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SPRAY GUN FOR MULTICOLOR PAINTS

Filed July 27, 1959

Fig. 1

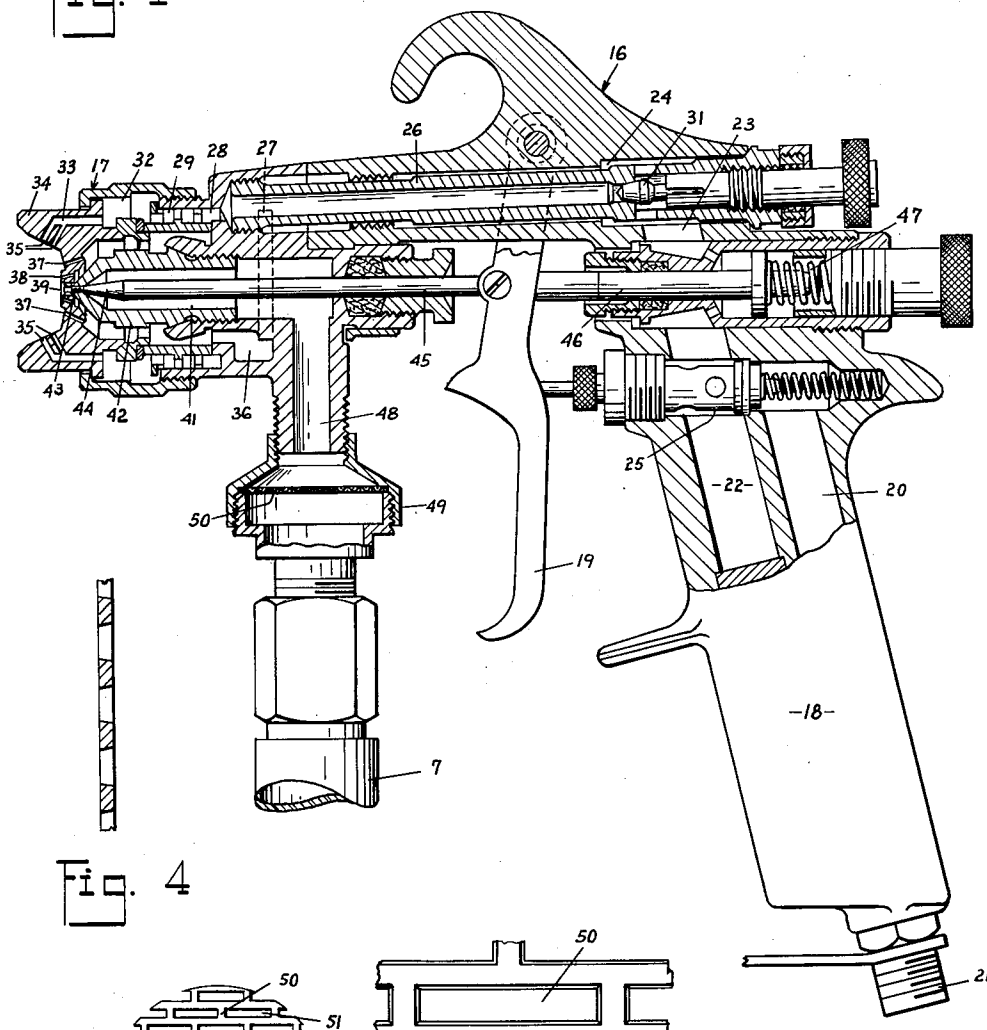


Fig. 4

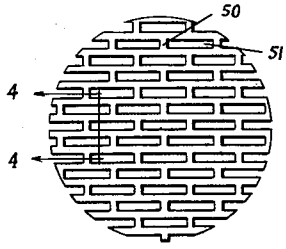


Fig. 2

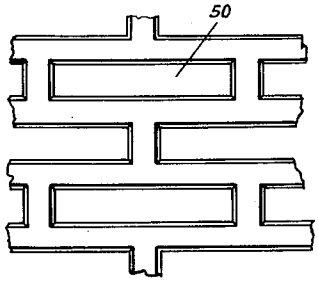


Fig. 3

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SPRAY GUN FOR MULTICOLOR PAINTS

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This invention relates, as indicated, to an apparatus which is characterized in that it possesses a plurality of stages for dispersing relatively immiscible materials, a particular type of apparatus being that especially adapted for the controlled spraying of multicolor paint.

Certain multicolor paint compositions are composed of an emulsion of a binder dispersed as microscopic particles in an aqueous medium which emulsion, has dispersed therethrough macroscopic particles of a liquid composition immiscible and non-emulsifiable with the binder emulsion. Certain of these compositions tend to be what is known as "metastable." By this it is meant that the macroscopic particles dispersed in the microscopic emulsion tend to coalesce forming undesirably large particles. In a multicolor paint, for example, the macroscopic particles may comprise liquid globules or particles, of one or more pigmented resins or binder compositions, while the microscopic emulsion is also a pigmented composition such as a styrene-butadiene "latex" paint. Upon standing, these liquid-liquid dispersions are somewhat unstable in that the macroscopic particles tend to coalesce forming undesirably large particles of color dispersed in the latex binder. A coating applied from a composition which has stood overnight, such coating being applied in juxtaposition to previously coated areas, will become readily apparent to the eye because the color flecks will appear to have increased in size. The result is unsatisfactory where uniformity of appearance on a multicolor paint decorated surface is desired.

It is a primary object of the present invention, therefore, to provide an apparatus to control the character of the liquid-liquid dispersion in terms of the size of the macroscopic particles dispersed therein, and to thereafter disperse this controlled liquid-liquid dispersion in particulate form in a gas stream, such as an air stream.

Other objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then consists of the means hereinafter fully described and particularly pointed out in the appended claims, the following description and annexed drawing setting forth in detail certain illustrative embodiments of the invention, such disclosed means constituting, however, but a few of the various forms in which the principles of this invention may be employed.

Briefly stated, the present invention is in the provision of an apparatus for dispensing a liquid as a spray, i.e. a dispersion of a liquid in a gas, such apparatus including a chamber having an inlet and an outlet. Means are provided adjacent the outlet for dispersing the liquid passing therethrough into a spray. Removable means including a plurality of apertures disposed in a plane transverse to the flow of liquid are provided spaced from the outlet and adjacent the inlet, the purpose of which is to selectively control the size of the macroscopic liquid particles in the liquid medium as dispensed.

In the annexed drawings:

FIG. 1 is a partial cross-sectional view of an apparatus constructed in accordance with the principles of this invention.

FIG. 2 is an enlarged illustration of a screen forming a part of the apparatus hereof.

FIG. 3 is an enlarged view of a portion of the screen shown in FIG. 2.

FIG. 4 is an enlarged cross-sectional view of apertures illustrated in FIG. 2, taken on the line 4—4.

Generally speaking, the apparatus of the present invention includes a gun which comprises a handle by which it may be held and manipulated, a nozzle from which liquid and compressed gaseous propellant are discharged, and suitable passages and valves by which the discharge of gas and liquid are controlled.

Referring now particularly to FIG. 1, there is illustrated a gun of this general character. The body of the gun is indicated by **16**, the nozzle generally by **17**, the handle by **18**, and the valve controlling lever or trigger by **19**. The handle includes a passage **20** which is connected through a nipple **21** to a suitable source of compressed gas, e.g. air. The passage **20** communicates with a second passage **22** which communicates through a port **23** with the rear portion of the bore **24**. A main, normally closed, shut-off valve **25** is provided in the passage **22** and is adapted to be opened by operation of the trigger **19** in a well known manner.

The bore **24** opens at the rear end of the body **16** to receive a tube **26** which is threaded at its forward end in a restricted portion of the bore **24** in advance of a port **27**, and the forward end of the tube communicates with the orifice **28** through which gas is supplied to the chamber **29**. The flow of gas through the tube **26** will be regulated by the valve **31**, and this gas is delivered from the chamber **29** through the annular chamber **32** into the passage **33** in the head **34** of the nozzle **17**, from whence it is discharged from the nozzle openings **35** diagonally toward the longitudinal axis of the gun. The gas from the bore **24** surrounding the tube **26** passes through the annular port **27** into the chamber **36**, from which it is discharged at the nozzle through the ports **37**, **38** and **39**.

A receiving chamber **41**, formed by a bore in the housing **16** and a tubular extension **42** threaded into the bore, is provided with a discharge orifice **43** positioned coaxially with the nozzle head **34**. The discharge orifice **43** is controlled by a valve **44** carried by a stem **45** which is connected with the trigger **19**. A plunger **46** and an expansion spring **47** normally urge the valve **44** into a position to close the orifice **43** and hold the trigger **19** in the position shown in FIG. 1.

The receiving chamber **41** is connected to receive the liquid being sprayed from a container (not shown) attached to the flexible hose **7**. A passage **48** communicating with the rear end of the chamber **41** is connected by a coupling **49** of enlarged diameter. Clamped between the male and female portions of the coupling **49** is a screen **50**, a preferred embodiment of which is more clearly shown in enlarged view in FIGS. 2, 3 and 4.

FIG. 2 illustrates a circular metallic screen member which may be used transversely of the path of flow of liquid from the supply container, not shown, through the flexible conduit **7**, into the spray gun **16**. The screen member thus employed has special characteristics enabling it to perform the desired function of controlling the character of the dispersion of the macroscopic particles in the liquid medium. Ordinary window screen, for example, will not suffice for the purposes of the present invention. While the screen **50** may be located at any point between the paint source and the gun, it is most conveniently located as shown in FIG. 1.

In a preferred embodiment of the present invention, the screen **50** is in essence a circular section of slotted screen having a plurality of slots **51** arranged in end-to-end relation defining rows, successive rows being arranged in staggered relationship with the next adjacent row. As shown in FIGS. 3 and 4, in enlargement and in cross-section, the slots **51** have a trapezoidal shape. If a cross-sectional view were taken transversely to the sec-

tion shown in FIG. 4, i.e. the long way of the slot, the opening would also appear as a trapezoidal shape. The surface described by the walls of the opening is regarded in the present specification as that of a frusto-rectangular pyramid. The screens **50** are conveniently made of thin metallic sheet material having slotted perforations, each slot of which is from about 4 to about 10 times longer than it is wide. The thickness of the screen is such that it is approximately the same as the slot width, and the open area of the screen to the closed plate area of the screen is, in the preferred case, of the order of from about 20% to about 40% of the total screen area.

The slot width of the perforations which are of rectangular configuration is the controlling dimension for the purposes of the present invention. It is the slot width, or the measure of the smallest dimension of the perforation which controls the size of the macroscopic particles which are immiscible with, but dispersed in the liquid medium, as hereinafter more particularly described. It should be understood that the gradation in slot size from one face to the other of the preferred screens for use in accordance herewith, i.e. the frusto-rectangular pyramidal surface, is provided by electroplating techniques. A variety of durable metals including nickel may be used to produce the screen structure desired. It does not appear to make any difference in the spraying operation or uniformity of control which side of the screen is toward the on-coming liquid stream.

Instead of elongated slots in end-to-end relation as above described, the screens of the present invention may also be made by perforating a thin metallic plate with circular holes defining small cylindrical bores and having random, or regular, orientation and from 10 to 70 openings per lineal inch, and from 15% to 60% open area. The side walls of the perforations regardless of planar shape of the opening may be parallel or diverging. The smallest dimension may range from about 0.005" to about 0.05".

Whatever the screen nature may be, it is preferred that the screen element be a disc having a diameter of at least about twice the diameter of the flexible tube **7**. It has been found that if the disc is substantially smaller, in standard spray guns there is a tendency to uneven distribution of the macroscopic color particles in the liquid binder. Best results are obtained, therefore, where the screen blank is a one inch circular member of the slotted type screen described above, with inlet tube **7** diameters of from 3/8" to 5/8".

The multicolor coating composition applied through the multi-stage dispersion apparatus of the present invention generally may comprise a paint latex emulsion which is normally pigmented containing microscopically dispersed particles of interpolymers of two or more ethylenically unsaturated monomers, e.g., butadiene-styrene, which as formulated, are preferably, but not essentially, capable of depositing continuous films. Dispersed in visibly discreet macroscopic particles in the latex paint carrier is still another liquid phase which is immiscible and non-emulsifiable in the emulsion paint latex system. The macroscopic phase is formulated generally to be of differing hue, value, and chroma over the pigmented latex emulsion paint which serves as a suspension medium for the macroscopically dispersed particles or globules. Upon application to surfaces and films by spray application, the product of this nature provides a base coat originating primarily from the microscopic particles of one color, and interspersed throughout the base coat are a plurality of macroscopic globules or particles of the second liquid paint system of distinct and different physical properties from that of the first or emulsion system, and generally one or more different colors. Macroscopic particles are exclusive of microscopic particles found in emulsion systems and include particles of at least 0.01" in diameter upwards. Particles as large as 0.25" in diameter are not uncommon in the macroscopic dispersed phase. Reference may be had to my copending application Serial Nos. 729,513 and 729,514, filed April 21, 1958 for detailed description of the preparation of multicolor coating compositions which may be applied by the apparatus of the present invention.

The particle sizes of the liquid-liquid dispersion in the gas stream is controlled in the usual manner for spray gun application of paints by regulating the valves **31**, **44** and **25** to provide aequate coverage without sagging or too light deposition of coating. Particle sizes within the liquid phase are controlled by selection of the desired screen size to produce a given multicolor effect. Time of standing of the "metastable" system is no longer a critical factor affecting the decorative result.

There has thus been provided an apparatus for dispensing liquid-liquid dispersions of macroscopic liquid particles of controlled size in a liquid medium immiscible therewith in spray dispersions of liquid in a gas medium also of controlled size or a multi-stage dispersion apparatus. It includes a chamber having an inlet and an outlet. At the outlet are provided means for dispersing a liquid in a gas as a spray. Before the liquid-gas dispersion is produced, the liquid passes through a means impervious to liquid having a plurality of apertures therein for selectively controlling the size of the macroscopic particles dispersed in the liquid medium.

Other modes of applying the principle of this invention may be employed instead of those specifically set forth above, changes being made as regards the details herein disclosed, provided the elements set forth in any of the following claims, or the equivalent of such being employed.

It is, therefore, particularly pointed out and distinctly claimed as the invention:

1. An apparatus for dispensing a liquid-liquid dispersion of macroscopic liquid particles in a liquid medium non-reactive therewith in a gas spray including a chamber having an inlet and an outlet, conduit means for conducting fluid to said inlet, means adjacent the outlet for dispersing a liquid passing therethrough as a mixture of discrete immiscible particles into a spray, and removable means impervious to liquid including a plurality of rectangular apertures disposed in said conduit in a plane transverse to the flow of liquid spaced from said outlet and toward said inlet to selectively control the size of said macroscopic liquid particles in said liquid medium as dispensed, said apertures having a length 4 to 10 times the width thereof, and said apertures occupying no more than about 66% of the total area of said removable means, the total area of said removable means being at least about twice the cross-sectional area of said conduit.

2. In a spray gun apparatus for dispensing a multicolor paint comprising a gun body defining a liquid receiving chamber and having a discharge orifice communicating with said chamber at one end thereof for discharging a liquid stream therefrom and a single inlet opening into said chamber, conduit means for conducting fluid to said inlet, a liquid control valve associated with sad orifice for opening and closing the same, passages in said body for receiving a gas under pressure and exhausting the same as a plurality of atomizing jets into the path of liquid discharged from said orifice, a gas control valve controlling the admission of gas to said passages, and manual control means for simultaneously opening both of said valves, the improvement which comprises a removable means impervious to liquid including a plurality of rectangular apertures disposed in said conduit in a plane chamber, said apertures having a length 4 to 10 times the width thereof, and having from 10 to 70 openings of substantially the same size per linear inch and from 15% to 66% open area, the total area of said removable means being at least about twice the cross-sectional area of said conduit.

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