

Storage box for bottles of pressurized fluid and associated storage frame

The invention relates to the field of the storage and transportation of cylinders (bottles) of pressurized fluid, notably pressurized gas, of composite construction.

In order to store and transport cylinders of pressurized fluid and notably pressurized gas, use is made, in a known way, of frames in which the cylinders are mounted horizontally or vertically. The cylinders are often arranged in said frames contiguously either side by side or in a staggered configuration, and held together transversely generally by straps, bars or metal bands.

More particularly, the cylinders are fixed at a first end by a fixed mechanical connection to part of the frame by means of a first plurality of retaining members, for example of screw/nut type, and are fixed at a second end by a fixed mechanical connection by means of a second plurality of retaining members for example of the screw/nut type.

This type of known storage configuration notably exhibits the disadvantage of adapting neither to the potential expansion of the cylinders as they are filled, nor to the geometry of the second end of the cylinders and the dimensions thereof that vary according to the manufacturer. Furthermore, certain configurations that propose storing cylinders contiguously damages the surface of the cylinders by abrasion, particularly the fibers of the cylinders when these cylinders are of composite construction.

It is an object of the invention to overcome all or some of the aforementioned disadvantages.

One subject of the invention is a storage box for at least one cylinder of pressurized fluid, said storage box being intended to be mounted in a primary structure of a storage frame, and comprising at least one first retaining member configured to collaborate fixedly with a first end of a cylinder, and at least one second retaining member configured to collaborate with a second end of the cylinder, characterized in that the second retaining member is configured to maintain the position of the second end of the cylinder while at the same time exhibiting at least one determined degree of freedom.

The storage box according to the invention offers the advantage of being able to absorb the expansion of the volume of the cylinders notably as they are being filled, while at the same time immobilizing said cylinders in terms of rotation as a result of the firm fixing provided at the first end of each cylinder. Thus, the box according to the invention forms a unit assembly of cylinders which are fixed firmly at one end and floatingly at the other end. In other words, there is no firm mechanical connection at the

second end of each cylinder, thus allowing the cylinders to move longitudinally in their region of retention.

In the present application what is referred to in a connection as a “degree of freedom” means the independent relative movements of one solid with respect to another which are permitted by this connection.

According to one feature of the invention, the storage box is configured to accept at least one cylinder arranged vertically or horizontally with respect to the ground.

According to one feature of the invention, the storage box comprises at least one first plate extending in a first direction, the first plate comprising at least one passage orifice configured to accept at least part of the first end of the cylinder in the mounted position.

Advantageously, the first direction is substantially perpendicular to the direction of mounting of the at least one cylinder when the cylinder is mounted in the box.

According to one feature of the invention, the storage box comprises several passage orifices equipping the first plate and configured to each accept the first end of each cylinder mounted or intended to be mounted in the storage box, the passage orifices being arranged on the first plate a regular or irregular distance apart. This makes it possible to avoid contact between the cylinders and wearing of these cylinders through rubbing.

According to one feature of the invention, the first plate is equipped with the first retaining member of the storage box, said first retaining member being configured to collaborate with a collar equipping the first end of the cylinder.

For preference, the at least one retaining member exhibits an internal screw thread configured to collaborate with an external screw thread formed on the collar of the first end of the cylinder, which allows the cylinder to be immobilized axially inside the storage box.

According to one feature of the invention, the storage box comprises at least one second plate extending in the first direction and positioned facing the first plate from a determined distance.

According to one feature of the invention, the determined distance between the first plate and the second plate is dependent on the dimensions of the cylinders to be mounted in the storage box and, in particular, is dependent on the length of the cylinders to be mounted in the storage box. For preference, the distance is comprised between 1000 mm and 2000 mm.

According to one feature of the invention, the storage box comprises a second retaining member corresponding to a passage orifice made in the second plate and configured to at least partially accept the second end of the cylinder.

5 According to one feature of the invention, the storage box comprises several retaining members corresponding to passage orifices made in the second plate and configured to each accept the second end of each cylinder mounted in the storage box, said retaining members being arranged a regular or irregular distance apart, which makes it possible to avoid contact between the cylinders and wearing thereof through rubbing.

10 According to one feature of the invention, each passage orifice of the plurality of the second plate are configured to collaborate, through having a complementary shape, with the second end of each cylinder, which makes it possible to index each cylinder and immobilize it in terms of rotation while at the same time maintaining the adaptation properties of the storage box.

15 For preference, each passage orifice has a multi-branch star shape.

According to one feature of the invention, the box comprises an immobilizing device configured to connect the first plate to the second plate while at the same time exhibiting at least one degree of freedom. For preference, this degree of freedom allows a degree of travel (limited adaptable positioning or clearance) in a
20 direction parallel to the longitudinal axis of the cylinders. This degree of freedom (clearance) may be limited, for example, by a limit-stop(s) system.

Advantageously, the immobilizing device exhibits longitudinal elasticity of around 5% to 30% and preferably 10%; for an initial length of around 1000 mm to 2000 mm and, for preference, around 1500 mm; which represents an elongation
25 comprised between around 5 to 60 cm and, for preference, 10 to 20 cm.

The immobilizing device makes it possible to absorb the possible elongation of the cylinders and therefore the potential movement of the first and second plates away from one another.

30 According to one feature of the invention, the immobilizing device comprises at least one screw/nut assembly extending in a direction substantially perpendicular to the direction in which the first plate and the second plate extend.

Advantageously, the screw/nut assembly passes through the first plate and the second plate.

35 According to another feature of the invention, the immobilizing device comprises at least two screw/nut assemblies spaced apart.

The invention also relates to a storage frame for cylinders, the storage frame comprising a primary structure and at least one storage box according to the invention, said at least one box being mounted in the primary structure.

In particular, the box is mounted removably in the primary structure.

5 According to one feature of the invention, the primary structure is defined by an all-welded assembly of metal uprights and bars.

 According to one feature of the invention, the mounting of the cylinders in the box is performed independently of the frame.

 According to one feature of the invention, the primary structure of the
10 frame comprises at least one wedging element intended to accept the second end of at least one cylinder.

 According to one feature of the invention, in the mounted position, the second end of each cylinder rests on a wedging element of the primary structure. Thus, part of the weight of the cylinders is also supported by the primary structure when the
15 box is mounted in the structure of the frame and when at least one cylinder is mounted in said box.

 According to one feature of the invention, the box is fixed to the primary structure by means of at least one fixed mechanical connection at the level of the second plate and by means of at least one mobile mechanical connection at the level of the first
20 plate. Thus, as the cylinders lengthen, the first plate is left free to move axially because of the clearance allowed by the at least one mobile mechanical connection as far as a positioned end stop, for example defined by the collars mounted on the cylinders.

 What is to be understood by a mobile mechanical connection in the present application is a mechanical connection of the bolt/nut type with a spacer or pin or
25 spring-loaded system.

 According to one feature of the invention, the at least one mechanical connection is configured to guide and fix the box on the primary structure at the level of the upper part of said box.

 According to one feature of the invention, the storage box comprises a
30 locking device comprising at least one locking member configured to pass through the structure of the box and, more preferably, the second end of the cylinder, when this is hollow.

 According to one feature of the invention, the storage box comprises a plurality of cylinders.

35 Thus, there are as many retaining members equipping the first plate as there are cylinders provided for or mounted in the storage box and/or there are as many passage orifices made in the first plate as there are cylinders provided for or mounted in

the storage box and/or there are as many retaining members equipping the second plate as there are cylinders provided for or mounted in the storage box.

According to one feature of the invention, each cylinder comprises a body, a first end and a second end opposite the first end. Advantageously, the first end is
5 intended to be equipped with a cock or a valve.

According to one feature of the invention, the second end of each cylinder is configured to index and immobilize the position of the cylinder, when said cylinder is in the mounted position in the storage box.

For preference, the second end of each cylinder has a non-circular non-
10 hemispherical polygonal cross section.

More preferably still, the second end has a cross section in the form of a multi-branch star, the branches being configured to index the cylinder and prevent the cylinder from rotating.

According to one feature of the invention, the length of the second end of
15 the cylinder is greater than the longitudinal expansion of said cylinder, making it possible to prevent the cylinder from coming out of the passage orifice in the second plate.

According to another feature of the invention, the primary structure comprises at least one intermediate element or spacer piece configured to provide the
20 interface between each cylinder and the primary structure. The intermediate element guarantees the absence of contact between the cylinder and the frame, for example metal-to-metal contact, which would cause premature wearing of the second end of the cylinder and notably damage to the, for example corrosion-resistant, coating applied to this region of the cylinder.

For preference, the at least one intermediate element is a ring or a gasket
25 made of rubber or of elastomer. Advantageously, the at least one intermediate element has a hardness of between 70 Shore A and 60 Shore D, preferably between 80 and 90 Shore A.

According to one feature of the invention, the at least one intermediate
30 element is removable with respect to the primary structure.

According to one feature of the invention, each at least one intermediate element is configured to accept and conform to the shape of the second end of each cylinder on an interior face.

According to one feature of the invention, each at least one intermediate
35 element is configured to accept and conform to the shape of a housing formed on the primary structure on an exterior face.

The invention will be better understood by virtue of the description which follows, which refers to some embodiments according to the present invention given by way of nonlimiting example and explained with reference to the attached schematic drawings in which:

- 5 - figure 1 is a schematic depiction of a first configuration of storage frame according to the invention,
- figure 2 is a schematic depiction of a second configuration of storage frame according to the invention
- figure 3 is a perspective view of a storage frame according to a first
10 embodiment of the invention,
- figure 4 is a perspective view from above of the storage frame depicted in figure 3,
- figure 5 is a view in part section on A-A of the storage frame depicted in figure 4,
- 15 - figure 6 is a detailed perspective view of the upper part of the storage frame according to a first embodiment of the invention,
- figure 7 is a detailed perspective view of the lower part of the storage frame according to a first embodiment of the invention,
- figure 8 is a perspective view of the lower part of the storage frame
20 according to a first embodiment of the invention,
- figures 9 to 14 are schematic views depicting the mounting of a box according to the invention in a frame according to a first embodiment of the invention,
- figures 15 to 18 are schematic views depicting the mounting of several
25 boxes according to the invention in a single frame whatever the embodiment of storage frame according to the invention,
- figures 19 to 23 are schematic views depicting the mounting of a box according to the invention in a frame according to a second embodiment of the invention,
- figure 24 is an alternative form of embodiment of the mounting depicted
30 in figures 19 to 23.

The storage frame 100 according to the invention comprises a primary structure 101 in which there is arranged at least one storage box 102 according to the invention, as illustrated in figures 1 to 3. The storage box 102 according to the invention 103 is intended to contain a plurality of cylinders 103 of pressurized fluid, and notably
35 pressurized gas, as illustrated in figure 3.

As can be seen in the figures, the storage box 102 with its cylinders 102 thus forms a physical entity distinct (separable) from the storage frame 100.

The cylinders 103 are arranged in the storage box 102 vertically or horizontally with respect to the ground. Furthermore, as illustrated in figure 1, the arrangement of the cylinders 103 in the storage box 102 may be according to a first configuration illustrated in figure 1 or according to a second configuration illustrated in figure 2. In figure 1, the cylinders 103 are aligned in two directions and arranged without contact with one another. In figure 2, the cylinders 103 are aligned in one direction and arranged in a staggered configuration in a second direction.

The mounting of the cylinders 103 in the storage box 102 is performed independently of the storage frame 100 as described hereinafter with reference to figures 9 to 14 according to a first embodiment or according to a second embodiment as depicted in figures 19 to 23.

The storage box 102 comprises at least one first plate 1 extending in a first direction substantially perpendicular to the direction of mounting of the cylinders 103, as illustrated in figures 3, 4 and 5.

As illustrated in figure 5, the first plate 1 comprises a plurality of passage orifices 3 each configured to accept the first end 103a of each cylinder 103. More particularly, the first end 103a of each cylinder 103 is equipped with a collar 103c that passes through the passage orifice 3 and comprises a shoulder that comes into abutment against the first plate 1. Furthermore, the passage orifices 3 made in the first plate 1 are arranged regular distances apart.

In the example illustrated particularly in figure 5, the first plate 1 is equipped with the first plurality of retaining members 4 which are configured to each collaborate with the collar 103c equipping the first end 103a of each cylinder 103. For preference, each retaining member 4 exhibits an internal screw thread configured to collaborate with an external screw thread formed on the collar 103c of each cylinder 103.

As illustrated in figures 3, 7 and 8 in particular, the storage box 102 comprises at least one second plate 2 extending in the first direction and positioned facing the first plate 1 from a predetermined distance.

In the example illustrated in figure 8, the second plate 2 exhibits a plurality of passage orifices 6 acting as retaining members 6 for the second end 103b of each cylinder 103. The passage orifices 6 made in the second plate 2 are arranged a regular distance apart.

Each passage orifice 6 of the second plate 2 are configured to collaborate, through having a complementary shape, with the second end 103b of each cylinder 103. In the example illustrated in figures 7 and 8, the second end 103b of each cylinder 103 is polygonal in shape, having a star-shaped cross section. The passage orifices 6 of the

second plate 2 forming the retaining members 6 are configured to hold the second end 103b of each cylinder 103 while at the same time exhibiting at least one determined degree of freedom.

5 As illustrated, this degree of freedom is notably longitudinal, which means to say that the second end 103b of the cylinder 103 may have a limited clearance in the second plate 2 in the longitudinal direction of the cylinder.

As illustrated in figures 5 to 7, the storage box 102 comprises an immobilizing device 7 configured to connect the first plate 1 to the second plate 2 while at the same time exhibiting at least one degree of freedom. The immobilizing device 7
10 comprises several screw/nut assemblies extending in a direction substantially perpendicular to the direction in which the first plate 1 and the second plate 2 extend. Each screw/nut assembly passes through the first plate 1 and the second plate 2.

Other equivalent immobilizing devices (studs, etc.) are conceivable.

According to the invention and as visible in figure 8, the primary structure
15 101 of the storage frame 100 comprises several wedging elements 101a. In the mounted position as illustrated in figure 8, the second end 103b of each cylinder 103 rests on a wedging element 101a of the primary structure 101.

As illustrated in figure 7, the storage box 102 is fixed to the primary structure 101 by means of fixed mechanical connections 9 at the level of the second
20 plate 2 and by means of mobile mechanical connections 8 at the level of the first plate 1 as visible in figures 3 to 7.

The mounting of a storage box 102 according to the invention in a storage frame 100 according to a first embodiment will now be described with reference to figures 9 to 14.

25 The cylinders 103 are first of all mounted between a first plate 1 and a second plate 2. More specifically, the first end 103a of each cylinder 103 passes through a passage orifice 3 made in the first plate 1 and the second end 103b of each cylinder 103 passes through a passage orifice 6 made in the second plate 2 as visible in figure 9.

As illustrated in figure 10, the first end 103a of each cylinder 103 is fixed
30 to the first plate 1 by means of retaining members 4. More particularly, each first end 103a of each cylinder 103 is equipped with a threaded collar 103c onto which a retaining member 4, for example a nut or a retaining ring, is screwed. Furthermore, the second end 103b of each cylinder 103 is retained through its collaboration, through having a complementary shape, with the passage orifice 6 made in the second plate 2.
35 Each passage orifice 6 in the second plate 2 therefore forms a retaining member. A system of the pulley block type and a jig may advantageously be used to make it easier to mount the cylinders 103 inside the storage box 102.

In order to immobilize the storage box 102, an immobilizing device 7 is arranged between the first plate 1 and the second plate 2. More particularly, a plurality of screw/nut assemblies is installed in the storage box 102 as can notably be seen in figure 10, and allows the first plate 1 to be connected to the second plate 2.

5 In figure 11, the storage box 102 is inserted into a primary structure 101 to form the storage frame 100. A lifting system of the pulley block or crane type may be used.

In figure 12, the storage box 102 is adjusted and secured inside the primary structure 101 of the storage frame 100 by means of mobile mechanical connections 8
10 perpendicular to the direction of the first plate, at the level of the first plate 1, and by means of fixed mechanical connections 9 at the level of the second plate 2.

The mechanical connections comprise for example screw and nut or screw and tapping or stud and nut and/or bolt systems or any other appropriate system that allows the storage box 102 to be secured inside the primary structure 101 of the frame.

15 For preference, the fixed mechanical connections 9 immobilize the second plate 2 on the primary structure in all three directions in space (fixed point with no degree of freedom). For example, several screws 9 pass through passages made in the second plate and fix this plate 2 to the primary structure 101. Note that this second plate 2 may comprise orifices (star-shaped or otherwise) that complement the exterior shape
20 of the second end of the cylinders 103b, to immobilize same in terms of rotation.

The mobile mechanical connections 8 immobilize the first plate 1 on the primary structure 101 in two directions (immobilization in the plane of the first plate 1) while at the same time allowing the first plate 1 a limited travel in a direction perpendicular to the plane of the first plate 1. What that means to say is that the first
25 plate 1 can move in a direction parallel to the longitudinal axis of the cylinders 103, notably to absorb longitudinal expansion thereof (the travel is limited vertically when the cylinders 103 are arranged oriented vertically in figures 9 and 10 for example). This limited movement has an amplitude for example of 5 to 30 mm and notably of 20 mm.

This also makes it possible likewise to absorb variations in dimensions
30 between the storage box 102 and the primary structure 101 of the frame (in order to adapt to suit the longitudinal dimensional tolerances and/or expansion tolerances).

In figure 13, the connecting-up is carried out and the gas distribution systems 10 are installed, then the primary structure 101 is closed.

35 Finally, as illustrated in figure 14, equipment 11 (plates, reinforcers, user façade, etc.) is fitted on the lateral faces of the storage frame 100 formed. In the case of a storage frame 100 for storing cylinders 103 horizontally, the storage frame 100 is turned over on the ground onto its lower part in order to stand it upright.

The mounting of a storage box 102 according to the invention in a storage frame 100 according to a second embodiment will now be described with reference to figures 19 to 23.

5 The second embodiment of the storage frame 100 according to the invention differs from the first embodiment in that the second plate 2 of the storage box 102 is omitted and replaced by a portion of the primary structure 101.

More specifically and as illustrated in figure 19, the primary structure 101 exhibits a plurality of housings 101b made in a portion of said primary structure 101. In a first mounting step, intermediate elements 101c or spacer pieces are positioned in said
10 housings 101b so as to provide the interface between the cylinders 103 and the primary structure 101.

As can be seen in figure 20, each at least one intermediate element 101c is configured to accept and conform to the shape of each housing 101b formed on the primary structure 101, on an exterior face.

15 The cylinders 103 are then placed in each intermediate element 101c as visible in figure 21. Each intermediate element 101c is configured to accept and conform to the shape of the second end 103b of each cylinder 103 on an interior face.

Next, the first plate 1 is positioned at the level of the first end 103a of each cylinder 103.

20 Finally, as illustrated in figure 23, connecting-up is performed, namely the connecting system and piping 10 with which the storage frame 100 is equipped are mounted, by cohabitation with the outlets of valves mounted at the outlet of the cylinders 103, and the gas distribution systems are installed, then the primary structure 101 is closed and equipment 11 (plates, reinforcers, user facades, etc.) is installed on the
25 lateral faces of the storage frame 100 formed. In the case of a storage frame 100 for storing cylinders 103 horizontally, the storage frame 100 is turned over on the ground onto its lower part in order to stand it upright.

In an alternative form of embodiment depicted in figure 24, the storage frame 100 comprises a locking device comprising at least one locking member 12
30 configured to pass through the primary structure 101 and also the second end 103b of the cylinder 103 when this is hollow.

When the storage frame 100 has capacity for several storage boxes 102, each storage box 102 is mounted independently as illustrated in figures 15 and 16. The storage boxes 102 are then grouped together and assembled in the primary structure 101
35 which accommodates them as illustrated in figures 17 and 18.

For a storage frame 100 that stores vertical cylinders, the storage frame 100 is positioned on the ground on its lower face. For a storage frame 100 for storing

horizontal cylinders, the storage frame 100 is positioned on the ground on one of its lateral faces.

5 In the example illustrated in figures 15 to 18, a storage box 102 contains from four to sixteen cylinders 103. A storage frame 100 designed according to the invention is constructed modularly with one to four storage boxes 102. For example, a storage frame 100 for storing sixteen cylinders 103 according to the invention can be designed on the basis of a storage box 102 for sixteen cylinders. A storage frame 102 for sixty four cylinders 103 is designed on the basis of four storage boxes 102 for sixteen cylinders 103.

10 Of course, the invention is not restricted to the embodiments described and depicted in the attached figures. Modifications remain possible, notably regarding the makeup of the various elements or through the substitution of technical equivalents, without thereby departing from the scope of protection of the invention.

CLAIMS

1. A storage frame (100) for cylinders of pressurized fluid, comprising a primary structure (101) and at least one storage box (102), the storage box (102) comprising least one cylinder (103) of pressurized fluid extending along a longitudinal axis between two ends, said storage box (102) being mounted in the primary structure (101) and comprising at least one first retaining member configured to collaborate fixedly with one end of the at least one cylinder (103) and blocking the rotation of the cylinder (103), and at least one second retaining member configured to collaborate with the other end of the cylinder (103), characterized in that the second retaining member is configured to maintain the position the relevant end of the cylinder while at the same time exhibiting at least one determined degree of freedom, and in that the storage box (102) forms, in the primary structure (101), a unit assembly of cylinder(s) fixed firmly at one end and floatingly at the other end, which means to say that there is no firm mechanical connection at one end of each cylinder so as to allow each cylinder (103) a longitudinal movement in its region of retention making it possible to absorb the expansion of the volume of the cylinder notably as it is being filled.

2. The frame as claimed in claim 1, characterized in that the storage box (102) comprising at least one first plate (1) extending in a first direction, the first plate (1) comprising at least one passage orifice (3) configured to accept, in the mounted position, at least part of that end of the cylinder (103) that is referred to as the “first end (103a)” which collaborates with the first retaining member (4), the other end which collaborates with the second retaining member (6) being referred to as the “second end (103b)”.

3. The frame as claimed in claim 2, in which the storage box (102) comprises several passage orifices (3) equipping the first plate (1) and configured to each accept the first end (103a) of each cylinder (103) mounted or intended to be mounted in the storage box (102), the passage orifices (3) being arranged on the first plate (1) a regular or irregular distance apart.

4. The frame as claimed in claim 2 or 3, in which the first plate (1) is equipped with the first retaining member (4) of the storage box (102), said first retaining member (4) being configured to collaborate with a collar (103c) equipping the first end (103a) of the cylinder (103).

5. The frame as claimed in claim 4, in which the at least one first retaining member (4) exhibits an internal screw thread configured to collaborate with an external screw thread formed on the collar (103c) of the first end (103a) of the cylinder (103).

6. The frame as claimed in any one of claims 2 to 5, comprising at least one second plate (2) extending in the first direction and positioned facing the first plate (1) from a determined distance.

7. The frame as claimed in claim 6, comprising a second retaining member (6) corresponding to a passage orifice (6) made in the second plate (2) and configured to at least partially accept the second end (103b) of the cylinder (103).

8. The frame as claimed in claim 6 or 7, comprising several retaining members corresponding to passage orifices made in the second plate and configured to each accept the second end of each cylinder mounted in the storage box, said retaining members being arranged a regular or irregular distance apart.

9. The frame as claimed in claim 8, in which each passage orifice of the plurality of the second plate is configured to collaborate, through having a complementary shape, with the second end (103b) of each cylinder (103).

10. The frame as claimed in any one of claims 6 to 9, comprising an immobilizing device (7) configured to connect the first plate (1) to the second plate (2) while at the same time exhibiting at least one degree of freedom.

11. The frame as claimed in claim 10, in which the immobilizing device (7) comprises at least one screw/nut assembly extending in a direction substantially perpendicular to the direction in which the first plate (1) and the second plate (2) extend.

12. The frame as claimed in claim 11, in which the screw/nut assembly passes through the first plate and the second plate.

13. The frame as claimed in any one of claims 6 to 12, in which the storage box (102) is fixed to the primary structure (101) by means of at least one fixed mechanical connection (9) at the level of the second plate (2) and by means of at least one mobile mechanical connection (8) at the level of the first plate (1).

14. The frame as claimed in claim 13, characterized in that the at least one fixed mechanical connection (9) immobilizes the storage box (102) on the primary structure (101) in all three directions in space.

15. The frame as claimed in claim 13 or 14, characterized in that the at least one mobile mechanical connection (8) immobilizes the storage box (102) on the primary structure (101) in the two directions of the plane of the first plate (1) while at the same time allowing limited axial travel in the third direction in space which is parallel to the longitudinal axis of the cylinders.

16. The frame as claimed in any one of claims 6 to 15, in which the primary structure (101) of the frame comprises at least one wedging element intended to accept the second end of at least one cylinder so that, in the mounted position, the second end of each cylinder rests on a wedging element of the primary structure.