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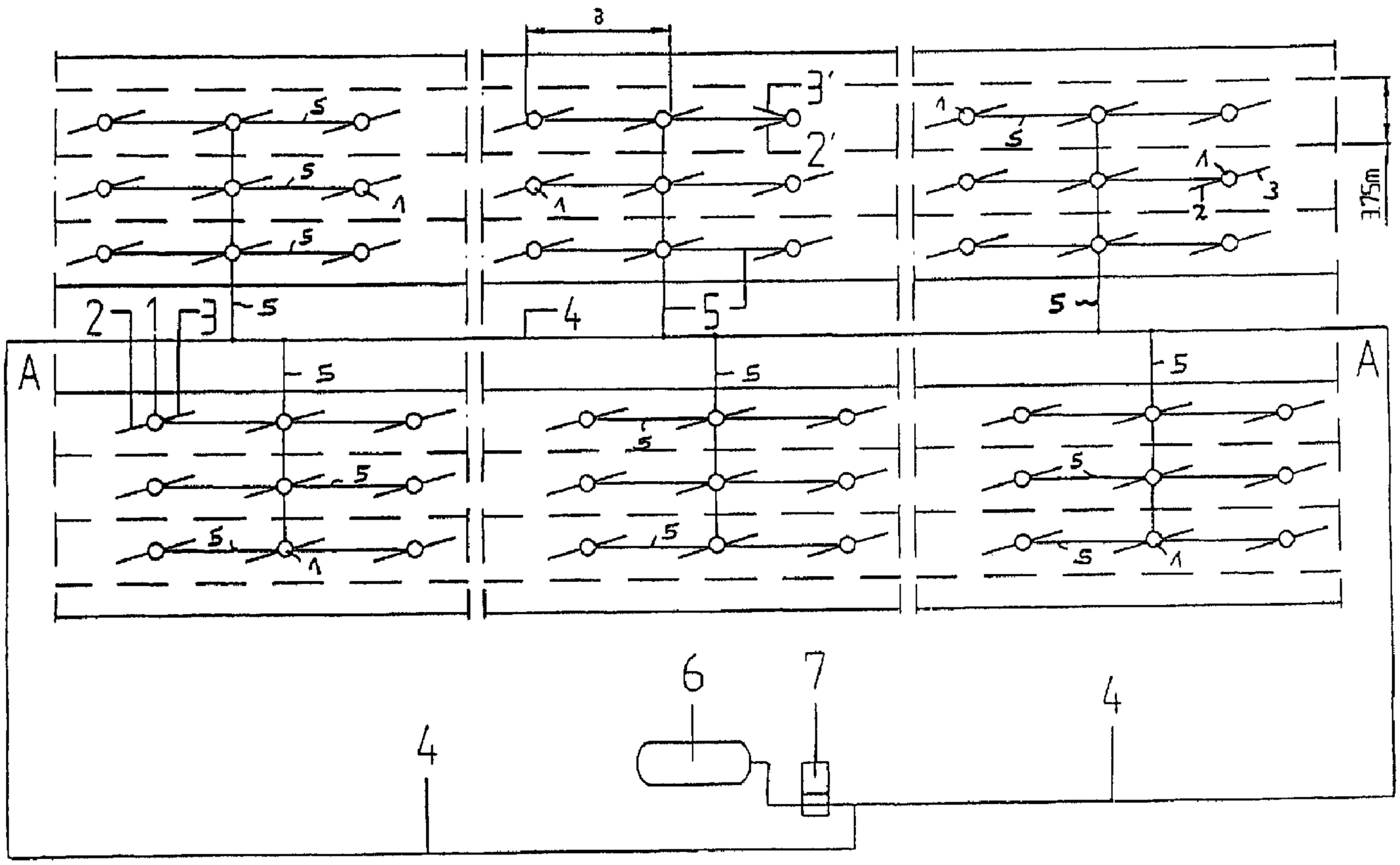
(54) Title: A METHOD AND A STATIONARY ARRANGEMENT FOR DISCHARGING A DEICING LIQUID



(57) Abrégé/Abstract:
In order to distribute thawing agents on a roadway, a plurality of spraying bodies are used which produce fine spray streams. Said spray streams can be activated for long spraying periods. In this manner, the disturbance of traffic is reduced compared to when preart systems are used, and the thawing agent spraying system is effectively simplified.

Abstract

In order to distribute thawing agents on a roadway, a plurality of spraying bodies are used which produce fine spray streams. Said spray streams can be activated for long spraying periods. In this manner, the disturbance of traffic is reduced compared to when preart systems are used, and the thawing agent spraying system is effectively simplified.

A METHOD AND A STATIONARY ARRANGEMENT FOR DISCHARGING A DEICING LIQUID

TECHNICAL FIELD

This is a divisional application of Canadian Patent Application Serial No. 2,324,948 filed on March 16, 1999.

The invention relates to a method and an arrangement for the dispersion of a deicing liquid on a traffic area. It should be understood that the expression "the invention" and the like encompasses the subject matter of both the parent and the divisional application.

BACKGROUND ART

Stationary arrangements for discharging of a deicing liquid are known for example from EP-A- 0 458 992. Such discharging arrangements apply a deicing liquid, which is usually a solution of NaCl, to a traffic area, this term including for example roads, bridges, airport runways and taxi strips. The bringing out of the deicing liquid is performed by spraying nozzles which are, for example, arranged at guard rails at the side of the traffic area or which are arranged in the surface of the traffic area, as this is for example known from CH-A-658 411 or EP-A- 0 461 295, respectively. A further stationary arrangement is known from US-A-5 447 272.

The known arrangements for discharging deicing liquid produce strong jets of deicing liquid of a short duration of 1 to 2 second, in order not to disturb the traffic. Strong, long-distance jets (approx. 10 meters) in an amount of liquid of 0,2 liters to 1 liter per second are produced. This way of the bringing out of the liquid either necessitates conduits with a considerable inner diameter, or local pressure reservoirs as shown in EP-A- 0 458 992.

Further, controllable valves, for example electrically controllable valves, are necessary for the short-time activation of the deicing liquid discharge and, accordingly, electrical control lines are necessary.

Further, it is possible - even if such a reaction may occur only in few cases - that the short-time, strong prior art jets may lead to a panic reaction of drivers which may cause accidents. DE-A-32 36 401 shows nozzle bodies for giving out water spray jets for fighting dust in underground mining. JP-A-82 69 927 shows an arrangement for the fighting of fog on roads, wherein jets are parabolically sprayed over the road.

DISCLOSURE OF INVENTION

Hence, it is an object of the invention to provide a method for discharging a deicing liquid of the mentioned kind which does not exhibit the drawbacks mentioned above. In particular a simple and inexpensive method that reduces the danger of panicky reactions of drivers shall be provided.

The present invention provides a method for the dispersion of deicing liquid on a traffic area, wherein the deicing liquid is ejected in liquid jets by spraying bodies, having outlet openings, arranged in the traffic area, and wherein the ratio of square meters of traffic area to the number of spraying bodies is in the range of 15 up to 40 to 1.

The present invention also provides an arrangement for the dispersion of a deicing liquid on a traffic area, wherein a plurality of spraying bodes are provided, such that the ratio of traffic area in square meters to the number of spraying bodies is in the range of 15:1 to 40:1.

By bringing out such very fine jets with a capacity that is considerably reduced in comparison with the prior art jets, it is possible on the one hand to reduce the effect of these fine jets to vehicles so far that sudden frightened reactions can practically be excluded. The very thin jets generated are usually invisible to drivers and do not generate audible noises when they impinge upon a vehicle. The small amount of liquid brought out by each jet, and also by several jets, further produces no significant reduction of pressure in the deicing liquid conduits or, on the other hand, allows the use of conduits with a small diameter.

Accordingly, the costs of material and the costs for the laying of the conduits is reduced considerably. The new method further allows to start and to stop the spraying of the deicing liquid by activating and deactivating the deicing liquid pump during a predetermined time, and makes it thus possible to dispense with the large number of valves of the prior art.

The deicing liquid is preferably brought-out for a duration lying in the range of 10 seconds to 10 minutes or more and in particular in the range of 30 seconds to 10 minutes, and further in the range of 30 seconds to 5 minutes.

The object is further met by the features that a multitude of spraying points, which bring-out the deicing liquid jets, are provided in such a way that one spraying point is provided for each 15 m^2 to 40 m^2 of the traffic area and in particular of road lane area.

Such a large number of spraying points allows the generation of very fine jets which in practice are invisible and which do not reach very far, which results in the above mentioned advantages and effects, and on the other hand results in a sufficiently distributed bringing out of deicing liquid on the traffic area.

Outlets of a small diameter, in particular in the form of nozzles, produce the small amount of brought out liquid. The outlet openings have a smallest inner diameter of 0.1 to 1 mm, in particular 0.3 to 0.6 mm.

BRIEF DESCRIPTION OF DRAWINGS

In the following special embodiments of the invention are shown with reference to the drawings, wherein

Figure 1 shows a schematic view of a deicing liquid spraying arrangement on a highway;

Figure 2 shows another embodiment of a deicing liquid spraying arrangement;

Figure 3 shows schematically a sectional view of a spraying body;

Figure 4 shows a sectional view of a nozzle, and

Figures 5a and 5b show schematic diagrams of deicing liquid spraying arrangements.

MODES FOR CARRYING OUT THE INVENTION

Figure 1 shows a schematic representation of an arrangement for bringing out deicing liquid in order to explain the method. Figure 1 represents a view from above on a highway having six lanes, as an example for a traffic area. A multitude of spraying points 1 are shown on the lanes. These points are for example spraying bodies incorporated into the road surface, as shown in Figure 3, so that they can be driven over by vehicles. Each of the spraying bodies 1 is able to emit in the shown example two deicing liquid jets 2, 3 or, as another example, 2, 3', which are emitted in non-parallel direction to the lane. The spraying bodies are fed with deicing liquid by conduits 4 and 5, respectively, which are running to the spraying bodies beside the lanes or below the road surface. A deicing liquid tank 6 is provided for the deicing liquid, which is fed by a deicing liquid pump 7 to the conduits 4 and 5, leading to the spraying bodies 1. The width of a single lane is 3,75 meters in the shown example, and the distance "a" between spraying bodies is between approximately 6 metres to 10 metres. If a distance of 6 metres is selected as the distance "a", a traffic area of 607,5 square metres is sprayed by 27 spraying bodies, which results in a relationship of square metres traffic area for each

spraying head of 22,5. If a distance "a" of 10 metres is selected, the relation corresponds to 37,5. As a rule, a value of 15, and in particular of 20, up to 40 will show good results. This high number of spraying bodies is clearly different from the prior art number, where each body emits strong long distance jets. Only 14 such prior art bodies would have been used in the example of Figure 1 compared to the 27 spraying bodies as shown.

In the shown example of the invention, each jet 2, 3 will reach within the range of about 1 metre to 4 metres, and in particular 1,5 metres to 2,5 metres and for example about 2 metres. The jets are very fine jets which are almost invisible and which are emitted under high pressure. The amount of liquid brought out is in the range of 0,1 litres per minute to 1 litre per minute only, and in particular 0,1 litres per minute to 0,8 litres per minute, preferably within the range of 0,1 litres per minute to 0,5 litres per minute. These jets of reduced output are generated by a very small output opening of each spraying body, which opening is preferably a nozzle, and which has a diameter in the range of 0,1 mm to 1 mm, and in particular a diameter of 0,3 mm to 0,6 mm. These fine jets are generated with a pressure of the liquid in the body in front of the output opening or nozzle, respectively, of about 8 bar to 15 bar, and in particular between 10 bar and 15 bar. The spraying bodies are fed with deicing liquid under this pressure by the conduits 4 and 5. The conduit 4 as main conduit may have for example an inner diameter of only 14 mm, since only a small amount of deicing liquid is leaving the small output openings, and therefore the flow of deicing liquid in the conduit produces only a reduction of the pressure in the conduit which is not significant. Conduits 5 leading to each subgroup of spraying bodies may even have an inner diameter of only 4 mm. Accordingly,

the laying of the conduits is made easier and less expensive by the small diameters. The conduit 4 can be a ring conduit as shown, whereby the same pressure is provided at both ends A - A of the feeding line. A ring line further allows a simple flushing of the conduit. However, because of the small amount of deicing liquid ejected per unit of time by all spraying bodies 1, a single non-ring conduit 4 may also be sufficient for feeding.

The start and the end of ejecting deicing liquid is prompted by activation and deactivation of pump 7, respectively. Due to the small amount of deicing liquid ejected by the very fine jets of deicing liquid, a bring-out time is effected that is considerably longer than in the prior art systems where the bring-out time is controlled by valves and has a duration of 1 to 2 seconds only. With the method and the deicing arrangement as shown a bring-out duration of 10 seconds up to 10 minutes or even more is used, in particular a duration in the range of 30 seconds to 5 minutes. The duration, of course, is related to the kind of spraying. In the case of a preventive deicing liquid spraying, where the effective amount of deicing substance is approximately 2 g/m^2, the duration will be about 30 seconds for bringing out a respective amount of the liquid deicing solution, which is for example a 20% solution of NaCl. If, however, a film of ice is already present and has to be thawed, which brings about an effective need of deicing substance in the range of 15 to 20 g/m^2, a spraying duration of several minutes is used. The long duration is further favorable for the spreading of the deicing liquid, since changing wind directions during the spraying have a positive influence on the spreading; further, air turbulences caused by vehicles can be used.

In the shown arrangement there are no controlled valves in the conduits so that all of the spraying bodies start ejecting liquid when the pump is activated.

Instead of the shown embodiment without valves, it is possible, though, to arrange controllable valves in conduits 5 which branch from conduits 4, so that the spraying of selected single sections of the lanes can be controlled. This is shown in the example of Figure 2, where two lanes are shown, each with a width of 3,75 metres, as shown before. Here several spraying bodies 1 are also shown schematically. Those bodies 1 being at the edge of each lane generate only one spraying jet 2 whereas the spraying bodies that are placed in the middle between the lanes generate each two spraying jets 2, 3. The spraying pressure is generated as well by a pump 7 fed from a liquid tank 6. A liquid meter 8 can be provided in the conduit. Conduit 4 leads along the entire lane to the spraying sections which are served by conduits 5. Conduits 5 are connected to the main conduit 4 by controllable valves 9, so that the lanes are divided into several spraying sections which may be activated and deactivated separately by controlling valves 9. In both examples shown so far it is also possible to use several parallel conduits, even with different diameters, instead of a single conduit 4.

It is possible to arrange nonreturn valves within conduit 4. These valves prevent on an incline the flowing back of liquid towards pump 7 when the pump is not activated. It is possible to omit these valves when a flowing back is wanted. It is usually preferred to have no liquid within conduits 5. This makes it further possible to use different kinds of deicing liquid for different temperature ranges, which liquids are not compatible with each other. It is also possible to use controlled valves and/or nonreturn valves

with the arrangement of Figure 1 if this is desirable for a controlled spraying of sections of the lanes.

Figure 3 shows a schematical sectional view of a spraying body 1. This body generates two deicing liquid jets 2 and 3. This preferred spraying body comprises a first part 10 which forms on the one hand a connection for connecting the body to conduit 5 and is provided on the other hand with the output openings for jets 2 and 3. The output openings can be provided with nozzles 11 and 12, wherein the openings or nozzle openings have an inner diameter in the range of 0,1 mm to 1 mm and preferably in the range of 0,3 mm to 0,6 mm or to 0,8 mm, for generating the desired fine jets. Further, the spraying body 1 is provided with a supporting flange 14 which comprises recesses 15 and 16 for the respective jet and allows as a supporting plate an embedding of the spraying body into the surface of the traffic area. The part 10 and the plate 14 may consist of two pieces as shown or may be one piece. The part 10 may be made of metal or a plastic material, and the plate 14 is preferably made of a plastic material, for example polyoxymethylene (POM). The shown embodiment of the spraying body 1 combines low production costs and a low height h of, for example, only 30 mm or less. This makes possible a mounting into the surfaces of bridges without the danger of injuring isolation layers or the mounting in very open asphalt. The spraying bodies, however, are only shown as an example for providing the large number of spraying points. These may also be provided as openings or nozzles, respectively, in a conduit which is laid near the lane or on the lane or in the surface of the lane, respectively, so that the conduit forms an elongated spraying body with a multitude of nozzles.

Figure 4 shows schematically a sectional view of a nozzle 11, 12 as preferably used. The smallest zone has a diameter b of 0,1 to 1 mm and preferably of 0,1 to 0,6 mm or

0,3 to 0,6 mm. The nozzle is fed for bringing out deicing liquid with deicing liquid with a pressure of 8 to 15 bar and generates the very fine liquid jets which in practice are almost invisible. Even a plurality of such nozzles results in a very small discharge section; for example 100 nozzles with a diameter of 0,6 mm result in a total sectional area of only 28 mm^2. A conduit with an inner diameter of 14 mm on the other hand has a cross-sectional area of about 154 mm^2 and is therefore able to feed a very large number of spraying points along its length without a relevant loss of pressure.

Too great a pressure loss is avoided further in that the liquid fed by the pump is discharged continuously so that the conduits are continuously transporting a smaller amount. If only half the amount is transported, the pressure loss is only a quarter. This effect was not used in the prior art deicing arrangements.

Figures 5a and 5b show in a very simplified schematical drawing deicing liquid spraying arrangements with a pump 7 connected to a deicing liquid tank not shown and with a multitude of spraying points 1, which are fed by the small diameter conduits 5 already mentioned. In addition to the conduit 4, as shown in Fig. 1 and 2, further conduits are provided, a feeding conduit 17 and additionally a by-pass conduit 18 (Fig. 5b). Nonreturn valves 19 are provided as well. In the case of Figure 5a, the pump is provided at the lowest point of the conduits 4, 7 and 18 which are laid along a sloping lane, in the case of Fig. 5b at the highest point.

The conduits are arranged in these examples in such a way that on the one hand diameters as small as possible can be used, and on the other hand such that the feed conduit and/or the by-pass conduit remain filled with liquid when the pump is deactivated, in order to attain a rapid spraying along the whole length after reactivation of the

pump. This is a result of the connecting conduits 20 and the nonreturn valves. Even if conduits 5 are empty, it is possible to spray only a short time after activation of the pump 7 with the help of mostly filled conduits 4, 17 and 18 depending on where the nonreturn valves have been arranged. Electrically controllable valves may be used instead of the nonreturn valves to hold a liquid reserve in conduits 4, 17 and 18 when the pump 7 is deactivated.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for the dispersion of deicing liquid on a traffic area, wherein the deicing liquid is ejected in liquid jets by spraying bodies, having outlet openings, arranged in the traffic area, and wherein the ratio of square meters of traffic area to the number of spraying bodies is in the range of 15:1 to 40:1.

2. A method according to claim 1, wherein the traffic area is a lane area of a roadway.

3. A method according to claim 1 or 2, wherein the pressure of the liquid before each outlet opening is in the range of 5 to 20 bar.

4. A method according to any one of claims 1 to 3, wherein the pressure of the liquid before each outlet opening is in the range of 10 to 15 bar.

5. A method according to any one of claims 1 to 4, wherein the spraying bodies are mounted substantially flush with a surface of the traffic area, which bodies each emit one or several jets of deicing liquid.

6. A method according to any one of claims 1 to 5, wherein the spraying bodies mounted substantially flush with the surface of the traffic area, which bodies each emit two jets of deicing liquid.

7. A method according to any one of claims 1 to 6, wherein the jets are emitted in the range of 10 seconds to 10 minutes.

8. A method according to any one of claims 1 to 6, wherein the jets are emitted in the range of 30 seconds to 5 minutes.

9. A method according to any one of claims 1 to 8, wherein the throwing range of the jets is from 1 to 4 meters.

10. A method according to any one of claims 1 to 8, wherein the throwing range of the jets is from 1.5 to 2.5 meters.

11. An arrangement for the dispersion of a deicing liquid on a traffic area, wherein a plurality of spraying bodies are provided, such that the ratio of traffic area in square meters to the number of spraying bodies is in the range of 15:1 to 40:1.

12. An arrangement according to claim 11, wherein a conduit connected to at least one pump is a ring conduit from which tap lines lead to the spraying bodies.

13. An arrangement according to claim 12, wherein the conduit is provided with a valve which keeps at least a part of the conduit filled with liquid when the pump is in deactivated state.

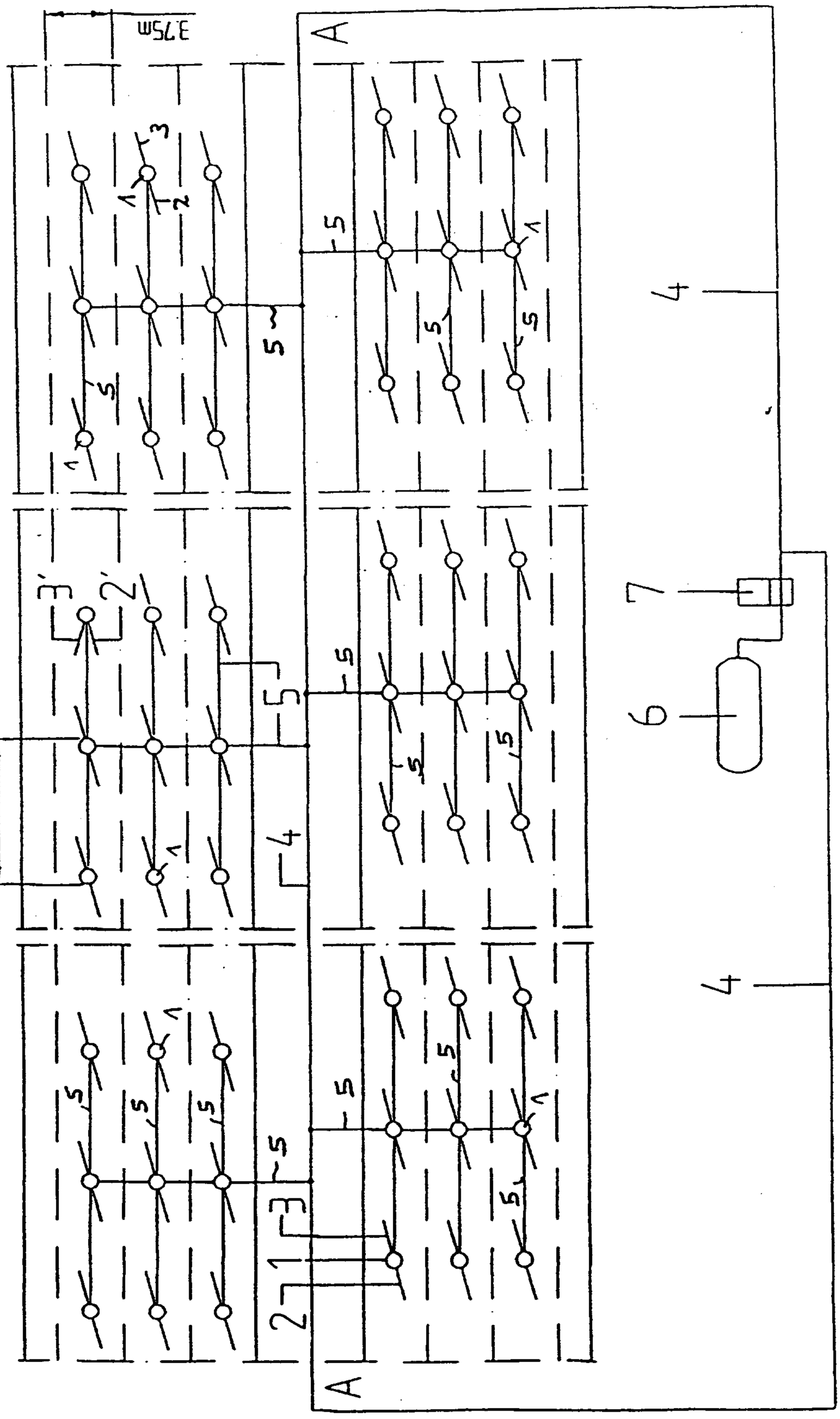


Fig. 1

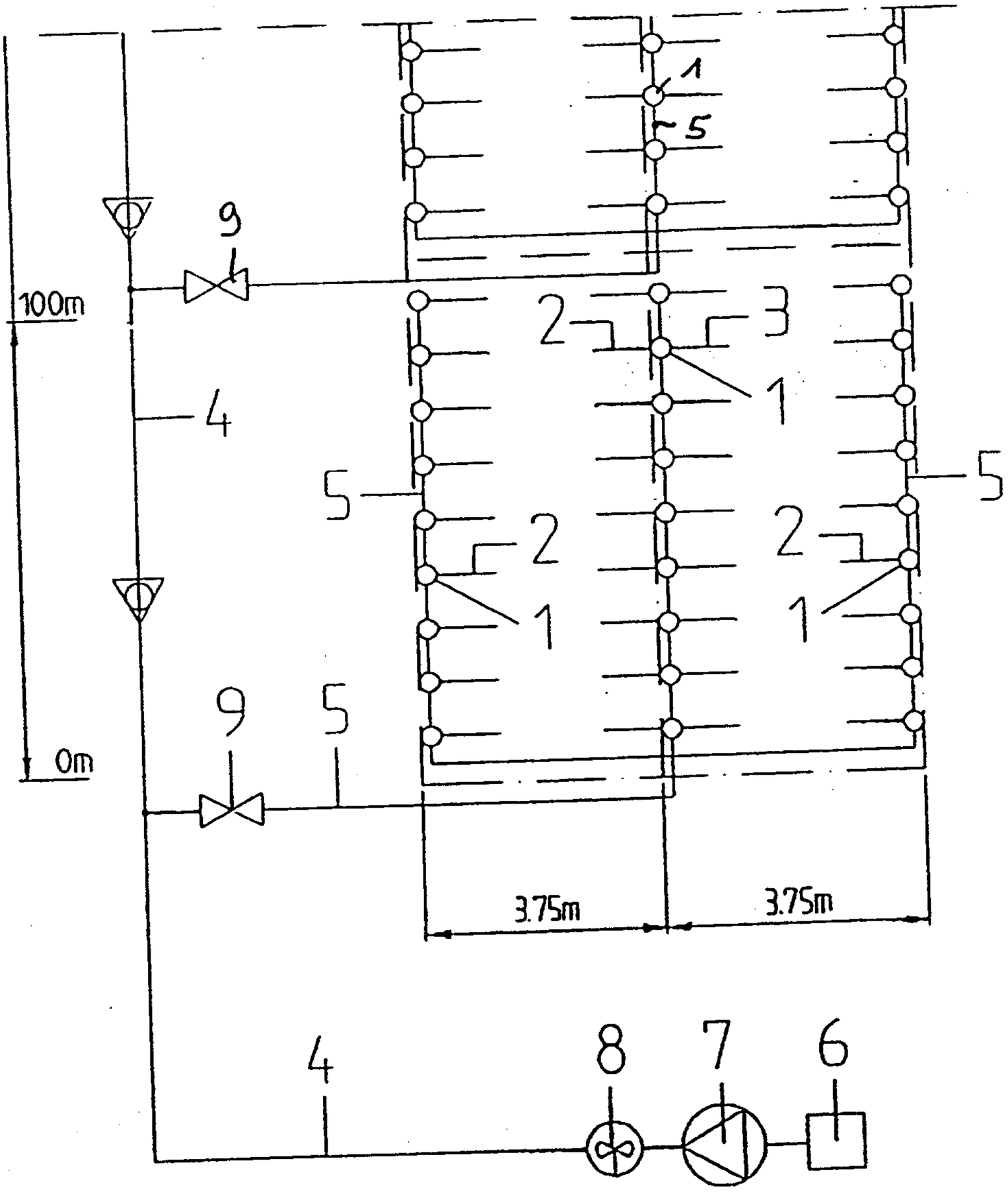
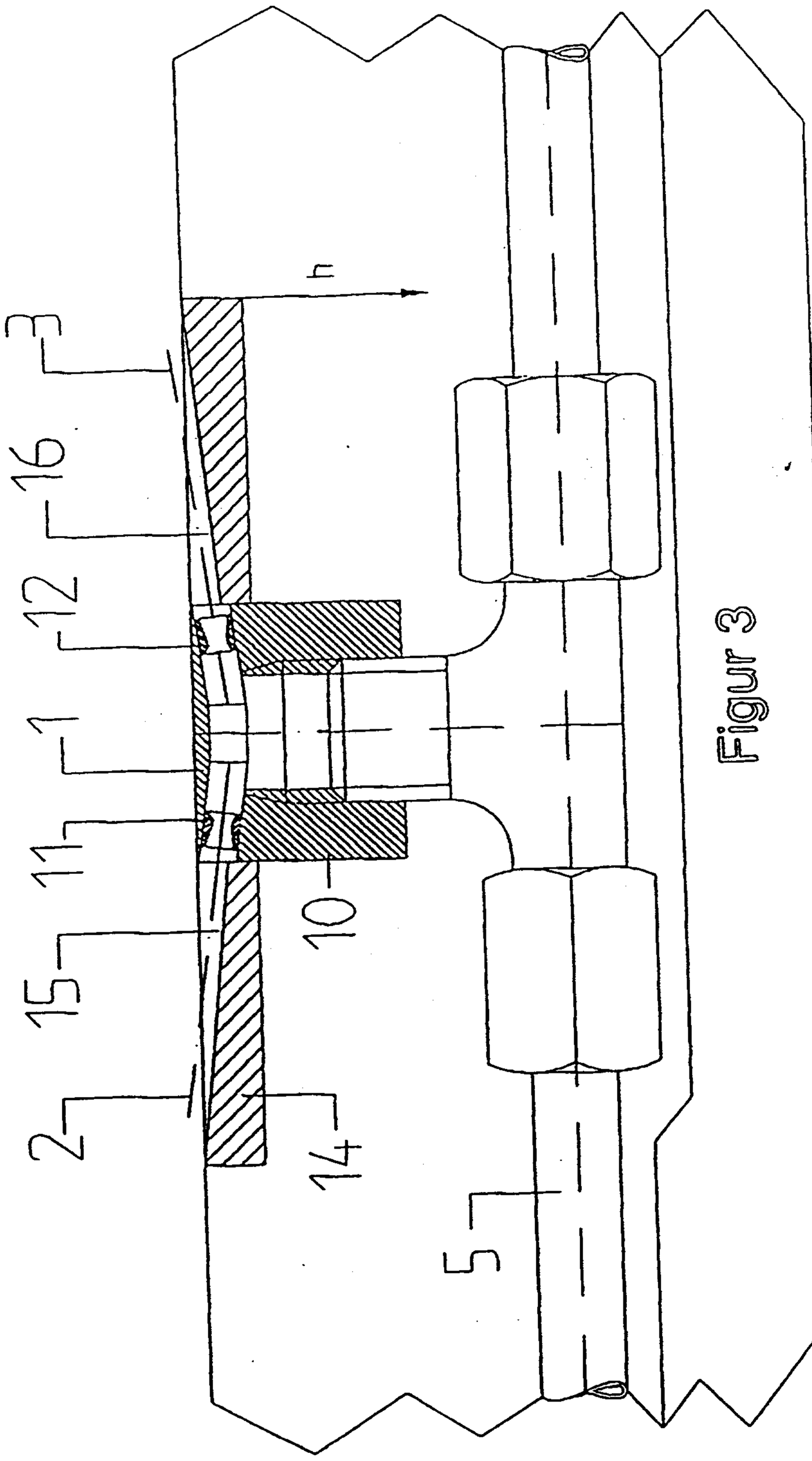
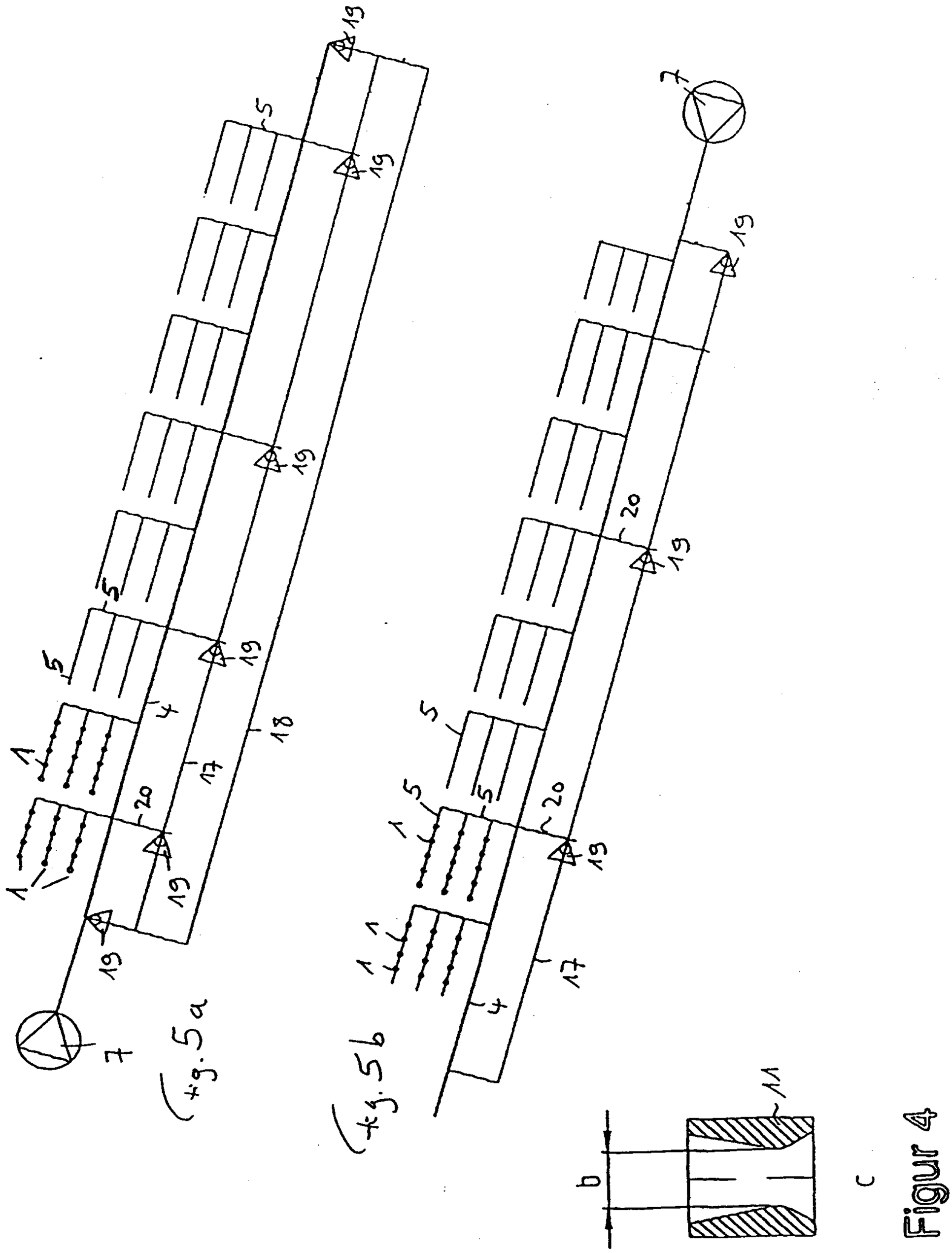


Fig. 2



Figur 3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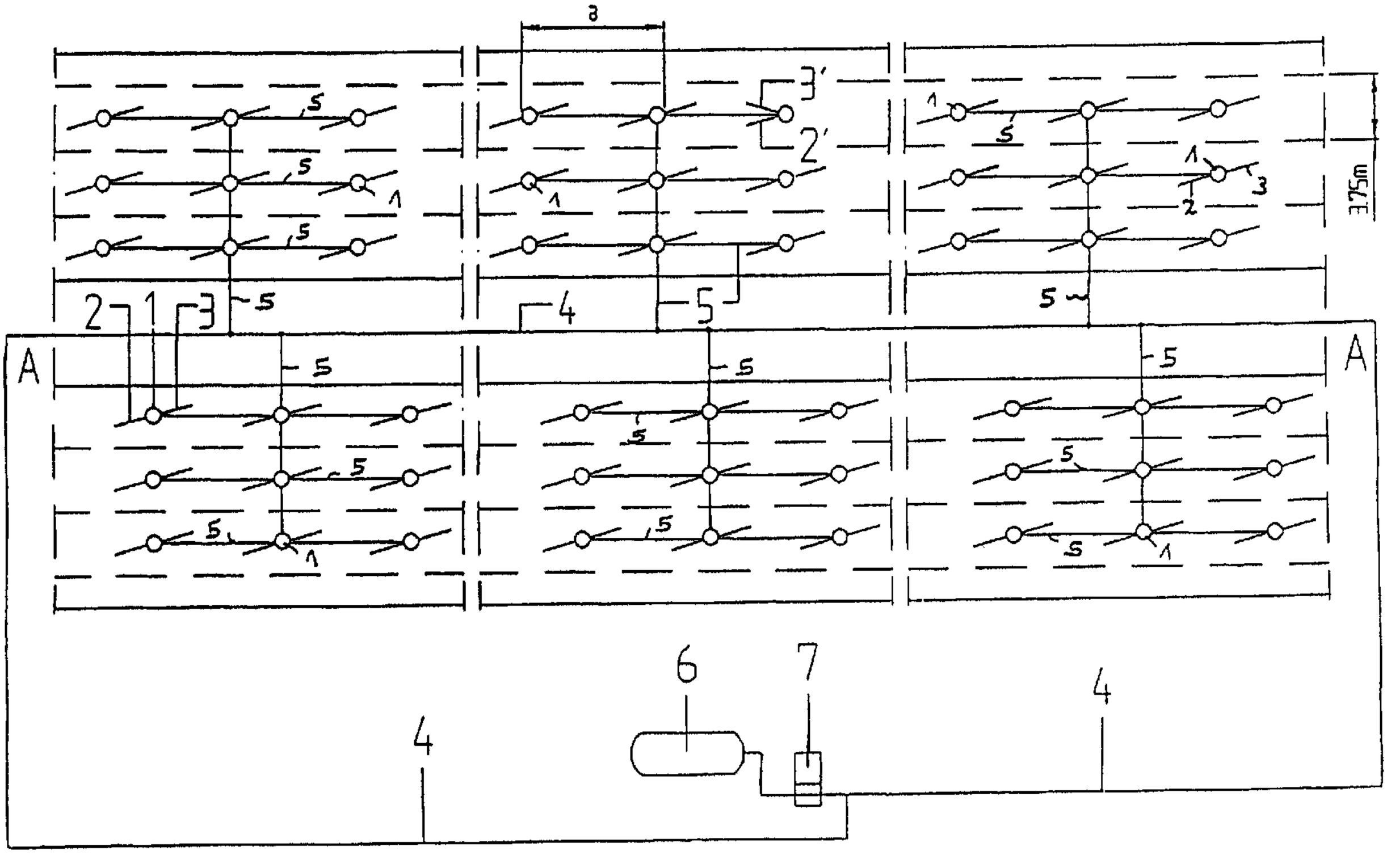
Figur 4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