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NOTICE OF ENTITLEMENT

I **GÖRAN SUNDHOLM**

of **Ilmari Kiannon Kuja 3, SF-04310 TUUSULA, FINLAND**

being the Applicant and Nominated Person, in respect of Application No. 29467/92
state the following:

I am the actual inventor of the invention the subject of the Application.

The actual inventor is the Nominated Person.

I am the applicant of the application listed in the declaration under Article 8 of the PCT.

Convention priority is claimed from the following basic application(s) referred to in the
declaration under Article 8 of PCT:

Basic Applicant	Application Number	Application Date	Country	Country Code
GÖRAN SUNDHOLM	915574	26 November 1991	Finland	FI
GÖRAN SUNDHOLM	924752	20 October 1992	Finland	FI

The basic applications referred to in the declaration under Article 8 of the PCT were the
first applications made in a Convention country in respect of the invention the subject
of the Application.

DATED this 15th day of July 1994

GÖRAN SUNDHOLM
By his Patent Attorneys


GRIFFITH HACK & CO



AU9229467

(12) PATENT ABRIDGMENT **(11) Document No. AU-B-29467/92**
(19) AUSTRALIAN PATENT OFFICE **(10) Acceptance No. 672374**

- (54) Title
FIRE-FIGHTING EQUIPMENT
- International Patent Classification(s)
(51)⁵ **A62C 013/00 A62C 035/00**
- (21) Application No. : **29467/92** (22) Application Date : **25.11.92**
- (87) PCT Publication Number : **WO93/10859**
- (30) Priority Data
- | (31) Number | (32) Date | (33) Country |
|---------------|-----------------|-------------------|
| 915574 | 26.11.91 | FI FINLAND |
| 924752 | 20.10.92 | FI FINLAND |
- (43) Publication Date : **28.06.93**
- (44) Publication Date of Accepted Application : **03.10.96**
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- (56) Prior Art Documents
US 1263291
GB 314490
- (57) Claim

1. Fire-fighting equipment, comprising a drive unit for extinguishing liquid that includes at least one hydraulic accumulator means which is chargeable to a high initial drive pressure, and which is arranged to, at a high drive pressure, deliver liquid, and at a reduced drive pressure, deliver a mixture of liquid and gas, the hydraulic accumulator means comprising a liquid space and a gas space, wherein the liquid space and the gas space communicate with outlet valve means and an outlet line, whereby the outlet valve means is responsive to drive pressure in the liquid space of the accumulator means in such a way that the valve means is arranged to, at a high pressure in the liquid space of the accumulator means, open a liquid outlet connection only and to, at a reduced pressure in the liquid space of the accumulator means, open an additional gas outlet connection.



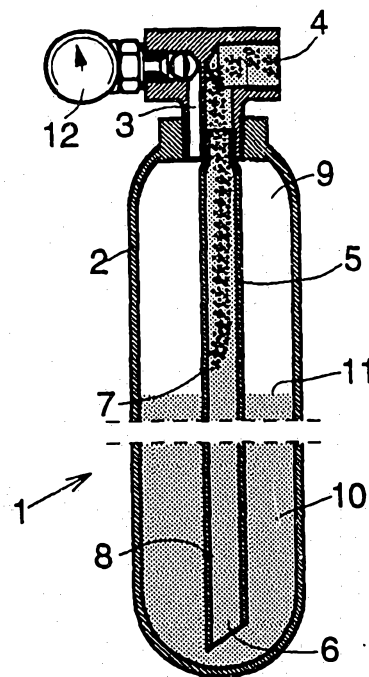
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : A62C 13/00, 35/00</p>	<p>A1</p>	<p>(11) International Publication Number: WO 93/10859 (43) International Publication Date: 10 June 1993 (10.06.93)</p>
<p>(21) International Application Number: PCT/FI92/00317 (22) International Filing Date: 25 November 1992 (25.11.92) (30) Priority data: 915574 26 November 1991 (26.11.91) FI 924752 20 October 1992 (20.10.92) FI (71)(72) Applicant and Inventor: SUNDHOLM, Göran [FI/FI]; Ilmari Kiannon kuja 3, SF-04310 Tuusula (FI). (74) Agent: VALROS, Frey; Marioff Ky, PB 25, SF-01511 Van- taa (FI). (81) Designated States: AT, AU, BB, BG, BR, CA, CH, CS, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, PL, RO, RU, SD, SE, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).</p>	<p>Published <i>With a revised version of the international search report.</i> (88) Date of publication of the revised version of the international search report: 17 February 1994 (17.02.94)</p> <p style="font-size: 2em; text-align: center;">672374</p>	

(54) Title: FIRE-FIGHTING EQUIPMENT

(57) Abstract

The invention relates to fire-fighting equipment having at least one hydraulic accumulator as a drive unit for extinguishing liquid. Drive gas (9) drives liquid (10) out of the accumulator (1) through an inner tube (5) which has at least one aperture (7; 8) in its wall. When the liquid level (11) in the accumulator reaches the wall aperture (7), drive gas flows into the liquid flow in the tube (5) to boost the liquid flow.



Fire-fighting equipment

The present invention relates to fire-fighting equipment, with a drive unit for extinguishing liquid.

To utilize at least one hydraulic accumulator, with
5 a high initial charge pressure, as a drive unit for
extinguishing liquid in fire-fighting equipment has been
suggested in the international patent application
PCT/FI92/00193, together with some preferable
embodiments. A high initial charge pressure means in
10 this context in general at least about 30 bar, but charge
pressure of up to about 300 bar may well be considered.

Known hydraulic accumulators have a liquid space and
a gas space separated from each other by a membrane. A
relatively large portion of the volume of the hydraulic
15 accumulator remains unutilized and, in addition, the
penetration power of the liquid spray is reduced during a
relatively long period when the hydraulic accumulator is
being discharged at a reduced drive pressure.

It would be advantageous if at least preferred
20 embodiments of the invention provided a new fire-fighting
equipment with an improved hydraulic accumulator enabling
a more efficient fire-fighting.

The present invention provides fire-fighting
equipment, comprising a drive unit for extinguishing
25 liquid that includes at least one hydraulic accumulator
means which is chargeable to a high initial drive
pressure, and which is arranged to, at a high drive
pressure, deliver liquid, and at a reduced drive
pressure, deliver a mixture of liquid and gas, the
30 hydraulic accumulator means comprising a liquid space and
a gas space, wherein the liquid space and the gas space
communicate with outlet valve means and an outlet line,
whereby the outlet valve means is responsive to drive
pressure in the liquid space of the accumulator means in
35 such a way that the valve means is arranged to, at a high
pressure in the liquid space of the accumulator means,
open a liquid outlet connection only and to, at a reduced
pressure in the liquid space of the accumulator means,



open an additional gas outlet connection.

In a preferred embodiment of the invention, the drive gas of the hydraulic accumulator is arranged to drive the accumulator liquid directly, without an
5 intermediate membrane, the liquid being arranged to be driven out through a tube which starts at the bottom part of the liquid space of the accumulator and runs through the gas space of the accumulator to an outlet line.

The tube can be provided with at least one aperture
10 in its wall, at a desired distance from the outlet end of the tube at the upper end of the gas space, so that drive gas flows into the tube through said at least one aperture in the tube wall, when the liquid level in the hydraulic accumulator has sunk to said aperture, in order
15 to boost the drive of extinguishing liquid.

In a preferred embodiment the tube is provided with a plurality of wall apertures at different levels, so that as the amount of liquid and the drive pressure of the hydraulic accumulator decrease the amount of drive
20 gas mixed into the liquid increases.

The drive gas mixed into the extinguishing liquid results in a surprisingly good extinguishing effect for a surprisingly long time, i.e., it is possible to effectively utilize practically all of the liquid of a
25 hydraulic accumulator in spite of a considerable pressure fall for the drive gas.

The foregoing embodiments can, in addition, be fabricated as a very simple structure and are thus very reliable.

A good automatic extinguisher is obtained with one
30 single hydraulic accumulator. For e.g., automatic fire extinguishing installations with a need of greater capacity it is preferred to use a plurality of hydraulic accumulators in parallel. The hydraulic accumulators preferably have a common source of high pressure gas,
35 e.g., a pressure bottle with nitrogen gas.

The nozzles included in the fire-fighting equipment are preferably made as presented in the international



patent application PCT/FI92/00156, and the nozzles are preferably mounted in a spray head as presented in the international patent application PCT/FI92/00155, to produce a high pressure fog-like liquid spray with a good penetration power.

5

By a fog-like spray is meant a spray of small droplets having a diameter typically 30 to 100 microns and preferably set in a strong whirling motion. As earlier mentioned, by a high charge pressure is here in general meant from about 30 bar up to about 300 bar, as compared to an operating pressure of generally 2 to 10 bar in conventional sprinkler installations which produce a rain-like spray. It shall be noted, however, that the values given above are not absolute; definite limiting values are difficult to present.

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Further preferred embodiments are described in the exemplifying attached drawings.

Figures 1, 2 and 3 illustrate how a preferred form of the invention works, in different stages.

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Figures 4, 5 and 6 show different preferred embodiments of the invention.

Figures 7-10 show alternative examples of release means.

25

Figure 11 shows a longitudinal section of a carriable fire extinguisher.

Figure 12 shows the extinguisher in inactive state.

Figure 13 the outlet valve of the extinguisher in detail, in the state of figure 12.

30

Figure 14 shows the extinguisher in active state, with open liquid valve.



Figure 15 shows the valve in detail, in the state of figure 14.

Figure 16 shows the extinguisher in active state, with open liquid valve and open gas valve.

5 Figure 17 shows the valve in detail, in the state of figure 16.

Figures 18 and 19 show an alternative embodiment in the same state as in figures 16 and 17.

10 In figures 1-3 a hydraulic accumulator is generally indicated by the reference numeral 1. The hydraulic accumulator comprises a pressure container 2 with an inlet 3 for compressed gas, e.g. nitrogen gas, and an outlet 4 for connection to an outgoing line or hose.

15 In the container 2 is arranged a tube 5 with an inlet 6 near the bottom of the container and with the opposite end connected to the outlet 4. The pipe 5 has two apertures 7 and 8 in its wall, at different levels in such a manner that the aperture 7 is relatively far from the tube inlet 6 whereas the aperture 8 is
20 considerably closer to the tube inlet 6. The reference numeral 9 indicates a gas space, 10 indicates water, 11 indicates the water surface, or water level, and 12 indicates a manometer.

25 In the state of readiness, the container 2 is to a great extent filled with liquid, preferably water, i.e. the gas space is small and the gas pressure is high. An outlet valve provided in the outgoing line, not shown, is closed.

30 When the extinguisher is activated, the high pressure drive gas starts driving the water out through the pipe 5 to the outlet 4. The water level sinks in the container 2 whereas the gas space 9 becomes larger, correspondingly, and the gas pressure
35 falls. In figure 1 the water level 11 has not yet reached the aperture 7 in the wall of the tube 5 and



the hydraulic accumulator delivers water only.

In figure 2 the water level has passed the wall aperture 7 of the tube 5 and gas flows through the aperture 7 into the water flow, as indicated in figure 2 by gas bubbles 13. In figure 3 the water level has passed the second wall aperture 8 also, and more drive gas flows into the tube 5, as indicated by bubbles 14 in figure 3. It is of course possible to provide apertures in the tube wall at more than two levels and to provide a plurality of apertures at each level. In general the desired effect is accomplished by a few small apertures having a diameter of e.g. 1 to 2 mm. By mixing drive gas in this manner into the flow of extinguishing liquid it is possible to maintain an effective liquid spray until the container 2 is practically completely empty, whereat the pressure of the drive gas has fallen considerably. The pressure fall of the drive gas is in figures 1-3 illustrated by the different positions of the indicator of the manometer 12. Since the tube 5 has wall apertures at a plurality of levels the amount of drive gas intermixed into the liquid flow increases as the gas pressure falls, and the increased amount of gas maintains the penetration power of the liquid spray.

In the embodiments of figures 4, 5 and 6, the drive unit of the fire-fighting equipment is generally indicated by 20. Three hydraulic accumulators are indicated by 21 and correspond to the accumulator 1 in figures 1-3, each accumulator 21 thus comprising an inner tube 22 like the tube 5 in figures 1-3, wall apertures included. The drive units 20 are in figures 4-6 in a state of readiness, i.e. the accumulators 21 are filled with liquid, numeral 23 in figure 4.

A common source of drive gas for the hydraulic accumulators 21, in figures 4-6 a pressure container with nitrogen gas and a charge pressure of about 200

bar, is indicated by 24. Connection means for gas into the accumulators and for liquid and a mixture of liquid and gas, respectively, out of the accumulators are indicated by 25, a common outlet line for the accumulators is indicated by 26 and a pilot valve therein is indicated by 27. An automatic, e.g. electrically operated pilot valve for connecting the gas container 24 is indicated by 28, a manually operable valve for the same purpose is indicated by 29 and a valve for filling and possibly emptying the accumulators is indicated by 30.

The drive unit of figure 4 works in the same way as has been described in the foregoing with reference to figures 1-3.

The drive unit of figure 5 comprises an additional hydraulic accumulator indicated by 31 and in parallel with the accumulators 21, and like these having an inner tube 22 with wall apertures. The accumulator 31 has preferably nitrogen gas as drive gas, like the accumulators 21, but the charge pressure is relatively low, e.g. about 25 bar. This additional accumulator 31 is used for spraying liquid and a mixture of liquid and gas, respectively, through activated spray heads in the beginning of the extinguishing process, in order to cool these spray heads and secure that the lines to the spray heads are filled with liquid before commencing high pressure liquid spraying.

In the drive unit of figure 6, a liquid pump 33 takes care of cooling the spray heads and filling the lines to them before spraying high pressure liquid. The pump 33 can further be used for refilling the hydraulic accumulators when emptied, preferably with a simultaneous cooling spray to the fire seat.

In figure 7, numeral 40 indicates a spray head with four nozzles 41 directed obliquely to the sides

and a central nozzle 42 in the forward direction. A release ampoule 43 is engaged by an end portion 45 of a valve spindle 44, said end portion being slidably positioned in the ampoule holder. The engagement is effected by a helical spring 46 around the valve spindle, the force of the spring being adjusted not to crush the ampoule 43 at normal temperature.

From that end of the valve spindle 44 which lies towards the outlet tube 5 of the container 2 extends an axial channel 47 to an annular chamber 48 with a cross section area so adjusted, that the pressure force acting on an end face 49 in the direction towards the valve spindle end at the outlet tube 5 balances that pressure force which acts from the tube 5 on said valve spindle end. A high charge pressure in the container 2 does therefore not damage the release ampoule prematurely.

The ampoule 43 breaks at an increased temperature, whereat the spring 46 presses the valve spindle 44 off the outlet tube 5 of the container 2 and opens connection from the tube 5 to the spray head 40.

The embodiments shown in figures 8, 9 and 10 all have a pressure compensating spindle structure like the one shown in figure 7. In figure 8, a heat sling 51 is arranged around a release ampoule 50, the electric feed line of the sling being indicated by 52. By means of the heat sling 51, the fire-fighting equipment can be activated faster, i.e. the ampoule 50 can be made to melt or weaken faster than what would be the case under the influence of the rising air temperature alone.

In figure 9, a manually releasable cotter pin is indicated by 53. When the pin 53 is released, a plug 54 is unblocked and is removed by the spindle mechanism via the ampoule 43.

In the embodiment shown in figure 10, the fire-fighting equipment is activated by loosening a holder screw 55, whereat the valve spindle follows under the influence of the helical spring 46.

5 In the following shall be described a carriable extinguisher, with reference to figures 11 to 19.

The reference numeral 61 indicates a hydraulic accumulator container with a liquid 62 and pressure gas 3, of e.g. about 200 bar. An outlet valve is generally indicated by 64, an outgoing hose by 65 and a spray head connected to the hose by 66. The spray head 66 is preferably made as presented in the international patent application PCT/FI92/00155, with a number of nozzles directed obliquely to the sides and with one central nozzle in forward direction.

15 In the container 61 is arranged a tube 67 and within the tube 67 a second tube 68 for leading liquid and gas, respectively, to the outlet valve 64. A closable connection to a source of pressure gas is indicated by 69; liquid 62 can be introduced through the connection 69 as well. A turnable handle for closing and opening the valve 64, respectively, is indicated by 70.

25 In figures 12 and 13, the handle 70 is turned to closed position and presses a movable spindle 71 of the valve 64, through springs 72, e.g. plate springs, to close both the connection from the liquid outlet 67a to the outlet 73 leading to the hose 65, by mutual engagement between a conical surface 74 and an annular edge 75 in the valve housing, and the connection from the gas outlet 68a to the outlet 73 leading to the hose 65, in a corresponding manner by means of a conical surface 77 of a valve pin 76 and an annular edge 78 in the valve spindle 71, as shown in figure 30 13.

35

In figures 14 and 15, the handle 70 has been

turned loose and the liquid pressure has driven the valve spindle 71 off the annular edge 75, while compressing the spring 72, so that a liquid connection 67a - 73 has opened, between the conical surface 74 and the annular edge 75. The gas connection from 68a to the outlet 73, via a bore 79 in the valve spindle 71, is still closed.

In figures 16 and 17, the pressure in the container 61 has fallen so much, that the springs 72 press the spindle 71 somewhat back, i.e. downwards in the figures so that the annular edge 78 of the spindle 71 comes off the conical surface 77 of the valve pin 76, which is axially locked to the handle 70, whereat a gas connection 68a - 80 (between the conical surface 77 and the edge 78) - 79 - 73 is opened. A mixture of gas, indicated by 81 in figure 16, and liquid is sprayed out through the hose 65 and through the spray head 66, and thanks to that it is possible to obtain an effective spray with a good penetration power in spite of a relatively low remaining pressure in the container 61. In this stage, the spray can be limited to the central nozzle of the spray head 66.

Figures 18 and 19 show an alternative embodiment where the gas is fed separately through an inner hose 82 to the central nozzle of the spray head.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Fire-fighting equipment, comprising a drive unit for extinguishing liquid that includes at least one hydraulic accumulator means which is chargeable to a high initial drive pressure, and which is arranged to, at a high drive pressure, deliver liquid, and at a reduced drive pressure, deliver a mixture of liquid and gas, the hydraulic accumulator means comprising a liquid space and a gas space, wherein the liquid space and the gas space communicate with outlet valve means and an outlet line, whereby the outlet valve means is responsive to drive pressure in the liquid space of the accumulator means in such a way that the valve means is arranged to, at a high pressure in the liquid space of the accumulator means, open a liquid outlet connection only and to, at a reduced pressure in the liquid space of the accumulator means, open an additional gas outlet connection.

2. Fire-fighting equipment according to claim 1, wherein the liquid space and the gas space are not divided from each other by means of a membrane.

3. Fire-fighting equipment according to claim 2, wherein the outlet valve means comprises a valve spindle and a valve pin, a spring being arranged between the valve spindle and the valve pin, whereby the force of the spring is arranged to open the additional gas outlet connection when the pressure drops from the high pressure to the reduced pressure by moving the spindle in relation to the valve pin.

4. Fire-fighting equipment according to claim 3, further comprising a manually operable handle for opening the outlet valve means and closing the same.

5. Fire-fighting equipment according to any one of claims 1 to 4, wherein the gas is arranged to be driven out intermixed with liquid through the outlet line.



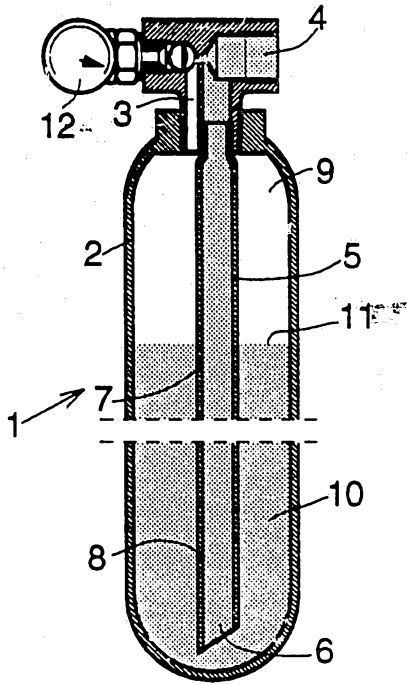


Fig. 1

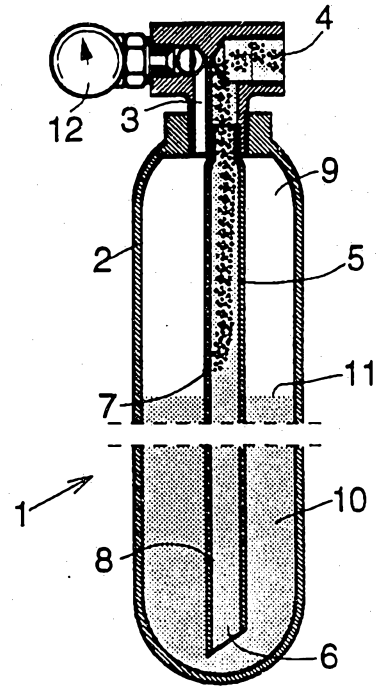


Fig. 2

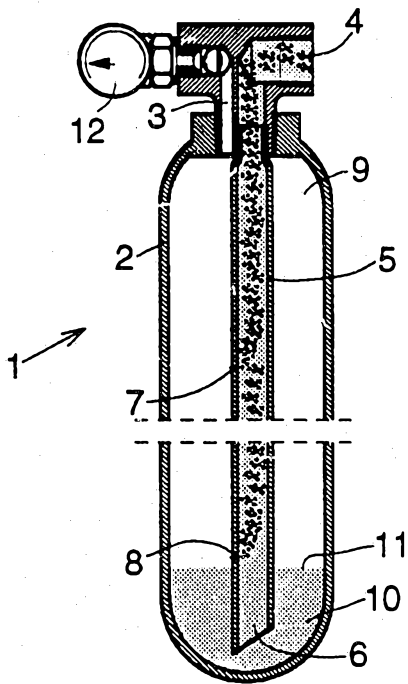


Fig. 3

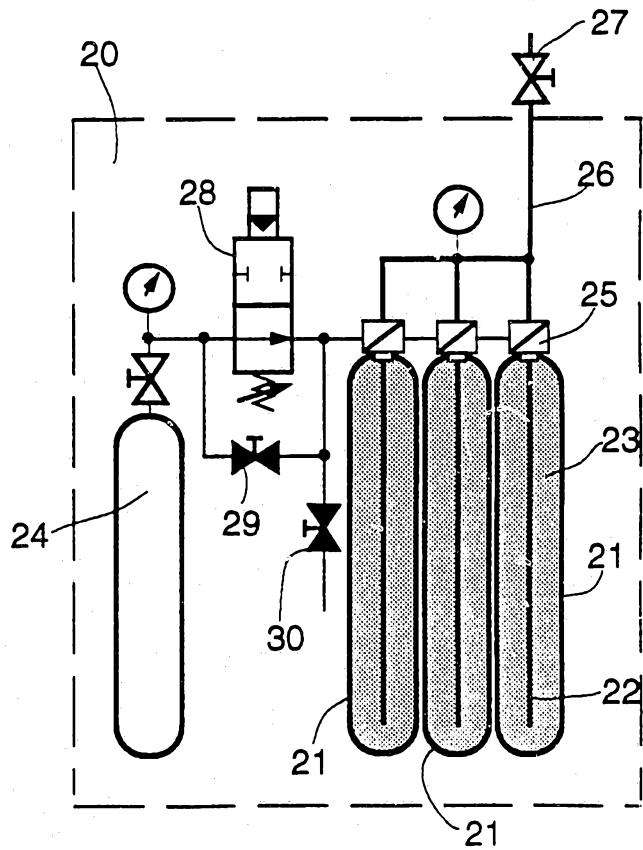


Fig. 4

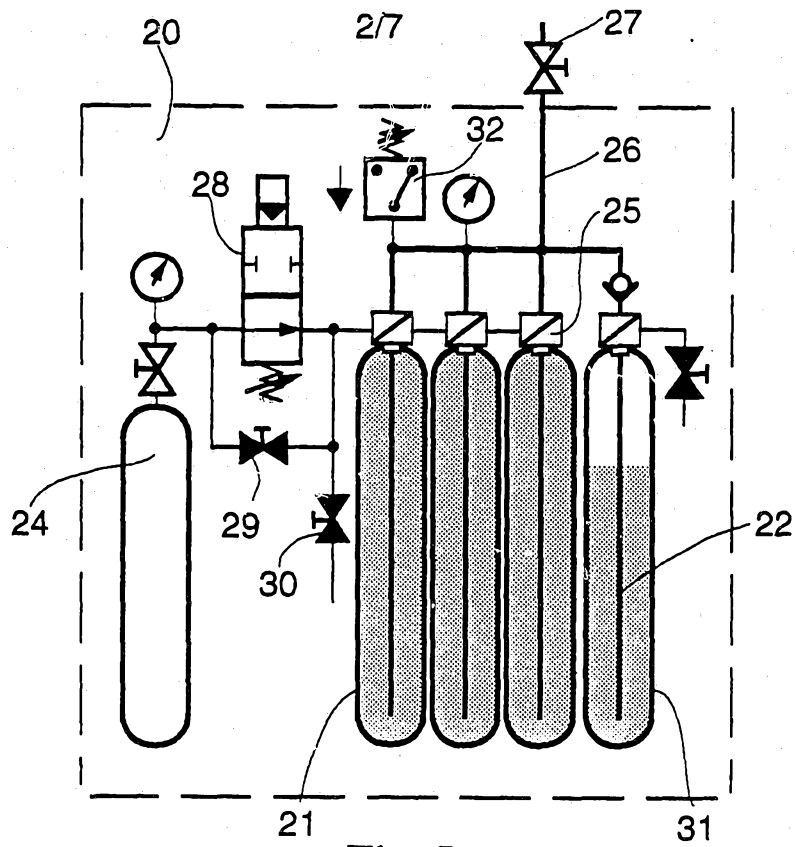


Fig. 5

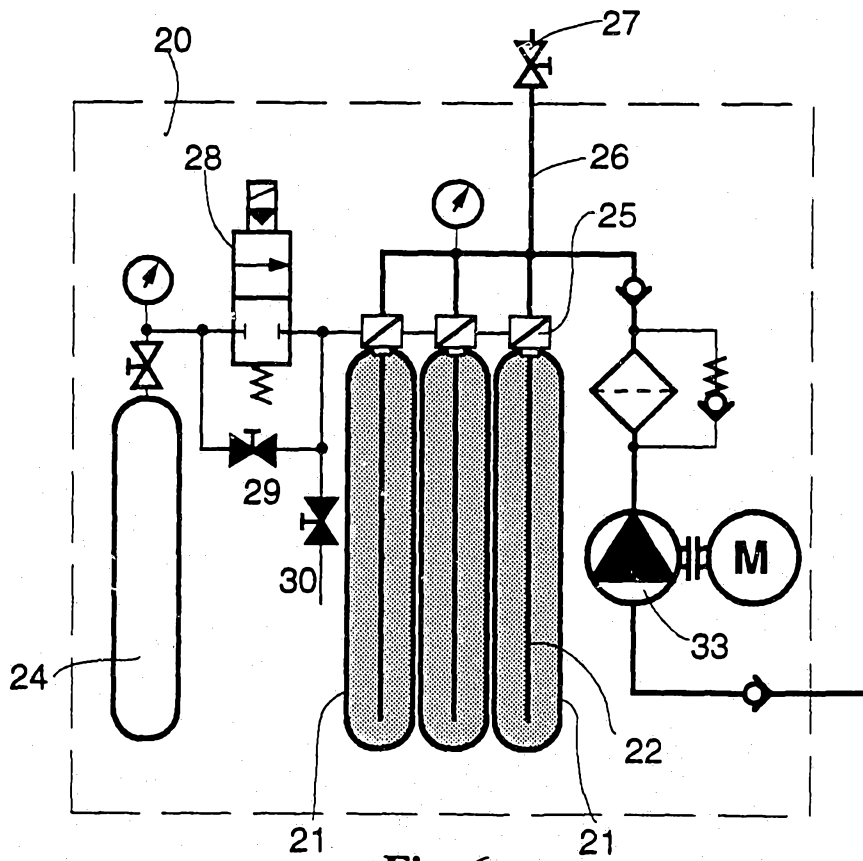


Fig. 6

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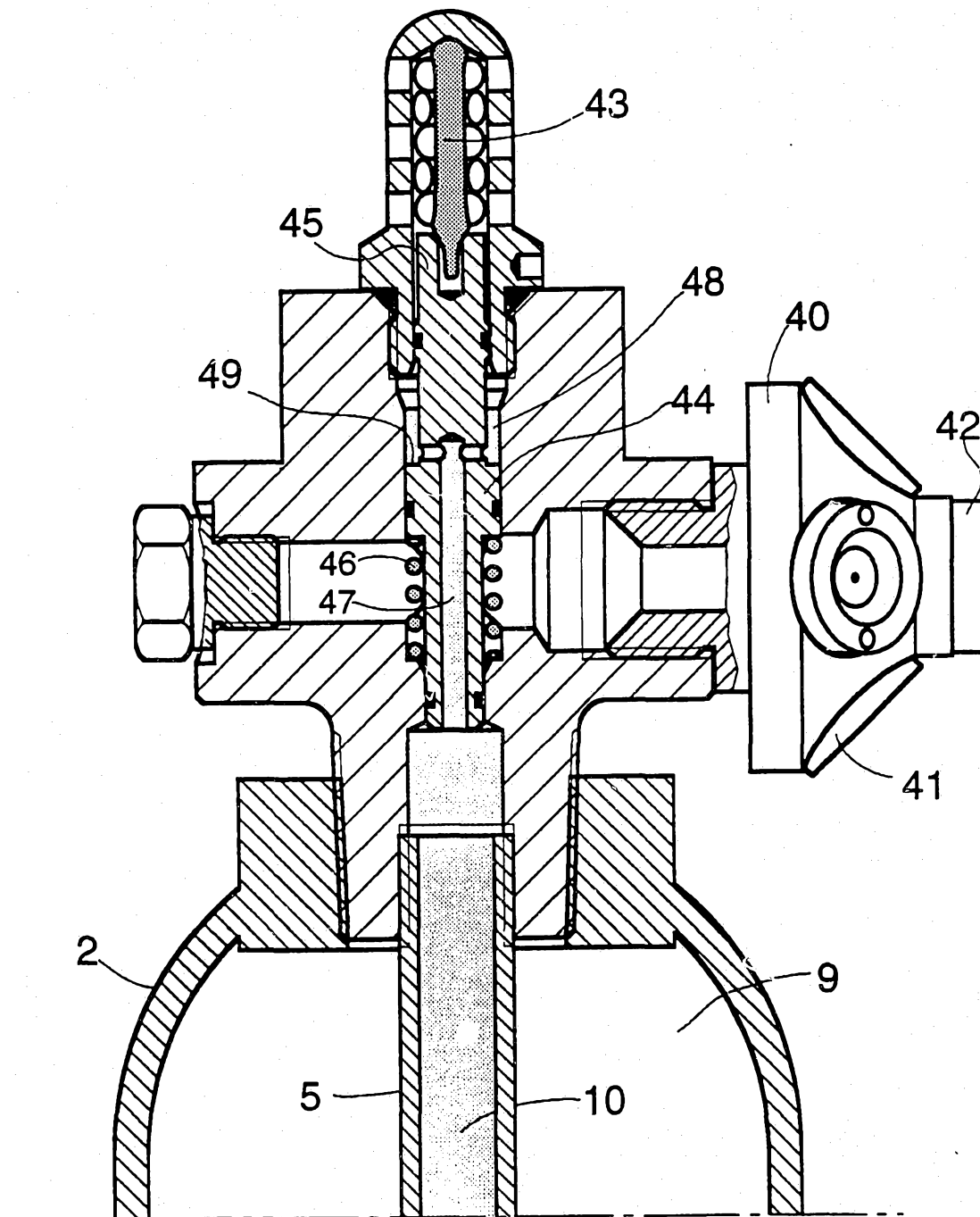


Fig. 7

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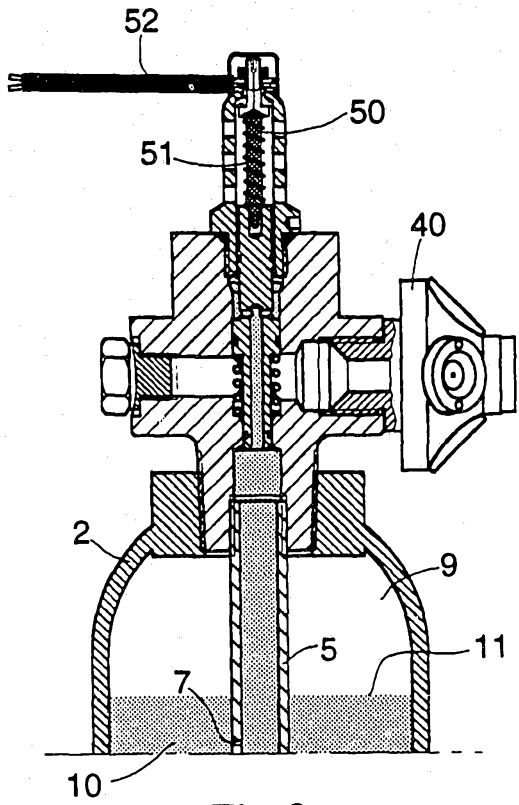


Fig. 8

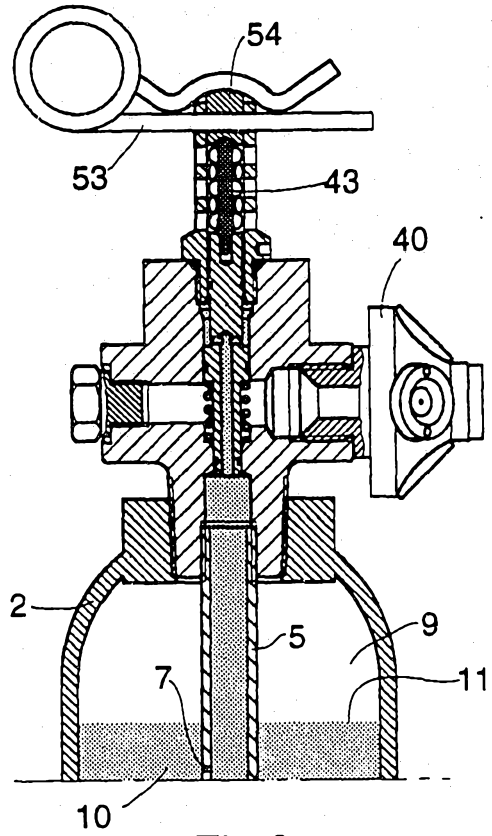


Fig. 9

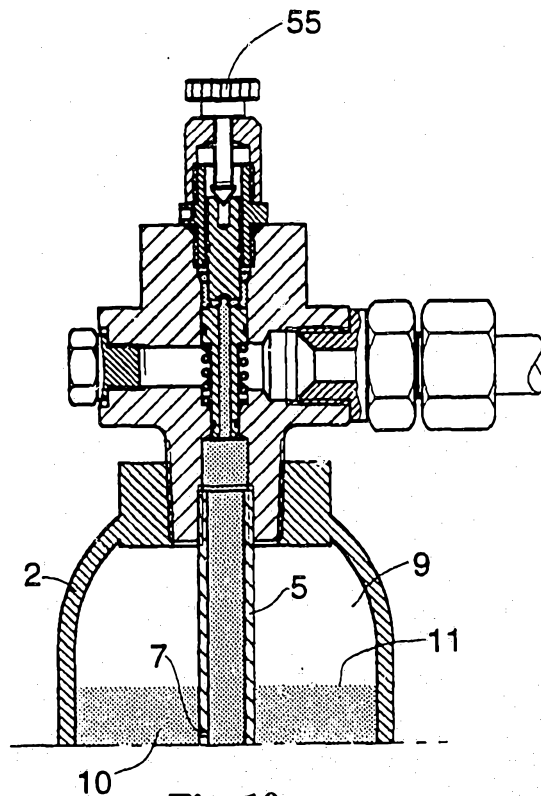


Fig. 10

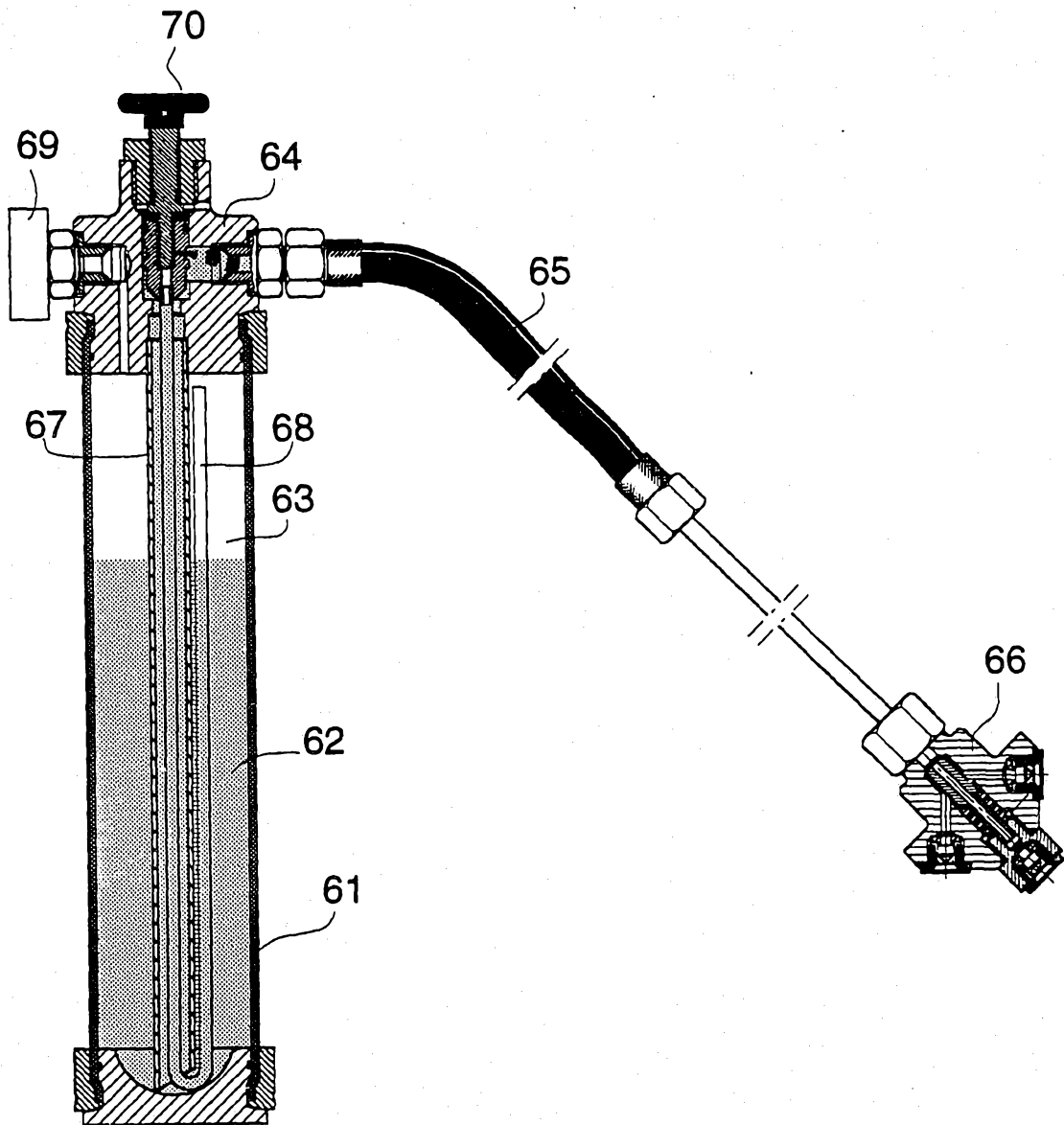


Fig. 11

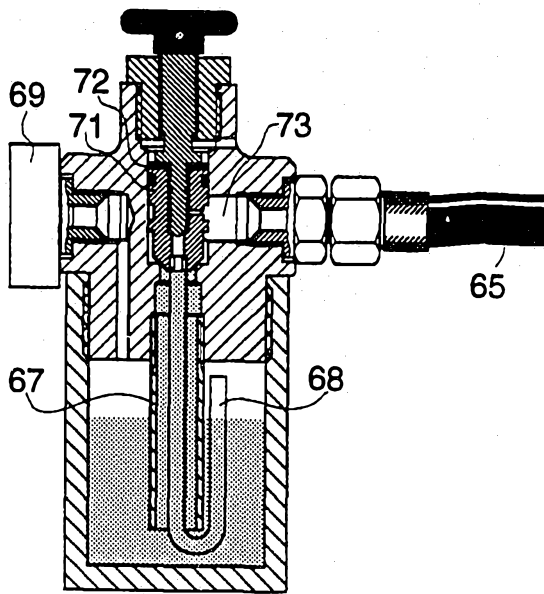


Fig. 12

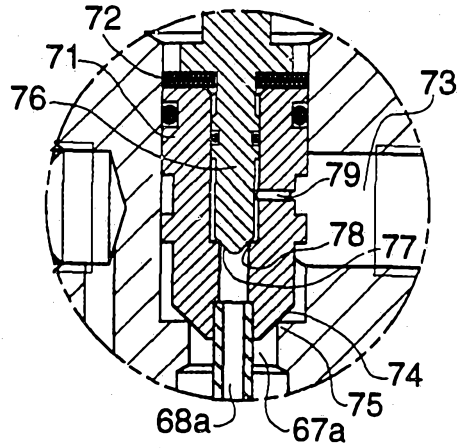


Fig. 13

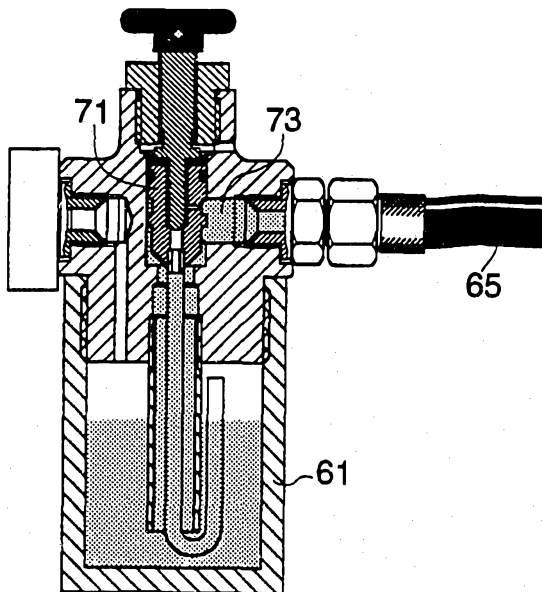


Fig. 14

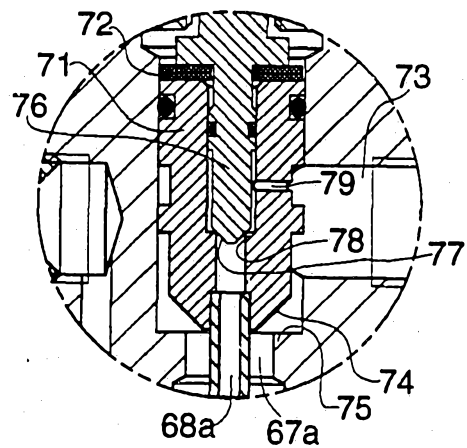


Fig. 15

7/7

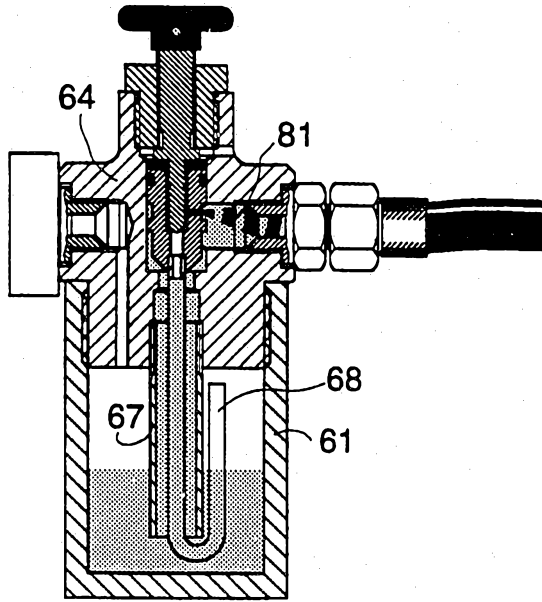


Fig. 16

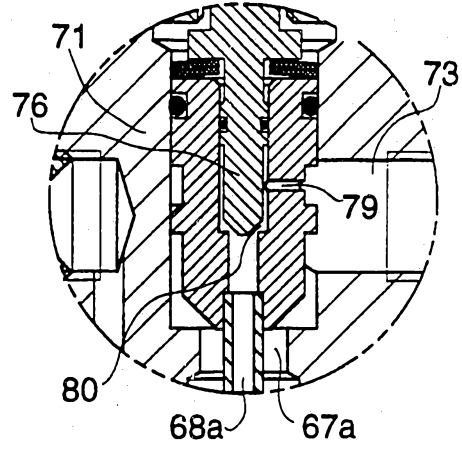


Fig. 17

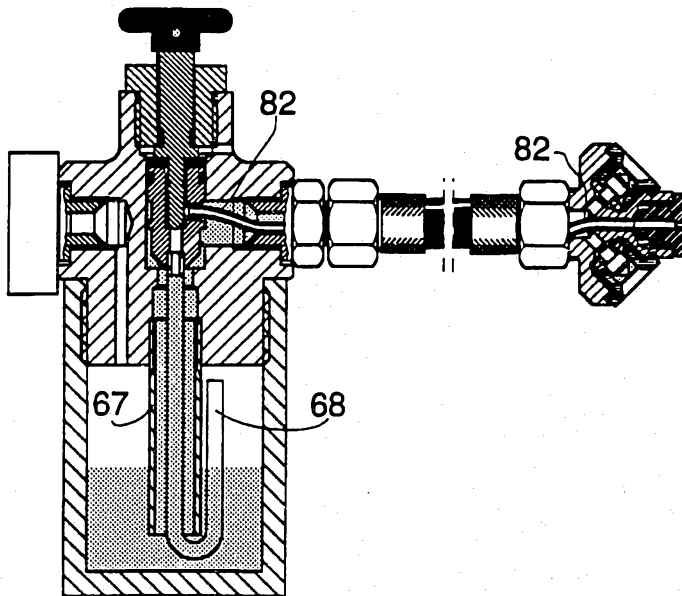


Fig. 18

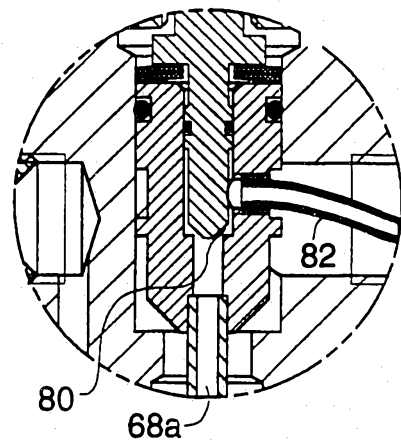


Fig. 19

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A62C 13/00, A62C 35/00

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)

IPC5: A62C

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent's abstract, No 81-J4581D/37, week 8137, ABSTRACT OF SU, 1225-585 (KWIA), 23 April 1986 (23.04.86)	1-4
Y	--	5
X	US, A, 1263291 (W.C. SCHULTZ), 16 April 1918 (16.04.18), page 1, line 33 - line 39	1
Y	--	5
Y	Derwent's abstract, No 92-182185/22, week 9222, ABSTRACT OF SU, A, 1674865 (BALGIN P G), 7 Sept 1991 (07.09.91)	5
	--	

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

12 March 1993

17-03-1993

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 92/00317

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO, A1, 9100122 (KIDDEGRAVINER LIMITED), 10 January 1991 (10.01.91), See page 1 last paragraph - page 2, first paragraph --	1
P,A	WO, A1, 9222353 (SUNDHOLM GÖRAN), 23 December 1992 (23.12.92), See especially page 9 lines 9-17 --	5-10
A	EP, A1, 0107837 (WORMALD FIRE SYSTEMS INC.), 9 May 1984 (09.05.84) -- -----	7-9

INTERNATIONAL SEARCH REPORT
Information on patent family members

26/02/93

International application No.
PCT/FI 92/00317

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 1263291	16/04/18	NONE	
WO-A1- 9100122	10/01/91	AU-A- 5832090 EP-A- 0478625	17/01/91 08/04/92
WO-A1- 9222353	23/12/92	AU-A- 1327192 WO-A- 9215370	06/10/92 17/09/92
EP-A1- 0107837	09/05/84	AU-B- 553816 AU-A- 1930783 CA-A- 1152857 US-A- 4520871	31/07/86 10/05/84 30/08/83 04/06/85
GB-A- 314490	06/03/30	NONE	
WO-A1- 9215370	17/09/92	AU-A- 1327192 WO-A- 9222353	06/10/92 23/12/92