April 26, 1960 E. C. BRIGGS 2,934,246

PAINT SPRAY GUN

Original Filed May 25, 1953 2 Sheets-Sheet 1

Fig. 1.

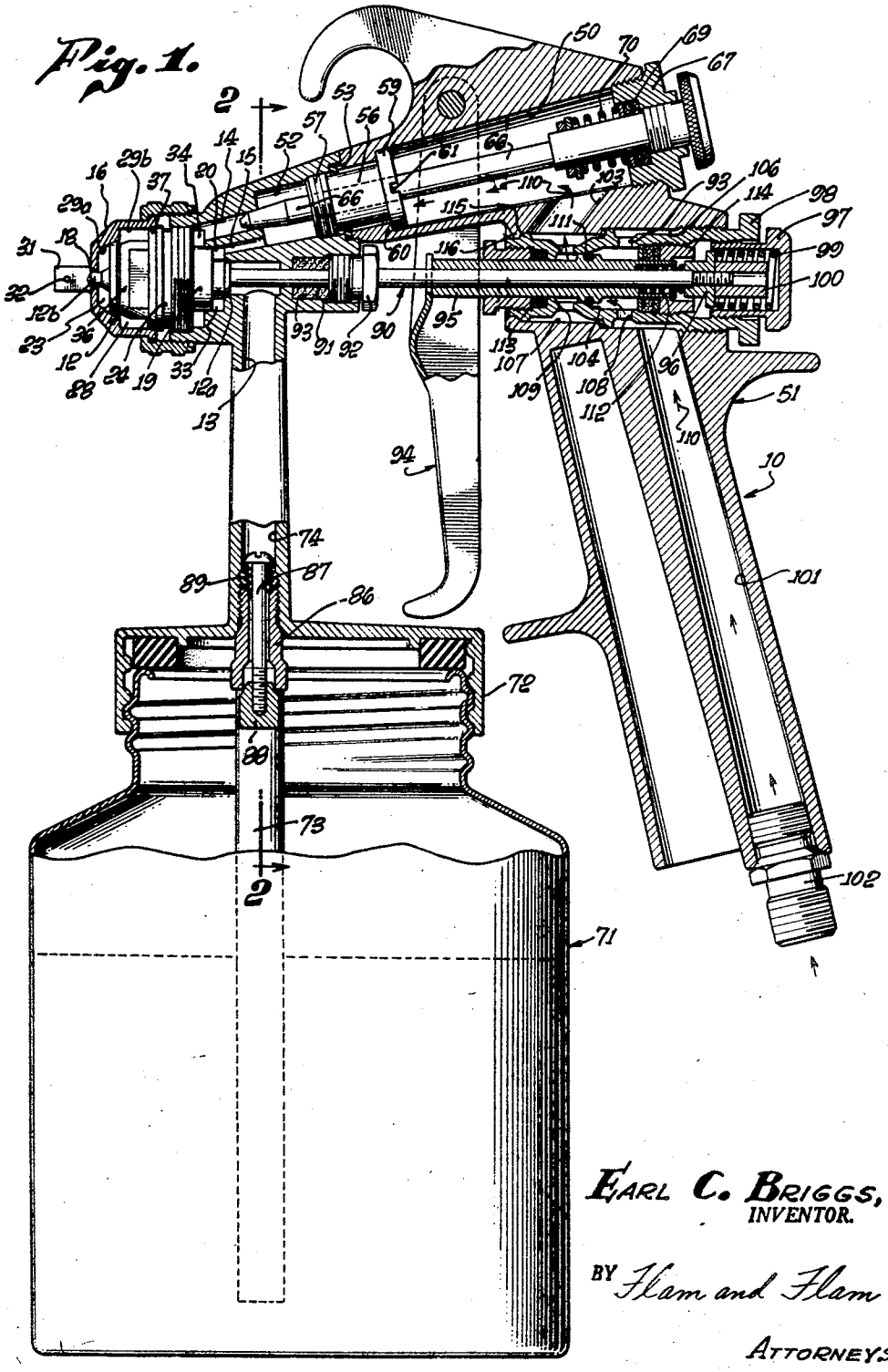

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Fig. 3.

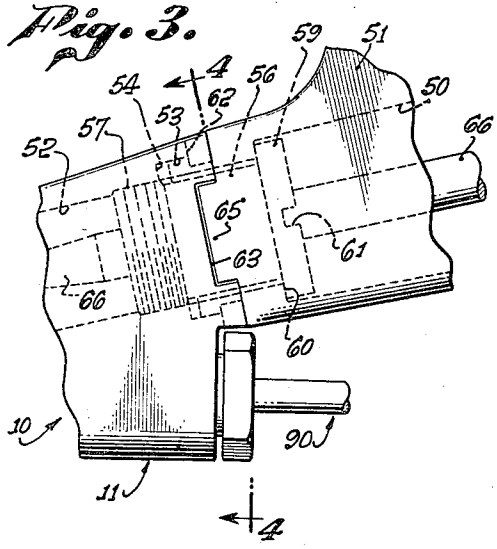
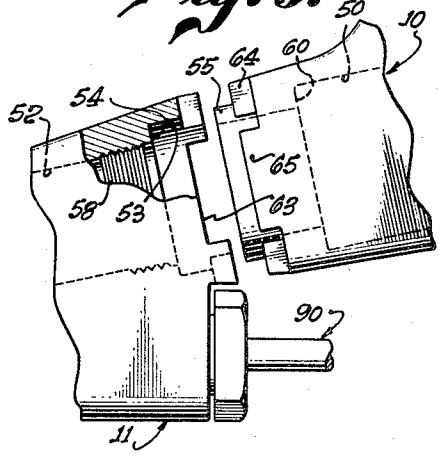


Fig. 5.



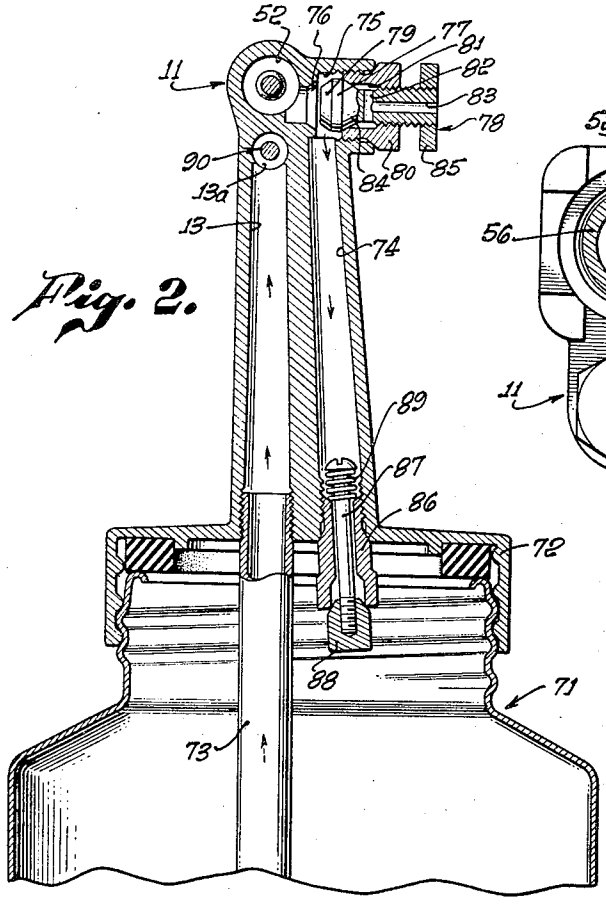
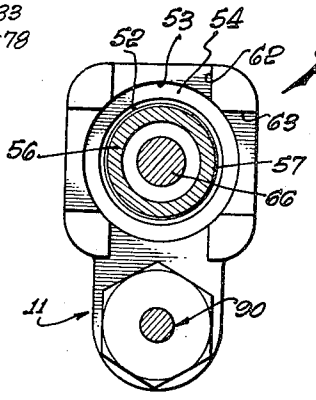


Fig. 2.

Fig. 4.



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2,934,246

PAINT SPRAY GUN

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Original application May 25, 1953, Serial No. 357,217, now Patent No. 2,880,940, dated April 7, 1959. Divided and this application September 15, 1958, Serial No. 768,513

1 Claim. (Cl. 222—400.7)

This invention relates to painting equipment, or the like, and particularly to a spray gun.

Many types of spray guns are manufactured to meet the demands of customers. It is highly desirable that the spray gun be inexpensive, even if certain features be omitted.

In order to make it possible to provide suitable spray gun equipment to meet various demands, a corresponding variety of designs or models is often offered by suppliers of such equipment.

For example, feed of the liquid to be sprayed may be obtained by the use of a siphoning action of the high velocity stream of atomizing air or by the use of various types of pressure feed containers; also, different size and arrangement of the nozzle orifices may be required for specific spray speeds and for various sprayed materials.

It is an object of this invention to provide a novel valve structure that is selectively positionable to condition the spray gun for operation either in connection with a pressurized motive fluid or for vacuum type operation.

This application is a division of an application of Earl C. Briggs, Serial No. 357,217, filed May 25, 1953, entitled Paint Spray Gun, now Patent No. 2,880,940, issued April 7, 1959.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose, there is shown a form in the drawings accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claim.

Referring to the drawings:

Figure 1 is a longitudinal sectional view of a spray gun embodying the present invention, a portion of the apparatus being shown in elevation, and the container being shown in an offset plane;

Fig. 2 is a fragmentary sectional view, taken along the plane indicated by line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view of a portion of the apparatus shown in Fig. 1;

Fig. 4 is a transverse sectional view, taken along the plane indicated by line 4—4 of Fig. 3;

Fig. 5 is a fragmentary longitudinal sectional view, taken along the plane indicated by line 5—5 of Fig. 3; and

Figs. 6, 7, and 8 are diagrammatic views of a portion of the apparatus shown in Figs. 1 and 3, and illustrating the manner in which the spray gun handle is detachably secured to the spray gun head, Fig. 6 being an enlarged fragmentary view of a portion of the apparatus shown in Fig. 3, Fig. 7 being a view taken along the plane indicated by line 7—7 of Fig. 6, and Fig. 8 being a view similar to Fig. 6 but illustrating the parts separated.

A spray gun 10 is disclosed that is generally of two-part construction.

A spray gun head 11, forming one of the parts, has a stepped socket for receiving a nozzle structure 12. The head 11 provides a material inlet passage 13 and separate air passages 14 and 15 leading into the nozzle structure 12. A generally cup-shaped spray gun tip 16 fits over the discharge end of the nozzle 12. The air passing through air passages 14 and 15, as hereinafter described, serves to determine the form of the paint spray.

The nozzle structure 12 is made up of parts having generally cylindrical configuration, appropriately formed to provide the requisite passages for paint and air.

Material from a source passes upwardly of the passageway 13 (Fig. 3) and into an axially extending longitudinal chamber 17 provided by the nozzle structure 12. This central chamber 17 opens rearwardly of a protruding end 12*a* of the nozzle structure for communication with the passageway 13. Material thence passes toward the left, outwardly of the chamber 17 through a restricted opening provided by converging walls of the nozzle 12 at a forwardly protruding end 12*b* of the nozzle.

The rearwardly protruding end 12*a* of the nozzle structure 12 has an annular tapered surface in engagement with a corresponding seat surrounding the left-hand end of the horizontal extension 13*a* of the passageway 13.

The material is induced to flow outwardly of the nozzle, at least partly by the aid of a high velocity air jet passing around the protruding end 12*b* of the nozzle structure 12. For this purpose, the nozzle structure 12 and the spray gun tip 16 cooperate properly to direct air from the passageway 15 past a central aperture 18 in the tip 16. This aperture 18 surrounds the protruding end 12*b* of the nozzle 12 with but slight clearance therewith to provide for an annular air stream surrounding the outlet of the material passageway 17.

A rear cylindrical surface 19 of the nozzle structure 12 is telescopingly received in an inner socket or annular recess 20 provided by the spray gun head 11. A shoulder 21 of the nozzle 12, adjoining the protruding end 12*a*, is, however, spaced from the bottom of the socket 20 to define an annular chamber 33.

The air passage 15 of the body 11 opens into the chamber 33 via the right-hand portion of the inner recess 20. An inner series of substantially equiangularly spaced, longitudinally extending ports 22 (Fig. 4) passes the air from the chamber 33 to a frontal annular space 23 defined by an inner recess 29*a* of the nozzle tip 16 and the forward end of the nozzle 12. The outlet aperture 18 forms the outlet from the space 23.

The nozzle 12 and the tip 16 also cooperate to direct air from the passageway 14 to side air jets of the tip 16 for affecting the width of the spray. For this purpose, the nozzle 12 has a peripheral flange 24 partially received at the rearward portion thereof in the cylindrical walls of an outer socket or annular recess 25 of the spray gun head 11. This recess 25 may be tapped, to be engaged by the external threads formed on the right-hand portion of flange 24. The left-hand portion of nozzle 12, as viewed in Fig. 3, is of general rectangular section (see Fig. 4).

The inner socket 20 opens into the bottom of the socket 25 and is concentric therewith. A rear shoulder 26, formed by the flange 24, is normally spaced from the bottom of the socket 25, and defines therewith an outer annular chamber 34. The air passage 14 of the spray gun body 11 opens into the chamber 34 via the bottom of the socket 25 at a place radially spaced from the inner socket 33.

An outer set of substantially equiangularly spaced, axially extending outer ports 27 establish communication between opposite sides of the peripheral flange 24. One end of each of the ports 27 opens into the outer cham-

ber 34 via the shoulder 26; and the other ends of the outer ports 27 open into a frontal space 28 defined by the flange 24 and an outer recess 29*b* of the spray gun tip 16 (see, also, Fig. 4).

As shown most clearly in Fig. 5, the frontal space 28 communicates with passageways 30, formed in diametrically oppositely disposed horns 31 integrally formed on the spray gun tip 16. These passageways 30 terminate in outlet openings 32 that are directed transverse to the axis of the nozzle 12. Air passing through the outlet openings 32 serves to flatten or otherwise control the width of the spray in a well-known manner.

The nozzle 12 is secured to the head 11 by the aid of the threaded connection between the flange 24 and the socket 25. The threaded connection is sufficiently fluid-tight to provide an effective seal to prevent extraneous flow of air from the socket 25 outwardly of the head 11.

The annular inlet spaces 33 and 34 are separated from each other by telescoping relationship of the nozzle 12 in the inner socket 20. Only relatively minor leakage can occur between the spaces 33 and 34. But the threaded connection between the nozzle 12 and the spray gun head 11 effectively prevents extraneous passage of air from the annular chamber 33, since the air of this chamber 33, to pass exteriorly of the head 11, must also pass into the annular chamber 34 which it adjoins.

An annular tapered surface 35, surrounding the discharge ends of the inner set of nozzle ports 22, cooperates with a correspondingly tapered surface formed between the concentric and adjoining tip recesses 29*a*, 29*b*.

A frusto-conical surface 37, on the protruding forward portion of the flange 24 and surrounding the discharge ends of the outer set of nozzle ports 27, cooperates with a correspondingly frusto-conical surface about the outer tip recess 29*b*.

The angularity of the surfaces 35 and 37 is identical; and movement of the spray gun tip 16 into wedging engagement with the nozzle structure 12 effects a seal for the spaces 23 and 28, respectively. To draw the tip 16 into engagement with the nozzle 12, the spray gun tip has a peripheral flange 38 engaged by a downwardly extending flange 39 of a lock nut 36.

The lock nut 36 is threadedly carried on an external annular surface of the body 11 surrounding the outer socket 25. By appropriate manipulation of the lock nut 36, the spray gun tip 16 is brought into firm engagement with the nozzle structure 12. Leakage of air outwardly of tip recess 29*b* is prevented by a firm engagement between the frusto-conical surface of the spray gun tip 16 and the flange 24.

As shown most clearly in Figs. 1 and 3, an elongate material flow controlling valve closure 90 extends, with substantial clearance, into the nozzle passageway 17. However, a tapered end of the valve 90 cooperates with the restricted outlet opening of the central passageway 17 of the nozzle 12. In the position illustrated in Fig. 3, the tapered head of the valve 90 is in annular engagement with the interior surface of the material passageway 17 of the nozzle 12. Accordingly, flow of material through the nozzle is effectively prevented. Upon longitudinal retraction of the valve 90 toward the right, the tapered head moves from annular engagement with the nozzle structure 12 and permits passage of material.

The valve 90 extends rearwardly of the head 11 past packing 91 and a packing gland 92 into a chamber 93 of the handle body 51. The chamber extends above the handle portion of body 10. The manner in which the valve 90 is operated will be described hereinafter.

The material conduit 13 is supplied by a paint receptacle 71, or the like. The spray gun head 11 has an enlarged integrally formed jar cap 72 extending about the lower end of the conduit 13. The cap 72 appropriately cooperates, together with sealing means, with the jar or container 71. A short conduit 73, threadedly received in the lower end of the conduit 13, projects the conduit 13 to a place adjacent the bottom of the jar container 71.

In order to urge the material of the container upwardly of the passageway 13 and through the central passageway 17 of the nozzle, fluid pressure may be introduced above the surface of the liquid in the container 71.

For this purpose, as shown most clearly in Fig. 2, the spray gun head 11 has a substantially vertical air passageway 74 that opens at its lower end at the interior of the cap 72. The upper end of the air passageway 74 opens into a side wall of a laterally extending and exteriorly opening recess 75 of the spray gun head 11. The bottom of the recess 75 communicates with a chamber or recess 52 of the head which forms a means of supply to the air passageways 14 and 15 of the head 11. Accordingly, air under pressure in the air passageway 52 of the spray gun head 11 may pass through the recess 75, thence downwardly through the air passageway 74 to the container 71 for urging the material upwardly of the conduits 73, 13 and through the nozzle 12.

It is sometimes desirable that the liquid of the container 71 be subjected only to atmospheric pressure rather than to high air pressure. Thus, for instance, the material to be applied may be sufficiently fluid relative to a particular nozzle structure such that the small reduction in pressure, due to the high velocity air jet around the outlet end of the nozzle, is sufficient to induce flow of the material from the container and outwardly from the nozzle 12.

A novel valve structure carried by the head 11 is intended to be operable for alternatively connecting the passageway 74 to the pressure passageway 52 or to the atmosphere.

Intermediate the length of the recess 75 and adjoining the upper opening of the vertical passageway 74, a frusto-conical seat 76 is formed, through which air from the passage or recess 52 must pass, if at all, to the upper opening of the vertical passageway 74. An enlarged head 77, integrally formed on a valve stem 78, forms a valve closure for seat 76. For this purpose, it has a frusto-conical surface 79 engageable with the seat 76. The stem 78 is movable longitudinally to bring the surface 79 into or out of engagement with the seat 76 to prevent or permit, respectively, communication between the passageways 52 and 74.

The outer end of stem 78 is threaded for providing such longitudinal movement, by engagement with a threaded aperture of a nut 80. The nut 80 is, in turn, threadedly received in the end opening of the recess 75 and serves as a body member mounting the stem 28.

Substantial clearance is provided between the stem 78 and the nut 80, rearwardly of the head 77. An annular passageway 81, surrounding the stem 78, is thus formed. This annular space, by the aid of a transverse and a longitudinal port 82 and 83 in the stem 78, is in continuous communication with the exterior of the head and the ambient air.

The space 81 extends on that side of the upper end of the vertical passageway 74 remote from the annular seat 76. The space 81 is either isolated from the passageway 74 or in communication therewith, depending upon the position of the head 77. For this purpose, a rearwardly facing frusto-conical valve closure surface 84 is formed on the head 77 that is selectively engageable with the end of the nut 80 to permit or prevent communication between the space 81 and the passageway 74.

Upon movement of the head 77 to close communication between the air passageways 52 and 74, as by the aid of an enlarged head 85, the frusto-conical surface 84 moves from the end of the nut 80 and permits communication between the space 81 and the air passageway 74. Accordingly, when the head 77 engages the seat 76, the passageway 74 is in communication with the ambient air. Correspondingly, when the head 77 is fully retracted

to establish communication between the passageways 52 and 74, the rearwardly facing frusto-conical surface 84 engages the end of the nut 80 to seal the space 81 from the passageway 74.

The spray gun head 11 has provisions for preventing material movement of the liquid of the container 71 into the air passageway 74. A flow restricting device is provided for this purpose.

As shown most clearly in Fig. 2, a tubular valve body 86 is threadedly accommodated in the end of the air passageway 74. A valve stem 87 extends with substantial clearance through the central aperture of the body 86, and carries at the lower end a check valve closure 88.

A compression spring 89, at the upper end of the body 86, urges the stem 87 in a direction corresponding to movement of the check valve closure 88 into engagement with the edge surrounding the downward opening of the through aperture of the body 86.

Upon a preponderance of pressure on the upper side of the valve body 86, the valve structure will, of course, be opened to admit pressurized air or atmospheric air. However, the check valve ensures against accidental flow of material into the air passageway 74 should the orientation of the device be favorable to such flow.

As shown most clearly in Fig. 1, the passages 14 and 15 of the spray gun head 11 communicate with an upper air passageway 50 of the handle body 51. For this purpose, the enlarged recess 52 of spray gun head 11 is provided that opens rearwardly of the head 11. The passages 14 and 15 each separately communicate with the bottom of the recess 52. The manner in which the spray gun body 51 is detachably secured to the spray gun head 11 is shown to best advantage in Figs. 6, 7 and 8.

The spray gun head recess 52 is slightly enlarged as at 53 (see Fig. 8) at the rearwardly opening end thereof, forming a shoulder 54. A cylindrical projection 55, at the forward end of the spray gun body 51, is received in the enlarged cylindrical recess 53. The projection 55 surrounds the opening of the upper air passageway 50.

A through apertured bolt 56, extending in the air passageway 50, engages both the handle body 51 and the spray gun head 11 and draws the members together. For this purpose, one end of the bolt 56 has exterior threads 57 cooperating with corresponding threads 58 in the end of the recess 52. The other end of the bolt 56 has an enlarged head 59 engaging a shoulder 60 in the air passageway 50 of the body 51.

Diametrically opposite slots 61 in the head 59 serve as a means whereby an appropriate tool may rotate the bolt 56. Such tool may be accessible through the rear opening of the recess 50 (see Fig. 1).

An appropriate sealing gasket is confined against the shoulder 54 by the end of the cylindrical projection 55.

In order to maintain alignment between the head 11 and the body 51, the spray gun head 11 has vertical and horizontal slots 62 and 63 (see Fig. 7) receiving corresponding lugs 64 and 65 formed near the base of the cylindrical portion 55.

In order that the spray gun pattern be controlled by the user of the gun, a metering device 66 is provided for controlling the flow of air through openings 32 in horns 31 of the nozzle. The device is in the form of an elongate needle valve closure 66 that extends with substantial clearance through the tubular bolt 56. This valve 66 has a tapered head projecting through the recess 52 and into the air passageway 14 of the head 11 (Fig. 3). The spray directing passageways 30 (Fig. 5) are supplied with air only by the aid of the passageway 14. By longitudinally positioning the valve member 66, different extents of clearance are provided about the tapered end thereof and the entrance to the air passage 14. Accordingly, longitudinal adjustment of the valve stem 66 controls the volume of air to the spray gun tip 16.

The manner in which the valve closure 66 is adjustably supported for this purpose is best shown in Fig. 1. The right-hand end of the valve member 66 extends through, and is in threaded engagement with, a through aperture of a connector 67. The connector 67 is, in turn, threadedly received in the rear end opening of the upper air passage 50. The closure 66, exterior of the connector, carries an enlarged annular head 68 for manipulation by the user.

Packing 69, carried in an enlarged recess of the connector 67 and surrounding the cylindrical portion of the valve member 66, effectively seals the upper air chamber 50. A compression spring 70, engaging a collar carried by the closure 66, urges a packing gland to compress the packing.

For retracting the nozzle closure 90, a trigger structure 94, pivotally suspended on the valve body 51, is provided. This structure is bifurcated at its upper end to embrace the body portion 51.

A sleeve 95, slidingly accommodated on the nozzle closure 90, and also extending into the chamber 93, serves as a means whereby counterclockwise movement of the trigger 94 serves to operate the nozzle closure 90. An ear, integrally formed on the trigger 94, engages the left-hand end of the sleeve for moving it toward the right, as viewed in Fig. 1.

The right-hand end of the sleeve 95, upon movement toward the right, engages a collar or nut 96 carried near the right-hand end of the nozzle closure 90. Accordingly, upon operation of the trigger 94, the sleeve 95 moves a distance corresponding to the separation between its right-hand end and the nut 96; further movement of the sleeve 95 causes movement of the nozzle closure 90 to the right to open the nozzle passageway.

The nut 96 is in threaded engagement with a reduced end of the nozzle closure 90. A peripheral cylindrical portion of the nut 96 is guidingly received in a central recess of a cap 97 which, in turn, is threadedly received in a valve body member 98, to be described more fully hereinafter.

A compression spring 99, in the recess of the cap 97, engages the nut 96 and thus urges the nozzle closure 90 to closed position.

A spacer member or lock nut 100 is carried at the right-hand end of the nozzle closure 90 beyond the nut 96, and is normally spaced from the bottom of the recess of the cap 97. The spacing between the member 100 and the bottom of the recess determines the limit of movement of the nozzle closure 90 to open position.

The member 100, being threaded on the rod closure 90, also serves to lock the nut 96 in an adjusted position axially of the nozzle closure 90. The longitudinal position of the nut 96 determines the extent of movement of the trigger member 94 required before movement of the nozzle closure 90. This delay prior to the opening of the nozzle is required for first ensuring that pressurized air is available at the nozzle.

The valve body 98 is telescopingly received into the chamber 93. A cylindrical surface 115 of the left-hand end of the body 98 is accommodated in guiding relationship with a cylindrical surface provided by an inwardly extending flange 116 at the left-hand end of the chamber 93.

The valve body 98 is hollow, and provides an inner annular tapered or frusto-conical surface forming a valve seat 104. The seat 104 divides the hollow interior of the valve body 98 into two axially spaced chambers.

Pressurized air is supplied to the upper air passageway 50 of the body 51 and the air passageways 14 and 15 of the head 11 through a generally vertical passageway 101 extending upwardly within the stock portion of the handle body. Air enters the passageway 101 through the bottom opening thereof. For this purpose, a coupling member 102 facilitates the connection of an air hose, or the like, leading to a remote source of pressurized air.

The passageway 101 opens at its upper end into the central chamber 93. The air, controlled by a valve apparatus, then passes through an auxiliary passageway 103

extending between the central chamber **93** and the upper air passageway **50**.

The air must pass, if at all, axially of the interior of the valve body **98** past the seat **104**. For this purpose, the valve body **98** has a peripheral shoulder **105** engaging a corresponding shoulder formed intermediate the chamber **93**. The valve body **98** thus defines separate axially spaced, generally annular spaces **106** and **107** around the valve body **98**.

The passageway **101** is in continuous communication with the external space **106**. The space **106**, in turn, communicates with the interior of the valve body **98** on the right-hand side of the seat **104** by the aid of transverse ports **108** in the body **98**. The interior of the valve body **98** on the other side of the seat **104** communicates with the annular space **107** by the aid of transverse ports **109**.

This structure, therefore, determines the passage of air designated generally by the arrows **110**.

The movable sleeve **95** intermediate its length carries a resilient sealing ring **111** in a groove defined by axially spaced annular flanges. The sealing ring **111** acts as a closure in cooperation with the seat **104**. The sleeve **95** otherwise has substantial clearance with the interior of the valve body **98** on opposite sides of the seat **104**.

In the position illustrated, the ring **111** is in annular closing engagement both with the seat **104** and the groove of the sleeve **95**. Accordingly, passage of air is interrupted. The control of the passage of air is thus achieved.

The air valve is biased to closed position by the aid of a compression spring **112** carried in an annular recess at the right-hand end of the sleeve **95**, engaging at respective ends the nut **96** and the sleeve **95**.

Since there is a lost motion connection between the sleeve **95** and the nozzle closure **90**, the nozzle closure **90** opens only after the air valve provided by the ring **111** and seat **104** is open, and proper operation of the spray gun is thus achieved.

A packing gland **113**, surrounding the sleeve **95** and threadedly carried by the valve body **98**, urges packing against a shoulder of the body to seal one end opening of the body **98** and the air chamber therein. In a similar manner, a packing gland **114**, surrounding the sleeve **95** and threadedly carried in the valve body **98**, urges packing against a shoulder of the body **98** to seal the air chamber near the other end of the body.

The inventor claims:

An assembled article of manufacture forming the dispensing portion of a combination pressure-siphon spray gun, comprising, first, a spray gun head having a portion provided with a fitting at which a nozzle may be attached, said spray gun head having a cap portion detachably cooperable with a container for fluid to be sprayed; said head having a connecting portion joining the cap portion and the fitting portion, said head having means forming a pair of separate passages in the connecting portion each opening interiorly of the cap portion, one of the passages being extended at one end to form an inlet for upward passage of fluid, said one passage at its other end opening at the fitting for registry with the nozzle, said head having means therein and adjacent the fitting, forming a passageway for air under pressure and opening at the fitting at a place spaced from said other end of said one passage, for registry with the nozzle, said spray gun head having an exteriorly opening threaded recess intersecting both said passageway and said other passage at its upper end, the places of intersection being spaced; and, secondly, a two-part pre-assembled valve unit, one part being a hollow open ended nut member threadedly secured at the outer end of the recess, the other part being an exteriorly manipulable member extending through said nut member and having closure means at its inner end, said valve unit including means forming a vent through said nut member, said valve unit also including means forming seats cooperable with said closure means and determining opposite limits of longitudinal movement of said manipulable member by wedging engagement with said closure means; said passageway, said vent forming means and also said other passage being so located that said passageway and said vent forming means are alternately and exclusively connected to said other passage upon movement of said manipulable member to its oppositely longitudinal limits.

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