

(19) **DANMARK**

(10) **DK/EP 3912689 T3**



(12)

Oversættelse af europæisk patentskrift

Patent- og
Varemærkestyrelsen

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- (51) Int.Cl.: **A 62 C 2/08 (2006.01)** **A 62 C 3/02 (2006.01)** **A 62 C 37/14 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2024-02-26**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-01-03**
- (86) Europæisk ansøgning nr.: **20175184.9**
- (86) Europæisk indleveringsdag: **2020-05-18**
- (87) Den europæiske ansøgnings publiceringsdag: **2021-11-24**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **BRANDSLUKNINGSANLÆG SAMT FREMGANGSMÅDE TIL BEKÆMPELSE AF EN BRAND**
- (56) Fremdragne publikationer:
EP-A1- 3 378 539
WO-A1-2004/002575
WO-A1-2004/089474

Description

The invention relates to a fire extinguishing system and a method for controlling a fire. The fire extinguishing system includes a plurality of sprinklers.

5 The sprinklers in a fire extinguishing system are usually set up so that they trigger when a temperature threshold is exceeded. An extinguishing agent then emerges from the fire extinguishing system and acts against a fire that caused the temperature increase.

In a building equipped with a fire extinguishing system, there may be regions that need special protection from the spread of fire. This can include, for example, stairwells, escape routes or parts of the building that are separate from the location of the fire. A
10 danger could, for example, be that the fire spreads to the region to be protected or that smoke gases spread into the protected region, making it impossible for people to stay there.

From the publication WO 2004/089474 A1 a fire extinguishing system is known in which sprinklers are disposed in rows, which are triggered simultaneously in the event of
15 a fire.

The invention is based on the object of presenting a fire extinguishing system and a method for extinguishing a fire, with which the effects of a fire can be limited to a protected region. Based on the stated prior art, the task is solved with the features of the independent claims. Advantageous embodiments are specified in the dependant claims.

20 The fire extinguishing system according to the invention includes a trigger sensor which emits a signal when a first sprinkler is triggered. A control unit processes the signal from the trigger sensor to generate control commands with which a plurality of second sprinklers are triggered so that the spray cones of the second sprinklers overlap one another and that the spray cones of the second sprinklers form an extinguishing agent
25 curtain between the first sprinkler and is disposed in an region to be protected.

The region of space over which the extinguishing agent emerging from a sprinkler is distributed is called a spray cone. The spatial region can be approximately conical, but the term spray cone is not associated with a restriction to the geometric shape of a cone. The extinguishing agent is usually a liquid extinguishing agent that emerges from the
30 sprinkler in the form of drops. The drops are heavier than air, so gravity causes them to fall to the floor. The drops form the spray cone of the sprinkler. The spray cones of two sprinklers overlap each other if the region in which the drops from the first sprinkler hit

the floor overlaps with the region in which the drops from the second sprinkler hit the floor.

5 The invention has recognized that the region to be protected can be protected from the effects of the fire with an extinguishing agent curtain formed from overlapping spray cones. On the one hand, the fire cannot spread through the extinguishing agent curtain. On the other hand, the smoke gases are prevented from entering the region to be protected by the extinguishing agent curtain. However, the extinguishing agent curtain does not create an obstacle for people. People trying to escape the fire can step through the extinguishing agent curtain and are therefore protected from both the fire and the smoke gases.

10 The extinguishing agent is preferably non-toxic; for example, water can be used as an extinguishing agent. The extinguishing agent curtain is then a water curtain.

The second sprinklers may be suspended from the ceiling of a room so that the spray cones extend from the ceiling of the room to a floor disposed below the ceiling. A passage that is used by people can be disposed in the region between the ceiling and the floor. It has been shown that it is not absolutely necessary to create an overlap between the spray cones that extends over the entire height between the floor and the ceiling. Presumably as a result of air turbulence, the effect of the extinguishing agent curtain occurs even if there is an region adjacent to the ceiling in which adjacent spray cones do not overlap with one another. The overlap region between two adjacent spray cones preferably extends over at least 30%, preferably at least 50%, furthermore preferably at least 70% of the height between the sprinklers and the floor. Also included are embodiments in which the overlap region extends over the entire height between the sprinklers and the floor.

25 The extent of the extinguishing agent curtain can be increased by forming the extinguishing agent curtain from more than two second sprinklers. There are then one or more central spray cones in the middle of the extinguishing agent curtain, which overlap with two adjacent spray cones. By arranging a suitable number of second sprinklers next to each other, the length of the extinguishing agent curtain can be extended as desired. 30 The extinguishing agent curtain can, for example, be composed of the spray cones of at least 5, preferably at least 10, furthermore preferably at least 20 second sprinklers.

The extinguishing agent curtain can extend between two lateral boundaries without interruption. A passage can be formed between the two side delimitations and is

disposed between a ceiling, a floor and two side walls. The extinguishing agent curtain can extend from the first side wall to the second side wall in that the two outer spray cones of the extinguishing agent curtain each overlap with one of the two side walls. The fire and the smoke gases are prevented by such an extinguishing agent curtain from spreading into the region beyond the extinguishing agent curtain. The passage can, for example, form a connection between a first part of the building and a second part of the building. If there is a fire in the first part of the building, the second part of the building can be protected from the effects of the fire.

It is also possible for the extinguishing agent curtain to separate a first section of a building from a second section of a building. For example, in a warehouse, an extinguishing agent curtain can be generated between two opposite external walls to divide the warehouse into two sections. For example, if the warehouse has an aisle that extends across the width of the warehouse, the extinguishing agent curtain can be disposed along the aisle.

In one embodiment, the extinguishing agent curtain extends along a closed path about a region to be protected. The extinguishing agent curtain can be designed so that each spray cone of the extinguishing agent curtain overlaps with two adjacent spray cones. Such an extinguishing agent curtain can be used, for example, to protect a stairwell that is disposed in the middle of a room or a building, i.e. is not limited by a wall of the building. With an extinguishing agent curtain around the stairwell, the fire is prevented from spreading through the stairwell to another floor and smoke gases are prevented from passing through the stairwell to another floor. However, people can use the stairwell essentially unhindered.

It is also possible for an region to be protected to be limited by a wall on only one side. This can be the case, for example, with a stairwell that is disposed next to a wall and also flows into the free space. In another example, a region, protected from the effects of fire, should be set up adjacent to a wall. For example, people waiting to be rescued by the fire department can gather in this region. In such a case, the extinguishing agent curtain can be designed so that it extends from a first section of the wall around the region to be protected to a second section of the wall.

More generally, the extinguishing agent curtain may extend without interruption along a straight or otherwise shaped path from a first lateral delimitation to a second lateral delimitation. There is then no path available between the first lateral delimitation

and the second lateral delimitation along which the fire can have a direct impact or in the form of smoke gases.

The fire extinguishing system can include a larger number of sprinklers, for example at least 10 sprinklers, preferably at least 20 sprinklers, furthermore preferably at least 50
5 sprinklers. All sprinklers in the fire extinguishing system or some of the sprinklers in the fire extinguishing system can be equipped with a trigger sensor. All sprinklers of the fire extinguishing system or some of the sprinklers of the fire extinguishing system can be set up so that they can be triggered by a control command from the control unit. The number of second sprinklers that are triggered to generate the extinguishing agent curtain is
10 preferably less than 50%, furthermore preferably less than 20%, furthermore preferably less than 10% of the total number of sprinklers of the fire extinguishing system. The sprinklers can be connected to a pipe system; When the fire extinguishing system is on standby, there may be excess pressure in the pipe system.

The control unit of the fire extinguishing system can be set up so that it generates
15 control commands to a plurality of water curtains after the first sprinkler is triggered. Two water curtains are separated from each other if the spray cones of the water curtains do not overlap each other.

The sprinklers may have an outlet opening which is closed when the fire extinguishing system is in standby mode and which is open when the sprinkler has
20 triggered. Once triggered, the extinguishing agent exits the pipe system through the sprinkler. The sprinkler can include a trigger element that keeps the outlet opening in the closed state when the fire extinguishing system is in the standby state.

The outlet opening of the sprinkler can be closed in the standby state with a plug, which is removed when the sprinkler is triggered. The triggering element of the sprinkler
25 can keep the plug in the closed state when the fire extinguishing system is in a standby state. When the sprinkler is triggered, the trigger element can release the plug so that the plug is pushed out of the outlet opening due to excess pressure in the pipe system.

The trigger element can be designed to react to the effects of heat. For example, the triggering element can be designed as a fusible link that is solid at ambient
30 temperature and melts under the influence of heat. A trigger element in the form of a glass vessel that shatters when exposed to heat is also possible. When the fire extinguishing system is in a standby state, the glass vessel can be supported between the stopper and a spray plate of the sprinkler. The spray plate can be designed to deflect a jet

of extinguishing agent emerging from the outlet opening of the sprinkler to the side, so that a spray cone is formed. Preferably, the extinguishing agent is distributed substantially evenly over all lateral directions.

5 The trigger sensor can include an electrical conductor path into which the trigger element is incorporated. When the glass vessel shatters, the electrical conductor path is interrupted. The interruption of the conductor path can represent a signal to the control unit that the sprinkler has triggered. In one embodiment, the triggering element is a glass vessel provided with an electrically conductive coating and the electrical conductor path is interrupted by shattering of the glass vessel.

10 The control command with which the second sprinklers forming the extinguishing agent curtain are triggered is transmitted from the control unit to the second sprinklers via a wired connection or a radio connection.

In one embodiment, there is an electrical circuit that extends from the control unit via the trigger element of the second sprinkler. By passing an electrical current through
15 the circuit, the tripping element can be triggered.

The trigger signal can contain information about which sprinkler triggered. Such information can be encoded in the trigger signal; alternatively, a trigger sensor can, for example, be assigned a unique position in a data bus cable. The control unit can comprise an electronic data processing unit with a memory, wherein information about the spatial
20 position of the sprinklers in the extinguishing area is stored in the memory. Depending on the spatial position of the triggered first sprinkler, the control unit can decide in which regions of the building an extinguishing agent curtain should be generated.

The fire extinguishing system can include an extinguishing agent supply from which a pipe system of the fire extinguishing system is fed with extinguishing agent. The
25 extinguishing agent supply can be an element of the fire extinguishing system. This can be achieved, for example, by the extinguishing agent supply being a tank filled with extinguishing agent. It is also possible for the fire extinguishing system to be connected to an extinguishing agent supply external to the fire extinguishing system. In this case, the extinguishing agent supply can be, for example, a water pipe.

30 The standby state of the fire extinguishing system is when all sprinklers in the pipe system are closed and the fire extinguishing system is otherwise active to the extent that extinguishing agent can escape after a sprinkler is triggered. The fire extinguishing system can be a dry system in which the pipe system is filled with a gas, in particular with air,

when the fire extinguishing system is in the standby state. It is also possible that the pipe system is already filled with extinguishing agent when the fire extinguishing system is ready.

5 The invention also relates to a building that is equipped with a fire extinguishing system according to the invention. The building can be used to accommodate people; for example, the building can be a residential building, an office building, a hospital or a shopping building. The building can be used to store items; for example, the building can be a warehouse building or a factory building. The building can have one or more floors.

10 The invention also relates to a method for controlling a fire, in which, after a first sprinkler has been triggered, control commands are generated with which a plurality of second sprinklers are triggered, so that the spray cones of the second sprinklers overlap one another and that the spray cones of the second sprinklers form an extinguishing agent curtain which is disposed between the first sprinkler and an region to be protected.

15 The method can be developed with further features that are described in connection with the fire extinguishing system according to the invention. The fire extinguishing system can be developed with further features that are described in connection with the method according to the invention.

The invention will now be described by way of example with reference to the accompanying drawings using advantageous embodiments. What is shown is:

20 FIG. 1: a building with a fire extinguishing system according to the invention in a schematic representation;

FIG. 2: a horizontal section through the building from FIG. 1;

FIG. 3: a section along line AA in FIG. 2;

25 FIG. 4: a warehouse with a fire extinguishing system according to the invention;

FIG. 5: a further embodiment of a warehouse with a fire extinguishing system according to the invention;

FIG. 6-8: further embodiments of buildings with fire extinguishing systems according to the invention;

30 FIG. 9: a schematic representation of a fire extinguishing system according to the invention;

FIG. 10: a sprinkler of a fire extinguishing system according to the invention;

FIG. 11: a schematic representation of an alternative embodiment of a fire extinguishing system according to the invention;

FIG. 12: a schematic representation of a fire extinguishing system.

5 A fire extinguishing system in FIG. 12 comprises a plurality of sprinklers 18, which are connected to a pipe system in the form of a pipeline 17. Each sprinkler 18 has an outlet opening that is closed when the fire extinguishing system is on standby. If the temperature increases after a fire breaks out, a first sprinkler 23 is triggered, whereby the outlet opening of the first sprinkler 23 is opened.

10 When in standby mode, the fire extinguishing system is filled with water as an extinguishing agent. After the first sprinkler 23 is triggered, a pump 21 is put into operation, which sucks in water from an extinguishing agent supply 20. The extinguishing agent is conveyed along the pipeline 17 to the first sprinkler 23. The extinguishing agent emerges from the outlet opening of the first sprinkler 23 and can act against the fire.

15 FIG. 9 is limited to a section of the pipe 17 of the fire extinguishing system with a first sprinkler 23 and a second sprinkler 24. The fire extinguishing system comprises a fire control centre 25, which is coupled to each of the sprinklers 18 of the fire extinguishing system via electrical lines 26.

20 The sprinklers 18 of the fire extinguishing system comprise, according to FIG. 10 a glass vessel 27, through which a plug (not shown) is held in position so that the outlet opening of the sprinkler 18 is closed. If the temperature exceeds a predetermined temperature threshold, the glass vessel 27 bursts and the outlet opening of the sprinkler 18 is released.

25 The glass vessel 27 is equipped with an electrically conductive coating. The electrically conductive coating is incorporated into a circuit that extends in the form of a closed conductor path from a sensor module 28 to the glass vessel 27 and back to the sensor module 28. The circuit is interrupted when the glass vessel 27 of the first sprinkler 23 shatters. The sensor module 28 registers the interruption of the circuit and sends a signal to a control unit 29. The sensor module 28 and the glass barrel 27 connected to it form a trigger sensor within the meaning of the invention.

30 After receiving the signal from the trigger sensor 27, 28, the control unit 29 sends a control command to a control module 30 to trigger a plurality of second sprinklers 24. The control module 30 feeds electric current into the lines 26 belonging to the second sprinklers 24 in order to heat the glass vessels 27 of the second sprinklers 24. The supply

of electric current continues until the respective temperature threshold is exceeded and the glass vessel 27 shatters. The second sprinklers 24 are also triggered.

In the embodiment according to FIG. 11, the fire extinguishing system comprises a branched pipe system 17 with a plurality of pipe strings 31, wherein each pipe string 31 is
5 equipped with a plurality of sprinklers 18. Each sprinkler 18 is assigned a sprinkler controller 32, which communicates with the control unit 29 via a data network 33. An electrical circuit is set up between the sprinkler controller 32 and the glass vessel 27 of the associated sprinkler 18, via which the sprinkler controller 32 can detect the state of the glass vessel 27 on the one hand and can heat the glass vessel 27 on the other hand in
10 order to trigger the sprinkler 18.

If the sprinkler controller 32 detects that the associated sprinkler 18 has been triggered, a signal is sent to the control unit 29. The control unit processes the signal from the sprinkler controller 32 of the first sprinkler 23 to determine second sprinklers 24 to be triggered by a control command to generate a water curtain 14 according to the
15 invention. The control unit 29 is also equipped with an operating unit 35 with which a water curtain 14 can be triggered manually.

FIG. 1 shows a vertical section through a building 15 with a fire extinguishing system 16 disposed on the ceiling. According to the horizontal section in FIG. 2, the fire extinguishing system comprises several lines 31, each with several sprinklers 18, which
20 are distributed over the surface of the building. The building 15 is divided into two sections 41, 42 by a wall 40. The sections 41, 42 are connected to each other via a passage 43 in the wall 40. A plurality of second sprinklers 24 are disposed above the passageway, evenly distributed over the entire width of the passageway 43.

When a fire occurs in the first section 41 of the building 15, one of the sprinklers 18
25 triggers as the first sprinkler 23. The trigger signal thus generated is processed in the control unit 29 to trigger all second sprinklers 24 disposed above the passage 43.

According to FIG. 3, the emerging water forms a spray cone 44 at each of the second sprinklers 24. The second sprinklers 24 are disposed at such a small distance from one another that the spray cones 44 of two neighbouring second sprinklers 24 each overlap
30 with one another. In this way, a continuous curtain of water is formed, which extends from the first lateral delimitation to the second lateral delimitation of the passage 43. The overlap extends over more than 50% of the height between the second sprinklers 24 and the floor.

The water curtain 14 prevents the fire or smoke gases generated by the fire from escaping from the first section 41 into the second section 42 of the building 15. The small gaps between the spray cones 44 in the upper region of the passage 43 are harmless. Presumably due to air turbulence, the flue gases do not pass through passage 43 in this region either.

FIG. 4 shows a building 15 in the form of a warehouse. The warehouse is equipped with a large number of high racks 45 with aisles between them. One line 31 of the fire extinguishing system 16, shown here only in part, extends across the warehouse from one wall to the opposite wall. After a fire breaks out and a first sprinkler 23 is triggered, as shown in FIG. 4, all second sprinklers 24 are triggered, resulting in a water curtain 14 that extends across the warehouse from one outer wall to the opposite outer wall. The water curtain 14 prevents the fire or flue gases from spreading to the other region of the warehouse.

FIG. 5 shows a warehouse 15 in which the line 31 of the fire extinguishing system 16 with the second sprinklers 24 does not extend in a straight line, but along a doubly deflected path between the opposite outer walls. The effect is the same as in FIG. 4. After a fire breaks out and a first sprinkler 23 is triggered, a water curtain 14 is formed which extends continuously between the two opposite outer walls of the warehouse 15.

In the embodiment according to FIG. 6, the building 15 is a shopping centre, in the centre of which a free-standing staircase 46 is disposed. The staircase 46 extends through an opening in the ceiling to a floor above. A pipe 17 of the fire extinguishing system 16 is disposed on the ceiling around the opening and is provided with a large number of second sprinklers 24. As shown in FIG. 6, after triggering a first sprinkler 23, the control unit 29 sends a triggering command to all second sprinklers 24 of the pipeline 17, resulting in a water curtain 14 that extends along a closed path around the staircase 46. The water curtain 14 prevents the fire or smoke gases caused by the fire from spreading through the opening in the ceiling. The staircase 46 can still be used by people.

FIG. 7, a building 15 in the form of a department store is shown, in which a staircase 46 adjoins a building wall 47.

The pipe 17 extends around the staircase 46, so that the pipe 17 together with the building wall 47 forms a closed path around the staircase 46. After a fire breaks out, all second sprinklers 24 of the pipeline 17 are triggered, resulting in a water curtain 14 that extends continuously from a first region to a second region of the building wall 47. The

spread of fire and smoke gases through the staircase 46 is prevented, while the staircase 46 can still be used by people.

5 A building 15 in FIG. 8 comprises a large hall 48 on an upper floor. On an outer wall of the building 15, a segment of the hall is bordered by a pipe 17 of the fire extinguishing system 16. After a fire breaks out in the room 48, all second sprinklers 24 of the pipeline 17 are triggered so that an uninterrupted water curtain 14 is formed, separating the segment from the rest of the room 48. People in the room can go to the segment separated by the water curtain 14 and wait there until they are rescued from outside via an escape route 49.

Patentkrav

1. Brandslukningsanlæg med et antal sprinklere (15), med en udløssersensor (27, 28), der giver et udløssersignal ved udløsning af en første sprinkler (23), og med en styreenhed (29), der behandler udløssersignalet for at frembringe
- 5 styrekommandoer, med hvilke et antal andre sprinklere (24) udløses, således at de andre sprinkleres (24) forstøvningskegler (44) overlapper hinanden, og at de andre sprinkleres (24) forstøvningskegler (44) danner et slukningsmiddelgardin (14), der er indrettet mellem den første sprinkler (23) og et område, der skal beskyttes, idet en styrekommando, med hvilken de andre sprinklere (24), der
- 10 danner slukningsmiddelgardinet (14), udløses, transmitteres fra styreenheden (29) til de andre sprinklere (24) over en kabelbunden forbindelse eller en radioforbindelse.
2. Brandslukningsanlæg ifølge krav 1, **kendetegnet ved, at**
- 15 slukningsmiddelgardinet (14) er et vandgardin.
3. Brandslukningsanlæg ifølge krav 1 eller 2, **kendetegnet ved, at** de andre sprinklere (24) er ophængt i loftet i et rum, således at forstøvningskeglerne (44) strækker sig fra loftet til gulvet.
- 20
4. Brandslukningsanlæg ifølge et af kravene 1 til 3, **kendetegnet ved, at** overlappingsområdet mellem to tilstødende forstøvningskegler (44) strækker sig over mindst 30 %, fortrinsvis mindst 50 %, mere foretrukket mindst 70 % af højden mellem de andre sprinklere (24) og gulvet.
- 25
5. Brandslukningsanlæg ifølge et af kravene 1 til 4, **kendetegnet ved, at** slukningsmiddelgardinet (14) strækker sig uden afbrydelse mellem to sideværts begrænsninger.
- 30
6. Brandslukningsanlæg ifølge krav 5, **kendetegnet ved, at** der mellem de sideværts begrænsninger er indrettet en passage (43).
7. Brandslukningsanlæg ifølge et af kravene 1 til 6, **kendetegnet ved, at** et første bygningsafsnit (41) adskilles fra et andet bygningsafsnit (42) med

slukningsmiddelgardinet (14).

8. Brandslukningsanlæg ifølge et af kravene 1 til 4, **kendetegnet ved, at** slukningsmiddelgardinet (14) strækker sig langs en lukket sti omkring et område, 5 der skal beskyttes.

9. Brandslukningsanlæg ifølge et af kravene 1 til 8, **kendetegnet ved, at** sprinklerne (18) har en udløbsåbning, og at udløbsåbningen i brandslukningsanlæggets beredskabstilstand holdes i en lukket tilstand af et 10 udløselement (27).

10. Brandslukningsanlæg ifølge krav 9, **kendetegnet ved, at** udløssensoren (27, 28) omfatter en elektrisk lederbane, i hvilken udløselementet (27) er indlejret.

15

11. Brandslukningsanlæg ifølge krav 9 eller 10, **kendetegnet ved, at** udløselementet (27) er en med en elektrisk ledende belægning forsynet glasbeholder.

20 **12.** Bygning med et brandslukningsanlæg (15) ifølge et af kravene 1 til 11.

13. Fremgangsmåde til bekæmpelse af en brand, ved hvilken der efter udløsningen af en første sprinkler (23) frembringes styrekommandoer, med hvilke et antal andre sprinklere (24) udløses, således at de andre sprinkleres (24) 25 forstøvningskegler (44) overlapper hinanden, og at de andre sprinkleres (24) forstøvningskegler (44) danner et slukningsmiddelgardin (14), der er indrettet mellem den første sprinkler (23) og et område, der skal beskyttes, idet de styrekommandoer, med hvilke de andre sprinklere (24), der danner slukningsmiddelgardinet (14), udløses, transmitteres fra styreenheden (29) til de 30 andre sprinklere (24) over en kabelbunden forbindelse eller en radioforbindelse.

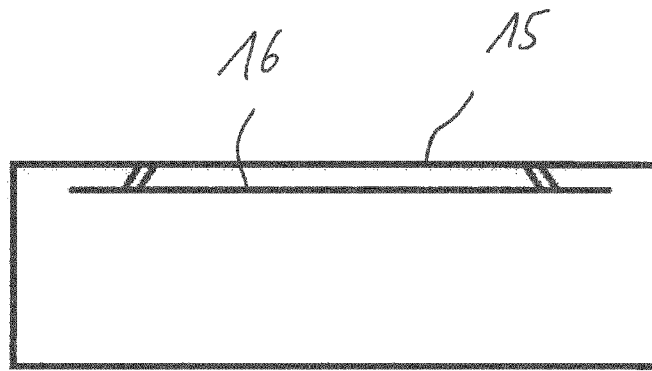


Fig. 1

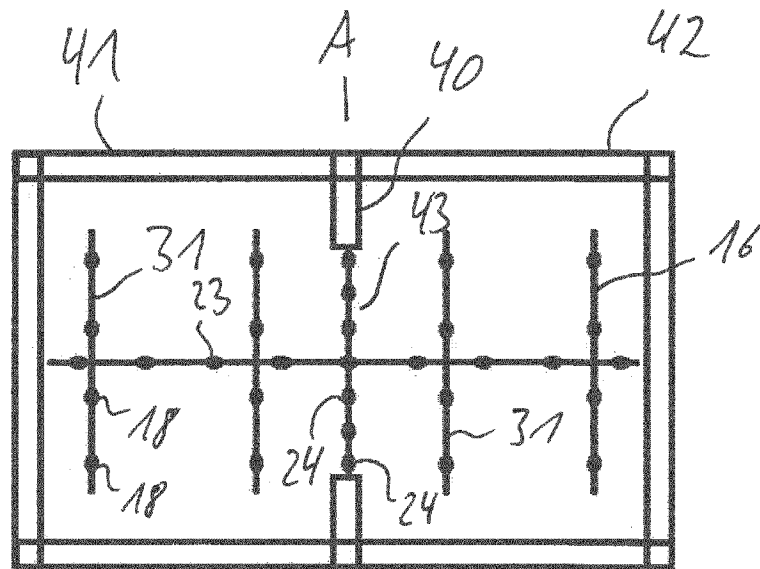
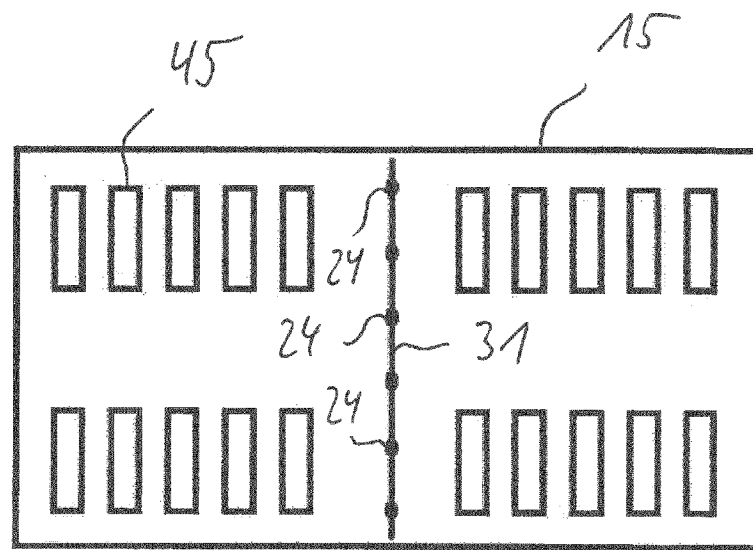
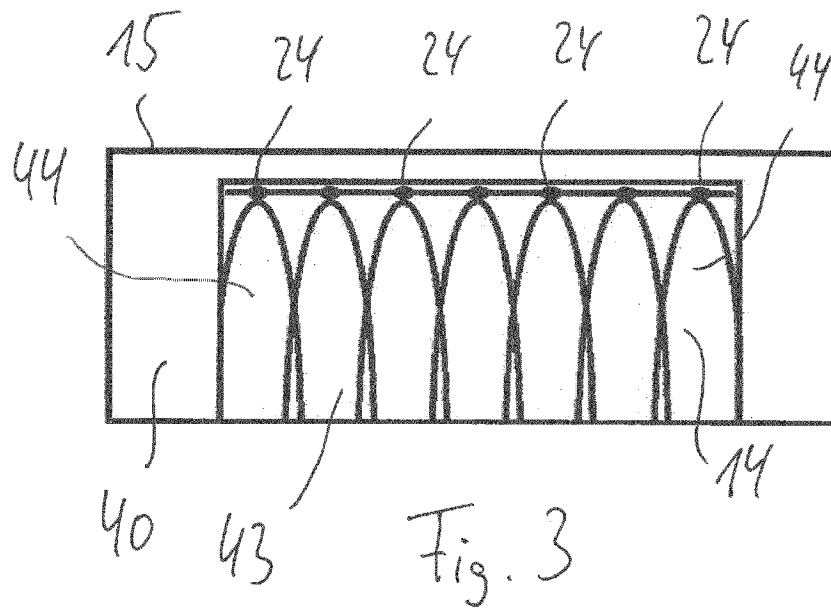
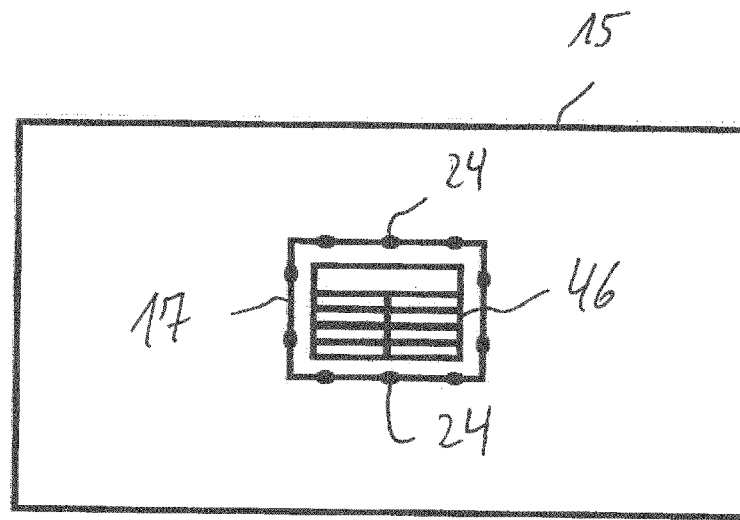
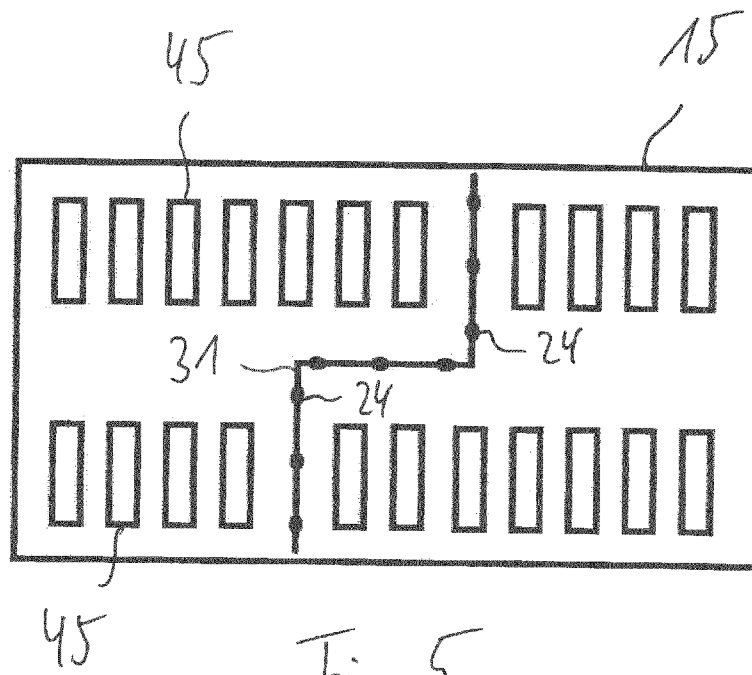


Fig. 2





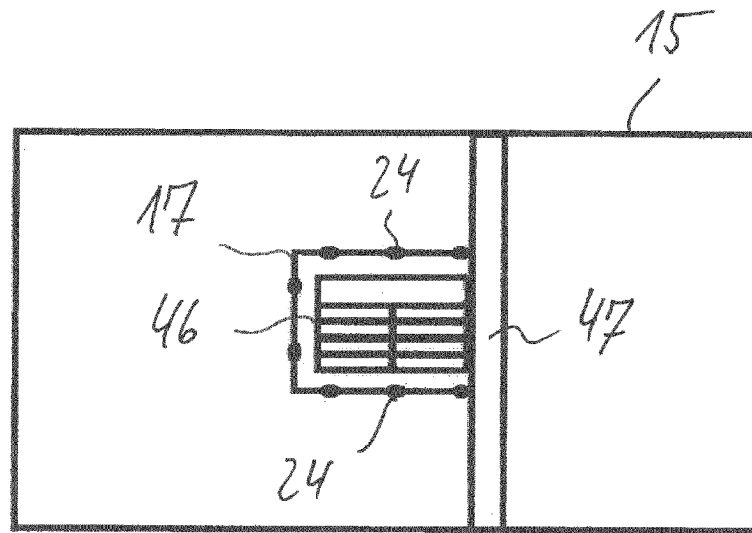


Fig. 7

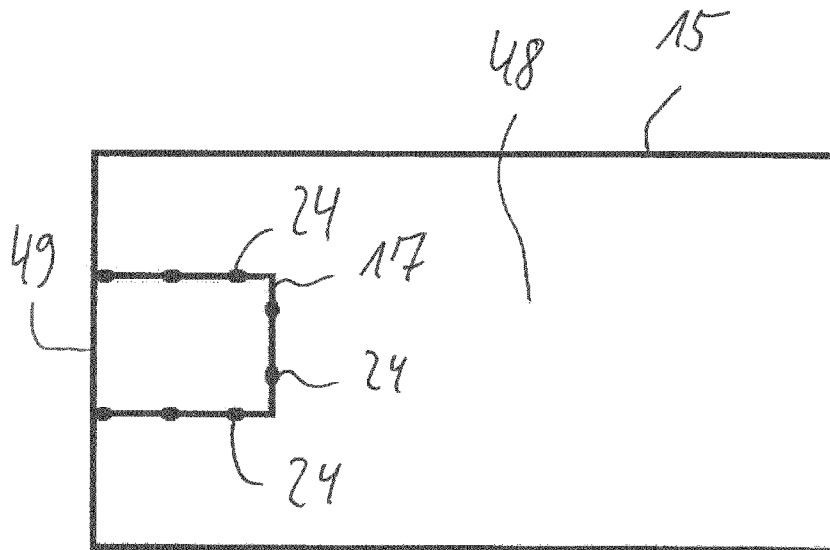


Fig. 8

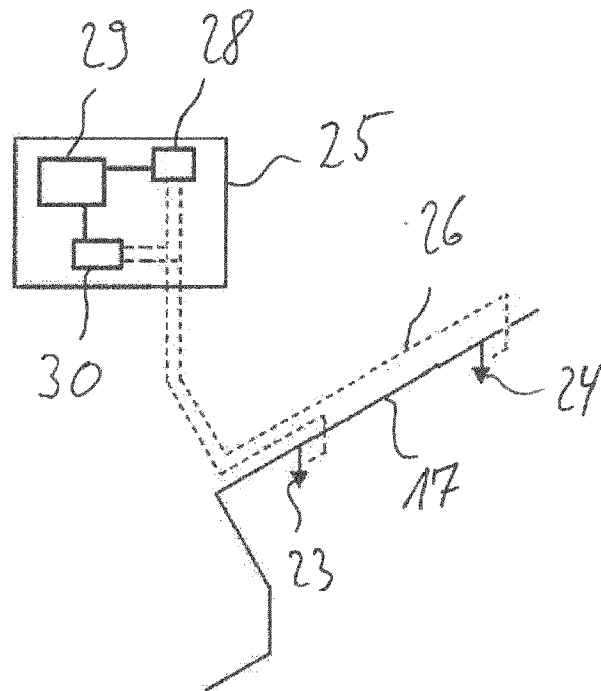


Fig. 9

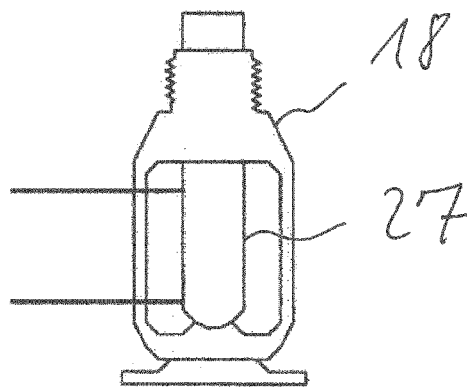


Fig. 10

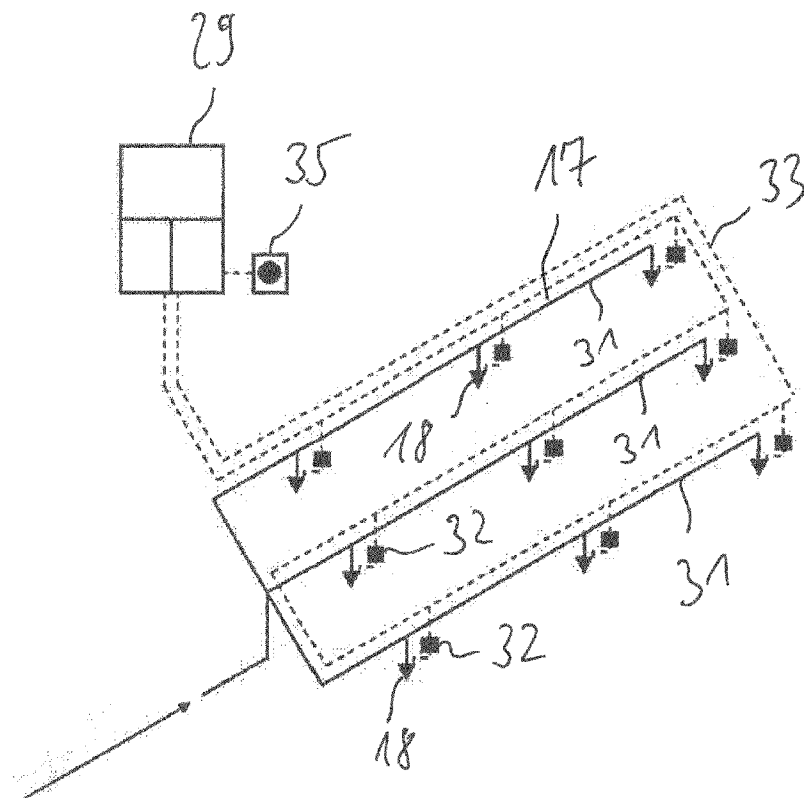


Fig. 11

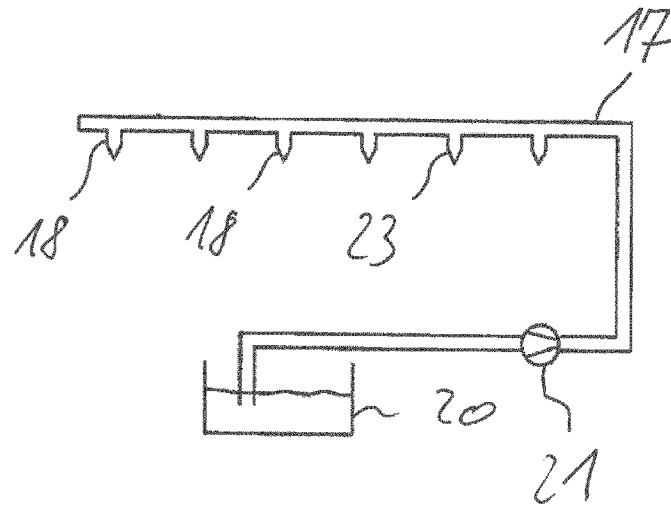


Fig. 12