

May 26, 1959

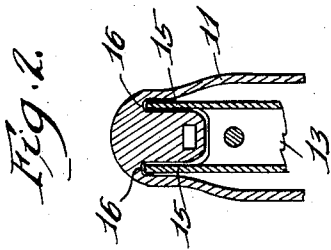
R. E. SYKES

2,888,207

SPRAY GUN

Filed Dec. 20, 1954

6 Sheets-Sheet 1



May 26, 1959

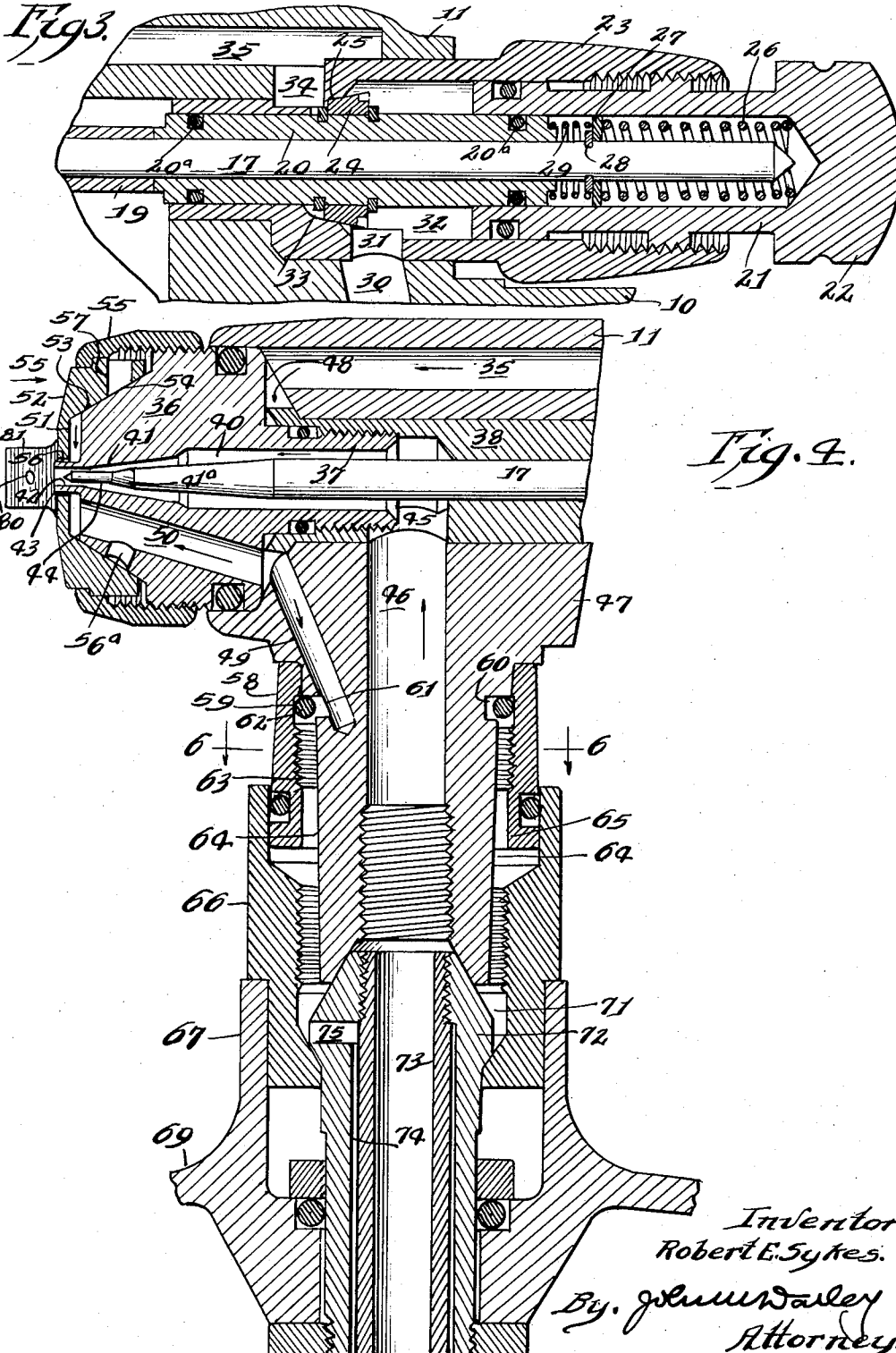
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Filed Dec. 20, 1954

6 Sheets-Sheet 2



May 26, 1959

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SPRAY GUN

Filed Dec. 20, 1954

6 Sheets-Sheet 3

Fig. 5.

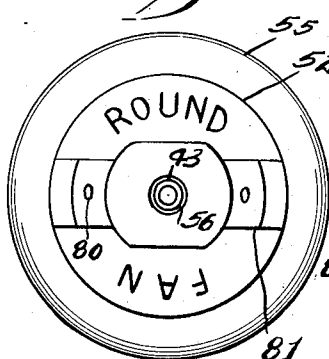


Fig. 8.

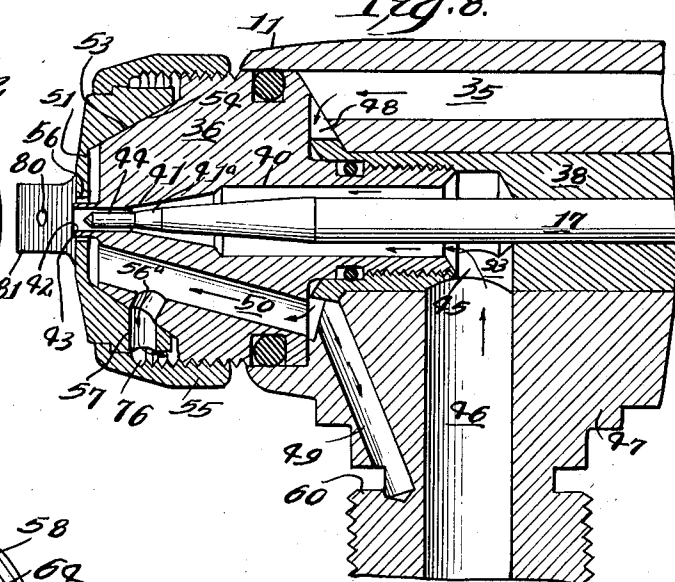


Fig. 6.

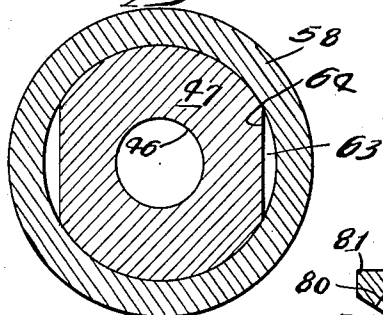


Fig. 9.

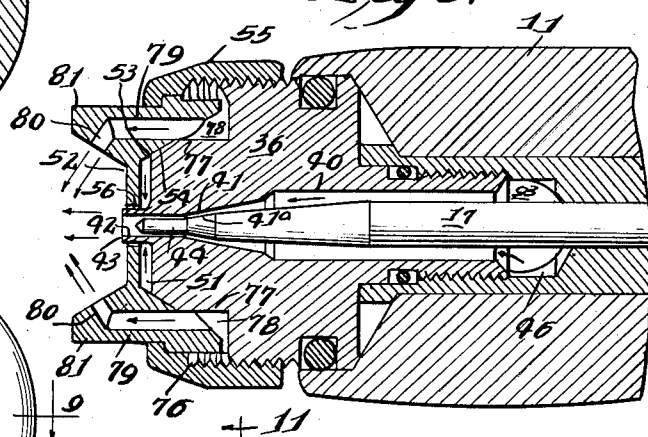
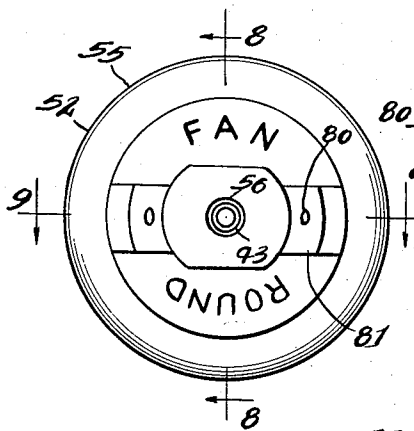


Fig. 7.

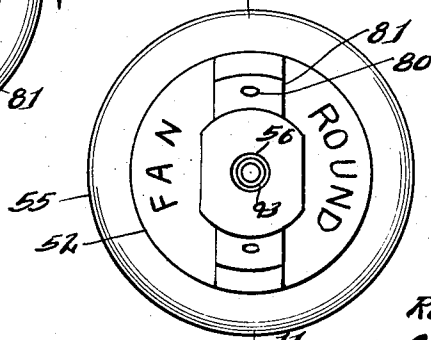


Fig. 10.

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2,888,207

SPRAY GUN

Filed Dec. 20, 1954

6 Sheets-Sheet 4

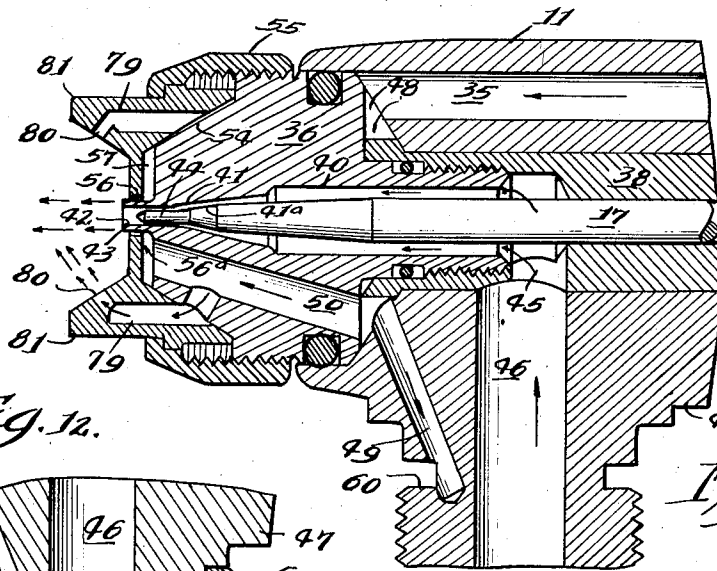


Fig. 12.

Fig. 11.

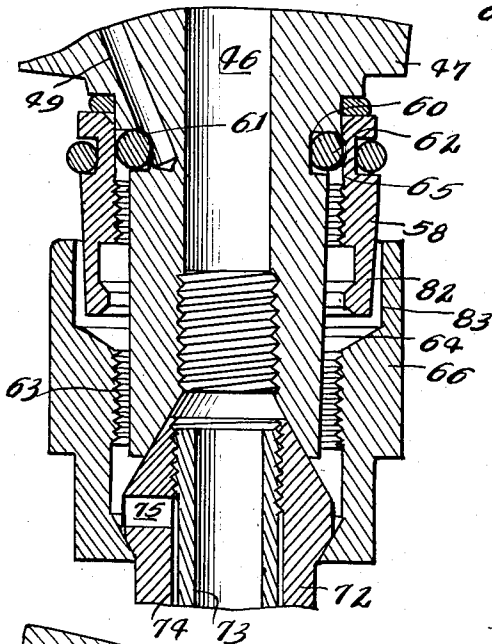
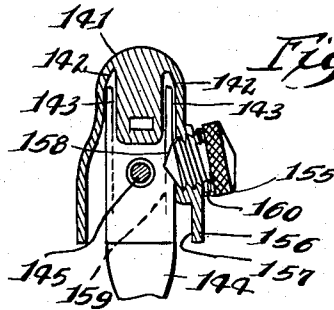


Fig. 19.

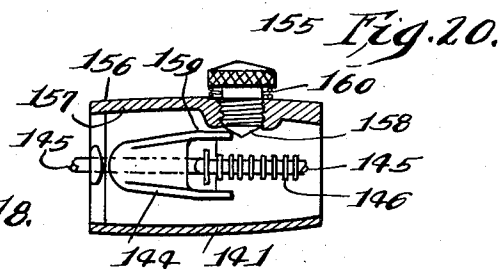


Fig. 20.

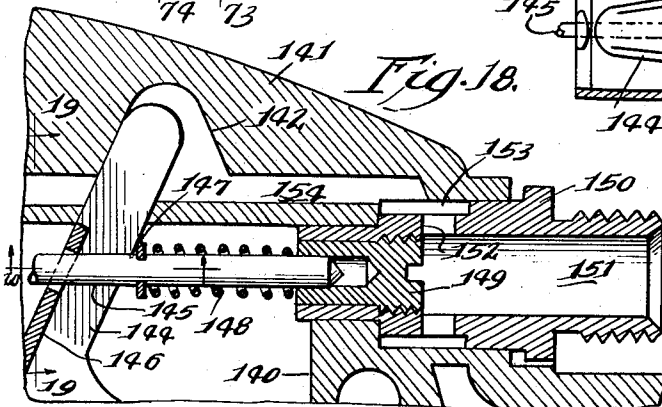


Fig. 18.

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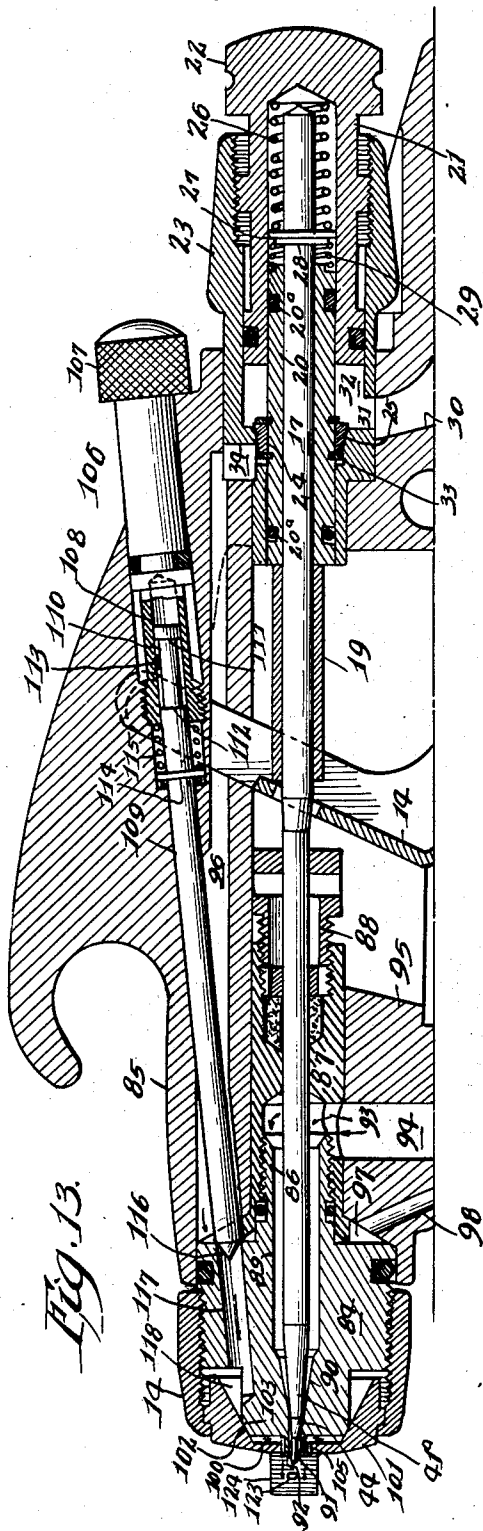
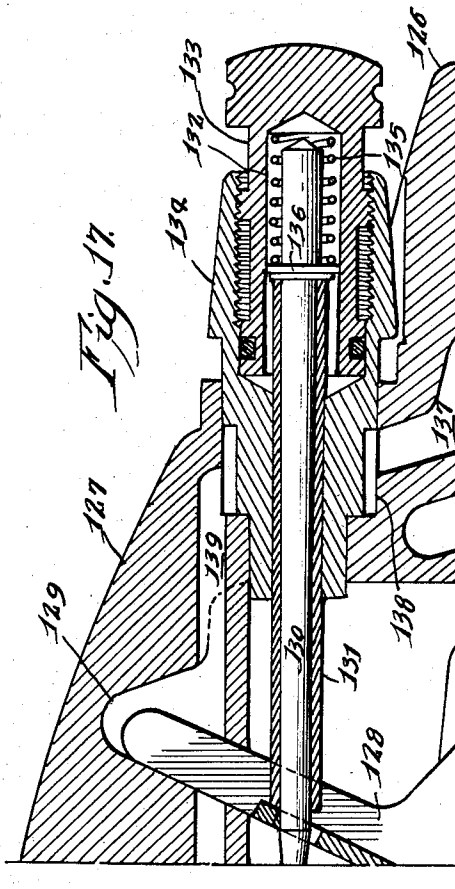
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2,888,207

SPRAY GUN

Filed Dec. 20, 1954

6 Sheets-Sheet 5



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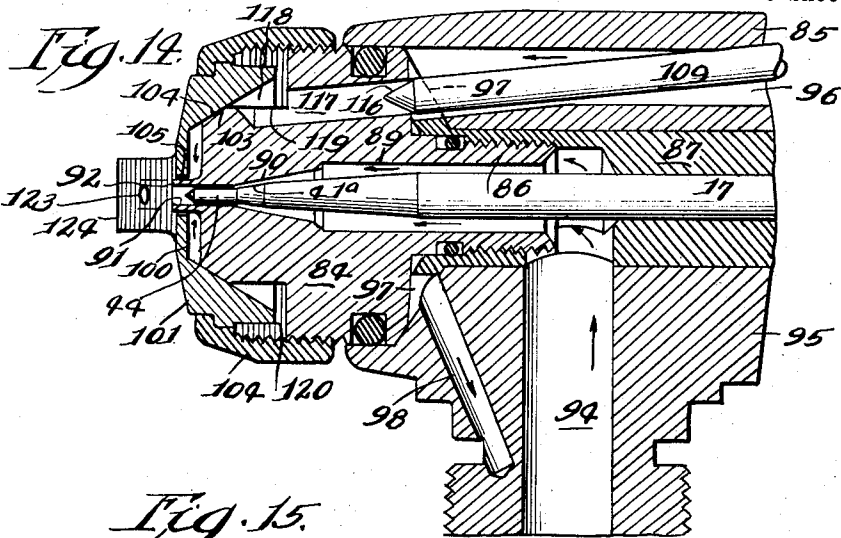
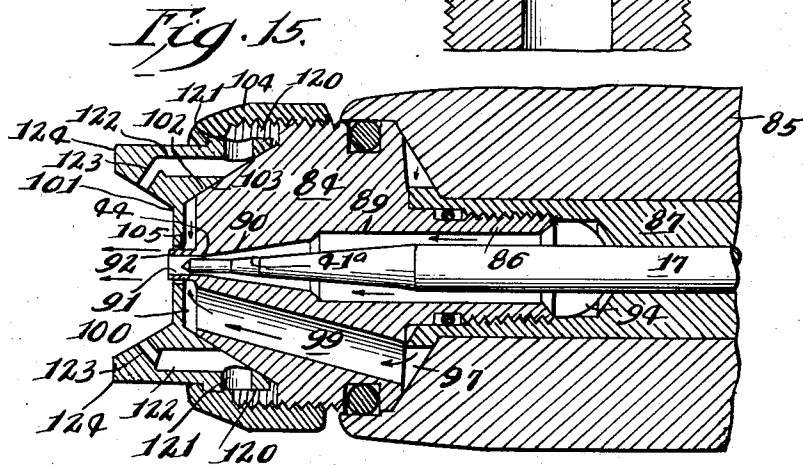
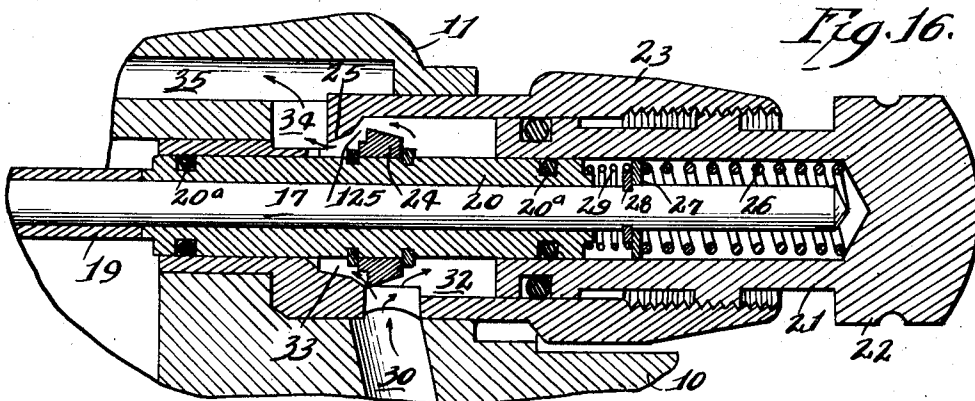
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6 Sheets-Sheet 6



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1

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SPRAY GUN

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Application December 20, 1954, Serial No. 476,250

7 Claims. (Cl. 239—301)

My invention relates to spray guns and more particularly to a device of this type which is capable of use in a variety of operating conditions by means of simple and relatively minor adjustments and is characterized by a novel method of spray formation.

One object of the invention is to devise a spray gun of the trigger controlled type which is usable under either a non-bleeder condition in which air flow through the gun is controlled by the trigger, or under a bleeder condition in which air flows constantly through the gun, merely by reversing an air valve whose position determines air flow through the gun.

A further object is to provide a spray gun whose operation is controlled by a trigger characterized by a wandering pivot in the gun body which eliminates bearing or pivot pins, which possesses a high mechanical advantage, and whose rocking movement is arranged to impart a linear movement to the liquid needle valve.

A further object is the provision of a spray gun of the non-bleeder type in which the air and liquid needle valves are related so that, when the trigger is rocked to an operating position, the air valve opens prior to the needle valve, and when the trigger is released, the air valve closes subsequent to the closing of the needle valve.

A further object in a gun as generally indicated is the relation of the air and needle valves and the floating support therefor which enables these valves to be coaxial, with the air valve surrounding the needle valve and facilitating removal of the needle valve without disturbing the air valve or the spray control at the delivery end of the gun.

A further object is the provision of a spray gun mechanism for either bleeder or non-bleeder operation which includes a connector between the gun and the liquid container whose position determines pressure or suction feed on the liquid and in which, under pressure feed conditions, a seal is automatically placed on the pressure air in the container when the air supply to the gun is cut off.

A further object is to provide types of spray guns whose spray control is exercised either at the delivery or front end, or at the rear or grip end, respectively, both types being conditioned for either bleeder or non-bleeder operation.

A further object is the provision of travel adjustment for the liquid needle valve which in one type of gun is effected coaxially of the valve and in another is regulated by controlling movement of the trigger.

A further object is to provide a spray gun in which the air and liquid is controlled in a manner to produce round, fan or angular sprays wholly externally of the gun.

These and further objects of the invention will be set forth in the following specification, reference being had to the accompanying drawings, and the novel means by which the objects are effectuated will be definitely pointed out in the claims.

2

In the drawings:

Fig. 1 is a sectional elevation of a non-bleeding type of spray gun in operating relation to a liquid receptacle and conditioned for pressure feeding of the liquid, the air and liquid needle valves being closed.

Fig. 2 is a fragmentary section along the line 2—2 in Fig. 1 showing the rockable mounting of the trigger in the gun barrel.

Fig. 3 is an enlarged section of the rear end of the gun as viewed in Fig. 1 and showing the relation of the air valve and the stem of the liquid needle valve.

Fig. 4 is an enlarged section of the forward or delivery end of the gun as viewed in Fig. 1, including the connector attachment to the liquid container, but with the needle valve in retracted or liquid delivering position and with air moving through the gun.

Fig. 5 is an end elevation of the air cap as viewed in the direction of the arrow 5 in Fig. 4, the cap occupying the position which determines the production of a small round spray.

Fig. 6 is a detail section along the line 6—6 in Fig. 4.

Fig. 7 is an elevation similar to Fig. 5, but showing the air cap rotated to produce a fan spray.

Figs. 8 and 9 are enlarged sections of the delivery end of the gun with the air cap in the position shown in Fig. 7 and the sections being respectively taken along the lines 8—8 and 9—9 in Fig. 7.

Fig. 10 is an elevation of the air cap in a position determining a ceiling spray.

Fig. 11 is an enlarged section of the delivery end of the gun as generally taken along the line 11—11 in Fig. 10.

Fig. 12 is an enlarged section of the connector attachment to the liquid container as shown in Figs. 1 and 4, but conditioned to provide suction feed of the liquid.

Fig. 13 is a fragmentary section of a modified, non-bleeder, spray gun equipped with a rear, fan spray control.

Figs. 14 and 15 are enlarged sections of the delivery end of the gun shown in Fig. 13 and which are normal to each other, the gun being conditioned to discharge a round spray.

Fig. 16 is a fragmentary section similar to Fig. 3, but showing the air valve reversed in position to provide bleeder operation.

Fig. 17 is a fragmentary section showing a further modification of the Fig. 1 gun consisting in the elimination of the air valve to provide bleeder operation.

Fig. 18 shows a further modification in fragmentary section including a side adjustment on the travel of the trigger and hence the movement of the liquid needle valve.

Figs. 19 and 20 are sections along the lines 19—19 and 20—20, respectively, in Fig. 18.

While the improved gun is more particularly intended for the spraying of paint, enamels, lacquers and the like by compressed air, it will be understood that the structure involved has general application in the field of liquid spraying.

Referring to the drawings, Figs. 1 to 11, inclusive, relate to a non-bleeder type of gun for pressure feeding of the liquid, i.e., air flows through the gun only when the trigger is actuated and this air flow divides, part passing through the spraying end of the gun and the remainder passing to the liquid receptacle to impose a discharging pressure on the liquid therein.

Referring to Figs. 1, 2 and 3, the spray gun includes a grip 10 and a connected barrel 11 which are related in typical pistol fashion. From the lower side of the barrel 11, a cavity 12 extends upwardly for receiving a trigger 13 whose lower portion 14 is shaped for finger gripping, while the upper portion is bifurcated at 15—15

(see Fig. 2) for free rockable mounting in spaced pockets 16—16 constituting parts of the cavity 12.

Except for the bifurcation, the trigger 13 is generally U-shaped in transverse section and an intermediate part of a valve stem 17 extends freely through the base wall 18 of the trigger section in supporting relation thereto and rearwardly thereof successively and slidably through aligned abutment and air valve sleeves 19 and 20, respectively. The valve stem 17 extends beyond the rear end of the air valve sleeve 20 and is received within an adjusting sleeve 21 carrying a finger knob 22. The adjusting sleeve 21 is threaded in the rear end of a hollow body 23 in telescopic and encircling relation to the rear end of the air valve sleeve 20, the rear end of the body 23 fitting within the rear end of the barrel 11 and being suitably held against axial movement, and the forward portion of this body fitting within another part of the barrel 11 in telescopic and encircling relation to the forward end of the air valve sleeve 20. The rear and front ends of the air valve sleeve 20 are floatingly mounted in the adjusting sleeve 21 and the body 23, respectively, by encircling sealing rings 20^a, commercially known as O rings. The air valve sleeve 20 externally carries in coaxial relation thereto an annular air valve 24 which is biased into closing engagement with a valve seat 25 provided interiorally of the body 23.

This biasing, as well as the closed biasing of the valve stem 17, is effected by the following instrumentalities. A helical spring 26 encircles the rear end of the valve stem 17 and is interposed between the knob 22 and a follower ring 27 which, in the relationship shown in Figs. 1 and 3, i.e., valve stem 17 in closed position, abuts a fixed washer 28 secured to the valve stem 17. A second and weaker spring 29 also encircles the valve stem 17 between the ring 27 and the adjacent end of the air valve sleeve 20.

From the foregoing, it will be apparent that, when the trigger 13 is rocked counterclockwise from the position shown in Fig. 1, it causes the abutment sleeve 19 to shift the air valve sleeve 20 towards the right against the relatively weak spring 29. This initial movement of the trigger 13 therefore opens the air valve 24 first and continued trigger movement in the same direction effects a compression of the stronger spring 26 and an engagement of the rear end of the air valve sleeve 20 with the fixed washer 28 to move the valve stem 17 to open position. This capacity for relative and successive movements of the air valve sleeve 20 and valve stem 17 insures a flow of air through the gun prior to the delivery of the liquid at the spraying end thereof.

Compressed air is suitably delivered to the inlet end of a passage 30 in the grip 10 and the opposite end connects through a port 31 in the hollow body 23 with an annular chamber 32 included between this body and the outer surface of the air valve sleeve 20. Flow from the chamber 32 is determined by opening the air valve 24 as above described which when effected permits the air to flow into an annular chamber 33 within the body 23 which connects through a port 34 with a passage 35 which extends longitudinally of the barrel 11 (see Fig. 1).

Referring to Fig. 4 which shows the front end of the gun and its connection to the liquid container and which is identical with the comparable parts shown in Fig. 1 except that the valve stem 17 is in retracted position for determining liquid delivery, a tip member 36 is sealably mounted in the front end of the barrel 11 and carries a rearward extension sleeve 37 which is threaded within the adjacent end of a tubular member 38 also fitted in the barrel 11. The rearward end of the member 38 carries a seal assembly 39 (see Fig. 1) through which and through the tubular member 38, the valve stem 17 extends forwardly and also through the tip member 36, being spaced from the latter member to define an annular passage 40. The forward end of this passage is suc-

cively reduced to provide a tapered valve seat 41 and a cylindrical passage 42 defined on its delivery end by an annular tip 43 projecting from the tip member 36 and which is coaxial with the valve stem 17. The front end of the latter stem is shaped as a needle 44 and adjacent thereto as a tapered valve 41^a for closing engagement with the valve seat 41. The rear end of the passage 40 communicates through a port 45 in the tubular member 38 with a passage 46 in a downward extension 47 carried by the barrel 11, the latter passage leading to a liquid container presently described.

Still referring to Fig. 4, air flowing through the passage 35 passes into an annular chamber 48 defined by the cooperating portions of the barrel 11, the tip member 36 and the end of the tubular member 38. From the annular chamber 48, the air divides, part flowing downwardly into a passage 49 in the barrel extension 47 for a purpose presently explained and part into a passage 50 extending generally lengthwise of the tip member 36 and connecting with an annular chamber 51 which extends around the annular tip 43 and is included between the opposing faces of the tip member 36 and an air cap 52. This cap is rotatably mounted through the medium of cooperating, annularly tapered surfaces 53 and 54 provided, respectively, on the air cap 52 and tip member 36 and is axially held by a retaining ring 55 threaded on the tip member 36.

The central portion of the air cap 52 surrounds the annular tip 43 in spaced relation thereto to provide an annular passage 56 so that when air is flowing through this passage, it mingles with and creates a small round spray with the liquid issuing under pressure, as presently described, through the tip passage 42. This spray is created externally of the gun which is characteristic of all modifications of the device and is determined by the then position of the air cap 52 which is located as shown in Fig. 5 with the indicia "Round" uppermost. As further shown in Fig. 4, the tip member 36 also includes a passage 56^a extending outwardly from the passage 50, but the former passage is masked by the air cap surface 53, while the air cap 52 includes a radial passage 57 which, in the indicated position of the cap, is positioned diametrically opposite to the passage 56^a and has its inner end masked by the tip member surface 54. Hence, air does not flow through the passages 56^a and 57.

The liquid to be sprayed is pressure fed from the container by the following means, reference being to Fig. 4. Threaded on the barrel extension 47 is a first connector sleeve 58 which adjacent its upper end is annularly recessed internally at 59 to register with an external annular recess 60 provided in the outer surface of the extension 47. The recess 60 intersects the passage 49 adjacent the lower end thereof to create a port 61 which is closed by an elastic packing ring 62 when air pressure is absent in the passage 49 as shown in Fig. 1. The recess 59 is sufficiently large to permit the expansion of the packing ring 62 thereinto (see Fig. 4) when air pressure is present in the passage 49 to permit air flow into an annular passage 63 included between the first connector sleeve 58 and oppositely flatted portions 64—64 (see Fig. 6) on the barrel extension 47 and which extend to the bottom thereof. Internally of the first connector sleeve 58, a smooth annular surface 65 extends upwardly from the lower end thereof for a purpose presently explained.

The upper end of a second connector sleeve 66 is telescoped over the lower end of the first connector sleeve in sealing relation thereto and its lower end is threaded on the extension 47 and fits snugly into a cup 67 provided on the top of a cover 69 (see Figs. 1 and 4) which is threaded on a liquid container 70. The annular passage 63 continues downwardly between the barrel extension 47 and the second connector sleeve 66 and communicates with an annular chamber 71 included between the second connector sleeve 66 and the upper end of a sleeve 72 suitably held in leak tight contact with the abutting lower

5

end of the barrel extension 47. The upper end of a tube 73 is threaded in the upper end of the sleeve 72 and extends downwardly therethrough and in spaced relation thereto to define an annular passage 74 and the lower end of the tube 73 terminates adjacent the bottom of the container 70. The lower end of the passage 74 communicates with the upper part of the container 70 while the upper part connects through a port 75 in the sleeve 72 with the annular chamber 71.

For spraying, the trigger 13 is rocked counterclockwise from the position shown in Fig. 1 to thereby first open the air valve 24 to establish a flow of air through the gun passages described above to the annular passage 56 at the spraying end and also an air pressure through the passages 49 and 63, port 75 and passage 74 over the surface of the liquid in the container 70, the packing ring 62 expanding to clear the port 61 as shown in Fig. 4, and a subsequent shifting of the valve 41^a to the open position shown in Fig. 4 by the continued movement of the trigger 13. This sequential opening of the air and needle valves insures a flow of air at the spraying end of the gun before liquid begins flowing through the tip passage 42, and, for the position of the air cap 52 as shown, produces a small round spray externally of the gun. When the trigger 13 is released, the valve 41^a closes first to shut off the liquid flow, followed by the closing of the air valve 24. This latter sequence, effected by the extension of the springs 26 and 29, insures a continued flow of air for a determined time after liquid flow ceases to clear the spraying end of any adhering liquid. Further, when the trigger 13 is closed, no air flowing through the gun, the packing ring 62 contracts to the position closing the port 61 as shown in Fig. 1, thus retaining pressure in the container 70, the valve 41^a then being closed.

The foregoing establishes a pressure feed on the liquid to form a spray of the indicated shape and the gun is of the non-bleeder type since air flows therethrough only in response to an opening movement of the trigger 13.

A further feature of the gun, which is also characteristic of the other modifications as presently described, is the mounting of the trigger 13. The passage of the valve stem 17 through the trigger wall 18 supports the trigger and the latter fulcrums in the pockets 16—16 to achieve a linear movement of the valve stem 17 with substantially a wandering or rolling pivot and with a higher mechanical advantage than known constructions. The trigger 13 therefore freely accommodates itself as its position changes without any binding restraint and the construction is further economical in that pivot pin or other fulcrum support is eliminated.

The travel of the valve stem 17 is easily adjusted by the knob 22 and the withdrawal of the latter provides for a simple removal of the valve stem for servicing or replacement without disturbing the other parts of the gun.

A further advantage resides in the floating support for the air valve sleeve 20 and hence for the air valve 24 at the rear end of the gun which insures full seating of the air valve 24 at all times with consequent maintenance of the efficient operation of the gun.

To produce a wide fan spray with the Fig. 1 gun, i.e., a flattening of what would otherwise be a round spray issuing from the gun, the air cap 52 is rotated 180° to the position shown in Fig. 7 with the indicia "Fan" uppermost and this adjustment relates the associated parts as shown in Figs. 8 and 9 and brings into action additional passages in the air cap 52 and others not previously described.

The "Fan" adjustment of the air cap 52 registers the passages 56^a and 57 so that with the air valve 24 open, air flows through the last named passages into an annular chamber 76 included between the coaxial surfaces of the air cap 52 and retaining ring 55, and the inner end of the air cap 52 and the adjacent face of the tip member 36, respectively, the two latter elements being spaced from each other as shown in Figs. 8 and 9. The

6

tip member 36 is oppositely flattened at the ends of a diameter which is transverse to the plane of the Fig. 8 section and adjacent the air cap end of the member 36, as indicated by the numerals 77—77 in Fig. 9. These flattings intersect the tapered surface 54 of the tip member 36 and create between the latter and the air cap 52 oppositely disposed pockets 78—78 which communicate with the annular chamber 76 and with the rear ends of oppositely disposed passages 79—79 extending lengthwise of the air cap 52 adjacent the periphery thereof. The forward or delivery ends of the passages 79—79 connect with passages 80—80 in oppositely disposed bosses 81—81, all respectively, in the air cap 52.

As shown in Fig. 9, the passages 80—80 lie on opposite sides of the axis of the valve stem 17 and are positioned in converging relation away from the tip 43. Hence, it will be apparent that, with the air valve 24 open and the valve stem 17 retracted as shown, the otherwise round spray, created by liquid moving through the tip 43 and air flowing through the annular passage 56, is impacted on opposite sides at a distance from the tip 43 by air streams issuing from the passages 80—80 which flatten the round spray into a wide fan shape.

The gun shown in Fig. 1 is also capable of producing an angle or the so-called ceiling spray, i.e., one that is directed upwardly when the axis of the gun barrel 11 is held generally horizontally. When so conditioned, the gun is useful for spraying overhead surfaces.

For this purpose, the air cap 52 is rotated counterclockwise from the position shown in Fig. 7 to that shown in Fig. 10 wherein the bosses 81—81 are located along a vertical diameter of the air cap. Referring to the latter figure and to Fig. 11, it will be noted that the inlet end of the then upper passage 79 is masked by the tip member surface 54 so that air cannot flow out of the connected passage 80. However, the inlet end of the then lower passage 79 connects with the tip member passage 56^a so that air flows out of the connected lower passage 80. The latter air stream is acutely directed at the underside of the otherwise round spray created by liquid and air flowing through the tip 43 and passage 56, respectively, and meets the latter spray at a point beyond the tip 43 and directs it upwardly.

Where a light or finely atomized spray is required, it may be desirable to provide a suction feed for the liquid as distinguished from the pressure feed described above. This result is accomplished in the Fig. 1 gun merely by reversing the position of one part providing a portion of the connection to the container 70.

Specifically and referring to Fig. 12, the second connector sleeve 66 is disconnected from the extension 47 and from the first connector sleeve 58 which is also removed from the extension 47. The first connector sleeve 58 is then reversed in position and rethreaded on the extension 47 as shown in Fig. 12, thus contracting the seal ring 62 by the annular surface 65 to close the port 61. Since the then lower portion of the sleeve 58 is tapered at 82 to a diameter less than the opposite end, this construction defines with the upper, telescoping end of the connector sleeve 66 an annular passage 83 whose upper end communicates with the atmosphere while the lower end connects through the passage 63, port 75 and passage 74 with the container 70. Hence, with air flowing through the gun and with the air cap 52 in any of the three positions noted, round, fan or ceiling spray, an aspirating action will be exerted on the liquid in the container, causing it to rise and flow through the passage 42. The closing of the port 61 by the seal ring 62 prevents any loss of gun air through the passage 49.

The suction position of the connector sleeve 58 is also used when the gun is employed in so-called paint tank service, i.e., where the liquid in the tank is maintained under pressure originating in an auxiliary source. The connector sleeve 66 is removed and a hose connection

leading from the tank (all not shown) is threaded on the lower end of the extension 47.

A modified form of the gun is shown in Figs. 13, 14 and 15 which is conditioned to externally produce small round and fan sprays in the non-bleeder type of gun, the latter spray being controlled by an adjustment rearwardly of the gun. This gun is therefore termed a rear adjustment gun. Since the trigger mechanism, valve stem, the adjustment therefor, the air valve and air valve sleeve are essentially identical with the comparable parts shown in the Fig. 1 gun, they are identified by the same numerals.

Referring to Figs. 13, 14 and 15, a tip member 84 is sealably mounted in the front end of the gun barrel 85 and carries a rearward extension 86 which is threaded within the adjacent end of a tubular member 87 also fitted in the barrel 85. The rearward end of the member 87 carries a seal assembly 88 through which and through the member 87, the valve stem 17 extends forwardly and also through the tip member 84, being spaced from the latter member to define an annular passage 89. The forward end of the passage 89 is successively reduced to provide a tapered valve seat 90 for coaction with the valve 41^a and a cylindrical passage 91 defined on its delivery end by an annular tip 92 projecting from the tip member 84 and which is coaxial with the valve stem 17. The rear end of the passage 89 communicates through a port 93 in the tubular member 87 with a passage 94 in a downward extension 95 carried by the barrel 85 and the latter passage and extension may connect with a liquid container through the assembly shown in the lower portion of Fig. 4, the passage 94 and extension 95 corresponding, respectively, to the passage 46 and extension 47 in the latter figure.

Still referring to Fig. 13, when the air valve 24 is opened as described for the Fig. 1 gun, air flows through the port 34 into a passage 96 which extends longitudinally of the barrel 85 and thence into an annular chamber 97 defined by the cooperating portions of the barrel 85, the tip member 84 and the end of the tubular member 87. From the chamber 97, the air divides, part flowing downwardly into a passage 98 and thence to the liquid container as described for the Fig. 1 gun, the passage 98 corresponding to the passage 49 in Fig. 1. The remaining air under the conditions stated flows into a passage 99 extending generally lengthwise of the tip member 84 and connecting with an annular chamber 100 which extends around the tip 92 and is included between the opposing faces of the tip member 84 and an air cap 101. This cap is rotatably mounted by means of the cooperating, annularly tapered surfaces 102 and 103 provided, respectively, on the air cap 101 and tip member 84 and is axially held by a retaining ring 104 threaded on the tip member.

The central portion of the air cap 101 surrounds the tip 92 in spaced relation thereto to define an annular passage 105 so that when air flows through this passage with the valve stem 17 retracted as shown in Figs. 14 and 15, it creates a small round spray from the liquid issuing under pressure as already described through the tip passage 91. As in the Fig. 1 gun, the genesis of this spray is established wholly externally of the gun.

To produce a fan spray with the Fig. 13 gun, a rear adjustment is provided whose position determines the width of the fan in the zone impacted by additional air streams which are located generally in the same positions as shown for the Fig. 1 gun in Fig. 11.

Specifically, an adjusting rod 106 (see Fig. 13) is threaded in the rear end of the barrel 85 and carries on its outer end a finger knob 107. Extending from the inner end of the rod 106 for a predetermined distance is an axial pocket 108 within which is slidable the rear end of a valve stem 109. A portion of the stem within the pocket 108 is reduced to provide a neck 110 whose ends are defined by annular shoulders 111 and 112 and sepa-

ration of this stem portion from the pocket is prevented by a chordal pin 113 mounted in the rod 106 and whose surface rides along the surface of the neck 110. The valve stem 109 is therefore conditioned for axial movement in the pocket 108 between limiting positions determined by the shoulders 111 and 112 for a purpose presently explained. The valve stem 109 also carries a washer 114 spaced from the inner end of the rod 106 and appropriately held against movement towards the forward end of the stem and interposed between this washer and the inner end of the rod 106 is a helical spring 115.

The axis of the valve stem 109 is inclined to and its forward portion intersects the generally horizontal barrel passage 96 and the forward extremity of the stem 109 is shaped as a valve 116 which, in the relationship shown in Fig. 13, closes the inlet end of a passage 117 which extends generally lengthwise of the tip member 84 and is circumferentially spaced from the passage 99 (see Figs. 14 and 15). The forward end of the passage 117 communicates with a chamber 118 included between a part of the air cap tapered surface 102 and a flatted portion 119 of the outer surface of the tip member 84. The chamber 118 communicates rearwardly with an annular chamber 120 included between the coaxial surfaces of the air cap 101 and retaining ring 104, and the inner end of the air cap 101 and the adjacent face of the tip member 84, respectively, the two latter elements being spaced from each other as shown in Figs. 14 and 15.

The chamber 120 connects with the outer ends of diametrically related, radial passages 121—121 whose inner ends connect with the rear ends of oppositely disposed passages 122—122 extending lengthwise of the air cap 101 adjacent the periphery thereof. The forward or delivery ends of the passages 122—122 connect with passages 123—123 in oppositely disposed bosses 124—124, all respectively, in the air cap 101.

As shown in Fig. 15, the passages 123—123 lie on opposite sides of the axis of the valve stem 17 and are positioned in converging relation away from the tip 92. Hence, when the air valve 24 is opened, the valve stem 17 retracted as shown in Figs. 14 and 15, and the valve stem 109 is retracted a determined distance from the position shown in Fig. 14 to connect the passages 96 and 117, air also flows through the passage 117 and the chamber and passages serially connected therewith and referred to above to the passages 123—123. Therefore, the otherwise round spray, created by liquid moving through the tip 92 and air flowing through the annular passage 105, is impacted on opposite sides at a distance from the tip 92 by air streams issuing from the passages 123—123 which flatten the spray into a fan shape. The extent of the flattening and the size of the fan within reasonable limits is varied by adjusting the valve 116 relative to the inlet end of the passage 117 to regulate the air flow therethrough.

The purpose of the slip connection between the valve stem 109 and adjusting rod 106 shown in Fig. 13 is to insure that if the operator removes the tip member 84 for cleaning or repair while the valve 116 is in the closed position, the valve stem 109 will freely retract against the spring 115 without damage either to the valve 116 or to the seating end of the passage 117.

The rear adjustment gun shown in Fig. 13 may be used under pressure or suction conditions, or in paint tank service, in the same manner as described for the Fig. 1 gun.

Either of the Fig. 1 or Fig. 13 guns may be changed from non-bleeder to bleeder type by a simple transposition of the air valve sleeve 20. In the bleeder type of gun, air flows continuously through the gun when connected to a source of air pressure and the trigger only controls the flow of liquid through the gun. Hence, the bleeder gun may be used directly with an air compressor since the gun provides for any pressure relief required by the compressor.

Referring to Fig. 3, for example, it will be noted that the air valve 24 is located closer to the left end than to the right end of the air valve sleeve 20. Therefore, by reversing the position of the sleeve 20 to that shown in Fig. 16, the air valve 24 is displaced from the valve seat 25 to provide an annular air passage 125 therebetween. This change merely requires the withdrawal of the subassembly including the adjusting sleeve 21, springs 26 and 29, washers 27 and 28, the valve stem 17, and abutment sleeve 19 as shown in Fig. 3. The air valve sleeve 20 is then reversed in position and the indicated subassembly is remounted in the barrel 11 as shown in Fig. 16. All of this is accomplished without disturbing any other part of the gun or its connection to the liquid container.

In Fig. 17 is illustrated a further modification wherein the air valve 24 is eliminated and air flows continuously through the gun and the trigger controls liquid flow only. This gun may be equipped with the spray forming controls shown in Fig. 1 and with any of the connections to a liquid container or tank as previously described.

Referring to Fig. 17, the gun includes a grip 126 and a barrel 127 and rockably mounted in the barrel is a trigger 128 which is generally similar to the trigger 13 and mounted in like fashion in a barrel pocket 129. A valve stem 130, similar to the valve stem 17, extends freely and supportingly through the trigger 128 and through an abutment sleeve 131 whose rear end extends within a pocket 132 in spaced relation thereto provided in an adjusting sleeve 133. The latter sleeve is threaded in a hollow body 134 which is fitted in the barrel 127 and the abutment sleeve is slidable through this body. A helical spring 135 encircles the valve stem 130 within the pocket 132 and between the closed end thereof and a washer 136 fast on the stem 130. Hence, movement of the stem 130 effected by the trigger 128 is against the spring 135 which returns the valve stem 130 to liquid closing position when the trigger is released. The grip 126 includes a passage 137 connectible to an air pressure source which communicates through an annular chamber 138 around the body 134 with a passage 139 in the barrel 127 which leads forwardly to the spraying end of the gun as previously described. Travel of the valve stem 130 in an opening direction is determined by the position of the adjusting sleeve 133.

In Figs. 18 to 20, inclusive, is illustrated a further modified gun which may be more economically manufactured than the types previously described and may therefore be marketed at a lower price. It is usable with the spray forming controls shown in Fig. 1 and with suction or pressure connection to a liquid container, or with a paint tank. It is termed a side adjustment gun and air flows continuously through the gun when connected to a source of air pressure.

This gun includes a grip 140 and a barrel 141 having in the upper portion thereof spaced pockets 142—142 for freely and rockably receiving the bifurcated ends 143—143 of the generally U-shaped trigger 144, all as previously described and shown in Fig. 2. A valve stem 145, similar to the valve stem 17, extends freely and supportingly through the base wall 146 of the trigger which, when actuated to operating position, causes this wall to engage a washer 147 fast on the stem 145 against a helical spring 148 interposed between the washer and the end of a bushing 149 within which the rear end of the stem 145 is slidable and which is threaded in a fitting 150 mounted in the rear end of the barrel 141. The fitting 150 is fashioned on its rear end for connection with an air hose or pipe from which air flows into a fitting chamber 151 and thence successively through radial passages 152 and an annular passage 153 in and around, respectively, the fitting 150 to a passage 154 extending lengthwise of the barrel 141 to spray forming controls such as are shown in the Fig. 1 gun.

The trigger accordingly exercises control only on the valve stem 145, i.e., a control on liquid flow, and adjustment of trigger movement in an opening direction is effected through the medium of an adjusting knob 155 (see Figs. 19 and 20) which is threaded in a side wall 156 of the barrel 141 so that its inner end projects into a barrel pocket 157 within which the trigger operates. The inner end of the knob 155 is shaped as a cone 158 and the knob is positioned so that an element of the lateral surface of the cone is most effectively presented for engagement with a wing 159 of the trigger. In the arrangement shown, the axis of the knob 155 is located at an angle of 12° with the horizontal plane through the valve stem 145. It will be apparent that different positions of the knob 155 present different diameters of the cone 158 to the trigger wing 159 with corresponding different limiting movements of the trigger 144 and valve stem 145. The knob 155 may be held in any adjusted position by a spring 160 which encircles the knob between the head thereof and the barrel 141.

I claim:

1. A spray gun having a barrel including a delivery end and a pocket, air and liquid passages in the barrel leading to the delivery end, a trigger having one end freely rockable in the pocket, valve means at the delivery end controlling flow through the liquid passage and having a stem extending through the trigger in supporting and loose relation thereto, means associated with said stem responsive to movement of the trigger in one direction for shifting the valve means to open position, and means associated with said delivery end of the barrel for directing air and liquid streams issuing from the passages into commingling relation to form a spray beyond the delivery end.

2. A spray gun having a barrel including a delivery end and an upwardly extending bifurcated pocket, air and liquid passages in the barrel leading to the delivery end with the air passage extending longitudinally of the barrel, a trigger having a bifurcated end extending into and freely rockable in the bifurcated pocket and straddling said air passage, valve means at the delivery end controlling flow through the liquid passage and having a stem extending through the trigger in supporting relation thereto, means associated with the stem responsive to movement of the trigger in one direction for shifting the valve means to open position, an air valve carried by the responsive means for controlling flow through the air passage and shifted to open position by said trigger movement, and means associated with said delivery end of the barrel for directing air and liquid streams issuing from the passages into commingling relation to form a spray beyond the delivery end.

3. A spray gun having a barrel including a delivery end and a pocket, air and liquid passages in the barrel leading to the delivery end, a trigger having one end freely rockable in the pocket, valve means at the delivery end controlling flow through the liquid passage and having a stem extending through the trigger in supporting relation thereto, sleeve means surrounding the valve stem and directly shiftable by the trigger, an air valve carried by the sleeve means for controlling flow through the air passage, yielding means interposed between the sleeve means and valve stem whereby the air valve is opened prior to the opening of the valve means, and means at said delivery end of the barrel for directing air and liquid streams issuing from the passages into commingling relation to form a spray beyond the delivery end.

4. In a spray gun, the combination of a barrel including a pocket and air and liquid passages leading to a spray head, a trigger having one end freely rockable in the pocket, valve means associated with the spray head controlling flow through the liquid passage and having a stem extending through the trigger in supporting rela-

tion thereto, a sleeve having a sliding, floating mounting and directly actuated by the trigger, the valve stem extending through the sleeve, an air valve surrounding and carried by the sleeve for controlling flow through the air passage, and yielding means interposed between the sleeve and valve stem whereby the air valve is opened prior to the valve means.

5. The combination of a spray gun having a barrel, a spray head carried by the barrel, pressure air and liquid passages in the barrel leading to the spray head, valves in each of the passages shiftable between closed and open positions, a container for holding the liquid to be sprayed, liquid passage means connecting the container with the liquid passage in the barrel, and air passage means connecting the air passage in the barrel with the container above the liquid therein and including a valving port and a member biased to a position closing the port when the valve in the barrel air passage is closed and air pressure opened when the last named valve opens.

6. The combination of a spray gun having a barrel provided with a lateral extension, a spray head carried by the barrel, pressure air and liquid passages in the barrel leading to the spray head and communicating with like passages in the extension, valves in each of the barrel passages shiftable between closed and open positions, a container for holding the liquid to be sprayed, and means connecting the barrel extension to the container including passage means connecting the barrel liquid passage through the extension liquid passage with the liquid zone in the container, partially telescoped, first and second sleeves threaded on the extension and defining with oppositely flatted portions on the extension air passage

means providing a connection between the extension air passage and the air zone in the container, the junction of the air passage means with the extension air passage defining a port, and yieldable sealing means biased to a position closing the port when the valve in the barrel air passage is closed and air pressure opened when the last named valve opens.

7. The combination of a spray gun having a barrel provided with a lateral extension, a spray head carried by the barrel, pressure air and liquid passages in the barrel leading to the spray head and communicating with like passages in the extension, valves in each of the passages shiftable between closed and open positions, a container for holding the liquid to be sprayed, and means connecting the extension to the container including air and liquid passages respectively communicating with like passages in the extension and selectively positioned to provide for pressure or suction flow on the liquid in the container.

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