ABSTRACT OF THE DISCLOSURE

This invention relates to a device which insures full power, pressure and flow from an aerosol container to a jet means, which in turn increases the speed of flow of the fluid for various purposes, such as, the production of a mixture thereof with another fluid. Low power, pressure and flow caused by partial opening only of the discharge valve is prevented from reaching the jet means by a valving system which allows fluid to flow to a control chamber but prevents flow to the jet means until the discharge valve has been removed a predetermined distance to its open position.

This invention relates to the provision of full power, pressure and flow of a primary fluid from an aerosol container for delivery to jet means which significantly increases the speed of the fluid for various purposes, particularly the mixture of the jet stream with a secondary fluid.

In the preparation of mixtures of fluids where one fluid is contained in a pressurized container, a mixture of substantially constant quality and proportions can be obtained if the user is careful and makes certain that the discharge valve of the container is fully open. This invention provides a system which prevents discharge until and unless the discharge valve is fully opened. Preferably the pressurized fluid is passed through a jet means to produce a high speed jet stream which is then passed through an in-line confined mixing zone where entrained and/or gravity fed secondary fluid is turbulently mixed therewith prior to discharge.

If the discharge valve is partially opened, the fluid flows into a control chamber of small capacity—in effect the control chamber is merely an extension of the container and its control chamber release valve can be viewed as being a second discharge valve. When the discharge valve is fully open, a flow path of significant capacity is provided to the jet means to insure delivery of full power, pressure and flow without significant losses or hold-up in the control chamber.

It will be recognized that in the hair tinting field, the instant invention provides a device which can be relied upon to prevent the discharge of dangerous and improperly proportioned hair tinting mixtures. The insured constant and thorough mix concept can be applied to foams in all fields, including foods.

Other objects and advantages of the present invention will be apparent upon reference to the accompanying description, when taken in conjunction with the following drawings, wherein:

FIGURE 1 is a cross-sectional view of one modification of a device mounted on a container;
FIGURE 2 is a cross-sectional view of the control chamber area taken in line 2—2 of FIGURE 1;
FIGURE 3 is a view similar to FIGURE 2 with the discharge valve of the container fully depressed to open position;
FIGURE 4 is a view taken on line 4—4 of FIGURE 1;
FIGURE 5 is a view taken on line 5—5 of FIGURE 3;
FIGURE 6 is a view taken on line 6—6 of FIGURE 1;

FIGURE 7 is a cross-sectional view of another modification of the device mounted on a container;
FIGURE 8 is a view of the lower portion of FIGURE 7 with the discharge valve of the container fully depressed to open position; and
FIGURE 9 is a view taken on line 9—9 of FIGURE 7.

Referring now to FIGURES 1–6, it will be seen that the device includes a jet means 15 which is capable of producing a higher speed jet stream than produced by the normal stem 16 of the discharge valve 17 of the primary fluid pressurized container 18. The jet means 15 may be positioned in a movable control means 19 as shown in FIGURE 1 or in the fixed housing means 60, as shown in FIGURE 7.

Preferably the jet means 15 includes an orifice having a cross sectional area equal to an opening of about 0.035 inch in diameter. The discharge valve 17 is of the vertical movement type, open position being reached upon vertical downward movement of the stem 16 a distance of about 1/4 to 3/8 of an inch. The stem 16 has a somewhat standardized opening of about 0.070 inch in diameter.

The housing means 20 has an outer flexible clamping member 21 for rigid clamped connection to the outer rim 22 of the container 18. Various other coupling means known in the art can be used. The body 25 of the discharge valve 17 is surrounded by a flexible sealing socket 23 of the housing means 20 to form control chamber 24.

In the modification shown, the discharge valve 17 along with the socket 23 defines the control chamber 24; other designs can include, for example, a sealable connection with the stem 16 with the control chamber being otherwise formed entirely by the housing means 20.

A valve means 26 is movably mounted in the housing for actuation of the discharge valve 17 between open and closed positions; a control chamber release valve 27 is positioned above the valve actuator 28 and seals the control chamber 24 until it has been moved with the valve actuator 28 a predetermined distance guaranteeing the predetermined full movement of the discharge valve 17 from closed to open position.

Full pressure and flow are then provided to the jet means 15.

In the modification shown in FIGURES 1–6, the valve means 26 is part of the operating mechanism or control means 19, which, in the downstream series as a rigid unit, includes the discharge valve actuator 28, the control chamber release valve 27, the passage seal 53, the jet means 15, the mixing chamber 31 and the discharge spout 32.

The housing means 20 includes a tank 40 for the secondary fluid which is entrained into the elongated tube or mixing chamber 31 through entrainment holes 42. Preferably, the housing means 20 includes a valving flange 43 around the tube 31 having slots 44 (FIGURE 5) therein which enable a selective uncovering of one or more entrainment holes 42 to vary the flow area for the secondary fluid. FIGURES 1 and 6 show the stop pin 46 which identifies the setting of entrainment holes 42 for various mixtures, stop pin 46 being mounted on housing means 20 for engagement by stop faces 47, 47 of the rotatable control means 19.

The discharge valve actuator 28 has a horizontally slotted and vertically notched head 45 (FIGURE 4) at its upstream end which receives and seats on the stem 16 to provide an open flow path from the stem to the control chamber 24.

The control chamber release valve 27 has an annular ridge 50 which sealably engages the passage 51 of the housing means 20 until it is moved into the control chamber 24 to instantly provide a large annular flow path for the primary fluid (FIGURE 3). It will be noted that the annular ridge 50 has a large diameter so that when it passes below the annular ledge 52 in the control chamber
an open annular path is provided of significant size to insure the transmission of full flow and pressure from the control chamber 24 to the passage 51.

Preferably, the control chamber 24 is small in volume to minimize the amount of material fed thereto when the discharge valve is only partially opened and remaining therein when the discharge valve 17 is closed. The small volume of the control chamber 24 also insures a direct flow path for the primary fluid from the stem 16 to the jet means 15. No large volume of material is present between the stem and the jet means.

Downstream from the control chamber release valve 27 is a passage seal 53 which has an annular member 54 sealably engaging the passage 51 at all times. This movable passage seal 53 directs the primary fluid from the control chamber 24 through large opening 55 in the control means 19 to the jet means 15.

Preferably the tube of the mixing chamber 31 is positioned in line with the jet means 15 and has a cross-sectional area equal to an opening having a diameter of about ¾ of an inch.

Referring now to FIGURES 7-9, it will be seen that the jet means 59 is positioned in the housing means 60 for side discharge, the high speed jet stream being projected through a mixing chamber 60 in the form of an elongated stem 71 and then into an enlarged swirl type mixing nozzle 63. This modification is particularly effective in producing mixtures for hair tincturing. The secondary fluid, when released, is delivered from the tank 40 to the downstream end of the jet means 59 by duct means 64 formed in the housing means 60 and terminating at entrainment holes 65 in the duct means 64 extending from the passage 66 of the housing means 60.

The device is seen connected to the container in the same fashion as previously described, the control chamber 67 having a slightly different shape but still retaining the desired small volume.

Because of the properties of certain fluids, such as those used in hair tincturing treatments, it is important and desirable that a completely sealed cartridge or replaceable type device be provided. It will be noted that the control means 19 of the FIGURE 1 modification includes a top cover with an opening 68 therein which facilitates the user's addition of water, flavoring material, and the like. The corrosive nature of some secondary fluids, however, requires the use of a completely enclosed secondary fluid tank 69 as shown in FIGURE 7 with a vent means or removable plug 70 provided in the closed top 71.

The control means 73 is made up of the valve means 73 and its upper post 74 which extends through and seals a bearing opening 75 in the top 71, annular bead 90 serving to seal opening 75 throughout the entire range of movement of control means 72. Return spring 76 seated on top 71 and retained by cap 77 aids the spring biased stem 78 in upwardly returning the control means 72 from its open position of FIGURE 8 to its closed position of FIGURE 7. It will be noted that the top 71 has a sealing threaded connection with the tank 69.

The valve means 73 includes in downstream series as a rigid unit, discharge valve actuator 79, control chamber release valve 80, passage seal 81, and annular ring 82. The passage seal 81 maintains a sealing engagement with passage 66 at all times. When the control means 72 is moved downwardly a small distance sufficient to just crack the stem 78, primary fluid flows into control chamber 67 until the pressure condition therein equals that of the contained flow past the release valve 80 takes place. When the control means 72 is fully depressed, release valve 80 passes below annular ledge 84 and primary fluid flows through passage 66 and sidewall duct 85 to jet means 59 where the speed of flow is significantly increased. At the same time, annular ring 82 having passed below secondary fluid flows through vertical grooves 86 in the valve means 73 downwardly to duct means 64 and then outwardly to entrainment holes 65 for further mixing flow with the primary fluid in mixing chamber 61 and nozzle 63 as shown in FIGURE 8. FIGURE 9 shows the three vertical grooves 86 which facilitate flow of secondary fluid through passage 66; the flow being caused by gravity and entrainment by the jet stream.

While the invention has been described with reference to a certain embodiment, it is to be considered illustrative rather than limiting, and it is intended to cover all further embodiments that fall within the spirit and scope of the appended claims.

We claim:

1. A device for mixing a secondary fluid with a primary fluid, said primary fluid being discharged from the discharge valve of a pressurized container, said discharge valve being normally biased to a closed position, the improvement which comprises:
   housing means mounted on said container and defining a control chamber in fluid communication with said discharge valve, a passage extending downstream from said control chamber, and a tank for secondary fluid; and
   control means movably mounted as a rigid unit in said housing including in downstream series:
      a discharge valve actuator for actuation of said discharge valve between open and closed positions;
      a control chamber release valve having an annular ridge sealably engaging said passage and producing substantially full release of primary fluid from said control chamber when moved from said passage into said control chamber upon said discharge valve reaching open position;
      a passage seal having an annular member sealably engaging said passage at all times;
      jet means in fluid communication with said passage for receipt of primary fluid on release from said control chamber to produce a higher speed jet stream than the stream from said discharge valve;
      a mixing chamber for in-line receipt of the resultant jet stream having an entrainment hole at its upstream end for entrainment flow of secondary fluid from said tank; and a discharge spout.

2. A device as defined in claim 1 and wherein said control means includes, in downstream series from said passage seal, said jet means, said mixing chamber and said spout.

3. A device as defined in claim 2 and wherein said mixing chamber is an elongated tube having a plurality of entrainment holes, and said housing means includes a valving flange around said tube, said control means being rotatably mounted in said housing for selective uncovering of said entrainment holes from said valving flange to vary the amount of entrained secondary fluid.

4. A device as defined in claim 3 and wherein said housing has a socket which sealably connects with the discharge valve to form the control chamber therewith.

5. A device as defined in claim 4 and wherein said discharge valve actuator includes a slotted head at its upstream end for engagement with the stem of the discharge valve, the slotted head providing an open flow path from said stem to said control chamber.

6. A device as defined in claim 1 and wherein said control means includes a tank release valve above and adjacent said passage seal sealably engaging said passage, said jet means being positioned in said housing having duct means from said passage to said entrainment hole for flow of the secondary fluid to the entrainment hole, said tank release valve controlling flow of secondary fluid to said duct means.

7. A device as defined in claim 6 and wherein said tank release valve has an annular ring sealably engaging said passage, said tank has a closed top and includes a vent to allow gravity flow of secondary fluid through said duct means, control means includes an upper post
extending through said top for enabling vertical actuation thereof.

8. In a device having a jet means for producing a high speed stream of fluid discharged from a primary fluid pressurized container, said container having a discharge valve of the type which is normally biased to a closed condition and incapable of producing the higher speed jet stream produced by said jet means, the improvement which comprises:

- housing means mounted on said container and defining a control chamber in fluid communication with said discharge valve;
- valve means including a valve actuator movably mounted in said housing means for actuation of said discharge valve between open and closed positions, said valve means including a control chamber release valve for controlling fluid communication between said control chamber and said jet means constructed and arranged to open and release fluid from said control chamber to said jet means when said discharge valve has been moved by said valve actuator to a predetermined open position to insure full pressure and flow from said container to said jet means;

a discharge spout, and a mixing chamber in fluid communication between said jet means and said discharge spout;

a tank means for secondary fluid in fluid communication with said mixing chamber;

said housing means including a passage between said control chamber and said jet means, and said control chamber release valve including an annular ridge slidably engaging said passage, the upstream end of said passage terminating at said control chamber to enable substantially full release of the primary fluid from the control chamber and smooth full flow from the discharge valve through the passage to the jet means when said annular ridge is moved upstream from sealing condition in the passage into open condition in the control chamber.

References Cited

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