

## DESCRIPTION

Title of the Invention: LIQUID SPRAY DEVICE

### 5 Technical Field

[0001] The present invention relates to a liquid spray device which sprays various liquids such as an aromatic, a deodorant, a disinfectant, and a sterilizer as a mist.

### 10 Background Art

[0002] Conventionally, an aroma diffuser and an aroma-diffusing apparatus which bring an air environment in space of a restroom or the like to a favorable state through an aroma or deodorization, a deodorizer and a deodorizing apparatus which spray a deodorant, or the like are under  
15 development.

[0003] For the above-described aroma diffuser and deodorizer, a container is only filled with an aromatic and a deodorant. For example, for the aroma diffuser, the aromatic is evaporated spontaneously to be diffused, thereby partially causing a portion having a strong aroma or a portion having a weak  
20 aroma in room space. In particular, for large space, the aroma is unlikely to spread uniformly throughout the space. The above point is also similar to that for the deodorizer.

[0004] To solve the above problem, for example, Patent Document 1 discloses a liquid spray device which can be used as an aroma-diffusing  
25 apparatus or a deodorizing apparatus designed for the aromatic or the deodorant to spread uniformly in not only small space such as a bathroom in

an ordinary home but also large space such as a restroom in a hotel, a restaurant, or the like. That is, inside a main body case having a suction port and a blowout port, a container sealing a liquid aromatic or the like is disposed, and the liquid aromatic or the like in the container is disposed to  
5 diffuse to an air flow path portion between the suction port and the discharge port of air in the main body case. Then, a flow of the air is generated from the suction port to the blowout port by driving an electric fan disposed in the air flow path portion.

[0005] When the electric fan is driven, the air is sucked from the suction port  
10 to the air flow path portion. The air forces the liquid aromatic or the like in the container to be evaporated and diffused, and blows out from the blowout port to the outside. The interior of a room such as the restroom is filled with the aroma or deodorized in such a manner as described above.

[0006] In the meantime, Patent Document 2 discloses a liquid spray device  
15 (air freshener) of a type of disposing a jet port of an air nozzle in the vicinity of a discharge port of a liquid nozzle for sucking an aromatic or a deodorant, and blowing a liquid discharged from the discharge port of the liquid nozzle away in jetting air from the air nozzle.

Prior Art Document

20 Patent Document

[0007] Patent Document 1: Japanese Patent Application Laid-open No. H5-329199

Patent Document 2: Japanese Utility Model Registration Publication No. 3201503

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Summary of the Invention

## Problems to Be Solved by the Invention

[0008] The device disclosed in Patent Document 1 which diffuses the aromatic or the deodorant is effective in that the aroma or the like can be spread uniformly throughout with respect to the large space, but since the  
5 liquid such as the aromatic evaporated from the container is blown out to the outside by the electric fan, only a component easy to evaporate is likely to be consumed first. Hence, the problem arises that an effect of the aroma or the like decreases relatively early with time.

[0009] In contrast with this, the air freshener disclosed in Patent Document 2  
10 is configured to blow the liquid such as the aromatic far away by the air, thereby having the advantage that a mist of the liquid is drifted in air for a long stretch of time and the effect of the liquid such as the aromatic works longer in a large area, as compared with that of the device described in Patent Document 1.

15 [0010] The air freshener in Patent Document 2 has a structure in which the cylindrical air nozzle is disposed along a direction orthogonal to the cylindrical liquid nozzle and the liquid discharged from the liquid nozzle is blown away by the air from the air nozzle. The liquid is made fine in a mist form by the air, but a difference in particle size of the liquid changed into a  
20 mist occurs depending on a separation distance between the liquid discharge port of the liquid nozzle and the air discharge port of the air nozzle. However, in Patent Document 2, the respective liquid nozzle and air nozzle are disposed independently and mounting positions of the two sometimes vary among products, and depending on the products, differences in diffusion  
25 range and diffusion time of the aroma sometimes occur. Further, an error between the mounting positions of the two causes bad contact between the

liquid and the air, which has made the liquid adhere to an inner surface of a case without being discharged from an opening to the outside with the particle size in a relatively large state in some cases.

[0011] The present invention was made in consideration of the above and has  
5 an object to provide a liquid spray device capable of spraying various liquids such as an aromatic, a deodorant, a disinfectant, or a sterilizer as a finer mist and spreading effects of the above liquids more uniformly with respect to larger space. Further, in addition to such an object, the present invention has an object to provide the liquid spray device capable of reducing the liquids  
10 adhering to an inner surface of a case.

#### Means for Solving the Problems

[0012] To solve the above problems, a liquid spray device according to the present invention includes:

15 a spraying mechanism including a liquid nozzle connected through a liquid supply tube to a liquid container in which a liquid is contained, and an air nozzle which is connected through an air supply tube to an air supply source and jets air to make the liquid discharged from a liquid discharge port of the liquid nozzle in a mist form; and

20 a case including an opening of which in a vicinity, the liquid discharge port of the liquid nozzle and an air discharge port of the air nozzle are disposed, the opening for discharging the liquid made in a mist form by jetting the air to an outside,

the liquid nozzle includes: a discharge port-side portion formed with a  
25 discharge port-side flow path having the liquid discharge port; and an inlet-side portion having a liquid inlet to which the liquid is introduced

through the liquid supply tube and formed with an inlet-side flow path communicating with the discharge port-side flow path,

through the air nozzle, an air flow path having the air discharge port is formed,

5           on and in peripheral wall portions of the liquid nozzle and the air nozzle, respective nozzle engaging portions in a positional relationship in which a discharge direction of the air forms a predetermined angle with a discharge direction of the liquid and the air discharge port and the liquid discharge port are close to each other at a predetermined distance are formed  
10       in a state of engaging in each other, and

          on the peripheral wall portion of the liquid nozzle, a pedestal engaging portion different from the nozzle engaging portion is formed, in a state of engaging the pedestal engaging portion in a nozzle mounting portion of a pedestal portion provided in a predetermined position in the case, the air  
15       discharge port and the liquid discharge port are disposed in the vicinity of the opening with the liquid discharge port further upward than a horizontal and with the air discharge port in a posture toward an outside of the opening.

[0013] Preferably, the liquid discharge port of the liquid nozzle is provided to be located on or further outside than an inner virtual line along an inner  
20       surface of the case which passes the opening. More preferably, the liquid discharge port of the liquid nozzle is provided to be located in a range of a thickness of a peripheral edge portion forming the opening, the thickness sandwiched between the inner virtual line and an outer virtual line along an outer surface of the case.

25           Further, preferably, the air discharge port of the air nozzle is provided to be located in the range of the thickness of the peripheral edge portion

forming the opening, the thickness sandwiched between the inner virtual line and the outer virtual line along the outer surface of the case.

Preferably, the pedestal portion has an inclined portion which becomes higher as approaching the opening, and the inclined portion is provided with  
5 the nozzle mounting portion.

[0014] Preferably, in the inlet-side portion of the liquid nozzle, a range of a predetermined length from the liquid inlet toward the discharge port-side portion serves as a connection cylinder portion for connecting the liquid supply tube, and through the pedestal portion, a tube through slit passed by  
10 the liquid supply tube connecting the connection cylinder portion and the liquid container is formed.

Further, preferably, the liquid supply tube includes: a first tube communicated on the liquid container side, and through the tube through slit, fixedly disposed so that a tip opening is open toward the connection cylinder  
15 portion of the liquid nozzle; and a second tube connecting the first tube and the connection cylinder portion.

[0015] Preferably, in the case, a container support shelf supporting the liquid container is provided, and a container connecting portion in which when a liquid outlet of the liquid container is connected in a state in which the liquid  
20 container is supported by the container support shelf, a liquid flow-through hole communicates with the liquid outlet is provided, and the liquid supply tube is disposed to communicate with the liquid flow-through hole of the container connecting portion.

Preferably, to be capable of biasing the liquid container supported by  
25 the container support shelf in a direction in which the liquid outlet is pressed in the container connecting portion direction, the container support shelf is

supported through elastic members in the case.

[0016] Preferably, any of the liquid nozzle, the air nozzle, and the pedestal portion is a molded product of synthetic resin.

#### Effect of the Invention

5 [0017] In the liquid spray device of the present invention, the air nozzle and the liquid nozzle can be integrated by engaging the nozzle engaging portions formed in/on the peripheral wall portions of the two in each other, and can have the positional relationship in which the discharge direction of the air forms the beforehand set angle with the discharge direction of the liquid and  
10 the air discharge port and the liquid discharge port are close to each other at the beforehand set distance. Then, in the air nozzle and the liquid nozzle engaged and integrated in/with each other in this manner, by mounting the pedestal engaging portion formed on the peripheral wall portion of the liquid nozzle in the nozzle mounting portion provided on the pedestal portion, the  
15 air nozzle and the liquid nozzle can always be mounted in fixed positions. Accordingly, the air nozzle and the liquid nozzle can be mounted easily in a positional relationship suitable for producing a mist having a fine particle size less than or equal to a predetermined size and can make a diffusion length and a diffusion range of the mist stable, which reduces variations in spray amount  
20 among products. As a result, a mist having a large particle size is less produced, an amount of a mist adhering to an inner surface of the case without diffusing from the opening to the outside can be decreased, and a waste of the liquid decreases, which enables suppression of the used amount of the liquid. The air nozzle, the liquid nozzle, and the pedestal portion are  
25 molded products of synthetic resin, thereby having high dimensional accuracy, which makes positional relationships among the members and mounting

positions thereof more stable, resulting in also further reduction of the variations in spray amount of the mist.

[0018] Further, the liquid discharge port of the liquid nozzle is provided to be located further outside than the inner virtual line along the inner surface of the case which passes the opening, and preferably in the range of the thickness of the peripheral edge portion forming the opening, the thickness sandwiched between the inner virtual line along the inner surface of the case which passes the opening and the outer virtual line along the outer surface of the case which passes the opening, and thereby the position of the liquid discharge port is further outside than the above-described inner virtual line, and preferably approximately flush with the opening of the case, and blowing the liquid away from the position to the outside by the air enables further reduction of the adhesion of the mist into the case. In this case, also placing the air discharge port of the air nozzle in a similar position makes it possible to further enhance an effect of suppressing the adhesion of the mist into the case.

[0019] Further, providing, through the pedestal portion, the slit for tube which the liquid supply tube can pass enables suppression of poor spray due to a kink.

## Brief Description of Drawings

[0020] [FIG. 1] FIG. 1 is a perspective view illustrating an external appearance of a liquid spray device of one embodiment of the present invention.

[FIG. 2] FIG. 2 is an exploded perspective view illustrating an internal configuration after removing a body cover of the liquid spray device.

[FIG. 3] FIG. 3 illustrates a disposition relationship among a liquid

supply tube, a pedestal portion, a container connecting portion, and the like.

[FIG. 4] FIG. 4 is a side view of a spraying mechanism in a state of being mounted in a case.

[FIGs. 5] FIG. 5(a) is a side view and FIG. 5(b) is a front view in a  
5 state of assembling an air nozzle, a liquid nozzle, and the pedestal portion.

[FIGs. 6] FIGs. 6(a) to (c) illustrate the air nozzle, (a) is a perspective view seen from a front side, (b) is a perspective view seen from a connection cylinder portion side, and (c) is a sectional view in a longitudinal direction.

[FIGs. 7] FIGs. 7(a) to (c) illustrate the liquid nozzle, (a) is a  
10 perspective view seen from the front side, (b) is a perspective view seen from the connection cylinder portion side, and (c) is a sectional view in the longitudinal direction.

[FIGs. 8] FIGs. 8(a) to (e) illustrate the pedestal portion, (a) is a perspective view seen from the front side, (b) is a perspective view seen from  
15 a back portion side, (c) is a plan view, (d) is a side view, and (e) is a sectional view taken along an A-A line of (c).

### Modes for Carrying out the Invention

[0021] One embodiment of the present invention will be hereinafter described  
20 in reference to the drawings. As illustrated in FIG. 1 to FIG. 3, a liquid spray device 1 according to this embodiment includes a spraying mechanism 50 disposed in a case 10. The case 10 is formed in a substantially box shape having a back cover 20 located on a back side, a body cover 30, and a top cover 40.

25 [0022] As illustrated in FIG. 2, the back cover 20 is provided with an upper shelf portion 21 projecting frontward in a substantially middle position in a

vertical direction and provided with a battery box 23 in which batteries 11 are disposed under the upper shelf portion 21. On the upper shelf portion 21, a container support shelf 22 is supported elastically through elastic members 21a such as coil springs. On the container support shelf 22, a liquid  
5 container 12 in which an aromatic, a deodorant, or the like is contained is placed. Then, the body cover 30 in a substantially squared U shape in a cross section is detachably provided to cover their front face and both side faces.

[0023] The top cover 40 covers a top side of the body cover 30 and is formed  
10 to be inclined and curved downward from a back side toward a front side in side view, and through a front wall thereof, an opening 41 for discharging a mist-form liquid jetted from the spraying mechanism 50 to the outside is formed.

[0024] Further, inside the top cover 40, a control board constituting a control  
15 unit 70 and an illumination sensor 13 for detecting surrounding illuminance are mounted. The illumination sensor 13 is electrically connected to the control unit 70. Close to the back side of a top wall of the top cover 40, an illumination sensor window 42 facing the illumination sensor 13 is formed.

[0025] Next, the spraying mechanism 50 constituting a main part of this  
20 embodiment will be described in detail. The spraying mechanism 50 includes an air nozzle 51, a liquid nozzle 55, and a pedestal portion 57. The air nozzle 51 and the liquid nozzle 55 are stacked and disposed, and both supported together by the pedestal portion 57 (refer to FIG. 3 to FIG. 5).

[0026] First, in the air nozzle 51, an air flow path 510 is formed through the  
25 interior thereof, and a tip serves as an air discharge port 511 and a back end serves as an air inlet 512 (refer to FIG. 6(c)). The air flow path 510 is

formed in a linear shape from the air inlet 512 to the air discharge port 511. Further, as illustrated in FIG. 3, one end of an air supply tube 52 is connected to the air inlet 512, and the other end of the air supply tube 52 is connected to a compressor 54 which is an air supply source. The compressor 54 is  
5 disposed close to the back cover 20 in a range surrounded by the battery box 23 and electrically connected to the control unit 70, and driven by receiving a control signal of the control unit 70 to supply air (compressed air) through the air supply tube 52 to the air nozzle 51.

[0027] In more detail, as illustrated in FIGs. 6(a), (b), the air nozzle 51 has a  
10 rectangular parallelepiped portion 51a formed in a substantially rectangular parallelepiped shape and a connection cylinder portion 51b projecting backward from the rectangular parallelepiped portion 51a. At the center in a width direction of a tip surface of the rectangular parallelepiped portion 51a, a pore serving as the air discharge port 511 preferably having a diameter of 1  
15 mm or less is formed, and a projecting end of the connection cylinder portion 51b serves as the air inlet 512 having a diameter of about 1 to 4 mm. As illustrated in a cross section in FIG. 6(c), the air flow path 510 is formed in a linear shape to pass through from the air inlet 512 to the air discharge port 511, and the vicinity of a near side of the air discharge port 511 formed of the pore  
20 is gradually narrowed down in a tapered shape to cause an increase in the flow velocity of air introduced from the air discharge port 511 in the tapered portion, resulting in that the air is ejected with force.

[0028] The liquid nozzle 55 has an inlet-side portion 551 and a discharge port-side portion 552 as illustrated in FIGs. 7(a) to (c). The inlet-side  
25 portion 551 is formed in a substantially rectangular parallelepiped shape and the discharge port-side portion 552 is integrally formed to be located on a

front side thereof. The inlet-side portion 551 has a connection cylinder portion 551a projecting backward. An end portion of the connection cylinder portion 551a serves as a liquid inlet 5511 having a diameter of about 1 to 4 mm, and from the liquid inlet 5511 toward the discharge port-side portion 552 direction, an inlet-side flow path 5510 is formed in a linear shape. To the connection cylinder portion 551a, a liquid supply tube 56 for supplying a liquid in the liquid container 12 from the liquid inlet 5511 into the inlet-side flow path 5510 is connected. Note that details on the liquid supply tube 56 and the liquid container 12 are described later together with a description of the pedestal portion 57.

[0029] The discharge port-side portion 552 is located in the front of the inlet-side portion 551 as described above, and a tip portion at which a liquid discharge port 5521 is formed projects further outward than an opposing surface 5515a to the air nozzle 51 on a peripheral wall portion 5515 of the substantially rectangular parallelepiped inlet-side portion 551. Hence, the liquid nozzle 55 is formed in a substantially L shape in side view as a whole in which the discharge port-side portion 552 is joined to the inlet-side portion 551.

[0030] Through the interior of the discharge port-side portion 552, as illustrated in FIG. 7(c), a discharge port-side flow path 5520 is formed in a direction orthogonal to the inlet-side flow path 5510. The discharge port-side flow path 5520 is formed to pass through from a back surface (a surface located on an opposite side to the above-described opposing surface 5515a of the inlet-side portion 551) 552a of the discharge port-side portion 552 up to the liquid discharge port 5521, and a tip of the inlet-side flow path 5510 communicates on a side surface of the discharge port-side flow path

5520 in the middle thereof. The liquid discharge port 5521 is formed in a pore preferably having a diameter of about 1 mm or less, and the discharge port-side flow path 5520 has a structure to be narrowed down in a tapered shape on a near side of the liquid discharge port 5521 to cause an increase in the flow velocity of the liquid. A back-side open end 5522 of the discharge port-side flow path 5520 facing the back surface 552a of the discharge port-side portion 552 is attached and closed with a cap member 5523. This causes the inlet-side flow path 5510 and the discharge port-side flow path 5520 to become one substantially L-shaped flow path crossing each other at approximately 90 degrees and make the liquid inlet 5511 to the liquid discharge port 5521 communicate with each other.

[0031] Here, the air nozzle 51 and the liquid nozzle 55 are stacked and disposed as described above, and respectively provided with nozzle engaging portions and integrated by engaging the two in each other. That is, the air nozzle 51 is provided with an engaging groove portion 516 formed in a groove shape in the opposing surface 515a to the liquid nozzle 55 in the peripheral wall portion 515 as illustrated in FIGs. 6(b), (c), and the liquid nozzle 55 is provided with an engaging projection 5516 projecting in the opposing surface 515a direction of the air nozzle 51 and engaging in the engaging groove portion 516, on the opposing surface 5515a of the peripheral wall portion 5515 of the inlet-side portion 55, as illustrated in FIGs. 7(a) to (c). These respective engaging groove portion 516 and engaging projection 5516 constitute the nozzle engaging portions.

[0032] The air nozzle 51 and the inlet-side portion 551 of the liquid nozzle 55 are both formed in a substantially rectangular parallelepiped shape, and the opposing surfaces 515a, 5515a are each formed on a flat surface.

Accordingly, when the engaging groove portion 516 and the engaging projection 5516 are engaged, the air flow path 510 formed in a linear shape through the air nozzle 51 and the inlet-side flow path 5510 formed through the introduction-side portion 551 are disposed in a substantially parallel positional relationship, and the connection cylinder portions 51b, 551a also extend in substantially parallel (refer to FIG. 5).

[0033] On one hand, the discharge port-side portion 552 is located in the front of the inlet-side portion 551 as described above, and the tip portion at which the liquid discharge port 5521 is formed projects further outward than the opposing surface 5515a of the substantially rectangular parallelepiped inlet-side portion 551. This causes the liquid discharge port 5521 to be adjacently located just next to the air discharge port 511 of the air nozzle 51 in a state in which the engaging groove portion 516 of the air nozzle 51 and the engaging projection 5516 of the inlet-side portion 551 of the liquid nozzle 55 are engaged (refer to FIG. 4 and FIG. 5). Note that a separation distance between the two is preferably as close as possible, and though it depends on a capacity of the compressor 54, the diameter of the liquid discharge port 5521, and the like, in a direction substantially orthogonal to the center of the liquid discharge port 5521, an end surface of the air discharge port 511 is preferably 3 mm or less, more preferably 2 mm or less, and further preferably 1 mm or less. This causes the air blown out from the air discharge port 511 of the air nozzle 51 to cross the liquid discharge port 5521 in a diameter direction to change the liquid into a mist by blowing away and diffuse it.

[0034] Note that in the air nozzle 51 and the liquid nozzle 55 of this embodiment, in a manner to have such a positional relationship as described above when the engaging groove portion 516 and the engaging projection

5516 which are the nozzle engaging portions are engaged, sizes of a length along an axial direction of the air nozzle 51, a length along an axial direction of the inlet-side portion 551 of the liquid nozzle 55, a protrusion length of the discharge port-side portion 552 from the opposing surface 5515a, and the like, formation positions of the engaging groove portion 516 and the engaging projection 5516, and the like are adjusted.

[0035] In the case 10, between the liquid container 12 supported by the container support shelf 22 and the top cover 40, pedestal-portion mounting frames 24 projecting frontward from the back cover 20 are provided, and the pedestal portion 57 is mounted to the pedestal-portion mounting frames 24 (refer to FIG. 3 and FIG. 4). The pedestal portion 57 has a substantially rectangular bottom portion 571 in plain view and a back portion 572 standing upward from a back edge of the bottom portion 571, and, is provided with a pair of side plate portions 573, 574, approximately at the center of both-side edges thereof, extending at a predetermined distance therebetween from the back portion 572 in a front edge direction, as illustrated in FIGs. 8. Upper edge portions 573a, 574a of the side plate portions 573, 574 extend flat from the back edge toward the front edge, whereas are gradually raised from the middle position up to the front edge to form an inclined portion 575. Note that the pedestal portion 57 is mounted to the pedestal-portion mounting frames 24 so that the inclined portion 575 is gradually raised toward the opening 41 direction of the top cover 40.

[0036] The inclined portion 575 is provided with a nozzle mounting portion 576. The nozzle mounting portion 576 is formed in a plate shape having a predetermined thickness, and a slit 576a extending from a side edge portion in a lateral direction is formed therein. The slit 576a is formed in a shape in

which a width on a lower-surface side is large and a width on an upper-surface side is small.

[0037] On one hand, a back surface (a surface located on an opposite side to the above-described opposing surface 5515a) 5515b of the inlet-side portion 551 of the liquid nozzle 55 is provided with a pedestal engaging projection 5517 projecting in the pedestal portion 57 direction and constituting the pedestal engaging portion (refer to FIGs. 7(a) to (c)). The pedestal engaging projection 5517 is, with a width at a projection-direction tip larger, capable of engaging in the slit 576a formed in the nozzle mounting portion 576 of the pedestal portion 57 by being inserted from a side edge portion thereof. Accordingly, the air nozzle 51 and the liquid nozzle 55 integrated by engaging the engaging groove portion 516 and the engaging projection 5516 which are the nozzle engaging portions in each other are supported together by the pedestal portion 57 by engaging the pedestal engaging projection 5517 of the liquid nozzle 55 in the nozzle mounting portion 576 of the pedestal 57 (refer to FIG. 4 and FIG. 5).

[0038] Further, the nozzle mounting portion 576 is provided on the inclined portion 575 inclined to be higher as approaching the front edge (opening 41) as described above. Accordingly, when the pedestal engaging projection 5517 of the liquid nozzle 55 is engaged in the nozzle mounting portion 576, the liquid nozzle 55 and the air nozzle 51 engaged in the liquid nozzle 55 are disposed obliquely by an inclination angle  $\theta$  of the inclined portion 575 (refer to FIG. 4 and FIG. 8(d)).

[0039] Since the air flow path 510 of the air nozzle 51 and the inlet-side flow path 5510 of the liquid nozzle 55 are in substantially parallel in positional relationship to each other, the air flow path 510 and the inlet-side flow path

5510 are disposed to be inclined obliquely upward at approximately the same angle. This angle, namely, the inclination angle  $\theta$  of the inclined portion 575 is set as a spray angle of the liquid blown away by the air. Accordingly, the inclination angle  $\theta$  of the inclined portion 575 is in a range of preferably 20  
5 degrees to 70 degrees and more preferably 30 degrees to 60 degrees to the horizontal.

[0040] Here, since the liquid discharged from the liquid discharge port 5521 of the liquid nozzle 55 is blown away toward the outside of the opening 41 by the air ejected from the air discharge port 511 of the air nozzle 51, the  
10 adjacently disposed air discharge port 511 and liquid discharge port 5521 are required to be in positions facing the opening 41 formed through the top cover 40. At this time, since the air nozzle 51 and the liquid nozzle 55 are mounted on the pedestal portion 57, they are positioned according to sizes or formation positions of the pedestal engaging projection 5517, the nozzle  
15 mounting portion 576, and the inclined portion 575, the inclination angle of the inclined portion 575, or the like. Accordingly, by adjusting these sizes or the like properly, the air discharge port 511 and the liquid discharge port 5521 are in the positions facing the opening 41.

[0041] Hence, to secure high dimensional accuracy so that the air discharge  
20 port 511 and the liquid discharge port 5521 are in proper positions when the air nozzle 51 and the liquid nozzle 55 are assembled in a state of mounting the pedestal portion 57 to the pedestal-portion mounting frames 24, three members of the air nozzle 51, the liquid nozzle 55, and the pedestal portion 57 are preferably each a molded product of synthetic resin through injection  
25 molding or the like.

[0042] When the air discharge port 551 and the liquid discharge port 5521 are

located further inside than the opening 41 even though located to face the opening 41, an amount of the liquid adhering to the inner surface of the case 10 increases. Accordingly, they are preferably provided in positions as close to the opening 41 as possible, and more preferably provided to be located on  
5 or further outside than an inner virtual line along the inner surface of the case 10 which passes the opening 41, as illustrated in FIG. 4. However, since projecting further outside than the opening 41 brings a person's hand or the like into contact with them or affects an external appearance, it is preferable not to project further outside than the opening 41.

10 [0043] Hence, as illustrated in FIG. 4, the liquid discharge port 5521 of the liquid nozzle 55 is further preferably provided to be located in a range of a thickness  $t$  of a peripheral edge portion forming the opening 41, the thickness  $t$  sandwiched between an inner virtual line P along the inner surface of the case 10 which passes the opening 41 and an outer virtual line Q along an  
15 outer surface of the case 10 which passes the opening 41. This nearly eliminates adhesion of the liquid blown away by the air to the inner surface of the case 10 since the liquid discharge port 5521 of the liquid nozzle 55 is not located inside the opening 41.

[0044] On one hand, as illustrated in FIG. 4, the air discharge port 551 of the  
20 air nozzle 51 is more preferably also provided to be located in the range of the thickness  $t$  of the peripheral edge portion forming the opening 41, the thickness  $t$  sandwiched between the inner virtual line P along the inner surface of the case 10 which passes the opening 41 and the outer virtual line Q along the outer surface of the case 10 which passes the opening 41. The air  
25 discharge port 551 of the air nozzle 51 is not necessarily limited to being provided in this position as long as the liquid discharged from the liquid

discharge port 5521 can be blown away to the outside of the opening 41, but is preferably close to the liquid discharge port 5521 and suitably provided in the range of the thickness  $t$  forming the above-described opening 41 in order to suck up the liquid and blowing it away with the vicinity of the liquid  
5 discharge port 5521 at a negative pressure.

[0045] Further, in this embodiment, the opening 41 of the case 10 is formed through the top cover 40 as described above, and the outer virtual line  $Q$  passing the opening 41 is curved. Accordingly, an outer surface 552b substantially parallel to the discharge port-side flow path 5521 of the  
10 discharge port-side portion 552 in the liquid nozzle 55 is preferably also curved to be roughly along the outer virtual line  $Q$  (refer to FIG. 4 and FIGs. 7(a) to (c)). This makes it possible that the outer surface 552b does not project to the outside of the opening 41 and the liquid discharge port 5521 is set at the above-described predetermined position.

15 [0046] Through the pedestal portion 57, a tube through slit 571a is formed over a range from a portion located between a pair of the side plate portions 573, 574 on the bottom portion 571 up to a middle position of the back portion 572 as illustrated in FIGs. 8(b), (c). The tube through slit 571a is formed in a size having an opening on an extension of the connection cylinder  
20 portion 551a of the liquid nozzle 55. This causes the liquid supply tube 56 connecting the connection cylinder portion 551a and the liquid container 12 to be disposed through the tube through slit 571a.

[0047] Here, the liquid container 12 used in this embodiment is in a substantially rectangular parallelepiped shape as a whole and has a cylindrical  
25 projecting portion 12a on the top thereof, and a liquid outlet 12b is provided at a substantially central portion of the cylindrical projecting portion 12a. In

the liquid container 12, an in-container tube 12c whose lower end is immersed in the liquid is disposed, and a top end of the in-container tube 12c is connected to the liquid outlet 12b to communicate therewith. On one hand, slightly under the pedestal-portion mounting frames 24 supporting the  
5 above-described pedestal portion 57, a container connecting-portion mounting frame 25 projecting frontward from the back cover 20 and extending to a range up to over the liquid outlet 12b in a state of placing the liquid container 12 on the container support shelf 22 is provided. The container connecting portion 58 is mounted at a portion, in the container connecting-portion  
10 mounting frame 25, corresponding to the top of the liquid outlet 12b of the above-described liquid container 12.

[0048] The container connecting portion 58 is formed in a substantially disk shape with a predetermined thickness capable of fitting in the cylindrical projecting portion 12a of the liquid container 12, and provided with a  
15 vertically penetrating liquid flow-through hole 58a. When the liquid container 12 is placed on the container support shelf 22, the cylindrical projecting portion 12a of the liquid container 12 is fitted in the container connecting portion 58 by being biased upward against the upper shelf portion 21 by the elastic members 21a. Hence, the liquid outlet 12b of the liquid  
20 container 12 communicates on a lower end side of the liquid flow-through hole 58a of the container connecting portion 58.

[0049] The liquid supply tube 56 is constituted by combining a first tube 561 and a second tube 562. One end 561a of the first tube 561 is connected on an upper end side of the liquid flow-through hole 58a of the above-described  
25 container connecting portion 58. The first tube 561 extends upward from the one end 561a and passes the tube through slit 571a of the pedestal portion 57,

and, is slightly bent in the middle thereof to be formed in a substantially L shape (preferably, a substantially L shape in which a crossing angle of two sides is an obtuse angle) extending in the connection cylinder portion 551a direction of the liquid nozzle 55. This causes a tip opening 561b of the first  
5 tube 561 to be in an opening direction nearly toward the connection cylinder portion 551a.

[0050] The second tube 562 connects the tip opening 561b of the first tube 561 and the connection cylinder portion 551a of the liquid nozzle 55. Since the tip opening 561b of the first tube 561 is in the opening direction nearly  
10 toward the connection cylinder portion 551a, the second tube 562 connecting the two is disposed nearly straight.

[0051] Note that the first tube 561 has a portion bent after passing the tube through slit 571a as described above, and is preferably formed of a pipe member of metal, rigid plastic, or the like so as to prevent crush of the tube  
15 from occurring at the bent portion.

[0052] Since the liquid supply tube 56 of this embodiment is constituted of the first tube 561 passing the tube through slit 571a as described above and the second tube 562 disposed nearly straight between the first tube and the liquid nozzle 55, as illustrated in FIG. 4, it is possible to suppress a spraying  
20 failure due to a kink without forming an extremely bent portion in the middle thereof.

[0053] Next, the operation of the spraying mechanism 50 will be described.

Air (compressed air) is fed into the air nozzle 51 by driving the compressor 54, and the air (compressed air) is jetted from the air discharge  
25 port 511 obliquely upward with respect to the horizontal direction. Note that when the illumination sensor 13 is provided as in this embodiment, detection

of a predetermined brightness with the illumination sensor 13 causes a control signal to be sent from the control unit 70 to drive the compressor 54.

[0054] When the air (compressed air) is jetted, the air passes the outside in the vicinity of the liquid discharge port 5521 of the liquid nozzle 55 so as to  
5 be substantially orthogonal to a discharge direction of the liquid, namely to cross the liquid since the liquid discharge port 5521 of the liquid nozzle 55 is close to the air discharge port 511 of the air nozzle 51 as described above. Hence, the vicinity of the liquid discharge port 5521 of the liquid nozzle 55 is brought into a negative pressure, and the liquid such as an aromatic or a  
10 deodorant in the liquid container 12 is sucked through the liquid supply tube 56 and discharged from the liquid discharge port 5521 at a tip of the liquid nozzle 55. The liquid is discharged from the liquid nozzle 55 to the outside, simultaneously to which the air, jetted from the air nozzle 51, passing the immediate front of the liquid discharge port 5521 collides therewith. Then,  
15 the liquid is made fine to a mist M of several tens  $\mu\text{m}$  or less or several  $\mu\text{m}$  or less and passes the opening 41 of the top cover 40 to be blown away and diffused to the outside in response to an air pressure jetted from the air nozzle 51 (refer to FIG. 4).

[0055] As described above, the air (compressed air) passes the outside in the  
20 vicinity of the liquid discharge port 5521 of the liquid nozzle 55, and thereby the liquid is forced to be sucked from the interior of the liquid container 12 through the liquid supply tube 56 and blown away. At this time, since there is no crush in the liquid supply tube 56 and the liquid is ejected smoothly as described above, and, the position of the liquid discharge port 5521 of the  
25 liquid nozzle 55 is located in the range of the thickness  $t$  of the opening 41 as described above, the amount of the liquid adhering to the inner surface of the

case 10 decreases, which enables suppression of a waste of the liquid. Further, the air nozzle 51, the liquid nozzle 55, and the pedestal portion 57 are molded products of synthetic resin as described above, and only engaging these in one another makes it possible to make the liquid discharge port 5521  
5 and the air discharge port 511 close to each other at a predetermined distance and to be located in such a proper range as the range of the thickness  $t$  of the opening 41. As a result, as compared with a conventional structure in which an air nozzle and a liquid nozzle are formed by pipes made of metal and disposed separately in a case, the air nozzle 51 and the liquid nozzle 55 are  
10 easy to mount in the proper positions in the case 10, which allows assembly operation to be simplified, and the mist  $M$  of the sprayed liquid is promoted to be finer. Hence, the mist  $M$  of the sprayed liquid is allowed to drift in air for a longer stretch of time, which allows a liquid effect of an aroma or the like to be spread more uniformly throughout in large space such as a restroom in a  
15 hotel, a restaurant, or the like.

[0056] Further, the control unit 70 can also be configured to spray automatically when a predetermined time comes by setting a timer for a driving time to spray the liquid, for example. On one hand, when the liquid spray device 1 of this embodiment is placed in a public restroom or the like,  
20 for example, the spraying is not required in a time zone in the absence of person's use. Thus, by providing the illumination sensor 13 as described above, a configuration to be driven to spray in only a case of becoming a brightness more than or equal to a predetermined brightness enables a reduction of waste of liquid consumption.

25 [0057] Further, the container support shelf 22 supporting the liquid container 12 is disposed through the elastic members 21a on the upper shelf portion 21.

This causes the liquid outlet 12b of the liquid container 12 to be communicated with the liquid flow-through hole 58a of the container connecting portion 58 located thereover by the elastic members 21a as long as the liquid container 12 is placed on the container support shelf 22. In a structure in Patent Document 2, a configuration to extend a liquid supply tube to the interior and the exterior of a liquid container and connect a liquid nozzle thereto has required time for exchange work of the liquid container. However, according to this embodiment, as long as the empty liquid container 12 on the container support shelf 22 is pushed downward against elastic force of the elastic members 21a and removed by releasing the fit with the container connecting portion 58, and next the new liquid container 12 is placed on the container support shelf 22 again while being pushed downward, the liquid container 12 is connected to the container connecting portion 58 by the elastic force of the elastic members 21a, which thus makes the exchange work easy.

[0058] Note that the configuration such that the liquid is sucked and discharged by the negative pressure of the air ejected from the air nozzle 51 is described above, and a configuration such that a pump (not illustrated) is provided between the liquid container 12 and the liquid supply tube 56 and a required amount of the liquid is sucked by driving this pump is also practicable. Driving the pump forces a predetermined amount of the liquid to be discharged from the liquid discharge port 5521 at a tip of the liquid nozzle 55, and the air jetted from the air nozzle 51 collides with the liquid. Thereafter, similarly to the above embodiment, the liquid is made fine in a mist form. When the performance of the compressor 54, namely, a pressure of the air jetted from the air nozzle 51 is not very high, or the like, such a configuration to use the pump as described above is also practicable.

## Explanation of Reference Signs

|    |          |                                                                   |
|----|----------|-------------------------------------------------------------------|
| 5  | [0059] 1 | liquid spray device                                               |
|    | 10       | case                                                              |
|    | 12       | liquid container                                                  |
|    | 20       | back cover                                                        |
|    | 30       | body cover                                                        |
| 10 | 40       | top cover                                                         |
|    | 41       | opening                                                           |
|    | 50       | spraying mechanism                                                |
|    | 51       | air nozzle                                                        |
|    | 516      | engaging groove portion (nozzle engaging portion (of air nozzle)) |
| 15 | 52       | air supply tube                                                   |
|    | 54       | compressor                                                        |
|    | 55       | liquid nozzle                                                     |
|    | 5516     | engaging projection (nozzle engaging portion (of liquid nozzle))  |
|    | 5517     | pedestal engaging projection (pedestal engaging portion)          |
| 20 | 56       | liquid supply tube                                                |
|    | 57       | pedestal portion                                                  |
|    | 575      | inclined portion                                                  |
|    | 576      | nozzle mounting portion                                           |

25

## CLAIMS:

1. A liquid spray device comprising:
  - a spraying mechanism including a liquid nozzle connected through a
  - 5 liquid supply tube to a liquid container in which a liquid is contained, and an
  - air nozzle which is connected through an air supply tube to an air supply source
  - and jets air to make the liquid discharged from a liquid discharge port of the
  - liquid nozzle in a mist form; and
  - a case including an opening of which in a vicinity, the liquid discharge
  - 10 port of the liquid nozzle and an air discharge port of the air nozzle are disposed,
  - the opening for discharging the liquid made in a mist form by jetting the air to
  - an outside,
  - the liquid nozzle comprising: a discharge port-side portion formed with
  - a discharge port-side flow path having the liquid discharge port; and an inlet-
  - 15 side portion having a liquid inlet to which the liquid is introduced through the
  - liquid supply tube and formed with an inlet-side flow path communicating with
  - the discharge port-side flow path,
  - through the air nozzle, an air flow path having the air discharge port
  - being formed,
  - 20 in and on peripheral wall portions of the liquid nozzle and the air nozzle,
  - respective nozzle engaging portions in a positional relationship in which a
  - discharge direction of the air forms a predetermined angle with a discharge
  - direction of the liquid and the air discharge port and the liquid discharge port
  - are close to each other at a predetermined distance being formed in a state of
  - 25 engaging in each other, and
  - on the peripheral wall portion of the liquid nozzle, a pedestal engaging

portion different from the nozzle engaging portion being formed, in a state of engaging the pedestal engaging portion in a nozzle mounting portion of a pedestal portion provided in a predetermined position in the case, the air discharge port and the liquid discharge port being disposed in the vicinity of the opening with the liquid discharge port further upward than a horizontal direction and with the air discharge port in a posture toward an outside of the opening.

2. The liquid spray device according to claim 1, wherein the liquid discharge port of the liquid nozzle is provided to be located on or further outside than an inner virtual line along an inner surface of the case which passes the opening.

3. The liquid spray device according to claim 2, wherein the liquid discharge port of the liquid nozzle is provided to be located in a range of a thickness of a peripheral edge portion forming the opening, the thickness sandwiched between the inner virtual line and an outer virtual line along an outer surface of the case.

4. The liquid spray device according to claim 3, wherein the air discharge port of the air nozzle is provided to be located in the range of the thickness of the peripheral edge portion forming the opening, the thickness sandwiched between the inner virtual line and the outer virtual line along the outer surface of the case.

25

5. The liquid spray device according to any one of claims 1 to 4, wherein

the pedestal portion has an inclined portion which becomes higher as approaching the opening, and the inclined portion is provided with the nozzle mounting portion.

5 6. The liquid spray device according to claim 5,

wherein in the inlet-side portion of the liquid nozzle, a range of a predetermined length from the liquid inlet toward the discharge port-side portion serves as a connection cylinder portion for connecting the liquid supply tube, and

10 wherein through the pedestal portion, a tube through slit passed by the liquid supply tube connecting the connection cylinder portion and the liquid container is formed.

7. The liquid spray device according to claim 6, wherein the liquid supply  
15 tube comprises:

a first tube communicated on the liquid container side, and through the tube through slit, fixedly disposed so that a tip opening is open toward the connection cylinder portion of the liquid nozzle; and

a second tube connecting the first tube and the connection cylinder  
20 portion.

8. The liquid spray device according to any one of claims 1 to 7, wherein in the case, a container support shelf supporting the liquid container is provided, and a container connecting portion in which when a liquid outlet of the liquid  
25 container is connected in a state in which the liquid container is supported by the container support shelf, a liquid flow-through hole communicates with the

liquid outlet is provided, and the liquid supply tube is disposed to communicate with the liquid flow-through hole of the container connecting portion.

9. The liquid spray device according to claim 8, wherein to be capable of  
5 biasing the liquid container supported by the container support shelf in a direction in which the liquid outlet is pressed in the container connecting portion direction, the container support shelf is supported through elastic members in the case.
- 10 10. The liquid spray device according to any one of claims 1 to 9, wherein any of the liquid nozzle, the air nozzle, and the pedestal portion is a molded product of synthetic resin.