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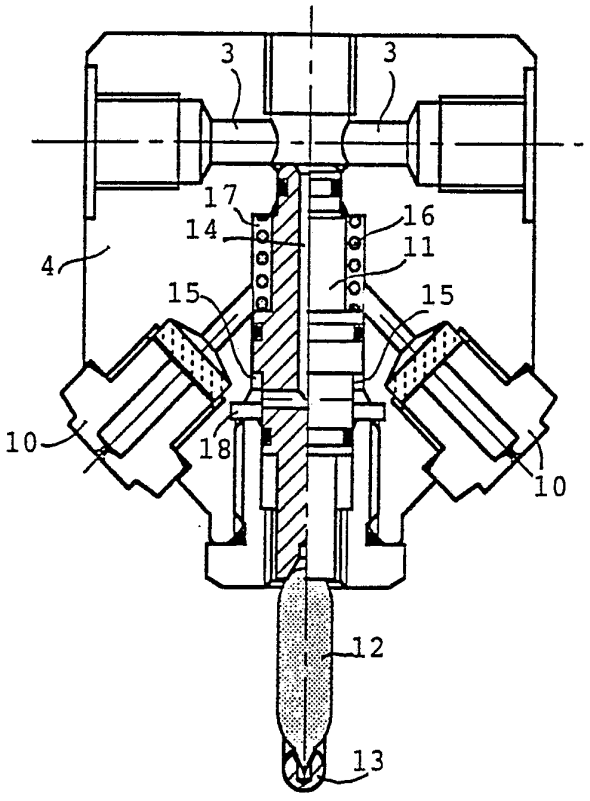
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(57) Abstract

The invention relates to a spray-head for fire fighting. The spray-head according to the invention comprises a housing having a central boring with a movable spindle (11), the spindle (11) comprising a shoulder (11a) for defining an annular space (15) between the spindle (11) and a surrounding boring wall, the annular space (15) communicating with a respective feed line (3) and having the same cross-sectional area as the end of the piston (11) subected to the liquid pressure in the line (3). A spring force (16) is arranged to act on the piston (11) in the direction of release.

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Spray-head for fighting fire

The present invention relates to a spray head for fighting fire.

Known spray heads operate at a liquid pressure of about 7 to 10 bar and require large quantities of water, wherefore the pipelines of the respective fire fighting system are inevitably large in dimensions and water damages are generally considerable.

The object of the invention is to provide a new spray head which can operate at a high liquid pressure, e.g. about 100 bar.

The spray head according to the invention, by which the above object is achieved, is mainly characterized in that it comprises a housing with a central boring in which a movable spindle is arranged; that the spindle comprises a shoulder for defining an annular space between the spindle and a surrounding boring wall; that the annular space communicates with a respective feed line and has the same cross-sectional area as the end of the piston subjected to the liquid pressure prevailing in the line, and that a spring force is arranged to act on the piston in the direction of release.

Due to said annular space, which compensates for the influence exerted on the spindle by the liquid pressure prevailing in the feed line, only said spring force acts on the release means in its inactivated state, the release means being usually a glass ampoule and does not withstand any high mechanical loads.

The high liquid pressure produces a fog-like spray of the fire fighting liquid with very small liquid drops which require a small quantity of water in relation to their fire fighting capacity and thus

the resultant water damages are insignificant in comparison with the previously known equipment. The pipe lines of the system can be considerably smaller in dimensions than what has been possible previously.

If desired, the system pressure can be kept constantly at the working pressure, which is high; preferably, however, the operating means of the system, usually a pump, is arranged to be activated to the working pressure from a considerably lower inactive rest-state pressure only after the detection of a fire.

As the spray heads are pressure compensated, the high working pressure of the fire fighting system, prevailing at least after the detection of a fire, does not lead to an undesired release in places where there is no fire; the high liquid pressure does not break the release means in question.

Similarly, if a fire breaks out in a ship cabin, it may be desirable that the spray heads in the neighbouring cabins are activated. In a preferred embodiment of the invention, the spray heads are therefore provided with a device for causing the release means to activate the spray head possibly on the basis of an advance judgement.

Existing release means usually comprise a glass ampoule containing liquid which expands on heating, or a fuse. An electric heating coil positioned about the release means is thus suitable for the purpose. The heating coil can be switched on automatically or manually.

In addition to activation as a precaution by breaking the ampoule by the heat of the coil before the temperature in the cabin does it, it is suggested that the system be provided with means for activating the heating coil positioned about the ampoule at an

early conventional alarm indication, such as a detected formation of smoke, or with some other means for switching on the equipment as early as possible in case of fire.

In this way, people sleeping in the cabin are protected from smoke poisoning, in addition to which a cabin fire can be extinguished with a smaller quantity of water.

With an explosive fire, whereby so-called over-ignition of flue gases may take place, there is a risk that the spraying of the fog-like fire fighting liquid is not able to extinguish the fire but only smother it partially. In order to ensure that the fire will be extinguished in such a case, it is suggested that the spindle of the spray head is provided with an axial, through-going boring the outlet end of which is closed with a plug such that it comes off at elevated temperature, whereafter a large quantity of liquid, e.g. about 50 l/min, can be sprayed through the axial boring.

The plug can be fixed to the spindle end by soldering with a solder material or it may be made of a solder material which melts at a relatively low temperature, such as 200°C. Alternatively, the plug may be made of a special metal which shrinks when the temperature rises; the plug is installed in position in heated state so that it is fastened in place on cooling and when the temperature rises in case of fire, the plug shrinks and falls off.

Transition from the so-called fog formation stage to the highly efficient fire-fighting may be unnecessarily retarded as the moist fog cools the lower portion of the spray head, where the fuse is positioned, the melting of the fuse being thus retarded.

To overcome this problem, it is suggested that an umbrella-like member is provided between the fog forming nozzles and the lower portion of the spray head.

The umbrella-like member not only prevents water drops from above from cooling the lower portion of the spray head but also provides the advantage that, at the beginning of a fire, it gathers the warm upwardly rising air against the ampoule, the melting of which initiates the first fire fighting stage, that is, the so-called fog-formation stage.

The invention also relates to a fire fighting system comprising at least one main line which is fed by a pump and from which branches extend to individual spray heads of the described construction. The system is characterized in

that the main line is dual;

that a circulation pump is connected to the dual main line for optional flushing of the equipment in the rest state; and

that the dual main line is arranged to be connected in parallel on the activation of the liquid pressure.

In the following the invention will be described with reference to the embodiments shown in the attached drawing.

Figures 1 and 2 are schematic views of two embodiments of a fire fighting system.

Figures 3 and 4 show a spray head housing and a detached spindle, respectively.

Figures 5 and 6 are sectional views of an individual spray head in rest state.

Figures 7 and 8 show the spray head in activated state.

Figure 9 shows an alternative embodiment of a

spray head similarly in section and in the same state as in Figure 4.

Figure 10 shows the spray head shown in Figure 4 in a section at right angles to the section shown in Figure 4.

Figure 11 shows a spray head from the nozzle side.

Figure 12 shows a preferred way of installing a spray head.

Figure 13 shows an embodiment with the heating coil positioned about the release means.

Figure 14 shows a further alternative embodiment of the spray head in inactivated state.

Figure 15 shows the embodiment of Figure 12 when spraying fog-like fighting liquid.

Figure 16 shows the same embodiment with increased spraying of fire fighting liquid.

Figures 17 and 18 and Figure 19 show two alternatives for closing the axial boring of the valve piston.

Figure 20 shows an embodiment with an umbrella-like member in a position before a fire.

Figure 21 shows the situation after a fire has broken out at the fire fighting stage called fog-formation.

In the embodiment shown in Figure 1, a so-called single-line system, the reference numeral 1 indicates a main feed line of a fire fighting system, with a diameter of e.g. 30 mm, and 2 indicates its inlet line, 3 indicates branch lines with a diameter of e.g. 10 mm, extending from the main line to a spray head 4.

The main line 1 is fed by a pump 5 having a pressure capacity of e.g. 100 bar, which is used only when fire fighting is needed; in a state of readiness

or rest state, nonreturn valves 6 and 7 together with an overflow valve 8 take care that a pressure of only e.g. 7 bar prevails in the main line.

The embodiment shown in Figure 2, a so-called two-line system, comprises a dual main line 1a, 1b, and a second feed pump 9 with a working pressure of e.g. 10 bar. In the state of readiness or rest state, the pump 9 can be used for creating a flushing liquid flow with an addition of desired chemicals through the system so as to prevent the accumulation of impurities, the line 1a acting as a feed line and the line 1b as a return line. When fire fighting is needed, the high-pressure pump 5 is switched on so that both the line 1a and the line 1b (diameter e.g. 20 mm) act as a main feed line while the line 2 acts as an inlet line, as in Figure 1.

In Figures 3 to 8, 3 and 4 indicate, similarly as above, liquid pipes and a spray head. The individual nozzles of the spray head are indicated with 10.

Figures 3 and 4 show a spray head housing and a spindle, respectively, when apart from each other. Figure 4 shows a shoulder 11a of the spindle 11 for forming an annular space 15 between the spindle 11 and the wall of the boring.

The spindle 11 is positioned in a boring extending from the pipe 3 toward the nozzles 10, and its outer end bears against a release means 12 which melts/breaks at a predetermined temperature and which bears against a retainer loop 13.

An axial boring 14 extends through the spindle 11 to the annular space 15, the cross-sectional area of which is as large as the cross-sectional area of an end of the spindle 11 which is positioned close to the liquid pipe and on which the liquid pressure

acts. In an inactivated state, the liquid pressure prevailing in the line 3 will not, irrespective of the pressure value, press the spindle 11 against the release means 12, which is relatively weak mechanically. Only the springs 16 in the annular space 17 press the spindle 11 against the means 12 in the rest state.

After the release means 12 has melted or broken, Figures 7 and 8, the spring 16 forces the spindle outward until a connection from the line 3 to the annular space 17 of the spring 16 opens past the spindle end, whereafter the liquid pressure, e.g. 100 bar, dominates and forces the spindle more rapidly onward. The annular space 18 dampens the movement when the transverse boring of the annular space 15 reaches a conical surface 19. The annular space 17 communicates with the nozzles 10.

Due to the annular compensation space 15 the high liquid pressure does not break the release means 12 in such spray heads of the system where there is no need of fire extinguishing.

As appears from Figures 6 and 8, the inner end of the annular space 17 close to the line 3 preferably communicates by means of a conduit 20 and a space 21 with a pressure switch 22 which is preferably arranged to be switched on at a pressure less than 1 bar, e.g. at 0.1 bar, thus activating the liquid pressure in the line 3.

The system usually comprises alarm gauges responsive to smoke or temperature. The pressure switch 22 can be utilized either so that it may alone activate the liquid pressure when the alarm gauge does not respond and the means 12 melts, or so that the activation of the liquid pressure requires both an alarm from the smoke indicator and the pressure

switch to be switched on, so that unnecessary water damages can be avoided if the means 12 is broken by mistake.

An air bleeding valve is indicated with 23; air pockets possibly remaining in the system after installation may cause damage on activation on account of the high liquid pressure.

In the embodiment shown in Figure 9, the outer end of the spindle 11 is provided with a bevel cutting 24 against which the end of a screw 25 can be driven, whereafter, if required, the release means 12 and the loop 13 can be removed for maintenance, for instance. In Figure 10, 26 indicates the attachment of the loop 13 to the spray head.

In Figure 11, 46 indicates an electric heating coil fitted around the release means 12, and 41 indicates a protection cap with openings allowing the entrance of ambient air.

In Figure 12, 30 indicates the visible inner ceiling which usually is not able to carry the spray head and pipes. These are attached to the load-bearing ceiling through a collared pipe section 31 by means of a flange 32 and through-going fastening bolts 33. The spray head is attached to the pipe section 31 by means of bolts 35. Slits 34 enable installation in the vertical direction.

In the case of a so-called normal fire, the above-described embodiments suffice for fog-like spray of the fire fighting liquid. The fog has a good fire extinguishing effect e.g. as the formation of steam binds large amounts of heat and oxygen is absorbed from the air.

However, so-called over-ignition may sometimes take place, i.e. the flue gases flare up with a resultant explosive fire. Fog alone is not able to

extinguish this type of fire but only smothers it partly. This problem will be discussed below with reference to Figures 14 to 19.

In Figures 14 to 19, the valve spindle of the spray head is indicated with 51; its release means comprising a glass ampoule is indicated with 52; and a protection cap surrounding the ampoule and supporting it from the below is indicated with 53. An axial boring through the spindle 51 is indicated with 54. As distinct from the embodiments shown in Figures 5 to 11, the axial boring 54 runs through the entire spindle 51, so that the outer end of the boring 54 is provided with a plug against which the ampoule 52 bears. In Figures 14 to 16, the plug is indicated with 55, in Figures 17 and 18 with 56, and in Figure 19 with 57.

In Figure 14, the spray head is in an inactivated state similarly as in Figures 5, 6 and 11. In Figure 15, the release ampoule 52 has broken and fog-like fire fighting liquid is sprayed through the spray head nozzles similarly as in Figures 7 and 8. The amount of high-pressure water is typically about 2 to 3 litres/minute. However, if so-called over-ignition takes place, and the fog shown in Figure 15 is able to only partially smother the fire, the temperature keeps rising. Preferably, the plug 55 is fixed by soldering with a solder material which melts at e.g. about 200°C, so that the plug 55 comes off when this temperature is reached, and the boring 54 through the valve spindle 51 opens, and so the high-pressure water may flow out into the protection caps 53 having openings 58 through which the water is distributed in the same way as in a conventional spray head system, i.e. in an amount of about 50 litres/minute. Fire fighting with fog is continued

simultaneously. Figure 16 shows this situation. In Figures 17 and 18, the plug 56 is arranged essentially in the same way as the plug 55 but it is smaller and simpler in structure. In Figure 19, the plug 57 is entirely of a solder material. In place of soldering, it might be possible to make the plug of a metal that shrinks with rising temperature.

The combination of two systems shown in Figures 14 to 19 improves the fire extinguishing effect and the total capacity of the system. Also, the demand of water and the size of the pipelines is only a fraction of those required in conventional spray head systems; it is highly probable that over-ignition occurs at several points simultaneously. In case of a normal fire, extinguishing with fog is adequate.

Transition from the so-called fog formation stage to the highly effective fire fighting can be delayed unnecessarily as the moist fog cools the lower portion of the spray head, where the fuse is disposed, thus delaying the melting of the fuse.

To solve this problem, it is suggested that an umbrella-like member is provided between the fog formation nozzles and the lower portion of the spray head.

In Figure 20, the ampoule is intact. When a fire breaks out, hot air rises up toward the umbrella-like member between the fog formation nozzles and the lower portion of the spray head, where not only the ampoule but also a fuse of e.g. a solder material, is positioned. The umbrella-like member leads the hot air against the ampoule and causes it to be broken rapidly.

In Figure 21, the fire fighting is in progress through so-called fog formation via the nozzles. The umbrella-like member prevents the fog drops from

cooling the lower portion of the spray head; if the fog formation is inadequate to extinguish the fire, the plug of solder material melts rapidly, whereafter the highly effective fire fighting is initiated by direct spraying of water through the lower portion of the spray head, as described above.

Claims:

1. A spray head for fire fighting, c h a ra c - t e r i z e d in that it comprises a housing with a central boring in which a movable spindle (11) is arranged;

that the spindle (11) comprises a shoulder (11a) for defining an annular space (15) between the spindle (11) and a surrounding boring wall;

that the annular space (15) communicates with a respective feed line (3) and has the same cross-sectional area as the end of the piston (11) subjected to the liquid pressure prevailing in the line (3), and

that a spring force (16) is arranged to act on the piston (11) in the direction of release.

2. A spray head according to claim 1, c h a r - a c t e r i z e d in that the annular space (15) communicates with the feed line (3) by means of an axial conduit (14) provided in the spindle (11).

3. A spray head according to claim 1, c h a r - a c t e r i z e d in that the spring force is arranged to be effected by a spiral spring (16) in an annular space (17) communicating with sprinkler nozzles (10).

4. A spray head according to claim 3, c h a r - a c t e r i z e d in that the annular space (17) communicates with a pressure switch (22).

5. A spray head according to claim 1, c h a r a c t e r i z e d in that the spindle (11) and the surrounding boring have a mutual configuration (18, 19) for dampening the movement of the piston.

6. A spray head according to claim 1 and 4, c h a r a c t e r i z e d in that the liquid

pressure is arranged to be activated on the release of the pressure switch (22).

7. A spray head according to claim 1 and 4, c h a r a c t e r i z e d in that the liquid pressure is arranged to be activated after the release of the pressure switch (22) and on any other indication known *per se*, such as a smoke alarm.

8. A spray head according to claim 2, c h a r a c t e r i z e d in that an air bleeding valve (23) is arranged in communication with the axial conduit (14) of the spindle (11).

9. A spray head according to claim 2, c h a r a c t e r i z e d in that a shoulder (24) is provided at the outer end of the piston (11) for optional contact with a retainer screw (25) or the like.

10. A spray head according to claim 1, c h a r a c t e r i z e d in

that a spindle (51) comprises an axial boring (54) extending through it and communicating with the feed line, the axial boring being provided at its outer end with a plug (55, 56, 57) positioned in contact with release means (52); and

that the plug (55, 56, 57) is arranged to come off the end of the boring (54) at a temperature higher than the release temperature of the release means (52).

11. A spray head according to claim 1, c h a r a c t e r i z e d by an electric heating coil (46) provided around the release means (12).

12. A spray head according to claim 1 and 10, c h a r a c t e r i z e d in that the axial boring (54) extending through the spindle (51) also communicates with said annular space (15).

13. A spray head according to claim 10,

characterized in that the plug (55, 56) is fixed by soldering to the outer end of the axial boring (54) with a solder material arranged to melt at a predetermined temperature, preferably at a temperature of about 200°C.

14. A spray head according to claim 10, characterized in that the plug (57) is made of a solder material arranged to melt at a predetermined temperature, preferably at a temperature of about 200°C.

15. A spray head according to claim 10, characterized in that the plug is made of a material which shrinks with rising temperature.

16. A fire fighting system, characterized in that it comprises at least one main line fed by a pump, from which branches extend to sprinklers comprising a movable spindle in contact with a release means (1) in the rest state, the sprinkler spindle comprising an axial boring extending through it and communicating with the feed line, the outer end of said boring being provided with a plug (3) in contact with the release means and arranged to come off from the boring end at a temperature higher than the release temperature of the release means (1), and an umbrella-like member (4) is provided between the fog formation nozzles (2) and the lower portion of the sprinkler, where a primary release ampoule (1) or the like and a secondary release fuse (3) are positioned.

FIG. 1

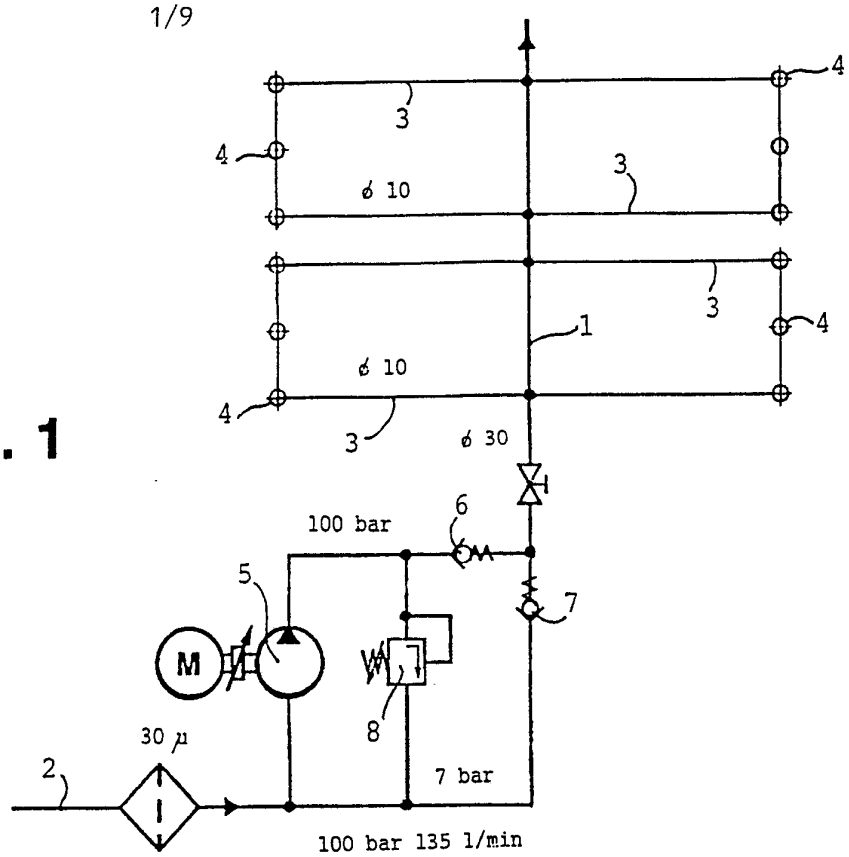
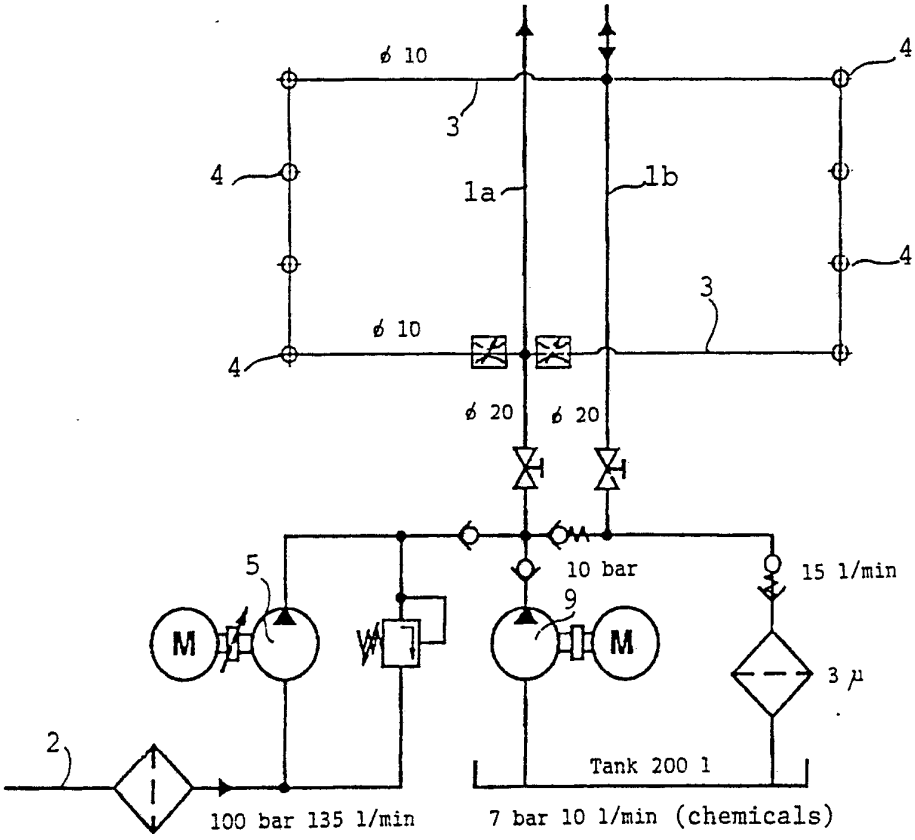

4
3
4
ø 10
3
3
4
1
ø 10
4
3
ø 30
100 bar
6
5
7
M
8
30 µ
2
7 bar
100 bar 135 l/min

FIG. 2


ø 10
4
3
4
1a
1b
4
3
ø 10
4
ø 20
ø 20
5
10 bar
15 l/min
9
M
M
3 µ
2
Tank 200 l
100 bar 135 l/min
7 bar 10 l/min (chemicals)

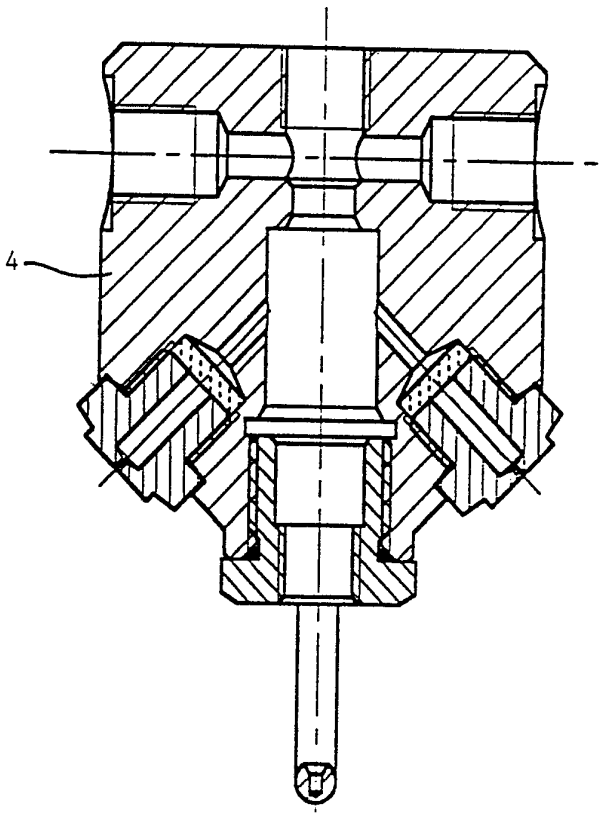


FIG. 3

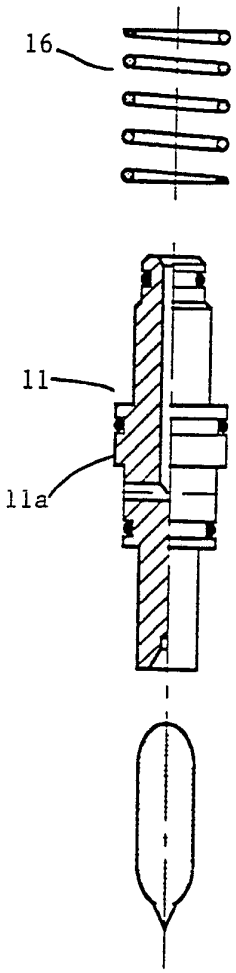


FIG. 4

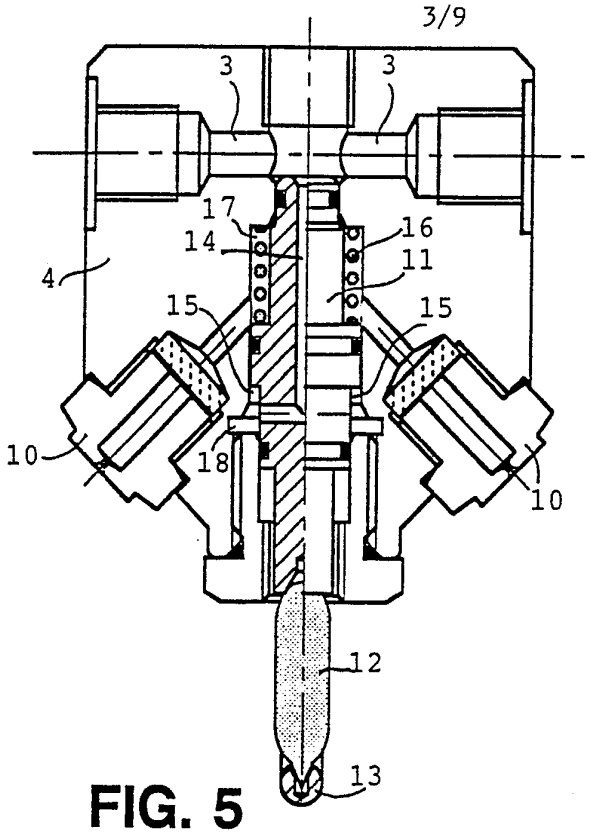


FIG. 5

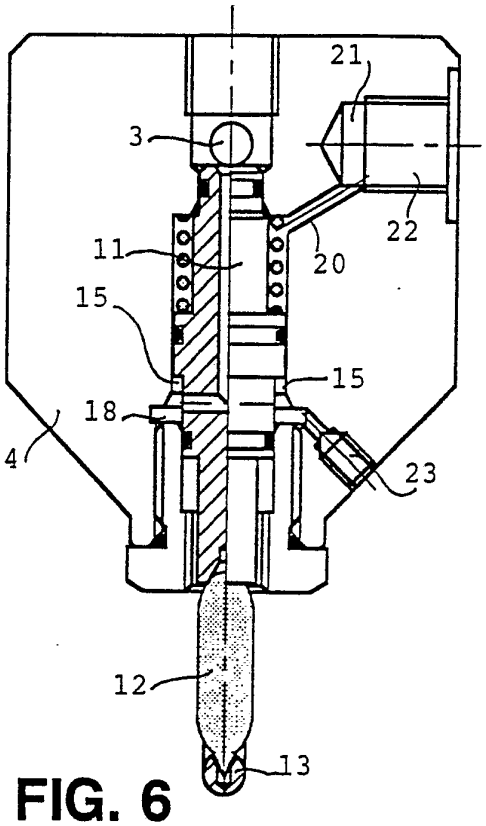


FIG. 6

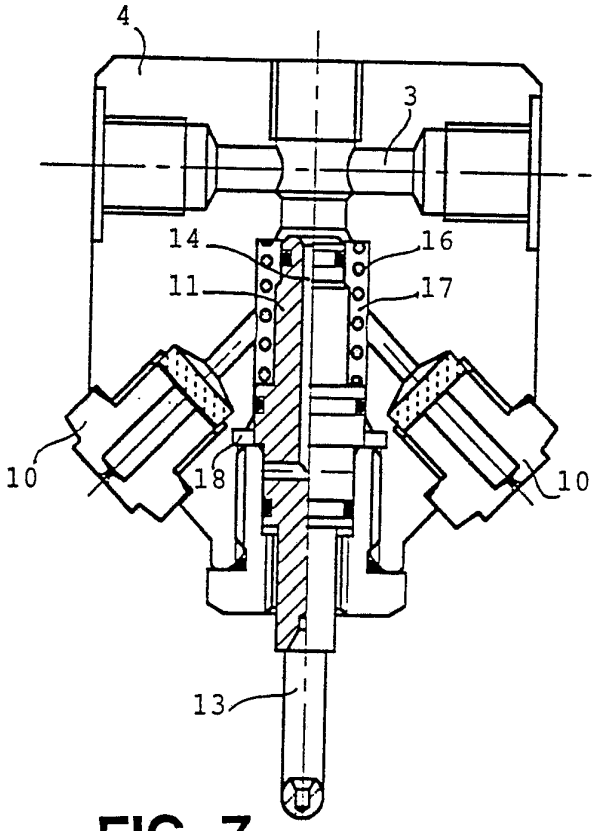


FIG. 7

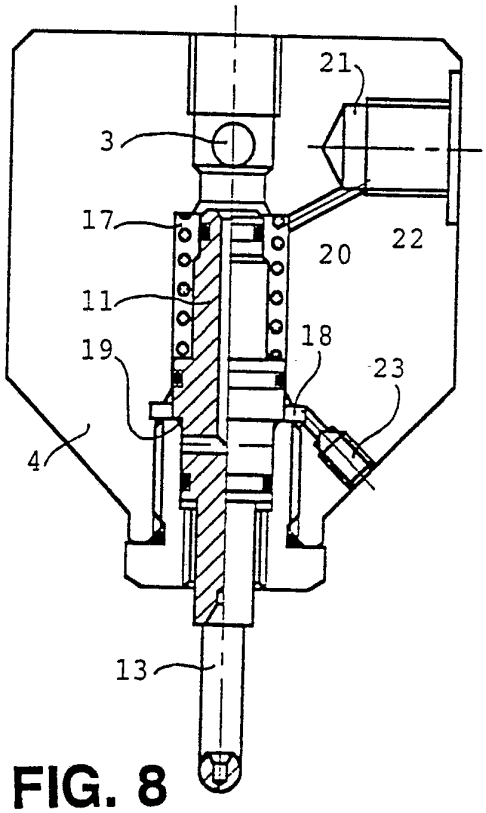


FIG. 8

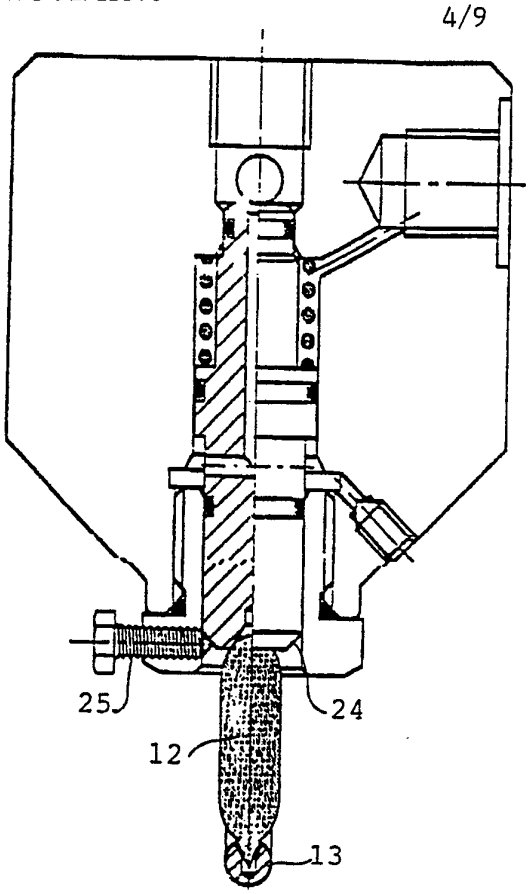


FIG. 9

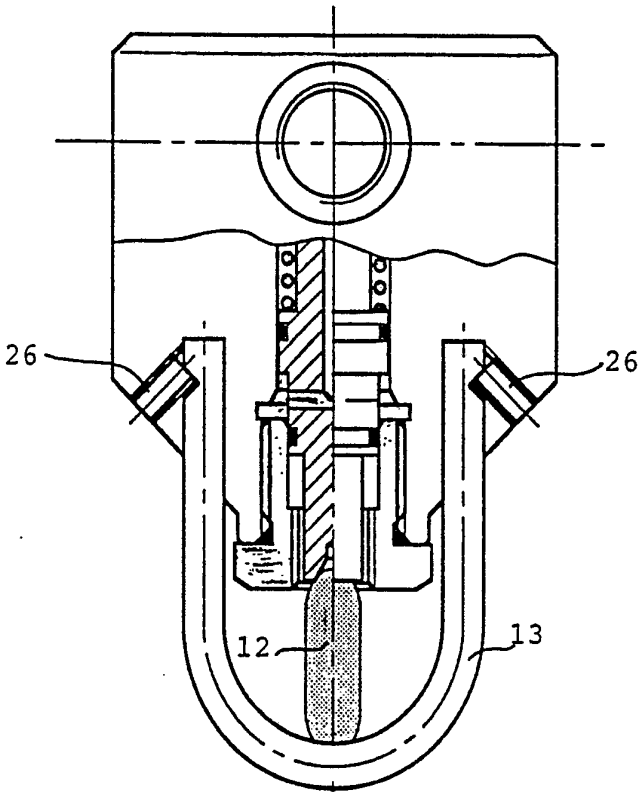


FIG. 10

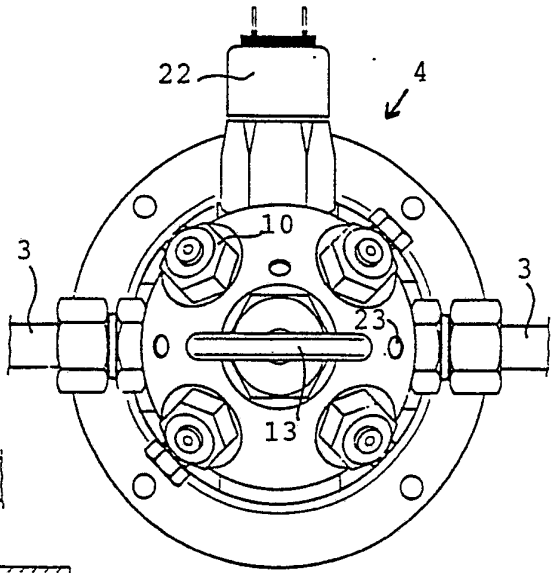
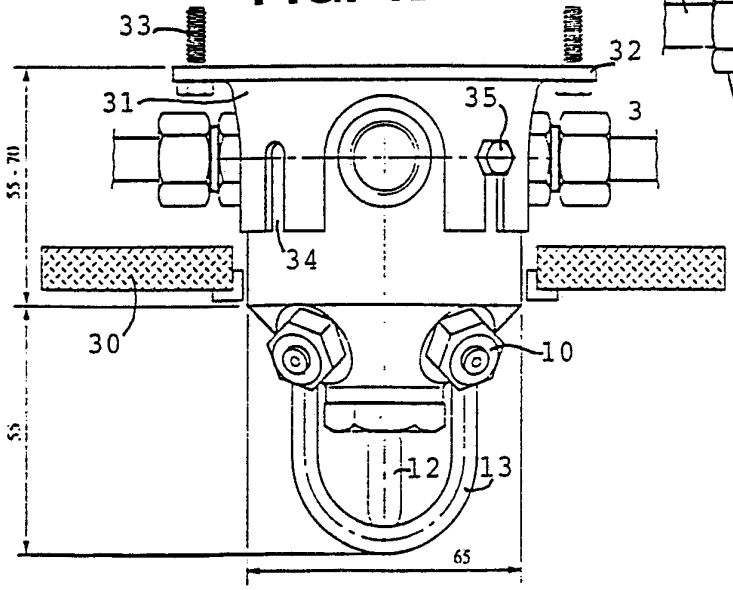


FIG. 11

FIG. 12



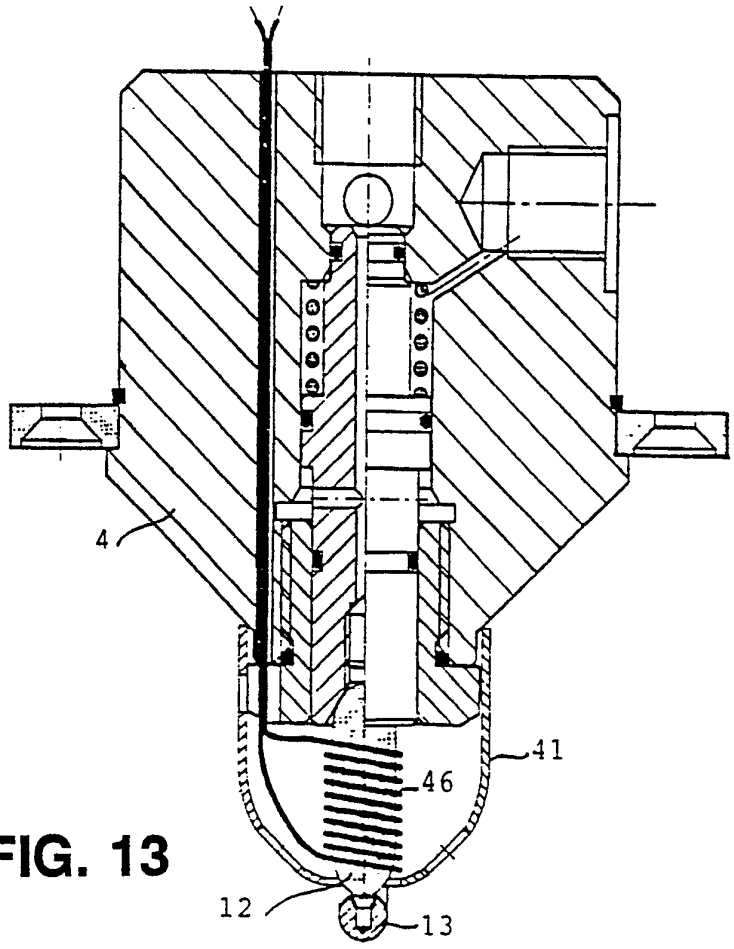


FIG. 13

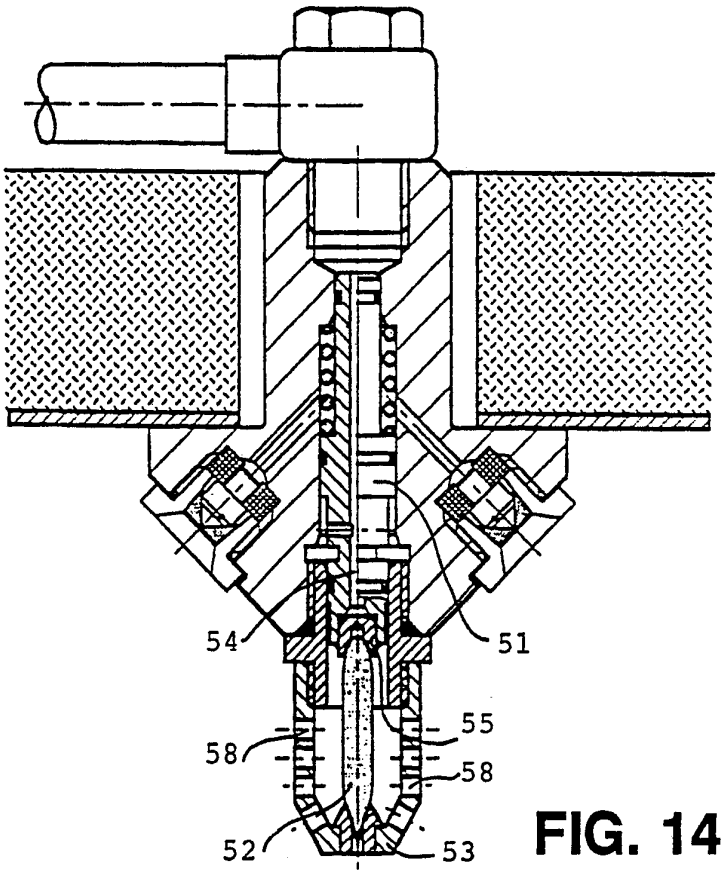


FIG. 14

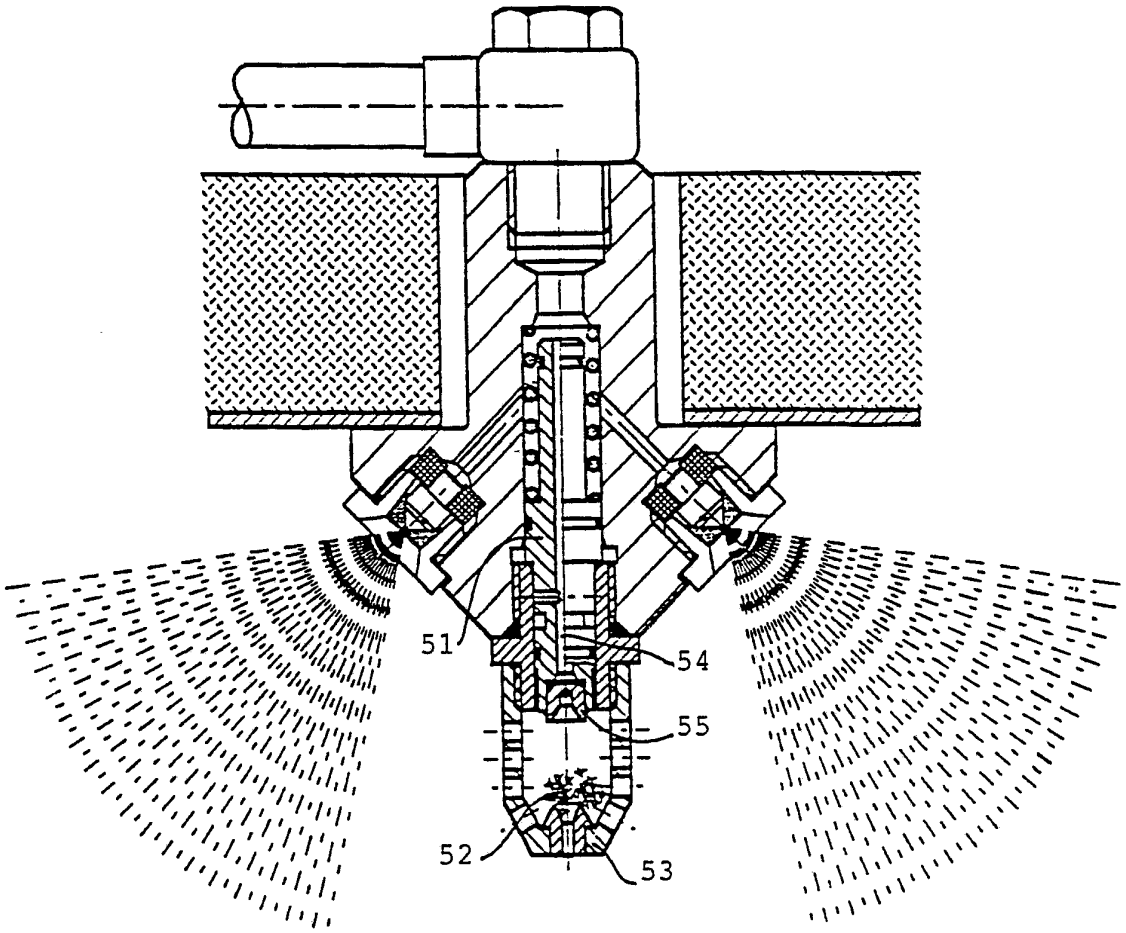


FIG. 15

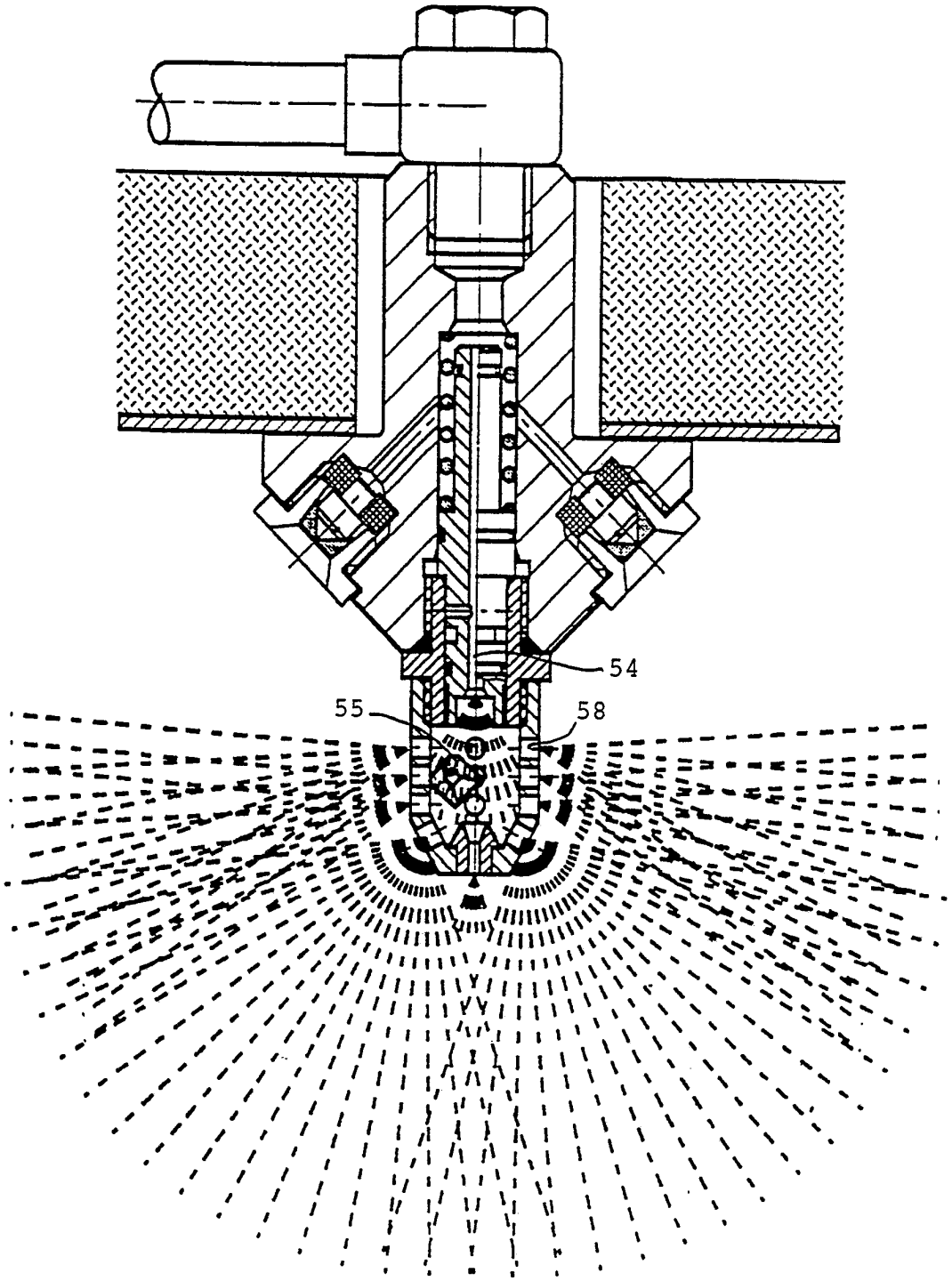


FIG. 16

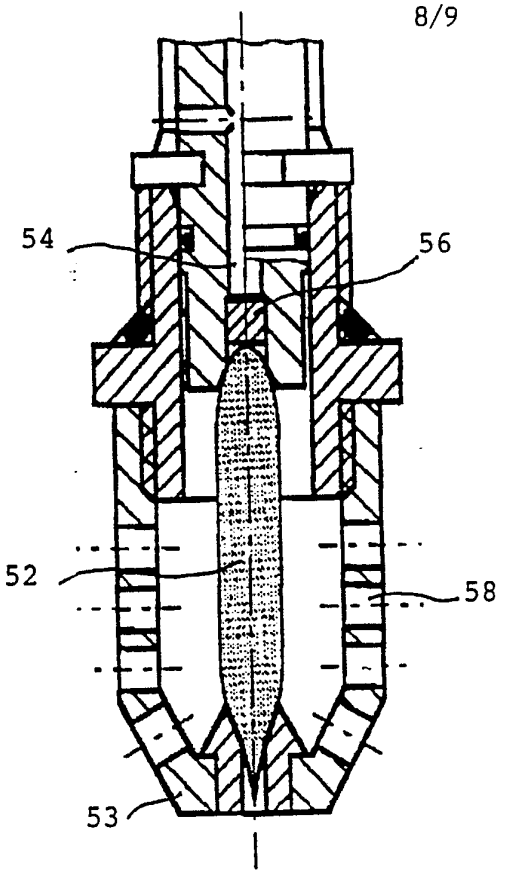


FIG. 17

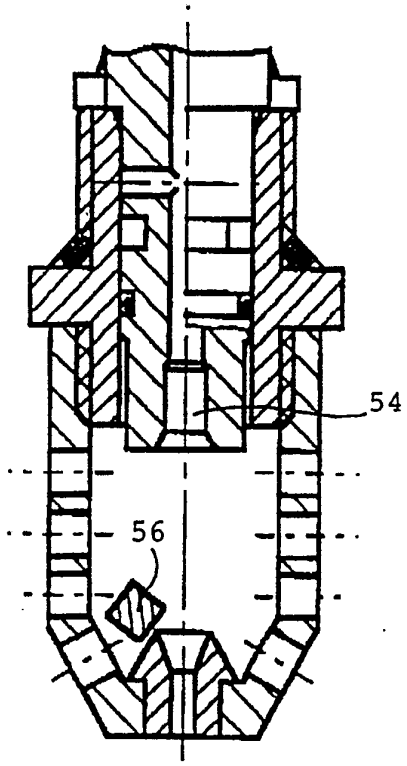


FIG. 18

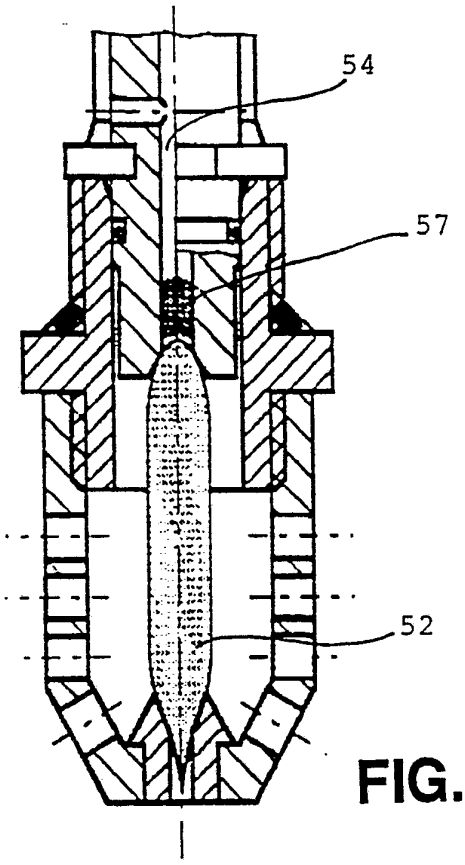


FIG. 19

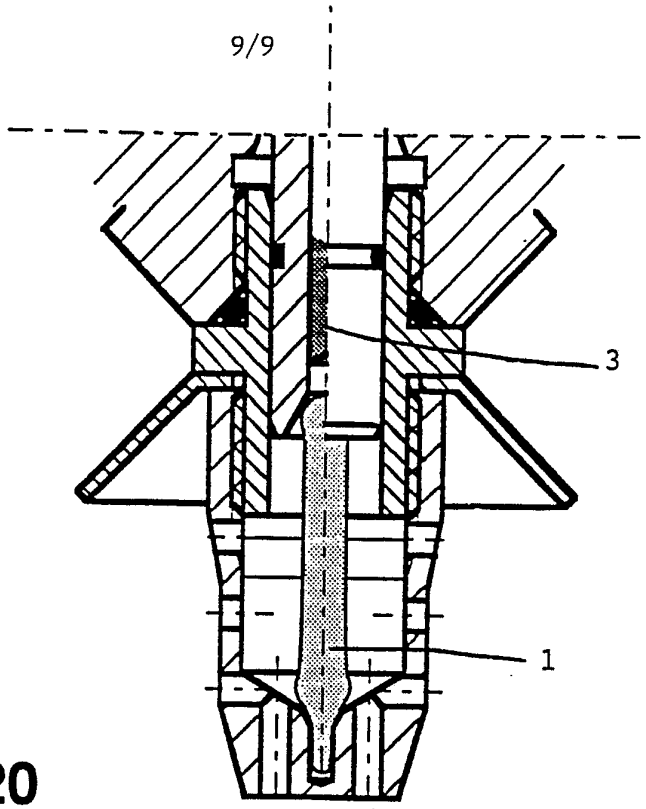


FIG. 20

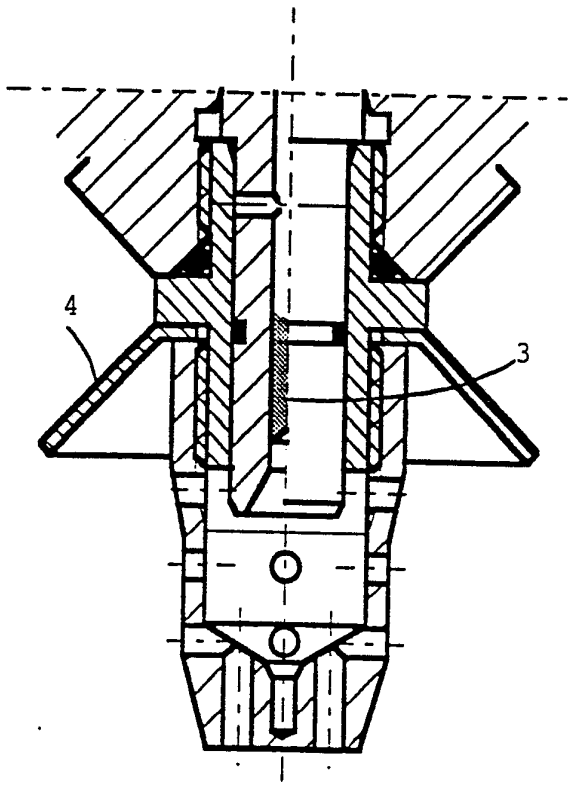


FIG. 21

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00060

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 62 C 37/10

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 62 C; F 16 K

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	US, A, 4434855 (GIVEN, JR.) 6 March 1984, see the whole document --	1
A	EP, A1, 0033062 (RUIZ, ALFONSO CALVO) 5 August 1981, see the whole document --	1

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* Special categories of cited documents: [10]

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

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"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

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
10th June 1992	1992 -06- 11
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Ulrika Drangel

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/FI 92/00060

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 30/04/92
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 4434855	84-03-06	NONE		
EP-A1- 0033062	81-08-05	DE-A-	3036140	81-07-09
		JP-A-	56156572	81-12-03