Dec. 6, 1938. J. A. PAASCHE 2,139,133

AIRBRUSH

Filed Sept. 28, 1936

Fig. 1.

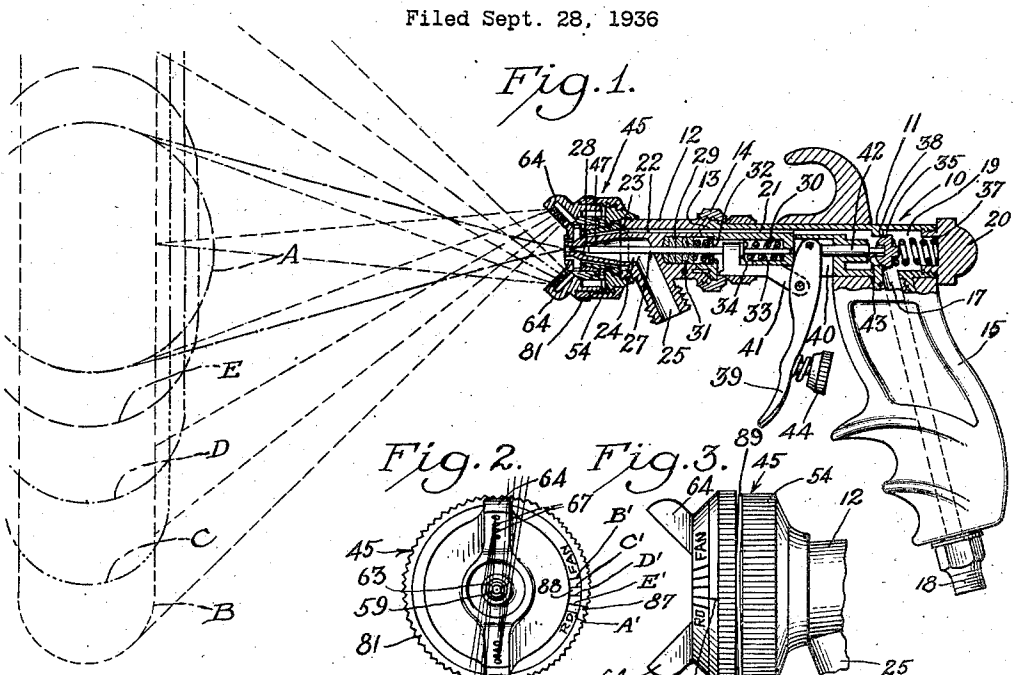


Fig. 2.

Fig. 3.

Fig. 4.

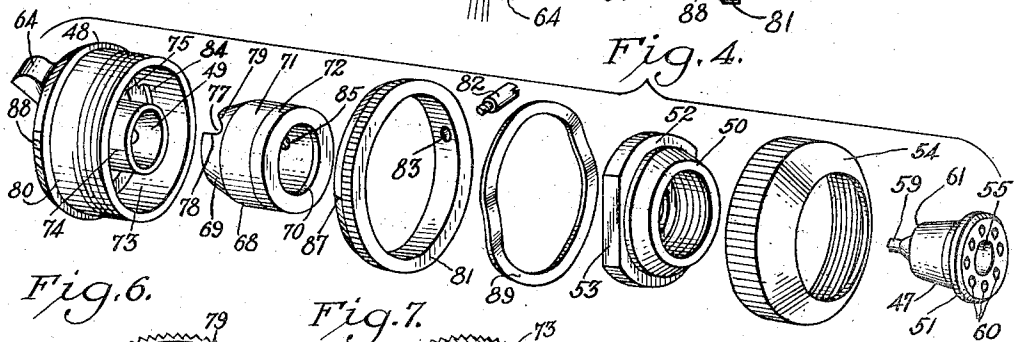


Fig. 6.

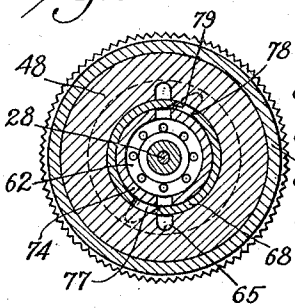


Fig. 7.

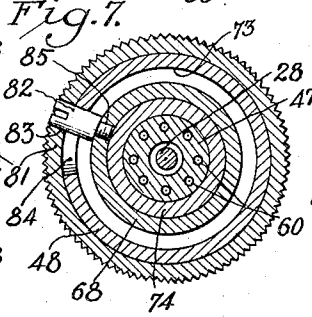


Fig. 5.

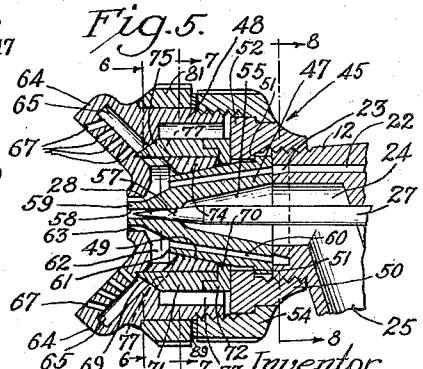
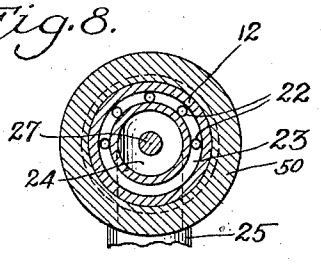


Fig. 8.



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UNITED STATES PATENT OFFICE

2,139,133

AIRBRUSH

Jens A. Paasche, Wilmette, Ill.

Application September 28, 1936, Serial No. 102,832

5 Claims. (Cl. 299—140.1)

This invention relates to improvements in airbrushes and more particularly concerns airbrushes having variable spraying characteristics.

An object of the invention is to provide an improved airbrush having widely variable spraying characteristics and which is minutely adjustable to produce all variables from a coarse spray circumscribing a relatively small area, to a finely divided spray adapted to cover a relatively large area.

More specifically stated, it is an object of the invention to provide an airbrush in which a column of material to be sprayed may be projected as a round pattern covering a relatively small area or in which the column of material may be transformed into selective gradations of finely divided form and relatively large coverage capacity by a series of jets of pressure fluid directed substantially tangentially of the material column and minutely controllable as to intensity.

Another object is to provide an improved spraying head having means for creating a fan-shaped spray stream through the dispersion of a column of material by projecting thereagainst intersecting streams of pressure fluid, and embodying novel control mechanism for varying the intensity of said intersecting streams and thereby the character of the spray pattern.

Another object is to provide a novel spray adjustment valve operable internally of the spray nozzle assembly to permit selective adjustment of the spray stream by minute increments.

Other objects reside in the improvements in construction and the novel relationships of parts by which the foregoing and other objects and advantages of the invention may be carried into practice efficiently and economically.

In the drawing:

Figure 1 is an elevational view partially in longitudinal section and partially diagrammatic showing the construction and operation of an airbrush embodying the present invention.

Figs. 2 and 3 are enlarged end and side elevational views, respectively, of the nozzle head.

Fig. 4 is an exploded assembly view of the nozzle head.

Fig. 5 is an enlarged longitudinal sectional view through the nozzle head.

Figs. 6, 7 and 8 are transverse sectional views taken substantially along the lines 6—6, 7—7 and 8—8, respectively, of Fig. 5.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring to the drawing, the airbrush illustrated is of the type in which coating material and pressure fluid are coactively emitted to provide a spray stream for coating the surface of an object to be treated. The airbrush includes a barrel 10 (Fig. 1) which is for manufacturing simplicity preferably divided into separable rear and front sections 11 and 12, respectively, having complementary interfitting surfaces 13 and being suitably secured together by such means as a gland nut 14. The gland nut union permits the front section to be rotatably adjusted relative to the rear section or to be replaced by a different section. Secured to the rear section 11 is a handle 15 which may have a passage 17 longitudinally therethrough communicating with a nipple 18 at the free end thereof to receive a suitable conduit (not shown) for delivering pressure fluid such as compressed air to the airbrush.

In communication with the passage 17 within the rear section 11 is a chamber 19 which opens rearwardly of the section and is closed by a threadedly secured plug 20. If it is desired to admit air through the rear end of the barrel instead of through the handle, the plug 20 may be replaced by a fitting similar to the nipple 18 and the latter may be replaced by a suitable plug. Passing longitudinally forwardly from the pressure fluid chamber 19 are one or more eccentrically disposed passages 21 which communicate through the interfitting surfaces 13 with a series of eccentrically arranged small ducts 22 that pass longitudinally through the front section 12 and communicate with an annular groove 23 in the front end thereof (Figs. 1, 5 and 8). Herein these ducts are shown as five in number grouped in an arc concentrically about an axially located material passage 24. The latter is fashioned rearwardly on an angle to pass through an inlet nipple 25 adapted to be connected to a conduit (not shown) for delivering thereto from any suitable source material such as a liquid to be sprayed.

Extending axially through the material passage 24 is an operating stem 27 which carries a material control needle valve 28 at its forward end. The rear end of the stem extends through the front section 12 and for a substantial distance through the rear section 11. Registering bores

28 and 30 in the front and rear sections respectively receive a spring pressed packing assembly, generally indicated at 31, to prevent leakage longitudinally of the valve stem. A transverse member 32 seated against an internal shoulder intermediately of the length of the bore 30 slidably guides the valve stem and provides an abutment for one end of the spring of the packing assembly. Rearwardly of the transverse member 32 a helical spring 33 bears between the base of the bore 30 and a collar 34 on the needle valve stem 27 and normally urges the stem forwardly into valve seated position.

The air supply through the airbrush is controlled by a valve 35 in the air chamber 19. A helical spring 37 which bears against the inner face of the plug 20 normally urges the air valve forwardly into sealing engagement with an internal shoulder 38 forwardly of the air inlet passage 17.

Preferably, both the material valve and the air valve are actuated by a single control lever or trigger 39. One end of the trigger is pivotally mounted within a recess 40 formed in the barrel 10 between the air chamber 19 and the valve stem chamber 30. Extending forwardly from the trigger is a pivotally connected link 41 which engages forwardly of the collar 34 on the valve stem 27. Abutting the rear face of the trigger is a pin 42 axially slidable in the front wall of air chamber 19 and seated loosely in a pocket 43 in the forward face of the air valve 35. Hence, as the trigger 39 is moved rearwardly, both the air valve 35 and the material valve 28 are actuated to allow material and air to flow through the barrel for discharge from the airbrush. A variable adjustment such as a knob 44 on the trigger limits the opening movement of the valves. On the forward end of the front section 12 is a nozzle structure or head 45 of improved construction adapted for creating a selectively controllable spray stream. The nozzle structure comprises an internally located, generally conically shaped tip 47 (Figs. 4 and 5) and an externally located cap 48 having an axial tapered bore 49 interfitting snugly with the tip. At its large end face the tip 47 abuts the front end face of the section 12, being secured in this position by suitable means such as a flange 50 which engages a peripheral shoulder 51 on the tip and is threadedly secured to the section 12. The flange 50 has an annular projection 52 which is provided with angular peripheral faces 53 (Fig. 4) for engagement by a wrench and affords a rearwardly facing shoulder for holding an annular gland nut 54 concentrically rotatable about the tip 47. Threaded engagement betwen the gland nut and the rear end of the cap 48 serves to draw the latter into rigid assembly with the tip 47.

Axially within the tip 47 is a generally conically shaped bore 55 which at its rear end registers with the material duct 24 and which is reduced in size forwardly to provide a valve seat section 57 arranged to receive the needle valve 28 in snug sealing engagement. Forwardly, the bore communicates with a cylindrically shaped passage or port 58 defined by a short axially concentric flange 59. The port 58 is fashioned to discharge a relatively small solid stream of material in substantially the form of a smooth column which may have a tendency to flare slightly as it travels from the nozzle. To act upon the column of material, pressure fluid is conducted through the tip 47 through a peripheral series of passageways 60 (Figs. 4, 6, 7) arranged concentrically about the bore 55 and in assembly communicating at their rear ends with the groove 23 in the forward face of the section 12. Toward the front end the external surface of the tip 47 is cut away, as at 61, and the passageways 60 terminate at the shoulder formed by this cut-away portion. In opposition to the cut-away portion the cap 48 is internally fashioned to complete an annular chamber 62 into which the passageways 60 discharge. In communication with the chamber 62, the cap has a nozzle aperture 63 of slightly greater diameter than the flange 59 for receiving the latter coaxially and defining thereabout a concentric air port. Air passing through the port 63 envelops the column of material issuing from the port 58 in a tubular air sheath which serves to initiate breaking up of the material stream and to carry the material toward the surface of the object to be treated in the form of a heavy spray of substantially round pattern circumscribing only a relatively small area, as shown diagrammatically at A in Fig. 1.

On diametrically opposite sides of the air port 63, and substantially equidistant therefrom, the air cap 48 is provided with projections 64 which extend divergently outwardly from the axis of the nozzle. Each projection is bored as at 65 to provide ducts communicating with the air chamber 62 in the cap, and a longitudinally arranged series of small bores or ports 67 leads from each duct outwardly toward the inner surface of the respective projection.

The discharge ports 67 have a definite cooperative relationship whereby to transform the substantially solid material stream issuing from the port 58 into an atomized stream comprised of small particles of substantially uniform size delivered against the surface to be treated in a narrow elongated pattern throughout which the particles are evenly distributed. Each series of ports preferably operates identically and a description of one will therefore suffice for both. The first discharge port 67 in the series, that is, the one nearest the axial pressure fluid port 63 in the cap, is fashioned to direct a stream of pressure fluid angularly toward the material stream projected from the axial passage 58 to strike the material stream relatively close to the cap and substantially tangentially of the stream. Each succeeding port in the series directs a jet of pressure fluid toward the remaining fluid material column more angularly and at a greater distance from the cap (Figs. 1 and 2), thus successively breaking up and diminishing one longitudinal half of the material column and spreading the same into an elongated pattern comprised of a series of shorter patterns in end to end alinement disposed in one direction relative to the axis of the material column. It will be evident that each series of discharge ports 67 produces a substantially continuous stream of pressure fluid which has a major cross sectional dimension extending generally in parallelism with the axis of the material column and the full force of such opposite directed pressure fluid streams produces a finely divided fan-shaped spray having an elongated, narrow pattern B (Fig. 1) covering a relatively large area. In this connection reference is made to my copending application Serial No. 127,637, filed February 25, 1937.

According to the present invention the force and the intensity with which the air streams projected from the jets 67 strike the material column, and thereby the extent of the fan action

thereof, the area of the target and the character of the spray may be selectively controlled with a high degree of accuracy. This control is preferably effected by valve means associated with the nozzle structure **45** in such manner as to be conveniently operable to control the flow of pressure fluid through ducts **65**, thereby governing the dispersing action of the intersecting pressure fluid streams upon the column of spray material. Herein a ring shaped valve **68** is operable to close the ducts entirely or to permit unrestricted passage of pressure fluid and is adjustable by minute increments to allow any selected volume of pressure fluid to pass through the ducts. The valve **68** has one edge tapered inwardly as at **69** and includes an inwardly extending annular flange **70** on its opposite edge. For convenience in manufacture, the valve may be assembled of two parts **71** and **72** which are preferably permanently united. To receive the valve, the interior of the air cap is fashioned to provide a large annular recess **73** concentric with the axial bore **49**, the inner wall of the recess being defined by an axial flange or hub **74** about which the valve is adapted to fit in snug slidable engagement with the flange **70** thereof abutting the rear end of the hub forwardly of the front face of the attaching flange **50**. In the forward wall of the recess is a groove **75** intersecting the ducts **65** intermediate the air chamber **62** and the first port **67** in each series and complementary in shape to the tapered edge **69** of the valve to receive the latter in pressure fluid controlling relation to the ducts.

On diametrically opposite sides, the tapered edge **69** of the valve is slotted or deeply notched to provide similar generally V-shaped openings **77** which are preferably fashioned with one axially extending substantially rectangular edge **78** and an interiorly biased opposite diagonal edge **79**. The width of the notches **77** is such that when in full register with the ducts **65** unrestricted passage of pressure fluid will be permitted therethrough. By effecting relative rotary movement between the air cap hub **74** and the valve **68** to carry the biased edges **78** across the ducts, the volume of air that will pass therethrough may be controlled variably to effect any desired gradation of spray from full fan-shape to round, several representative gradations being shown diagrammatically at C, D and E in Fig. 1. These gradations may conveniently be denominated ¾- ½- and ¼- fan, respectively.

Means is provided for convenient selective adjustment of the valve **68** and for attaining repeatedly similar ascertained adjustments. For this purpose, the air cap **48** has an annular peripheral groove **80** forwardly of the front edge of the gland nut **54** to receive a manually rotatable valve adjusting ring or operator **81** which may be exteriorly knurled and of slightly greater exterior diameter than the gland nut to facilitate finger purchase thereon. An operating connection between the operator and the valve is effected through the medium of the connecting pin **82** the head of which fits snugly within a radial aperture **83** in the operator. The shank of the pin extends through an elongated circumferential slot **84** in the wall of the air cap and the inner end of the pin has threaded engagement with a radial aperture **85** in the valve. Preferably the slot **84** is of such length and location that when the connecting pin is in abutment at one end with the wall defining the slot (as shown for example in Fig. 7) the ducts **65** will be closed, and when the operator **81** is moved to the opposite end of the slot the ducts will be fully opened.

To permit the determination of any adjusted condition of the valve **68** exteriorly of the spray head, a shallow indexing notch **87** may be provided in the exterior periphery of the operator to register with a series of shallow calibrated notches **88** in the adjacent peripheral surface of the air cap, the latter notches indicating a plurality of conditions of adjustment A', B', C', D' and E' (Fig. 2), in which the targets A, B, C, D and E, respectively, will be produced. Friction means may be provided to maintain the valve and operator assembly in any adjusted position until manual readjustment is effected. A deformed annular spring **89** interposed between the adjoining edges of the operator **81** and the gland nut **54** is suitable for this purpose.

From the foregoing, it will be apparent that the present invention provides a novel airbrush comprising a compact and sturdy combination of easily assembled, efficiently related parts coacting to secure new and improved results in operation. In addition to the selective control of the passage of pressure fluid and spray material through the air brush by means of the operating trigger, the character and type of spray stream emitted are selectively controllable in an improved manner through the medium of the novel adjustable spray head of the device to secure gradations from coarse, heavy to fine, light spray in target patterns ranging from round and of limited area to full, narrow fan of relatively large area.

I claim as my invention:

1. An airbrush of the character described comprising, in combination, a body having material and pressure fluid passages, a spray head assembly connected to said barrel and being interiorly fashioned to permit material and pressure fluid to flow therethrough, said head assembly including means for directing a spray column axially therefrom, a pair of pressure fluid ducts located in spaced relation on opposite sides of said column, discharge ports communicating with said ducts and arranged to direct alined pressure fluid streams angularly and tangentially against said spray column to spread the same fanwise, an annular valve element adapted in one position to halt pressure fluid flow through said ducts and having slots adapted in another position of said valve to register with said ducts to permit uninterrupted pressure fluid flow therethrough, each of said slots having a diagonal edge, and means connected with said valve operable to shift said valve by minute increments to carry the respective diagonal edges of said slots selectively across said ducts to vary the volume of pressure fluid passing through the latter.

2. An airbrush of the character described comprising, in combination, a barrel having an axial material passage and eccentrically arranged pressure fluid passages, a tip having a tapered bore in concentric register with said material passage and eccentrically disposed pressure fluid bores arranged to communicate with said pressure fluid passages, a flange threadedly connected to said barrel and engaging said tip to force the same into abutment with the end of said barrel, an air cap having an axial tapered bore interfitting snugly with said tip, a gland nut coacting with said flange and connecting said cap in place, said cap and said tip having coacting concentric material and pressure fluid ports for directing a

spray column axially from said cap, a pair of diametrically opposite divergent projections spaced from said ports and having pressure fluid ducts therein, a pressure fluid chamber within said air cap communicating with said ducts and with said pressure fluid bores in said tip, a series of discharge ports in said projections communicating with said ducts and coacting to direct alined pressure fluid streams angularly and tangentially against said spray column to spread the same fanwise, an annular recess within said air cap concentric with the bore therein and having a forwardly tapered groove intersecting said ducts intermediate said air chamber and the first port in each of said series, a ring-shaped tapered edge valve element operative in said recess and groove having substantially V-shaped slots adapted to register with said ducts to permit uninterrupted pressure fluid flow therethrough, and a manually operable element exteriorly of said air cap connected with said valve for shifting said valve rotatably to carry one respective edge of each of said slots across said ducts to vary the volume of pressure fluid passing through the latter for controlling the force of the pressure fluid streams emitted from said ducts.

3. In combination in a spray nozzle construction for airbrushes, a material tip having a discharge port at its front end and a base adapted to be secured to the front face of an airbrush barrel, means for securing said tip to the barrel, an air cap concentrically surrounding said tip and having means connecting the same to said tip-securing means, said air cap having an air port concentric with said material discharge port and air passages extending to opposite sides of said air port including ports directed to impinge upon and flatten a column of air and material issuing from the concentric ports, valve means mounted between said tip securing means and said air cap interiorly of the latter and extending into said air passages, said valve means being movable to adjustably control the flow of air through said air passages, and means manipulable exteriorly of said air cap for adjusting said valve means.

4. A nozzle construction of the character described comprising, in combination, a nozzle head having a bore for discharging a flaring column of material adapted to produce a round spray pattern, a plurality of pressure fluid discharge orifices located on opposite sides of said bore and arranged in progressive series generally in line with the column of material, each orifice in each series being directed to cause a jet therefrom to strike at one side of the axis of said column on an axis spaced from the axis of an adjacent jet of the series but in alinement therewith to act progressively longitudinally of the column, said jets being coactive to spread the column fanwise into a uniform elongated pattern, and means for controlling the volume of pressure fluid issuing from said orifices independently of said bore to vary the shape of the spray pattern from round through selective gradations to full fan.

5. In combination in a spray nozzle construction of the character described, a tip member having a central material discharge port and an eccentric pressure fluid passage terminating at a shoulder back of said port, an air cap having an axial bore for snugly receiving said tip and providing a chamber forwardly of the shoulder for pressure fluid from said passage, said cap having a pressure fluid discharge orifice concentric with said port and communicating with said chamber, a pair of ducts communicating with said chamber and opening on opposite sides of said port and orifice to project flattening streams of pressure fluid against the spray column issuing from the latter, the interior of said air cap being fashioned to provide an annular recess concentric with said axial bore and defining an axial hub, an annular substantially V-shaped groove in the forward wall of said recess intersecting said ducts between the outer ends thereof and said chamber, and a ring-shaped rotary valve slidably engaging said hub, the forward edge of said valve being complementary in shape to said groove to fit snugly but slidably therein and having openings corresponding to said ducts, said openings being arranged to register simultaneously with the respective ducts in one rotary position of the valve and to be shifted by minute increments out of register upon rotation of the valve, whereby to control the volume of pressure fluid flowing through said ducts independently of pressure fluid flow through said discharge orifice.

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