Feb. 22, 1966 T. P. McRITCHIE 3,236,459

APPARATUS FOR SPRAYING MATERIALS

Filed Dec. 16, 1963 3 Sheets-Sheet 1

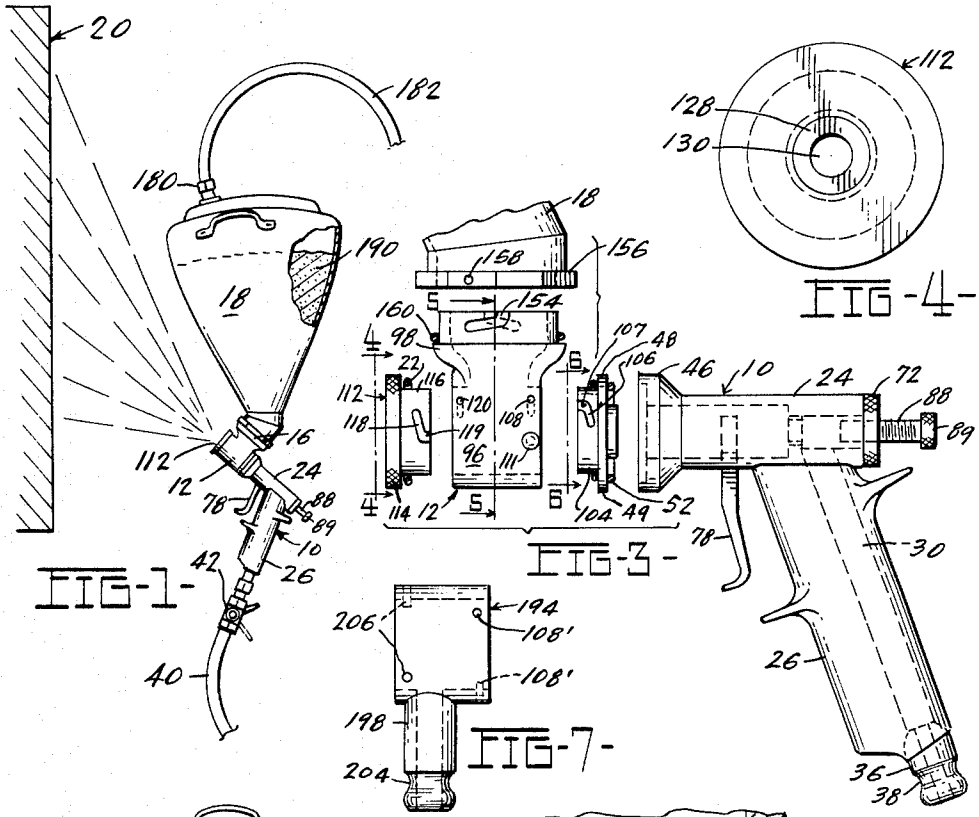

FIG-1-

FIG-4-

FIG-3-

FIG-7-

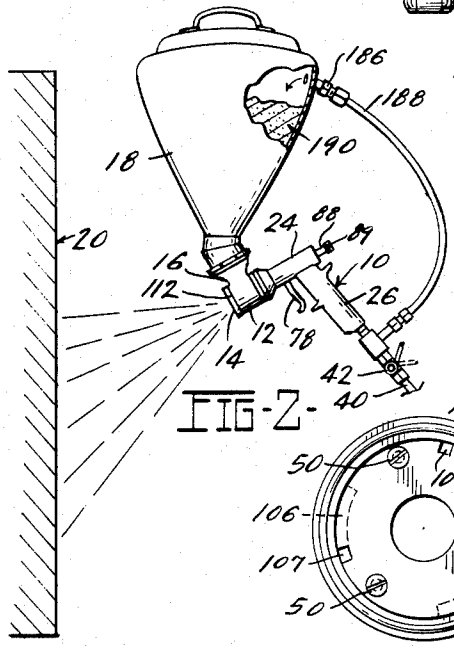

FIG-2-

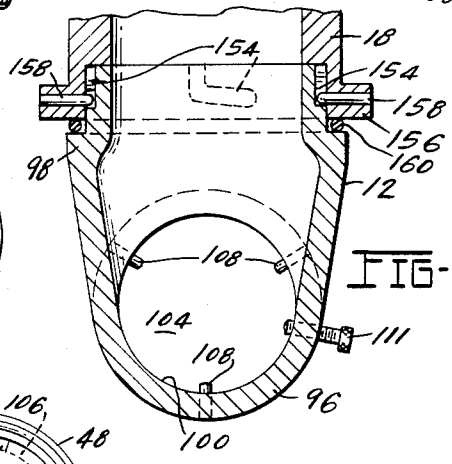

FIG-5-

FIG-6-

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Feb. 22, 1966 T. P. McRITCHIE 3,236,459

APPARATUS FOR SPRAYING MATERIALS

Filed Dec. 16, 1963 3 Sheets-Sheet 2

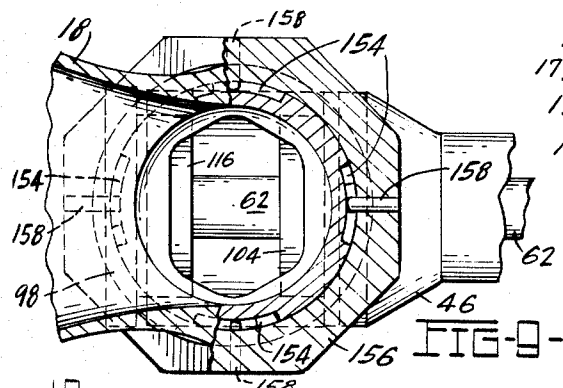

FIG-9-

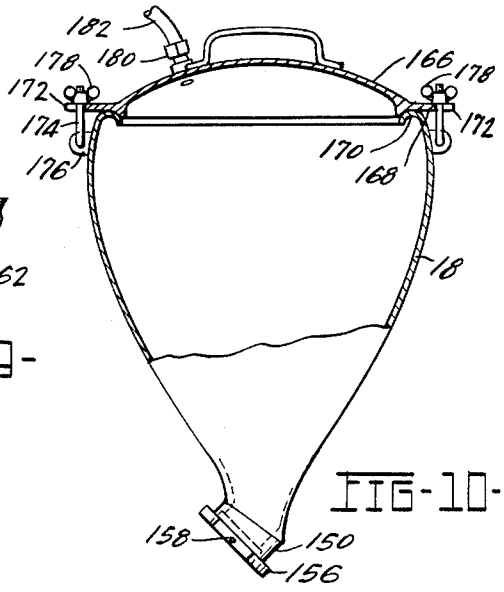

FIG-10-

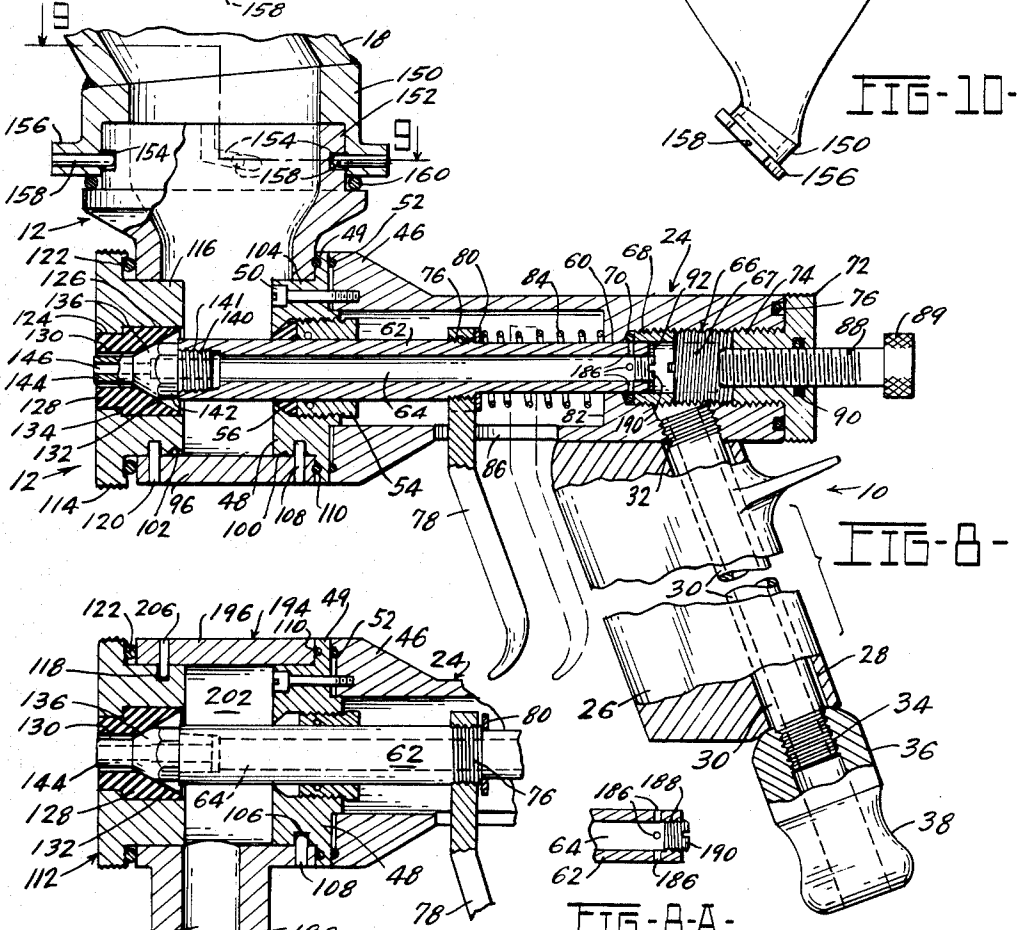

FIG-8-

FIG-11-

FIG-8-A-

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APPARATUS FOR SPRAYING MATERIALS

Filed Dec. 16, 1963 3 Sheets-Sheet 3

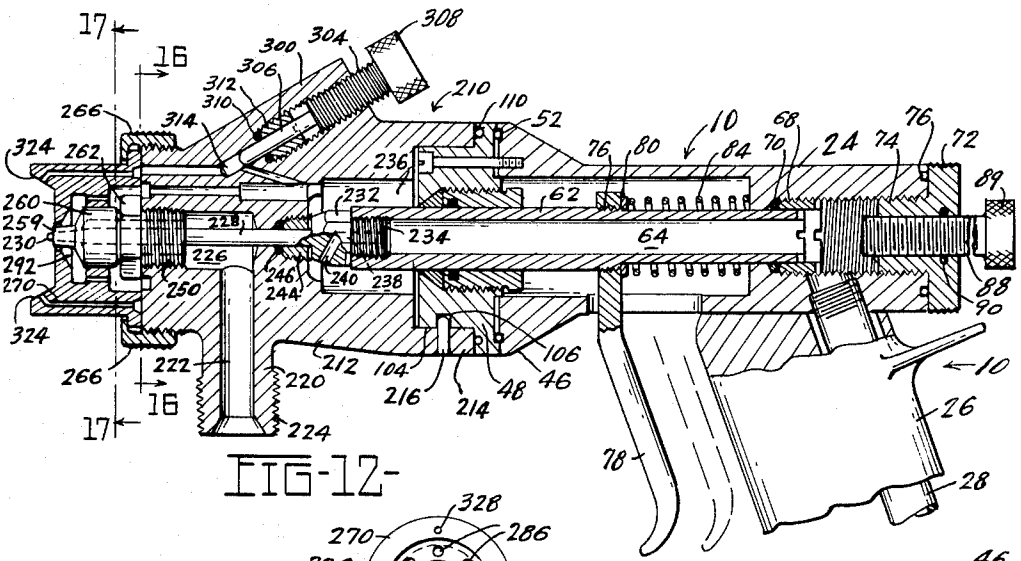

FIG-12-

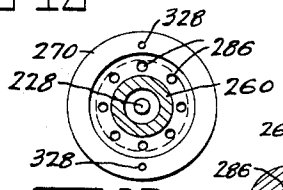

FIG-17-

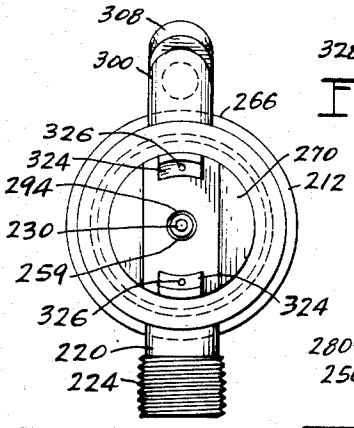

FIG-15-

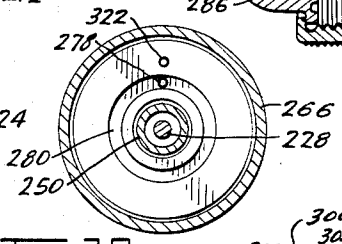

FIG-16-

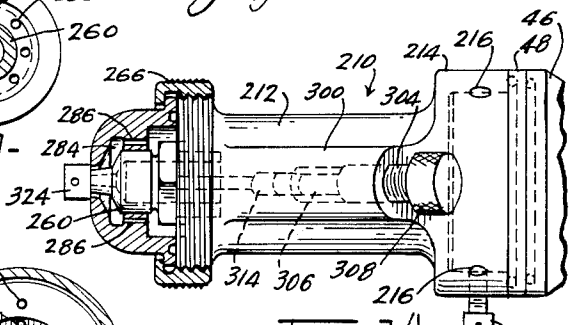

FIG-14-

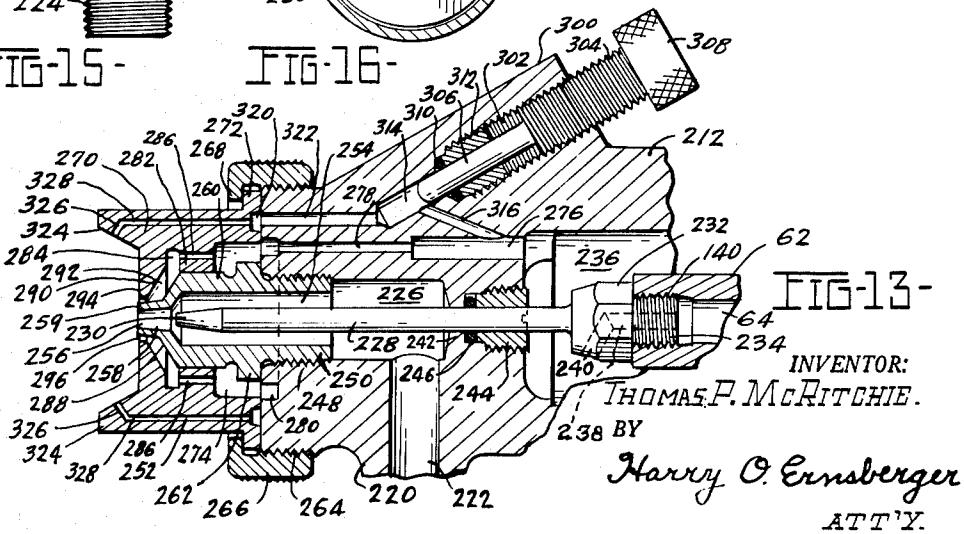

FIG-13-

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Patented Feb. 22, 1966

3,236,459

APPARATUS FOR SPRAYING MATERIALS

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Filed Dec. 16, 1963, Ser. No. 330,703
9 Claims. (Cl. 239—416)

This invention relates to method of spraying materials and to a spray gun or spray apparatus particularly adaptable for spraying various materials including heavy or viscous materials as well as more liquidus coating materials.

Spray guns have been developed and used for spray application of various materials but heretofore a spray gun or apparatus for applying paints and liquidus materials was not suitable for applying heavy or viscous materials, the latter requiring a type of spray gun different from that usable for applying liquidus materials.

The present invention embraces a method of applying materials and particularly a method of spraying or applying comparatively heavy materials or aggregates in slurries through the use of air pressure and for spraying or applying liquidus or low viscosity materials.

Another object of the invention is the provision of a spray gun or spray apparatus usable for applying either heavy viscous materials or comparatively thin liquidus or low viscosity materials from a gravity supply or under conditions wherein the supply of material may be pressurized.

Another object of the invention resides in the provision of spray apparatus which may be attached to a material supply hopper or container in various relative positions to enable the use of the spray gun in any position while maintaining the supply hopper in a position to assure proper flow of the material to the gun.

Another object of the invention is the provision of a spray gun which is readily adaptable for delivering or applying the material in a desired spray pattern and which is adaptable to provide various spray patterns.

Another object of the invention resides in a spray gun or spray applicator wherein fittings or adapters may be quickly and readily interchanged to facilitate the use of the spray gun with various materials and wherein the fittings may be quickly interchanged without the use of special tools.

Another object of the invention resides in a spray gun or spray apparatus adaptable for applying materials such as slurries of fine aggregates in the nature of fine sand, vermiculite, perlite, gypsum, lime and the like or materials of mortar-like consistency, plaster, cement stuccos or epoxy and polyester resins, and is adaptable for the application of more liquidus materials such as paints or materials contained in water soluble or solvent type vehicles containing normal pigmentation.

Another object of the invention resides in the provision of a spray gun construction wherein the major components are fashioned of lightweight material such as aluminum usable with a material supply hopper formed of lightweight material such as aluminum or molded plastic.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

FIGURE 1 is an elevational view of the spray gun of the invention and a material supply hopper in one position of use;

FIGURE 2 is a view similar to FIGURE 1 illustrating the supply hopper in a different relation with the spray gun;

FIGURE 3 is an elevational view of components of the spray gun in disassembled relation;

FIGURE 4 is an end view of the nozzle plate, the view being taken on the line **4—4** of FIGURE 3;

FIGURE 5 is a sectional view taken substantially on the line **5—5** of FIGURE 3;

FIGURE 6 is an elevational view taken substantially on the line **6—6** of FIGURE 3;

FIGURE 7 is an elevational view of a fitting forming a component of the spray gun for use with viscous materials;

FIGURE 8 is a longitudinal sectional view through the spray gun and the connection with the supply hopper, the gun including the components shown in FIGURE 3;

FIGURE 8*a* is a fragmentary sectional view of a modification of an arrangement shown in FIGURE 8;

FIGURE 9 is a sectional view taken substantially on the line **9—9** of FIGURE 8;

FIGURE 10 is a vertical sectional view of a material supply receptacle or hopper for use with the spray gun;

FIGURE 11 is a longitudinal fragmentary sectional view of the spray gun assembled with the fitting illustrated in FIGURE 7;

FIGURE 12 is a longitudinal sectional view illustrating the spray gun and fitting construction adapting the gun for application of liquidus materials;

FIGURE 13 is an enlarged sectional view of a portion of the construction shown in FIGURE 12;

FIGURE 14 is a top plan view of a portion of the construction shown in FIGURE 12 with certain parts shown in cross-section.

FIGURE 15 is a front end view of the construction shown in FIGURE 12;

FIGURE 16 is a transverse sectional view taken substantially on the line **16—16** of FIGURE 12, and

FIGURE 17 is a transverse sectional view taken substantially on the line **17—17** of FIGURE 12.

Referring to the drawings in detail and initially to FIGURES 1 through 6, 8 and 9, the spray gun and fitting construction illustrated in these figures provide an arrangement particularly adapted for spraying viscous materials or slurries onto a surface. As shown in FIGURES 1 and 2, the spray gun **10** is equipped with a component or fitting **12** equiped with a nozzle construction and a connecting portion **16** to which is removably secured a material containing receptacle or hopper **18**, these components being hereinafter more fully described.

The hopper **18** is adapted for connection with the fitting **12** in various positions. FIGURE 1 illustrates the relation between the spray gun **10** and the hopper **18** where the material spray is directed upwardly onto a surface **20** with the hopper in an upright or vertical position. FIGURE 2 is similar to to FIGURE 1 illustrating another relationship between the fitting **12** and the hopper **18** where the material spray from the gun is directed angularly downwardly onto a surface with the hopper **18** maintained in a substantially vertical or upright position.

The spray gun construction is particularly shown in FIGURES 3, 4, 6 and 8. Referring particularly to these figures, the spray gun is inclusive of a generally cylindrically shaped body **24** and a hand grip portion **26**. The hand grip portion **26** is provided with a lengthwise tubular passage **28** which accommodates a tube or tubular member **30**.

The upper end of the tubular member **30** is threaded, as shown at **32**, and is threaded into an opening formed in the body **24**. The opposite end of the tube **30** is threaded as at **34** to receive a locking fitting **36** having

a threaded interior bore. When the fitting **36** is drawn up into the position shown in FIGURE 8, the hand grip **26** is rigidly secured to the gun body **24**.

The fitting **36** is configured as at **38** to receive the end of a hose or flexible tube **40**, shown in FIGURES 1 and 2, connected with a supply of compressed air. As shown in FIGURES 1 and 2, an air control valve **42** may be intercalated in the air line to regulate and control flow of air under pressure through the tube **30** into the interior of the spray gun body **24**.

The front end region of the gun body **24** has an enlarged cone-shaped portion **46**. Fitted onto the end of portion **46** is a plunger guide means or member **48** which is secured to member **46** by three screws **50**, as particularly shown in FIGURES 6 and 8. The end region of the portion **46** is fashioned with a circular recess accommodating a sealing ring **52** of resilient material of the O-ring type. The fitting or member **48** is provided with a threaded interior bore to accommodate a threaded bushing **54**, the end region of the bore in the fitting **48** being frusto-conically shaped to accommodate a sealing ring or gasket **56** of rubber or other suitable resilient sealing material.

An interior region of the gun body **24** is provided with a bore **60**, shown in FIGURE 8. Slidably disposed in the bushing **54** and the bore **60** is a reciprocable tubular plunger **62** providing a lengthwise passage **64** to provide for air flow through the plunger. The gun body **24** is provided with a threaded bore **66** forming a chamber **67**. A bushing **68** threaded into the bore **66** engages an O-ring **70** to effect a sealing engagement of the O-ring with the exterior cylindrical surface of the plunger **62**. The rear end of the gun body **24** is provided with a bushing **72** having a tenon portion **74** threaded into the bore **66**. The end of the gun body is formed with a circular recess accommodating a sealing ring **76** which is engaged by the member **72** forming a seal for the end of the gun body.

It will be noted from FIGURE 8 that the portion of the plunger **62** which is slidable in the brushing **54** is of slightly larger diameter than the portion of the plunger which is slidable in the bore **60** of the gun body and the bushing **68**. The region of the larger diameter portion of the plunger **62** adjacent its juncture with the smaller diameter portion is threaded as at **76** to accommodate the upper end of a trigger **78**, the trigger being provided with a threaded opening which is received on the threaded portion **76**.

Disposed on a plunger **62** adjacent the trigger **78** is a washer **80**, and disposed between the washer **80** and an abutment **82** in the gun body is an expansive coil spring **84**, the spring normally biasing the plunger **62** toward valve closing position as hereinafter explained.

The wall of the gun body **24** is provided with a slot **86** through which extends the trigger **78**. The fitting **72** at the rear end of the gun body has an interiorly threaded bore to accommodate a threaded member **88** having a knurled maniplating head **89**. The fitting **72** is formed with an interior circular recess accommodating a sealing ring **90** or rubber or the like which engages the periphery of the threaded member **88** and provides a seal to prevent escape of air along the member **88**.

The member **88** may be adjusted by manipulating the head portion **89** and forms an abutment or stop means to limit the movement of the plunger **62** in valve opening position. Thus the extent of movement of the plunger may be predetermined by the particular position of adjustment of the threaded member **88**. The end of the tubular plunger **62** is fashioned with a recess or kerf **92** to receive a suitable tool in order to rotate the plunger in assembling the plunger into the threaded opening in the trigger member **78**. A row of small openings **186** is provided in a wall of the plunger **62** for a purpose hereinafter explained.

When the spray gun is to be used for applying viscous or slurries of materials contained in the hopper **18**, the fitting **12** is employed. The fitting **12** is arranged to be quickly assembled to or disengaged from the member **48** secured to the front end region of the gun body **24**. The fitting **12** is fashioned with a hollow generally cylindrical portion **96** and a hollow side branch or lateral attachment section **98** for connection with the outlet end of the hopper **18**.

The cylindrical wall region of the fitting **12** defines two circular openings **100** and **102** of the same diameter. The circular opening **100** snugly yet slidably receives a circular tenon portion **104** forming an integral part of the fitting **48**.

The tenon portion **104** is provided with three circumferentially spaced bayonet-like slots **106** provided with entrance slots or openings **107**, as shown in FIGURES 3 and 6. The wall region defining the opening **104** in the fitting **12** is provided with three circumferentially spaced inwardly extending pins **108** which are adapted to enter the entrance slots **104** and bayonet-like slots **106** to removably secure the fitting **12** to the fitting **48** carried by the gun body **24**.

An annular sealing ring or gasket **110** of suitable resilient material is contained in a recess formed in the flange portion **49** of the fitting **48** and engages the end wall region of the fitting **12** defining the opening **104**. When the fitting **12** is assembled through the medium of the pin and bayonet slot connection with the fitting **48**, the sealing ring **110** is compressed to form a fluid tight seal between the fitting **48** and the fitting **12**. A setscrew **111** may be drawn up in engagement with the tenon **104** to securely fasten the fitting **12** to the fitting **48**.

An orifice plate or nozzle member **112** is arranged to be removably secured to the fitting **12**. As particularly shown in FIGURES 3 and 8, the nozzle member **112** is fashioned with a flange portion **114** and a tenon portion **116**, the latter being of cylindrical shape and adapted to slidably yet snugly fit into the opening **102** formed by a wall region of the fitting **12**.

The peripheral region of the tenon **116** is formed with three bayonet-like slots **118** having entrance openings **119**, one of these slots being illustrated in FIGURE 3.

The wall region defining the opening **102** in the fitting **112** is provided with three circumferentially spaced pins **120** for cooperation with the bayonet-like slots **118** for removably securing the orifice plate or member **112** in assembled relation with the fitting **12**, in the manner illustrated in FIGURE 8. An annular sealing ring **122** is disposed between the flange **114** and the wall of the fitting **12** to form a fluid tight seal between the fitting **12** and orifice plate. The orifice plate **112** is fashioned with a bore **124** and a counterbore **126** to receive a member **128** of semi-hard rubber or the like provided with an orifice or outlet **130**.

The outlet or opening **130** is cylindrical and joins with a frusto-conically shaped valve seat portion **132** formed on member **128**. The ledge **134** at the juncture of the bores **124** and **126** functions to properly position the valve seat member **128** to prevent dislodgement of the member when the same is engaged by a valve means. The plunger **62** is provided with a removable valve member **136**, shown in FIGURE 8. The valve member **136** is formed with a frusto-conically shaped portion for cooperation with the frusto-conically shaped valve seat **132** of the orifice member **128**.

The valve member **136** is provided with a threaded tenon **140** which is threaded into a threaded region **141** in the distal end of the plunger **62**. A portion **142** on the valve member **136** is polygonally shaped, as for example hexagonal, to accommodate a suitable tool to assemble on or disassemble the valve member **136** from the plunger **62**. The valve member **136** is fashioned with a forwardly extending cylindrical tenon portion **144** which is of lesser diameter than the orifice or opening **130** formed in the member **128** to facilitate flow of viscous material through

the annular space between the wall of the orifice **130** and the tenon **144** when the valve **136** is moved to open position. A passage **146** in the valve member **136** provides for delivery of air forwardly of the orifice plate **112**.

The hopper **18** is adapted to be secured to the fitting **12** by bayonet slot and pin connecting means. The exit end of the hopper **18** is fashioned wtih a fitting **150** bored to snugly yet slidably receive a tenon portion **152** formed on the fitting **12**, as shown in FIGURES 5 and 8. The tenon portion **152** is fashioned with four bayonet-like slots **154**, particularly shown in FIGURE 9, which are spaced equal distances apart circumferentially of the tenon **152**. A flange portion **156** formed integrally with the hopper fitting **150** is provided with four pins **158** spaced circumferentially and adapted to cooperate with the bayonet-like slots **154** to secure the hopper **18** to the fitting **12**.

An annularly-shaped sealing ring **160** of rubber is arranged between a flange **98** on the fitting **12** and the flange portion **156** on the hopper fitting **150** to provide a fluid tight seal between the hopper and the fitting **12**. The peripheral surface of the flange **156** is polygonally shaped, as shown in FIGURES 9 and 10, to accommodate a wrench or suitable tool to facilitate affixing the hopper fitting to the tenon portion **152** and removing the same therefrom.

As shown in FIGURE 10 the axis of the fitting **150** is angularly arranged with respect to the vertical axis of the hopper **18**. Through this angular position of the fitting **150** with respect to the hopper and the four bayonet slots **154** and the pins **158**, the hopper may be selectively secured to the fitting **12** in four different positions spaced ninety degrees apart. This enables the use of the gun in various angular positions such as those shown in FIGURES 1 and 2 while maintaining the hopper **18** in a substantially vertical or upright position. By this arrangement the material in the hopper is disposed so as to flow through the hopper fitting **150** into the fitting **12** for delivery through the orifice in the orifice member **128**.

If desired, the hopper may be pressurized with compressed air particularly when slurries of viscous materials or materials of mortar-like consistency are to be applied by the spray gun.

As shown in FIGURE 10, the hopper **18** may be provided with a cover **166** having a flange portion **168** which seats against a circular ledge or flange **170** formed on the hopper **18**. The cover **166** may be provided with slotted projections **172** to receive securing bolts **174** pivoted to ear portions **176** carried by the hopper **18**. Wing nuts **178** are threaded onto the bolts **174** to secure the cover in position. A coupling or fitting **180** on the cover is secured to a hose **182** for connection with a supply of compressed air.

A fitting for introducing compressed air into the upper region of the hopper **18** and above the material may be secured to the side wall of the hopper. As shown in FIGURE 2, a fitting or coupling **186** is secured in an opening in the side wall of the hopper connected by a hose **188** with the valve fitting **42** to establish pressure above the material **190** in the hopper. The air flow into the hopper in the arrangement shown in FIGURE 1 may be controlled by suitable conventional valve means (not shown). In the form shown in FIGURE 2, the valve arrangement **42** is adapted to control the flow of compressed air to the spray gun **10** and into the hopper **18**.

The operation of the spray gun construction above described is as follows: The hopper **18** is substantially filled with material **190** to be applied by the gun. The material may be a slurry of fine aggregate, such as sand, perlite or other similar materials.

The pressurizing of the hopper **18** may or may not be used dependent upon the character and viscosity of the material in the hopper **18**. The fitting **36** on the grip portion **26** of the spray gun is connected by a hose **40** with a suitable supply of compressed air.

The threaded member or abutment **88** is then adjusted by manipulating the knurled head **89**, shown in FIGURE 8, to a position to limit the movement of the plunger **62** in a right-hand direction as viewed in FIGURE 8. Compressed air flows through the tube **30** into the chamber at the rear of the plunger **62**, through the passage **64** in the plunger and through the passage **146** in the valve member **136**. In the arrangement shown in FIGURE 8, the air flows continuously through the passage **146** whenever the air valve **42**, shown in FIGURES 1 and 2 is opened.

When it is desired to apply or spray material from the spray gun, the operator moves the trigger member **78** in a right-hand direction retracting the plunger **62** in a right-hand direction, moving the valve portion **136** away from the valve seat **132** whereby material from the hopper flowing into the interior of the fitting **12** is aspirated through the annular orifice surrounding the tenon **144** of the valve member under the influence of high velocity air moving through and exhausting from the passage **146**. The amount of material delivered through the orifice **130** may be determined by adjusting the position of the abutment screw **88** to limit the extent of movement of the plunger **62** and valve member **136**.

It should be noted that the regions of engagement of the components, when in assembled relation, are sealed through the use of the several sealing rings or gaskets hereinbefore described. When it is desired to change the angle of application of material from the spray gun relative to the hopper **18**, the hopper may be quickly removed from the fitting **12** by applying a suitable tool to the polygonal surface **156** to disengage the bayonet slot-pin locking arrangement between the fitting **12** and the hopper **18** and shifting the position of the hopper as desired dependent upon the angle at which the material is to be delivered from the nozzle **130** of the spray gun.

The spray gun construction is of a character to facilitate its use with an automatic pressure actuated pump of conventional construction for pumping material to the spray gun. As shown in FIGURES 8 and 8*a*, the rear end region of the plunger **62** is provided with a peripheral row of small openings **186** and an interiorly threaded end portion **188**. As shown in FIGURE 8*a*, a screw plug **190** is threaded into the threaded portion **188** of the plunger **62**.

When the gun is used with the plug **190** in the position in the end of the plunger **62**, as shown in FIGURE 8*a*, and the plunger is in a position seating the valve **136** in the frusto-conically shaped seat **132**, the openings **186** are closed by the ring **68** shown in FIGURE 8 whereby air flow is interrupted through the lengthwise passage **64** in the plunger **62**.

When the trigger **78** moves the plunger to open the valve **136**, the openings **186** are moved rearwardly of the ring **168** to facilitate air flow from the chamber **67** through the openings **186** into the passage **64** of the plunger. With this arrangement the air flow through passage **64** and orifice **146** occurs only when the plunger is retracted by the trigger **78** to open the ports or openings **186** to admit air into the passage **64**.

FIGURES 7 and 11 illustrate a modified form of fitting usable in lieu of the fitting **12** where the supply of material may be a pressurized tank containing material or a material delivering pump. The assembly illustrated in FIGURE 11 includes a fitting **194** having a hollow cylindrical portion **196** and a lateral stem or branch portion **198**. The stem **198** is tubular providing a passage **200** in communication with a chamber **202** defined by the cylindrical portion **196**. The stem **198** has a nipple portion **204** to receive the end of a hose (not shown) connected to a pressurized tank containing material to be sprayed from the gun or with a material delivering pump.

The fitting **194** is constructed to be removably secured to the fitting **48** of the spray gun construction and for receiving the nozzle construction **112** through the use of the pin and bayonet slot interlocking connections of the character hereinbefore described in connection with the construction shown in FIGURE 8.

In the assembly of the fitting **194** and spray gun construction illustrated in FIGURE 11, the wall region of the cylindrical configuration **196** adjacent the fitting **48** is provided with three circumferentially spaced pins **108'** which are adapted to interlock with the bayonet-like slots **106**, shown in FIGURES 3 and 6.

Thus when the fitting **194** is assembled with the fitting **48** as shown in FIGURE 11, the stem portion **198** extends downwardly vertically in the same direction as the trigger **78**. The wall region of the cylindrical portion **196** adjacent the nozzle construction **112** in the assembly shown in FIGURE 11, is provided with a second set of pins **206**, shown in FIGURES 7 and 11. The pins **206** are adapted to enter the bayonet-like slots **118** in the orifice plate **112**, shown in FIGURE 3

In the arrangement illustrated in FIGURE 11 the valve member **136** secured to the forward end of the plunger **62** cooperates with the surface **132** of valve seat **128** to control the delivery of material from the chamber **202** through the annular orifice **130** surrounding the portion **144** of the valve member **136**, the plunger **62** being controlled by the trigger **78**.

Attention is directed to FIGURE 7 wherein it will be seen that the pins **206**, while spaced one hundred and twenty degrees apart circumferentially of the cylinder **196**, are spaced circumferentially a distance of sixty degrees from the pins **108'**.

Through this particular arrangement of spacing of the pins **108'** and **206**, the fitting **194** may be reversed with respect to the fitting **48** whereby the pins **206** engage in the bayonet-like slots **106** of the fitting **48** and the pins **108'** engage in the bayonet-like slots **118** in the nozzle construction **112**.

When the fitting is assembled with the gun and the nozzle construction **112** in this fashion, the stem **198** is positioned to project upwardly from the gun or in a position one hundred and eighty degrees removed from the position shown in FIGURE 11. In the upwardly projecting position of the nipple or stem **198**, a small spotting hopper (not shown) of conventional construction may be connected with the stem **198** to facilitate spray application of decorative finish in spots or in random from the spray gun.

The spotting hopper may contain granular or comminuted materials such as mica, marble dust, metallic flakes, glass flake, or other types of decorative materials conventionally employed for decorative purposes. With the stem **198** in upwardly projecting position and used with a small spotting hopper, the hopper is unpressurized whereby the granular or comminuted materials move by gravity into the chamber **202** for delivery from the spray gun by aspiration of the air stream when the valve **136** is moved to open position.

FIGURES 12 through 17 illustrate the spray gun and fitting construction for utilization of the spray gun in spraying or delivering liquidus or low viscosity materials such as paints, resinous coatings or the like. In this form of the invention, the spray gun **10** is equipped with a fitting construction and assembly **210**, the assembly **210** being readily affixed to and removed from the fitting **48** through a pin and bayonet slot-like arrangement hereinbefore described. In the form of construction employed for spraying liquidus materials, a needle valve arrangement is used in lieu of the valve member **136** shown in FIGURE 8.

The assembly **210** includes a fitting or body **212** having a sleeve portion **214** arranged to slidably fit over the tenon portion **104** of the fitting **48**. As shown in FIGURE 12 the sleeve portion **214** is provided with three circumferentially arranged, equally spaced pins **216** which are adapted to be received in the bayonet-like slots **106** of the fitting **48** for removably securing the body **12** to the fitting **48**. The sleeve portion **214** is provided with a threaded opening to accommodate a setscrew **218** which

may be drawn into engagement with the tenon **104** to securely fasten the body **212** to the fitting **48**.

The body **212** is fashioned with a downwardly projecting stem or nipple portion **220** which is tubular providing a passage **222**.

The nipple portion **220** is provided with a threaded section **224** adapted to receive a coupling (not shown) for securing a hose to the stem **220**, the hose being connected with a receptacle containing a supply of liquidus material such as paint or the like to be sprayed from the spray gun. The passage **222** is in communication with a chamber **226** formed in the body **212**.

In this form of the invention, the valve member **136**, shown in FIGURE 8, is replaced by a needle valve **228** having a tapered valve portion **230** at its forward end, as shown in FIGURES 12 and 13. The needle valve member **228** is integrally formed with a polygonally shaped portion **232** and a threaded portion **234**, the latter being threaded into the threaded region **140** in the forward end of the plunger **62**. The polygonal portion **232** facilitates the use of a suitable tool to assemble and disassemble the needle valve **228** with the plunger **62**. The fitting or body **212** is fashioned with a chamber **236** adjacent the end of the plunger **62** and the enlarged portion **232** of the needle valve construction.

The rear region of the chamber **236** is sealed by the sealing ring **110** contained in a recess in the flange portion of the fitting **48**. Formed in the enlarged portion **232** and threaded portion **234** of the needle valve construction is a central passage **238** which is in communication with an angularly arranged passage **240** provided in the enlarged portion **232**. Through this arrangement, air from the passageway **64** of the tubular plunger **62** is admitted into the chamber **236** through the communicating passageways **238** and **240**.

An inwardly projecting wall portion **242** separates the chamber **226** from the chamber **236**. The wall portion **242** is formed with a threaded bore extending partially therethrough to receive a threaded bushing **244** through which extends the needle **228** of the valve construction. A sealing gasket **246** in the form of an O-ring in cross-section is nested in the end of the bore formed in the wall **242**, the bushing **244** being arranged to be drawn into engagement with the sealing gasket or ring **246** to engage the ring **246** with the peripheral surface of the needle **228** to prevent air seepage from chamber **236** along the needle **228**.

The forward region of the body **212** is interiorly formed with a threaded portion **248** which receives a threaded tenon portion **250** of a nozzle member or fitting **252**. The fitting **252** is fashioned with an interior bore **254** of larger diameter than the needle **228** to admit air along the needle in the passage **254**. The forward extremity of the fitting **252** is fashioned with a central passage **256** providing an orifice for the passage and discharge of air from the chamber **226** and passage **254** when the needle valve portion **230** is moved in a right-hand direction as viewed in FIGURES 12 and 13 to open the orifice **256**.

It should be noted that the interior wall **258** defining the orifice or passage **256** is of a taper substantially the same as the taper on the needle valve portion **230** to effect a seating of the needle valve **230** when in closed position.

The fitting **252** is provided with a cylindrical section **260** and a polygonally shaped portion **262**, the latter being adapted to accommodate a wrench or other suitable tool for assembling or disassembling the fitting **252** with the fitting or body **212**.

The body or fitting **212** is formed at its end region with a threaded portion **264** to accommodate a threaded clamping ring **266**, the clamping ring **266** being formed with an inwardly extending flange **268** as shown in FIGURES 12 and 13.

Arranged to be fitted onto the face of the boss portion of the fitting **212** is a frontal plate or orifice member **270**

fashioned with a flange portion **272** which, in assembly, is engaged by the flange **268** on the threaded clamping ring **266** for securing the frontal plate or orifice member **270** in fixed relation with the body **212**. The orifice member **270** is formed with an interior bore providing a chamber **274** which is in communication with the air chamber **236** by connecting passages **276** and **278** formed in the body **212**, the passage **278** being of comparatively small cross-sectional area to meter or restrict the flow of air into the chamber **274**. The restricted passage **278** opens into a circular recess or manifold **280** formed in the frontal face region of the body **212** to effect distribution of air in the chamber **274** in the orifice member **270**.

The cylindrical section or portion **260** of member **252** snugly yet slidably fits into a bore formed in a central partition region **282** of the member **270**.

Formed in the member **270** adjacent the section **282** is a circular recess **284** providing a circular manifold which is in communication with the chamber **274** through a circular row of comparatively small passages **286** extending through the central partition section **282** of the member **270**.

The frontal region of fitting **252** is provided with a cone-shaped surface **288** and the interior of the orifice member **270** is formed with a cone-shaped surface **290**, the surfaces **288** and **290** defining a frusto-conically shaped passage **292**. The frontal portion of the member **270** is formed with a cylindrical surface **294** which, as shown in FIGURE 13, is spaced from the nozzle portion **259** of the fitting **252** to form an annular orifice or nozzle **296**.

Air from the chamber **236** flows through the interconnecting passages **276** and **278**, the circular manifold recess **280**, chamber **274** thence through passages **286** and the conically-shaped passage **292**, and through the annular discharge orifice **296** to the atmosphere. The passage **222** in the fitting **212** is connected by a hose means (not shown) with a pressurized supply of coating material such as paint which is to be sprayed from the spray gun. The paint or other liquidus coating material is delivered under pressure through the passage **222** through chambers **226** and **254** for discharge through the central circular outlet or orifice **256** when the needle valve portion **230** is retracted in a direction away from the orifice **256** to open the orifice.

Means is provided for delivering air in a manner from the member **270** to modify the cone-shaped pattern of discharge of the material from the gun to provide a fan-shaped pattern. The body **212** is formed with an angularly arranged boss portion **300** having an interiorly threaded bore **302** which accommodates a threaded valve member **304** having a valve portion **306** and a knurled head **308** for facilitating manual adjustment of the valve member **306**. A sealing ring **310** is disposed in the end of the bore **302** and a threaded bushing **312** is threaded into the bore **302** to compress the sealing ring **310** into sealing engagement with the valve portion **306**.

The valve portion **306** is slidably yet snugly fitted in a passage **314**, the passage **314** being in communication with the passage **276** by a channel or passage **316**. The rear face region of the orifice member **270** is formed with a circumferential recess **320** which is in communication with the passage **314** by a duct or passage **322**. The frontal face of the orifice member **270** is provided with two diametrically disposed horns or projections **324**, each provided with an angularly arranged outlet or orifice **326**. Each of the orifices or outlets **326** is in communication with the circular manifold **320** by a passage **328**.

In the operation and use of the gun an fitting construction illustrated in FIGURES 12 through 17, the stem **220** is connected by means of a hose (not shown) with a pressurized receptacle or tank containing paint or other liquidus coating material to be delivered from the spray gun.

Compressed air is supplied through the tube **28** in the handle **26** of the gun, the air flowing through the lengthwise passage **64** in the plunger **62** through the interconnecting passages **238** and **240** into the chamber **236**.

From the chamber **236** air is delivered in two paths as follows: Air flows from chamber **236** through the passageways **276, 278**, the circular manifold **280**, chamber **274**, passages **286** through the cone-shaped chamber **292** thence through the annular nozzle or orifice **296**. When the needle valve **230** is retracted through manipulation of the trigger **78** the coating material such as paint being under pressure flows through the central circular orifice **256** and is atomized or broken up into fine particles by the velocity of the air discharged through the annular orifice **296** which surrounds the central circular orifice **256**.

When the valve member **304** is threaded a sufficient distance into the bore **302** whereby the valve portion **306** blocks or interrupts air flow through passage **316**, the pattern of coating material under the influence of the air discharged through the orifice **296** will be substantially cone-shape, being the conventional pattern of delivery from a circular or annular orifice. When the operator desires to modify the spray pattern of the delivered material this may be accomplished by manipulating the valve member **304** to partially or wholly uncover the port **316** by moving the valve **306** in an upward right-hand direction as viewed in FIGURE 13.

Air under pressure from chamber **236** additionally flows through the port or passage **316**, passages **314** and **322** into the circular manifold **320** thence through the passages **328** and is discharged from the orifices or outlet ducts **326**. As particularly shown in FIGURE 13, the direction of the outlet ducts **326** is angular with respect to the axis of delivery of the air and coating material from the gun and the jets of air delivered from the orifices **326** modify or flatten the spray pattern of material delivered from the gun. The operator may modify the configuration of the spray pattern by manually regulating the relative position of the valve **306** by manipulating the valve body **304** to control air flow from the port **316** into the passage **314**.

From the foregoing description it will be seen that through the use of the interchangeable fittings **12, 196** and the fitting assembly **210**, the latter being shown in FIGURES 12 through 17, the spray gun construction is quickly and readily adaptable for use in spraying viscous or heavy materials in slurry form or the construction employed for delivering liquidus coating materials through the use of the fitting assembly and components **210**. The interlocking arrangements provided by the pin and bayonet slot-type connections enable an operator to quickly interchange fittings to adapt the gun to many and various uses as hereinbefore described.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than as herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. Apparatus for spraying materials including, in combination, a spray gun body, a hand grip member, a tubular plunger slidable in a bore in the body, trigger means for moving the plunger, a passage in the grip member, a tube in said passage having threaded connection in a threaded opening in said body, a fitting threaded on said tube engaging the hand grip member for securing the hand grip member to the body, said tube being in communication with the bore in the body and adapted to be connected with a supply of compressed air, a hollow fitting providing a material receiving chamber, means for removably securing the fitting to the front end of the gun body, a nozzle plate removably secured to the fitting and provided with a valve seat, a tubular valve member removably secured to the tubular plunger arranged for cooperation with the valve seat, said hollow

fitting arranged to be connected with a supply of material for delivery into the chamber, said valve member and nozzle plate being arranged to effect delivery of a stream of compressed air from the tubular plunger and material from the chamber in the fitting when said valve member is moved to open position.

2. Apparatus for spraying materials including, in combination, a spray gun including a body provided with a cylindrical portion, a grip portion for the body, a tubular plunger slidable in a bore in the cylindrical portion, a passage in the grip portion, a tube in said passage having threaded connection in a threaded opening in said body, a fitting threaded on said tube engaging the grip portion for securing the grip portion to the body, said tube being in communication with the bore in the body and adapted to be connected with a supply of compressed air, means for effecting slidable movement of the plunger, plunger guide means provided on the gun body, a hollow fitting providing a chamber, means for removably connecting the fitting with the gun, a nozzle plate, means for removably securing the nozzle plate to said fitting, said fitting having a passage in a wall thereof adapted to be connected with a supply of material, a valve member movable with the tubular plunger, said valve member having a passage therein to accommodate flow of air from said plunger, a valve seat carried by said nozzle plate providing a material delivery opening, said valve member having a valve portion arranged for cooperation with the valve seat for controlling delivery of material from the chamber into a stream of air projected forwardly of the nozzle plate.

3. Apparatus for spraying materials including, in combination, a spray gun including a body provided with a cylindrical portion, a grip portion for the body, a tubular plunger slidable in a bore in the cylindrical portion, a passage in the grip portion, a tube in said passage having threaded connection in a threaded opening in the body, a fitting threaded on said tube engaging the grip portion for securing the grip portion to the body, said tube being in communication with the bore in the body and adapted to be connected with a supply of compressed air, trigger means for effecting slidable movement of the plunger, a plunger guide means associated with the gun body, a hollow member providing a chamber, a plurality of pins carried by one of said members, a plurality of slots in the other of said members arranged to receive said pins for removably securing said hollow member to said guide means, a nozzle plate, means for removably securing the nozzle plate to said fitting, said hollow member having a passage in a wall thereof adapted to be connected with a supply of material, a valve member removably connected with the tubular plunger and movable therewith, said valve member having a passage therein to accommodate flow of air from said plunger, a valve seat associated with said nozzle plate, means providing a material delivery outlet for the orifice plate, said valve member having a valve portion arranged for cooperation with a valve seat associated with the nozzle plate for controlling delivery of material from the chamber into a stream of air projected forwardly of the nozzle plate.

4. Apparatus for spraying materials including, in combination, a spray gun including a body provided with a cylindrical portion, a hand grip for the body, a tubular plunger slidable in a bore in the cylindrical portion, a passage in the hand grip, a tube in said passage having threaded connection in a threaded opening in said body, a fitting threaded on said tube engaging the hand grip for securing the hand grip to the body, said tube being in communication with the bore in the body and adapted to be connected with a supply of compressed air, trigger means for effecting slidable movement of the plunger, a plunger guide member secured to the front end of the gun body, a hollow member providing a chamber, pin and slot means for removably securing said hollow member to said guide member, a nozzle plate, a second pin and slot means for removably securing the nozzle plate to said hollow member, said hollow member having a lateral branch portion, passage means in the branch portion adapted to be connected with a supply of material, a valve member removably connected with the tubular plunger and movable therewith, said valve member having a passage therein to accommodate flow of air from said plunger, a valve seat associated with said nozzle plate, means providing a material delivery outlet for the orifice plate, said valve member having a valve portion arranged for cooperation with a valve seat associated with the nozzle plate for controlling delivery of material from the chamber into a stream of air projected forwardly of the nozzle plate.

5. Apparatus for spraying materials including, in combination, a spray gun having an elongated body, a hand grip portion for the body, a tubular plunger slidable in the bore in the cylindrical portion, a passage in the grip portion, a tube in said passage having threaded connection in a threaded opening in said body, a fitting threaded on said tube engaging the hand grip portion for securing the hand grip portion to the body, said tube being in communication with the bore in the body and adapted to be connected with a supply of compressed air, trigger means for effecting slidable movement of the plunger, a hollow member providing a chamber, pin and slot means for removably securing the hollow member in assembled relation with the gun body, said hollow member having a lateral branch portion provided with a passage, a hopper having an outlet fitting adapted to mate with the lateral branch portion of the hollow member, means for removably securing the hopper outlet fitting to said branch portion, said hopper adapted to contain a supply of material for delivery into the chamber of the hollow member, an orifice member removably secured to said hollow member, a valve means connected with said plunger for controlling delivery of material from the hopper through an opening in the orifice member, said valve member and orifice member being arranged whereby air under pressure from the interior of the tubular plunger is projected forwardly of the orifice plate whereby the material is entrained thereby.

6. Apparatus for spraying materials including, in combination, a spray gun including a body having a cylindrical portion, a grip portion for the body, a tubular plunger slidable in a bore in the cylindrical portion, passage means in the grip portion arranged to be connected with a supply of compressed air, trigger means for effecting slidable movement of the plunger, a plunger guide member secured to the front end of the gun body, a hollow member providing a chamber, pin and slot means for removably securing the guide member and hollow member together, said hollow member having a side branch portion provided with a passage, said side branch arranged to be connected with a receptacle containing a supply of material for use with the spray gun, an orifice plate, a member of nonmetallic material mounted by said plate, said nonmetallic member having an orifice and a valve seat formed therein, a valve member carried by the tubular plunger having a cylindrical tenon portion and a valve portion arranged to engage said valve seat, an air passage in said valve member in communication with the interior of the tubular plunger, said cylindrical portion being of lesser diameter than the orifice in the nonmetallic member providing an annular outlet through which material is delivered from the chamber in the hollow member when the valve member is in open position.

7. Apparatus for spraying materials including, in combination, a spray gun including a body having a cylindrical portion, a grip portion for the body, a tubular plunger slidable in a bore in the cylindrical portion, passage means in the grip portion arranged to be connected with a supply of compressed air, trigger means for effecting slidable movement of the plunger, a plunger guide member se-

cured to the front end of the gun body, a hollow member providing a chamber, pin and slot means for removably securing the guide member and hollow member together, said hollow member having a side branch portion provided with a passage, a hopper adapted to contain a supply of material having an outlet portion mating with the side branch portion, means for removably securing the hopper to the fitting, an orifice plate arranged to be removably connected with the fitting, a member of nonmetallic material mounted by said plate, said nonmetallic member having an orifice and a valve seat formed therein, a valve member carried by the tubular plunger having a cylindrical tenon portion and a valve portion arranged to engage said valve seat, an air passage in said valve member in communication with the interior of the tubular plunger, said cylindrical portion being of lesser diameter than the orifice in the nonmetallic member providing an annular outlet through which material is delivered from the chamber in the hollow member when the valve member is in open position.

8. Apparatus for spraying materials including, in combination, a spray gun including a grip portion and a body having a cylindrical portion, a tubular plunger slidable in a bore in the cylindrical portion, passage means in the grip portion arranged to be connected with a supply of compressed air, trigger means for effecting slidable movement of the plunger, a plunger guide member secured to the front end of the gun body, a hollow member providing a chamber, pin and slot means for removably securing the plunger guide member and hollow member together, said hollow member having a lateral branch portion provided with a passage, said lateral branch portion adapted to be connected with a supply of material for use with the spray gun, said hollow member having a partition formed therein dividing the chamber into a material receiving compartment and an air receiving compartment, an orifice member, means removably securing the orifice member to the hollow member, a central orifice in said orifice member, a bushing carried by the hollow member providing a valve seat, a valve member carried by the tubular plunger having a needle valve portion cooperating with the valve seat for controlling flow of material from the material receiving compartment through the central orifice, said bushing forming with the central orifice an annular outlet means through which air is delivered, and passage means connecting said outlet means with the air compartment in said hollow member for supplying air under pressure to said outlet means.

9. Apparatus for spraying materials including, in combination, a spray gun including a grip portion and a cylindrical body portion, a tubular plunger slidable in a bore in the cylindrical portion, passage means in the grip portion arranged to be connected with a supply of compressed air, trigger means for effecting slidable movement of the plunger, a plunger guide member secured to the front end of the gun body, a hollow member providing a chamber, pin and slot means for removably securing the plunger guide member and hollow member together, said hollow member having a lateral branch portion provided with a passage, said lateral branch portion adapted to be connected with a receptacle containing a supply of material for use with the spray gun, said hollow member having a partition formed therein dividing the chamber into a material receiving compartment and an air receiving compartment, an orifice member, means removably securing the orifice member to the hollow member, a central orifice in said orifice member, a bushing in said hollow member providing a valve seat, a valve member carried by the tubular plunger having a needle valve portion cooperating with the valve seat for controlling flow of material from the material receiving compartment, said bushing forming with the central orifice an annular outlet through which air is delivered, passage means connecting the annular outlet with the air compartment in said hollow member for supplying air under pressure to said annular outlet, a pair of projections provided on the orifice plate, air discharge passages in said projections, an annular manifold formed in said orifice member, said air discharge passages being in communication with said manifold, a hollow boss portion on said hollow member, manually adjustable valve means in a bore in said boss, an air passage between the air compartment and the bore in the boss portion, and passage means establishing communication between said manifold and the bore in the boss portion for conveyance of air under pressure to the air discharge passages in said projections.

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