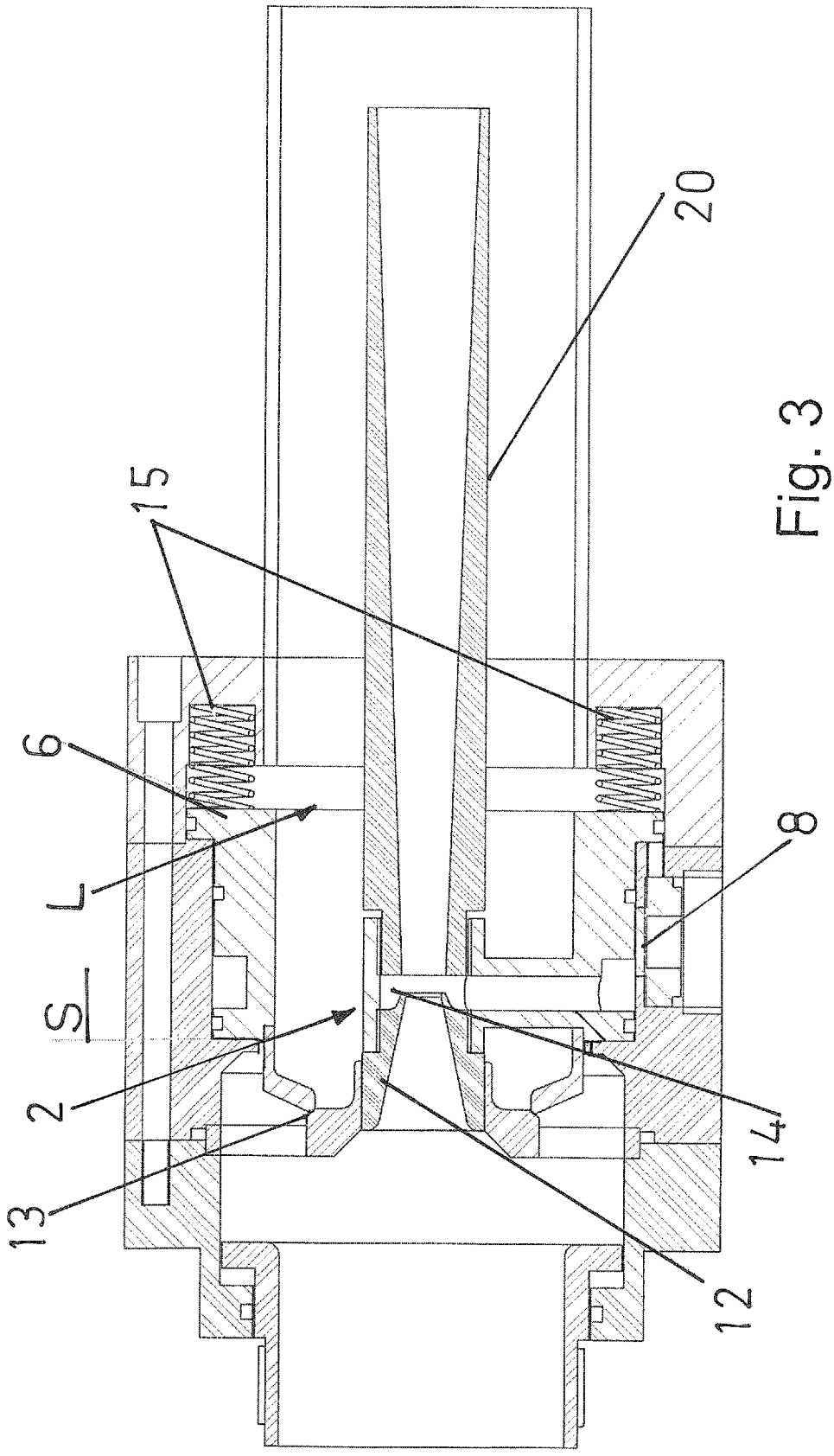



Fig. 3

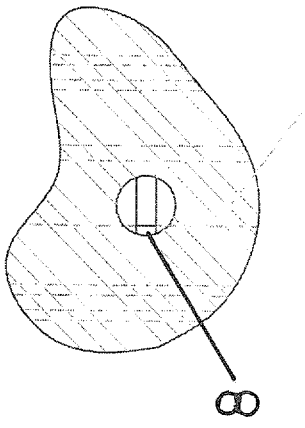



Fig. 4

# INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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: A62C, B01F, F04F

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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|---|---|---|
| X | US 6659187 B1 (CRABTREE DENNIS W ET AL), 9 December 2003 (2003-12-09); column 1, line 24 - column 2, line 12; column 3, line 44 - column 4, line 27; figures 4A,4B<br>-- | 1-8 |
| A | DE 905928 C1 (ALLG FEUERLOESCHER AG IN LIQU), 8 March 1954 (1954-03-08); whole document<br>-- | 1-8 |
| A | GB 772604 A (PYRENE CO LTD), 17 April 1957 (1957-04-17); page 1, line 63 - page 2, line 49; figure 1; claims 1, 2<br>-- | 1-8 |
| A | CH 220869 A (TOTAL FOERSTNER & CO), 30 April 1942 (1942-04-30); whole document<br>-- | 1-8 |

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 16-08-2013 | 19-08-2013 |

| Name and mailing address of the ISA/SE | Authorized officer |
|---|---|
| Patent- och registreringsverket<br>Box 5055<br>S-102 42 STOCKHOLM<br>Facsimile No. + 46 8 666 02 86 | Niels Rasmussen<br>Telephone No. + 46 8 782 25 00 |

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/SE2013/050590

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | US 20040112984 A1 (HUBMANN CURTIS H ET AL), 17 June 2004 (2004-06-17); abstract; paragraphs [0053]-[0060]; figures 3-5<br>--<br>-------- | 1-8 |

International application No.
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**Continuation of:** second sheet

**International Patent Classification (IPC)**

***A62C 5/02*** (2006.01)
***B01F 5/04*** (2006.01)

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