Feb. 2, 1965 J. A. PAASCHE 3,168,250

AIRBRUSH MECHANISM

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Fig. 1.

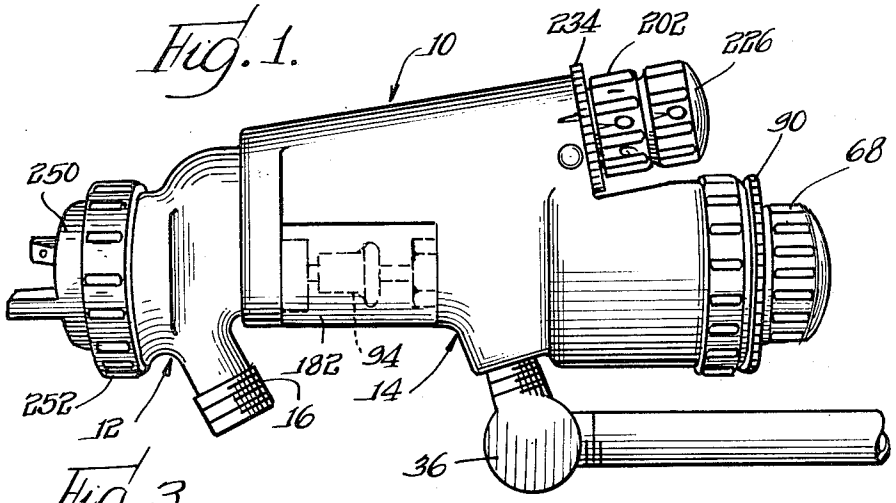
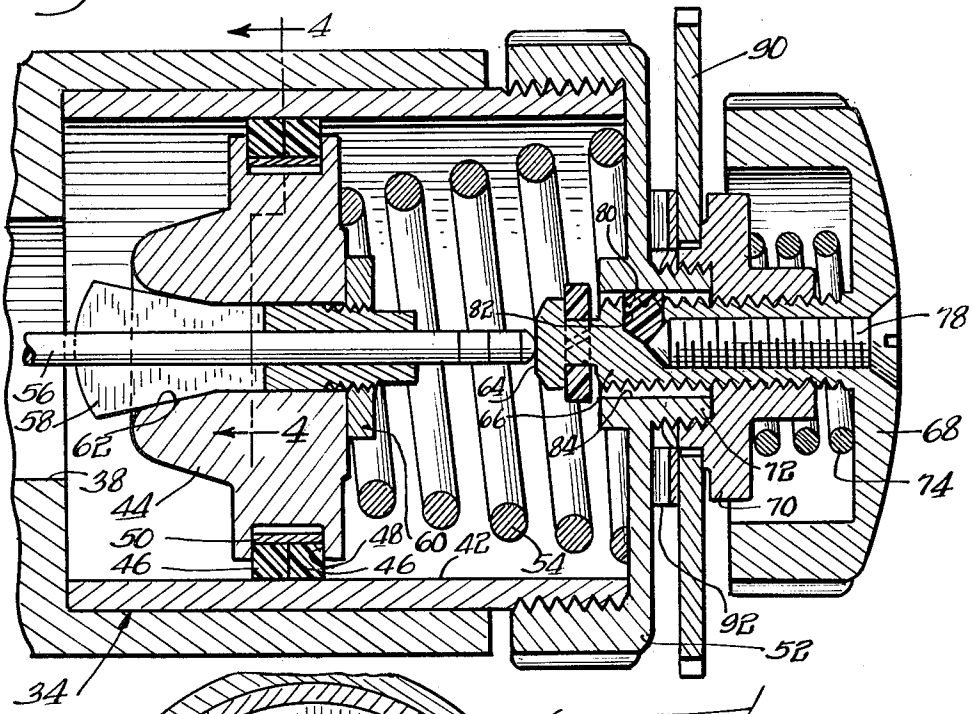


Fig. 3.



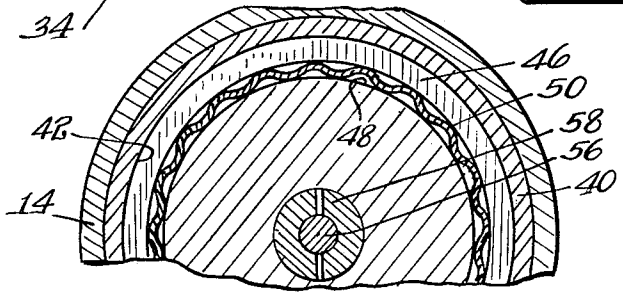


Fig. 4.

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AIRBRUSH MECHANISM

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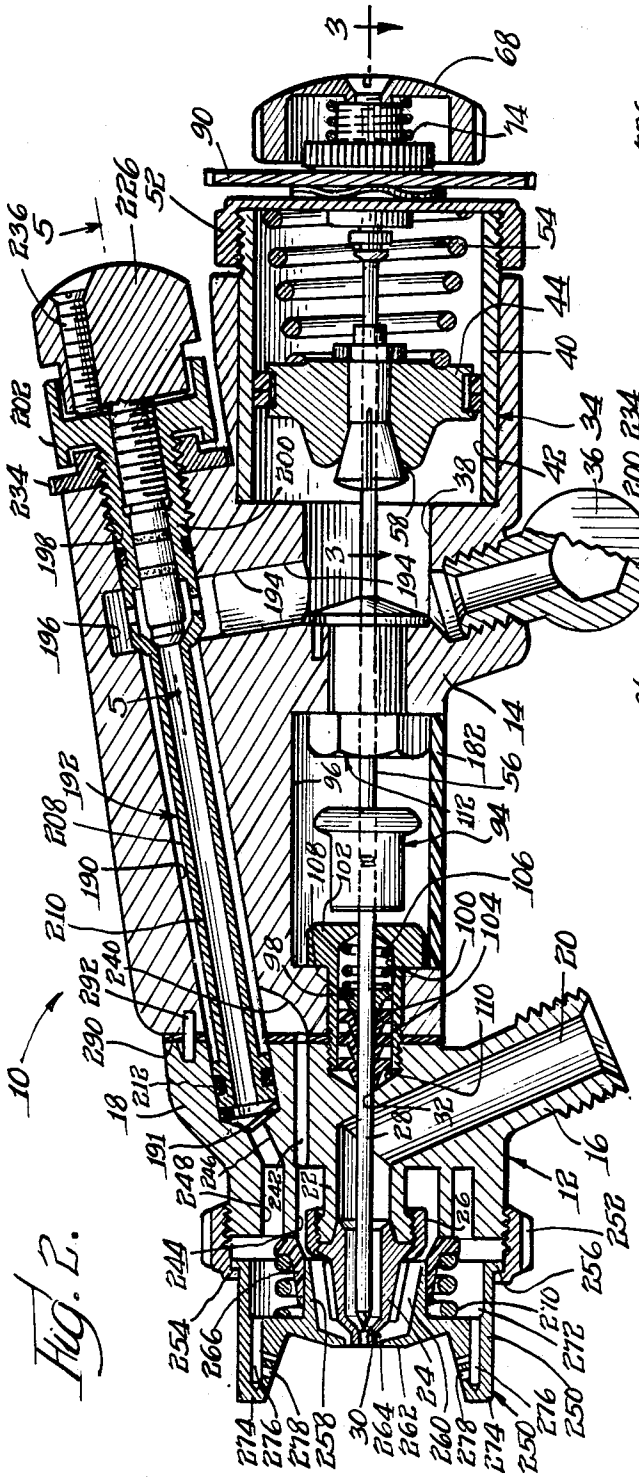

Fig. 2.

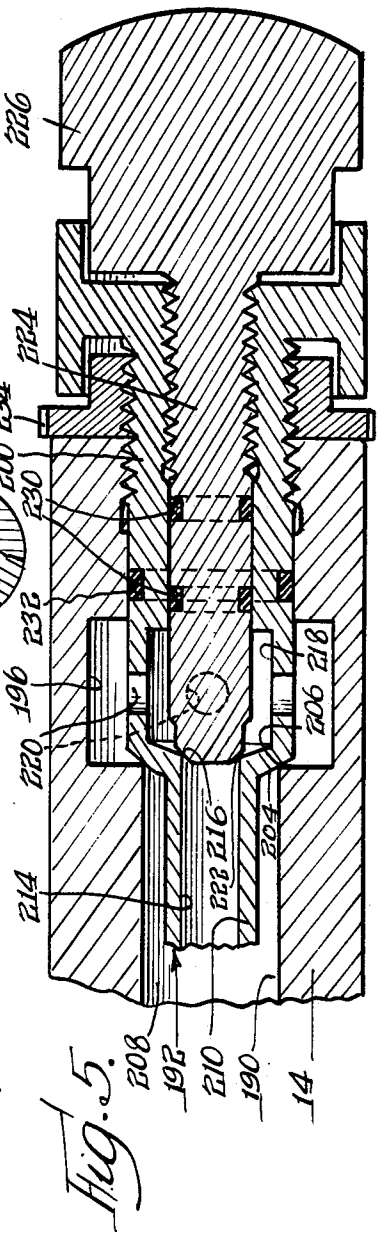

Fig. 5.

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AIRBRUSH MECHANISM

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Fig. 6.

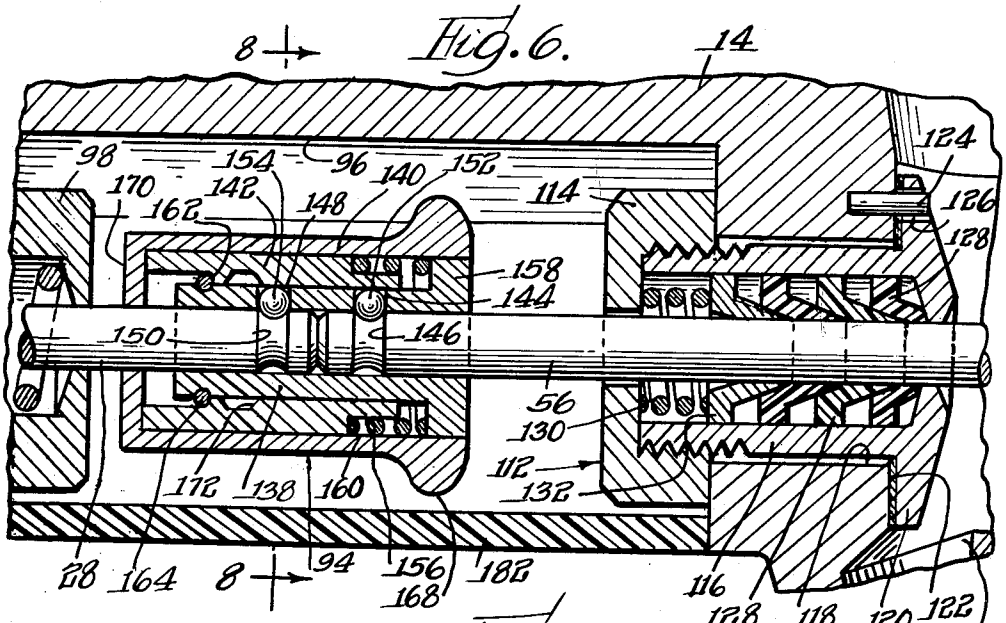


Fig. 7.

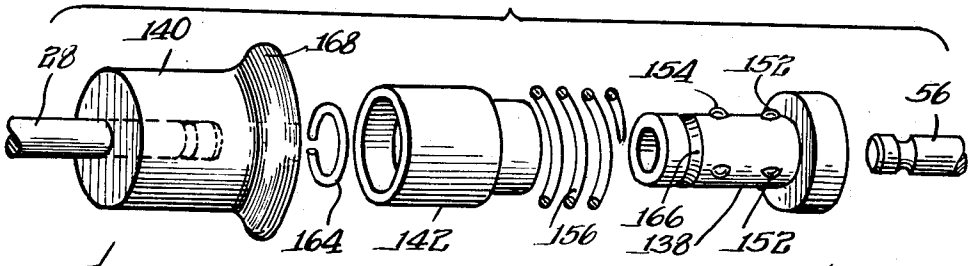


Fig. 8.

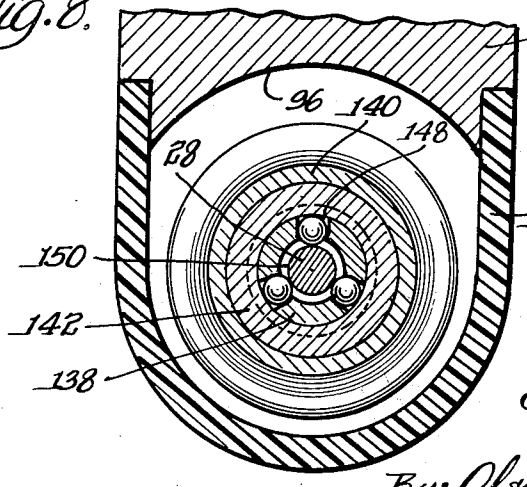
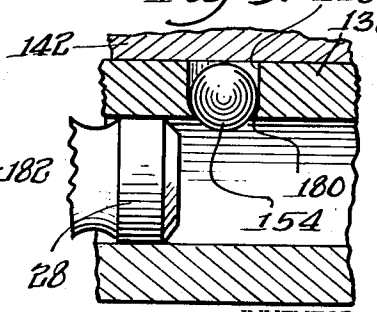


Fig. 9.



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Patented Feb. 2, 1965

3,168,250

AIRBRUSH MECHANISM

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Filed Nov. 24, 1961, Ser. No. 154,770
13 Claims. (Cl. 239—300)

The present invention relates to airbrushes or spray guns and is concerned more specifically with airbrushes which are controlled automatically in response to the pressure of operating air.

One object of the invention is to provide a new and improved airbrush.

Another object is to provide an improved airbrush which is so constructed that components of the airbrush which are subject to contamination by the liquid are confined to an atomizing head which can be readily detached from coacting support and control structure for the head for cleaning and to provide for convenient and efficient handling of a great variety of fluid materials.

Another object is to provide an airbrush having an improved construction which provides for quick detachment and replacement of an atomizing head, including a liquid control valve, in relation to coacting support and control structure for the head without disassembling of liquid control valve structure in the head or coacting valve operating structure mounted on the support structure for the head.

Another object is to provide in an airbrush of the character recited for the flow of separated streams of atomizing air and fan air through a common bore in the airbrush at high flow rates which are separately controlled at the input end of the bore for high speed coating with heavy materials.

Another object is to provide an airbrush of the above character having an improved construction which provides for a quick uncoupling of a valve needle in a detachable atomizing head from needle valve operating means on support structure for the head as an incident to detachment of the head from the support structure.

Another object is to provide an airbrush of the character recited which will remain sealed against leakage of fluid past control valve operating structure over an extended service life.

Another object is to provide an airbrush controlled in response to the changes in the pressure of operating air and having an improved construction which facilitates mutual alinement and coupling and uncoupling of an air motor from valve actuating means on a detachable atomizing head.

Another object is to provide an improved automatic airbrush requiring no lubrication to serve dependably over an extended service life and remain continuously responsive to changes in operating pressure to be self controlling.

Another object is to provide an airbrush having a new and simplified construction whicth affords advantages in adjusting the atomizing air outlet of the brush.

Another object is to provide an airbrush having an improved and highly compact construction which provides for easy and precise adjustment of the atomizing air flow and the fan air flow independently of each other with independent liquid flow control.

Another object is to provide an improved airbrush of the character recited in the preceding objects which is compact in construction and well adapted for economical manufacture and inherently capable of serving dependably and efficiently in use over a long service life.

Other objects and advantages will become apparent from the following description of the exemplary embodiment of the invention illustrated in the drawings, in which:

FIGURE 1 is a side view of an airbrush forming the exemplary embodiment of the invention;

FIG. 2 is a longitudinal sectional view of the airbrush;

FIG. 3 is a fragmentary longitudinal sectional view on an enlarged scale taken with reference to the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary section view taken generally along the line 4—4 of FIG. 3;

FIG. 5 is a fragmentary sectional view taken along the line 5—5 of FIG. 2;

FIG. 6 is a fragmentary sectional view showing detailed construction of valve actuating and sealing structure appearing in the medial portion of FIG. 2;

FIG. 7 is an exploded view of a quick release coupling appearing in FIG. 6;

FIG. 8 is a fragmentary sectional view taken along the line 8—8 of FIG. 6; and

FIG. 9 is a detail view of elements within the quick disconnect coupling.

Referring to the drawings in greater detail, the airbrush **10** forming the illustrated embodiment of the invention comprises, FIGS. 1 and 2, an atomizing or spray head **12** detachably mounted on a support body **14** which houses valve control and air supply structure for the head.

Spray liquid from a suitable source (not shown) is supplied under pressure to the atomizing or spray head **12** through a spray liquid inlet connection **16** integrally formed on the body **18** of the head **12** and defining an internal liquid inlet passageway **20** communicating with a hollow nozzle support boss **22** projecting forwardly from the center of the head body, as shown. Normally spray fluid is supplied under pressure through the boss **22** to a centrally bored spray nozzle **24** secured to the boss by a retaining nut **26** to project forwardly from the boss, as shown.

The discharge of liquid through the nozzle **24** is controlled by a reciprocable needle valve element **28** coacting with a reduced diameter tip **30** of the nozzle **24** and projecting rearwardly through a head body bore **32**. Retraction of the valve needle **28** opens the nozzle **24** and forward advancement of the needle closes the nozzle. Retraction and advancement of the needle valve **28** to start and stop the outflow of liquid is powered by an air control motor **34** mounted within the lower rear portion of the main body **14** to respond to the pressure of operating air supplied to the airbrush.

As illustrated, operating air from a suitable source (not shown) is supplied through a coupling **36** to an internal air inlet chamber or passage **38** formed within the main body **14** ahead of the motor **34**, FIG. 2.

The control motor **34** is formed by a sleeve **40** fitted in the body **14** to define a power cylinder **42** coaxial with the valve needle **28**. The cylinder **42** communicates at its forward end with the inlet passage **38** and receives a piston **44** which is encircled by two sealing rings **46** disposed in a circumferential groove **48** and urged radially outward into optimum sealing engagement with the cylinder by a corrugated metal expander ring **50** disposed in the groove **48** behind the ring, as shown in FIGS. 3 and 4.

The rings **46** are advantageously formed of nylon or a polymeric material of similar physical qualities and functions without benefit of lubrication to maintain a good seal between the piston **44** and cylinder **42** over a long service life. The nylon piston rings not only eliminate any need for lubrication, but serve to advantage in avoiding sticking of the piston, which would cause it to fail to respond as intended to changes in operating air pressure applied to the cylinder.

The outer end of the cylinder **42** is covered by a threaded cap **52** supporting adjustable stop structure, to

be described, for determining the open position of the valve needle **28**.

A coiled compression spring **54** positioned between the cap **52** and piston **44** urges the latter forwardly for closing the nozzle **24**. Motion of the piston is transmitted to the nozzle control needle **28** by a piston stem **56** extending through a clamping chuck **58** centrally mounted in the piston. Tightening of a nut **60**, FIG. 3, on the chuck **58** draws the enlarged forward end of the chuck into a chuck receiving space **62** in the piston, causing the chuck to clamp tightly in an adjusted position on the stem **56**.

The piston **44** is adjusted along the stem **56** to adjust the residual compression in the spring **54** when the valve needle **28** is in its closed position, thereby adjusting the pressure of the operating air required to move the piston against the spring and open the nozzle **24**.

The connection between the forward end of the piston stem **56** and the needle **28** will be described presently. The rear end of the piston stem **56** projects rearwardly from the piston to coact with an adjustable abutment **64** which determines the open position of the needle **28** and hence the discharge rate of liquid from the nozzle **24**.

The abutment **64** is formed on the forward end of a threaded stem **66** of a liquid adjusting knob **68**. The threaded stem **66** is threaded through a stepped nut **70**, which in turn is threaded onto a hollow boss **72** on the cap **52**. The nut **70** is tightened firmly on the boss **72** so that it is not loosened by rotation of the knob **68** and the stem **66**, which is loosely threaded in the nut **70**.

A controlled frictional resistance to rotation of the knob **68** is provided by a compression spring **74** mounted between the nut **70** and the knob, as shown, to apply a friction producing axial force to the stem **66**.

The adjusting knob **68** is firmly secured against rotation in its adjusted position by tightening of an axial screw **78** in the knob, to cause the pointed forward end of the screw, to force a friction plug **80** radially outward through a supporting well **82** in the stem **66** into tight frictional engagement with the central bore **84** within the cap **52** which receives the stem **66**.

The rotary position of the liquid flow adjusting knob **68** is read with reference to a calibrated dial **90** journalled on the nut **70** to permit rotation of the dial into a desired reference position for properly indicating the position of the knob **68** with reference to the position of the valve needle **28**. A corrugated washer **92** exerts an axial force on the dial **90** to effect frictional holding of the dial in the desired rotary position.

As previously intimated, the head **12** is detachably mounted on the body **14**. The head is so constructed that all components of the airbrush including the valve needle **28**, which are subject to contamination by the spray liquid, are removed with the head upon detachment of the head from the support body **14**. Upon detachment of the head **12**, the valve needle **28** is disconnected from the piston stem **56** by operation of a quick release coupling **94**, which normally connects the valve needle and stem, disposed within a recess **96** formed in the lower side of the body **14** ahead of the air inlet space **38**.

The valve needle **28** and the piston stem **56** extend into the recess **96** and are sealed by packing means which provides advantageously for easy positioning of the valve needle and piston stem in mutual coaxial alinement.

As shown in FIG. 2, the rear end of the valve needle bore **32** in the spray head body **18** is counterbored and threaded to receive the forward end of a threaded retaining or holding element **98** rotatably disposed within a bore **100** formed in the support body **14** and extending forwardly to the head **12** from the recess **96**. An enlarged rotating head **102** on the holding element **98** abuts against the body **14** at the forward end of the recess **96**. The holding element **98** is axially bored to permit passage therethrough of the valve needle **28** and is counterbored

from its forward end to accommodate a plurality of sealing or packing elements **104** having central portions of generally conical shape. The packing elements **104** encircle the valve needle **28** and nest together with the extended apices of the conical central portions of the elements pointing toward the nozzle **24**.

A helical compression spring **106**, disposed within the holding element **98** as shown, acts on a conical spring seat **108**, engaging the rear one of the stacked packing elements **104** to urge the packing elements forwardly to hold the packing elements together and effect engagement of the forwardmost one of the elements **104** with the conical bottom **110** of the counterbore in the bore **32** which receives the holding element **98**.

The generally conical packing elements **104** are advantageously formed from a yieldable polymeric material, preferably polytetrafluoroethylene, sold commercially under the name "Teflon."

The sealing elements **104** thus formed will maintain a tight effective seal around the valve needle **28** over a long service life. Any wear on the elements **104** is automatically compensated for by an inward contraction of the elements to continue an effective seal around the valve needle. In this connection, it will be noted that any liquid which escapes into the space housing the elements **104** operates to apply a squeezing force to the exposed element or elements **104** to enhance the seal around the valve needle.

The piston stem **56** is sealed by a packing unit **112**, FIGS. 2 and 6, which provides to advantage for easy location of the stem **56** in precise coaxial alinement with the valve needle **28**. The packing unit **112** is designed to provide for limited radial adjustment of the packing unit in any direction on the support body **14**. As shown, the packing unit comprises a generally spool shaped packing capsule formed by a centrally open cap **114** encircling the stem **56** within the recess **96** and threaded onto the adjacent end of a cylindrical element **116** loosely disposed within a bore **118** formed in the body **14** to extend between the inlet space **38** and the recess **96**.

The rear end of the element **116** is enlarged to form a radially extending sealing shoulder **120** which bears against an annular gasket **122** to form a seal between the rear end of the element **116** and the body **14**. A pin **124** is set in the body **14** and extends into a hole **126** in the shoulder or flange **120** larger than the pin **124** to hold the element **116** against rotation upon tightening of the cap **114**.

The element **116** is centrally bored to receive the piston stem **56** and is counterbored from its forward end to accommodate a nest of three yieldable polymeric packing elements **128**, generally similar to the previously described packing elements **104** used to seal the valve needle **28**. The extended apices of the elements **128** point rearwardly in the direction of the air pressure applied to this seal.

A coiled compression spring **130** disposed between the cap **114** and a spring seat **132** engaging the forwardmost one of the packing elements **128**, applies a residual compressive force to the packing elements. The central portion of the spring seat **132** has a conical shape similar to that of the individual packing elements **128**.

As shown, three yieldable polymeric packing elements **128** are used in the packing unit **112**, and three yieldable polymeric packing elements **104** are used to form a seal around the valve needle **28**.

Freedom of the packing unit **112** to move a limited distance radially is provided by the bore **118** being somewhat larger than the cylindrical element **116** received within the bore **118**. This facilitates a radial movement of the forward end of the stem **56** in any direction to have a coaxial alinement with the valve needle **28**, as recited. The forward force of air pressure on the packing unit **112** urges the annular shoulder **120** firmly into engagement with the annular gasket **122** to form an effective seal against the escape of air around the element **116**.

The quick disconnect coupling 94 used to connect the forward end of the piston stem 56 to the valve needle 28 comprises an inner sleeve 138, an outer sleeve 140 and an intermediate sleeve 142. The inner sleeve 138 defines a rear series of circumferentially spaced retaining ball apertures 144, which register with an annular groove 146 in the forward end of the piston sleeve 56, and a forward series of circumferentially spaced apertures 148 which register with an annular groove 150 in the rear end of the valve needle 28, FIGS. 6 and 8.

The rear apertures 144 receive a plurality of locking balls 152, FIG. 7, which are normally held by the intermediate sleeve 142 in radially inward positions in which the balls 152 are locked in the stem groove 146. Similarly, a plurality of locking balls 154, FIG. 7, are positioned in the forward apertures 148 and held normally by the intermediate sleeve 142 in inner positions in which the balls 154 lock in the valve needle groove 150.

A compression spring 156 disposed within the outer sleeve 140 between an annular flange 158 on the inner sleeve 138 and a shoulder 160 on the intermediate sleeve 142 urges the intermediate sleeve forwardly to its normal position which is determined by engagement of a forward shoulder 162 on the intermediate sleeve with a snap ring 164 engaging a groove 166 in the inner sleeve 138.

The outer sleeve 140 houses the coupling 94 and includes on its rear end a radially enlarged annular hand grip 168 adapted to be grasped to move the outer sleeve rearwardly. An annular flange 170 on the forward end of the outer sleeve 140 extends radially inward across the forward end of the intermediate sleeve 142, as shown in FIG. 6. This flange forms an abutment confronting the rear end of the head retaining element 98 and coacts with the intermediate sleeve 142 to move the latter rearwardly. The forward end of the inner sleeve 138 stops short of the flange 170.

Rearward displacement of the outer sleeve 140 displaces the intermediate sleeve 142 rearwardly to bring an inner annular groove 172 in the intermediate sleeve into axial alinement with the forward locking balls 154, thus allowing these balls to be cammed radially outward by the valve needle groove 150, to release the valve needle 28 from the coupling 94.

Upon removal of the valve needle 28 from the coupling 94, the locking balls 154 are prevented from dropping out of the apertures 148 in the inner sleeve 138 by an annular lip 180 formed on the inner sleeve 138 at the inner extremity of each ball receiving aperture 148, as shown in FIG. 9.

Normally, the recess 96 in the body 14 is closed by a U-shaped removable cover or shield 182 formed preferably of nylon. The cover 182 is shown in place in FIGS. 1, 2, 6 and 8.

Removal of the cover 182 provides access to the recess 96 for rotating the holding element 98 which moves rearwardly to release the spray head 12. Rearward movement of the element 98 can engage the element 98 with the releasable coupling 94, causing the outer sleeve 140 to move rearwardly to release the valve needle 28. If necessary, hand pressure can be applied to the outer coupling sleeve 140 to move this sleeve rearwardly and release the valve needle 28 for separation of the spray head, including the valve needle, from the components which remain on the body 14.

Fan air and atomizing air are supplied to the spray head 12 in separate streams both of which are caused to flow freely through a common generally longitudinal bore 190, FIG. 2, in the body 14. A short continuation 191 of the bore 190 in the body 14 is formed in the spray head body 18 to register with the body bore 190 and form a part of the body bore upon attachment of the spray head to the body 14.

The full transverse sectional area of the bore 190, except for a relatively small portion used to accommodate a flow dividing sleeve 192, is used in the transmission of atomizing and fan air through the bore to the spray head 12 to provide for maximum air flow efficiency within an airbrush body 14 of minimum size. As will presently appear, the air flows forwardly through the major portion of the length of the bore 190.

The inlet space 38 communicates through an internal passage 194 in the body 14 with an internal chamber 196 through which the bore 190 passes. Rearwardly of the chamber 196, the bore 190 is counterbored to a larger size and threaded as indicated by the number 198.

The rear segment 200 of the sleeve 192 which fits in the enlarged counterbore 198 is also enlarged and is threaded into the counterbore, as shown, so that rotation of the sleeve 192 by means of a radially enlarged annular hand grip 202, integrally formed on the rear end of the sleeve, causes the sleeve to move axially.

At the forward end of the enlarged sleeve segment 200 the sleeve 192 defines an annular valve element 204, FIG. 5, which coacts with an opposing annular valve seat 206 formed by the body 14 at the juncture of the inner chamber 196 with the forwardly extending portion of the bore 190. The valve element 204 is moved toward and away from the valve seat 206 by rotation of the sleeve 192 in opposite directions and coacts with the seat 206 to regulate or meter the flow of atomizing air from the chamber 196 into an annular flow space 208 extending forwardly through the bore 190, FIGS. 2 and 5, between the wall of the bore and a reduced diameter segment 210 of the sleeve 192 which extends forwardly of the sleeve valve element 204.

The forward end of the sleeve 192 extends into the continuation 191 of the bore 190 in the head 12, and is radially enlarged at its forward end in relation to the reduced diameter sleeve segment 210 to support an annular sealing ring 212 in slidable sealing contact with the bore extension 191.

The sleeve 192 is centrally bored longitudinally and defines internally a longitudinal air passage space 214 extending rearwardly from the forward end of the sleeve to an internal valve seat 216 formed by the sleeve just rearwardly of the sleeve valve element 204, as shown in FIG. 5.

Immediately rearwardly of the valve seat 216, the sleeve 172 defines an internal circular air flow space 218 which is connected through radial apertures 220 in the sleeve with the air chamber 196. The internal valve seat 216 is opposed by a coacting valve element 222 formed on the forward end of a valve stem 224 threaded into the enlarged rear segment 200 of the sleeve 192. Rotation of the stem 224 by means of a control knob 226 integrally formed on the rear end of the stem moves the valve element 222 toward and away from the seat 216 to control or meter the flow of air from the passage 196 into the flow space 210.

The escape of air rearwardly past the stem 224 is advantageously prevented by two nylon sealing rings 230 encircling the stem 224 in sealing engagement with the sleeve 192. A sealing ring 232 encircling the rear sleeve segment 200 in engagement with the body 14 and the previously mentioned annular seal 212 encircling the forward end of the sleeve are also advantageously formed of nylon.

As previously intimated, rotation of the sleeve 192 adjusts the valve element 204 in relation to the seat 206 to control the flow of fan air into the longitudinal air passage space 208. The sleeve 192 is held tightly in any position of adjustment by tightening a lock nut 234 threaded on the sleeve and engaging the body 14, as shown. Rotation of the stem 224 by the knob 226 controls the flow of fan air to the longitudinal air passage space 210. The knob 226 is firmly held in any rotary position of adjustment by tightening of a set screw 236 in the knob 226 against the annular grip element 202 of the sleeve 192. Hence, rotary adjustment of the sleeve 192 after loosening of the lock nut 234 does not disturb

the adjustment of the valve stem 224 in relation to the sleeve 192. Similarly, rotary adjustment of the stem 224 after loosening of the screw 236 is effected without disturbing the adjustment of the sleeve 192, which remains tightly held by the lock nut 234.

The forward end of the atomizing air flow space 208 in the bore 190 connects with a passage 240 in the forward end of the body 14 which registers with a bore 242 in the head body 18 that connects with an annular passage 244 formed in the head body in encircling relation to the nozzle support 22 and opening outward in a forward direction.

The forward end of the bore extension 191 connects through a passageway 246 with an annular passage 248 encircling the passage 244 in radially spaced relation thereto and opening outwardly in a forward direction.

An air cap 250 is detachably secured to the forward end of the head body 18 by an annular nut 252 threaded onto the head body 18 and coacting with the air cap to provide for axial adjustment of the air cap in relation to the nozzle tip 30. An annular lip 254 on the forward end of the nut 252 encircles the air cap 250 forward of a radial flange 256 on the rear end of the air cap to hold the air cap against outward displacement, and to form an airtight seal with the flange 256.

The air cap 250 is shaped to define a hollow boss 258 extending rearwardly in encircling spaced relation to the nozzle 24 to define with the nozzle an annular air passage space 260 communicating with the air supply passage 244 in the head body 18. At the forward end of the boss 258, the air cap 250 defines an inwardly extending annular lip 262 designed to coact with the forward end of the nozzle 30, as shown in FIG. 2, to define an atomizing air outlet orifice 264.

The boss 258 is slidably encircled by a nylon sleeve 266 which has a rear end shaped as shown to sealably engage the forward end of the head body 18 between the passages 244 and 248, and to form a rear seat for a compression spring 270, encircling the sleeve 266 between the rear end of the sleeve and the bottom of an annular recess 272 formed in the air cap between the boss 258 and the circumferential periphery of the air cap. The air cap recess 272 opens rearwardly in confronting relation to the annular fan air supply passage 248 in the head body 18.

Two forwardly extending projections 274 on the air cap 250 are bored to define fan air passages 276 connecting the annular recess 272 with fan air orifices 278.

The rear end of the air cap 250 stops short of the forward end of the head body 18. The space between the air cap and head body is bridged by the retaining nut 252 and by the sleeve 266 which is formed to advantage from nylon. The spring 270 holds the air cap in tight sealing engagement with the nut 252 and holds the sleeve 266 in sealing engagement with the head body 18 so that the sleeve effectively forms a seal between the air passage spaces leading to the atomizing air outlet 264 and the fan air outlets or orifices 278.

The effective size of the atomizing annular air orifice 264 is adjustable by rotation of the nut 252 to effect axial displacement of the air cap 250 which varies the space between the lip 262 and the nozzle structure defining the orifice 264. The spring 270, sleeve 266 and coacting structure maintain the described relationship of the parts for all adjustments of the atomizing air orifice 264.

The airbrush 10 thus provided can be readily adjusted to provide the optimum desired air spray. Rotation of the knob 68 adjusts the open position of the valve needle 28, and hence the rate of liquid flow from the nozzle 24. Rotation of the nut 252 adjusts the atomizing air orifice 264, as recited. Rotation of the knob 226 adjusts the rate of fan air flow to the outlets 278, and rotation of the hand grip 202 adjusts the rate of atomizing air to the orifice 264, as recited. Operating air supplied to the inlet space 38 flows through the described air passage spaces to the atomizing air orifice 264 and the fan air outlets 278. When this operating air supplied to the inlet space 38 reaches a predetermined pressure, the piston 44 automatically opens the nozzle 24 to start the air spray. The nozzle 24 is automatically closed when the air inlet pressure drops below the predetermined operating pressure.

To clean contaminated portions of the airbrush, or to change over the airbrush to the spraying of a different liquid, the shield 182 is removed and the retainer 98 and coupling 94 operated to release the head 12 from the body 14 and disconnect the valve needle 28 from the piston stem 56, as described. This can be done quickly and easily and removes all contaminated components of the airbrush.

A clean head is easily positioned on the body 14 and secured in place by tightening of the retaining element 98. The coupling 94 readily accepts and retains the valve needle 28 of the clean head. A gasket 290 forms a seal between the head 12 and body 14 and a locating pin 292 fixed in the body extends into the head body 18 to aid in orienting the head on the body.

The invention is not necessarily limited to the use of the structure illustrated but includes the use of alternatives and equivalents within the spirit and scope of the invention as defined by the claims.

The invention is claimed as follows:

1. An airbrush comprising in combination, a body including means defining an inlet air passage, a spray head disposed on the forward end of said body and including a nozzle, a centrally bored holding element journalled in said body and threaded into said head to releasably hold the latter on said body, a valve needle reciprocably mounted in said spray head in controlling relation to said nozzle and extending through said holding element, packing cones in said holding element encircling said needle, a spring urging said cones together to seal around said needle, means on said body defining a cylinder generally coaxial with said needle and communicating with said air passage, a piston in said cylinder, a piston stem extending from said piston forwardly into proximity to the rear end of said needle, a quick release coupling connecting said stem to said needle and positioned in relation to said holding element to be engaged and released by the holding element as an incident to movement of said holding element to release said head, a packing assembly disposed around said piston stem between said piston and said coupling and including a plurality of packing cones and spring means urging said cones into engagement with each other, said body defining a generally longitudinal bore extending therethrough, said spray head defining a continuation of said bore, said spray head including first orifice means positioned for discharging atomizing air adjacent said nozzle and second orifice means positioned for discharging fan air around said nozzle, said head defining a first passageway connecting one of said orifice means to the forward end of said bore, said head and said body defining a second passageway connecting the other of said orifice means to said bore a substantial distance rearwardly of the forward end thereof, said bore including an enlarged rear segment thereof, said body defining a first valve seat connected with said inlet air passage and encircling said bore immediately forward of said enlarged rear segment thereof, a valve sleeve disposed in said bore and including a rear segment of relatively large diameter threaded in the enlarged rear segment of said bore, said sleeve defining an annular valve element opposing said first valve seat, said sleeve including a segment extending forwardly within said bore and having a reduced diameter smaller than said bore, the forward end of said valve sleeve defining an enlarged sealing head fitting slidably in said bore forwardly of the connection thereto of said second passageway whereby said first valve element cooperates with said first valve seat to control the flow of air from said inlet air passage to said other

orifice means, means for rotating said valve sleeve to adjust said first valve element in relation to said first valve seat, a lock nut for holding said valve sleeve in its adjusted position, said sleeve defining a longitudinal bore extending therethrough and defining internally a second valve seat at the juncture of said reduced diameter forward segment of the sleeve with said relatively large diameter segment thereof, said sleeve defining an air flow connection between said inlet passage and the upstream side of said second seat, a second valve element threaded into said relatively large diameter segment of said sleeve and extending into coacting relation to said second seat to control the flow of air from said inlet passage to said one orifice means, means for rotating said second valve element to adjust the latter in relation to said second valve seat, and means for releasably securing said second valve element nonrotatably to said sleeve.

2. An airbrush comprising in combination, a body including means defining an inlet air passage, a spray head disposed on the forward end of said body and including a nozzle, a centrally bored holding element coacting with said body and threaded into said head to releasably hold the latter on said body, a valve needle reciprocably mounted in said spray head in controlling relation to said nozzle and extending through said holding element, packing means in said holding element encircling said needle, means on said body defining a cylinder alined with said needle and communicating with said air passage, a piston in said cylinder, a piston stem extending from said piston forwardly into proximity to the rear end of said needle, a coupling releasably connecting said stem to said needle, packing means sealably encircling said stem between said piston and said coupling, said body defining a generally longitudinal bore therein, said spray head including first orifice means positioned for discharging atomizing air adjacent said nozzle and second orifice means positioned for discharging fan air around said nozzle, said head defining a first passageway for connecting one of said orifice means to the forward end of said bore, said head and said body defining a second passageway connecting the other of said orifice means to said bore a substantial distance rearwardly of the forward end thereof, said bore including an enlarged rear segment thereof, said body defining a first valve seat having an upstream side communicating with said inlet air passage and having a downstream side communicating with said bore immediately forward of said enlarged rear segment thereof, a valve sleeve disposed in said bore and including a rear segment of relatively large diameter threaded in the enlarged rear segment of said bore, said sleeve defining a valve element coacting with said first valve seat, said sleeve including a segment extending forwardly within said bore and being smaller than said bore to provide for a free flow of air through said bore around said sleeve from said first valve seat to said second passageway, the forward end of said valve sleeve defining an enlarged sealing head fitting slidably in said bore forwardly of the connection thereto of said second passageway to block communication between said first valve seat and said first passageway whereby said first valve element cooperates with said first valve seat to control the flow of air from said inlet air passage to said other orifice means, means for rotating said valve sleeve to adjust said first valve element in relation to said first valve seat, said sleeve defining a longitudinal bore extending therethrough and defining internally a second valve seat located near the forward end of said relatively large diameter segment of the sleeve and communicating at its inlet and outlet sides respectively with said air inlet passage and the forward end of said sleeve bore, a second valve element threaded into said relatively large diameter segment of said sleeve and coacting with said second seat to control the flow of air from said inlet passage to said one orifice means, and means for rotating said second valve element to adjust the latter in relation to said second valve seat.

3. An airbrush comprising, in combination, a body including means defining an air inlet, a spray head detachably secured to said body and including a nozzle, a reciprocable flow control element mounted in said spray head in flow controlling relation to said nozzle, means on said body defining an air cylinder connected with said air inlet, a piston in said cylinder, means including a releasable coupling for releasably connecting said piston to said flow control element, said body defining a bore therein extending forwardly toward said head, said spray head including means for discharging atomizing air and means for discharging fan air, said head defining a first passageway for connecting one of said air discharge means to the forward end of said bore, said head and said body defining a second passageway for connecting the other of said air discharge means to said bore a substantial distance rearwardly of the connection thereto of said first passageway, said bore including an enlarged rear segment thereof, said body defining a first valve seat having an upstream side communicating with said air inlet and having a downstream side communicating with said bore forward of said enlarged rear segment thereof, a valve sleeve disposed in said bore and including a rear segment threaded in the enlarged rear segment of said bore, said sleeve defining a first valve element coacting with said first valve seat, said sleeve including a segment extending forwardly within said bore and being smaller than said bore to provide for a free flow of air through said bore around said sleeve from said first valve seat to said second passageway, means forming a seal between said bore and the forward end of said sleeve to block communication between said first valve seat and said first passageway whereby said first valve element cooperates with said first valve seat to control the flow of air from said air inlet to said other air discharge means, means for rotating said valve sleeve to adjust said first valve element in relation to said first valve seat, said sleeve defining a longitudinal bore extending therethrough and defining internally a second valve seat located near the forward end of said rear segment of the sleeve and communicating at its inlet and outlet sides respectively with said air inlet passage and with said sleeve bore forward of said second seat, a second valve element threaded into said rear segment of said sleeve and coacting with said second seat to control the flow of air from said air inlet to said one air discharge means, and means for rotating said second valve element to adjust the latter in relation to said second valve seat.

4. An airbrush comprising, in combination, body means including means defining an air inlet, a spray head detachably secured to said body means in a forward position thereon, said spray head including liquid discharge means and a reciprocable flow control element for said liquid discharge means, packing means encircling said flow control element, means on said body means defining an air cylinder alined with said flow control element and communicating with said air inlet, a piston in said cylinder, a piston stem extending from said piston, a coupling releasably connecting said stem to said flow control element, packing means sealably encircling said stem between said piston and said coupling, said body means defining a bore therein extending forwardly toward said spray head, said spray head including means for discharging atomizing air and means for discharging fan air, said head defining a first passageway for connecting one of said air discharge means to the forward end of said bore, said head and said body means defining a second passageway connecting the other of said air discharge means to said bore a substantial distance rearwardly of the connection thereto of said first passageway, a valve sleeve disposed in said bore, means forming a sliding seal between said bore and said sleeve at a location along the bore between the connections thereto of said first and second passageways, said sleeve including a segment extending rearwardly from said seal between the bore and sleeve to define therewith a first air passage space com-

municating with said second passageway and extending along said sleeve rearwardly away from said spray head, said sleeve being centrally bored to define a second and internal air passage space communicating through the forward end of said sleeve with said first passageway and extending along said sleeve rearwardly away from said spray head, and means forming two flow control valves connecting said air inlet with said respective air passage spaces at locations along said sleeve which are spaced rearwardly from the forward end of the sleeve.

5. In an airbrush, the combination of a body, a spray head, means detachably connecting said spray head to said body, flow control means on said spray head including a reciprocable control member extending in the direction of said body, an air motor disposed on said body and including a piston substantially coaxial with said control member, said body defining an operating air space on the spray head side of said piston, a piston stem connected with said piston and extending through and beyond said air space toward said control member, means releasably connecting said piston stem and said control member, a packing capsule encircling an intermediate portion of said piston stem between said coupling and said air space, said body defining a bore therein receiving said capsule and being larger in transverse section than said capsule to provide for limited radial movement of said capsule in all directions, means providing a circumferential seal between said capsule and said body for different positions of radial adjustment of said capsule within said bore, and packing means within said capsule forming a slidable seal between the capsule and said piston stem.

6. In an airbrush, the combination of a body, a spray head, means detachably connecting said spray head to said body, flow control means on said spray head including a reciprocable control member extending in the direction of said body, an air motor disposed on said body and including a piston substantially coaxial with said control member, said body defining an operating air space on the spray head side of said piston, a piston stem connected with said piston and extending through and beyond said air space into proximity to the adjacent end of said control member, coupling means connecting said piston stem and said control member, a packing capsule encircling an intermediate portion of said piston stem between said coupling and said air space, said body defining a bore therein receiving said capsule and being larger in transverse section than said capsule to provide for limited adjustment of said capsule in all radial directions, means providing a circumferential seal between said capsule and said body for different positions of radial adjustment of said capsule within said bore, said seal providing means including an annular sealing shoulder on the air space end of said capsule and threaded means for forcing said shoulder hard toward said body, a plurality of flexible polymeric packing elements disposed within said capsule in encircling sealing relation to said stem, and the central portion of each of said packing elements having a truncated conical shape the apex of which points in the direction of said air space.

7. In an airbrush, the combination of a support, a spray head, means for detachably mounting said spray head on said support to occupy a forward position thereon, flow control means on said spray head including a reciprocable flow control member extending rearwardly from the spray head, an air motor on said support located rearwardly of said control member and including a piston, said support defining an internal operating air space disposed forwardly of said piston, a piston stem connected with said piston and extending forwardly through and beyond said air space into proximity to the rear end of said flow control member in generally coaxial relation thereto, means for connecting together said flow control member and said piston stem, and means forming a seal between said stem and said support forwardly of said air space, said last mentioned means including a plurality of flexible polymeric packing elements having conically shaped portions thereof encircling said piston stem to point in the direction of said air space, and spring means acting on said packing elements to urge the latter toward said air space.

8. An airbrush comprising, in combination, body means, spray means on the forward end of said body means, said spray means including first air discharge means for discharging atomizing air and including second air discharge means for discharging fan air, a fan air flow control valve and an atomizing air flow control valve both disposed on said body means in rearwardly spaced relation to said spray means, said body means defining an air flow bore extending from said valves forwardly toward said spray means, a valve sleeve disposed within said bore and defining within the sleeve a longitudinal bore connected to only one of said flow control valves and to one only of said air discharge means to conduct air from said one control valve forwardly through the sleeve bore to said one air discharge means, means forming a slidable circumferential seal between said bore and the forward end of said sleeve, said sleeve including a segment extending rearwardly of said seal and being smaller than said bore to define therewith an air passage space which is connected to the other only of said valves and to the other only of said air discharge means to conduct air from said other control valve forwardly through said air passage space to said other air discharge means.

9. In air spray apparatus, the combination of a first element constituting a support, a movable second element constituting an air cap, holding means coacting with said first and second elements to retain said second element adjustably in an operative position in relation to said first element, said holding means including a threaded element for adjusting said operative position of said second element toward and away from said first element through a substantial range of operative adjustment, an outwardly extending spray liquid nozzle on said first element, said second element including orifice means shaped to coact with said nozzle and define therewith an air discharge orifice having an effective size determined by the adjustment of said second element in relation to said first element, said second element defining an air discharge outlet separate from said orifice, said first element defining two air supply passages confronting said second element, connecting means for effecting connections of said air supply passages with said air outlet and said air orifice respectively for all operative positions of adjustment of said second element on said first element within said range of adjustment; said connecting means including two annular partition members sealably related to said respective elements and being disposed in coaxial mutually telescoped relation for slidable, telescopic, relative movement in the direction in which said second element is adjusted in relation to said first element; and said holding means and said first and second elements being shaped and dimensioned to provide beyond one end of each of said annular partition members clearance for free adjustment of said second element throughout said range of adjustment in said direction without subjecting either of said partition members to compression in said one direction.

10. In air spray apparatus, the combination of a first element constituting a support, a movable second element constituting an air cap, holding means coacting with said first and second elements to retain said second element adjustably in an operative position in relation to said first element, said holding means including a threaded element for adjusting said operative position of said second element toward and away from said first element through a substantial range of operative adjustment, an outwardly extending spray nozzle on said first element, said second element including orifice means shaped to coact with said

nozzle and define therewith an air discharge orifice having an effective size determined by the adjustment of said second element in relation to said first element, said second element defining an air discharge outlet separate from said orifice, said first element defining two air supply passages confronting said second element, connecting means for effecting connections of said air supply passages with said air outlet and said air orifice respectively for all operative positions of adjustment of said second element within said range of adjustment; said connecting means including a first annular partition member formed on one of said elements and projecting toward the other of said elements in generally coaxial relation to said nozzle, said connecting means including a second annular partition member disposed in slidable telescoped relation to said first partition member for telescopic movement relative thereto in the direction in which said second element is adjusted in relation to said first element; spring means mounted to urge said second partition member axially into sealing engagement with the other of said first and second elements and to urge said second element to a position on said first element determined adjustably by said threaded element, and said holding means and said first and second elements being shaped and dimensioned to provide beyond one end of each of said annular partition members clearance for free adjustment of said second element throughout said range of adjustment in said direction without subjecting either of said partition members to compression in said one direction.

11. In air spray apparatus, the combination of a support, a movable air cap, holding means coacting with said support and said air cap to hold the latter adjustably in an operative position on said support, said holding means including a threaded element for adjusting said operative position of said air cap toward and away from said support through a substantial range of operative adjustment, an outwardly extending spray liquid nozzle on said support, said air cap including orifice means encircling said nozzle to define therewith an annular air discharge orifice having an effective size determined by the adjustment of said air cap in relation to said support, said air cap defining an air discharge outlet separate from said orifice, said support defining two air supply passages confronting said air cap, and connecting means for effecting connections of said air supply passages with said air outlet and said air orifice respectively for all operative positions of adjustment of said air cap on said support within said range of adjustment; said connecting means being formed of relatively movable parts shaped to provide for free adjustment of said air cap within said range of adjustment thereof.

12. An airbrush comprising, in combination, body means, means defining on the forward end of said body means a spray nozzle and atomizing air discharge means and fan air discharge means coacting with said nozzle, means for supplying a liquid to said nozzle, said body means defining therein an air supply bore extending forwardly toward said nozzle, a sleeve disposed in said bore and including a forwardly extending longitudinal segment having a size smaller than said bore for defining within said bore around said sleeve a first air supply passage space extending forwardly longitudinally within said bore, said sleeve being centrally bored to define a second air supply passage space therein extending forwardly longitudinally within said bore in isolation from said first air supply passage space, means forming an annular seal between the nozzle end of said sleeve and said bore to isolate the forward ends of said first and second air passage spaces from each other, means defining air passageways connecting the forward ends of said respective air passage spaces with said respective air discharge means, two independent and adjustable air metering valves, said body means defining an air inlet connected to the inlet sides of both said metering valves to supply air thereto under pressure, and the outlet sides of said metering valves being connected to inlet portions of said respective passage spaces located substantial distances from the forward ends of said respective passage spaces so that each passage space receives air only from its associated metering valve and air metered through the valves flows forwardly through said respective passage spaces to said respective air discharge means.

13. In an airbrush, the combination of a body, fan air discharge means located forwardly on said body, atomizing air discharge means located forwardly on said body, said body defining a forwardly extending bore therein, means disposed within said bore to coact with the bore defining portion of the body to form two separated air flow spaces extending forwardly through the bore, means defining separate air passages connecting the forward ends of said respective air flow spaces with said respective air discharge means, air supply means connected to said respective air flow spaces to supply air under pressure to said respective air flow spaces at locations with respect to said bore spaced substantial distances rearwardly of the forward end of said bore so that mutually isolated streams of air flow forwardly through said respective air flow spaces to said respective air discharge means; and two adjustable air metering valves connected in series with said respective air flow spaces to effect independent metering by the metering valves of the two streams of air flowing through the respective air flow spaces, each of which valves serving to pass therethrough only the stream of air which flows through the corresponding air flow space.

References Cited in the file of this patent

UNITED STATES PATENTS

2,060,894	Potter	Nov. 17, 1936
2,189,644	Wingard	Feb. 6, 1940
2,614,793	Storm	Oct. 21, 1952
2,708,589	Masek	May 17, 1955
2,743,963	Peeps	May 1, 1956
2,843,425	Paasche	July 15, 1958
2,864,649	Adams	Dec. 16, 1958
2,889,134	Bryant	June 2, 1959
2,929,566	Paasche	Mar. 22, 1960
2,991,940	Dupler et al.	July 11, 1961