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Method for fighting fire

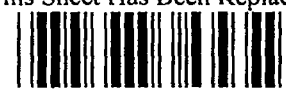
5 The present invention relates to a method for fighting fire, in which method extinguishing liquid is delivered to at least one spray head, preferably a plu-
rality of spray heads, by means of a drive unit compris-
ing at least one hydraulic accumulator containing pro-
pellent gas chargeable up to a high initial pressure as
well as a low-pressure water pump.

10 One advantage of using hydraulic accumulators in fire fighting equipments is a reduced dependence on availability of electric current for pump functions re-
quiring energy. The problem is serious especially in
ships and units comparable with them, in which the elec-
15 tric main system including the main generator is often put out of function in case of fires, and the emergency generator set, if existing, has an unsufficient effect for practically whichever pump functions.

20 In case hydraulic accumulators are used, efficient fire fighting usually presupposes a high charging pressure, preferably up to 200 to 300 bar, in the hy-
draulic accumulators. For securing the function of the fire fighting equipment in an intended way, predeter-
mined stages with relatively low driving pressure, e.g.
25 10 to 30 bar, should preferably also be included in the procedure, however. An example of such a stage is an initial cooling of the pipe system and especially the
sprinklers or spray heads which before release have been heated by the fire broken out.

30 The object of the invention is to attend also to necessary low-pressure functions in a novel way by means of a high-pressure drive unit having one or sev-
eral hydraulic accumulators, in order to achieve a mini-
mum dependence on availability of electric energy.

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The purpose of the invention is mainly that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump.

5 A preferred procedure is that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump, in order to refill the hydraulic accumulators with liquid and to spray simulta-
10 neously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

Alternatively, it is in many cases of advantage
15 that part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads and that the remaining propellant gas is then utilized for driv-
20 ing the low-pressure pump, in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have
25 been filled.

According to a further-developed embodiment of the invention, the delivery of high-pressure liquid is delayed initially when the drive unit is switched on, during which delay stage gas is led preferably via a
30 pressure reducing valve to drive the low-pressure pump for delivering cooling liquid to the pipe system and sprinklers and/or spray heads in question, and at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is
35 utilized for redriving the low-pressure pump.



The delivery of high-pressure liquid is preferably delayed by leading the propellant gas from said at least one hydraulic accumulator to empty a liquid cylinder so that the liquid driven out of the cylinder affects, before passing a throttle, a spindle of a valve arranged in an outlet line of said at least one hydraulic accumulator in a direction closing the valve. Hereby the spindle surface affected by the pressure of said cylinder liquid is larger than the spindle surface affected by the outgoing liquid pressure of said at least one hydraulic accumulator, which pressure strives to open the valve, so that the valve is not opened until all liquid has been driven out of the cylinder and its pressure has sunk over the throttle to a level lower than the outgoing liquid pressure of said at least one hydraulic accumulator in a proportion equal to the proportion between said two spindle surfaces of the valve.

The opening time of the valve can be adjusted by means of said throttle.

Upon opening the valve, the liquid pressure affecting the valve spindle via the throttle is preferably allowed to sink preferably via an overflow valve to a predeterminable value, for adjusting the pressure at which the valve is closed again.

The propellant gas being left over after the hydraulic accumulators have been emptied is preferably utilized for redriving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

Particularly in equipments for fighting fires in engine rooms of ships, it is of advantage that part of the propellant gas being left over after the hydraulic



lic accumulators have been emptied is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads and the remaining propellant gas is then utilized for redriving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

In engine rooms of ships, it is also desirable that, at least during the initial stage with delayed delivery of high-pressure liquid and during the stage after the hydraulic accumulators have been emptied of liquid, gas, preferably propellant gas, is led from said at least one hydraulic accumulator into a bilge space of the engine room. Gas from a separate source can alternatively be utilized.

All functions described above can be realized, if necessary, without available electric energy. By means of suitable dimensioning, it is possible to carry out an emptying and filling cycle during approximately 2 x 15 minutes.

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

Figure 1 shows a basic embodiment of a fire fighting equipment according to the invention.

Figure 2 shows a further-developed embodiment having a higher capacity than the embodiment of Figure 1.

In Figure 1, an engine room is indicated by reference numeral 1, the floor of the engine room is indicated by 2, a bilge space below the floor is indicated by 3 and the engine in question, e.g. a diesel engine, is indicated by 4. Up to the ceiling of the



engine room are positioned a number of sprinklers or spray heads 5 and on the floor level are positioned a number of spray heads and/or sprinklers 6 directed upwards and a number of nozzle heads 7 directed downwards, into the bilge space 3.

5 A drive unit for delivering extinguishing liquid and/or extinguishing gas is indicated by 8. An outgoing liquid line 9 of the drive unit 8 can be connected selectively with separate fire zones; the engine
10 room 1 constitutes a fire zone comprising a feederline 10 to the spray heads 5 at the ceiling of the engine room and a branching 11 to the spray heads 6, 7 at the engine room floor 2.

The drive unit 8 comprises two pressure gas
15 containers 12 and 13 having an initial charging pressure of e.g. 200 bar and automatically or manually controllable outlet valves for leading pressure gas into and driving extinguishing liquid out of two liquid containers 14 through the line 9. The pressure gas containers
20 12 may be constituted by so-called standard gas bottles. The extinguishing liquid from the containers 14 is arranged to flow into the line 9 via a valve 15, the opening of which effected by the liquid pressure is, however, counteracted by a liquid cylinder 16, arranged in
25 connection with the propellant gas pressure, in combination with a throttle 17, which shall be described in greater detail below.

A common outlet line 18 of the propellant gas containers 12 and 13 is connected, besides to the liquid
30 containers 14, also to a low-pressure water pump 19, 20, where 19 indicates a pneumatic driving motor for the actual water pump 20 having an operating pressure of e.g. about 16 bar via a pressure reducing valve 21, which may be adjusted for 10 bar. It is alternatively
35 possible to use a low-pressure pump of another type,



e.g. a double-acting piston pump. The pump 20 sucks water from a sweet water container via a line 22 or e.g. sea or lake water, alternatively. The water is filtered by means of filters 23 and 24 to a particle level of 10 μ , for instance. Occurring variations in pressure may be balanced by means of an accumulator not shown in Figure 1.

Figure 1 shows the equipment ready for being used. The pressure bottles 12 and 13 are filled with propellant gas, having a pressure of e.g. 200 bar, and the liquid bottles 14 are filled with water, as is the liquid cylinder 16, the filled liquid space of which is indicated by 25. A spring 27, which may be relatively weak, keeps the spindle 26 of the valve 15 in the shown position closing the valve.

When a fire is detected, one of the propellant gas containers, e.g. the container 12, is switched on at first, whereby the gas strives to drive the liquid out of the containers 14 via the valve 15 to the outlet line 9 by pressing up the valve spindle 26 from the position of Figure 1 under the influence of the liquid pressure.

However, the same gas pressure also acts on a membrane 28 of the liquid cylinder 16, which membrane may also be a piston, and therefore presses the liquid 25 out partly via the throttle 17 and a subsequent non-return valve 29 into the line 9, but partly also towards the spindle 26 of the valve 15 against the effect of the liquid pressure from the containers 14. As shown schematically in the drawing, by making the spindle 26 surface affected by the pressure of the cylinder liquid 25 larger than the spindle 26 surface affected by the equally high pressure of the extinguishing liquid of the containers 14, e.g. in the proportion 2,5:1, the valve 15 will remain closed until the liquid 25 has been



pressed out of the cylinder 16 entirely and its pressure has subsequently sunk via the throttle 17 to about 40 bar in the present example case, whereby the extinguishing liquid is able to press away the spindle 26 of the valve 15.

During the just-described initial stage, the length of which may be adjusted as desired by means of the throttle 17, the pressure gas drives, however, via the line 18 and the pressure reducing valve 21 the pump 20 delivering liquid via its outlet line 30, having the filter 24 and a non-return valve 31 after filler branching to the containers 14, to the outlet line 9 of the drive unit 8 over the non-return valves 29 and 31, for an initial cooling of at least the spray heads 5 and the parts of the line 10 which extend in the engine room 1. The pressure of the cylinder liquid 25 after the throttle 17 is lower than the outlet pressure of the pump 20. Additionally, the pneumatic motor 19 can deliver gas via an outlet line 32 to the nozzles 7 in the bilge space 3 of the engine room 1.

Upon opening the valve 15, the driving of the extinguishing liquid out of the containers 14 will begin and the pump 20 stops when the non-return valves 29 and 31 are closed. Excess liquid pressed by the valve 15 into the line space around the throttle 17 is allowed to flow out through an overflow valve 33, which may be adjusted for e.g. 16 bar. The gas container 12 and the liquid containers 14 can be dimensioned for instance in such a way that, with the containers 14 emptied of liquid, a gas pressure of about 80 bar prevails in them and in the container 12. Gas will then continue flowing out after the liquid through the line 9 until the pressure has sunk so much that the pressure in the space around the throttle 17 is able to close the valve 15. If the last-mentioned pressure is about 16 bar, the



valve 15 is closed at a pressure of about 40 bar in the containers 14, and subsequently, the remaining gas in the containers 12 and 14 continues driving the pump 20.

5 The pump 20 now refills the containers 14 with water. If the overflow valve 33 is adjusted to a value somewhat higher than the outlet pressure of the pump 20, liquid is delivered also to the outlet line 9 exactly in the same way as during the initial stage described previously, and simultaneously, the cylinder 16 is re-
10 filled with water. When the containers 14 have been filled, the procedure can be repeated by switching on the other pressure gas container 13.

Both during the initial stage and during the liquid filling stage, the pneumatic motor 19 can also
15 deliver propellant gas, say nitrogen or argon gas, via a gas line 32 extending from the motor 19 and via the nozzles 7 to the bilge space 3 of the engine room.

Figure 2 shows an embodiment of the invention for a fire fighting equipment having a higher capacity, e.g. a car ferry. Figure 2 shows two high-pressure units
20 38 and 38a, each of them comprising four pressure gas containers 42, which can be constituted by so-called standard gas bottles as in Figure 1, and four liquid containers 44. A common outlet line 39 can be connected
25 for instance to a number of fire zones in a sprinkler system, to a number of fire zones on car deck and to a number of fire zones in the engine room and cargo hold. The common outgoing gas line of low-pressure pumps 50 of the drive units 38 and 38a is connected to corre-
30 sponding fire zones in the engine room and cargo hold in principle in the same way as shown in Figure 1.

The embodiment according to Figure 2 works essentially in the same way as the embodiment of Figure 1. The initial stage with delayed liquid delivery occurs
35 in the same way as in Figure 1, with the same combina-



tion of valve 45, liquid cylinder 46, throttle 47 and overflow valve 63, and subsequently, the units 38 and 38a, respectively, are emptied of liquid alternately one after the other or simultaneously, if necessary, and the propellant gas being left over after the emptying continues driving the corresponding pumps 50. The number of gas containers 42 and water containers 44 connected in each case may be varied as desired. For instance, a gas bottle together with four water bottles can be used for sprinkler systems and two gas bottles together with four water bottles can be used for engine rooms, etc.

The drive unit 38, which is supposed to be the first to be activated, comprises a separate pressure gas container 64, which can be connected to the pump 50 via a pressure reducing valve adjusted e.g. for 6 bar, in order to maintain preferably a low liquid pressure in the sprinkler system during the activated state of the equipment. When there is a flow in some part of the sprinkler system, a flow indicator 65 generates a signal in a corresponding section valve 66, upon which signal the drive units are activated.

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Patentkrav:

1. A method for fighting fire, in which method extinguishing liquid is delivered to at least one spray head, preferably a plurality of spray heads, by means of a drive unit comprising at least one hydraulic accumulator (12, 13, 14) containing propellant gas chargeable up to a high initial pressure as well as a low-pressure water pump (19, 20), c h a r a c t e r -
i z e d i n

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump.

2. A method according to claim 1, c h a r -
a c t e r i z e d i n

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas

so that the procedure can be repeated after the hydraulic accumulators have been filled.

3. A method according to claim 1, c h a r -
a c t e r i z e d i n

that part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads (5),

that the remaining propellant gas is then utilized for driving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray





simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas

so that the procedure can be repeated after the hydraulic accumulators have been filled.

5 4. A method according to claim 1, c h a r -
a c t e r i z e d i n

that the delivery of high-pressure liquid is initially delayed when the drive unit (8) is switched on, during which delay stage gas is led preferably via
10 a pressure reducing valve to drive the low-pressure pump for delivering cooling liquid to a pipe system (10) and sprinklers and/or spray heads (5) in question, and

that at least part of the propellant gas being left over after the hydraulic accumulators have been
15 emptied of liquid is utilized for redriving the low-pressure pump.

5. A method according to claim 4, c h a r -
a c t e r i z e d i n

that the delivery of high-pressure liquid is initially delayed when the drive unit (8) is switched
20 on, by leading the propellant gas of said at least one hydraulic accumulator to empty a liquid cylinder (16)

so that the liquid (25) driven out of the cylinder affects, before passing a throttle (17), a spindle
25 (26) of a valve (15) arranged in the outlet line of said at least one hydraulic accumulator in a direction closing the valve,

whereby the spindle (26) surface affected by the pressure of said cylinder liquid (25) is larger than
30 the spindle (26) surface affected by the outgoing liquid pressure of said at least one hydraulic accumulator, which pressure strives to open the valve (15),

so that the valve is not opened until all liquid (25) has been driven out of the cylinder (16) and
35 its pressure has sunk over the throttle (17) to a level,





which is lower than the outgoing liquid pressure of said at least one hydraulic accumulator in a proportion equal to the proportion between said two spindle surfaces of the valve.

5 6. A method according to claim 5, c h a r -
a c t e r i z e d i n

that, upon opening the valve (15), the liquid pressure acting on the spindle (26) of the valve (15) via the throttle (17) is allowed to sink, preferably via
10 an overflow valve (33), to a predeterminable value, for adjusting the pressure at which the valve (15) is closed again.

7. A method according to claim 4, c h a r -
a c t e r i z e d i n that, at the initial stage with
15 delayed delivery of high-pressure liquid, propellant gas is led from said at least one hydraulic accumulator to drive a low-pressure pump for delivering cooling liquid to the pipe system (10) and sprinklers and/or spray heads (5) in question.

20 8. A method according to claim 4, c h a r -
a c t e r i z e d i n that, at the initial stage with delayed delivery of high-pressure liquid, gas is led from a separate source to drive a low-pressure pump for delivering cooling liquid to the pipe system and sprink-
25 lers and/or spray heads in question.

9. A method according to any of the foregoing claims, particularly for fighting fire in engine rooms of ships, c h a r a c t e r i z e d i n that, at least during the initial stage with delayed delivery of high-
30 pressure liquid and during the stage after the hydraulic accumulators have been emptied of liquid, gas, preferably propellant gas, is led from said at least one hydraulic accumulator into a bilge space (3) of the engine room.

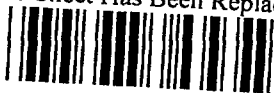
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Abstract

The object of the invention is to attend to necessary low-pressure functions at fire fighting in a novel way by means of a high-pressure drive unit having one or
5 several hydraulic accumulators in order to achieve a minimum dependence on availability of electric energy. This is achieved in such a way that at least part of the gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving a
10 low-pressure pump. (Figure 1)

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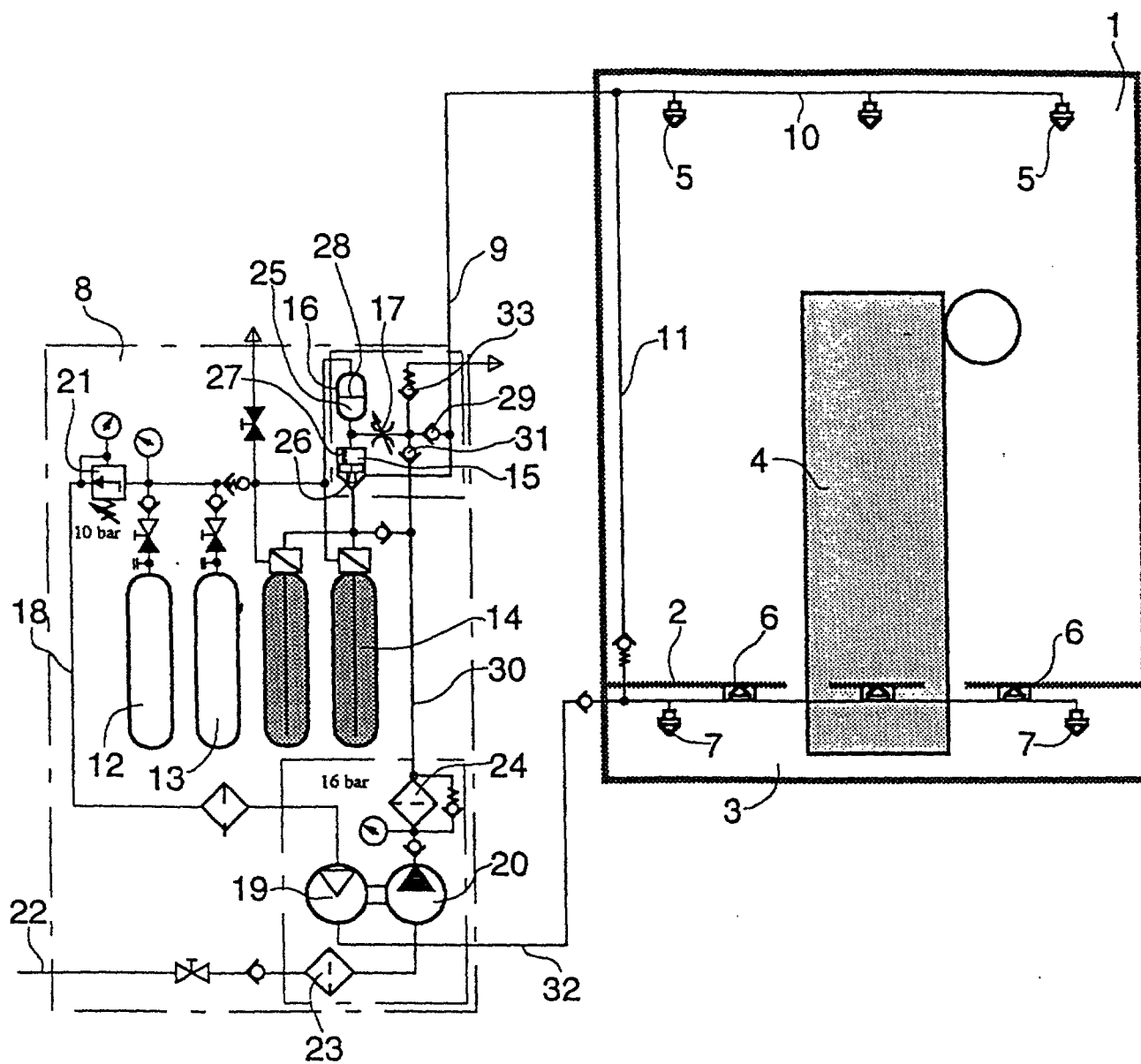


Fig. 1

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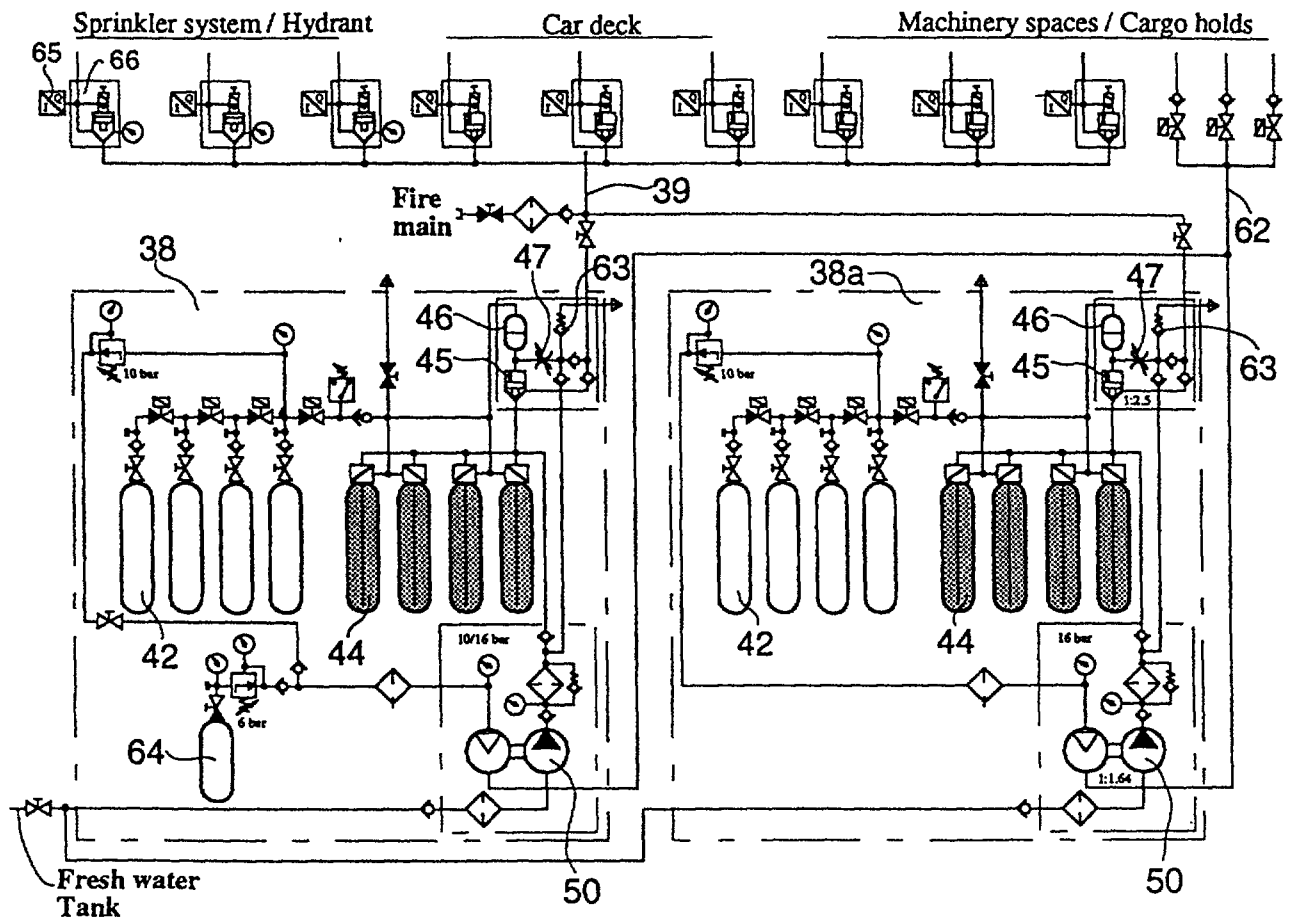


Fig. 2

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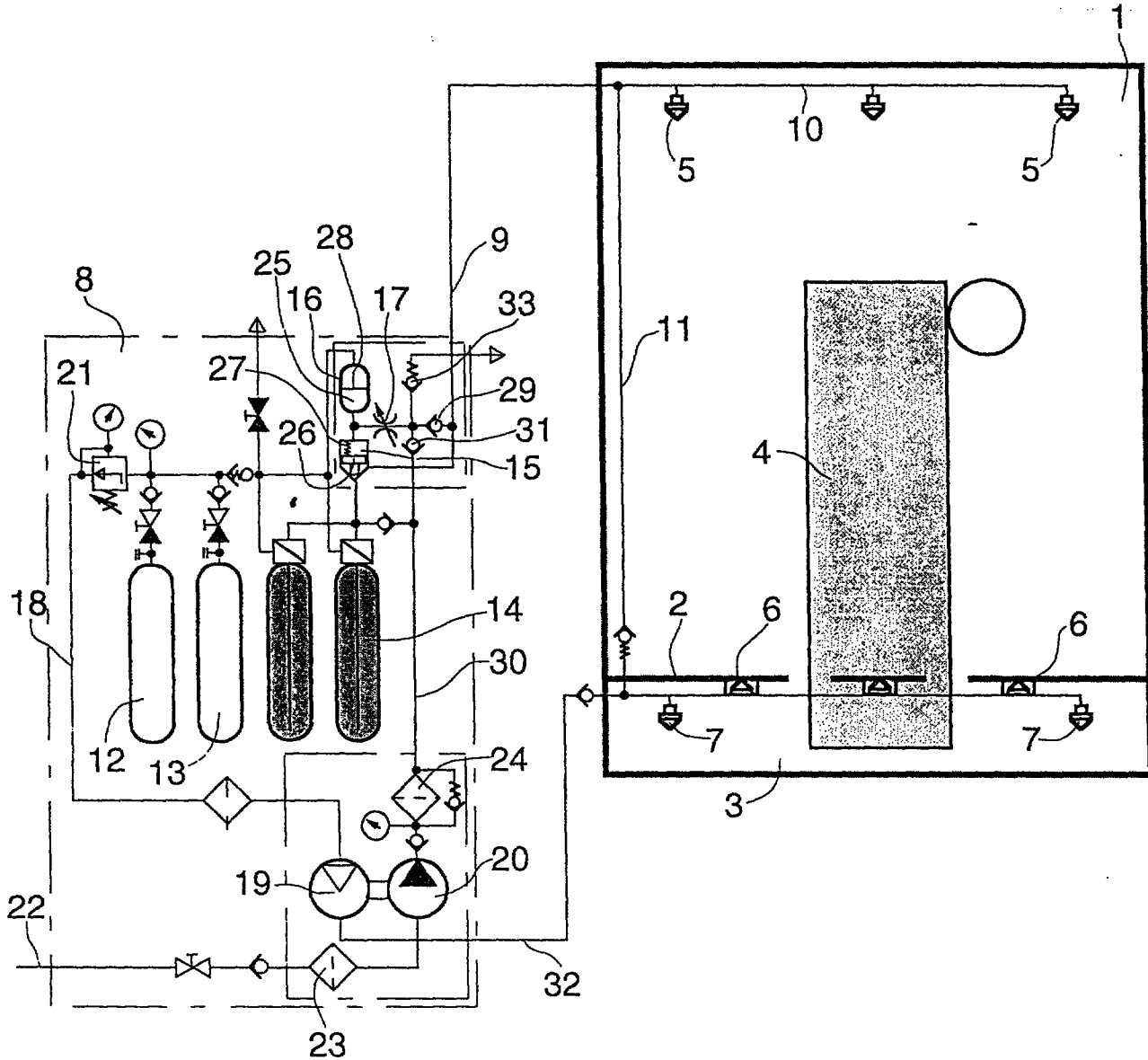


Fig. 1

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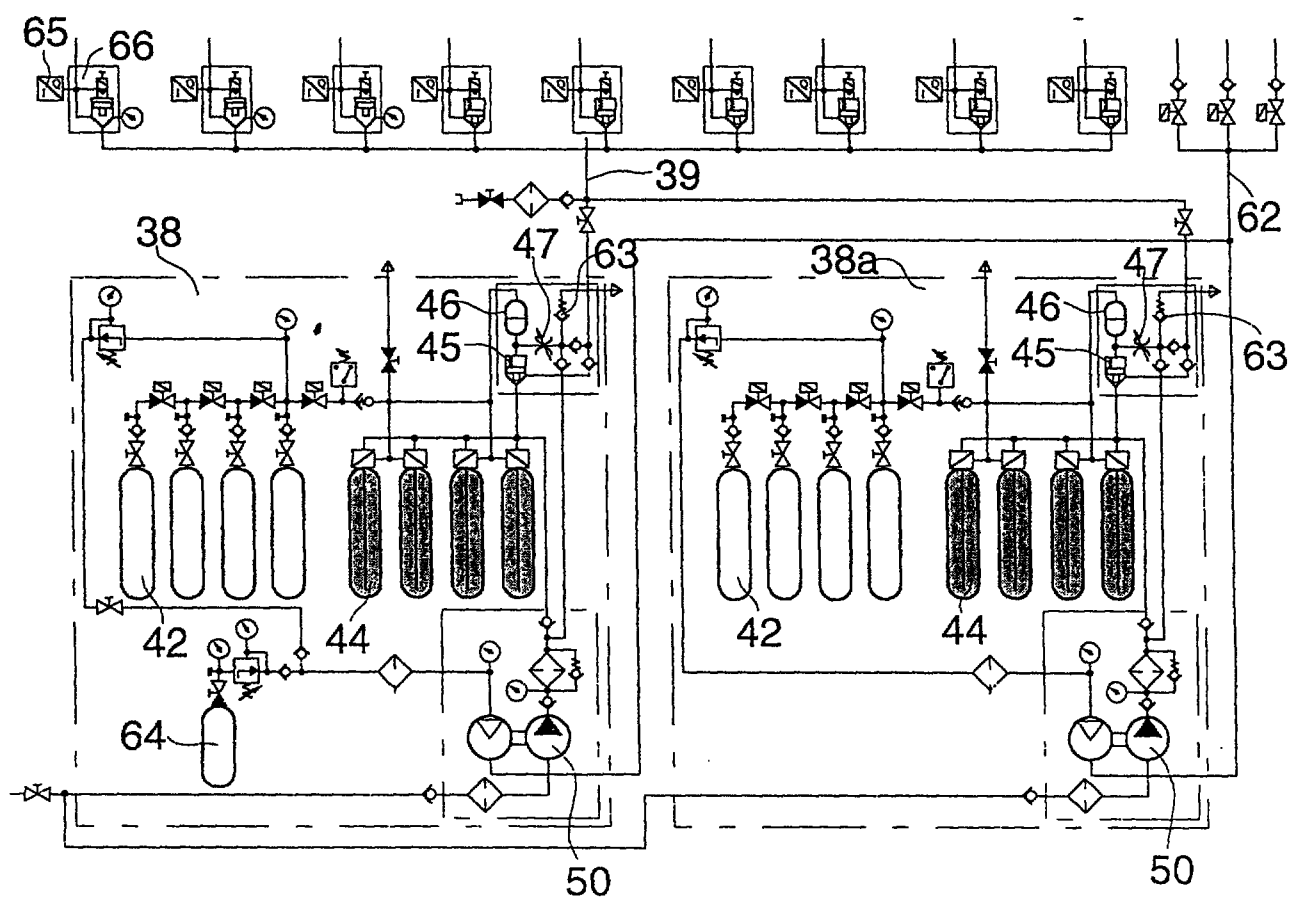


Fig. 2

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Method for fighting fire

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The present invention relates to a method for fighting fire, in which method extinguishing liquid is delivered to at least one spray head, preferably a plurality of spray heads, by means of a drive unit comprising at least one hydraulic accumulator containing propellant gas chargeable up to a high initial pressure as well as a low-pressure water pump.

One advantage of using hydraulic accumulators in fire fighting equipments is a reduced dependence on availability of electric current for pump functions requiring energy. The problem is serious especially in ships and units comparable with them, in which the electric main system including the main generator is often put out of function in case of fires, and the emergency generator set, if existing, has an unsufficient effect for practically whichever pump functions.

In case hydraulic accumulators are used, efficient fire fighting usually presupposes a high charging pressure, preferably up to 200 to 300 bar, in the hydraulic accumulators. For securing the function of the fire fighting equipment in an intended way, predetermined stages with relatively low driving pressure, e.g. 10 to 30 bar, should preferably also be included in the procedure, however. An example of such a stage is an initial cooling of the pipe system and especially the sprinklers or spray heads which before release have been heated by the fire broken out.

The object of the invention is to attend also to necessary low-pressure functions in a novel way by means of a high-pressure drive unit having one or several hydraulic accumulators, in order to achieve a minimum dependence on availability of electric energy.

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The purpose of the invention is mainly that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump.

A preferred procedure is that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump, in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

Alternatively, it is in many cases of advantage that part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads and that the remaining propellant gas is then utilized for driving the low-pressure pump, in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

According to a further-developed embodiment of the invention, the delivery of high-pressure liquid is delayed initially when the drive unit is switched on, during which delay stage gas is led preferably via a pressure reducing valve to drive the low-pressure pump for delivering cooling liquid to the pipe system and sprinklers and/or spray heads in question, and at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for redriving the low-pressure pump.



The delivery of high-pressure liquid is preferably delayed by leading the propellant gas from said at least one hydraulic accumulator to empty a liquid cylinder so that the liquid driven out of the cylinder affects, before passing a throttle, a spindle of a valve arranged in an outlet line of said at least one hydraulic accumulator in a direction closing the valve. Hereby the spindle surface affected by the pressure of said cylinder liquid is larger than the spindle surface affected by the outgoing liquid pressure of said at least one hydraulic accumulator, which pressure strives to open the valve, so that the valve is not opened until all liquid has been driven out of the cylinder and its pressure has sunk over the throttle to a level lower than the outgoing liquid pressure of said at least one hydraulic accumulator in a proportion equal to the proportion between said two spindle surfaces of the valve.

The opening time of the valve can be adjusted by means of said throttle.

Upon opening the valve, the liquid pressure affecting the valve spindle via the throttle is preferably allowed to sink preferably via an overflow valve to a predeterminable value, for adjusting the pressure at which the valve is closed again.

The propellant gas being left over after the hydraulic accumulators have been emptied is preferably utilized for redriving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

Particularly in equipments for fighting fires in engine rooms of ships, it is of advantage that part of the propellant gas being left over after the hydrau-

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lic accumulators have been emptied is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads and the remaining propellant gas is then utilized for redriving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

In engine rooms of ships, it is also desirable that, at least during the initial stage with delayed delivery of high-pressure liquid and during the stage after the hydraulic accumulators have been emptied of liquid, gas, preferably propellant gas, is led from said at least one hydraulic accumulator into a bilge space of the engine room. Gas from a separate source can alternatively be utilized.

All functions described above can be realized, if necessary, without available electric energy. By means of suitable dimensioning, it is possible to carry out an emptying and filling cycle during approximately 2 x 15 minutes.

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

Figure 1 shows a basic embodiment of a fire fighting equipment according to the invention.

Figure 2 shows a further-developed embodiment having a higher capacity than the embodiment of Figure 1.

In Figure 1, an engine room is indicated by reference numeral 1, the floor of the engine room is indicated by 2, a bilge space below the floor is indicated by 3 and the engine in question, e.g. a diesel engine, is indicated by 4. Up to the ceiling of the

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engine room are positioned a number of sprinklers or spray heads 5 and on the floor level are positioned a number of spray heads and/or sprinklers 6 directed upwards and a number of nozzle heads 7 directed downwards, into the bilge space 3.

A drive unit for delivering extinguishing liquid and/or extinguishing gas is indicated by 8. An outgoing liquid line 9 of the drive unit 8 can be connected selectively with separate fire zones; the engine room 1 constitutes a fire zone comprising a feederline 10 to the spray heads 5 at the ceiling of the engine room and a branching 11 to the spray heads 6, 7 at the engine room floor 2.

The drive unit 8 comprises two pressure gas containers 12 and 13 having an initial charging pressure of e.g. 200 bar and automatically or manually controllable outlet valves for leading pressure gas into and driving extinguishing liquid out of two liquid containers 14 through the line 9. The pressure gas containers 12 may be constituted by so-called standard gas bottles. The extinguishing liquid from the containers 14 is arranged to flow into the line 9 via a valve 15, the opening of which effected by the liquid pressure is, however, counteracted by a liquid cylinder 16, arranged in connection with the propellant gas pressure, in combination with a throttle 17, which shall be described in greater detail below.

A common outlet line 18 of the propellant gas containers 12 and 13 is connected, besides to the liquid containers 14, also to a low-pressure water pump 19, 20, where 19 indicates a pneumatic driving motor for the actual water pump 20 having an operating pressure of e.g. about 16 bar via a pressure reducing valve 21, which may be adjusted for 10 bar. It is alternatively possible to use a low-pressure pump of another type,

e.g. a double-acting piston pump. The pump 20 sucks water from a sweet water container via a line 22 or e.g. sea or lake water, alternatively. The water is filtered by means of filters 23 and 24 to a particle level of 10 μ , for instance. Occurring variations in pressure may be balanced by means of an accumulator not shown in Figure 1.

Figure 1 shows the equipment ready for being used. The pressure bottles 12 and 13 are filled with propellant gas, having a pressure of e.g. 200 bar, and the liquid bottles 14 are filled with water, as is the liquid cylinder 16, the filled liquid space of which is indicated by 25. A spring 27, which may be relatively weak, keeps the spindle 26 of the valve 15 in the shown position closing the valve.

When a fire is detected, one of the propellant gas containers, e.g. the container 12, is switched on at first, whereby the gas strives to drive the liquid out of the containers 14 via the valve 15 to the outlet line 9 by pressing up the valve spindle 26 from the position of Figure 1 under the influence of the liquid pressure.

However, the same gas pressure also acts on a membrane 28 of the liquid cylinder 16, which membrane may also be a piston, and therefore presses the liquid 25 out partly via the throttle 17 and a subsequent non-return valve 29 into the line 9, but partly also towards the spindle 26 of the valve 15 against the effect of the liquid pressure from the containers 14. As shown schematically in the drawing, by making the spindle 26 surface affected by the pressure of the cylinder liquid 25 larger than the spindle 26 surface affected by the equally high pressure of the extinguishing liquid of the containers 14, e.g. in the proportion 2,5:1, the valve 15 will remain closed until the liquid 25 has been

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pressed out of the cylinder 16 entirely and its pressure has subsequently sunk via the throttle 17 to about 40 bar in the present example case, whereby the extinguishing liquid is able to press away the spindle 26 of the valve 15.

During the just-described initial stage, the length of which may be adjusted as desired by means of the throttle 17, the pressure gas drives, however, via the line 18 and the pressure reducing valve 21 the pump 20 delivering liquid via its outlet line 30, having the filter 24 and a non-return valve 31 after filler branching to the containers 14, to the outlet line 9 of the drive unit 8 over the non-return valves 29 and 31, for an initial cooling of at least the spray heads 5 and the parts of the line 10 which extend in the engine room 1. The pressure of the cylinder liquid 25 after the throttle 17 is lower than the outlet pressure of the pump 20. Additionally, the pneumatic motor 19 can deliver gas via an outlet line 32 to the nozzles 7 in the bilge space 3 of the engine room 1.

Upon opening the valve 15, the driving of the extinguishing liquid out of the containers 14 will begin and the pump 20 stops when the non-return valves 29 and 31 are closed. Excess liquid pressed by the valve 15 into the line space around the throttle 17 is allowed to flow out through an overflow valve 33, which may be adjusted for e.g. 16 bar. The gas container 12 and the liquid containers 14 can be dimensioned for instance in such a way that, with the containers 14 emptied of liquid, a gas pressure of about 80 bar prevails in them and in the container 12. Gas will then continue flowing out after the liquid through the line 9 until the pressure has sunk so much that the pressure in the space around the throttle 17 is able to close the valve 15. If the last-mentioned pressure is about 16 bar, the

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valve 15 is closed at a pressure of about 40 bar in the containers 14, and subsequently, the remaining gas in the containers 12 and 14 continues driving the pump 20.

The pump 20 now refills the containers 14 with water. If the overflow valve 33 is adjusted to a value somewhat higher than the outlet pressure of the pump 20, liquid is delivered also to the outlet line 9 exactly in the same way as during the initial stage described previously, and simultaneously, the cylinder 16 is re-filled with water. When the containers 14 have been filled, the procedure can be repeated by switching on the other pressure gas container 13.

Both during the initial stage and during the liquid filling stage, the pneumatic motor 19 can also deliver propellant gas, say nitrogen or argon gas, via a gas line 32 extending from the motor 19 and via the nozzles 7 to the bilge space 3 of the engine room.

Figure 2 shows an embodiment of the invention for a fire fighting equipment having a higher capacity, e.g. a car ferry. Figure 2 shows two high-pressure units 38 and 38a, each of them comprising four pressure gas containers 42, which can be constituted by so-called standard gas bottles as in Figure 1, and four liquid containers 44. A common outlet line 39 can be connected for instance to a number of fire zones in a sprinkler system, to a number of fire zones on car deck and to a number of fire zones in the engine room and cargo hold. The common outgoing gas line of low-pressure pumps 50 of the drive units 38 and 38a is connected to corresponding fire zones in the engine room and cargo hold in principle in the same way as shown in Figure 1.

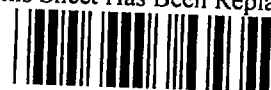
The embodiment according to Figure 2 works essentially in the same way as the embodiment of Figure 1. The initial stage with delayed liquid delivery occurs in the same way as in Figure 1, with the same combina-

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tion of valve 45, liquid cylinder 46, throttle 47 and overflow valve 63, and subsequently, the units 38 and 38a, respectively, are emptied of liquid alternately one after the other or simultaneously, if necessary, and the propellant gas being left over after the emptying continues driving the corresponding pumps 50. The number of gas containers 42 and water containers 44 connected in each case may be varied as desired. For instance, a gas bottle together with four water bottles can be used for sprinkler systems and two gas bottles together with four water bottles can be used for engine rooms, etc.

The drive unit 38, which is supposed to be the first to be activated, comprises a separate pressure gas container 64, which can be connected to the pump 50 via a pressure reducing valve adjusted e.g. for 6 bar, in order to maintain preferably a low liquid pressure in the sprinkler system during the activated state of the equipment. When there is a flow in some part of the sprinkler system, a flow indicator 65 generates a signal in a corresponding section valve 66, upon which signal the drive units are activated.



Patentkrav:

1. A method for fighting fire, in which method extinguishing liquid is delivered to at least one spray head, preferably a plurality of spray heads, by means of a drive unit comprising at least one hydraulic accumulator (12, 13, 14) containing propellant gas chargeable up to a high initial pressure as well as a low-pressure water pump (19, 20), c h a r a c t e r - i z e d i n

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump.

2. A method according to claim 1, c h a r - a c t e r i z e d i n

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas

so that the procedure can be repeated after the hydraulic accumulators have been filled.

3. A method according to claim 1, c h a r - a c t e r i z e d i n

that part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads (5),

that the remaining propellant gas is then utilized for driving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray





simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas

so that the procedure can be repeated after the hydraulic accumulators have been filled.

4. A method according to claim 1, c h a r - a c t e r i z e d i n

that the delivery of high-pressure liquid is initially delayed when the drive unit (8) is switched on, during which delay stage gas is led preferably via a pressure reducing valve to drive the low-pressure pump for delivering cooling liquid to a pipe system (10) and sprinklers and/or spray heads (5) in question, and

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for redriving the low-pressure pump.

5. A method according to claim 4, c h a r - a c t e r i z e d i n

that the delivery of high-pressure liquid is initially delayed when the drive unit (8) is switched on, by leading the propellant gas of said at least one hydraulic accumulator to empty a liquid cylinder (16)

so that the liquid (25) driven out of the cylinder affects, before passing a throttle (17), a spindle (26) of a valve (15) arranged in the outlet line of said at least one hydraulic accumulator in a direction closing the valve,

whereby the spindle (26) surface affected by the pressure of said cylinder liquid (25) is larger than the spindle (26) surface affected by the outgoing liquid pressure of said at least one hydraulic accumulator, which pressure strives to open the valve (15),

so that the valve is not opened until all liquid (25) has been driven out of the cylinder (16) and its pressure has sunk over the throttle (17) to a level,

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which is lower than the outgoing liquid pressure of said at least one hydraulic accumulator in a proportion equal to the proportion between said two spindle surfaces of the valve.

6. A method according to claim 5, c h a r - a c t e r i z e d in

that, upon opening the valve (15), the liquid pressure acting on the spindle (26) of the valve (15) via the throttle (17) is allowed to sink, preferably via an overflow valve (33), to a predeterminable value, for adjusting the pressure at which the valve (15) is closed again.

7. A method according to claim 4, c h a r - a c t e r i z e d in that, at the initial stage with delayed delivery of high-pressure liquid, propellant gas is led from said at least one hydraulic accumulator to drive a low-pressure pump for delivering cooling liquid to the pipe system (10) and sprinklers and/or spray heads (5) in question.

8. A method according to claim 4, c h a r - a c t e r i z e d in that, at the initial stage with delayed delivery of high-pressure liquid, gas is led from a separate source to drive a low-pressure pump for delivering cooling liquid to the pipe system and sprinklers and/or spray heads in question.

9. A method according to any of the foregoing claims, particularly for fighting fire in engine rooms of ships, c h a r a c t e r i z e d in that, at least during the initial stage with delayed delivery of high-pressure liquid and during the stage after the hydraulic accumulators have been emptied of liquid, gas, preferably propellant gas, is led from said at least one hydraulic accumulator into a bilge space (3) of the engine room.



ABSTRACT

Method for fighting fire

The object of the invention is to attend to necessary low-pressure functions at fire fighting in a novel way by means of a high-pressure drive unit having one or several hydraulic accumulators in order to achieve a minimum dependence on availability of electric energy. This is achieved in such a way that at least part of the gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving a low-pressure pump. (Figure 1)

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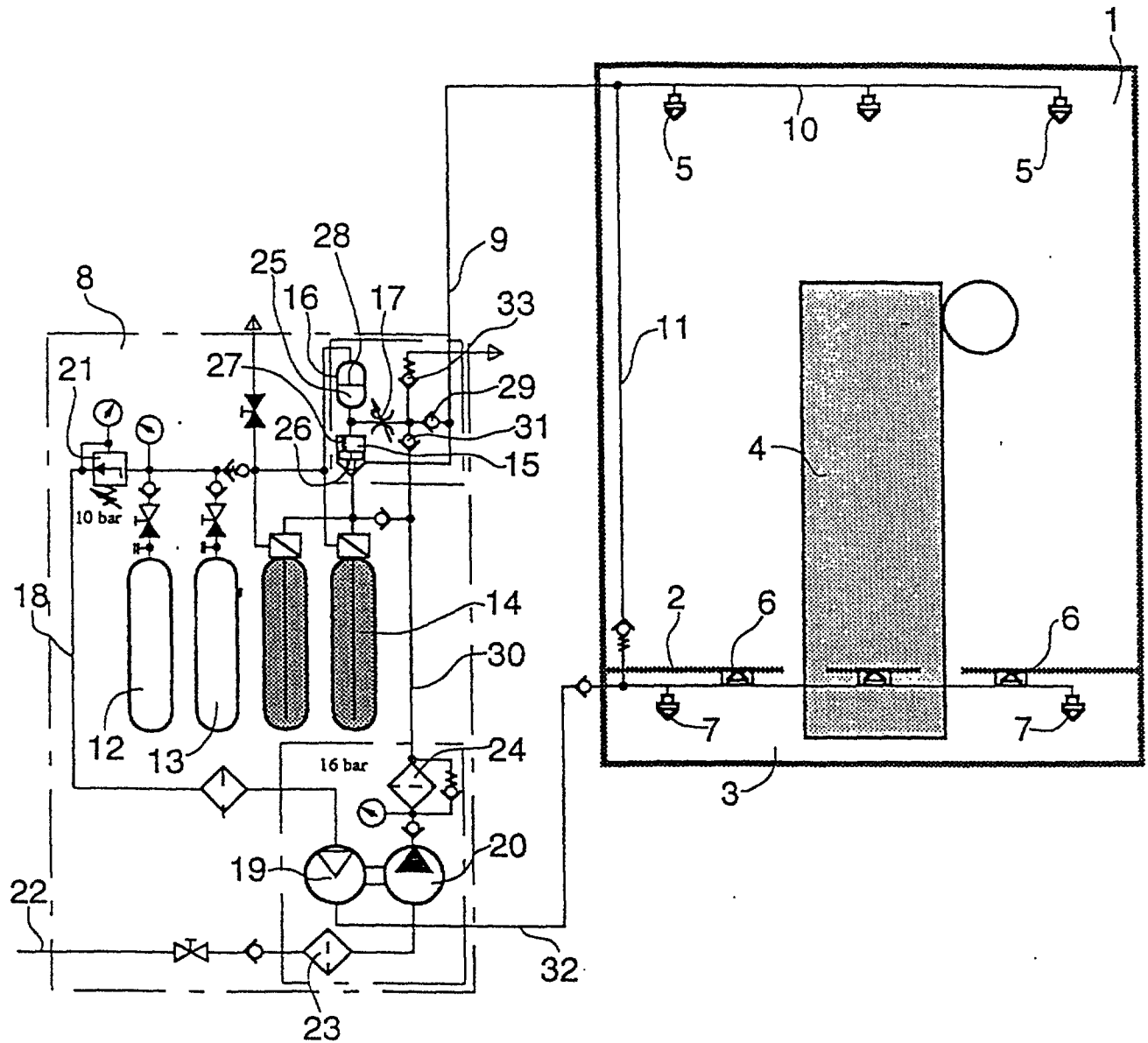


Fig. 1

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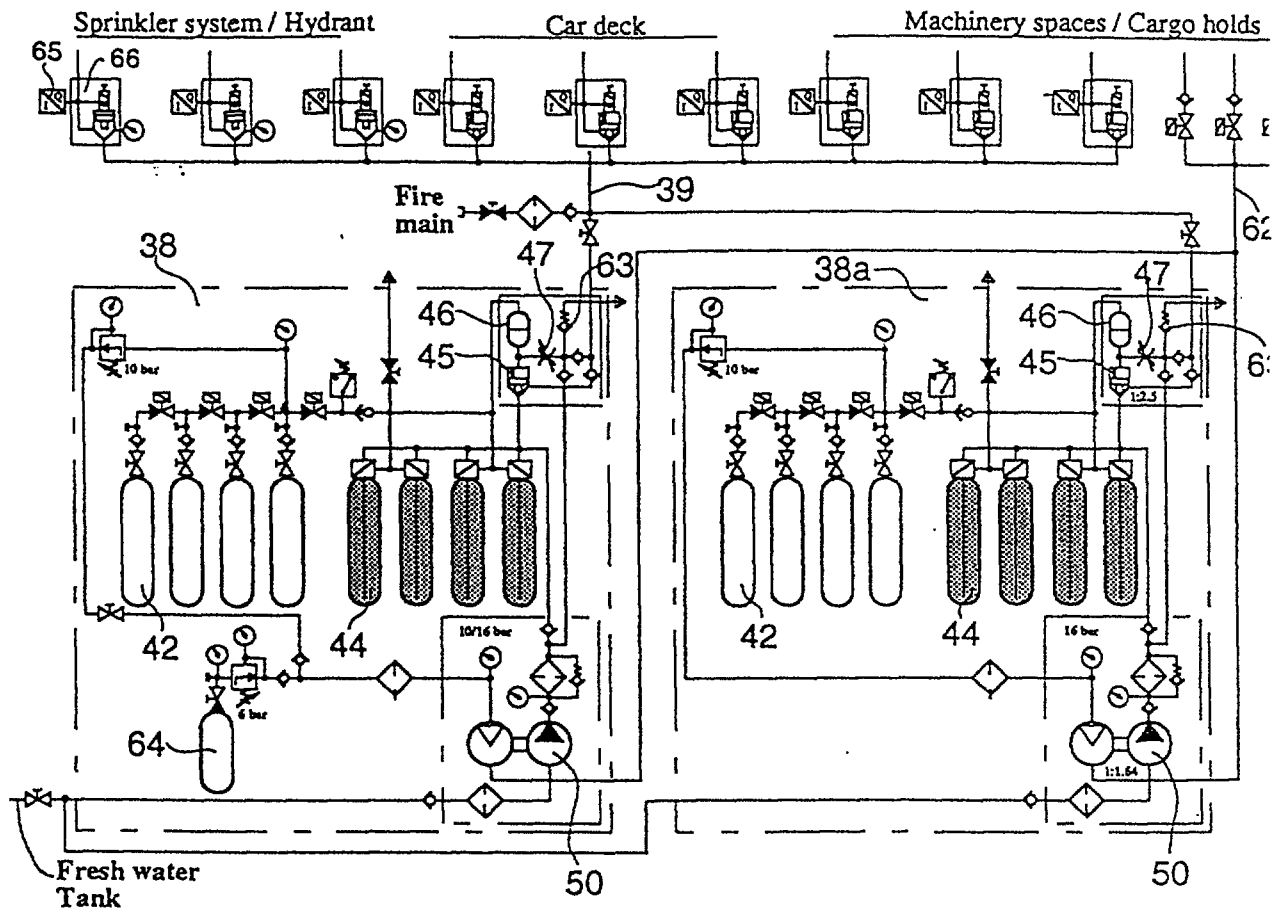


Fig. 2

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METHOD FOR FIGHTING FIRE

The present invention relates to a method for fighting fire, in which method extinguishing liquid is delivered to at least one spray head, preferably a plurality of spray heads, by means of a drive unit comprising at least one hydraulic accumulator containing propellant gas chargeable up to a high initial pressure as well as a low-pressure water pump.

One advantage of using hydraulic accumulators in fire fighting equipments is a reduced dependence on availability of electric current for pump functions requiring energy. The problem is serious especially in ships and units comparable with them, in which the electric main system including the main generator is often put out of function in case of fires, and the emergency generator, if existing, is insufficient for practically whichever pump functions.

In case hydraulic accumulators are used, efficient fire fighting usually presupposes a high charging pressure, preferably up to 200 to 300 bar, in the hydraulic accumulators. However, for securing the function of the fire fighting equipment in an intended way, predetermined stages with relatively low driving pressure, e.g. 10 to 30 bar, should preferably also be included in the procedure. An example of such a stage is an initial cooling of the pipe system and especially the sprinklers or spray heads which before release have been heated by the fire broken out.

It would be advantageous if at least preferred embodiments of the invention attended also to necessary low-pressure functions in a novel way by means of a high-pressure drive unit having one or several hydraulic accumulators, in order to achieve a minimum dependence on availability of electric energy.

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In the present invention at least part of the propellant gas that is left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump.

A preferred procedure is that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump, in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

Alternatively, it is in many cases of advantage that part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads and that the remaining propellant gas is then utilized for driving the low-pressure pump, in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas so that the procedure can be repeated after the hydraulic accumulators have been filled.

According to a further-developed embodiment of the invention, the delivery of high-pressure liquid is delayed initially when the drive unit is switched on, during which delay stage gas is led preferably via a pressure reducing valve to drive the low-pressure pump for delivering cooling liquid to the pipe system and sprinklers and/or spray heads in question, and at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for redriving the low-pressure pump.

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Claims

1. A method for fighting fire, in which method extinguishing liquid is delivered to at least one spray head, preferably a plurality of spray heads, by means of a drive unit comprising at least one hydraulic accumulator (12, 13, 14) containing propellant gas chargeable up to a high initial pressure as well as a low-pressure water pump (19, 20), c h a r a c t e r - i z e d in

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump.

2. A method according to claim 1, c h a r a c t e r i z e d in

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas

so that the procedure can be repeated after the hydraulic accumulators have been filled.

3. A method according to claim 1, c h a r a c t e r i z e d in

that part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is initially allowed to flow directly after the liquid to corresponding sprinklers and/or spray heads (5),

that the remaining propellant gas is then utilized for driving the low-pressure pump in order to refill the hydraulic accumulators with liquid and to spray simultaneously preferably the seat of fire and its surroundings with liquid and/or propellant gas

so that the procedure can be repeated after the hydraulic accumulators have been filled.

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4. A method according to claim 1, c h a r -
a c t e r i z e d i n

that the delivery of high-pressure liquid is initially delayed when the drive unit (8) is switched on, during which delay stage gas is led preferably via a pressure reducing valve to drive the low-pressure pump for delivering cooling liquid to a pipe system (10) and sprinklers and/or spray heads (5) in question, and

that at least part of the propellant gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for redriving the low-pressure pump.

5. A method according to claim 4, c h a r -
a c t e r i z e d i n

that the delivery of high-pressure liquid is initially delayed when the drive unit (8) is switched on, by leading the propellant gas of said at least one hydraulic accumulator to empty a liquid cylinder (16)

so that the liquid (25) driven out of the cylinder affects, before passing a throttle (17), a spindle (26) of a valve (15) arranged in the outlet line of said at least one hydraulic accumulator in a direction closing the valve,

whereby the spindle (26) surface affected by the pressure of said cylinder liquid (25) is larger than the spindle (26) surface affected by the outgoing liquid pressure of said at least one hydraulic accumulator, which pressure strives to open the valve (15),

so that the valve is not opened until all liquid (25) has been driven out of the cylinder (16) and its pressure has sunk over the throttle (17) to a level, which is lower than the outgoing liquid pressure of said at least one hydraulic accumulator in a proportion equal to the proportion between said two spindle surfaces of the valve.

6. A method according to claim 5, c h a r -
a c t e r i z e d i n

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that, upon opening the valve (15), the liquid pressure acting on the spindle (26) of the valve (15) via the throttle (17) is allowed to sink, preferably via an overflow valve (33), to a predeterminable value, for adjusting the pressure at which the valve (15) is closed again.

7. A method according to claim 4, c h a r - a c t e r i z e d in that, at the initial stage with delayed delivery of high-pressure liquid, propellant gas is led from said at least one hydraulic accumulator to drive a low-pressure pump for delivering cooling liquid to the pipe system (10) and sprinklers and/or spray heads (5) in question.

8. A method according to claim 4, c h a r - a c t e r i z e d in that, at the initial stage with delayed delivery of high-pressure liquid, gas is led from a separate source to drive a low-pressure pump for delivering cooling liquid to the pipe system and sprinklers and/or spray heads in question.

9. A method according to any of the foregoing claims, particularly for fighting fire in engine rooms of ships, c h a r a c t e r i z e d in that, at least during the initial stage with delayed delivery of high-pressure liquid and during the stage after the hydraulic accumulators have been emptied of liquid, gas, preferably propellant gas, is led from said at least one hydraulic accumulator into a bilge space (3) of the engine room.

10. A method for fighting fire comprising the steps of:

(i) delivering extinguishing liquid to at least one spray head or sprinkler by a drive unit that comprises:

at least one hydraulic accumulator having at least one pressure gas container containing propellant gas chargeable up to a high initial pressure and a liquid container containing liquid; and

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a low-pressure water pump;
such that a portion of the propellant gas is left over
after the hydraulic accumulator has been emptied of liquid;
and

(ii) driving the low-pressure pump utilizing at least
part of the remaining portion of the propellant gas;
wherein the delivering of liquid is initially delayed when
the drive unit is switched on;

during this delay the low-pressure pump is initially
driven; and

this initial driving delivers cooling liquid to a pipe
system and thence to the spray head or sprinkler; and

wherein the driving that utilizes said part of the
remaining portion of the propellant gas includes a
redriving of the low-pressure pump.

11. A method for fighting fire comprising the steps
of:

(i) delivering extinguishing liquid to at least one
spray head or sprinkler by a drive unit that comprises:

at least one hydraulic accumulator having at least one
pressure gas container containing propellant gas chargeable

up to a high initial pressure and a liquid container
containing liquid;

a low-pressure water pump;

such that a portion of the propellant gas is left over
after the hydraulic accumulator has been emptied of liquid;
and

(ii) driving the low-pressure pump utilizing at least
part of the remaining portion of the propellant gas;

wherein said driving refills the hydraulic accumulator
with liquid and, simultaneously with said refilling, sprays
the fire and surroundings thereof with extinguishing
medium;

and wherein emptying of the hydraulic accumulator after
said refilling is repeated.

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12. A method for fighting fire comprising the steps of:

(i) delivering extinguishing liquid to at least one spray head or sprinkler by a drive unit that comprises:

at least one hydraulic accumulator having at least one pressure gas container containing propellant gas chargable up to a high initial pressure and a liquid container containing liquid; and

a low-pressure water pump;

such that a portion of the propellant gas is left over after the hydraulic accumulator has been emptied of liquid; and

(ii) driving the low-pressure pump utilizing at least part of the remaining portion of the propellant gas;

wherein initially, a first part of the remaining portion of the propellant gas is allowed to flow directly after the liquid to the spray head or sprinkler and then

a second part of the remaining portion of the propellant gas is used for driving the low-pressure pump and so that the hydraulic accumulator is refilled with liquid by said driving utilizing said second part and,

with said refilling, the fire and surroundings thereof is sprayed simultaneously with extinguishing medium;

and after said refilling emptying of the hydraulic accumulator is repeated.



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ABSTRACT

Method for fighting fire

The object of the invention is to attend to necessary low-pressure functions at fire fighting in a novel way by means of a high-pressure drive unit having one or several hydraulic accumulators in order to achieve a minimum dependence on availability of electric energy. This is achieved in such a way that at least part of the gas being left over after the hydraulic accumulators have been emptied of liquid is utilized for driving a low-pressure pump. (Figure 1)

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