STRUCTURE OF GYRATING NOZZLE SPRAY GUN

An improved structure of gyrating nozzle spray gun includes a grip including an air inlet and a trigger-controlled valve seat, an attachment tube connected to the valve seat, and a gyrating nozzle head including a connection nut threaded onto a front tubular mating connection screw rod of the attachment tube, an end cap threaded onto outer thread of the connection nut, a bearing positioned in the end cap, and a rotator supported on the connection nut and inserted through the bearing into a front opening of the end cap and rotatable with an inner race of the bearing and defining therein a plenum chamber for receiving compressed air from the valve seat via the attachment tube and the connection nut and an oblique jet hole eccentrically located in a front side thereof for ejecting compressed air and causing the rotator to rotate during ejection of compressed air.
FIG. 4
STRUCTURE OF GYRATING NOZZLE SPRAY GUN

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to spray gun technology and more particularly, to an improved structure of gyrating nozzle spray gun, which comprises a grip, an attachment tube connected to the grip, and a gyrating nozzle head connected to the attachment tube and holding a rotator in a bearing inside an end cap thereof for ejecting compressed air in a spiral pattern.

[0003] 2. Description of the Related Art

[0004] With advances in technology, all aspects of the quality of our lives have been continuously improving. In transportation, cars and motorcycles are widely used by people as personal transportable vehicles. The number of cars and motorcycles keeps increasing. Many automatic washing machines are commercially available for washing cars and motorcycles. These automatic washing machines commonly use rotating brushes for cleaning cars. Cleaning a car with rotating brushes cannot effectively remove stains and dirt from the edges, or convex and concave portions of the body of the car. Some people would wash their car manually with clean water, and then wipe off residual water stains from the body of the car with a dry cloth. However, cleaning a car in this manner is labor intensive and time consuming.

[0005] In the implementation of a general cleaning work, people normally will apply a flow of water to the surface of the object to be cleaned and simultaneously wipe the surface of the object with a brush or cloth. When cleaning a car or a building, it is necessary to apply a strong jet of water to the surface to be cleaned and then to wipe the surface with a brush or cloth. For ejecting a strong jet of water onto the surface to be cleaned, people normally will attach a water hose to a water tap and squeeze the terminal end of the water hose with the fingers, causing water to be ejected out of the terminal end of the water hose onto the surface to be cleaned. After washing the surface with jets of water, a brush or cloth is then used to clean the washed surface. This cleaning method is time-consuming and wastes a large amount of water, and therefore, it does not meet the demands of energy and water saving. In order to improve the problem of waste of water resources, some designs are created to combine the use of high-pressure air with a water gun for strengthening the force of water scour and controlling the time of water consumption, avoiding causing a huge loss of water. As illustrated in FIG. 7, a conventional gyrating nozzle spray gun A is shown. The gyrating nozzle spray gun A generally comprises a handle A1, a T-bar A2, a liquid tank A3, and a spray nozzle assembly B. The spray nozzle assembly B comprises a horn-shaped barrel B1 having a screw connection B11 located at one end thereof and fastened to an air output end A4 of the T-bar A2, a gyrating tube C having connector C1 located at one end thereof and rotatably coupled to air output end A4 of the T-bar A2 inside the screw connection B11, a plurality of counterweights C2 mounted around the periphery of the gyrating tube C, a dip tube C3 inserted through the gyrating tube C and the T-bar A2 and dipped in the liquid tank A3, and a nozzle tip C31 located at one end of the dip tube C3. In application, a flow of compressed air from an external compressed air source is guided through an air passage in the handle A1 and the T-bar A2 into the gyrating tube C. When compressed air goes through the gyrating tube C and the nozzle tip C31 of the dip tube C3, a Venturi effect is created to suck the storage liquid out of the liquid tank A3 into the T-bar A2 for mixing with the compressed air around the nozzle tip C31 so that the air-liquid mixture can be forced out of horn-shaped barrel B1 in the form of a mist of fine droplets for application. However, in actual application, when the gyrating tube C of the gyrating nozzle spray gun A is forced by the flow of compressed air to rotate in the horn-shaped barrel B1 at a high speed, the gyrating tube C and the counterweights C2 will be forced to rub against the inside wall of the horn-shaped barrel B1, causing the horn-shaped barrel B1 to wear quickly with use. After a long use, the connection area between the connector C1 of the gyrating nozzle C and the output end A4 of the T-bar A2 can break easily, and the broken component part can be forced out of the horn-shaped barrel B1, leading to an accident.

[0006] Therefore, it is desirable to provide a gyrating nozzle spray gun that eliminates the problem of rubbing between the gyrating nozzle and the inside wall of the horn-shaped barrel and the problem of breaking risk of the gyrating tube during operation.

SUMMARY OF THE INVENTION

[0007] The present invention has been accomplished under the circumstances in view. It is therefore the main object of the present invention to provide an improved structure of gyrating nozzle spray gun, which comprises a grip, an attachment tube connected to the grip, and a gyrating nozzle head connected to the attachment tube and holding a rotator in a bearing inside an end cap thereof for ejecting compressed air in a spiral pattern, and thus, the invention eliminates the problem of rubbing between component parts and the problem of breaking risk of the gyrating tube during operation as seen in the prior art design.

[0008] In one embodiment of the present invention, the improved structure of gyrating nozzle spray gun comprises a grip that comprises a trigger-controlled valve seat, an attachment tube connected to the valve seat of the grip, and a gyrating nozzle head mounted on the attachment tube. The gyrating nozzle head comprises a connection nut threaded onto the attachment tube, an end cap threaded onto the connection nut, a bearing positioned in an accommodation open chamber of the end cap, and a rotator mounted in the accommodation open chamber of the end cap and rotatable with the inner race of the bearing relative to the end cap. When operating the trigger of the grip to open the valve seat, compressed air is guided from an external high-pressure air source through an air inlet of the grip into the attachment tube and the gyrating nozzle head and then forced out of an oblique jet hole in the rotator of the gyrating nozzle head, and thus, a swirling flow of compressed air is ejected out of the spray gun.

[0009] In an alternate form of the present invention, the rotator further comprises a through hole located in the front side thereof. Further, the attachment tube is a T-shaped three-way tube, comprising a bottom connection tube located at a bottom side thereof and mounted with a water tank, a dip tube connected to the bottom connection tube and inserted into the water tank for sucking a fluid (such as clean water, cleaning solution, soapy water or water wax) from the water tank into the bottom connection tube, a water-supply tube connected to the bottom connection tube in commun-
cation with the dip tube and inserted into the gas-delivery hole of the attachment tube, the through hole of the connection nut and the plenum chamber of the rotator and terminating in a water outlet tip that is inserted into the through hole in the front side of the rotator. Further, the diameter of the through hole of the rotator is larger than the outer diameter of the water outlet tip so that an annular gap is defined in the through hole of the rotator around the water outlet tip for the passing of compressed air. Thus, when a swirling flow of compressed air is ejected out of the oblique jet hole of the gyrating nozzle, and simultaneously ejected out of the annular gap in the through hole around the water outlet tip, a flow of fluid is sucked into the bottom connection tube of the attachment tube and ejected out of the water outlet tip of the water-supply tube, and the fluid being ejected out of the water outlet tip is then turned into a mist, compressed air is simultaneously ejected out of the oblique jet hole, making the mist finer.

[0010] Other advantages and features of the present invention will be fully understood by reference to the following specification in conjunction with the accompanying drawings, in which like reference signs denote like components of structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is an oblique top elevational view of an improved structure of gyrating nozzle spray gun in accordance with the present invention.
[0012] FIG. 2 is an exploded view of the improved structure of gyrating nozzle spray gun in accordance with the present invention.
[0013] FIG. 3 is a schematic sectional side view of the improved structure of gyrating nozzle spray gun in accordance with the present invention.
[0014] FIG. 4 is an enlarged view of Part A of FIG. 3.
[0015] FIG. 5 is a schematic sectional side view of an alternate form of the improved structure of gyrating nozzle spray gun in accordance with the present invention.
[0016] FIG. 6 is an enlarged view of Part B of FIG. 5.
[0017] FIG. 7 is a sectional side view of a gyrating nozzle spray gun according to the prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] Referring to FIGS. 1-4, an elevational view of an improved structure of gyrating nozzle spray gun, an exploded view of the improved structure of gyrating nozzle spray gun, a sectional side view of the improved structure of gyrating nozzle spray gun and an enlarged view of Part A of FIG. 3 are shown. As illustrated, the gyrating nozzle spray gun comprises a grip 1, an attachment tube 2 and a gyrating nozzle head 3.

[0019] The grip 1 comprises an air inlet 11 located at a bottom side thereof, a valve seat 12 located at a top side thereof, and a trigger 13 operable to open the valve seat 12 for letting an outer compressed flow of air go through the air inlet 11 into the valve seat 12 toward an air outlet 121 of the valve seat 12.

[0020] The attachment tube 2 comprises a mating connection end piece 21 located at one end thereof, a mating connection screw rod 22 located at an opposite end thereof, and a gas-delivery hole 20 axially extending through the mating connection end piece 21 and the mating connection screw rod 22.

[0021] The gyrating nozzle head 3 comprises a connection nut 31, an end cap 32 fastened to the connection nut 31, and a rotator 33 and a bearing 34 movably mounted in the end cap 32. The connection nut 31 comprises a through hole 310 extending through opposing front and rear sides thereof. A screw hole 311 located in the rear side within the through hole 310, and an outer thread 312 extending around the periphery of the front side. The end cap 32 comprises an accommodation open chamber 320, an inner thread 321 located in one side of the accommodation open chamber 320 and threaded onto the outer thread 312 of the connection nut 31, and an opening 322 located in an opposite side of the accommodation open chamber 320. The rotator 33 is accommodated in the accommodation open chamber 320 of the end cap 32, comprising a recessed plenum chamber 330, an oblique jet hole 331 eccentrically and obliquely located at the front wall 334 in communication with the plenum chamber 330, a radial stop flange 332 formed around the plenum chamber 330 and a circular peripheral stop wall 333 located on the front surface of the radial stop flange 332. The bearing 34 is mounted in the accommodation open chamber 320 of the end cap 32 around the rotator 33 and stopped at the radial stop flange 332 of the rotator 33 with the inner race 340 abutted against the circular peripheral stop wall 333 of the rotator 33. Thus, after the outer race of the bearing 34 is positioned in the accommodation open chamber 320 of the end cap 32, the front wall 334 of the rotator 33 is rotatably inserted into the opening 322 of the end cap 32 with the oblique jet hole 331 facing toward the outside of the end cap 32, and the rotator 33 can then be rotated with the inner race 340 of the bearing 34 in the accommodation open chamber 320 of the end cap 32.

[0022] In installation of the gyrating nozzle spray gun, the air inlet 11 of the grip 1 is connected to an external high-pressure air source (such as air compressor), and then, the mating connection end piece 21 of the attachment tube 2 is connected to the air outlet 121 of the valve seat 12 of the grip 1, and then a gasket ring 221 is attached to the tubular mating connection screw rod 22 of the attachment tube 2, and then the screw hole 311 of the connection nut 31 of the gyrating nozzle head 3 is threaded onto the tubular mating connection screw rod 22 of the attachment tube 2 and stopped against the gasket ring 221 tightly to seal the gap in the connection between the connection nut 31 and the tubular mating connection screw rod 22 and to keep the through hole 310 of the connection nut 31 and the plenum chamber 330 of the rotator 33 in line and communication with the gas-delivery hole 20 of the attachment tube 2. Thus, the grip 1, the attachment tube 2 and the gyrating nozzle head 3 are assembled to constitute the gyrating nozzle spray gun of the present invention. When a flow of high-pressure air is delivered through the air inlet 11 of the grip 1 and the air outlet 121 of the valve seat 12 into the gas-delivery hole 20 of the attachment tube 2 and the plenum chamber 330 of the rotator 33, the running flow of high-pressure air will be accumulated in the plenum chamber 330 of the air rotator 33 and forced out of the oblique jet hole 331, and the rotator 33 will be simultaneously forced by the running flow of high-pressure air to rotate with the inner race 340 of the bearing 34 in the end cap 32.
In actual application of the gyrating nozzle spray gun, the user can operate the trigger 13 of the grip 1 to open the valve seat 12, enabling a flow of high-pressure air to be delivered from the external high-pressure air source through the air inlet 11 of the grip 1 and the air outlet 121 of the valve seat 12 into the gas-delivery hole 20 of the attachment tube 2, the through hole 310 of the connection nut 31 and then the plenum chamber 330 of the rotator 33. When the running flow of high-pressure air is being delivered into the plenum chamber 330 of the air rotator 33, it will be accumulated in the plenum chamber 330 of the air rotator 33 and forced out of the oblique jet hole 331. Because the oblique jet hole 331 is eccentrically and obliquely located at the front wall 334 and the bearing 34 is supported on the radial stop flange and circular peripheral stop wall 333 of the rotator 33, when the high-pressure air is accumulated in the plenum chamber 330 of the air rotator 33 and forced out of the oblique jet hole 331, the rotator 33 will be forced by the running flow of high-pressure air to rotate with the inner race 340 of the bearing 34 in the opening 322 of the end cap 32, and therefore, the high-pressure air is continuously ejected out of the oblique jet hole 331 of the rotator 33 in a spiral pattern.

Referring to FIGS. 5 and 6, a schematic sectional side view of an alternate form of the present invention and an enlarged view of Part B of FIG. 5 are shown. This alternate form is practical for ejecting a swirling flow of water mist. According to this alternate form, the attachment tube 2 is a T-shaped three-way tube comprising a bottom connection tube 23 vertically disposed at a bottom side thereof for the connection of a water tank 231. Further, a dip tube 232 is connected to the bottom connection tube 23 and suspending in the water tank 231 near the bottom wall of the water tank 231. Further, a water-supply tube 233 is mounted in the gas-delivery hole 20 of the attachment tube 2 and extended from the bottom connection tube 23 through the gas-supply hole 20 of the attachment tube 2 and the through hole 310 of the connection nut 31 of the gyrating nozzle head 3 into the plenum chamber 330 of the rotator 33, and terminating in a water outlet tip 2331 that is inserted into a through hole 335 in the front wall 334 of the rotator 33. Further, the through hole 335 has a diameter larger than the outer diameter of the water outlet tip 2331 so that an annular gap is left in the through hole 335 around the water outlet tip 2331 of the water-supply tube 233.

In application, connect the air inlet 11 of the grip 1 to an external high-pressure air source (air compressor) with a high pressure hose 111, and then operate the trigger 13 of the grip 1 to control the intake of compressed air from the external high-pressure air source through the air inlet 11 and an air-delivery hole 121 of the valve seat 12 into the gas-delivery hole 20 of the attachment tube 2, enabling the intake flow of compressed air to go through the through hole 310 of the connection nut 31 of the gyrating nozzle head 3 into the plenum chamber 330 of the rotator 33 of the gyrating nozzle head 3 and then to go from the plenum chamber 330 through the oblique jet hole 331 toward the outside of the spray gun and to simultaneously force the rotator 33 to rotate with the inner race 340 of the bearing 34 relative to the end cap 32, and thus, a strong jet of air is continuously rotated and ejected out of the spray gun. When the intake flow of compressed air goes through the annular gap in the through hole 335 around the water outlet tip 2331, a Venturi effect is created in the through hole 335 of the rotator 33, causing the contained fluid to be sucked from the water tank 231 through the dip tube 232 and the bottom connection tube 23 into the water-supply tube 233 and then guided out of the water-supply tube 233 through the water outlet tip 2331 that is inserted into the through hole 335 of the rotator 33. When a flow of fluid is being ejected out of the water outlet tip 2331, compressed air is continuously guided into the plenum chamber 330 of the rotator 33 and ejected out of the oblique jet hole 331 and the annular gap in the through hole 335 around the water outlet tip 2331, causing the flow of fluid being ejected out of the water outlet tip 2331 to be turned into a mist.

Thus, when the user operates the trigger 13 of the grip 1 to let a flow of compressed air go from the external high-pressure air source through the air inlet 11 into the attachment tube 2 to the outside of the spray gun through the oblique jet hole 331 of the rotator 33 of the gyrating nozzle head 3 and the annular gap in the through hole 335 around the water outlet tip 2331, a flow of fluid is ejected out of the water outlet tip 2331 and turned into a mist. When a strong jet of compressed air is ejected out of the annular gap in the through hole 335 around the water outlet tip 2331 to turn the ejected flow of fluid into a mist, compressed air is simultaneously ejected out of the oblique jet hole 331, making the mist finer.

Further, the threading direction of the connection between the inner thread 321 of the end cap 32 and the outer thread 312 of the connection nut 31 is reversed to the direction of rotation of the rotator 33 in the accommodation open chamber 320 of the end cap 32. Therefore, in application, the end cap 32 will not be forced away from the connection nut 31, assuring a high level of spray gun operating safety and reducing the degree of danger in application.

As described above, the attachment tube 2 is connected to the grip 1 and the screw hole 311 of the connection nut 31 of the gyrating nozzle head 3 is threaded onto the tubular mating connection screw rod 22 of the attachment tube 2, and then the end cap 32 of the gyrating nozzle head 3 is threaded onto the connection nut 31 to hold the bearing 34 and the rotator 33 therein. In application, the air inlet 11 of the grip 1 is connected to an external high-pressure air source. When the trigger 13 is operated to open the valve seat 12, compressed air is guided through the air inlet 11 of the grip 1 and the gas-delivery hole 20 of the attachment tube 2 and the rotator 33 of the gyrating nozzle head 3, and then forced out of the oblique jet hole 331 of the rotator 33, and the centrifugal force thus produced causes the rotator 33 to rotate with the inner race 340 of the bearing 34. Further, the water tank 231 is connected to the bottom connection tube 23 of the attachment tube 2, and the dip tube 232 is connected to the bottom connection tube 23 and dipped in the water tank 231. Thus, when a swirling flow of compressed air is ejected out of the annular gap in the through hole 335 around the water outlet tip 2331, a flow of fluid is sucked into the dip tube 232 and guided through the water-supply tube 233 and the water outlet tip 2331 toward the outside of the rotator 33, and the fluid being ejected out of the water outlet tip 2331 is then turned into a mist, compressed air is simultaneously ejected out of the oblique jet hole 331, making the mist finer.

In conclusion, the invention provides an improved structure of gyrating nozzle spray gun, which comprises a grip that comprises a trigger-controlled valve seat, an attachment tube connected to the valve seat of the grip, and a
gyrating nozzle head mounted on the attachment tube. The gyrating nozzle head comprises a connection nut threaded onto the attachment tube, an end cap threaded onto the connection nut, a bearing positioned in an accommodation open chamber of the end cap, and a rotator mounted in the accommodation open chamber of the end cap and rotatable with the inner race of the bearing relative to the end cap. When operating the trigger of the grip to open the valve seat, compressed air is guided from an external high-pressure air source through an air inlet of the grip into the attachment tube and the gyrating nozzle head and then forced out of an oblique jet hole in the rotator of the gyrating nozzle head, and thus, a swirling flow of compressed air is ejected out of the spray gun. Further, the attachment tube can be configured to provide a bottom connection tube for the connection of a water tank, and a water-supply tube can be mounted in the attachment tube and extended from the bottom connection tube to the rotator. Thus, when a swirling flow of compressed air is ejected out of the annular gap in the through hole around the water outlet tip, a flow of fluid is sucked into the bottom connection tube of the attachment tube and ejected out of the water outlet tip of the water-supply tube, and the fluid being ejected out of the water outlet tip is then turned into a mist, compressed air is simultaneously ejected out of the oblique jet hole, making the mist finer.

[0030] Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

What the invention claimed is:

1. An improved structure of gyrating nozzle spray gun, comprising a grip, an attachment tube connected to said grip, and a gyrating nozzle head mounted on a front end of said attachment tube remote from said grip, said grip comprising an air inlet connectable to an external high-pressure air source for the intake of compressed air, a valve seat and a trigger operable to open said valve seat for letting said compressed air flow into said attachment tube and said gyrating nozzle head, wherein:

said attachment tube comprises a tubular mating connection screw rod located at the front end thereof;
said gyrating nozzle head comprises a connection nut, said connection nut comprising a through hole extending through opposing front and rear sides thereof, a screw hole located in said rear side and threaded onto said tubular mating connection screw rod of said attachment tube, an outer thread extending around the periphery of the front side thereof, an end cap, said end cap comprising an accommodation open chamber, an inner thread located in a rear side of said accommodation open chamber and threaded onto said outer thread of said connection nut and an opening located in an opposing front side of said accommodation open chamber, a bearing positioned in said accommodation open chamber of said end cap, and a rotator mounted in said bearing inside said accommodation open chamber and rotatable relative to said end cap and said attachment tube, said rotator comprising a plenum chamber disposed in communication with the through hole of said connection nut for receiving said compressed air flow and an oblique jet hole obliquely located in a front side thereof in communication with said plenum chamber for ejecting said compressed air flow out of said rotator and said end cap.

2. The improved structure of gyrating nozzle spray gun as claimed in claim 1, wherein said rotator inserted into said opening of said end cap comprises a radial stop flange formed around the plenum chamber, and a circular peripheral stop wall located on the front surface of the radial stop flange; said bearing is stopped at the radial stop flange of the rotator thereof abutting against the circular peripheral stop wall of the rotator.

3. The improved structure of gyrating nozzle spray gun as claimed in claim 1, further comprising a gasket ring mounted on said tubular mating connection screw rod of said attachment tube and sealed between said attachment tube and said connection nut of said gyrating nozzle head.

4. The improved structure of gyrating nozzle spray gun as claimed in claim 1, wherein said bearing is tightly press-fitted into said accommodation open chamber of said end cap of said gyrating nozzle head, comprising a rotatable inner race attached to said rotator for rotation with said rotator relative to said end cap and said attachment tube; said rotator inserted into said opening of said end cap comprises a radial stop flange formed around the plenum chamber, and a circular peripheral stop wall located on the front surface of the radial stop flange; said bearing is stopped at the radial stop flange of the rotator thereof abutting against the circular peripheral stop wall of the rotator.

5. The improved structure of gyrating nozzle spray gun as claimed in claim 1, wherein said oblique jet hole of said rotator of said gyrating nozzle head is disposed at an eccentric location in communication with said plenum chamber.

6. The improved structure of gyrating nozzle spray gun as claimed in claim 1, wherein said rotator further comprises a through hole located in the front side thereof, said attachment tube is a T-shaped three-way tube, comprising a bottom connection tube located at a bottom side thereof and mounted with a water tank, a dip tube connected to said bottom connection tube and inserted into said water tank for sucking a fluid from said water tank into said bottom connection tube, a water-supply tube connected to said bottom connection tube in communication with said dip tube and inserted into said gas-delivery hole of said attachment tube, the through hole of said connection nut and said plenum chamber of said rotator and terminating in a water outlet tip, said water outlet tip of said water-supply tube being inserted into the through hole in the front side of said rotator near said oblique jet hole.

7. The improved structure of gyrating nozzle spray gun as claimed in claim 6, wherein the through hole of said rotator is located at one lateral side of said oblique jet hole and disposed in communication with said plenum chamber; said oblique jet hole of said is obliquely located at an eccentric location in the front side of said rotator.

8. The improved structure of gyrating nozzle spray gun as claimed in claim 6, wherein the diameter of the through hole of said rotator is larger than the outer diameter of said water outlet tip so that an annular gap is defined in the through hole of said rotator around said water outlet tip for the passing of said compressed air flow.

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