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(54) **METHOD AND ARRANGEMENT FOR KEEPING A MAGAZINE OF ICE CUBES AND LIQUID IN A
LOOSE AND LUMP-FREE CONDITION**

VERFAHREN UND EINRICHTUNG UM EISWÜRFEL UND FLÜSSIGKEIT IN EINEM LAGERRAUM
LOSE UND KLUMPFREI ZU HALTEN

PROCEDE ET AGENCEMENT POUR QU'UN STOCK DE CUBES DE GLACE DANS UN LIQUIDE
RESENT DETACHES LES UNS DES AUTRES ET NE S'AGGLOMERENT PAS

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Description

The present invention concerns a procedure and an arrangement for storing a mixture of ice cubes and water in a magazine, and, when needed, collecting and transporting ice cubes to an area of use, especially for vessels such as fishing vessels. The main purpose of the present invention is to keep the ice cubes in a loose and lump-free condition. The invention also concerns the abovementioned arrangement integrated in an application designed to collect and transport the ice cubes to the processing area. The present invention is especially concerned with plants for producing and storing ice for industrial purposes. One is in this context primarily thinking of food articles, and especially fisheries, such as ocean fisheries, where a catch consisting of fish, shellfish, etc., must be refrigerated by ice in order to preserve its quality.

The ice itself, with which this invention is intended to be used in relation to, can either be brought along from ashore in a separate magazine on board, or the vessel can have its own ice machine installed, which produces the necessary ice from seawater. The present invention shall in the ensuing be described in connection with the mentioned sea water ice machine, but shall not limit itself to this.

At present there are several refrigeration systems in operation on board fishing vessels. One of these is the so-called RSW-system (Refrigerated Sea Water), which involves that seawater is chilled in a separate unit, and when the catch is taken onboard from e.g. trawl or seine, the chilled seawater is added so that the fish is kept refrigerated. This system, however, has one disadvantage; when the fish dies, its osmotic qualities cease, i.e. the quality that separates the salt from the water when the fish is alive. This quality causes the meat in seawater fish to taste basically unsalted, but when the osmosis ceases the salt will penetrate the fishmeat and make it taste salt. This will in turn result in a deteriorated quality of the fish.

Also fodder producers who manufacture fish meal for the breeding industry, using fish raw materials, demand that the fish meat should be without salt. For such raw materials it is therefore necessary to use ice refrigeration.

Ice may be manufactured from fresh water in conventional ice machines located on board the vessel. This, however, means that the fresh water must be brought from ashore, and also that the vessel must be equipped with a storage tank with a grab device for collecting the ice, as well as an ice screw for transporting the ice to the processing area on board. Another disadvantage is that it is impossible to chill fresh water to the same degree as seawater.

Another and major problem will arise as a consequence of the fact that ice cubes have a lower specific weight than water or seawater, which will cause the ice cubes to float, forming a layer on the surface of the wa-

ter. If a supply of ice cubes and water is kept stagnate for a longer period of time, this will result in the ice cubes clogging up or freezing into big flakes or cakes of ice which are quite difficult to handle.

As far as the handling of ice in a magazine is concerned, one is dependent on the ice having the appropriate compactness and size division, to obtain an adequate dosing into the ice screws, using a grab, an accomplishment almost impossible to achieve in a rational way if the ice is clogging. The applications will therefore be costly, they are space-consuming and involve large maintenance costs.

To some extent ice in bulk is used together with fresh water from ashore based plants. The ice is refrigerated and a number of magazines on board are filled with a mixture of fresh water and ice, normally up to 15% of the loading capacity. This is both time consuming and expensive, and many vessels, in order to comply with the requirements from the authorities (Veritas), must run with full tanks. Normally there will be water in one tank and ice in the others. The ice, however, will clog as soon as it comes into contact with water in each tank when loading the raw material. It is therefore apparent that this system for manufacturing ice for refrigerating purposes, also entails big disadvantages.

In ice machines based on sea water, one obtains fresh water ice and a water portion which is strongly enriched by salt, and the salt water portion is disposed of. These machines are not found very often on board fishing vessels. One of the reasons for this, is that salt water ice machines are less effective, as the ocean water often has a temperature of up to 10 °C, and a lot of the coldness from the refrigeration device in the ice machine is needed to reduce the seawater temperature down to 0 °C before the actual refrigeration process can start. It is also hard to avoid the storing problems in the ice bins, as mentioned above, concerning the clogging and the difficulties in obtaining an adequate dosing of finely portioned ice particles for the fish raw material.

It is previously known to transport ice cubes through pipes in a mixture with water. Examples of such systems are disclosed in US-patent No. 4.901.539 and International application WO 89/00668.

More specific, the US-patent No. 4.901.539 discloses a machine for producing cold water for drinks. The produced ice cubes float to the top of a water bath and are, mixed with water, pumped through a line and recirculated for cooling the admixed water.

International application WO 89/00668 discloses in figure 5 and accompanying text, a slurry of finely divided snow/ice particles and water which is obtained more pumpable by activating an auger and adding salt water to the mixture.

The object of the present invention is to provide a method and an apparatus with which a mixture of ice cubes and water may be kept in a loose and lump free condition.

In consequence, a purpose of the present invention

is to introduce a procedure and an arrangement which will totally eliminate the beforementioned problems with ice clogging in the magazine on board fishing vessels.

A further purpose of this invention is to design the arrangement in such a way that it can be incorporated in an already existing fish handling application, which in this case also may be used for collecting ice cubes and transport them to a processing area.

According to the invention, the procedure for storing a mixture of ice cubes and water in a magazine, and, when needed, collecting and transporting ice cubes to an area of use, especially for use on vessels such as fishing vessels, is characterized in bringing the ice cubes and water into strong movement by injecting a fluid like air or water with a high pressure pulse into the magazine with time intervals, so that the ice cubes are kept in a loose and lumpfree condition.

The mixing influence achieved by injecting a fluid into the magazine is intended to create fluid bubbles which will affect the mixing motion. The fluid is preferentially injected in pulses with regular time intervals of approximately 1-3 hours, the optimal time interval being 3 hours. The fluid is injected in a horizontal direction and/or in a vertical direction from the bottom of the magazine.

Preferentially the fluid will be injected through a pipe applied in the bottom area of the magazine, and into the magazine, through a number of outlet nozzles in the pipe. The fluid is injected into the magazine through a number of branch pipes which are spread over the magazine bottom area, in that each branch pipe contains a number of outlet nozzles for the fluid. Three such branch pipes can be applied.

Preferably, the liquid is sea water and the fluid is air. When the liquid is sea water, the salt content can be approximately 3%.

According to the present invention, the arrangement for effecting the foregoing method comprising a magazine of ice cubes and water, means for delivering fluid to said magazine, and means for collecting ice cubes from said magazine, is characterized by

said means for delivering fluid comprising an injection pipe being positioned in the bottom portion of the magazine and comprising a number of outlet nozzles, and pumping means for injecting high pressure air or water pulses to the pipe, and said means for collecting ice cubes comprising a suction pipe positioned in the magazine for sucking a mixture of ice cubes and water from a border area between the layers of water and ice cubes, which border area establishes after each agitating, by the high pressure pulses, of the ice cubes/water-mixture.

According to a preferred embodiment, the injection pipe comprises a number of separate branch pipes, which from a branching point are distributed over the

bottom area of the magazine, and each branch pipe comprises a number of out nozzles for injecting pipe pressure air.

According to an especially preferred embodiment, the arrangement according to the invention as described before, is integrated with an arrangement comprising a rising pipe including an intermediate storage tank, and where the intermediate storage tank by means of a pressure transmitter in consecutive order:

- a) is subjected to vacuum in order to suck a mixture of ice cubes and water up from the magazine through the pipe and fill up the tank,
- b) after which the inlet side of the tank is subjected to over-pressure to discharge the ice cubes and water mixture further through the pipe to the area of use,

and is characterized by comprising a separate pipe for injecting the air into the magazine and the rising pipe constituting said suction pipe, and the injection pipe and the suction pipe being arranged in proportionally unequal height levels in the magazine.

In this context, the term 'area of use' means that the ice/water mixture is transported to a dosing machine of a fairly well-known type, where the ice cubes, after being separated from the sea water, will be evenly dosed in suitable amounts together with the fish that is being removed from the trawl or seine.

As far as the specified features or the arrangement, as outlined in the specification, are concerned, one refers to the subsequent dependent claims 11-17.

In one of these preferred embodiments, the arrangement is characterized by means for controlling the fluid injecting process and the suction process in such a way that the ensuing stages are carried out consecutively:

- 1) injection of high pressure air pulse into the magazine,
- 2) sucking of an ice/water mixture into the tank from the magazine by subjecting the tank to vacuum, and
- 3) pressing the ice/water to the area of use by subjecting the tank to over-pressure.

The present invention shall in the following be described in detail, with reference to the enclosed drawings, wherein:

Fig. 1 shows a sectional drawing of a plant for producing ice on board a vessel.

Fig. 2 shows another section of the same plant and illustrates a combined arrangement, which produces the mixing influence for the ice/saltwater mixture, and at the same time extracts ice/saltwater to the processing area.

Fig. 3 and 4 show a schematic outlines of different designs for arranging a fluid injection pipe with three branch pipes in a magazine.

In as far as the arrangement for the present inven-

tion normally (e.g. on board a vessel with limited space) would be integrated with an ice machine, shall the ice machine also be described in relative detail in the following description.

Fig. 1 shows an ice plant, as on board a vessel with a deck D and an engine room M where a refrigeration device 8 is located, a hold 3 which functions as an ice magazine, and a hold L for the fish. The bottom of the vessel is marked B, and is also described as a tank top 21. The holds are separated by isolated partition walls V.

An ice machine 1 is positioned on the deck, for instance an ice machine which produces tube ice or plate ice, and it delivers the ice in free fall down into the magazine 3,4. The refrigerator 8 produces chilled sea water which, by means of the pump 11, is pumped up from the seawater source 22 below the vessel. The water is carried through the refrigerator 8 to the magazine 3,4, which consists of a mixture of ice cubes (from the ice machine 1) and salt water. During standstill the ice 3 floats up due to lower specific weight, and forms a layer on the surface of the salt water 4, like the figure shows. From the bottom of the magazine 3,4, the suction/feed pump 5, suctions salt water 4 through a pipe 32, and this salt water 4 is carried into the condenser of the ice machine through the valve/pipe 6, and also through the valve/pipe 7 to the ice machine 1.

To convey the ice 3 through to the processing area, e.g. for the purpose of refrigerating fish in another hold on the vessel, the magazine tank has been equipped with a conveyor/rising pipe 42/15. The conveyor system for ice is additionally designed as described in connection with figure 2.

Each of the holds A, B, C of the vessel have a countersunk well 16 in the bottom B for the purpose of complete drainage of residue water from the holds. Drainage water is sucked out of the well 16 through a pipe 59. Also downwards into the bottom of the ice magazine tank, a pipe 59 is arranged.

Figure 1 shows that the ice 3 and the salt water 4 are phase separated into two main layers, but it will be evident from the following description that when ice is taken out from the magazine 3,4, the magazine is first subjected by the mixing influence a loose and lump free mixture of ice cubes and water, so that a mixture of ice 3 and salty water 4 can be pumped up to the deck D.

From the bottom of the magazine 3,4 a possible water outlet is guided through a pipe 10 into the refrigerator 8, for instance, in the case of heat exchanging, to be used for precooling of the sea water which is pumped in from the source 22. This outlet water is discharged through a pipe 12 with valve back to the sea. A grate is arranged in front of the outlet pipe.

The plant further consists of a set of temperature sensors 13 in the tank, which record the temperature in the different horizontal layers of the magazine 3,4.

With this plant it is now possible to easily adjust the ice production, according to the immediate need for ice in the processing area. The level in the magazine 3,4

can be further controlled by adjusting the pumps 11 (sea water in) and 12 (salt water out). Furthermore it is now possible to make very effective use of the capacity of the ice machine, since use is made of sea water, which has been precooled to approximately 0 °C in the RSW-unit, is fed directly into the ice machine. This makes it possible to increase the ice production by almost 20%.

In figure 2 is shown in detail, according to the invention, the specific system which produces the mixing influence in the magazine with the mixture of ice cubes and water, as well as, according to the invention, a system for transporting a mixture of ice cubes and water to a processing area.

Figure 2 shows the ice machine 2 which delivers ice to hold A as described previously. On each side of this hold, hold sections B and C have been arranged, for storing fish refrigerated by ice from hold A.

A mixture of ice 3 and salt water 4 is sucked through the pipe 15 and into an intermediate storage tank 30 and squeezed or pressed further through the pipe 27 to a feeding tank 33 for ice, with the help of the pressure transmitting from a compressor or pump 29. The intermediate storage tank 30 is moreover arranged in a tilted position, so that its outlet side is positioned at a lower level than its inlet side, in the vertical direction. In the feeding tank 33 the salt water runs off the ice and is carried through the pipe 26 back to the magazine 3,4. The ice is conveyed further by a transport screw 24, (or possibly a conveyor belt) up to a dosing unit 18 for delivery to a dosing plate 23, while the fish intended for refrigeration is transported from the feeding unit 17 from a seine or a trawl. From the dosing plate 23 the fish/ice mixture is guided into distribution ducts 20 for transport to the relevant holds.

A pipe 35, which is connected between the pump/pressure transmitter 29 and the pipe 15, contains in succession:

- a) a branching to an outlet 36 to the surroundings through a shift valve 34 (4-ways) which when shifting in succession can produce pressure and vacuum in the pipe 35 by means of the pressure transmitting function of the pump 29,
- b) a reversing valve 28 from where the pipe 35 branches into:
 - one first branch pipe 37 which leads into a further branch point 41 which includes a 3-way shift valve, and a second branch pipe 38 which leads into the inlet side of the tank 30.

From the branching point 41 a pipe 40 leads down to the bottom of the magazine, and leads further by a more or less horizontal section 44 into the magazine 3,4. The horizontal section is designed with a number of outlet nozzles 45 from where the fluid is injected into the magazine 3,4.

Furthermore, from the branching point 41 with the 3-ways valve, a pipe 62 connects to the pipe 15 at a

given distance from the floor of the magazine. Upstream of the inlet of the pipe 15, the pipe 62 contains a manifold 39 and a back pressure valve 43.

The valve 34 has been designed in such a way that when the pump 29 with strong pressure blows fluid through the pipe 36, this will entail a simultaneous strong suctioning vacuum in the pipe 35.

Fig. 3 shows a horizontal section of a preferred arrangement of the injection arrangement. From the inlet at the bottom of the magazine 3,4 the pipe 40 branches out into three branch pipes 46, 47, 48 which are distributed so that they cover a large area of the floor of the magazine. The branch pipes comprise the valves 51, 52, 53, 54, 55, and these can be controlled during injection so that the fluid is injected alternately from the nozzles 45 in the three branch pipes.

Fig. 4 shows an alternative design of the positioning of the branch pipes in the bottom of the magazine. It follows that from the connection point 70 three branch pipes 72, 74, 76, each with an outlet nozzle on the end, branch out over the floor of the magazine. The pipe 74 is positioned furthest off inwards in the magazine seen from the branching point 70, while the pipe 72 is positioned nearest. This positioning is suitable when the bottom of the magazine has a rectangular floor area, as shown in the figure. The control of the alternate injection through the three pipes is achieved in the same way as described in fig. 3.

In the magazine the rising pipe 15 comprises a suction pipe in the form of a flexible hose 42 which from a distance over the floor level of the magazine 3,4, extends more or less horizontally inwards into the magazine 3,4. The hose 42, at the inlet 57 to the magazine 3,4, forms a hinge connection, in the shape of a flange, so that the hose can be tipped upwards and downwards round a horizontal axis. The hose 42 further comprises a float gadget 58 to enable it to float in the water in the border area between the ice layer 3 and the water 4. In this way the hose 42 always floats in a position close to the ceiling of the ice substance (seen from below), and the height position of the hose will always vary upwards and downwards (see arrows on fig. 2) in pace with the changing height level of the boarder area, depending on the volume of the magazine. When suctioning ice/liquid through the opening 64 of the hose 42, one is ensured to obtain a suitable mixture of water and ice. The mixture will in this boarder area be adequately suction- and pump-able.

Any residue water in the tank may be emptied by connecting the pipe 59 to the rising pipe 15 within a suction step.

When fluid is injected into the magazine 3,4, the valves 34, 28 and 41 are adjusted so that the fluid is carried through the pipes 35, 37, 40 and 44 up until and into the magazine 3,4, through the injection nozzles 45. If desired, the injection may also be arranged through the pipe 15, by adjusting the valve 41 to injection through the pipe 62, further into the pipe 15 and into the maga-

zine 3,4 through the suction opening 64 on this pipe 62. Injection through the pipes 62 and 15 may also be relevant when the unit is used for pumping fish, in order to blow out fish which might be stuck in the pipe 15 during the suction process.

It has been found that the above mentioned high pressure pulse of fluid, which preferentially is air, forms air bubbles which make the magazine 3,4 "boil" during a vigorous stirring.

In accordance with an optional embodiment, water, for example sea water from the magazine 3,4, may be injected into the magazine instead of air. This may for example be effected by suction of a volume of water 4 from the magazine and into the pipe 42, 15 and thereafter reinjecting it back into the magazine with a powerful over-pressure.

At an optional time thereafter, e.g. 2 seconds after the injection, the valves 34, 28, 41 readjust, so that a strong vacuum builds up in the pipes 35, 38, 15, which will discharge the ice/water mixture in through the opening 64 to the horizontally positioned hose 42 and further up through the pipe 15 and into the tank 30. During this part of the process the pipe 62 is shut down by means of the reversing valve 43, to stop ice and water from penetrating into the fluid injection pipes 37 and 62. The valve 41 will close to prevent suction effect in the injection pipe 40.

When the tank 30 is filled with a mixture of ice cubes and water, the valves 34 and 28 will readjust so that the full fluid pressure from the pump 29 is guided into the back side of the ice/water in the tank 30, i.e. through the pipe 38 to the inlet side of the tank, and in consequence the said ice/water content is squeezed out of the tank 30 and into the rising pipe 27 all the way to the feeding tank 33 where the water runs off the ice and is carried through the pipe 26 back to the magazine.

How a possible water surplus in the magazine 3,4 can be carried away, is indicated in figure 1 with attached text.

One pipe 15 (of the pipes 40, 15) which can carry pressure fluid to the magazine 3,4 constitutes, according to a preferred embodiment of the invention, the same pipe that the ice/liquid mixture is suctioned into from the magazine 3,4 to be carried to the processing area, something that is achieved by readjusting of the said valves.

The control of these valves, in order to achieve all steps of fluid injection, suction of ice/water, and the distribution of the fluid injection through the previously mentioned branch pipes 46, 47, 48, will be carried out automatically, by means of a computer system.

Summarized, the process of the mixing influence and the suction process of the invention, include these steps in consecutive order:

- 1) blowing air into the magazine,
- 2) suctioning an ice/water mixture into the tank 30 from the magazine, and

3) conveying the ice/water mixture to the surface by subjecting the tank 30 to over-pressure.

With a continuous demand for ice on deck D, this cycle will be carried out with injection of fluid (air) at suitable time intervals, while the suction of the ice/water mixture may take place any chosen number of times after each injection. Normally it will be enough to inject fluid every 3 hours.

For long periods on board, however, there will be no need for ice supply from the magazine 3,4. If the ice in the magazine 3,4 is kept stagnant too long, phase separated in the layer 3, the clogging of the ice particles will increase to form larger lumps. According to the invention, it is therefore preferred, when there is no immediate need for ice, to discharge a pulse of compressed air approximately once every hour, to keep the aggregate of ice and salt water in a loose mixture.

In this way the injection system 29, 35, 15 according to the invention can also be used separately for the sole purpose of keeping an ice/water substance 3,4 in a loose mixture. The extent of the injection will of course be adjusted in accordance with the size of the magazine.

Figure 2 further indicates that the pipe 15 includes a branch pipe 59 (with a two-way shut-off valve 60 in the branching point) to the bottom of the storage tank C. The system according to the invention thus may be used for emptying other tanks on the vessel, e.g. of fish, and that it might give a choice of possibilities regarding which hold the ice magazine at best should be stored in.

EXAMPLE

The arrangement according to the invention was assembled and tested in a fishing vessel.

In the bottom of a storage tank with an ice/sea water magazine with a volume of 100 m³, with an ice cube share of approximately 60%, air was injected after a given procedure through three pipes positioned in the bottom of the tank. The air was injected alternately between the three branch pipes, first on one side, then on the other side and finally through the branch pipe in the centre. The air blasts were made in pulses of approximately 5 seconds from each pipe. The injection capacity of the air blasts was 900 m³ air per hour. The complete injection cycles thus lasted for a total of 15 seconds with a total amount of air of 6 m³. During the air blasting procedure it was visually observed that the mixture of ice cubes and sea water almost boiled as the sea water/air bubbles rose approximately 50 cm over the normal surface level. After the blasting the ice was completely calm after just a few seconds. Injection was carried out every 3. hour.

The injection test showed that the positioning of the horizontal pipe 42 had a decisive effect on the amount of ice that was suctioned.

During the ensuing suction process for ice cubes/sea water, the pressure in the vacuum tank, which was

approximately 2000 litres, was reduced to approximately 40% vacuum by means of which the ice/sea water mixture was suctioned up. When the tank 30 was approximately full, pressure was introduced at the inlet side of the tank, and the ice/sea water mixture was pressed up to the deck. While the complete suction/pumping cycles lasted for about 40 seconds, the process of pressing the mixture up to the deck lasted for only 13 seconds. After separating the sea water, the ice cube substance was weighed at approximately 850 kg ice cubes. Since the tank was almost full, this meant that an ice/sea water mixture with an ice-share of approximately 50% had been suctioned up from the magazine.

Judging from this test, the capacity for ice delivery will be approximately 1275 kg ice per minute, equivalent to 76,5 ton per hour. The capacity according to this will be more than adequate for fishing vessels and also for other areas of utilization.

In the case of a loading capacity of approximately 250 ton fish per hour it will according to this be possible to dose up to 30% ice with the above mentioned ice delivery capacity.

Based on the present invention one has accordingly produced an ice delivery plant that is compact and which can also be installed on smaller fishing vessels. The plant keeps the ice in a loose and easily dosable mixture with water that is strained away before use, resulting in a product of fresh water ice of a more than adequate quality for keeping the load of fish refrigerated on board the vessel.

When the fish that is caught is to be refrigerated in the vessel's storage tanks, the procedure starts with filling the storage tanks with 8 volume% sea water and 8 volume% ice, after which the fish-catch is added, mixed with 8-10% ice cubes. This will result in a more economical and effective refrigeration of fish than with earlier R. S.W.-systems. Additionally this will produce an ice/water/fish mixture which is very easy to pump for the plant, according to the invention. The plant according to the invention is very well suited for use on board vessels as well as for use in ashore based units.

All of the draw-backs mentioned at the beginning, which are found in previously known ice supplying systems, have consequently been eliminated by means of the present invention.

Claims

1. Procedure for storing a mixture of ice cubes (3) and water (4) in a magazine, and, when needed, collecting and transporting ice cubes to an area of use, especially for use on vessels such as fishing vessels, **characterized** in bringing the ice cubes and water into strong movement by injecting a fluid like air or water with a high pressure pulse into the magazine with time intervals, so that the ice cubes are kept in

a loose and lumpfree condition.

2. Procedure in accordance with claim 1,
characterized in that the fluid is air and the air injection is effected with regular time intervals of approximately 1-3 hours, and most preferably with time intervals of 3 hours. 5
3. Procedure in accordance with claims 1 and 2,
characterized in that the fluid is air and the air is injected in horizontal direction and/or in vertical direction from the bottom of the magazine. 10
4. Procedure in accordance with any of the preceding claims,
characterized by the water being sea water. 15
5. Procedure in accordance with any of the preceding claims,
characterized in that the fluid is air and the air is injected through a pipe (44) which is arranged in the bottom portion of the magazine, and into the magazine through a number of outlet nozzles (45) in the pipe. 20
6. Procedure in accordance with any of the preceding claims,
characterized in that the fluid is air and the air is injected into the magazine through a number of branch pipes (46,47,48) which are distributed over the bottom area of the magazine, in that every branch pipe comprises a number of outlet nozzles (45) for the air. 25
7. Procedure in accordance with any of the claims 1-6,
characterized in that the ice cubes are collected by sucking an ice cube/water mixture from the magazine, the fluid is air, and the air injection and the suction of ice-water-mixture are effected in proportionally unequal height levels in the magazine. 30
8. Procedure in accordance with any of the preceding claims,
characterized in that when the mixture separates in an upper ice cube layer and a lower water layer, the suction is effected in a border area between the layers of water and ice cubes. 35
9. Procedure in accordance with claim 1,
characterized in that the strong movement is provided by sucking a volume of water from the magazine and into a pipe (42), which water-volume thereafter is re-injected into the magazine. 40
10. Procedure in accordance with claim 1,
characterized by when using a magazine volume of 100 m³, and an ice cube/sea water share of the magazine of approximately 60%, the injection ca- 45

capacity of the air blasts being 900 m³ air per hour, and preferably the high pressure air injection pulse lasting for a total of 15 seconds with a total amount of air injection of 6 m³.

11. Arrangement for effecting the method of claims 1-10, comprising a magazine of ice cubes (3) and water (4), means (44) for delivering fluid to said magazine, and means (42,15) for collecting ice cubes from said magazine,
characterized by

said means for delivering fluid comprising an injection pipe (44) being positioned in the bottom portion of the magazine and comprising a number of outlet nozzles (45), and pumping means (29) for injecting high pressure air or water pulses to the pipe, and
said means for collecting ice cubes comprising a suction pipe (42) positioned in the magazine for sucking a mixture of ice cubes and water from a border area between the layers of water and ice cubes, which border area establishes after each agitating, by the high pressure pulses, of the ice cubes/water-mixture.

12. Arrangement in accordance with claim 11,
characterized by the injection pipe (44) comprising a number of separate branch pipes (46,47,48) which from a branching point are distributed over the bottom area of the magazine, and each branch pipe comprises a number of outlet nozzles (45) for injecting high pressure air.
13. Arrangement in accordance with claim 11,
characterized by the suction pipe comprising a flexible hose (42) which more or less horizontally extends inwards in the magazine, and the hose (42) is arranged to follow the varying height levels of the border area between ice cubes and water, depending on the volume of the magazine, by means of hinging the hose at the inlet (57) of the magazine to enable it to swing upwards and downwards in accordance with the level variations in the magazine, and that the hose comprises a float gadget (58) to enable it to follow the varying height levels of the border area.
14. Arrangement in accordance with any of the preceding claims 11-13, where the arrangement is integrated with an arrangement comprising a rising pipe (15) including an intermediate storage tank (30), and where the intermediate storage tank (30) by means of a pressure transmitter (29) in consecutive order:

a) is subjected to vacuum in order to suck a mixture of ice cubes and water up from the maga-

zine through the pipe (15) and fill up the tank (30),
 b) after which the inlet side of the tank (30) is subjected to over-pressure to discharge the ice cubes and water mixture further through the pipe (27) to the area of use,

characterized by the arrangement comprising a separate pipe (40) for injecting the air into the magazine and the rising pipe (15) constituting said suction pipe (42), and the injection pipe (44) and the suction pipe (42) being arranged in proportionally unequal height levels in the magazine.

15. Arrangement in accordance with claim 14, **characterized** by the suction pipe (42) being applied in a border area between the layers of water and ice cubes.

16. Arrangement in accordance with claim 14 or 15, **characterized** by a pipe (35) being connected between the pressure transmitter (29) and the pipe (15), the said pipe (35) comprising in consecutive order:

- a) a branching to an outlet (36) through a valve (34) that by readjustment, by means of the pressure transmitting function of the pump (29), in consecutive order can produce an over pressure and a vacuum in the pipe (35),
- b) a valve (28), from which the pipe (35) branches out into a branch pipe (37) leading directly into the separate pipe (40) and further into the magazine, and a branch pipe (37) leading into the inlet area of the tank (30).

17. Arrangement in accordance with the preceding claims 11-16, **characterized** by means for controlling the fluid injecting process and the suction process in such a way that the ensuing stages are carried out consecutively:

- 1) injection of high pressure air pulse into the magazine,
- 2) sucking of an ice/water mixture into the tank (30) from the magazine by subjecting the tank (30) to vacuum, and
- 3) pressing the ice/water to the area of use by subjecting the tank (30) to over-pressure.

Patentansprüche

1. Verfahren zur Lagerung einer Mischung von Eiswürfeln (3) und Wasser (4) in einem Depot und bei Bedarf zum Sammeln und Transportieren von Eiswürfeln zu einem Verwendungsbereich, insbeson-

dere zur Anwendung auf Schiffen, wie Fischereifahrzeugen, **dadurch gekennzeichnet**, daß man die Eiswürfel und das Wasser durch injizieren eines Fluids, wie Luft oder Wasser, unter hohem Druckimpuls in das Depot in Zeitintervallen in heftige Bewegung versetzt, so daß die Eiswürfel in einem losen und klumpfreien Zustand gehalten werden.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß das Fluid Luft ist, und daß die Luftinjektion in regelmäßigen Zeitintervallen von etwa 1 - 3 Stunden, besonders bevorzugt mit Zeitintervallen von 3 Stunden durchgeführt wird.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, daß das Fluid Luft ist und die Luft in horizontaler und/oder vertikaler Richtung vom Boden des Depots injiziert wird.

4. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß das Wasser Meerwasser ist.

5. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß das Fluid Luft ist und diese durch ein Rohr (44) injiziert wird, welches im Bodenbereich des Depots angeordnet ist und in dieses durch eine Anzahl von Auslaßdüsen (45) gelangt.

6. Verfahren nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet**, daß das Fluid Luft ist und diese in das Depot durch eine Anzahl von Zweigleitungen (46, 47, 48) injiziert wird, die über den Bodenbereich des Depots verteilt sind, wobei jede Zweigleitung eine Anzahl von Auslaßdüsen (45) für die Luft aufweist.

7. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet**, daß die Eiswürfel durch Absaugen einer Eiswürfel/Wasser-Mischung aus dem Depot gesammelt werden, wobei das Fluid Luft ist, und die Luftinjektion und die Absaugung der Eis/Wasser-Mischung in proportional ungleichen Höhenniveaus im Depot durchgeführt werden.

8. Verfahren nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet**, daß, wenn sich die Mischung in eine obere Eiswürfelschicht und eine untere Wasserschicht auf trennt, das Absaugen in einem Grenzbereich zwischen den Schichten aus Wasser und Eiswürfeln durchgeführt wird.

9. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß die heftige Bewegung durch Absaugen eines Wasservolumens aus dem Depot und in eine Leitung (42) bewirkt wird, wonach das Wasservolumen in das Depot zurück injiziert wird.

10. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß bei Verwendung eines Depotvolumens von 100 m³ und eines Eiswürfel/Meerwasseranteils des Depots von etwa 60 % die Injektionskapazität der Luftströme 900 m³ je Stunde beträgt und vorzugsweise der Injektionsimpuls mit hochverdichteter Luft, für die Dauer von 15 Sekunden, mit einer Gesamtmenge der Luftinjektion von 6 m³ aufrecht erhalten wird.

11. Anordnung zur Durchführung des Verfahrens nach den Ansprüchen 1 bis 10, enthaltend ein Depot für Eiswürfel (3) und Wasser (4), ein Medium (44) für die Zuleitung von Fluid zu dem Depot sowie ein Medium (42, 15) zum Sammeln von Eiswürfeln aus dem Magazin, **dadurch gekennzeichnet**, daß das Medium für die Zuleitung eine Injektionsleitung (44) aufweist, die am Bodenbereich des Depots angeordnet ist, und die eine Anzahl von Auslaßdüsen (45) besitzt, sowie Pumpmittel (29) zur Injizierung von hochverdichteter Luft- oder Wasserimpulsen in die Leitung, und das Medium zum Sammeln der Eiswürfel eine Saugleitung (42) aufweist, die im Depot angeordnet ist, um eine Mischung von Eiswürfeln und Wasser aus einem Grenzbereich zwischen den Wasser- und den Eiswürfelschichten abzusaugen, wobei sich die Grenzschicht nach jedem Rühren der Eiswürfel/Wasser-Mischung durch die Hochdruckimpulse neu bildet.

12. Anordnung nach Anspruch 11, **dadurch gekennzeichnet**, daß die Injektionsleitung (44) eine Zahl von separaten Zweigleitungen (46, 47, 48) aufweist, die sich von einem Verzweigungspunkt über den Bodenbereich des Depots verteilen, und daß jede Zweigleitung eine Anzahl von Auslaßdüsen (45) für die Injizierung von hochverdichteter Luft besitzt.

13. Anordnung nach Anspruch 11, **dadurch gekennzeichnet**, daß die Saugleitung einen flexiblen Schlauch (42) aufweist, der sich im wesentlichen horizontal in das Depot erstreckt, wobei der Schlauch (42) derart angeordnet ist, daß er den unterschiedlichen Höhenniveaus der Grenzschicht zwischen den Eiswürfeln und dem Wasser abhängig vom Depotvolumen folgt, wobei der Schlauch am Einlaß (57) des Depots derart befestigt ist, daß er in Übereinstimmung mit den Niveauänderungen im Depot aufwärts und abwärts schwingt, und der Schlauch einen Schwimmer (58) aufweist, der ihm das Folgen der Niveauänderungen der Grenzschicht ermöglicht.

14. Anordnung nach einem der vorigen Ansprüche 11 bis 13, wobei diese in einer Anordnung integriert ist, die eine Steigleitung (15) mit einem Zwischenlagertank (30) aufweist, und wobei der Zwischenlager-

tank (30) mit Hilfe eines Druckträgers (29) in Folge

a) einem Vakuum ausgesetzt ist, um eine Mischung aus Eiswürfeln und Wasser aus dem Depot durch die Leitung (15) abzusaugen und den Tank (30) zu füllen,

b) nach welchem die Einlaßseite des Tanks (30) einem Überdruck unterworfen ist, um die Eiswürfel und Wasser-Mischung weiterhin durch die Leitung (27) dem Verwendungsbereich zuzuführen, **dadurch gekennzeichnet**, daß die Anordnung eine separate Leitung (40) aufweist um die Luft in das Depot zu injizieren, und daß die Steigleitung (15) diese Saugleitung (42) bildet und die Injektionsleitung (44) und die Saugleitung (42) in proportional ungleichen Höhenniveaus im Depot angeordnet sind.

15. Anordnung nach Anspruch 14, **dadurch gekennzeichnet**, daß die Saugleitung (42) auf eine Grenzschicht zwischen den Schichten aus Wasser und Eiswürfeln einwirkt.

16. Anordnung nach Anspruch 14 oder 16, **dadurch gekennzeichnet**, daß zwischen dem Drucküberträger (29) und der Leitung (15) eine Leitung (35) angeschlossen ist, wobei die Leitung (35) nacheinander aufweist

a) eine Verzweigung zu einem Auslaß (36) durch ein Ventil (34), das bei Neueinstellung mit Hilfe der Druckübertragungsfunktion der Pumpe (29) in Folge einen Überdruck und einen Unterdruck in der Leitung (35) erzeugen kann,

b) ein Ventil (28) von welchem sich die Leitung (35) in eine Zweigleitung (37), die direkt in die separate Leitung (40) und weiter in das Depot führt und eine Zweigleitung, die in den Einlaßbereich des Tanks (30) führt, aufteilt.

17. Anordnung nach einem der vorigen Ansprüche 11 bis 16, **gekennzeichnet durch** Mittel zur Regelung des Fluidinjektionsvorganges und des Saugvorganges in der Art, daß die nachfolgenden Stufen aufeinanderfolgend durchgeführt werden:

1) Injektion des Impulses von Luft mit hohem Druck in das Depot.

2) Absaugen einer Eis/Wasser-Mischung in den Tank (30) aus dem Depot durch Beaufschlagung des Tanks (30) mit einem Vakuum und

3) Drücken von Eis/Wasser zum Verwendungsbereich durch Beaufschlagen des Tanks (30)

mit einem Überdruck.

Revendications

1. Procédé de stockage d'un mélange de cubes (3) de glace et d'eau (4) dans un magasin et, le cas échéant, de collecte et de transport des cubes de glace vers une région d'utilisation, notamment destinés à être utilisés dans des réservoirs tels que des réservoirs à boissons,

caractérisé par la mise des cubes de glace et de l'eau en mouvement intense par injection d'un fluide tel que de l'air ou de l'eau avec une impulsion à haute pression dans le magasin à certains intervalles, afin que les cubes de glace restent libres et non agglomérés.

2. Procédé selon la revendication 1, caractérisé en ce que le fluide est l'air, et l'injection d'air est réalisée à intervalles réguliers d'environ 1 à 3 h et de préférence à des intervalles de temps de 3 h.

3. Procédé selon la revendications 1 et 2, caractérisé en ce que le fluide est l'air, et l'air est injecté en direction horizontale et/ou en direction verticale depuis le fond du magasin.

4. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que l'eau est l'eau de mer.

5. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que le fluide est l'air et l'air est injecté par un tube (44) placé à la partie de fond du magasin, et dans le magasin par un certain nombre de buses (45) de sortie dans le tube.

6. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que le fluide est l'air et l'air est injecté dans le magasin par un certain nombre de tubes de dérivation (46, 47, 48) qui sont répartis sur la région de fond du magasin, et en ce que chaque tube de dérivation comporte un certain nombre de buses (45) de sortie d'air.

7. Procédé selon l'une quelconque des revendications 1 à 6, caractérisé en ce que les cubes de glace sont collectés par aspiration d'un mélange de cubes de glace et d'eau du magasin, le fluide est l'air, et l'injection d'air et l'aspiration du mélange de glace et d'eau sont réalisées à des niveaux de hauteur proportionnellement inégaux dans le magasin.

8. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que, lorsque le mélange se sépare en une couche supérieure de cubes de glace et une couche inférieure d'eau, l'aspi-

ration est réalisée dans une région marginale entre les couches d'eau et de cubes de glace.

9. Procédé selon la revendication 1, caractérisé en ce que le mouvement intense est assuré par aspiration d'un volume d'eau du magasin dans un tube (42), ce volume d'eau étant ensuite réinjecté dans le magasin.

10. Procédé selon la revendication 1, caractérisé en ce que, lors de l'utilisation d'un volume de magasin de 100 m³ et d'un partage entre les cubes de glace et l'eau de mer dans le magasin d'environ 60 %, la capacité d'injection d'air soufflé est de 900 m³/h d'air et, de préférence, l'impulsion d'injection d'air à haute pression dure au total 15 s avec une quantité totale d'air injecté de 6 m³.

11. Ensemble destiné à la mise en oeuvre du procédé des revendications 1 à 10, comprenant un magasin de cubes de glace (3) et d'eau (4), un dispositif (44) de distribution d'un fluide au magasin, et un dispositif (42, 15) destiné à collecter les cubes de glace du magasin, caractérisé en ce que :

le dispositif de distribution de fluide comporte un tube d'injection (44) placé dans la partie de fond du magasin et comprenant un certain nombre de buses de sortie (45), et un dispositif de pompage (29) injectant des impulsions d'eau ou d'air à haute pression dans le tube, et le dispositif de collecte des cubes de glace comporte un tube d'aspiration (42) placé dans le magasin afin qu'il aspire un mélange de cubes de glace et d'eau d'une région limite entre les couches d'eau et de cubes de glace, cette région limite s'établissant après chaque agitation du mélange de cubes de glace et d'eau par les impulsions à haute pression.

12. Ensemble selon la revendication 11, caractérisé en ce que le tube d'injection (44) comprend un certain nombre de tubes séparés de dérivation (46, 47, 48) qui sont répartis à partir d'un point de dérivation sur la région de front du magasin, et chaque tube de dérivation comprend un certain nombre de buses (45) de sortie utilisées pour l'injection d'air à haute pression.

13. Ensemble selon la revendication 11, caractérisé en ce que le tube d'aspiration comporte un tube souple (42) qui s'étend vers l'intérieur du magasin en direction plus ou moins horizontale, et le tube souple (42) est destiné à suivre le niveau variable de hauteur de la région limite entre les cubes de glace et l'eau, suivant le volume du magasin, par articulation du tube souple à l'entrée (57) du magasin afin qu'il puisse pivoter vers le haut et vers le bas en fonction

des variations de niveaux dans le magasin, et le tube souple comprend un accessoire flottant (58) lui permettant de suivre les niveaux variables de hauteur de la région limite.

14. Ensemble selon l'une quelconque des revendications précédentes II à 13, dans lequel l'ensemble est intégré à un ensemble qui comporte une colonne montante (15) qui possède un réservoir intermédiaire de stockage (30), et le réservoir intermédiaire de stockage (30), par l'intermédiaire d'un transmetteur de pression (29), est soumis consécutivement aux opérations suivantes :

a) l'application d'un vide qui aspire un mélange de cubes de glace et d'eau à partir du magasin dans le tube (15) pour le remplissage du réservoir (30), puis

b) l'application d'une surpression au côté d'entrée du réservoir (30) pour l'évacuation du mélange de cubes de glace et d'eau dans le tube (27) vers la région d'utilisation,

caractérisé en ce que l'ensemble comporte un tube séparé (40) pour l'injection d'air dans le magasin et la colonne montante (15) constitue le tube d'aspiration (42), et le tube d'injection (44) et le tube d'aspiration (42) sont placés à des niveaux en hauteur proportionnellement inégaux dans le magasin.

15. Ensemble selon la revendication 14, caractérisé en ce que le tube d'aspiration (42) est placé dans une région limite entre les couches d'eau et de cubes de glace.

16. Ensemble selon la revendication 14 ou 15, caractérisé en ce qu'un tube (35) est raccordé entre le transmetteur de pression (29) et le tube (15), ledit tube (35) comprenant successivement dans l'ordre :

a) une dérivation vers une sortie (36) par l'intermédiaire d'une vanne (34) qui, par nouvel ajustement et à l'aide de la fonction de transmission de pression de la pompe (29) peut donner consécutivement une surpression et un vide dans le tube (35),

b) une vanne (28) à partir de laquelle le tube (35) part en dérivation vers un tube de dérivation (37) qui rejoint directement le tube séparé (40) puis le magasin, et un tube (37) de dérivation débouchant dans la région d'entrée du réservoir (30).

17. Ensemble selon les revendications précédentes 11 à 16, caractérisé par un dispositif de commande de l'opération d'injection de fluide et de l'opération d'aspiration de manière que les étapes suivantes

soient exécutées consécutivement :

1) l'injection d'une impulsion d'air à haute pression dans le magasin,

2) l'aspiration d'un mélange d'eau et de glace dans le réservoir (30) à partir du magasin par application d'un vide au réservoir (30), et

3) le déplacement par pression du mélange d'eau et de glace vers la région d'utilisation par application d'une surpression au réservoir (30).

FIG. 1

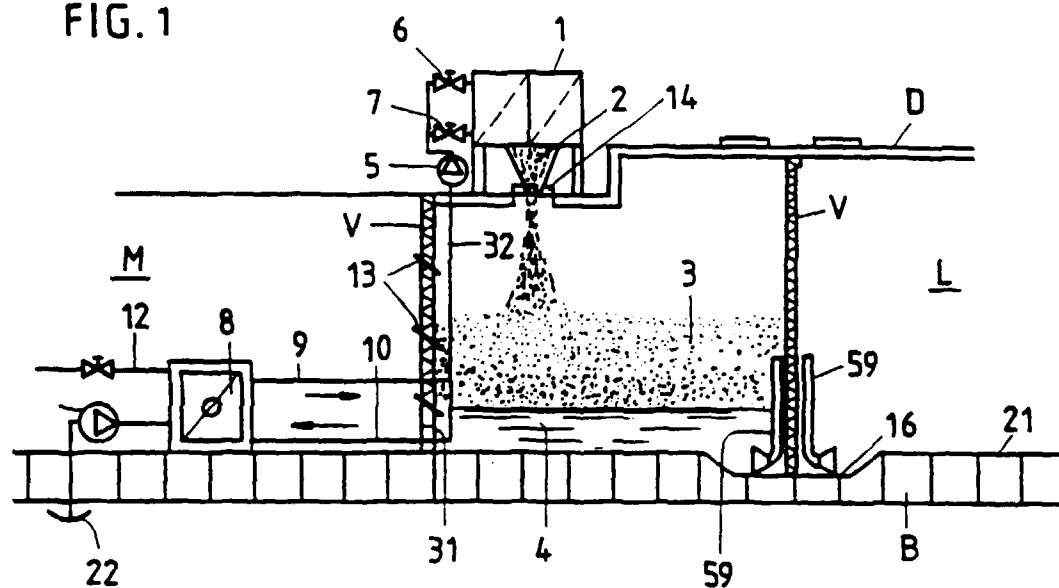


FIG. 2

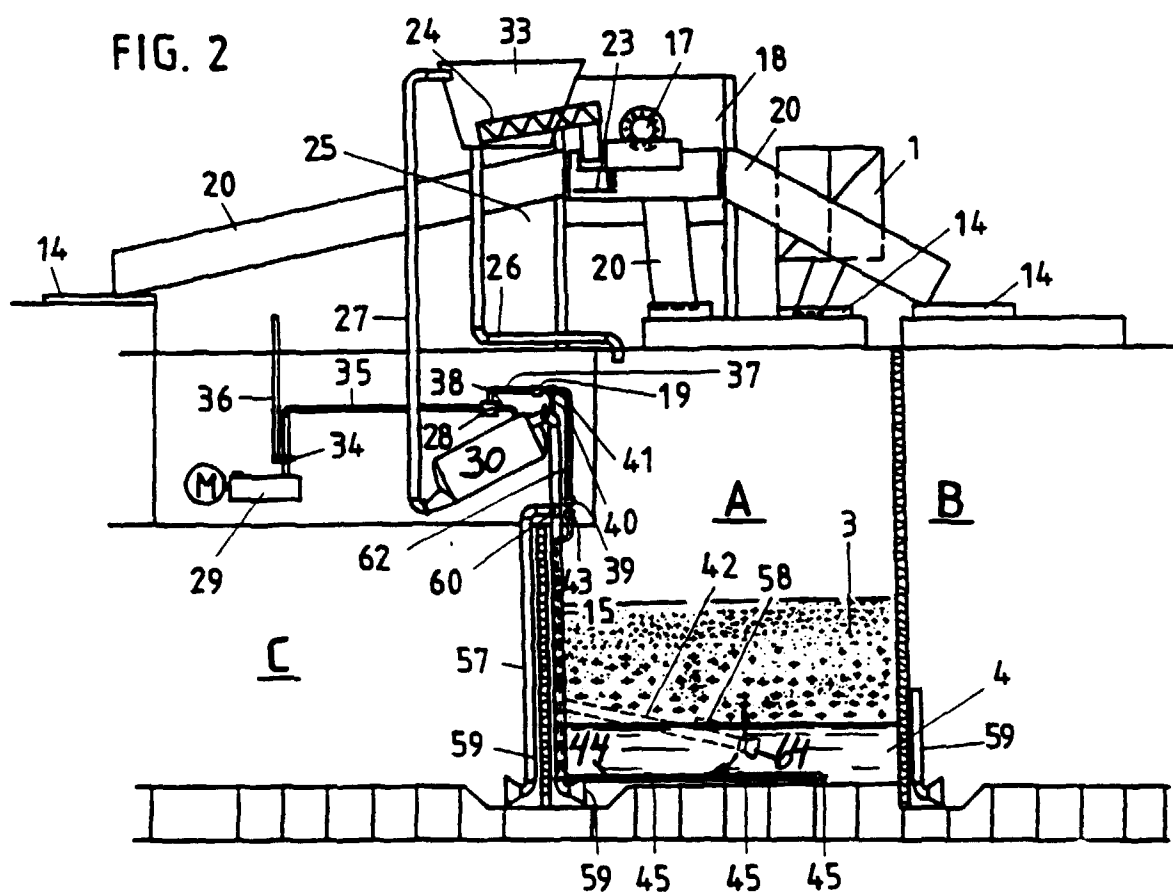


FIG. 3

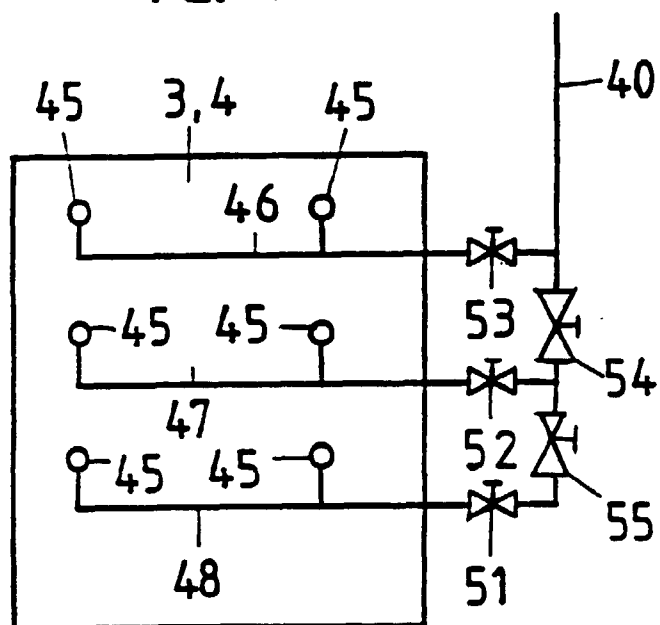


FIG. 4

