

LIQUID STORAGE TANK

[TECHNICAL FIELD]

[0001]

This invention relates to a liquid storage tank and a liquid supplying apparatus which are suitable to be used when an aqueous solution of a reduction agent for purifying exhaust gas from, for example, a diesel engine is supplied, capable of supplying a large quantity of aqueous solution from, for example, a tank truck rapidly and safely, capable of manually supplying a small quantity of aqueous solution easily and which can be manufactured easily and economically with a simple structure.

[BACKGROUND ART]

[0002]

As means for reducing NOx contained in an exhaust gas from a diesel engine, there are known some technique in which an NOx reducing catalyst constituting an exhaust gas purifying device is installed on a diesel car, a prescribed reduction agent is added to the NOx reducing catalyst, and reduction reacting the reduction agent with NOx contained in the exhaust gas, so that exhaust concentration of NOx is reduced.

[0003]

Of them, there is one which employs a non-toxic urea. An NOx reducing catalyst as an exhaust gas purifying device and an automatic blending device for preparing a reduction agent solution are installed on a diesel car. The automatic blending device comprises a urea powder tank and a water tank, an agitation tank for reserving and agitating predetermined quantities of urea powder and water, and a reduction agent solution tank for supplying a predetermined quantity of the blended urea powder and water to the exhaust gas purifying device.

[0004]

A predetermined quantity of water is supplied to the agitation tank from the water tank and a predetermined quantity of urea powder is supplied to the agitation tank from the urea powder tank. After agitating and preparing in a predetermined concentration, this urea water is reserved in the reduction agent solution tank. The urea water is properly sent under pressure by pump so as to be jetted to the exhaust gas purifying apparatus. By doing so, NOx contained in the exhaust gas exhausted from a muffler can be reduced and purified (see, for example, Patent Document 1).

[0005]

However, the above automatic blending device has the following problems. Since the device includes an agitation tank, a water tank and a urea powder tank, the size is increased and the weight is also increased. Moreover, the diesel car becomes complicated in structure. In addition, an installation space for those tanks is required. Moreover, since the loaded urea powder absorbs moisture and is hardened, the amount of reduction agent to be added is difficult to control. At the time of a long distance driving, there is a worry of driving with no addition of reduction agent. In order to prevent this occurrence, it is required to prepare a supplementing urea powder and water, and troublesome supplementing operation for it is required.

[0006]

To solve the above problems, there is known a device in which a reduction agent solution tank is provided with a liquid surface sensor and a concentration sensor. The device also includes a controller capable of outputting an alarm operation signal when the liquid surface is lowered to a predetermined level or lower or when the concentration is reduced to a predetermined value or less. Owing to this arrangement, urea water is

properly prepared based on the alarm signal and supplemented (see, for example, Patent Document 2).

[0007]

However, this conventional device again has the following problems. Since it requires a liquid surface sensor, a concentration sensor, an alarming device, and a controller for controlling them, its structure becomes complicated and the manufacturing cost is increased. Moreover, it is practically impossible to prepare a required quantity of urea water rapidly. Thus, a required amount of urea powder and a required quantity of water must be loaded. This requires an installation space. Thus, the vehicle is increased both in size and weight. In addition, since the loaded urea powder absorbs moisture and is hardened, it is difficult to carry out a stable exhaust gas purifying operation.

[0008]

In view of the above, the present applicant has already developed and proposed an apparatus for preparing an aqueous solution of a reduction agent for purifying exhaust gas, which is suited to be used for purifying exhaust gas from a diesel engine, in which the diesel car can be free from the above-mentioned problems in structure and installation, a reduction agent aqueous solution such as a urea water can be prepared to a predetermined concentration economically and rapidly, the prepared solution can easily be supplied to a diesel car, and which can be made small in size and light in weight and used easily, and which can be manufactured economically.

[0009]

This apparatus comprises an aqueous solution preparing tank for dissolving a granular or powdery reduction agent for purifying exhaust gas in water, preparing a reduction aqueous solution having a predetermined concentration and storing the aqueous solution, and an agitator capable of agitating the reduction agent dissolved in water in the aqueous solution

preparing tank. The aqueous solution preparing tank is separately arranged from a vehicle as an object to which the aqueous solution is to be supplied.

The tank can be movable or installed in a predetermined place. The aqueous solution can be supplied to the outside through the agitator.

[0010]

Although this aqueous solution preparing apparatus has such advantages that the reduction aqueous solution can easily be prepared and it is small in size and light in weight and thus suitable to be used for a small quantity, the reduction aqueous solution must be prepared frequently when a large quantity is needed. Thus, a device is demanded which can meet with both small and large quantities of reduction aqueous solution.

[0011]

[Patent Document 1] Japanese Patent Application Laid-Open No. 2002-370016

[Patent Document 2] Japanese Patent Application Laid-Open No. 2002-371831

[DISCLOSURE OF THE INVENTION]

[PROBLEM TO BE SOLVED]

[0012]

It is, therefore, an object of the present invention to provide, in order to solve the above-mentioned problems, a liquid storage tank and a liquid supplying apparatus which are suitable to be used when an aqueous solution of a reduction agent for purifying exhaust gas from, for example, a diesel engine is supplied, capable of supplying a large quantity of aqueous solution from, for example, a tank truck rapidly and safely, capable of manually supplying a small quantity of aqueous solution easily and which can be manufactured easily and economically with a simple structure.

[SOLVING MEANS]

[0013]

According to the present invention, there is provided a liquid storage tank having a tank cap removably mounted thereon for opening/closing a liquid supplying port formed at an outer peripheral surface thereof, the liquid storage tank comprising a pipe joint one end of which is attached to the tank cap and the other end of which is allowed to project to the outside of the tank cap, and an air releasing pipe attached to the pipe joint, one end of the air releasing pipe being arranged at the inner side of the tank cap and the other end being arranged at the outer side of the tank cap. Owing to this arrangement, a large quantity of supplying solution can be supplied from the other end side of the pipe joint through, for example, a tank truck. Air remained in the liquid storage tank can be released through the air releasing pipe and the supplying liquid can be supplied to the liquid storage tank smoothly. At the time of supplying the liquid stored in the liquid storage tank, an accident caused by contraction of the liquid storage tank and air compression can be prevented from occurring when a pump is actuated.

[0014]

In a liquid storage tank according to the present invention, the air releasing pipe includes a generally U-shaped air collecting part, and a generally inverted U-shaped exhaust part the other end of which is allowed to project to the outside. Owing to this arrangement, air contained in the liquid storage tank can be collected easily and discharged outside smoothly with a simple structure.

Moreover, in a liquid storage tank according to the present invention, one end of the air collecting part is arranged upward of an upper wall of the liquid storage tank at an inner side of the tank cap. Owing to this arrangement, the air releasing pipe can be attached/detached when the tank cap is attached/detached. The supplying liquid can be prevented from entering through one end of the air collecting part and stable operation and effect of the air releasing pipe can be obtained.

[0015]

In a liquid storage tank according to the present invention, the tank cap, the pipe joint and the air releasing pipe are integrally connected with one another. Owing to this arrangement, the pipe joint and the air releasing pipe can be attached/detached together when the tank cap is attached/detached. Thus, the attaching/detaching operation can be performed easily and rapidly.

In a liquid storage tank according to the present invention, the tank cap is mounted on the liquid storage tank so that a large quantity of liquid can be supplied from the other end part of the pipe joint, while the tank cap, the pipe joint and the air releasing pipe are removed to open the liquid supplying port, so that a small quantity of liquid can be supplied from the liquid supply port. Owing to this arrangement, the supplying parts can be properly used depending on a large quantity or small quantity of supplying water.

[0016]

Moreover, in a liquid storage tank according to the present invention, the liquid storage tank can store an aqueous solution of a reduction agent for purifying an exhaust gas from a diesel engine. Owing to this arrangement, a large quantity of aqueous solution can be supplied rapidly and safely.

In addition in a liquid storage tank according to the present invention, the aqueous solution is a urea water. Owing to this arrangement, supply of urea water, which is often used as an aqueous water of a reduction agent for purifying exhaust gas from a diesel engine, and its handling are suitable.

[0017]

From another aspect of the invention, there is provided a liquid supplying apparatus capable of moving and arranging a supplying liquid upward of a liquid supplying port formed at an outer peripheral surface of a liquid storage tank, the liquid supplying apparatus comprising a base frame

provided with a traveling wheel, a support frame attached to the base frame and a mounting shelf turnably attached to the supporting frame capable of storing a container which stores the supplying liquid. Owing to this arrangement, the container storing the supplying liquid can be conveyed to a predetermined position easily. Moreover, by turning the mounting shelf and tilting the container, the supplying liquid stored in the container can manually easily be supplied to the liquid storage tank.

Also, in a liquid supplying apparatus according to the present invention, a liquid supplying hose is removably attached to the container, a distal end part of the liquid supplying hose is insertable into the liquid supplying port and a hose receptacle into which the liquid supplying hole can be inserted is disposed at the mounting shelf. Owing to this arrangement, the supplying liquid stored in the container can be supplied to the liquid storage tank reliably and easily. The liquid supplying hose can be inserted in the hose receptacle so that the liquid supplying hose is stabilized. Moreover, since the hose receptacle is bottomed, the liquid can be prevented from leaking from the hose after the supply of liquid is over.

[0018]

Also, in a liquid supplying apparatus according to the present invention, the traveling wheel is attached to one end of the base frame, and the other end of the base frame can be landed on the ground so that the liquid supplying apparatus can move or stand still. Owing to this arrangement, a movement and a stop of the liquid supplying apparatus can be realized with a simple structure.

In a liquid supplying apparatus according to the present invention, the supporting frame is expansible and contractible so that the height of the mounting shelf can be adjusted. Owing to this arrangement, supply of liquid to liquid storage tanks having various sizes can be met.

Moreover, in a liquid supplying apparatus according to the present invention, a belt, which can be laid across a peripheral surface of the container, is attached to the mounting shelf. Owing to this arrangement, the container can be prevented from slipping down and the container can be conveyed safely.

Therefore, if the belt is formed into a Y-shaped configuration, the slip preventing function of the container is enhanced and the slip prevention of the container is improved.

[0019]

Moreover, in a liquid supplying apparatus according to the present invention, the supplying liquid in the container can be supplied to a storage tank located on a supplied side through the liquid supplying hose. Owing to this arrangement, the supplying liquid can be supplied easily and rapidly without transferring the liquid from the container to the liquid storage tank.

In a liquid supplying apparatus according to the present invention, the supplying liquid is an aqueous solution of a reduction agent for purifying an exhaust gas from a diesel engine. Owing to this arrangement, easy supply of a small quantity of aqueous water is realized and this can be prepared easily and economically.

Moreover, in a liquid supplying apparatus according to the present invention, the aqueous solution is a urea water. Owing to this arrangement, supply of urea water, which is often used as an aqueous water of a reduction agent for purifying exhaust gas from a diesel engine, and its handling are suitable.

[EFFECT OF THE INVENTION]

[0020]

The liquid storage tank according to the present invention comprises a pipe joint one end of which is attached to the tank cap and the other end of which is allowed to project to the outside of the tank cap, and an air releasing

pipe attached to the pipe joint, one end of the air releasing pipe being arranged at the inner side of the tank cap and the other end being arranged at the outer side of the tank cap. Accordingly, there can be obtained the following effects. A large quantity of supplying solution can be supplied from the other end side of the pipe joint through, for example, a tank truck. Air remained in the liquid storage tank can be released through the air releasing pipe and the supplying liquid can be supplied to the liquid storage tank smoothly. At the time of supplying the liquid stored in the liquid storage tank, an accident caused by contraction of the liquid storage tank and air compression can be prevented from occurring when a pump is actuated.

[0021]

In a liquid storage tank according to the present invention, the air releasing pipe includes a generally U-shaped air collecting part, and a generally inverted U-shaped exhaust part the other end of which is allowed to project to the outside. Accordingly, there can be obtained the following effects. Air contained in the liquid storage tank can be collected easily and discharged outside smoothly with a simple structure.

Moreover, in a liquid storage tank according to the present invention, one end of the air collecting part is arranged upward of an upper wall of the liquid storage tank at an inner side of the tank cap. Accordingly, there can be obtained the following effects. The air releasing pipe can be attached/detached when the tank cap is attached/detached. The supplying liquid can be prevented from entering through one end of the air collecting part and stable operation and effect of the air releasing pipe can be obtained.

[0022]

In a liquid storage tank according to the present invention, the tank cap, the pipe joint and the air releasing pipe are integrally connected with one another. Accordingly, the pipe joint and the air releasing pipe can be

attached/detached together when the tank cap is attached/detached. Thus, the attaching/detaching operation can be performed easily and rapidly.

In a liquid storage tank according to the present invention, the tank cap is mounted on the liquid storage tank so that a large quantity of liquid can be supplied from the other end part of the pipe joint, while the tank cap, the pipe joint and the air releasing pipe are removed to open the liquid supplying port, so that a small quantity of liquid can be supplied from the liquid supply port. Accordingly, there can be obtained such an effect that the supplying parts can be properly used depending on a large quantity or small quantity of supplying water.

[0023]

Moreover, in a liquid storage tank according to the present invention, the liquid storage tank can store an aqueous solution of a reduction agent for purifying an exhaust gas from a diesel engine. Accordingly, a large quantity of aqueous solution can be supplied rapidly and safely.

In a liquid storage tank according to the present invention, the aqueous solution is a urea water. Accordingly, there can be obtained such an effect that supply of urea water, which is often used as an aqueous water of a reduction agent for purifying exhaust gas from a diesel engine, and its handling are suitable.

[0024]

A liquid supplying apparatus according to the present invention comprises a base frame provided with a traveling wheel, a support frame attached to the base frame and a mounting shelf turnably attached to the supporting frame capable of storing a container which stores the supplying liquid. Accordingly, the container storing the supplying liquid can be conveyed to a predetermined position easily. Moreover, by turning the mounting shelf and tilting the container, the supplying liquid stored in the container can manually easily be supplied to the liquid storage tank.

Also, in a liquid supplying apparatus according to the present invention, a liquid supplying hose is removably attached to the container, a distal end part of the liquid supplying hose is insertable into the liquid supplying port and a hose receptacle into which the liquid supplying hose can be inserted is disposed at the mounting shelf. Accordingly, the supplying liquid stored in the container can be supplied to the liquid storage tank reliably and easily. The liquid supplying hose can be inserted in the hose receptacle so that the liquid supplying hose is stabilized. Moreover, since the hose receptacle is bottomed, the liquid can be prevented from leaking from the hose after the supply of liquid is over.

[0025]

Also, in a liquid supplying apparatus according to the present invention, the traveling wheel is attached to one end of the base frame, and the other end of the base frame can be landed on the ground so that the liquid supplying apparatus can move or stand still. Accordingly, a movement and a stop of the liquid supplying apparatus can be realized with a simple structure.

In a liquid supplying apparatus according to the present invention, the supporting frame is expansible and contractible so that the height of the mounting shelf can be adjusted. Accordingly, there can be obtained such an effect that supply of liquid to liquid storage tanks having various sizes can be met.

[0026]

Moreover, in a liquid supplying apparatus according to the present invention, a belt, which can be laid across a peripheral surface of the container, is attached to the mounting shelf. Accordingly, the container can be prevented from slipping down and the container can be conveyed safely. Therefore, if the belt is formed into a Y-shaped configuration, the slip

preventing function of the container is enhanced and the slip prevention of the container is improved.

Moreover, in a liquid supplying apparatus according to the present invention, the supplying liquid in the container can be supplied to a storage tank located on a supplied side through the liquid supplying hose. Accordingly, the supplying liquid can be supplied easily and rapidly without transferring the liquid from the container to the liquid storage tank.

[0027]

In a liquid supplying apparatus according to the present invention, the supplying liquid is an aqueous solution of a reduction agent for purifying an exhaust gas from a diesel engine. Accordingly, easy supply of a small quantity of aqueous water is realized and this can be prepared easily and economically.

Moreover, in a liquid supplying apparatus according to the present invention, the aqueous solution is a urea water. Accordingly, there can be obtained such an effect that supply of urea water, which is often used as an aqueous water of a reduction agent for purifying exhaust gas from a diesel engine, and its handling are suitable.

[BRIEF DESCRIPTION OF DRAWINGS]

[0028]

[FIG. 1] is a front view showing one embodiment in which the present invention is applied to a liquid storage tank which stores a urea water as an aqueous water of a reduction agent for purifying an exhaust gas from a diesel engine.

[FIG. 2] is a plan view of FIG. 1.

[FIG. 3] is a left side view of FIG. 1.

[FIG. 4] is a front view showing, on an enlarged scale, an essential part of an installation situation of a liquid supplying pump which is applied to the liquid storage tank of FIG. 1.

[FIG. 5] is a left side view of FIG. 4.

[0029]

[FIG. 6] is a sectional view showing, on an enlarged scale, mounting situations of a tank cap, an air releasing pipe, a lever coupling and a dust preventing coupling which are applied to the liquid storage tank of FIG. 1.

[FIG. 7] is a sectional view showing, on an enlarged scale, a liquid surface displaying mechanism which is applied to the liquid storage tank of FIG. 1, and showing installation situations of a float and a float gauge, and a float stopper and a gauge pipe, and a fully storing situation of urea water.

[FIG. 8] is a sectional view showing, on an enlarged scale, the liquid surface displaying mechanism which is applied to the liquid storage tank of FIG. 1, and showing installation situations of the float and the float gauge, and the float stopper and the gauge pipe, and a predetermined quantity consuming situation of urea water.

[0030]

[FIG. 9] is a front view showing a second embodiment of the present invention, showing one example in which a container storing a predetermined quantity of urea water as an aqueous solution of a reduction agent for purifying exhaust gas from a diesel engine is supplied to the liquid storage tank, and showing a situation in which the container is loaded on a mounting shelf.

[FIG. 10] is a right side view of FIG. 9.

[FIG. 11] is a side view showing an essential part of a situation in which the mounting shelf is turned to tilt the container so that the urea water in the container is supplied to the liquid storage tank.

[FIG. 12] is a front view showing a third embodiment of the present invention, showing one example in which a container storing a predetermined quantity of urea water as an aqueous solution of a reduction agent for purifying exhaust gas from a diesel engine is supplied to the liquid

storage tank, and showing a situation in which the container is loaded on a mounting shelf.

[FIG. 13] is a plan view of FIG. 12.

[FIG. 14] is a perspective view showing an essential part of a situation in which in the embodiment of FIG. 12, a Y-shaped belt is laid across and held on a peripheral surface of the container stored on the mounting shelf.

[DESCRIPTION OF REFERENCE NUMERAL]

[0032]

- 1.....liquid storage tank
- 7.....liquid supplying port
- 9.....tank cap
- 11.....pipe joint
- 25.....air releasing pipe
- 26.....air collecting part
- 27.....exhaust part
- 28....supplying liquid (urea water)

[0033]

- 46.....container
- 47.....liquid supplying hose
- 48.....liquid supplying apparatus (truck)
- 49.....base frame
- 51.....supporting frame
- 52.....mounting shelf
- 54.....traveling wheel
- 55.....ground surface
- 59.....hose receptacle
- 61.....belt

[BEST MODE FOR CARRYING OUT THE INVENTION]

[0034]

Embodiments of the present invention will now be described with reference to the accompanying drawings, in which the present invention is applied to a liquid storage tank for storing a urea water as an aqueous solution of a reduction agent for purifying exhaust gas from a diesel engine, and an apparatus for supplying such aqueous solution. In FIGS. 1 through 8, reference numeral 1 denotes a transparent or translucent liquid storage tank which is made of synthetic resin. The liquid storage tank 1 is formed in a generally rectangular parallelepiped configuration which can store about 1,000 liters of urea water. A plurality of recesses or recessed ribs for reinforcement are formed on a peripheral surface of the liquid storage tank 1.

[0035]

The liquid storage tank 1 is placed on a conveyance base frame 3 for conveying, for example, a forklift and normally set in a suitable place such as an oil supplying station, a truck station, a factory or the like.

In the illustration, reference numeral 4 denotes a protection net attached to a periphery of the liquid storage tank 1. The protection net 4 is formed by assembling protection frames vertically and horizontally. Lower end parts of the protection frame are fixed to the conveyance base frame 3. Reference numeral 6 denotes a pair of fork insertion holes open to a peripheral surface of the base frame 3.

[0036]

The liquid storage tank 1 is provided at an upper center thereof with a liquid supplying port 7. A tank cap 9 is screwed into a screw part 8 formed on an opening edge of the liquid supplying port 7. A screw hole 10 is formed in the center of the tank cap 9. A basal end part of an elbow-like pipe joint 11 is screwed into the screw hole 10. One end of the pipe joint 11 is allowed to project inside the tank cap 9.

[0037]

In the illustration, reference numeral 12 denotes a stopper ring mounted on a peripheral surface of the basal end part of the pipe joint 11. The ring 12 is arranged in such a manner as to be engageable with an inner projecting edge 13 of the screw hole 10, so that the pipe joint 11 is prevented from escaping and stably supported. Reference numeral 14 denotes an annular guide groove formed on a peripheral surface of an intermediate part of the pipe joint 11. The groove 14 is arranged in such a manner as to be engageable with an outer projecting edge 15 of the screw hole 10 so that the pipe joint 11 can be supported stably.

[0038]

A screw part 16 is formed on a peripheral surface of the other end part of the pipe joint 11 and a screw hole 18 of a lever coupling 17 is crewed to the screw part 16 for connection. The lever coupling 17 has a connecting pipe 19 projecting therefrom. One end of a liquid supplying pipe 20 such as a tank truck capable of supplying a large quantity of urea water can be connected to the connecting pipe 19.

[0039]

In the illustration, reference numeral 21 denotes a dust-proof coupling which can be fitted to the connecting pipe 19. When one end part of the pipe is closed and the pipe joint 11 is not used, in other words, when the urea water is not supplied, the coupling 21 is connected to the connecting pipe 19 so that foreign matter is prevented from entering into the pipe joint 11.

Reference numeral 22 denotes a towing lever turnably connected to a peripheral surface of the dust-proof coupling 21. The lever 22 is provided at a tip end part 23 thereof with a grip part 23. Reference numeral 24 denotes a chain for connecting the lever coupling 17 and the dust-proof coupling 21 with each other.

[0040]

The pipe joint 11 is provided at a basal end part side with an air releasing pipe 25. The pipe 25 comprises a generally U-shaped air collecting part 26 and a generally inverted U-shaped exhaust part 27 connected to one end part of the collecting part 26. More than a half part of the air collecting part 26 is submerged in a urea water 28 as a supplying solution which is stored in the liquid storage tank 1, and the other end is allowed to project from the liquid surface of the urea water 28 in the liquid storage port 7.

[0041]

One end of the exhaust part 27 is allowed to project outside the pipe joint 11 and the end part is open to the atmospheric air. A netted cap 29 is attached to the end part so that foreign matter is prevented from entering therein.

In the illustration, reference numeral 30 denotes a check valve located at a suitable place of the exhaust part 27. The check valve 30 is adapted to prevent a backflow of air from outside.

[0042]

A liquid supplying pump 31 is installed in a position above the liquid storage tank 1 and away from the pipe joint 11. A pumping-up pipe 32 for the liquid supplying pump 31 is submerged in the urea water 28. One end of a supplying liquid conduit 33 is connected to the outside of the liquid storage tank 1 and the other end is attached with a supplying liquid gun nozzle 34.

[0043]

A fitting 35 is fitted to a position above the liquid storage tank 1 and away from the pipe joint 11, and a plurality of nuts 37 are screwed to its screw shaft 36. An upper end part of a float stopper 38 having a generally U-shaped cross section and made of synthetic resin is held between the nuts 37, 37. A hollow cylindrical float 39 made of synthetic resin is engageably arranged at a lower end part of the float stopper 38.

[0044]

A lower end part of the float stopper 38, in this embodiment, is placed in a position generally $\frac{3}{4}$ the height of the liquid storage tank 1, so that the liquid surface indication can be started by a float gauge as later described when a quantity of the urea water 28 equal to approximately $\frac{3}{4}$ the capacity of the liquid storage tank 1 is supplied.

[0045]

A rod-like float gauge 40 made of synthetic resin projects from the float 39. The gauge 40 is passed through the fitting 35 and slidably fitted to a gauge pipe 41 made of transparent synthetic resin.

Gradations (not shown) are formed on the gauge pipe 41 and a cap 42 is attached to an upper end part of the gauge pipe 41. In a situation of FIG. 8 where the upper end part of the float gauge 40 moves to an upper part of the gauge pipe 41, the gradations show a fully filled state wherein about 1,000 liters of the urea water 28 is stored.

Reference numeral 43 in the illustration denotes a drain pipe disposed at a lower part of the liquid storage tank 1. The drain pipe 43 can be opened/closed through a drain cock 44. Reference numeral 45 denotes a power supplying cord of the supplying liquid pump 31.

[0046]

The liquid storage tank 1 thus constructed is placed on the rectangular parallelepiped base frame 3 having a large capacity. The periphery of the liquid storage tank 1 is protected with the protection net 4 so that the tank 1 can be protected from being broken by external force. The storage tank 1 can properly be conveyed by, for example, a forklift. The storage tank 1 is normally installed in a suitable place such as an oil supplying station, a truck station, a factory or the like.

[0047]

The tank cap 9 is put on the center of the upper part of the liquid storage tank 1 and the cap 9 is attached with the pipe joint 11. The pipe joint

11 is connected with the lever coupling 17 and the lever coupling 17 is connected with the dust-proof coupling 21. By the closed end part of the coupling 21, external entry of foreign matter is prevented.

[0048]

On the other hand, the pipe joint 11 is provided at its basal end side with the air releasing pipe 25, and the air collecting part 26 is disposed within the liquid storage tank 1. A part of the exhaust part 27 is allowed to project outside, and the projected one end part of the exhaust part 27 is open to the atmospheric air. The end part is attached with the netted cap 29, thereby preventing entry of foreign matter..

[0049]

The supplying liquid pump 31 is installed in a position away from the tank cap 9 placed on an upper part of the liquid storage tank 1, and the supplying gun nozzle 34 is attached to the pump 31 through the supplying liquid conduit 33.

The gauge pipe 41 projects from a position away from the tank cap 9 placed on an upper part of the liquid storage tank 1, and the float gauge 40 is slidably inserted in the pipe 41. The lower end of the gauge 40 is connected with the float 39. Before the urea water 28 is supplied or when the urea water level is equal to a predetermined liquid surface level or less, the float 39 is engaged with and held still at the lower end of the float stopper 38.

[0050]

Next, in case a large quantity of urea water 28 is supplied to the liquid storage tank 1 from a tank truck (not shown) or the like, the tank truck is stopped in the vicinity of the liquid storage tank 1, and the dust-proof coupling 21 is detached to expose the connecting pipe 19 of the lever coupling 17.

Then, one end of the supplying liquid pipe 20 of the tank truck is connected to the connecting pipe 19 and the pipe end part of the supplying

liquid pipe 20 is connected through a coupling (not shown) on the tank truck side. Then, a pressure feed pump of the tank truck is actuated to deliver the already prepared urea water 28 to the supplying liquid pipe 20.

As already described, since the present invention uses the already prepared urea water 28, it is no more required to take such a trouble as to prepare a urea water in the tank and the urea water 28 having a uniform quality can be supplied to a diesel car rapidly.

[0051]

The urea water 28 is introduced through the supplying liquid pipe 20 and moved from the lever coupling 17 to the pipe joint 11. The urea water 28 is then flowed down within the liquid storage tank 1. At that time, the liquid surface level within the liquid storage tank 1 can easily visually be recognized from outside because the liquid storage tank 1 is made of a transparent or translucent member.

When a predetermined quantity of urea water 28 in the liquid storage tank 1 is supplied, the liquid surface is lowered and reaches the lower end part of the float stopper 38 as shown in FIG. 7 and the float 39 is floated up in accordance with the change of the liquid surface to allow the float gauge 40 to move upward within the gauge pipe 41.

[0052]

When the upper end part of the float gauge 40 is moved to the upper end part of the gauge pipe 41 as shown in FIG. 8, a generally fully filled state of the urea water 28 is visually recognized and actuation of the pressure feed pump is stopped to stop supply of the urea water 28.

[0053]

At that time, air within the liquid storage tank 1 is pushed upward by the liquid surface rising of the urea water 28 within the liquid storage tank 1. The air is then pushed in one direction of the air collecting part 26 which is open to the upper part within the tank 1. The air is then moved in the other

direction, introduced to the exhaust part 27 and then pushed out into the atmospheric air through one side of the exhaust part 27 which projects outside.

Accordingly, the remaining air within the liquid storage tank 1 is removed and the urea water 28 is smoothly supplied into the liquid storage tank 1. Thereafter, when the supplying liquid pump 31 is actuated to supply the urea water 28 to a vehicle, an air compression accident of the supplying liquid pump 31 can be prevented from occurring.

[0054]

When the urea water 28 is fully supplied into the liquid storage tank 1, the coupling on the tank truck side is removed. After the supplying liquid pipe 20 is removed, the dust-proof coupling 21 is connected to the lever coupling 17.

[0055]

Next, in case the urea water 28 supplied to the liquid storage tank 1 is supplied to a diesel truck, the supplying liquid pump 31 is actuated to pump up the urea water 28 through the pumping-up pipe 32 and introduced to the supplying liquid gun nozzle 34 from the supplying liquid conduit 33. Before or after this, the supplying liquid gun nozzle 34 is inserted in a filling port of a urea water storage tank (not shown) loaded on a diesel car on the supplied side and its nozzle trigger is operated to open a valve to supply the urea water 28 into the urea water storage tank.

In that case, since the inside of the liquid storage tank 1 is communicated with the atmospheric air through the exhaust part 27, the urea water 28 is smoothly introduced to the supplying liquid gun nozzle 34 and moved into the urea water storage tank (not shown).

[0056]

When the urea water 28 is supplied to the diesel car, the liquid surface of the urea water 28 within the liquid storage tank 1 is lowered. In

accordance with the liquid surface lowering, the float 39 is lowered to lower the float gauge 40. The upper end part of the float gauge 40 is moved downward within the gauge pipe 41.

Accordingly, a worker can know the current supplying capacity to the diesel car by visually recognizing the current lowered position from the initial upper end part position of the float gauge 40 at the start of supply of the urea water 28.

In that case, if a supplying liquid gun nozzle equipped with a flow meter is used instead of the supplying liquid gun nozzle 34, the supplying capacity to the diesel car can be known correctly.

[0057]

FIGS. 9 through 11 show a second embodiment of the present invention. This embodiment is applicable to a case wherein a comparatively small quantity of urea water 28 is manually supplied to a liquid storage tank 1 instead of supplying the urea water 28 to the liquid storage tank 1 by a tank truck.

[0058]

To this end, a commercially available box type container (packing box) 46 of a required quantity is purchased. The container 46 has an attachment hole (not shown) such as a screw hole or through-hole at its one end. A supplying hose 47 having a required length, which is attached to the container 46, is attachable to the attachment hole and a required quantity of urea water 28 is stored in the container 46.

In this embodiment, the container 46 has an inner and outer double structure. The outer part is made of corrugated board and the inner part is made of synthetic resin so that it can be reused. About 20 to 30 liters of urea water 28 can be stored within the container 46. The container 46 can be conveyed by a carrier 48 as a liquid supplying apparatus.

[0059]

The carrier 48 comprises a pair of left and right base frames 49 having a generally inverted U-shaped configuration, and supporting posts 50 erected from the base frames 49, a supporting frame 51 having a generally inverted U-shaped configuration and slidably fitted to the supporting posts 50, and a mounting shelf 52 turnably attached between the supporting frames 51, 51.

The base frames 49 are connected through a reinforcement frame 53. One end of the base frame 49 is rotatably attached with a traveling wheel 54 and the other end can be landed on a ground surface 55. By those two ends, the base frame 49 can be held in its standing position and in its stand still position.

[0060]

The supporting posts 50 are connected through a reinforcement frame 56. Lower end parts of the supporting frames 50 are slidably fitted to upper end parts of the supporting posts 50. Owing to this arrangement, the supporting frames 51 can be expanded/contracted and adjusted in height. Any desired expanded/contracted position or height of the supporting frames 51 can be fixed by a lock knob 57.

The mounting shelf 52 is turnably supported by the supporting frames 51 through the supporting posts 58. The mounting shelf 52 has a generally-shaped cross section and is provided at one end thereof with a sheath-like hose receptacle 59 into which the supplying hose 47 can be inserted.

[0061]

In the illustration, reference numeral 60 denotes a generally U-shaped grip disposed at the other end part of the mounting shelf 52 and reference numeral 61 denotes a belt one end of which is attached to front and rear end parts of the mounting shelf 52. The belt 61 is disposed across the peripheral surface of the container 46 so that it can be retained by a fastener 64.

Reference numeral 62 denotes a lock handle disposed coaxially with the supporting post 58 and reference 63 denotes a stopper projecting from an

outer surface of the mounting shelf 52. The stopper 63 is engageable with the supporting frame 51. When the stopper 63 is in engagement with the supporting frame 51, the mounting shelf 52 can be supported in its horizontal posture.

[0062]

In the above embodiment, the carrier 48 is placed in a vicinity of a storing place of the liquid storage tank 1 or urea water contained container 46, and the carrier 48 is moved to a storing place of the container 46.

At the time of this movement, a distal end part of the supporting frame 51 is grasped and turned downward about the wheel 54, the other end of the base frame 49 is brought away from the ground surface 55 and the supporting frame 51 is pushed so that the wheel 54 travels on the ground surface 55. When the carrier 48 is moved to the storing place, the other end of the base frame 49 is landed on the ground surface 55 and the supporting frame 51 is brought into a vertical posture and stood still.

[0063]

Then, the lock knob 57 is operated to adjust the length or height of the supporting frame 51 so that the height of the mounting shelf 52 is adjusted to be equal to or more than the height of the tank cap 9 of the liquid storage tank 1. The adjusted position is then fixed by the lock knob 57. Thereafter, the container 46 containing the urea water is loaded on the mounting shelf 52, the belt 62 is laid across the outer surface of the container 46 and the belt 61 is tightened by the fastener 64 to retain the container 46.

[0064]

When the loading of the container 46 onto the mounting shelf 52 is finished, the carrier 48 is moved to the periphery of the liquid storage tank 1 and the supporting frame 51 is held vertically and stood still.

Then, the liquid supplying hose 47 attached to the container 46 is taken out and the basal part of the hose 47 is connected to the attachment

hole (not shown) of the container 46. This situation is as shown in FIGS. 9 and 10.

[0065]

On the other hand, after arrival of the carrier 48, the tank cap 9 of the liquid storage tank 1 is detached, the cap 9 and the air releasing pipe 25, and the lever coupling 19 and the dust-proof coupling 21 are detached altogether to open the upper part of the liquid supplying port 7.

Then, the liquid supplying hose 47 is retained. After the distal end part of the hose 47 is inserted into the liquid supplying port 7, the lock handle 62 is operated to turn the mounting shelf 52 downward about the supporting shaft 58 while holding the grip 60 so that the container 46 is tilted. This situation is as shown in FIG. 11.

[0066]

By doing so, the urea water 28 contained in the container 46 is flown into the liquid storage tank 1 through the liquid supplying hose 47. At that time, since the mounting shelf 52 is turnably placed, the turning angle of the container 46 is gradually increased while holding the grip 60. By gradually increasing the tilting angle of the container 46, the total quantity of the urea water contained in the container 46 can be supplied to the liquid storage tank 1.

[0067]

After the urea water 28 contained in the container 46 is supplied to the liquid storage tank 1, the supporting frame 51 is tilted and the carrier 58 is moved from the liquid storage tank 1 in the manner mentioned above. Then, the fastener 64 is unfastened to remove the belt 61. The empty container 46 is taken out of the mounting shelf 52 and stored in a suitable place so as to be ready for refilling the urea water 28 and reuse of the container 46.

Thereafter, in case the urea water 28 contained in the liquid storage tank 1 is supplied to the diesel car on the supplied side, the same procedure as mentioned above is executed.

[0068]

In case the total quantity of urea water 28 is not used and the urea water 28 is remained within the container 46, the distal end part of the liquid supplying hose 47 is inserted in the hose receptacle 59 and the carrier 58 is moved to a suitable place to stand still in a vertical posture. The mounting shelf 52 is supported in its horizontal posture and the container 46 is placed on the shelf 52.

By doing so, the urea water 38 remained in the container 46 can be supplied to the liquid storage tank 1 at proper time and rapidly.

[0069]

In the above embodiment, the tank cap 9 is removed and the liquid supplying hose 47 is inserted in the liquid supplying port 7 to supply the urea water 38. It is also accepted that the tank cap 9 is not removed and the liquid supplying hose 47 is inserted to the distal end part of the lever coupling 19 to supply the urea water 28.

[0070]

FIGS. 12 through 14 show a third embodiment of the present invention. In this embodiment, the hose receptacle 59 in the second embodiment has a bottom, and the bottomed hose receptacle 59 is arranged on a single side of a front end or rear end part of the mounting shelf 52. Owing to this arrangement, the liquid supplying hose 47 can be inserted in the hose receptacle 59 in a compact manner and neatly, and leak of the urea water can be prevented from occurring after supply of the urea water is finished.

[0071]

The belt 61 is formed in a generally Y-shaped configuration and laid across the peripheral surface of the container 46. Since the contact area of

the belt 61 with the container 46 is increased, the force for retaining the container 46 is more increased compared with a case where the belt 61 is linearly laid across the peripheral surface of the container 46 as in the second embodiment. In this way, the slip-down prevention of the container 46 is more enhanced.

[0072]

In this embodiment, by using the container 46 containing a required quantity of urea water 28 and the carrier 48 for conveying the container 46, a required quantity of urea water 28 can be supplied to the liquid storage tank 1 easily and conveniently with an easy and economical equipment and without the need of preparing the urea water 28.

Accordingly, the apparatus of this embodiment is suitable when used as an emergency measure in case rapid supply of urea water is difficult by, for example, a tank truck, or in case the liquid storage tank 1 having a comparatively small capacity is installed for home use and the urea water 28 is applied to the tank 1 easily and conveniently.

[0073]

In the second and third embodiments, the supplying fluid contained in the container 46 is once transferred to the liquid storage tank 1 and then supplied from the tank 1 to the storage tank on the supplied side. However, in case a small quantity of supplying fluid is supplied, it is also accepted that the liquid supplying hose 47 is inserted in the supplying port of the storage tank on the vehicle side and the supplying fluid contained in the container 46 is supplied directly to the storage tank. By doing so, the labor for transferring the supplying fluid can be eliminated and the supplying fluid can be supplied easily and rapidly.

[INDUSTRIAL APPLICABILITY]

[0074]

As described hereinbefore, a liquid storage tank and a liquid supplying apparatus according to the present invention can suitably be applied when an aqueous solution of a reduction agent for purifying exhaust gas from, for example, a diesel engine, because a large quantity of aqueous solution can be supplied from, for example, a tank track rapidly and safely, a small quantity of aqueous solution can manually be supplied easily and they can be manufactured easily and economically with a simple structure.

CLAIMS:

1. A liquid storage tank having a pipe joint (11) and an air releasing pipe (25) respective one ends of which are attached to a tank cap (9), which is removably mounted on a liquid supplying port (7), connecting them integrally with one another, said one end of said pipe joint (11) and said one end of said air releasing pipe (25) being open at an upper inner side of the tank (1), said ends of the pipe joint (11) and air releasing pipe (25) being arranged at an inner side of said tank cap (9), such that the other ends of said pipe joint (11) and said air releasing pipe (25) being arranged at an outer side of said tank cap (9), allowing the other end of said pipe joint (11) to connect to a supplying liquid pipe (20); wherein:

a liquid supplying hose (47) is insertable to the other end of said pipe joint (11);

a generally U-shaped part which is near said one end of said air releasing pipe (25) is submersible in a supplying liquid (28) in said tank (1); and

an air collecting part which is at said one end of said air releasing pipe (25) is directed upward to the inner side of said tank cap (9).

2. A liquid storage tank according to claim 1, wherein a transparent gauge pipe (41) is disposed upright on said tank (1), such that a rod-like float gauge (40) operable to move in accordance with a float (39), which is used to detect the surface of a supplying liquid (28) in said tank (1), is stored slidably in the transparent gauge pipe (41).

3. A liquid storage tank according to claim 1, wherein said supplying liquid (28) is an aqueous solution of a reduction agent for purifying an exhaust gas from a diesel engine.
4. A liquid storage tank according to claim 3, wherein said aqueous solution is urea water.