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(54) **Extraction system, particularly for extracting noxious gases from spaces located partially below ground level**

(57) An extraction system, particularly for extracting noxious gases from an enclosed space (50) located partially below ground level, comprising a plurality of floor-level intakes (2) connected to a first suction duct (5) as-

sociated with a water discharge channel provided with means that allow the unidirectional flow of the water. The first suction duct (5) is conveniently affected by at least one second duct (8) suitable for the forced external expulsion of the collected gas.

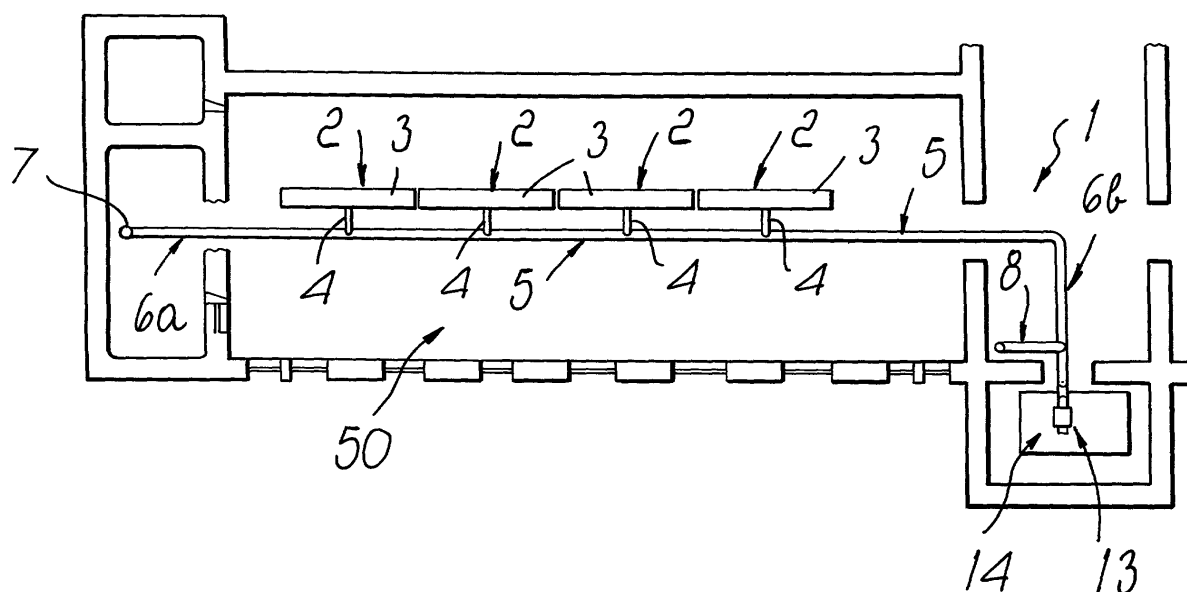


Fig. 1

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Description

[0001] The present invention relates to an extraction system, particularly suitable for extracting noxious gases such as carbon dioxide generated by the fermentation of foodstuffs.

[0002] The most frequent case is the process for the fermentation of grapes into wine, which, since it requires great stability of environmental conditions, is preferably performed in cellars located partially below ground level.

[0003] In these enclosed spaces, the presence of carbon dioxide obtained as a waste product of grapes fermentation, which converts into ethyl alcohol the sugars contained in grapes, is extremely dangerous.

[0004] At atmospheric pressure and ambient temperature, carbon dioxide has a density of approximately 1.8 kg/m³, which is higher than the average density of air at the same pressure conditions, which is approximately 1.2 kg/m³.

[0005] For this reason, carbon dioxide, which is heavier, settles to the floor and stratifies, reaching a height of several decimeters in the case of scarcely ventilated spaces.

[0006] This is very dangerous for anyone who may access cellars and particularly for the operators assigned to monitoring fermentation, since inhalation of carbon dioxide causes in man at first loss of consciousness and then death in a short time.

[0007] The dangerousness of this gas is worsened by the fact that it is totally odorless and colorless and it is therefore almost impossible to notice its presence.

[0008] Cases of death of operators who have fallen to the ground accidentally during an inspection performed in a cellar are known.

[0009] The following summary calculation of the carbon dioxide (also known by the chemical formula CO₂) produced during fermentation can be useful in clarifying the importance of this problem.

[0010] The conversion of 1 kg of sugar into alcohol generates approximately 476 g of CO₂, polluting, according to the standards commonly set by local health authorities, approximately 10 cubic meters of air.

[0011] If 1000 quintals of product, each with a maximum sugar content of approximately 20 kg, are fermenting in a cellar, one obtains a total conversion of 20,000 kg of sugar and therefore the pollution of approximately 200,000 m³ of air.

[0012] Currently, as a remedy to this situation, aspirator devices are used which are usually constituted by one or more connecting ducts arranged adjacent to the wall of the space located partially below ground level and the outside environment.

[0013] These ducts, which extend vertically, are controlled by one or more fans suitable to generate a negative pressure, allowing the extraction of air and gases from the underground space.

[0014] Such aspirator devices are predominantly arranged in the lower regions and in the corners of such

spaces and act by processing a large amount of air mixed with carbon dioxide.

[0015] For this reason, they are large and require the use of fans that generate a considerable flow-rate.

[0016] The main drawback of these known types of aspirator device is that the noxious gases are removed partially and unevenly, since their extraction occurs mostly in the regions proximate to the intake of the duct, while the distant regions of the enclosed space are affected to a much smaller extent.

[0017] Another drawback of prior art aspirator devices is that the fans are very noisy and also consume considerable power and therefore entail high energy consumptions.

[0018] Another important drawback is that conventional aspirator devices are often located proximate to work areas or along passages that are accessed frequently, entailing considerable inconvenience both logistically and aesthetically due to their considerable size.

[0019] The aim of the present invention is to solve the above-mentioned problems, eliminating the drawbacks of the cited prior art, by providing an extraction system that allows to achieve effectively and safely the extraction of noxious gases, such as carbon dioxide, from spaces located partially below ground level.

[0020] Within this aim, an object of the invention is to provide an extraction system that has reduced overall dimensions, facilitating logistical organization as well as fermentation and conveyance operations.

[0021] Another important object is to provide an extraction system that does not compromise the aesthetic impact of the enclosed space suitable for fermentation.

[0022] Another object is to provide an extraction system that generates a low noise level and consumes little electric power.

[0023] Another object is to provide an extraction system that is structurally simple and has low manufacturing costs.

[0024] This aim and these and other objects that will become better apparent hereinafter are achieved by an extraction system, particularly for extracting noxious gases from spaces located partially below ground level, characterized in that it comprises a plurality of floor-level intakes connected to a first suction duct affected by at least one second duct for a forced external expulsion of collected gas, a water discharge channel being associated with said first duct and being provided with means that allow a unidirectional flow of water.

[0025] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a particular embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic plan view of the extraction system according to the invention;

Figure 2 is a schematic view of the invention;

Figures 3 and 4 are respectively a top view and a side view of an intake associated with a first type of channel system;

Figure 5 is a side view of an intake associated with a second type of channel system;

Figures 6 and 7 are front views of an intake respectively associated with a first type of channel system and with a second type of channel system;

Figure 8 is a side view of the first and second ducts and of the water discharge channel of the invention.

[0026] With reference to the figures, the reference numeral 1 designates an extraction system particularly suitable for extracting noxious gases from enclosed spaces located partially below ground level.

[0027] The system 1 is usable especially for aspirating carbon dioxide produced during the fermentation of foodstuffs, such as wine and others, in enclosed spaces located partially below ground level, of which the reference numeral 50 designates, in Figure 1, a schematic plan view.

[0028] The extraction system 1 is constituted by a plurality of intakes, designated by the reference numeral 2, which are advantageously constituted by discharge channels meant to convey outside the water used to wash the enclosed space located partially below ground level and the vessels in which fermentation occurs.

[0029] The intakes 2 are formed below the surface of the floor, usually but not necessarily at a central corridor, and are closed in an upward region for example by means of one or more grilled plates 3 that allow to rest the operators' feet thereon or to temporarily place equipment thereon and at the same time allow the passage of fluids such as liquids or gases.

[0030] The intakes 2 are associated laterally or in a downward region with one or more channel systems, generally designated by the reference numeral 4, for connection to a first suction duct 5, which is preferably slightly inclined with respect to a horizontal plane and constitutes the main duct for disposal of water and carbon dioxide.

[0031] The first suction duct 5 has, at a first end 6a, which is slightly raised, a temporary closure device, such as for example a plug, designated by the reference numeral 7, so that it can be accessed to perform inspection or washing of said first duct 5.

[0032] At a second end, designated by the reference numeral 6b, the first intake duct 5 is affected by at least one second expulsion duct, designated by the reference numeral 8, which is conveniently connected to the outside environment.

[0033] Along the second expulsion duct 8, which usually has at least one approximately vertical portion 8a, there is at least one fan 9 that is suitable to allow forced external expulsion of the gas collected proximate to the floor of the cellar 50.

[0034] The carbon dioxide being heavier than air, the mixture of gases aspirated through the intakes 2 is con-

stituted to a large extent by carbon dioxide stratified on the floor.

[0035] As mentioned, the intakes 2 are also used to convey into the first suction duct the water used to wash the internal space and the vessels contained therein.

[0036] In Figures 2 and 8, the reference numeral 10 designates a water discharge channel, which is associated, at a third end 11a, with the first ducts 5.

[0037] The interconnection between the channel 10 and the first and second ducts 5 and 8 is advantageously performed by means of a T-shaped connecting element, designated by the reference numeral 12.

[0038] In order to avoid the accumulation of water proximate to the T-shaped element 12, the channel 10 is conveniently provided with means 13 that allow the unidirectional flow of the water toward a fourth end 11b of the channel 10 and then toward a well for collecting wastewater, designated by the reference numeral 14.

[0039] The channel 10 in fact has an inclined portion 15 that is suitable to lower the hydraulic grade line; this lowering can be estimated, by way of non-limitative example, at approximately 1.5 times the diameter of the channel 10.

[0040] Downstream of the inclined portion 15 there is, conveniently, a siphon, designated by the reference numeral 16, that is suitable to prevent the portion of the channel 10 located downstream of the siphon 16 from being placed at a negative pressure by the presence of the fan 9 and is therefore suitable to prevent aspiration of the air that is present proximate to the wastewater collection well 14.

[0041] A one-way valve, designated by the reference numeral 17, is conveniently arranged between the siphon 15 and the fourth end 11b of the channel 10 and is suitable to prevent backflow of the water that is present in the well if said well fills.

[0042] Operation is therefore as follows: with reference to Figures 1 and 2, it can be noted that when the fan 9 is switched on, the first and second ducts 5 and 8 are placed under negative pressure, forcing the air and/or gas that is present proximate to the intakes 2 to converge toward the free end, connected to an outside environment, of the second duct 8.

[0043] Any water that is present in the channel systems 4 is induced to converge toward the channel 10 both by the negative pressure generated by the fan and by the slight inclination of said channel systems.

[0044] The means 13 suitable to allow the unidirectional flow of the water, constituted by the oblique portion 15, by the siphon 16 and by the one-way valve 17, allow to send the water toward the collection well 14, at the same time avoiding its backflow toward the T-shaped connecting element 12.

[0045] It has thus been found that the invention has achieved the intended aim and objects, a system having been devised which allows to obtain effectively and safely the extraction of noxious gases and particularly of carbon dioxide obtained from the fermentation of

grapes in cellars.

[0046] The invention allows to reduce overall dimensions, since the channels and ducts have a reduced diameter and can thus be buried or concealed easily, allowing to achieve optimum aesthetic impact of the enclosed space suitable for fermentation.

[0047] In this manner, logistical organization and operations for fermentation and conveyance of the material are also facilitated, since the system does not hinder operations.

[0048] By performing the localized aspiration of the carbon dioxide, the intended aim is achieved by using very small fans, allowing to achieve a considerable energy saving and to work in a low-noise environment.

[0049] Finally, the described system is also suitable to achieve extraction of humid air, which is present very often in enclosed spaces located below ground level, and its replacement with air drawn from outside environments.

[0050] The materials used, as well as the dimensions that constitute the individual components of the invention, may of course be more pertinent according to specific requirements.

[0051] The disclosures in Italian Patent Application No. TV2001A000038 from which this application claims priority are incorporated herein by reference.

[0052] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An extraction system, particularly for extracting noxious gases from spaces located partially below ground level, **characterized in that** it comprises a plurality of floor-level intakes connected to a first suction duct affected by at least one second duct for a forced external expulsion of collected gas, a water discharge channel being associated with said first duct and being provided with means that allow a unidirectional flow of water.
2. The system according to claim 1, wherein said intakes are advantageously constituted by the discharge channels meant to convey externally the water used to wash an enclosed space located partially below ground level and vessels where fermentation occurs, **characterized in that** said intakes are associated laterally or in a downward region with one or more channels for connection to said first suction duct.
3. The system according to claim 1, **characterized in**

that said first duct is slightly inclined with respect to a horizontal plane and has, at a first end, which is slightly raised, a temporary closure device which allows access, inspection and/or washing of said first duct.

4. The system according to claim 2, **characterized in that** along said second duct, which is connected to the outside environment or to a separate air filtration and regeneration system, there is at least one fan suitable to allow forced extraction of the gas collected proximate to the floor of said enclosed space located partially below ground level.
5. The system according to one or more of the preceding claims, **characterized in that** the second end of said first duct is associated with said second duct and said discharge channel advantageously by means of a connecting element that is approximately T-shaped.
6. The system according to claims 1 and 5, **characterized in that** said discharge channel, associated at a third end with said connecting element, allows the unidirectional flow of the water toward a fourth end, which is connected to a wastewater collection well.
7. The system according to one or more of the preceding claims, **characterized in that** said means suitable to allow the unidirectional flow of water comprise an inclined portion that is suitable to lower the hydraulic grade line.
8. The system according to one or more of the preceding claims, **characterized in that** said means suitable to allow unidirectional flow of water comprise a siphon that is suitable to prevent the portion of channel that lies downstream of said siphon from being placed under negative pressure by the presence of said fan and is therefore suitable to prevent the aspiration of the air that is present proximate to said wastewater collection well.
9. The system according to one or more of the preceding claims, **characterized in that** said means suitable to allow the unidirectional flow of the water comprise a one-way valve, which is suitable to prevent the backflow of the water that is present in the well if said well is full.
10. The system according to claims 1, 7, 8 and 9, **characterized in that** said siphon is arranged downstream of said inclined portion, said one-way valve being conveniently arranged between said fourth end of said channel and said siphon.
11. The system according to one or more of the preced-

ing claims, **characterized in that** said intakes, provided below the surface of the floor of said space located partially below ground level, preferably at a central corridor, are closed in an upward region by means of one or more grilled plates, which are suitable to act as a support and simultaneously allow the passage of fluids such as liquids or gases.

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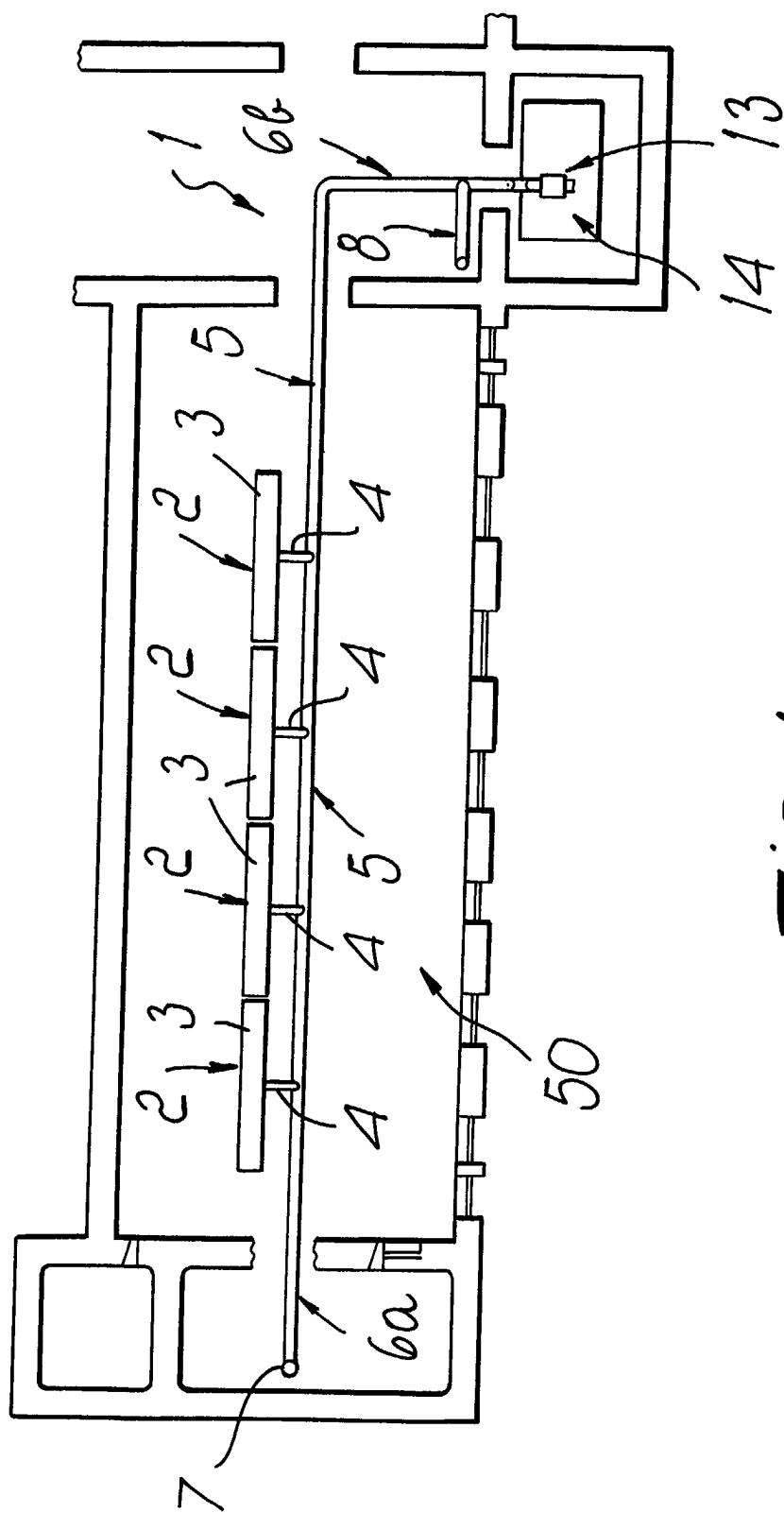


Fig. 1

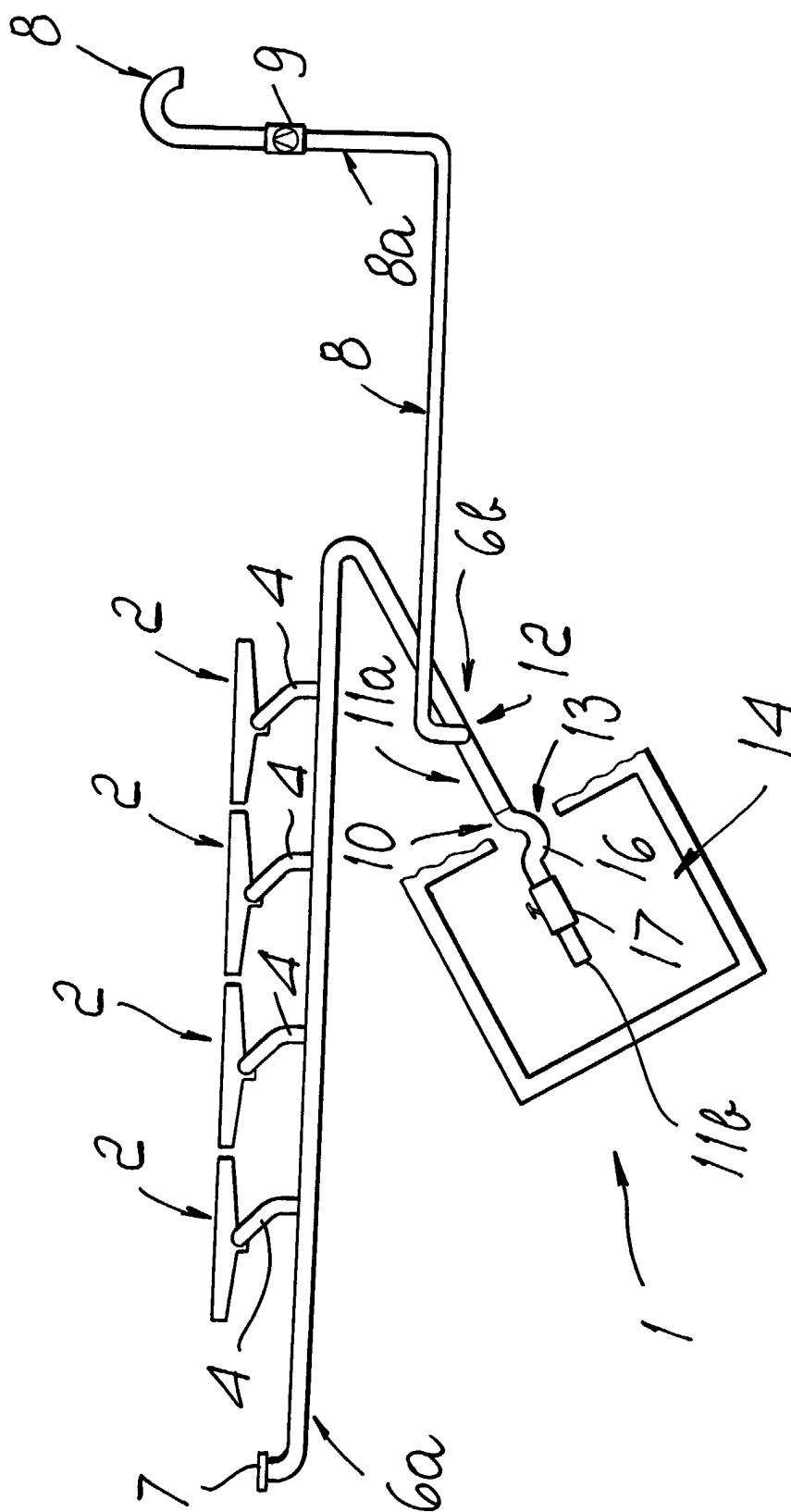


Fig. 2

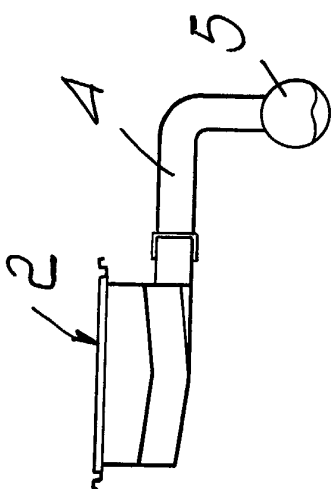


Fig. 6

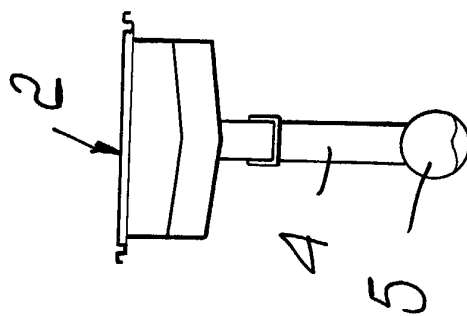


Fig. 7

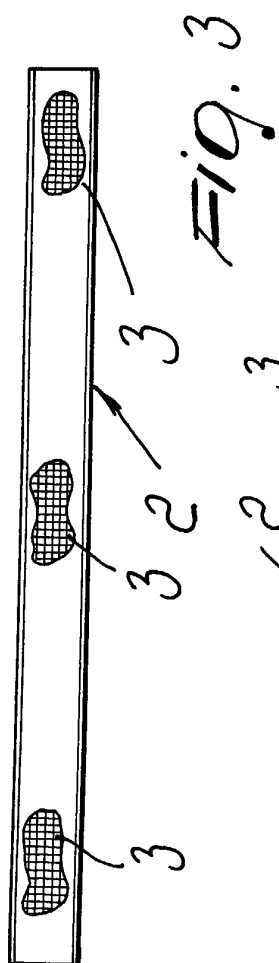


Fig. 3

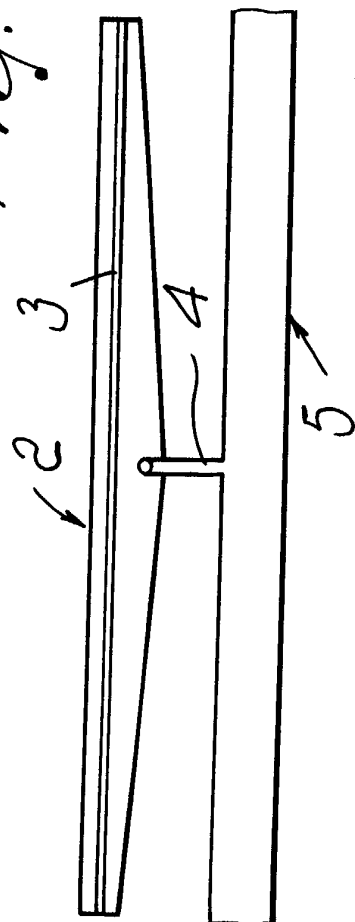


Fig. 4

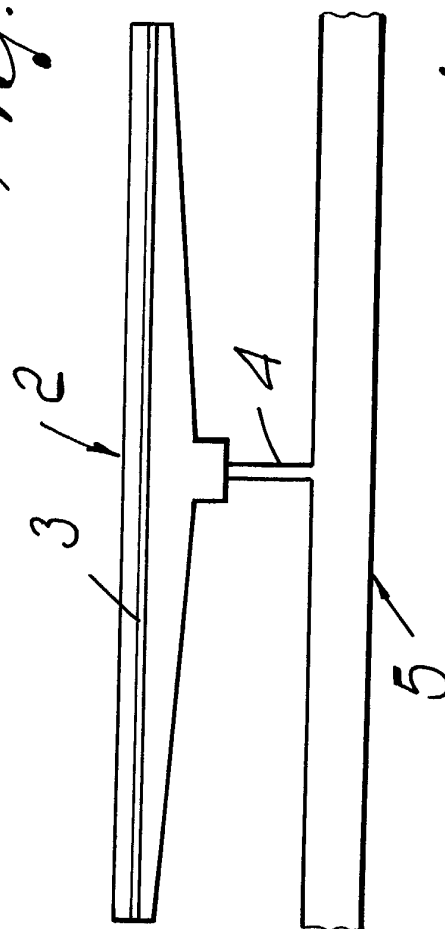


Fig. 5

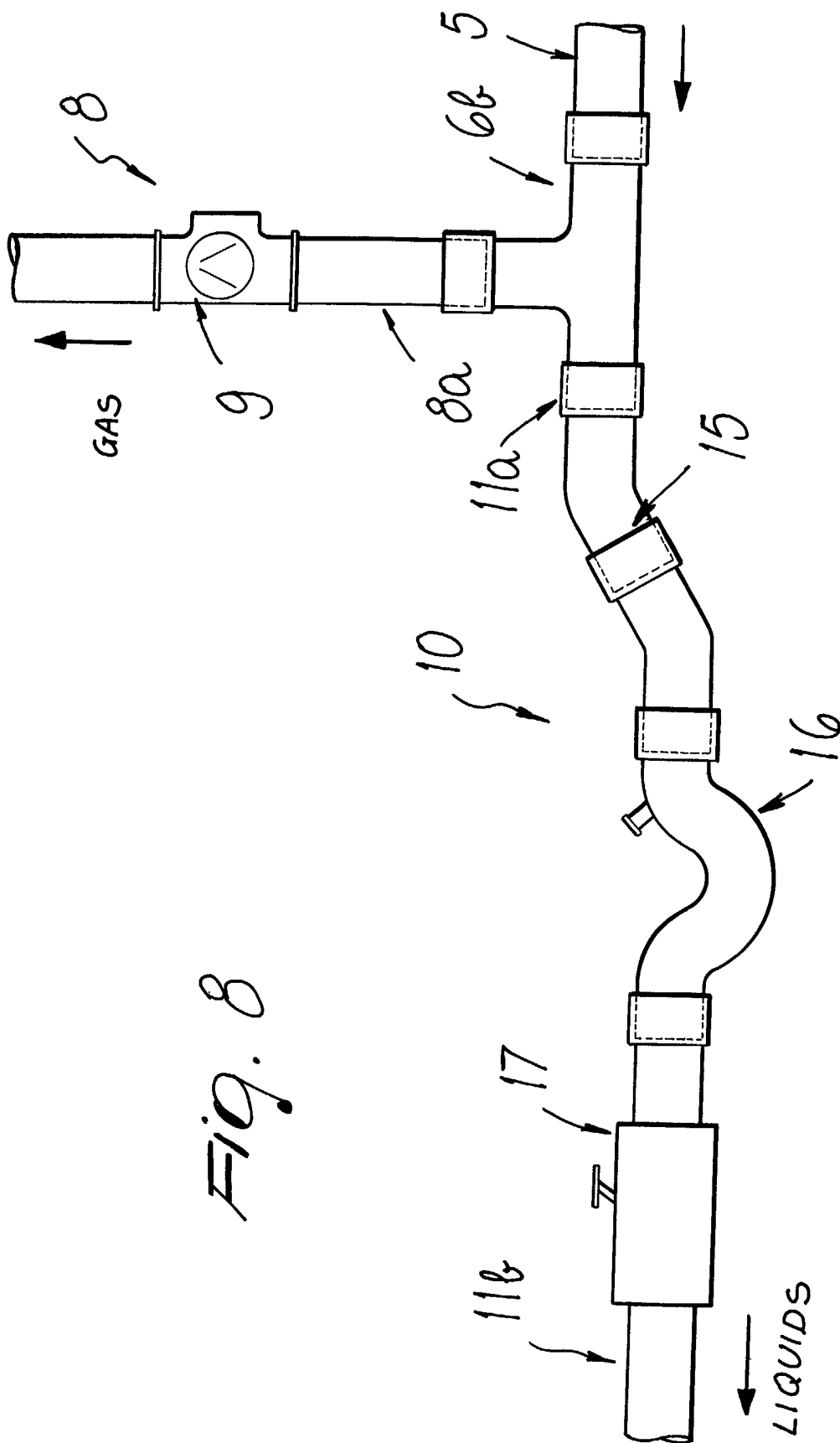


Fig. 8