No. 669,020. Patented Feb. 26, 1901.

W. & J. BOEKEL.

SPRAY TUBE FOR NEBULIZERS.

(Application filed Oct. 13, 1900.)

(No Model.)

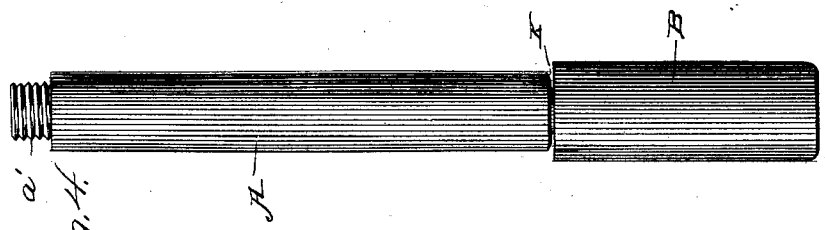


Fig. 4.

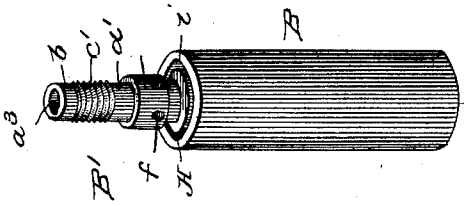


Fig. 3.

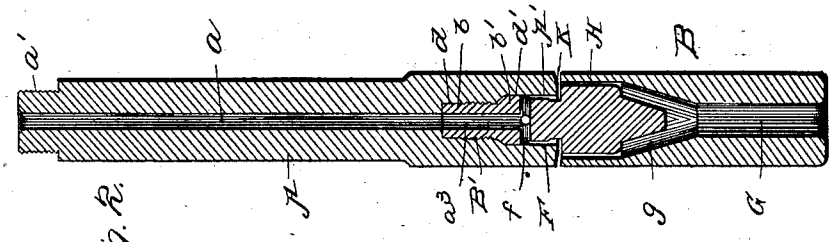


Fig. 2.

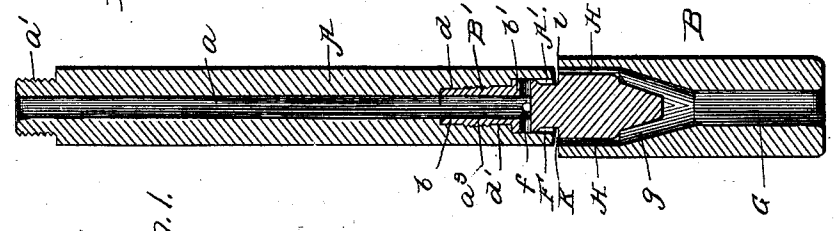


Fig. 1.

WITNESSES.

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SPRAY-TUBE FOR NEBULIZERS.

SPECIFICATION forming part of Letters Patent No. 669,020, dated February 26, 1901.

Application filed October 13, 1900. Serial No. 33,001. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM BOEKEL and JULIUS BOEKEL, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Spray-Tubes for Nebulizers and Similar Articles; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to spray-tubes which use a downwardly-extending air-passage and an upwardly-extending liquid-passage, the two being provided with converging outlets. Hitherto such tubes have generally had the air passage and outlet formed throughout in the same piece, the liquid-passage being also formed therein, and the opening to which the air and liquid passages converge being a round hole or small slot which is incapable of adjustment as to size.

In our present invention the liquid-outlet and the air-outlet are each of annular form, and the spray-opening is annular also, being formed by the approximation of two pieces which together make up the spray-tube, but are prevented from coming quite in contact at this point. One of these parts of the tube contains only the upper portion of the main central air-passage. The other and lower part of the said tube contains the remainder of said air-passage and the air-outlet, as well as the liquid-passage and the liquid-outlet. These two parts are screwed together, allowing for easy attachment and detachment and providing a certain amount of adjustability of the size of the spray-opening, which will be found especially serviceable when the air-passage is to be cleared of impurities by enlarging said opening without entirely detaching the two parts of the tube, a strong current of air being then directed through said passage and opening.

Our invention consists in the peculiarities of construction above indicated and in certain additional details, all as hereinafter particularly set forth and claimed.

In the accompanying drawings, Figure 1 represents a longitudinal section of a spray-tube embodying our invention. Fig. 2 represents a similar view of a modified form of the same. Fig. 3 represents a detail perspective view of the lower part or section of the tube constructed as shown in Fig. 1, and Fig. 4 represents a view in elevation of the complete tube thus constructed.

A designates the upper part or section of the tube, having screw-threads a' at its upper end for attachment to a nebulizer-bulb or other device and also a central bore forming an air-passage a. In the lower part of the said section is formed a downwardly-opening recess A′ of greater diameter than the said bore or passage and in longitudinal extension thereof. This recess is screw-threaded at c to engage the corresponding screw-threads c' of an upward extension B′ of the lower section B of said tube. The said recess is provided above the said screw-thread with a cylindrical guiding-surface d and below the said threads with a similar surface d', where the said recess has a greater diameter than above. These two guiding-surfaces receive, respectively, the cylindrical parts b and b', the former being of less diameter than the latter. When the extension B′ is screwed into the recess A′, as aforesaid, the cylindrical parts of the said extension are in contact with and guided by the said internal cylindrical surfaces of the upper section A, forming parts of the said recess, and the same is true when the said parts are slightly unscrewed, so as to open the outlet or spray-opening more widely, as hereinbefore mentioned. The said extension B′ is provided with an air-passage a^3, which is in alinement with and in continuation of the said passage or bore a, these two constituting a single main central longitudinal air-passage, the lower end of which within the said extension B′ is provided with several radial horizontal passages f, which are preferably four in number, as shown. These horizontal air-passages communicate with a vertical annular air-outlet passage F, extending to the lower end of part or section A and formed by a reduction of the diameter of the extension B′ below the cylindrical part b', which leaves an annular space between the part thus reduced and the wall of the lower part of the said recess. The lower section B is also provided below the said extension B′ with a bore or liquid-passage G of

considerably greater diameter than the air-passage *a* aforesaid and extending down to the lower end of said lower section. The upper end of this liquid-passage branches into several oblique upward passages *g*, which communicate with the lower end of an annular liquid-outlet I, discharging at the upper end of said section. This outlet must be always wider than the air-outlet aforesaid, but may vary somewhat in width, as shown in Figs. 1 and 2, the outlet in the latter instance being thinner than in the former, and the diameter of the two sections of the tube being the same in Fig. 2, whereas in Fig. 1 the lower section is of greater diameter than the upper.

It has not been deemed necessary to distinguish the corresponding parts by different letters in the said figures, which are alike except in the particulars of dimension named.

The length of the extension B′ is so calculated with relation to that of the recess A′ which receives it that there will be an interval between the lower end of the upper section A and the shoulder *i* at the upper end of the main part of the lower section B at the base of the said extension B′ when the latter is screwed home in the said recess. This interval is, however, but slight and constitutes a fine annular spray-opening K, arranged and discharging horizontally and receiving vertically the downward blast of the air at its inner edge where the aforesaid air-outlet joins the same. The annular liquid-outlet H discharges into the said opening outside of the said air-outlet, so that the blast from the air-passage *a*, issuing as before described, will pass outward from the inner edge of the said opening horizontally across the mouth of the said liquid-outlet, drawing up the liquid through the same by the vacuum thus created and driving it out of the tube in a fine horizontal cloud of spray, for the egress of which with less resistance or obstruction the outer edge of the said opening is slightly beveled on the upper side at *k*. This flaring construction need not, however, extend inwardly beyond the center of the liquid-outlet and is wholly in the lower end of the upper section A, the shoulder *i* being perfectly horizontal on top. The air-passage *a* and its continuation a^3, as well as the horizontal branch passages *f*, are of considerably greater diameter than the width of the spray-opening K, to avoid friction in passing through the upper section A and the extension B′, which afford a continuous air-passage of considerable length. The air-outlet F is also of greater capacity than the said opening, being made wider at all points for the same reason so far as is compatible with the strength of the parts between which it is formed; but it is so short that this is of far less consequence than in the case of the air-passages *a*, a^3, and *f*. When this air-outlet becomes clogged, it is very easy to turn either of the sections of the tube, by preference the lower one, B, so as to partly unscrew the latter, increasing the spray-opening K, so as to afford an ample outlet for a greater blast of air, which will effectually remove all such obstructions. In such a procedure the guiding cylindrical surfaces hereinbefore described are particularly serviceable, keeping the air-passages *a* a^3 in exact alinement and also bracing the two sections of the said tube one against the other at two longitudinal points in each position of such adjustment.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A spray-tube for nebulizers consisting of an upper section and a lower section detachably fastened together, the upper section being provided with an annular air-outlet and means for supplying the same and the lower section being provided with an annular liquid-outlet and means for supplying it, both of these outlets being arranged to discharge into an annular spray-opening located between the two sections aforesaid, substantially as set forth.

2. A spray-tube provided with an annular air-outlet, an annular liquid-outlet, an annular spray-opening into which these outlets discharge, and air and liquid passages supplying the said outlets, substantially as and for the purpose set forth.

3. A spray-tube provided with an annular, horizontal spray-opening, an air-outlet discharging vertically into the same at or near its inner limit, a liquid-outlet arranged concentrically with and exterior to the said air-outlet and discharging in the opposite direction into the said spray-opening as a consequence of the action of the blast of air from the said air-outlet, and air and liquid passages supplying the said outlets respectively, substantially as set forth.

4. A spray-tube provided with an annular horizontal spray-opening which flares outwardly on the upper side near the outer surface of the said tube and with air and liquid outlets discharging vertically into the said opening in opposite directions and at different radial points, and supplied by air and liquid passages, substantially as set forth.

5. A spray-tube consisting of two sections, the upper section having an air-passage *a* formed entirely within it and the lower section having an air-passage a^3 formed entirely within it and in alinement with the passage *a* aforesaid, these two passages forming a single longitudinal air-passage when the tube-sections are screwed together, the lower section being further provided with branch air-passages and a liquid-passage and both the air and liquid discharging through a spray-opening formed between the proximate ends of the said sections substantially as set forth.

6. A spray-tube consisting of the upper section A provided with the air-passage *a* and the recess A′, and the lower section B provided with the extension B′ adapted to fit into the said recess and having within it the

air-passage a^3 in alinement with passage a aforesaid and also the horizontal branch passages f arranged as described, the relative lengths of the said extension and recess being such as to leave an annular spray-opening K between the end of section A and the opposite shoulder i of section B, and an air-outlet space being also provided between the lower part of the extension B′ and the opposite part of section A, and the section B being also provided with a liquid passage and outlet discharging into the said opening, substantially as set forth.

7. A spray-tube consisting of two sections A and B provided with air and liquid passages and outlets and an annular spray-opening which is left between said sections when they are screwed home together and which receives the discharge from the outlets aforesaid, the said section B being provided also with an extension B′, which has screw-threads formed upon it and cylindrical guiding parts respectively above and below the said screw-threads, and the section A being provided with a recess having corresponding threads and cylindrical guiding-surfaces, adapted to fit those of the said extension when it is screwed in or out, substantially as set forth.

8. A spray-tube consisting of two sections A and B, the lower section, B, of which is provided with an upward extension B′, a liquid-passage G, oblique branch liquid-passages g, an annular liquid-outlet H, a shoulder i, an air-passage a^3, branch air-passages f, and external screw-threads and cylindrical surfaces, and the upper section A provided with an air-passage a continuous with passage a^3 aforesaid, and a recess A′ having screw-threads and surfaces arranged to fit those above mentioned, the said sections A and B being further adapted to leave between them when screwed home together, a vertical annular air-outlet F and a horizontal annular spray-opening K, substantially as and for the purpose set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

WM. BOEKEL.
JULIUS BOEKEL.

Witnesses:
WM. HAAR,
JOHN H. SCHERER.