April 26, 1932. J. D. MURRAY 1,855,457

SPRAYING APPARATUS AND METHOD

Filed Aug. 22, 1927

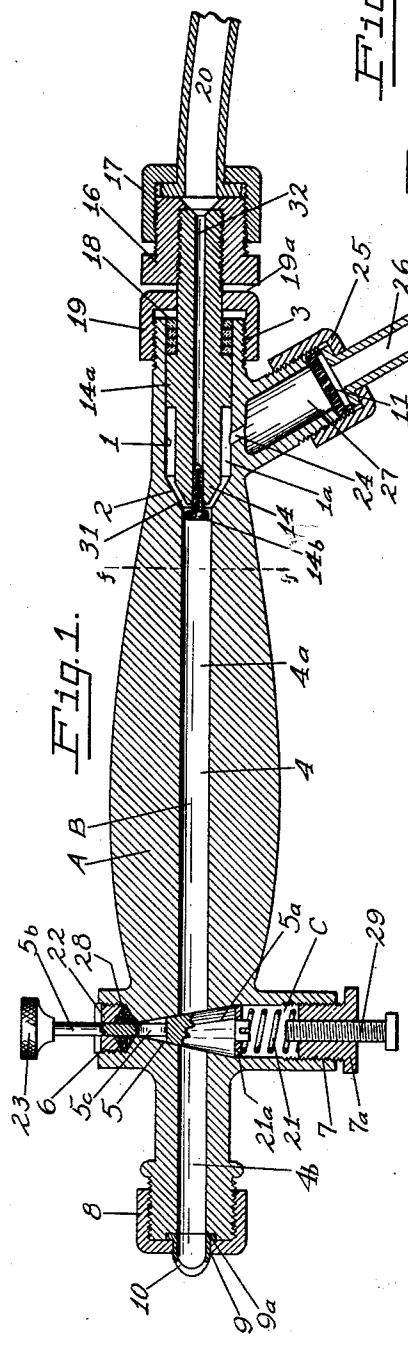


Fig. 1.

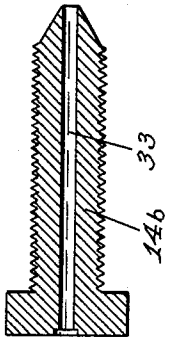


Fig. 5.

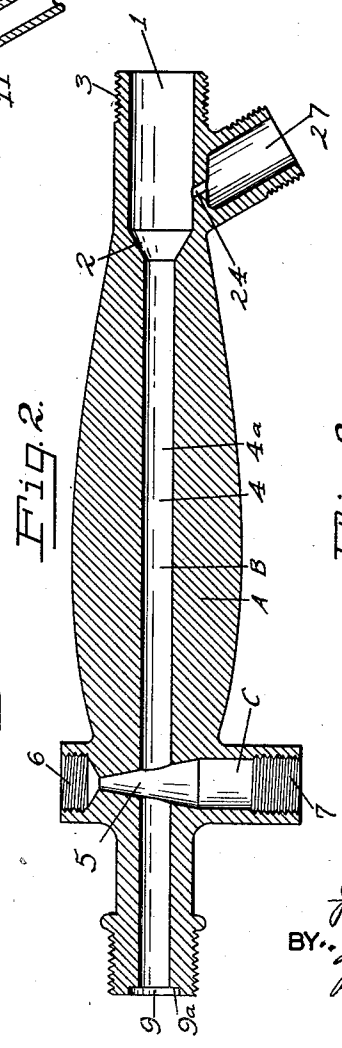


Fig. 2.

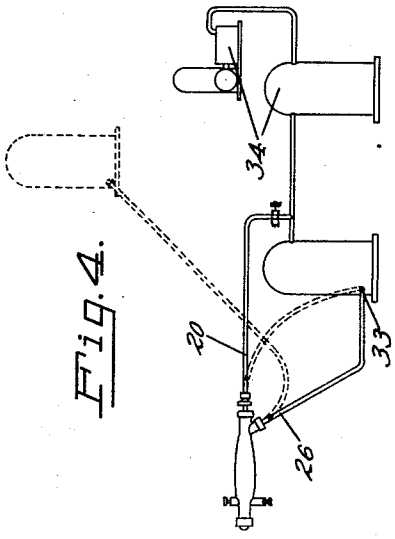


Fig. 4.

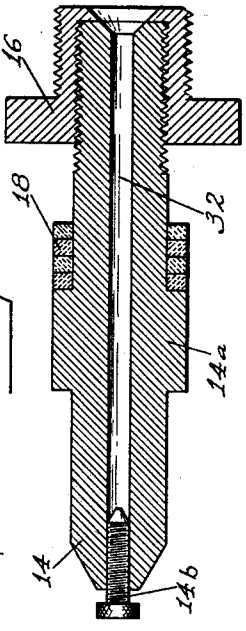


Fig. 3.

INVENTOR

John D. Murray.

BY.. Wm. S. Graham

ATTORNEY

Patented Apr. 26, 1932 1,855,457

UNITED STATES PATENT OFFICE

JOHN D. MURRAY, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GUY A. YEDD, OF OAKLAND, CALIFORNIA

SPRAYING APPARATUS AND METHOD

Application filed August 22, 1927. Serial No. 214,483.

My present invention relates to improvements in spraying apparatus and more specifically to the type commonly known as "air brushes" or spraying guns for applying to surfaces of liquids under pressure.

An object of my invention is to produce a spraying apparatus adaptable for combined use in the spraying of heavy liquid coatings, such as enamels having a celluloid base, and also materials having lighter body weight such as ordinary paint thinned with turpentine, orchard spray liquids, oils and the like, and which is capable of both spraying liquids under pressure by atomization thereof and also by the method technically known as "flowing", and discharging the same in a flat, fan-shaped film. Other objects are to provide a spraying device having an expansion chamber for fluids under pressure, and having readily adjusted control of intake and discharge; also which is economical in production, easily taken apart for cleaning or replacement of parts; which may be operated in the normal manner of handling an ordinary bristle paint brush; and which is adaptable to the use of air behind the liquid or air before the liquid, and use with air or liquid separately or with the two combined.

It is to be understood that, for convenience of expression, the term "enamel" refers to all liquids of heavy viscosity, "paint" to all liquids of light viscosity, and "air" to any auxiliary pressure medium, including the pressure of gravity flow.

It is well known that in the application of enamels having a heavy base material, difficulty is experienced in operating the material with an air brush or spray gun due to the heavy viscosity, since in that form it does not readily lend itelf without cutting to the atomization necessary in use of the existing types of spraying apparatus. Such material when cut by a solvent losses portions of its efficiency, and the use thereof in the existing types of spray guns, expends great portions of the material into the atmosphere, resulting in waste of material and contamination of the air near the orifice of discharge. By my invention I may apply any form of liquid material susceptible to use in a spraying device, in the method known as flowing, or I may atomize the material in the discharge thereof.

With the above mentioned and other objects in view, the invention consists of the novel construction hereinafter described, illustrated in the accompanying drawings of one embodiment of my invention, it being understood that various changes in form, proportion, size and minor details of construction within the scope of the claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Referring to the drawings:

Fig. 1 is a longitudinal cross section taken vertically through the center of an air brush embodying the present invention.

Fig. 2 is a longitudinal cross section taken vertically through the body portion of the air brush.

Fig. 3 is an enlarged longitudinal cross section taken vertically through the center of the hollow needle valve nozzle.

Fig. 4 is a side view of a spraying system showing an assembly arrangement of my air brush in connection with a liquid and pressure supply.

Fig. 5 is an enlarged longitudinal section of a cap screw fitting for the induction valve.

Referring to the drawings, I provide a body portion generally indicated A of the type usually found in the handle of bristle paint brushes, having a chamber of any suitable shape but preferably comprising a cylindrical bore generally indicated B, of varying diameters centrally aligned and longitudinally extending through said body portion, and through which the liquid material to be sprayed is conducted, said chamber B having its greater diameter at an inlet end portion 1, and having its diameter reduced by a bevel as at 2, continued in its reduced diameter 4, and terminating at a discharge orifice 9. Said discharge orifice is particularly shown as provided by a discharge tip 10, removably seated on a recessed shoulder 9*a*, said tip being of any suitable type but preferably of the type illustrated, described and claimed in my

pending application for U. S. Letters Patent, Serial Number 195,281, filed May 31, 1927, which said tip is transversely slotted as hereinafter described to direct the sprayed material in a flat film sheet and has an annular shoulder at its base end, and is axially turnable on recessed seat 9*a* to provide for adjustability of angular direction of the spray. The tip 10 is removably secured to the body A by a threadably engaged collar 8, the inwardly extending face of said collar having a port therethrough for accommodation of the tip 10, said collar also engaging the annular shoulder of tip 10 to hold the tip firmly in its desired position. Manifestly the collar and tip could be constructed integrally and the slot of the tip adjusted angularly by turning the collar on the threaded connection with body A.

Intermediate the ends of body A and extending vertically therethrough and continuing in the same axial alignment through a boss on either side of said body A, is a bore generally indicated C, passing cylindrically through the boss indicated 7 on the lower side of the body A, becoming a cone-taper 5 centrally where it extends across the bore 4 and again becoming cylindrical at its upper end 6, both ends 6 and 7 of said intermediate bore C being threaded for purposes hereafter explained. Internally of the lower end of bore C is a threadably engaged plug 7*a* which mounts a spring 21, said spring 21 being normally compressed and having superimposed thereon a washer 21*a* which in turn mounts a spring actuated frusto-cone valve 5*a* snugly and slidably within the portion 5 of the bore C. The cone portion 5*a* is normally pressed upwardly by action of the spring 21 seated upon washer 21*a* whereby to provide a cut-off valve in the bore 4, it being understood that the conical bore 5 intrenches upon the cylindrical walls of bore 4, and thus permits the seating of valve 5*a* to completely interrupt the passage through the bore 4. Valve 5*a* is manually actuated downward by means of an extension stem 5*b* which extends vertically through the portion 6 of the bore C, and is maintained centrally thereof by a threaded plug 22 at the bottom of which threaded plug 22 is a packing gland 28 to prevent leakage along the valve stem 5*b*. At the upper end of stem 5*a* is a finger cap 23 removably and threadably attached to the vertical stem 5*b*. Pressure exerted upon the finger cap 23 opens the valve 5*a* for the passage of material through the bore 4, and release of the pressure on the finger cap causes the valve 5*a* to reseat, actuated by spring 21. By removing the finger cap 23 and the plug 7*a* the entire valve structure may be readily removed for cleaning or replacement of parts. On the stem 5*b*, oppositely disposed, and intermediate conoidal valve 5*a* and plug 6, are recessed faces 5*c* which permit a wider free channel space in the bore 4 when valve 5*a* is pressed downwardly sufficiently so that the faces 5*c* are in alignment with the bore 4.

Disposed centrally and extending vertically through the plug 7*a* is a threaded bore 29 for accommodation of a turnable set screw, adapted to advance and recede by manual finger operation, for regulating the depth to which the valve 5*a* may be pressed, thus facilitating uniformity of action of said valve.

At the inlet end of bore B at the portion 1 thereof is a longitudinally slidable tubular induction nozzle or hollow needle valve 14 having less diameter throughout portions of its length than the bore 1, and having intermediate its ends an annular bearing 14*a*, constructed integrally if desired, slidably and snugly fitting the smooth walls of bore 1, maintaining induction nozzle 14 in central axial alignment with bore 1 and acting as a baffle against back pressure of liquid or air, said axial alignment of nozzle 14 and resistance to back pressure being further assured by a packing gland 18 of any suitable material, but preferably leather or rubber washers slidably mounted on the rearward portion of the circumference of nozzle 14 and forming a snug, longitudinally yieldable fit with the smooth inner bore 1. Back pressure will serve to expand the packing gland to form a tight fit. The discharge end of nozzle 14 is conoidally tapered with the same degree of angle as bevel 2 of the bore B, forming a valve with bevel 2 which, when seated, serves to prevent passage of liquid or air through the opening 31 normally defined between the nozzle point and the bevel. It will thus be obvious that a closable chamber 1*a* is formed in bore 1 circumferential of nozzle 14, which chamber 1*a* serves to hold a supply of liquid so that the feed thereof through the opening 31 will be more uniform and constant.

To the best of my knowledge no known spraying apparatus provides a mixing chamber for air and liquid between the point of intake and the means controlling discharge. My invention provides such a chamber 4*a* extending from the discharge end of induction nozzle 14 to the discharge control valve 5*a*. Obviously this mixing chamber may be lengthened in degree by mounting the hollow valvular nozzle 14 at any point between the source of liquid supply and the discharge orifice and permitting a suitable conduit to act as the mixing chamber for air and liquid. It is not essential that the hollow valve structure 14 be housed within the body portion of the air brush, especially where the spraying to be done is not located a great distance from the liquid supply. It is quite practicable to divide my spraying apparatus into sections, for instance, as on line *f*—*f*, so that the discharge and control portions may remain in the hand of the operator and the

chamber 1 and the appurtenant nozzle structure 14 be positioned at a point intermediate the source of liquid supply and the discharge portion, as for example, by placing the structure of chamber 1 and nozzle 14 on top of the liquid receptacle and having a conduit therefrom to the orifice of discharge and controlling means, thus permitting the conduit to become the mixing chamber corresponding to the chamber 4*a*.

In the atomizing method of spraying, the chamber 4*a* permits the admixture of liquid and air within the apparatus prior to reaching the point of discharge, and provides a constantly filled reservoir which absorbs the rapid expansion of air forced into the liquid, thus eliminating the annoying vibration resultant from back pressure, and also permitting the discharge of air and liquid in amalgamated form, instead of the usual injection of jets of air at or adjacent the orifice of discharge. The solidity of the fluid stream is broken up in passing valve 5*a* and said stream is permitted to again unite, under a reduced pressure, in that portion of chamber 4 indicated 4*b*, prior to its discharge.

Longitudinally within the induction nozzle 14 is a bore 32 having a cap screw 14*b* at the discharge end, said cap screw 14*b* also having an axial longitudinal bore 33 therethrough, (see Fig. 5). Cap screws having bores of different diameters are provided for regulation of the quantities of air necessary in the use of differing amounts of air pressure.

Packing gland 18 may extend from the collar 14*a* to the inlet end of the bore 1 and is held in position under pressure of a collar 19 having threaded engagement as at 3 with body A at its rearward or inlet end. Collar 19 has a cover face 19*a* which closes the inlet opening of the bore 1, but having a port centrally thereof through which extends the rearward portion of nozzle 14. The rearward end of nozzle 14 threadably mounts a collar nut 16 (see Fig. 3), which has threads both internally and externally, the external threads engaging collar coupling 17 which connects a conduit 20 leading to a source of supply (see Fig. 4), which supply may be air or liquid according to whether the air brush is being used in flowing liquids or in atomizing liquid, as hereafter explained.

Body A mounts adjacent bore 1 a boss containing a bore 27 having a port 24 connecting with the bore 1, which boss threadedly mounts a collar coupling 25 which connects a conduit 26 to a source of supply, (see Fig. 4), which supply may also be air or liquid according to the manner in which the brush is being used.

Within the coupling attaching the supply conduit 26 to the air brush is a strainer 11 which may be used for the purpose of refining the liquid material prior to its passage into the air brush, such strainer being of any suitable type, but preferably consisting of a perforated disc of resilient material such as rubber, retained in its position in the coupling by engagement of the threads of the coupling with corresponding threads of the air gun body.

The use of the strainer 11 in any method of spraying is optional. A good operator will strain his liquid each time he replenishes his liquid container and in that event it is not essential that the strainer 11 be used. However, there are also numerous instances where small pieces of fiber or rubber will become detached from the liquid supply conduit and in that event the strainer is highly desirable to prevent clogging of the tip orifice. While in the majority of instances the clogging material will eventually blow through the tip, nevertheless when it does so it is likely to cause blotch spraying. When in use under pressure the perforations in the resilient strainer will open sufficiently to permit the passage of the spraying liquid.

The ordinary existing type of spraying apparatus is constructed in the form of a pistol having barrel and pistol grip. I realize that the ordinary shape of a paint brush handle is old, but may adaption thereof is more than a matter of form; it accomplishes a new and useful result. With the pistol grip type, the weight of the gun and conduit hose are a very considerable stress upon the wrist of the operator, especially with finger trigger operation which leaves only three fingers to support the grip and weight of the spraying apparatus. This is particularly burdensome in that type where the hose or container for material is attached to the aparatus adjacent the orifice of discharge, as well as the inconvenience of having the hose or container dangling in front of the operator's hand. By my invention the operator may firmly grip the body portion with all five fingers of the hand and operate the valve 5*a* with the use of the fore part of the thumb which is the most muscular finger of the hand, thus eliminating fatigue to the operator. This form of body further permits straight line action of fluids, thus eliminating back pressure caused by angular change of course of liquids being sprayed, especially those having heavy viscosity. This form of body and the arrangement of nozzle 14 and its accessory operating parts in longitudinal axial alignment with the bore of the body A also provides for the ready removal, by unscrewing collar cap 19, of the operating mechanism within the body portion for cleaning or replacement, and for positioning or removing cap screw 14*b*.

The existing type of spray gun will not spray liquids of heavy viscosity, such as enamels and lacquers without first "cutting" them with a solvent. My invention permits of spraying of liquids of heavy viscosity

without cutting. The existing type of spray apparatus is capable of spraying liquids by atomization only, and where it has been desired to "flow" liquids such as enamels resort to the method of the bristle brush has been required; and "flowing" with a bristle brush being an art which requires expert high-priced painters, it is an expensive method. The existing method of spraying by atomizing is to pass the liquid through the apparatus and at its point of discharge to inject into the liquid stream a jet of air under pressure and thus break the liquid mass into a myriad of tiny globules, a great portion of which pass into the atmosphere instead of being applied to the surface to be sprayed. In the invention here disclosed both the atomizing and flowing methods may be used without the usual waste of liquid material. The atomizing method is accomplished by conducting the liquid under pressure from any suitable source, such as air, steam or gravity, from a liquid receptacle such as indicated 33, (see Fig. 4) through the conduit hose 26 and into the chamber 1*a* surrounding the forward end of the nozzle 14, the nozzle 14 in this instance being drawn rearwardly from the impingement on the bevel 2 to what may be called its normal position by means of turning the collar cap 19 on its threaded connection with the body A until it forces rearwardly the nut 16 which in turn draws the nozzle 14 rearwardly and away from the bevel 2. Obviously, the passage 31 is thus created from chamber 1*a* to the bore 4. Auxiliary air under pressure is conducted from any suitable compressing source, such as shown at 34 through the conduit hose 20 and through the bore 32 of the hollow induction nozzle 14, and the cap screw 14*b*. The bore 4*a* thus becomes a mixing chamber for the air and liquid. The quantity flow of liquid desired is thus uniformly regulated from time to time by the adjustment of nozzle 14 with relation to bevel 2. The operator by pressure on the finger cap 23 opens the valve 5*a* and thus permits the mixed compressed air and liquid to pass through the portion of the bore indicated 4*b* and discharge through the tip 10. It is obvious that when the operator releases pressure on finger cap 23 the spring 21 will reseat valve 5*a* and stop the passage of the liquid and air. This method of operation passes the material into the mixing chamber bore 4*a* before the air. The invention is also adaptable to the method of spraying with the air behind the material and in this method the hose 26 from the liquid supply and the hose 20 from the air supply have their places of attachment to the apparatus reversed, the liquid supply conduit being attached to the nut 16 and the air supply conduit 20 being attached to the boss 27. In other ways this method of operation is the same as above described, the distinction being that by this method the air is before the material and assists by its suction the action of the pressure exerted directly upon the material.

In the method of "flowing" of liquids a pressure from any suitable source, for instance, as shown in Fig. 5, is exerted directly upon the liquid to be sprayed, forcing the liquid to the air brush. Where compressed air is the pressure used, this requires substantially less air to become mixed with the liquid than where compressed air is used to atomize the liquid in atomization spraying, thus causing substantially pure liquid to be discharged; where the gravity system of pressure is used to bring the liquid to the air brush, it is obvious that there would be no admixture of air with the liquid and that the discharge would be of the pure liquid only.

Where the spraying job may be done entirely by the flowing method the supply conduit from the liquid may be threadably attached direct to the body A by withdrawing the nozzle 14 and its appurtenant mechanism, the threading and gauge of the couplings 17, 19 and 25 being standardized. In that instance a cap or plug of usual type is used to close the opening of the bore 27. If, however, it is not desired to withdraw the nozzle 14, the nozzle 14 may be moved forward for impingement against the bevel 2 by means of turning in a forward direction the collar cap 19 which in turn exerts pressure against the packing material 18 and the annular bearing 14*a*. This closes the channel 31, and creates a straight unobstructed channel for the flow of liquid into the bore 4*a*, from whence the discharge is regulated by operating the valve 5*a*. The straight flow of the liquid is interrupted by the tip 10, and in my preferred form of tip having an elongated transversely slotted discharge orifice the liquid under pressure is discharged in a fan-like flat film, the tip 10 accomplishing this by being so constructed that the resistance to the flow of liquid therethrough is greater centrally of the orifice of discharge of said tip and diminishes in each direction in equal degrees of gradation from said central point to the ends of the slotted orifice.

Alternating in the method of operation from the atomization method to the flowing method and vice-versa may be repeated as often as desired. My invention is, therefore, an air brush of universal adaptability, providing for interchangeable use in the atomizing and flowing methods, with the liquid before the air or the air before the liquid, for use with air exclusively, liquid exclusively, or the two combined, and may be used with pressure solely upon the liquid or as a siphon apparatus.

In the use of the flowing method, to facili-

tate the passage of the liquid past the valve 5*a*, there is provided on the stem 5*b*, intermediate the conoidal portion 5*a*, and the packing gland 28, oppositely disposed recessed faces which, when finger cap 23 is pressed downwardly by the operator, may be made to coincide with the longitudinal axial alignment of the bore 4 thus reducing the resistance to the passage of the liquid therethrough, and providing a substantially unobstructed passage of the fluid to the tip 10.

Obviously channel 31 may be opened to various widths so as to regulate the amount of flow therethrough.

Having thus described my invention, I claim:

1. A pressure type spraying apparatus comprising a body portion having a chamber therein and a valve controlled discharge orifice, said chamber formed of a plurality of portions of different transverse dimensions with a bevel connecting two of said portions, a reciprocally slidable injector having an opening therethrough and terminating forwardly in a bevelled discharge end adapted to seat on the bevel of the chamber, a circumferential shoulder on said injector intermediate the ends thereof with snug slidable fit against the walls of the chamber, an intake port into said chamber intermediate said circumferential shoulder and the discharge orifice, a plurality of compressible washers slidably mounted on said injector, and means slidably to reciprocate said injector.

2. A pressure type spraying apparatus comprising a body portion having a chamber therein with a discharge orifice and means to control the discharge therefrom, said chamber formed of a plurality of portions of different transverse dimensions with a bevel connection between two of said portions, an elongated reciprocally slidable injector having a longitudinal passage therethrough and terminating forwardly in a bevelled discharge end adapted to seat on said bevel of the chamber and extending rearwardly beyond the confines of the chamber, a circumferential shoulder on said injector intermediate the ends thereof snugly and slidably fitting the walls of the chamber, an intake opening into said chamber forwardly of said shoulder, a plurality of compressible washers slidably mounted on the injector, a perforated cap nut mounted at the rearward end of said chamber, means cooperating with said cap nut slidably to reciprocate said injector, and means to regulate the passage through said injector.

3. A pressure type spraying apparatus comprising a body portion having a chamber therein and a valve controlled discharge orifice, said chamber formed of a plurality of portions of different transverse dimensions with a bevel connecting two of said portions, a reciprocably slidable injector nozzle engaged in a chamber portion and terminating forwardly in a bevelled discharge end adapted to seat against the bevel of the chamber, a circumferential shoulder on said nozzle intermediate the ends thereof with snug slidable fit against the chamber wall thereat, an intake port into said chamber intermediate said shoulder and the seat and a sealing washer mounted on said injector adjacent said shoulder and operative between the nozzle and opposed chamber wall thereat.

4. A pressure type spraying apparatus comprising a body portion having a chamber therein and a valve controlled discharge orifice, said chamber formed of a pluarlity of portions of different transverse dimensions with a bevel connecting two of said portions, a reciprocably slidable injector nozzle engaged in a chamber portion and terminating forwardly in a bevelled discharge end adapted to seat against the bevel of the chamber, means intermediate the ends of the nozzle operative to center and seal the same in and with respect to the walls of the chamber, an intake port discharging into said chamber intermediate said sealing means and the forward nozzle end, and means to axially reciprocate said nozzle with respect to said seat.

JOHN D. MURRAY.