LIQUID SPRAY DEVICE

BACKGROUND OF THE INVENTION

(1) Field of the Invention

[0001]

The present invention relates to a liquid sprayer.

(2) Description of Related Art

[0002]

As is well known, there are conventionally spray cans using propellants as liquid sprayers for spraying liquid fragrance or the like. This spray can type liquid sprayer is not safe, because it requires use of flammable gas and such gas cannot be said to have a positive influence on a body. Therefore, in recent years, many transducer type liquid sprayers for spraying liquid fragrance or the like by using transducers for generating ultrasonic vibration have been developed.

[0003]

As the liquid sprayer using the transducer, there is a sprayer, as disclosed in JP 2010-7899 A, including a liquid storage tank for storing spray liquid, a mist producing means for turning the spray liquid into mist, and a spray liquid supply means for supplying the spray liquid in the liquid storage tank to the mist producing means. The spray liquid supply means includes a first liquid retaining body having one end disposed at a predetermined position in the liquid storage tank to absorb the spray liquid in the liquid storage tank, a substantially cylindrical second liquid retaining body brought into contact with the other end of the first liquid retaining body and

having a predetermined inside diameter and a predetermined outside diameter, and a third liquid retaining body having one end brought into contact with an outer peripheral face of the second liquid retaining body at predetermined contact pressure and the other end brought into contact with the mist producing means at predetermined contact pressure.

[0004]

In the sprayer disclosed in JP 2010-7899 A, however, the liquid storage tank for storing the spray liquid is detached from the liquid retaining body for absorbing the spray liquid in the liquid storage tank and only the liquid storage tank is attached and detached to add the spray liquid. Therefore, if the sprayer is used for a long term, solid components and impurities included in the spray liquid accumulate in the liquid retaining body and the liquid retaining body cannot soak up the spray liquid. Moreover, the liquid retaining body is housed in an L-shaped casing and therefore the liquid retaining body is difficult to detach from the casing and is not easy to replace.

SUMMARY OF THE INVENTION

[0005]

Therefore, it is a technical object to achieve a transducer type liquid sprayer in which a storage tank for storing spray liquid can be easily replaced together with a core for soaking up the spray liquid from the storage tank. To realize the object, the present inventor has repeatedly carried out test production and experiments through a trial and error process. As a result, the inventor has found a notable fact that a transducer is detached

from the core when a lid member is opened from a support member and that a spray liquid storage unit supported on the support member can be easily attached and detached and has achieved the above-described technical object with a liquid sprayer including the spray liquid storage unit and a main body for supporting the spray liquid storage unit inside itself, the spray liquid storage unit including the core for soaking up the spray liquid stored in the storage tank to an outside of the storage tank and the main body including the lid member to be put on the support member for supporting the spray liquid storage unit so that the lid member can be opened and closed, in which a spray hole is formed in the lid member so as to face a horizontally-oriented front face of the core provided to the spray liquid storage unit when the lid member is closed onto the support member, the transducer facing the spray hole is disposed inside the lid member, and the transducer disposed inside the lid member is in close contact with and pressed against the horizontally-oriented front face of the core provided to the spray liquid storage unit supported by the support member when the lid member is closed onto the support member.

[0006]

The above-described technical object can be achieved by the following aspects of the invention.

[0007]

According to an aspect of the invention, there is provided a liquid sprayer including a spray liquid storage unit and a main body for supporting the spray liquid storage unit inside itself, in which the spray liquid storage unit includes a core for soaking up spray liquid stored in a storage tank to an

outside of the storage tank, the main body includes a lid member to be put on a support member for supporting the spray liquid storage unit so that the lid member can be opened and closed, a spray hole is formed in the lid member so as to face a horizontally-oriented front face of the core provided to the spray liquid storage unit when the lid member is closed onto the support member, a transducer facing the spray hole is disposed inside the lid member, and the transducer disposed inside the lid member is in close contact with and pressed against the horizontally-oriented front face of the core provided to the spray liquid storage unit supported by the support member when the lid member is closed onto the support member.

[0008]

According to an aspect of the invention, in the liquid sprayer, the transducer disposed inside the lid member is fixed to a support arm supported between side faces rising from opposite sides of a front face of the lid member in which the spray hole is formed.

[0009]

According to an aspect of the invention, in either one of the above-described liquid sprayers, the core is divided into a tip end portion including the front face to be in close contact with the transducer and a base end portion extending from the tip end portion into the storage tank.

[0010]

According to the aspects of the invention, the spray hole is formed in the lid member so as to face the horizontally-oriented front face of the core provided to the spray liquid storage unit when the lid member is closed onto the support member, the transducer facing the spray hole is disposed inside

the lid member, and the transducer disposed inside the lid member is in close contact with and pressed against the horizontally-oriented front face of the core provided to the spray liquid storage unit supported by the support member when the lid member is closed onto the support member. Therefore, the transducer is detached from the core when the lid member is opened from the support member and the spray liquid storage unit supported on the support member can be easily attached and detached.

[0012]

Therefore, the invention has extremely high industrial applicability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a perspective view showing an outward appearance of the liquid sprayer according to First Embodiment;

Fig. 2 is a front view of an inside of a lid member of the liquid sprayer shown in Fig. 1;

Fig. 3 is a sectional view showing a section of the lid member shown in Fig. 2 and taken along line A-A;

Fig. 4 is a front view showing an inside of a support member of the liquid sprayer shown in Fig. 1;

Fig. 5 is a sectional view showing a section of the support member shown in Fig. 4 and taken along line B-B;

Fig. 6 is a sectional view showing a central vertical sectional view of the liquid sprayer shown in Fig. 1;

Figs. 7A, 7B, and 7C are explanatory sectional views showing open

and closed states of the lid member and the support member of the liquid sprayer shown in Fig. 1; and

Fig. 8 is a sectional view showing a central vertical sectional view of a liquid soaking member according to Second Embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0013]

Embodiments of the present invention will be described below.

[0014]

First Embodiment

[0015]

As shown in Fig. 1, a liquid sprayer 1 according to First Embodiment includes a case main body 4 (main body) having a lid member 2 forming a front face side and a support member 3 forming a back face side. In the case main body 4, as shown in Figs. 2 and 3, a spray liquid storage unit 5 for storing spray liquid, a transducer unit 6 for turning the spray liquid stored in the spray liquid storage unit 5 into mist, and a power supply unit 7 for supplying electric power to the transducer unit 6 are housed.

[0016]

As shown in Figs. 1 to 3, the lid member 2 is formed by left and right side faces 10 and 11 and upper and lower faces 12 and 13 extending backward in rising manners from a front face 9 provided, at a substantially central portion thereof, with a spray hole 8 for discharging the spray liquid which has been turned into the mist and the left and right side faces 10 and 11 extend to be longer than the upper and lower faces 12 and 13. On inner

sides of the left and right side faces 10 and 11, fitting shafts 14, 14 to be connected to the support member 3 protrude to face each other from back upper end portions and support plates 15, 15 for supporting the transducer unit 6 are provided to face each other at positions above the spray hole 8. Connecting holes 16 are formed in the opposite support plates 15 and 15 and each of the connecting holes 16 is formed by a circular hole 17 and a pair of fan-shaped holes 18, 18 extending to be symmetric with respect to a point from the circular hole 17 (see an enlarged view of the connecting hole shown in Fig. 3). A pair of lock holes 19, 19 is formed in the lower face 13.

[0017]

As shown in Figs. 4 and 5, the support member 3 is formed by left and right side faces 21 and 22 and upper and lower faces 23 and 24 extending forward in rising manners from a back face 20 disposed to be sandwiched between the opposite side faces of the lid member 2. The upper face 12 of the lid member 2 and the upper face 23 of the support member 3 form an upper face of the case main body 4 and the lower face 13 of the lid member 2 and the lower face 24 of the support member 3 form the lower face of the case main body 4. Fitting holes 25, 25 in which the fitting shafts 14, 14 of the lid member 2 are to be fitted are formed in upper end portions of the left and right side faces 21 and 22. Therefore, the lid member 2 is connected to the support member 3 to be able to turn by using the fitting shafts 14, 14 fitted in the fitting holes 25, 25 in the support member 3 as rotary shafts.

[0018]

Inside the support member 3, the power supply unit 7 is fixed to an upper portion and the spray liquid storage unit 5 is disposed at a lower

portion. As shown in Fig. 6, at a lower end portion in the support member 3, resilient plates 26 having U shapes in a side view protrude forward with their only upper ends fixed to the back face 20 and lock pins 27 protruding downward from the resilient plates 26 can move in a vertical direction as the resilient plates 26 bend. In this way, when the lid member 2 is closed onto the support member 3, the lock pins 27 of the support member 3 are fitted in the lock holes 19, 19 in the lid member 2 to lock opening and closing of the lid member 2 with respect to the support member 3.

[0019]

As shown in Figs. 4 and 6, the spray liquid storage unit 5 is formed by a storage tank 28 for storing the spray liquid and a liquid soaking holder 29 for soaking up the spray liquid from the storage tank 28.

[0020]

The storage tank 28 has an opening portion 30, into which the liquid soaking holder 29 is inserted, in its upper face. An outer side face of the opening portion 30 has a base end formed in a shape of a thread groove and a tip end having a large diameter. Between the thread-shaped portion and the large-diameter portion, a holding face 31 having a smaller diameter than both the portions is formed.

[0021]

The liquid soaking holder 29 includes an outer tube portion 32 fitted and fixed into the opening portion 30 in the storage tank 28 and an inner tube portion 33 inserted through a hollow portion in the outer tube portion 32 and extending from an inside to an outside of the storage tank 28 and a core 34 for soaking up the spray liquid in the storage tank 28 by utilizing

capillarity is fixed in a hollow portion of the inner tube portion 33. Remaining portions which are parts of the outer tube portion 32 and the inner tube portion 33 are connected by a connecting bridge 35 and a surplus of the spray liquid soaked up by the core 34 returns into the storage tank 28 from a portion between both the tube portions 32 and 33 which are not connected by the connecting bridge 35. A front face of a tip end portion of the inner tube portion 33 is notched to expose the core 34 and respective wall faces of the tip end portion of the inner tube portion 33 brought into contact with left and right side faces, a back face, and an upper face of the core 34 form a surrounding portion 36.

[0022]

By screwing a cap (not shown) onto the thread groove formed at the opening portion 30 of the storage tank 28, it is possible to prevent evaporation of the spray liquid from the storage tank 28.

[0023]

The core 34 is formed to have a rectangular section. As material of the core 34, felt, nonwoven fabric made of natural pulp, and material obtained by twining fibers such as polypropylene and polyethylene may be used.

[0024]

As shown in Figs. 4 to 6, the power supply unit 7 includes a box portion 37 for housing a battery and a control board, a holding plate 39 supported by a pair of support pieces 38, 38 extending downward from the box portion 37, and a retaining groove 40 provided to a front face of the box portion 37. As shown in Fig. 5, a C-shaped holding portion 41 which is open

forward is formed in the holding plate 39 and the holding portion 41 has such an inside diameter as to be fitted over the holding face 31 of the storage tank 28. When the holding portion 41 of the power supply unit 7 holds the holding face 31 of the storage tank 28, the surrounding portion 36 of the inner tube portion 33 extending upward from the opening portion 30 of the storage tank 28 is fitted in the retaining groove 40.

[0025]

As power-supply voltage of the power supply unit 7, DC 4.5 V, 6.0 V, and 7.5 V may be used.

[0026]

As shown in Figs. 2 and 3, the transducer unit 6 includes a support arm 42 having a recessed shape and a transducer 44 fixed to a center of a lateral bar portion 43 of the support arm 42, and vertical bar portions 45, 45 of the support arm 42 extend, while tilting, from the lateral bar portion 43. The lateral bar portion 43 is provided with two protecting pieces 46, 46 positioned parallel on opposite sides of the transducer 44. At tip ends of the vertical bar portions 45, 45 of the support arm 42, connecting shafts 47 protruding outward are provided. Each of the connecting shafts 47 includes a round shaft 48 and restricting shafts 49, 49 extending to be symmetric with respect to a point from the round shaft 48 (see the enlarged view of the connecting shaft shown in Fig. 3). By fitting the opposite connecting shafts 47 into the connecting holes 16 in the support plates 15 provided to the inner side of the lid member 2, the support arm 42 is supported to be able to turn between the opposite support plates 15 of the lid member 2. Turning of the support arm 42 is restricted by interference between the restricting shafts 49

of the connecting shafts 47 and the fan-shaped holes 18 of the connecting holes 16.

[0027]

Next, a method of assembling the liquid sprayer 1 according to the embodiment will be described.

[0028]

First, the power supply unit 7 is fixed into the upper portion of the support member 3. The connecting shafts 47 of the support arm 42 are fitted into the connecting holes 16 formed in the opposite support plates 15 of the lid member 2 to support the support arm 42 between the opposite side faces of the lid member 2. Next, the opposite fitting shafts 14 of the lid member 2 are inserted into the opposite fitting holes 25 in the support member 3 to connect the lid member 2 to the support member 3 so that the lid member 2 can turn. After that, an electric wire (not shown) extending from the power supply unit 7 is connected to the transducer 44 of the transducer unit 6. Then, the holding face 31 of the spray liquid storage unit 5 formed by inserting the liquid soaking holder 29 into the storage tank 28 is fitted into the holding plate 39 of the power supply unit 7 to thereby fix the spray liquid storage unit 5 into the lower portion of the support member 3. Lastly, the lid member 2 is closed onto the support member 3 and the lock pins 27 of the support member 3 are fitted into the lock holes 19 in the lid member 2 to thereby lock opening and closing of the lid member 2 with respect to the support member 3.

[0029]

In the assembled liquid sprayer 1, the transducer 44 and the core 34

with which the transducer 44 is in close contact are exposed through the spray hole 8 in the lid member 2. If the electric power is supplied from the power supply unit 7 to vibrate the transducer 44, the spray liquid retained by the core 34 is turned into the mist by the vibration of the transducer 44 and sprayed outside the case main body 4 through the spray hole 8. Because the respective faces except the front face of the tip end portion of the core 34 in close contact with the transducer 44 are surrounded with the surrounding portion 36, it is possible to prevent the spray liquid, which has been turned into the mist by the transducer 44, from being sprayed inside the case main body 4.

[0030]

To replace the spray liquid storage unit 5, by inserting a pin (not shown) into the lock hole 19 in the lid member 2 to push the lock pin 27 inward, the locking of the lid member 2 to the support member 3 is released and the lid member 2 is turned upward with respect to the support member 3. Next, the old spray liquid storage unit 5 is detached from the holding plate 39 of the power supply unit 7 and a new spray liquid storage unit 5 is fixed to the holding plate 39. Lastly, the lid member 2 is closed onto the support member 3 and locked.

[0031]

Next, a positional relationship between the support arm 42 and the core 34 when the lid member 2 is opened and closed with respect to the support member 3 of the liquid sprayer 1 according to the embodiment will be described based on Figs. 7A to 7C. In each of Figs. 7A to 7C, a lower portion of the case main body 4 and the power supply unit 7 are not shown

and an enlarged view showing a relationship between the connecting shaft 47 of the support arm 42 and the connecting hole 16 of the support plates 15 is shown.

[0032]

First, if the lid member 2 is completely closed onto the support member 3, an entire back face of the transducer 44 fixed to the support arm 42 comes into close contact with a front face of the core 34 as shown in Fig. 7A. At this time, the restricting shafts 49 of the connecting shafts 47 are not interfering with the fan-shaped holes 18 of the connecting holes 16 and therefore the support arm 42 can turn in a front-back direction with respect to the support plates 15. Furthermore, because the lateral bar portion 43 and the transducer 44 are positioned on the front side of the axis of turning of the support arm 42, the center of gravity of the support arm 42 is positioned on the back side of the axis of turning and a force for turning backward is always acting on the support arm 42. Therefore, the transducer 44 fixed to the support arm 42 is in close contact with and pressed against the front face of the core 34.

[0033]

Next, if the lid member 2 is completely opened from the support member 3, as shown in Fig. 7B, the back face of the transducer 44 fixed to the support arm 42 is separated from the front face of the core 34. At this time, the restricting shafts 49 of the connecting shafts 47 are interfering with the fan-shaped holes 18 of the connecting holes 16. As a result, if the support arm 42 turns backward to some extent with respect to the support plates 15, the backward turning of the support arm 42 with respect to the

support plates 15 is restricted.

[0034]

Then, if the lid member 2 is closed onto the support member 3, as shown in Fig. 7C, a lower end of the transducer 44 fixed to the support arm 42 comes into contact with the front face of the core 34. At this time, the restricting shafts 49 of the connecting shafts 47 are not interfering with the fan-shaped holes 18 of the connecting holes 16 and, as a result, the support arm 42 can turn in the front-back direction with respect to the support plates 15. Moreover, because the lateral bar portion 43 and the transducer 44 are positioned on the front side of the axis of turning of the support arm 42, the center of gravity of the support arm 42 is positioned on the back side of the axis of turning and the force for turning backward is always acting on the support arm 42. Therefore, the lower end of the transducer 44 fixed to the support arm 42 is in contact with and pressed against the front face of the core 34.

[0035]

If the lid member 2 is completely closed onto the support member 3, they come into the state shown in Fig. 7A again.

[0036]

Second Embodiment

[0037]

The present embodiment is a variation of the inner tube portion of the liquid soaking holder in First Embodiment described above and the same reference numerals as those in Figs. 1 to 7C designate the same or corresponding portions in Fig. 8.

[0038]

In an inner tube portion 50 according to the embodiment, as shown in Fig. 8, a large opening 51 is formed in a side face of a portion to be housed in the storage tank 28 and cores 52 and 53 having different lengths and having circular sections are housed in a hollow portion in the inner tube portion 50. The short core 52 is housed in a portion of the inner tube portion 50 to be positioned above the opening portion 30 in the storage tank 28 and the long core 53 is housed in a portion of the inner tube portion 50 to be positioned below the opening portion 30 in the storage tank 28.

[0039]

In the present embodiment, the core forming the liquid soaking holder is divided into two at the position of the inner tube portion corresponding to the opening portion in the storage tank and therefore it is easy to replace only the upper end portion of the core which the transducer is in contact with and pressed against and which is relatively likely to be deformed.

[0040]

The spray liquid in the invention may be fragrance, deodorant, germicide, or the like but is not limited to them. The spray liquid may be other agents which can be turned into mist by the ultrasonic vibration of the transducer.

[0041]

Although the center of gravity of the support arm is positioned on the back side of the axis of turning so that the force for turning backward acts on the support arm when the transducer fixed to the support arm is brought

into close contact with and pressed against the core in the method employed in First Embodiment described above, the method is not limited to it. For example, resilient bodies such as springs may be disposed at connecting portions between the support arm and the support plates to thereby always press the support arm backward.

DESCRIPTION OF REFERENCE SIGNS

[0042]

1	Liquid sprayer
2	Lid member
3	Support member
4	Case main body
5	Spray liquid storage unit
6	Transducer unit
7	Power supply unit
8	Spray hole
9	Front face
10	Left side face
11	Right side face
12	Upper face
13	Lower face
14	Fitting shaft
15	Support plate
16	Connecting hole
17	Circular hole

18 Fan-shaped hole

19 Lock hole

20 Back face

21 Left side face

22 Right side face

23 Upper face

24 Lower face

25 Fitting hole

26 Resilient plate

27 Lock pin

28 Storage tank

29 Liquid soaking holder

30 Opening portion

31 Holding face

32 Outer tube portion

33 Inner tube portion

34 Core

35 Connecting bridge

36 Surrounding portion

37 Box portion

38 Support piece

39 Holding plate

40 Retaining groove

41 Holding portion

42 Support arm

43 Lateral bar portion

44 Transducer

45 Vertical bar portion

46 Protecting piece

47 Connecting shaft

48 Round shaft

49 Restricting shaft

50 Inner tube portion

51 Opening

52, 53 Core

What is claimed is:

1. A liquid sprayer comprising a spray liquid storage unit and a main body for supporting the spray liquid storage unit inside itself, wherein the spray liquid storage unit includes a core for soaking up spray liquid stored in a storage tank to an outside of the storage tank, the main body includes a lid member to be put on a support member for supporting the spray liquid storage unit so that the lid member can be opened and closed, a spray hole is formed in a position of the lid member facing a horizontally-oriented front face of the core of the spray liquid storage unit supported by the support member when the lid member is closed onto the support member, a transducer facing the spray hole is disposed inside the lid member, and the transducer disposed inside the lid member is in close contact with and pressed against the horizontally-oriented front face of the core of the spray liquid storage unit supported by the support member when the lid member is closed onto the support member.

2. The liquid sprayer according to claim 1, wherein the transducer disposed inside the lid member is fixed to a support arm supported between side faces rising from opposite sides of a front face of the lid member in which the spray hole is formed.

3. The liquid sprayer according to claim 1 or 2, wherein the core is divided into a tip end portion including the front face to be in close contact with the transducer and a base end portion extending from the tip end portion into the storage tank.