

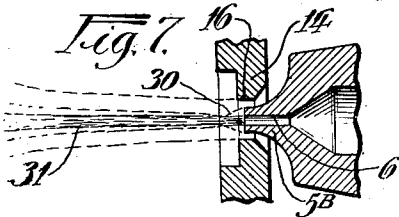
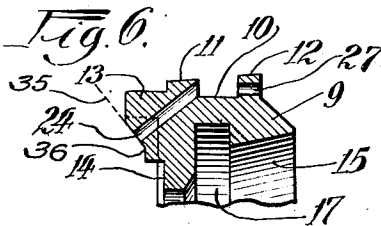
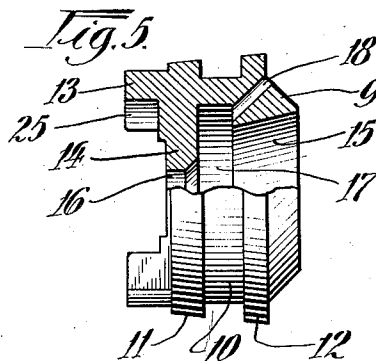
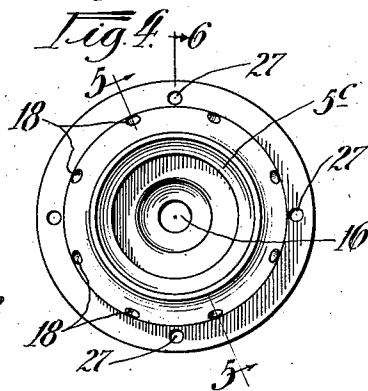
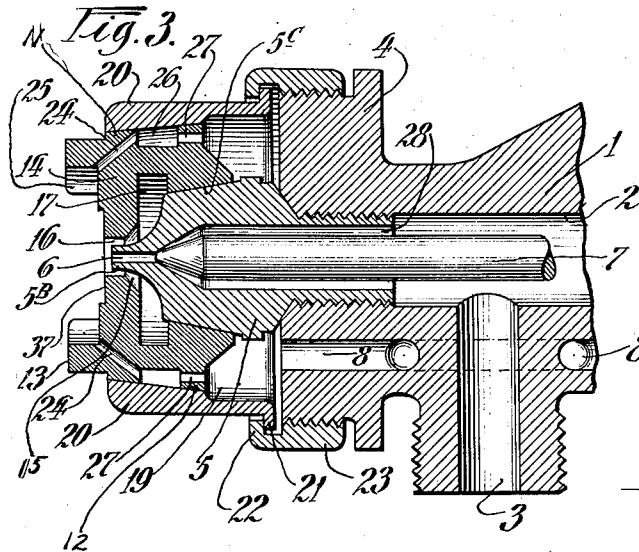
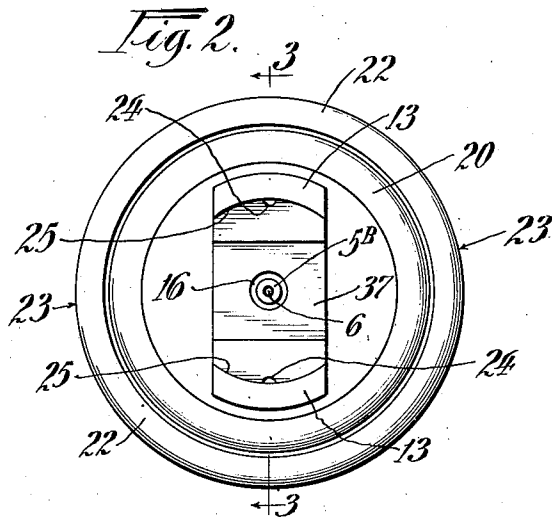
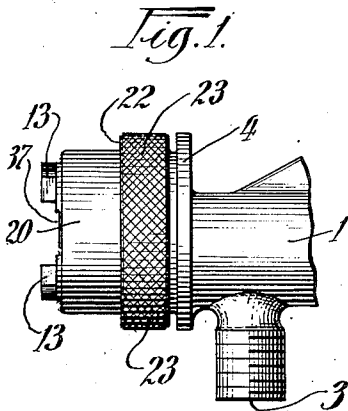
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M. J. BINKS ET AL

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SPRAY GUN HEAD

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Inventors:

William Hersleb
and Melvin J. Binks

by Albert Schmitt
Attorney

UNITED STATES PATENT OFFICE

MELVIN J. BINKS, OF OAK PARK, AND WILLIAM HERSLEB, OF CHICAGO, ILLINOIS, ASSIGNORS TO BINKS MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

SPRAY GUN HEAD

Application filed January 21, 1929. Serial No. 334,024.

Our invention relates to appliances for projecting liquids in the form of a flattened or fan-like spray, and in its general objects aims to provide a spray appliance head construction which will produce a flattened spray of accurate symmetry with an unusually fine atomization of the liquid in the spray, and which will consume a much smaller amount of compressed air than has heretofore been required for this purpose. Furthermore, our invention aims to provide a spray head in which the extent of the flattening of the spray can easily be varied by merely changing the bores of certain air passages.

In the class of spray appliance to which our invention relates, the liquid is projected through an orifice of circular cross-section in a stream which would expand to a conical shape if unrestrained, but which is restricted in such radial expansion by a tubular sheath of compressed air projected coaxial with the liquid stream, thereby reducing the conicity of the projected liquid stream which is flattened and broken up into a spray by the impact of opposed lateral jets of air against the air-sheathed liquid stream at some distance from the said orifice. During the resulting atomization, the air sheath is also broken up and its particles are distributed between the particles of liquid spray, but the atomization is effected mainly by the lateral jets of air. Since the amount of compressed air needed for the sheathing is many times greater than the amount permissible for the lateral air jets, an undesirably large proportion of compressed air is consumed by such spray gun heads. Moreover, the usual spray gun head constructions afford a tubular air sheath in which the distribution and compression of the air is not uniform circumferentially of the air sheath when it leaves the orifice through which the air for this sheath is projected, thereby producing a corresponding lack of uniformity in the resulting spray.

Our present invention overcomes one of the just recited shortcomings of the customary spray appliance heads by emitting the air for the tubular sheath through an annular port so constructed that this sheath can expand radially inward before it is free to expand

radially outward, thereby causing inner portions of this air sheath to cut into and partially atomize the projected liquid stream before the latter encounters the opposed lateral jets of air. It also provides a substantially uniform density and compression of the air for the tubular sheath circumferentially of the latter at the annular orifice through which this air sheath issues, and accomplishes this partly by supplying the compressed air to this orifice through a relatively large air chamber in which the pressure and distribution of the supplied air is equalized before this air reaches the orifice.

As the result of these two cooperating features, we secure a spray appliance head construction which causes the forwardly converging (spray-flattening) air jets to encounter a liquid stream which already has been partially atomized and somewhat expanded in diameter, and in which the particles of liquid and air are distributed with substantial uniformity circumferentially of the stream at the point where this stream encounters the said opposed air jets.

Then we also provide novel means for permitting an expanding of these spray-flattening air jets in certain directions radially of the axes of the parts from which they issue, so that each of these air jets will be suitably flattened before it impacts against the partially atomized and somewhat expanded liquid stream, thereby permitting these lateral air jets to exert a much greater flattening and atomizing effect in proportion to a given volume and pressure of air than is possible with the customary spray gun head construction.

For this latter purpose, we emit the air for each of these lateral air jets through a straight port inclined to the axis of the stream of liquid, which port has the axis of its mouth substantially at the intersection of two air-confining and air-deflecting walls, namely a wall in a plane transverse of the said axis and a second wall concentric with the said axis.

Moreover, we provide an air nozzle for this purpose which can easily be manufactured so as to secure an accurate positioning of the said two air-confining walls with respect to

the axes of the two lateral air jets, and so as to effect the desired proportioning of the spray-flattening air jets to the annular air sheath which issues around the projected liquid stream.

5 Still further and also more detailed objects will appear from the following specification and from the accompanying drawings, in which

10 Fig. 1 is a side elevation of the forward end of a spray gun embodying our invention.

Fig. 2 is an enlarged front elevation of the head of the same spray gun.

15 Fig. 3 is a central and vertical section taken along the line 3—3 of Fig. 2.

Fig. 4 is a rear elevation of the air nozzle alone.

20 Fig. 5 is a side elevation of the air nozzle, with approximately the upper half sectioned along the line 5—5 of Fig. 4.

25 Fig. 6 is an enlarged and fragmentary section taken along the line 6 of Fig. 4, with dotted lines showing the initial shape of the forward portions of the nozzle through which one of the lateral air ports extends.

Fig. 7 is a view showing the changes in the shape of the projected liquid and air sheath before the lateral air jets impact against them.

30 In the illustrated embodiment, the spray gun body 1 has the usual longitudinal bore 2, to which liquid is supplied through an inlet bore 3, and this liquid supply bore 2 opens through the forward end of the head 4 of the spray gun body. A liquid nozzle 5 is threaded at its rear end into the bore 2 and this liquid nozzle has at its forward end a radially constricted tip 5B affording a liquid orifice 6 of quite small diameter, the flow of liquid through this liquid orifice being controlled by the usual needle valve 7.

35 The liquid nozzle 5 has a forwardly tapering conical exterior portion 5C disposed between its said tip 5B and the front of the spray gun head 4, and the spray gun body has an air supply passage 8 opening at the front of this head radially outward of the liquid nozzle. The air nozzle 9 of our spray gun has a generally spool-shaped exterior presenting an annular groove 10 between a forward annular rib 11 and a more rearward annular rib 12, and has two diametrically opposite arcuate projections 13 extending forwardly beyond the forward head 14 of this air nozzle.

40 Extending axially through this spool-shaped air nozzle is a bore including a forwardly flaring rear portion 15 shaped to fit upon the conical peripheral portion 5C of the liquid nozzle, and a frontal bore portion 16 of somewhat larger diameter than the outside diameter of the tip 5B of the liquid nozzle. Interposed between and connecting 45 these two bore portions is an air chamber 17

toward which the frontal bore portion 16 flares, this chamber being larger in diameter than the forward end of the rear bore portion 15. A plurality of uniformly spaced air passages 18 connect this air chamber 17 with the annular space 19 around the liquid nozzle behind the air nozzle. These air passages 18 are desirably spaced uniformly circumferentially of the air nozzle and have a considerably greater total cross-sectioned area than the annular air port between the frontal bore portion 16 and the liquid nozzle tip 5B.

70 The air nozzle is clamped rearwardly against the liquid nozzle by a collar 20 which has a forwardly tapering conical bore portion fitting the forwardly tapering exterior of the peripheral ribs 11 and 12 on the air nozzle. This collar 20 has at its rear end a peripheral flange 21 overhung by an inwardly directed flange 22 on the front end of an attaching ring 23 threaded upon the head 4 of the spray gun body. When the ring 23 is tightened, it draws the air nozzle rearwardly to clamp the latter on the liquid nozzle, and the ring 23 cooperates with the collar 20 to form a lateral wall of the annular air chamber 19 to which compressed air is supplied through the air passage 8 in the spray gun body.

75 A lateral air port 24 extends through each of two forward projections 13 on the air nozzle, with its forward end intercepting both the inwardly directed arcuate face 25 of that projection 13 and the front face of the head 14 of the air nozzle. Each lateral air port 24 has its axis in a common plane with the axis of the air nozzle, and both air port axes converge at a common point on the air nozzle axis. Each such lateral air port has its inlet open to the annular space 26 bounded by the peripheral groove 10 on the air nozzle and the inner face of the collar 20. Air passages 27 extend through the rearward peripheral ring 12 on the air nozzle to connect this annular space 26 with the air space 19 behind the air nozzle. These air passages 27 are here shown as four in number and may be varied both in number and in diameter so as to alter the air supply for the lateral air jets in proportion to that for the annular air jet. The length of the air nozzle is preferably such that the forward end of its central bore 16 is disposed forwardly of the forward end of the tip 5B of the liquid nozzle, and the inwardly directed faces 25 of the two projections 13 may be cheaply formed as parts of a surface of revolution coaxial with the central orifice 16.

120 With the frontal portion of a spray appliance thus constructed, the liquid flowing under pressure through the main bore portion 28 of the liquid nozzle is increased in velocity when it issues from the forward end of the cylindrical liquid outlet 6 and tends 130

to expand conically as soon as it leaves this outlet. The compressed air issuing from the annular air port 16 also expands somewhat as soon as it issues, but the resulting tubular air sheath is prevented from an immediate radial expansion because the cylindrical bore 16 in the head of the air nozzle extends forward beyond the tip of the liquid nozzle around which tip the air for this sheath emerges.

Consequently, this air sheath initially retains an exterior diameter corresponding to that of the port 16 but compresses the air within it and increases in thickness radially inward of the sheath (as shown at 30 in Fig. 7), thus causing the radially inner portion of the tubular air sheath to impact against the peripheral portion of the liquid stream 31, so that the liquid stream is partially atomized and expanded to a greater extent than it would be if the tip of the liquid nozzle had been flush with the forward end of the annular air port as has heretofore been customary. As the result, the lateral air jets impact against an air sheathed liquid stream which has already been partially atomized and intermingled with air.

By disposing each lateral air port so that it intersects the juncture of a frontal face portion of the air nozzle with a radially inwardly directed face portion of one of the forward projections on the air nozzle, we dispose portions of the outlet of each such port farther than other portions from the part of the liquid stream against which the issuing air jet impinges. Hence we considerably modify the issuing lateral air jets, each of which in the usual types of flat-spray producing appliance is a frustoconical air jet.

In our construction, the outlet end of each lateral air port comprises two semi-circles at right angles to each other, and the juncture of these semi-circles is at some distance behind the middles of the arcuate portions of the semi-circles. Consequently, the issuing jet of compressed air expands in wedge-shaped formation from each of these junctures and starts this expansion before other portions of the jet issue from the port. Since these junctures (or angles in the port outlet) aline in a line at right angles to a plane through the axes of both of the lateral air ports 24, each issuing jet is expanded in a direction substantially parallel to the plane along which the liquid stream is to be flattened.

Hence each lateral air jet is expanded somewhat along this plane by the time it impinges against the air-sheathed, already partly atomized and somewhat expanded liquid stream. As the result, the impact of the two somewhat flattened lateral air jets against opposite sides of the air-sheathed liquid enables these lateral air jets to exert a far greater atomizing and flattening effect on the liquid stream than is produced by the

impact of substantially cylindrical air jets against a substantially cylindrical air-sheathed stream of liquid. This may be because central portions of the lateral air jets impact against the central liquid stream portion, while the wing portions of these jets (due to the spreading action of the angular outlets of the ports from which they issue) impact against already atomized portions of the liquid stream. At any rate, we have found that with our here presented construction, we can secure a symmetrical flattening of the spray, with a much smaller consumption of compressed air and with a more uniform distribution of the liquid particles in the spray.

Hence we can operate our spray guns much more rapidly (for spraying a given amount of liquid) than with a spray gun designed for projecting cylindrical lateral air jets against a cylindrical liquid stream which has not already been partially atomized.

In practice, we have found that we can secure the most effective results by having the axis of each lateral air port intersect the line of juncture between the inner face of the corresponding projection 13 and the forward face of the air nozzle. However, it is quite difficult to center such a port accurately when forming it by a drill entering at such an angular juncture of two wall portions. To overcome this manufacturing difficulty, we desirably form the air nozzle initially with forwardly thickened head portions at each side of its central bore and with the two projections 13 extending toward each other beyond the intended extent, as shown in full line in Fig. 6. Next we machine these projections initially to present conical inner faces 35 at right angles to the proposed axes of the two lateral air ports, as shown in dotted lines in Fig. 6, after which we drill the bores 24 for the two lateral air ports.

Then we cut away the forward air nozzle portions as shown in dotted lines in Fig. 6, by using a square-cornered milling cutter of a diameter corresponding to the desired spacing between the middle points of the opposed inner faces 25 of the two projections 13. By continuing this milling until the rear edge of the milling cutter has reached the middle of each bore 24, we can readily secure the desired disposition of the outlets of these bores, regardless of petty variations in the angular diversion of these bores from each other when the said bores were symmetrically drilled with respect to the axis of the air nozzle.

By starting with thickened frontal face portions 36, we can allow for the needed variations in the machining, while still leaving the central portion of the head of the air nozzle of the thickness desired for affording the proper length to the central air port 16. Since the opposed inner faces 25 of the two

projections extend in a general direction parallel to the plane in which the spray is to be flattened, we preferably make these faces of considerably greater width (circumferentially of the nozzle) than their length (longitudinally of the nozzle). To secure an accurately uniform spacing of these opposed faces from the axis of the air nozzle, we also preferably form them as parts of a common cylindrical surface, but do not wish to be limited to this curvature.

When our spray gun is in operation, the numerous air passages 18 in the air nozzle (which preferably have a much larger total cross-sectional area than the annular air port 16 through which the air sheath issues) afford a ready supply of compressed air to the air chamber 17 within the air nozzle. This air chamber is of much greater cross-sectional area than the total of the air passages 18, so that the compressed air admitted to that chamber expands somewhat within it and equalizes in pressure in the chamber. Since the rear chamber 19 is also of large capacity, so that the air supplied through the air passage 8 can equalize in this rear chamber, and since the uniform distribution of the air passages 18 admits air uniformly at numerous points to the inner air chamber 17, the further equalization of the air pressure in the latter chamber permits us to secure a circumferentially uniform distribution of the pressure of the air issuing through the annular air port between the tip 5B of the liquid nozzle and the central forward bore portion 16 of the air nozzle. Hence we avoid the streakiness encountered with spray guns in which no large air chamber is interposed between the air supply passages and the annular air port.

The annular space 26 likewise acts as an air-storage and pressure equalizing chamber from which air is supplied to the air ports, so that we readily secure a uniformity of the two lateral air jets. By employing straight bores for the passages 24, 27 and 18, we facilitate the cleaning of these passages, and by providing a large rear portion 15 for the bore of the air nozzle, we permit a ready cleaning of the air chamber 17 within this nozzle when the air nozzle has been detached, so that our entire spray head assembly is easily kept clean.

Moreover, by increasing or decreasing either the number or the diameter of the air passages 18, we can readily increase or decrease the amount of air for the air sheath in proportion to the air supplied to the lateral air ports, without changing the sizes of any other parts, thereby making it easy for the manufacturer to furnish air nozzles affording different spray flattening effects.

However, while we have described the various features of our invention in a handheld appliance of the so-called spray gun

type, we do not wish to be limited to this respect. Nor do we wish to be limited to the details of the construction and arrangement here disclosed, since changes might obviously be made without departing either from the spirit of our invention or from the appended claims.

So also, we do not wish to be limited to the providing of concaved inner faces 25 as surfaces intersecting the lateral air ports at the outlets of the latter. These opposed surfaces might be flat, being here described as curved because it is easy to space them uniformly from the axis of the air nozzle by using a milling cutter which rotates coaxial with the nozzle.

We claim as our invention:

1. In a head for a flat-spray appliance, a tubular air nozzle having a central air port and having two diametrically opposite forwardly directed projections presenting curved inner faces in a common cylindrical surface coaxial with the said central air port, the air nozzle having forward face portions extending radially inward from the said faces, the air nozzle also having two diametrically opposite and forwardly converging lateral air ports each of which opens through the juncture of one of the said curved faces with the forward face portion adjacent thereto.

2. A head construction for a spraying appliance, including an air nozzle having a central aperture, a liquid nozzle having its tip extending into the said central aperture coaxial with the latter, the said tip being smaller in outside diameter than the bore of the central aperture, the air nozzle having two forwardly directed projections presenting inner faces equally spaced from the axis of the said central aperture and having frontal face portions from which the said inner faces extend forwardly, the air nozzle also having two ports each of which opens through the juncture of one of the said inner faces with one of the said frontal face portions, the said ports having their axes intersecting the axis of the liquid nozzle tip at some distance forward of the said frontal face portions.

3. An air nozzle for a spray appliance, including a frontal portion provided with a central aperture and also including diametrically opposite projections extending forwardly from the forward face of the said frontal portion and presenting radially inward faces toward the axis of the said aperture, the said projections being equally spaced radially from the said aperture, the air nozzle having two air discharge ports whose axes intersect at a common point on the axis of the said aperture forwardly of the said frontal head, each of the said port axes extending also through the juncture of the forward face of the said frontal portions with the

radially inward face of one of the projections.

4. An air nozzle as per claim 3, in which the said port axes are disposed in a common plane with the axis of the said central aperture.

Signed at Chicago, Illinois, January 14th, 1929.

MELVIN J. BINKS.
WILLIAM HERSLEB.