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(54) **PROTECTING DEVICE**

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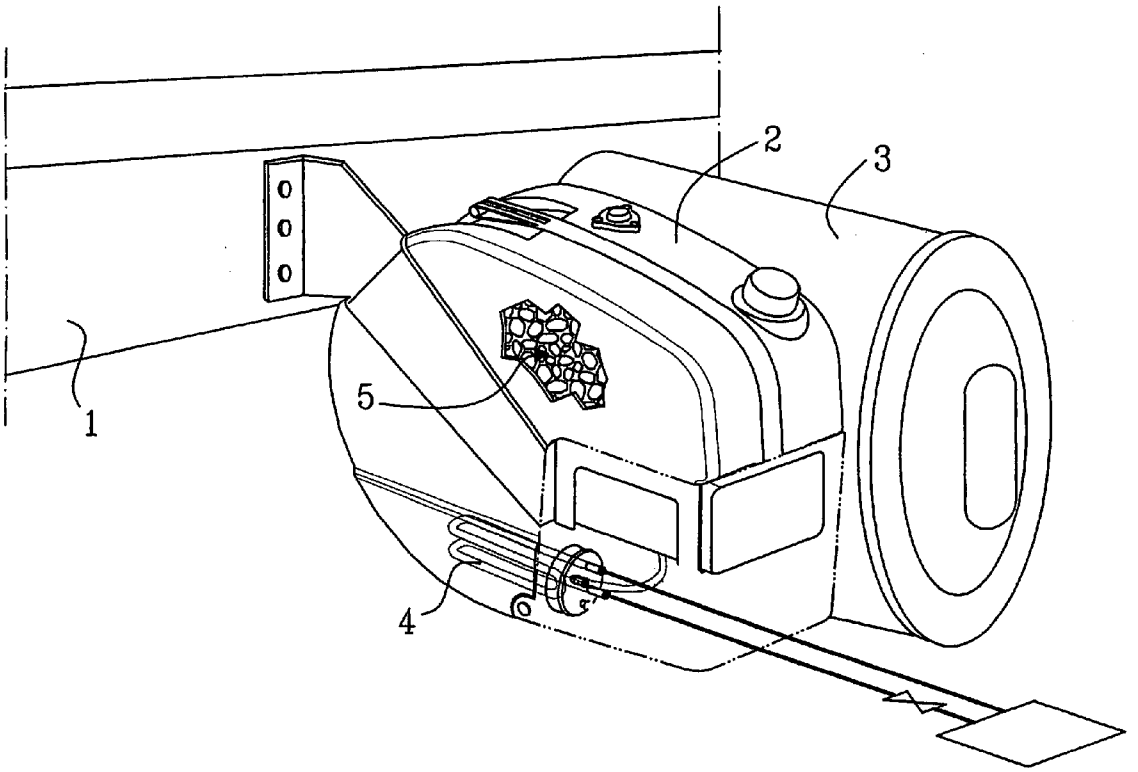
(57) **ABSTRACT**

A protecting device for a reservoir (**2**) disposed on a vehicle (**1**) and intended to contain a medium. The device includes an arrangement (**5**) disposed inside the reservoir (**2**) and which takes the form of at least one solid body that deters relative movement, given the presence of the medium in frozen form in the reservoir (**2**), between the frozen medium and the reservoir during transport of the vehicle (**1**).



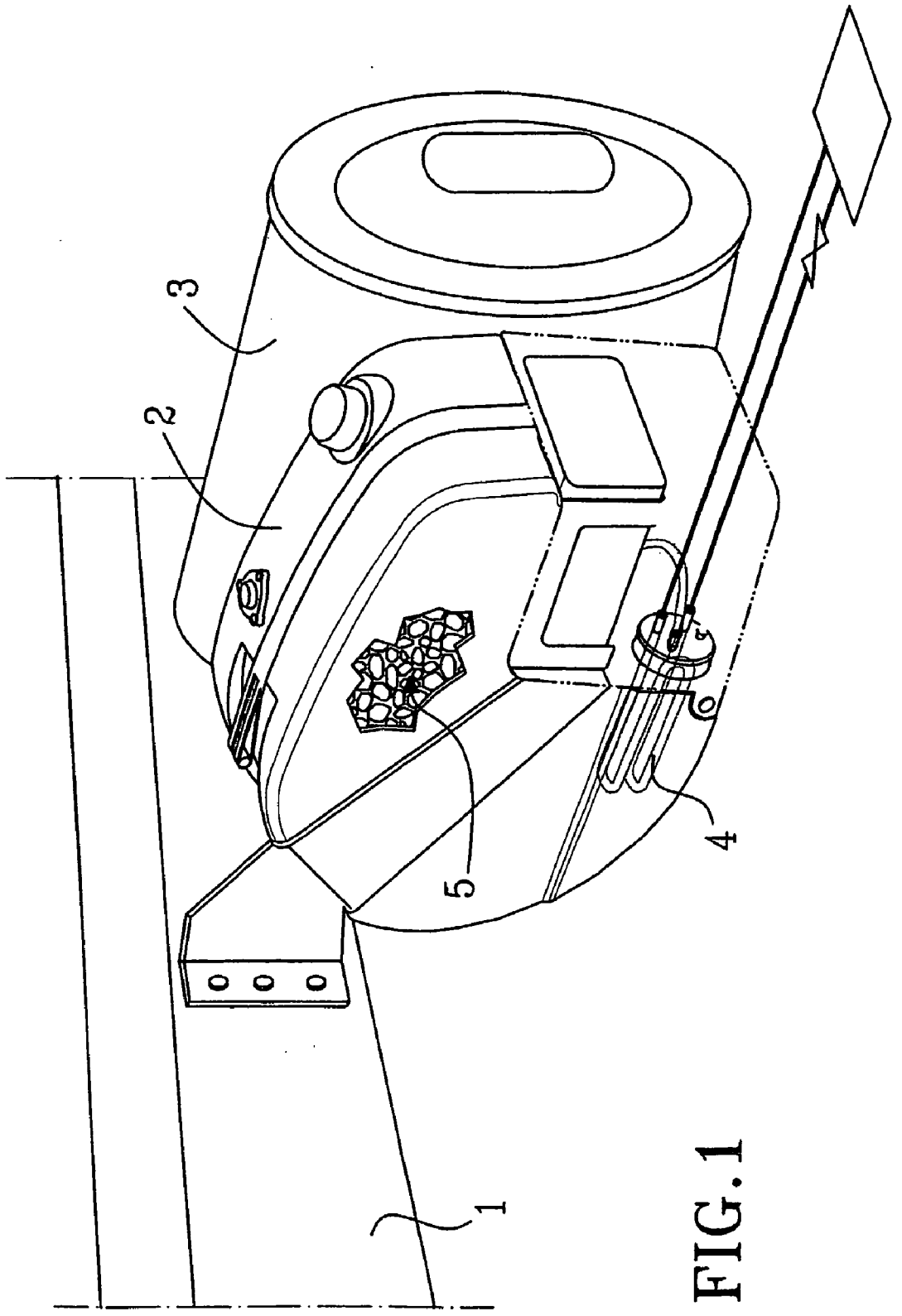


FIG. 1

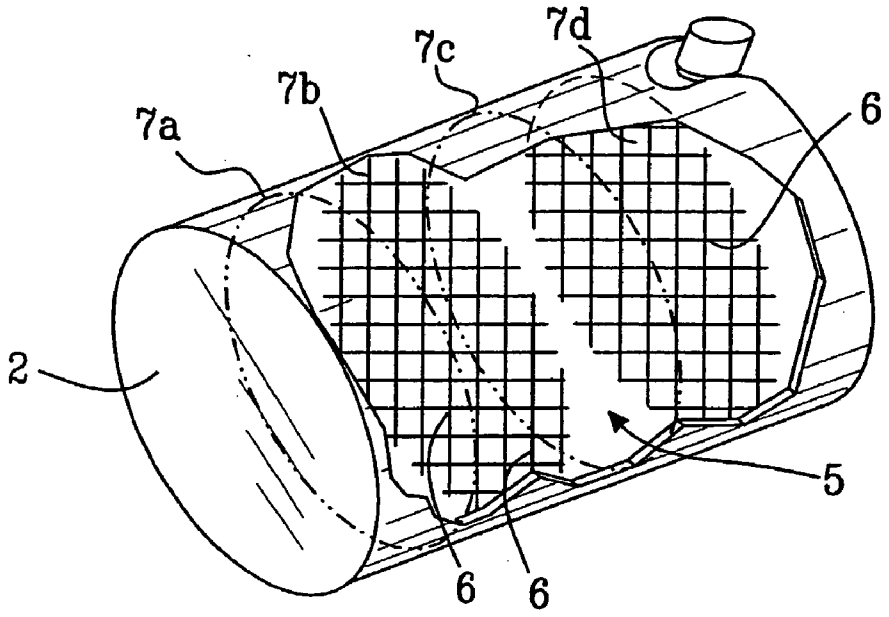


FIG.2a

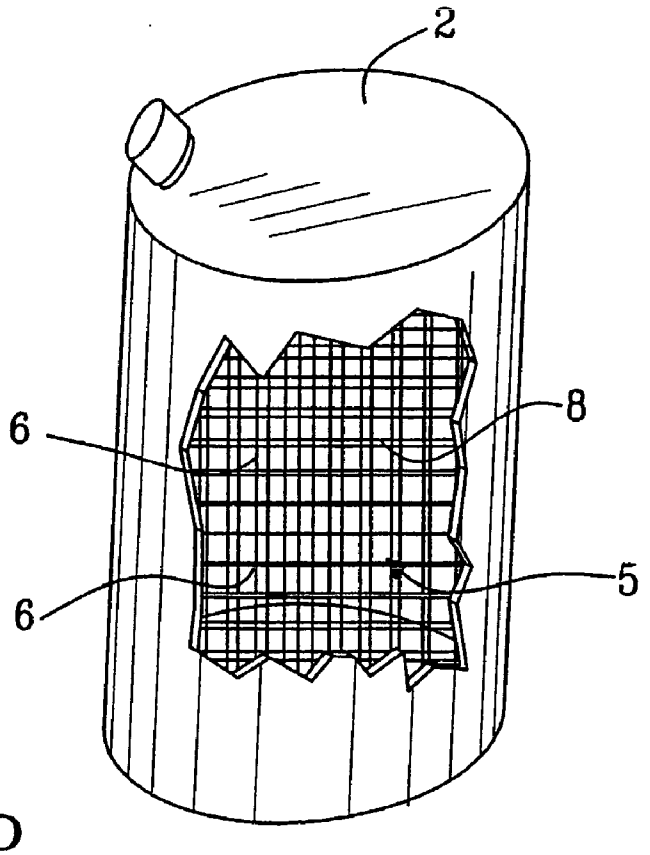


FIG.2b

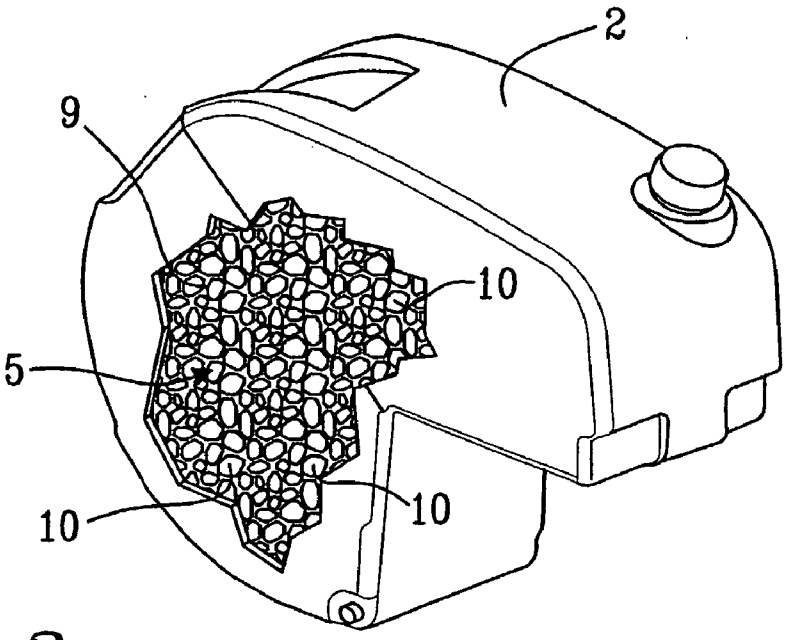


FIG.3a

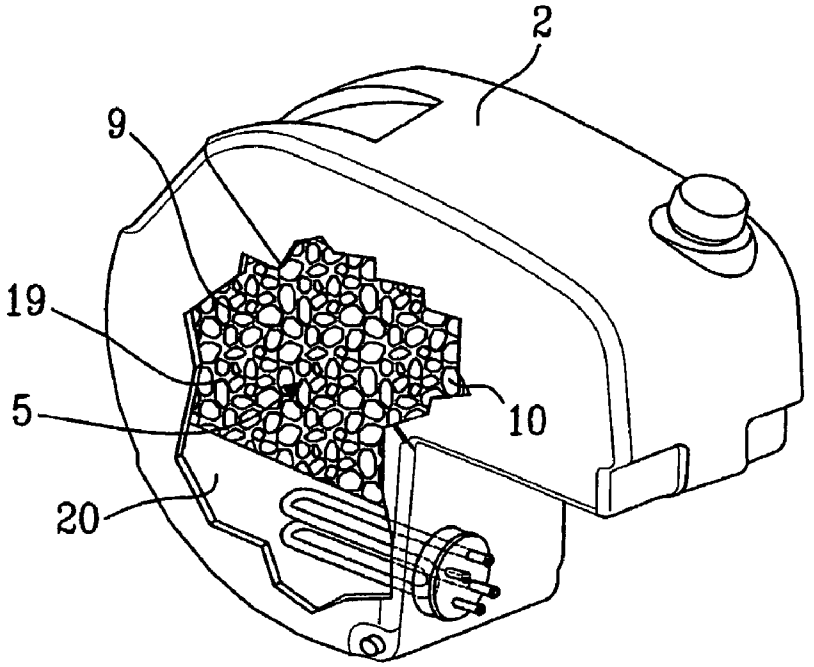


FIG.3b

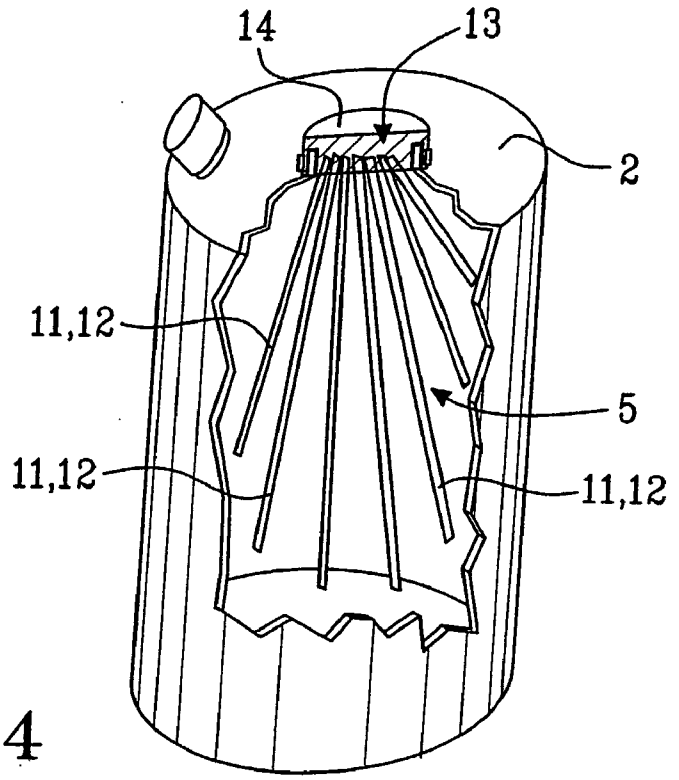


FIG.4

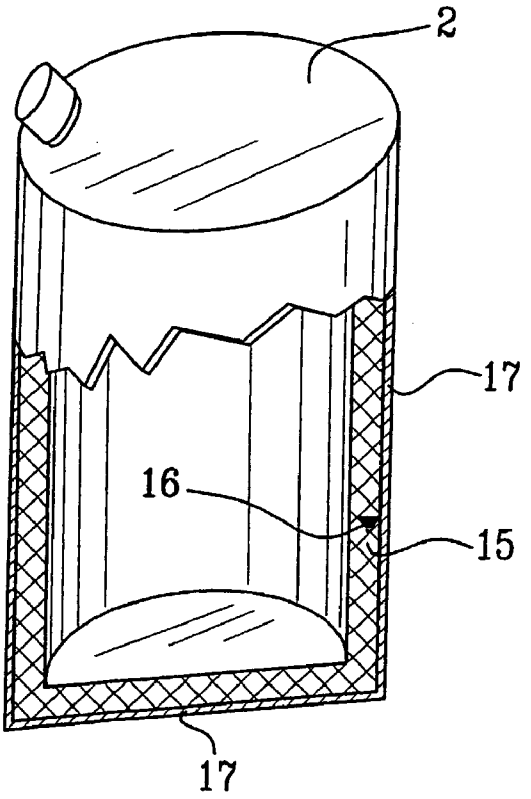


FIG.5

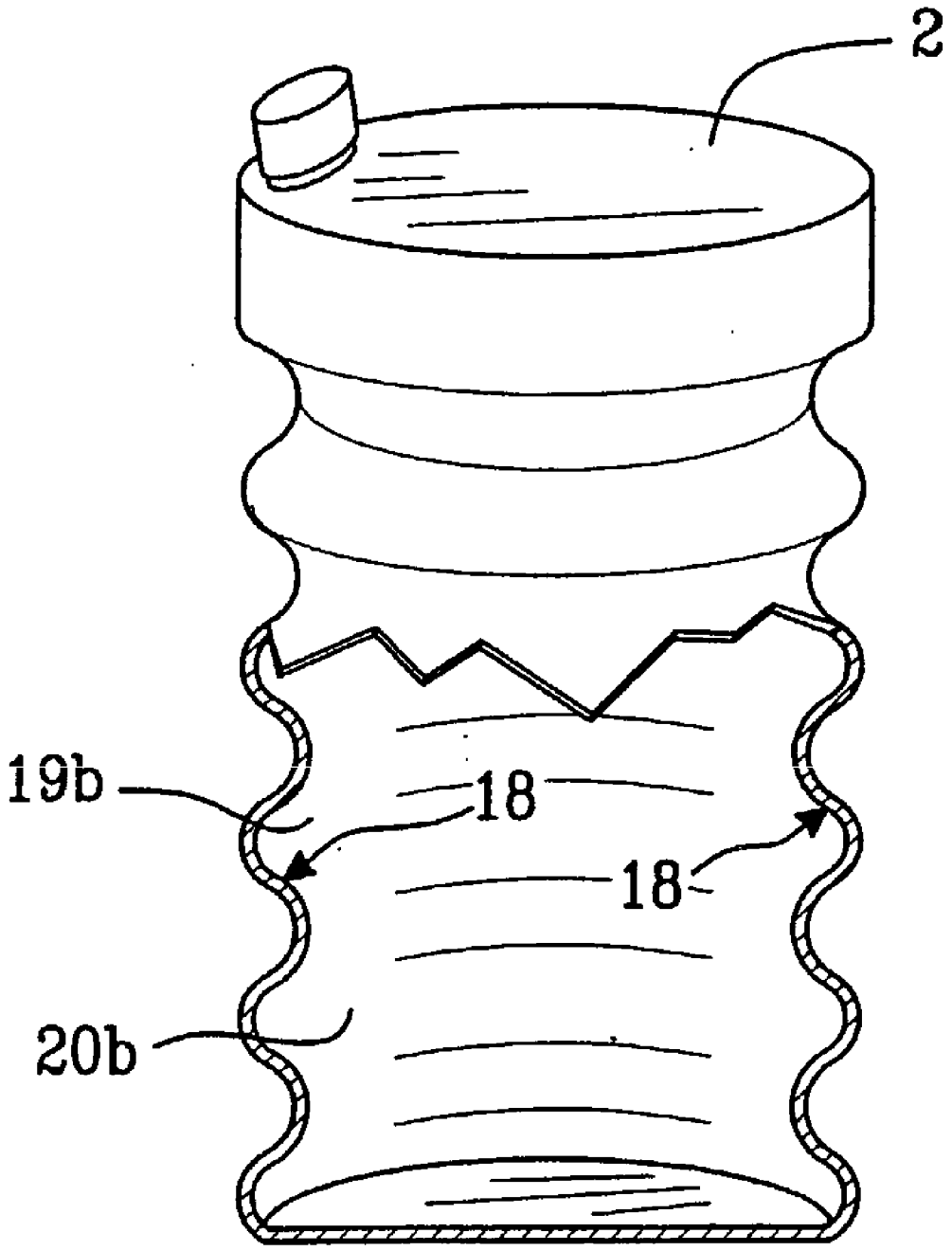


FIG.6

PROTECTING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation patent application of International Application No. PCT/SE2004/001567 filed 27 Oct. 2004 which is published in English pursuant to Article 21(2) of the Patent Cooperation Treaty, and which claims priority to Swedish Application No. 0302836-2 filed 27 Oct. 2003. Said applications are expressly incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

[0002] The present invention relates to a protective device that includes a portion disposed inside a reservoir and which is constituted by at least one solid body adapted for deterring relative movement of a frozen medium therein during transport of the reservoir on a vehicle.

BACKGROUND OF THE INVENTION

[0003] In various types of vehicle, there are reservoirs for liquids used for different functions of the vehicle. In certain cases, these liquids and reservoirs are used at temperatures which are so low that the liquid passes wholly or partially into the frozen state. The present invention can be utilized for various reservoirs for vehicle applications, but the following description will discuss specifically (for illustrative purposes, but in no way indicative of limitations) how the invention can be used together with a reservoir intended for urea. There is a need to store urea in a reservoir disposed in a vehicle so as to be able to provide urea for cleaning of exhaust gases deriving from an internal combustion engine of the vehicle.

[0004] One way of meeting the increasingly strict requirements for cleaning exhaust gases produced from internal combustion engines is to convert the exhaust gases into safe or less harmful gases by injecting urea into the exhaust gas stream. This can reduce, above all, the nitrogen oxide NOX content, which can help to reduce the emissions of harmful substances into the environment.

[0005] To this end, there is a need, however, for a continuous supply of urea while the internal combustion engine is running. This means that a vehicle, such as a truck, that utilizes this cleaning methodology must be equipped with a reservoir for urea. From the reservoir, urea can then be delivered for cleaning the exhaust gases.

[0006] There are problems, however, associated with the use of urea. In cold weather, for example, urea can freeze in the reservoir. If urea freezes in the reservoir, it can mean, in turn, that the reservoir or other equipment disposed inside the reservoir, such as, for example, warming members for warming the urea, is damaged by the frozen matter through collision with the latter and/or through abrasion between the frozen matter and the reservoir and/or equipment disposed inside the reservoir. The problem is especially pronounced when the frozen matter re-thaws, since, as the frozen matter melts, loose lumps or blocks of frozen matter can be formed/released in the reservoir. Since the matter very often thaws from the perimeter toward the center of the frozen mass, a large lump of frozen material often ends up being created and which moves around in the reservoir during the thawing process.

SUMMARY OF THE INVENTION

[0007] One object of the invention is to provide a protecting device for reservoirs in vehicle applications, which device, in the use of a reservoir containing a medium in frozen form, is capable of avoiding damage to the reservoir and/or to equipment disposed inside the reservoir.

[0008] As described above, the inventive device comprises a means disposed inside the reservoir, in the form of at least one solid body, for deterring relative movement, given the presence of said medium in frozen form in the reservoir, between said frozen medium and the reservoir during transport of the vehicle. This means that damage to the reservoir, arising from the effect of frozen matter, can be considerably reduced.

[0009] Further advantageous embodiments and other advantages of the invention derive from the following description and dependent patent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Hereinafter is provided a detailed description of an exemplary embodiment of the present invention which includes reference to the accompanying drawings, in which:

[0011] **FIG. 1** is a perspective view illustrating a mechanism for cleaning exhaust gases deriving from an internal combustion engine by the admixture of a medium, which mechanism includes a device according to the invention for protecting a reservoir containing said medium;

[0012] **FIG. 2***a* illustrates a protecting means according to the invention which has grid sections;

[0013] **FIG. 2***b* illustrates a variant of a protecting means according to the invention which has a three-dimensional grid;

[0014] **FIG. 3***a* illustrates a further variant of a protecting means configured according to the invention and which has a hollow structure;

[0015] **FIG. 3***b* illustrates a variant of the protecting means configured according to the embodiment of the invention shown in **FIG. 3***a;*

[0016] **FIG. 4** illustrates a further variant of a protecting means configured according to the invention and having elongated elements;

[0017] **FIG. 5** illustrates a further variant of a protecting means configured according to the invention in the form of a resilient layer disposed on the inner side of the reservoir; and

[0018] **FIG. 6** illustrates a further variant of a protecting means configured according to the present invention and taking the form of a counter-stay disposed inside the reservoir.

DETAILED DESCRIPTION

[0019] **FIG. 1** illustrates in perspective view a mechanism for cleaning exhaust gases from an internal combustion engine (not shown) of a vehicle **1** by the admixture of a medium. A reservoir **2** for said medium, such as, for example, urea, is disposed on the vehicle so as to deliver said medium to a combined muffler and catalyzer **3** connected to the internal combustion engine. The reservoir **2**, which

expediently is fastened to the chassis **1** of an engine-driven vehicle, can also be provided with a member **4** for warming the first medium present in the reservoir. Such a warming member **4** can be used to thaw matter (material containing at least a partially liquid state component) which has frozen in the reservoir **2**. It should be pointed out that the reservoir **2** may, of course, be placed on a vehicle unit which does not have an engine. Where the protecting device is utilized in connection with exhaust-gas cleaning, the reservoir **2** is disposed, however, on an engine-driven vehicle or on a vehicle unit which is linked with another vehicle unit provided with an engine.

[**0020**] The medium which is added for cleaning of the exhaust gases can have differing chemical composition. Said medium can be urea, for example, or a solution consisting of or containing urea (CO [NH2] 2+H20). Urea can be used to reduce the presence of nitrogen oxides NOX in the exhaust gases deriving from the internal combustion engine of the vehicle.

[**0021**] The protecting device according to the invention comprises an arrangement or means **5** disposed inside the reservoir **2**, in the form of at least one solid body, for deterring relative movement, given the presence of said medium in frozen form in the reservoir **2**, between said frozen medium and the reservoir **2** during transport of the vehicle **1**.

[**0022**] In the embodiments illustrated in **FIGS. 2***a*, **2***b*, **3***a*, **3***b* and **4**, said means **5** has at least one position **6**, preferably a plurality of positions **6**, for the freezing of said medium to said at least one position or to the positions **6**. Said means **5**, hereinafter referred to as the protecting means **5**, can be, for example, a network or a grid **7** onto which said medium can freeze. In this way, freezing and/or thawing of the urea can be controlled, at the same time as the reservoir **2** can be protected against the effect of frozen matter in the reservoir **2**. As a result of said medium being frozen to the protecting means **5**, the frozen matter is deterred from colliding with the walls of the reservoir, which might otherwise occur owing to frozen matter in lump form swishing around in the non-frozen liquid in the reservoir **2** during displacement of the reservoir **2**.

[**0023**] When frozen matter in the reservoir **2** thaws, the protecting means **5** can advantageously be configured to cause this thawing to occur without sizeable loose lumps or blocks of frozen matter being released and adversely affecting the reservoir **2**.

[**0024**] **FIG. 2***a* shows an embodiment in which a plurality of grid sections **7***a*, **7***b*, **7***c*, **7***d* are utilized to protect the reservoir. For the sake of clarity, every second grid section is illustrated diagrammatically with dash-dot lines. Depending on various conditions, such as, for example, the volume, shape and the like of the reservoir **2**, one or more grid sections **7***a*, **7***b*, **7***c*, **7***d* of different size and shape can be disposed within the volume of the reservoir **2** in order to create the protecting means **5**. For example, a plurality of grid sections can be disposed essentially parallel to one another and at a mutual distance apart to produce the protecting means **5**. The protecting means **5** can therefore be formed by means of one or more two-dimensional grids, but it can also be an integrated, three-dimensional grid or network structure **8** as illustrated in **FIG. 2***b*. By two-dimensional and three-dimensional it is meant that the grid **7** has the openings disposed in one and the same plane **7***b* and disposed in at least two different planes **8**, respectively. The reservoir **2** can be of any chosen shape and size and the protecting means **5** configured accordingly. The outer contour of the protecting means **5** can be matched to the inner limit surface of the reservoir so that the protecting means, even though it is disposed loose inside the reservoir, is essentially detained in its position by the walls of the reservoir.

[**0025**] Alternatively, the protecting means **5** can be fastened in the reservoir **2** in order, in respect of at least one position, to fix the protecting means **5** in relation to the reservoir **2**.

[**0026**] The protecting means **5** is advantageously configured and constructed from a material so as to enable a flexibility such that, when the protecting means **5** is subjected to load as a result of the inertia of the frozen matter acting on the protecting means **5**, primarily as a result of the carrying vehicle's movement, the protecting means **5** can move in relation to the reservoir by flexing of the protecting means. In certain cases, the protecting means **5** can be made of a material with relatively high elasticity, and/or dimensioned so as to allow such flexing in relation to the reservoir. The movement of one or more lumps which are frozen to the protecting means can thereby be gently and sensitively dampened, while unwelcome collisions between these lumps and the walls of the reservoir are prevented, or at least deterred, or only occur at a lower speed than would be the case without said protecting means.

[**0027**] In **FIGS. 3***a* and **3***b*, variants of the protecting means **5** are illustrated. The protecting means **5** is a porous three-dimensional body **9**, which has a large quantity of cavities **10** of the same or varying size. The cavities **10**, which account for at least 50%, preferably more than 80%, and in most cases over 90%, mean that the protecting means **5**, despite essentially filling the whole of the reservoir **2** (see, for example, **FIG. 3***a*) still does not occupy too great a volume of the reservoir, so that space remains for intended said medium. Such a structure **9** with pores or cavities **10** has an appearance similar to that exhibited by sponge material. This protecting means **5**, too, can have the characteristics which are described above for the network and grid constructions. In **FIG. 3***b*, a member **4** for warming the medium in the reservoir **2** is also present, disposed in the lower part of the reservoir **2**. In this case, a larger cavity, offering space for the warming member **4**, can be disposed in the protecting means, or the extent of the protecting means **5** can be limited, as illustrated in **FIG. 3***b*, to that part of the reservoir **2** which is without the warming member **4**.

[**0028**] In **FIG. 4**, the protecting means **5** has a plurality of elongated elements **11** fastened in the upper end of the reservoir **2**. One or more such elongated elements, such as, for example, rods **12** of different length and cross section, can be used for said medium to freeze to these rods. Preferably, the rods **12** are designed to extend into the reservoir **2** from an opening **13** in the reservoir **2** and, expediently, the rods **12** are suspended from a component **14** which is detachably disposed in the reservoir. The component **14** can be configured so that the opening **13** can be closed and opened by means of the component **14**. This component **14** can be configured and have a flexibility such that the protecting means **5** can move in relation to the

reservoir **2** by flexing of the suspension component **14** when the protecting means **5** is subjected to load as a result of transport of the vehicle. The component **14** preferably has an elasticity which is higher than that of the material of the protecting means **5**, in this case the rods, so as to allow certain flexing, and thus movement, of the rods in relation to the reservoir **2**.

[**0029**] The movement of one or more lumps which are frozen to the protecting means **5** can thereby be dampened in the manner which is described above. Alternatively, or in combination with a flexible component **14** of this kind, the rods **12** per se can be configured and made of a material which allows the rods themselves to be able to spring, i.e. bend, to the point where the movement of the rods, and therefore the movement of matter frozen to the rods, will be able to be dampened and unwelcome collisions between frozen matter and the walls of the reservoir will be able to be avoided during transport of the vehicle. Although, in the illustrated embodiment, the opening for the elongated elements **11** is disposed in the upper part of the reservoir **2**, it could be disposed elsewhere in the reservoir. The protecting means in the form of elongated elements could also be arranged without special opening in the reservoir, by the fastening of rods, for example, on the inner side of the walls of the reservoir.

[**0030**] For all the above-described embodiments, the protecting means can be designed to deter displacement of said frozen medium from a first part-volume **19** of the reservoir **2** to a second part-volume **20** of the reservoir **2**, see especially **FIGS. 3***a* and **3***b*. In particular, the protecting medium **5** can be designed to deter displacement of said frozen medium from a first part-volume **19** of the reservoir to a second part-volume **20** of the reservoir, which second part-volume contains a further member **4** disposed inside the reservoir **2**. Such a member can be designed, for example, to warm said medium in the reservoir **2**.

[**0031**] **FIG. 5** shows a further embodiment of the protecting means **5** according to the invention in the form of a resilient layer **15** disposed along at least a part of the inner limit face **16** of the reservoir **2**. Such a layer **15** expediently has a higher flexibility than the material in the walls **17** of the reservoir so as to act as a shock absorber between frozen matter present in the reservoir **2** and the bearing walls **17** of the reservoir. The resilient layer can be made, for example, of rubber or the like. Such a protecting means **5**, apart from acting as a shock absorber, can also prevent abrasion on the walls of the reservoir. In addition, the thickness and deformability of the layer **15** can be matched to the expansion which said medium suffers in the reservoir as it freezes, so that, at least at a certain level of filling of said medium in the reservoir, the expansion upon freezing is wholly or partially compensated by the elastic deformation of the layer. The layer can hence help to hold the frozen matter still through pressurization of the frozen matter by the compressed layer.

[**0032**] **FIG. 6** illustrates a variant of the inventive protecting means **5** which is based on the fact that one or more counter-stays **18** are disposed inside the reservoir **2** in order to essentially detain the frozen medium in a certain part or parts of the reservoir. Preferably, one or more such counter-stay **18** is disposed close to a wall **17** of the reservoir **2**. It is also possible, as illustrated, to form the counter-stays **18** by a special configuration of the walls **17** of the reservoir. In such a case, the at least one solid body (i.e. the protecting means **5**) is constituted by at least one component which, at the same time, constitutes part of a wall **17** of the reservoir **2**. Whether the counter-stay(s) **18** is created by the configuration of a wall **17** of the reservoir **2** or by the placement of separate apparatus inside the reservoir, the counter-stay(s) **18** is designed to deter displacement of the frozen medium from a first part-volume **19***b* of the reservoir to a second part-volume **20***b* of the reservoir **2** and thereby essentially detain the frozen medium in a certain part of the reservoir, for example in the lower or upper part of the reservoir **2**.

[**0033**] The protecting means **5** can be designed especially to deter displacement of said frozen medium from a first part-volume of the reservoir to a second part-volume of the reservoir, which second part-volume contains a further member disposed inside the reservoir in order to protect this member. In order to protect, for example, a warming member disposed inside the reservoir, it is possible, by means of the protecting means, essentially to detain frozen matter in a volume which does not comprise the warming member, but it might also be possible to utilize the protecting means to detain the frozen medium in the volume containing the further member in order instead to ensure that the matter frozen on this member does not adversely affect the member by moving, and hence moving along the member and subjecting it to load.

[**0034**] It should be stressed that the invention is not limited to the embodiments of the invention that are described herein, but instead is only limited by the patent claims. Once the concept of the invention is known, a number of modifications within the scope of the invention will most likely become evident to those persons skilled in these arts.

What is claimed is:

1. A protecting device for a reservoir (**2**) disposed on a vehicle (**1**) and configured to contain an at least partially liquid-state medium, said device comprising:

an arrangement (**5**) disposed inside the reservoir (**2**) and comprising at least one body element composed of a substantially continuous material that deters relative movement between a frozen state medium mass contained within the reservoir (**2**) and the reservoir during transport of the reservoir on a vehicle (**1**).

2. The protecting device as recited in claim 1, wherein said arrangement (**5**) is configured to have at least one position (**6**) for the freezing of said medium to said at least one position.

3. The protecting device as recited in claim 1, wherein said arrangement (**5**) has a plurality of positions (**6**) for the freezing of said medium to these positions.

4. The protecting device as recited in claim 1, wherein said arrangement (**5**) comprises a grid (**7**, **8**) network.

5. The protecting device as recited in claim 1, wherein said body element is at least partially composed of a porous material having a volume ratio Vh/Vtot greater than 0.5, in which Vh is equal to a combined volume of cavities in the body element and Vtot is the total volume constituting the sum of said cavities and solid matter of the body element.

6. The protecting device as recited in claim 1, wherein said arrangement (**5**) comprises at least one elongated element (**11**).

7. The protecting device as recited in claim 1, wherein said arrangement (5) is configured to extend into the reservoir (2) from an opening (13) in the reservoir.

8. The protecting device as recited in claim 7, wherein said arrangement (5) is suspended in the reservoir (2) from a component (14) disposed in the opening (13).

9. The protecting device as recited in claim 8, wherein said suspension component (14) is configured and has a flexibility such that said arrangement (5) can move in relation to the reservoir (2) by flexion of the suspension component (14) when said arrangement (5) is subjected to load as a result of transport on a vehicle (1).

10. The protecting device as recited in claim 9, wherein said suspension component (14) has a high elasticity in relation to the material of said arrangement (5).

11. The protecting device as recited in claim 7, wherein said opening (13) is disposed in an upper part of the reservoir (2).

12. The protecting device as recited in claim 7, wherein said arrangement (5) is configured to deter displacement of frozen medium from a first part-volume (19) of the reservoir (2) to a second part-volume (20) of the reservoir (2).

13. The protecting device as recited in claim 12, wherein said arrangement (5) is designed to deter displacement of frozen medium from the first part-volume (19) of the reservoir (2) to the second part-volume (20) of the reservoir (2), said second part-volume (20) containing a member (4) disposed inside the reservoir (2).

14. The protecting device as recited in claim 13, wherein said member (4) is configured to warm medium in the reservoir (2).

15. The protecting device as recited in claim 12, wherein the first part-volume (19) is positioned above the second part-volume (20).

16. The protecting device as recited in claim 12, wherein said arrangement (5) further comprises at least one counter-stay (18).

17. The protecting device as recited in claim 16, wherein said at least one counter-stay (18) is disposed close to a wall (17) of the reservoir (2).

18. The protecting device as recited in claim 17, wherein said at least one counter-stay (18) is created by the configuration of a wall (17) of the reservoir (2).

19. The protecting device as recited in claim 1, wherein said arrangement (5) comprises a resilient layer (15) disposed along at least a part of an inner limit face (16) of the reservoir (2).

20. The protecting device as recited in claim 1, wherein said arrangement (5) has sufficient flexibility to accommodate movement of said arrangement (5) relative to the reservoir (2) by flexion of said arrangement (5) when said arrangement (5) is subjected to load as a result of transport of the vehicle (1).

21. The protecting device as recited in claim 1, wherein said arrangement (5) is disposed in a reservoir (2) configured to contain a medium for cleaning exhaust gases from an internal combustion engine.

22. A reservoir containing a protecting device and being configured to be disposed on a vehicle (1) and further being configured to contain an at least partially liquid-state medium, said device comprising an arrangement (5) disposed inside the reservoir (2) and comprising at least one body element composed of a substantially continuous material that deters relative movement between a frozen state medium mass contained within the reservoir (2) and the reservoir during transport of the reservoir on a vehicle (1).

23. A vehicle carrying a reservoir containing a protecting device and said reservoir being configured to contain an at least partially liquid-state medium, said device comprising an arrangement (5) disposed inside the reservoir (2) and comprising at least one body element composed of a substantially continuous material that deters relative movement between a frozen state medium mass contained within the reservoir (2) and the reservoir during transport of the reservoir on a vehicle (1).

* * * * *