April 8, 1969

G. D. HAGFORS

3,437,273

SPRAY GUN

Filed June 29, 1967

Sheet 1 of 2

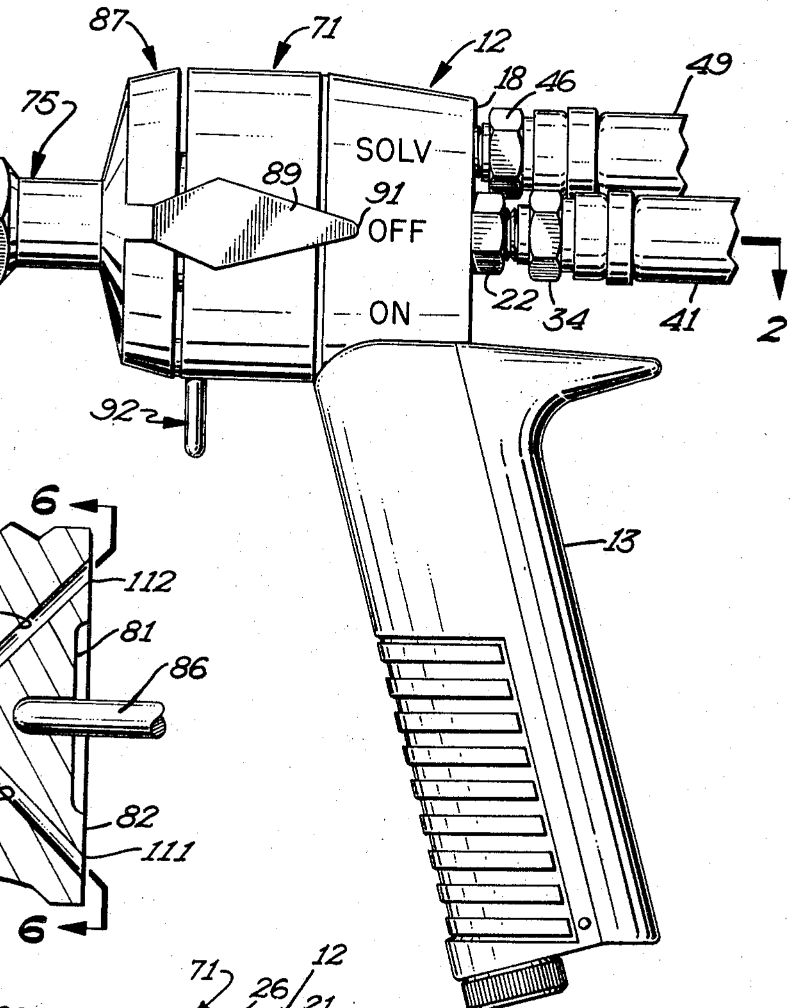

FIG 1

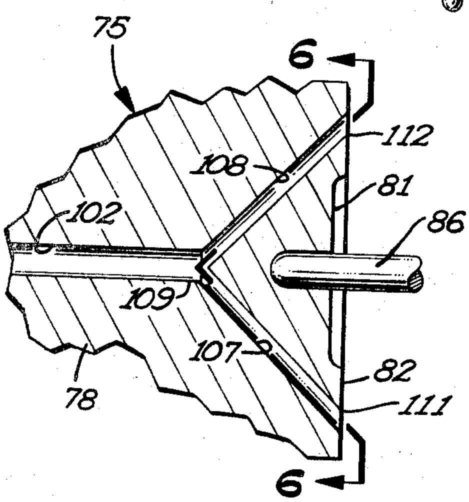

FIG 5

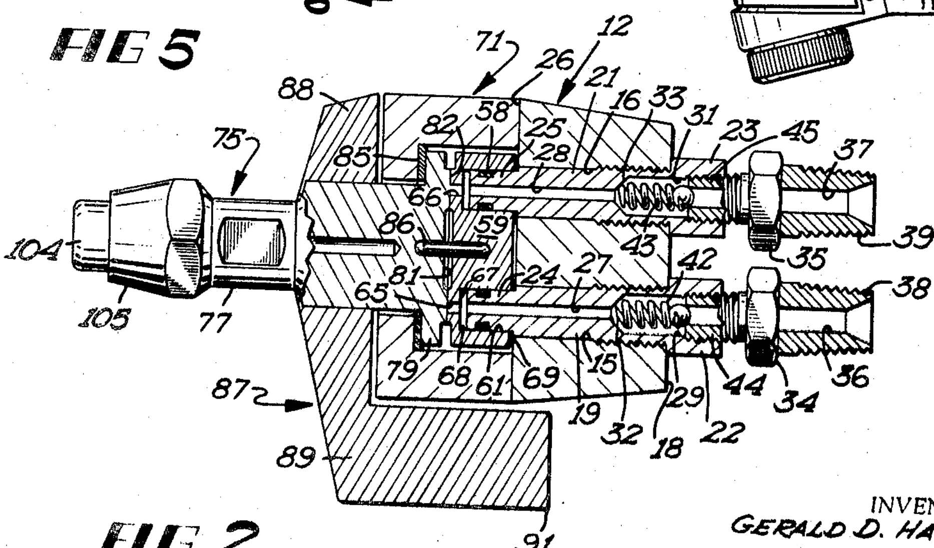

FIG 2

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Sheet 2 of 2

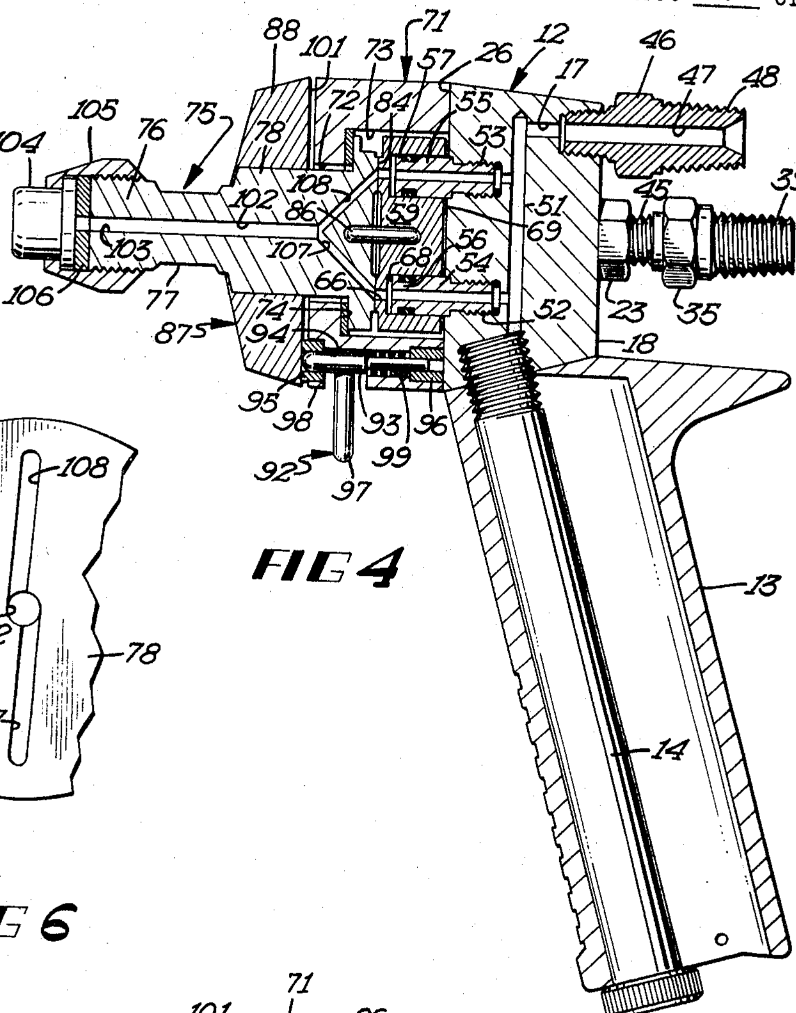

FIG 4

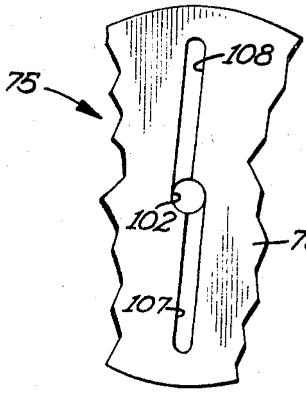

FIG 6

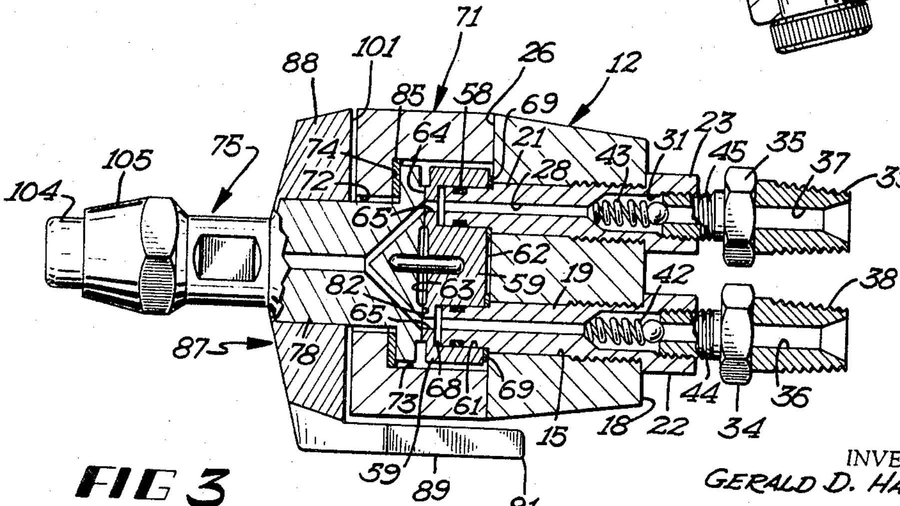

FIG 3

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3,437,273
SPRAY GUN

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Int. Cl. F23d *13/38;* B05b *7/06;* A62c *11/06*
U.S. Cl. 239—414 21 Claims

ABSTRACT OF THE DISCLOSURE

An improved airless spray gun for spraying plural fluid component materials, such as foams, thermosetting resins, epoxies, polyesters, and other rapidly reacting chemical materials as a homogeneous mixture. The spray gun includes a body having a generally cylindrical mixing chamber wherein the component materials are introduced at one end through a pair of passages. The passages are arranged so that their longitudinal axes are parallel to each other, and intersect a diameter of the mixing chamber at points equally spaced from the central longitudinal axis of the chamber. In addition, the passages are arranged so that the plane including the diameter of the chamber and the axis of one of the passages is perpendicular to the plane including the diameter of the chamber and the axis of other passage, and the axes of the passages are both disposed at an angle of approximately four degrees with respect to a vertical plane including the central longitudinal axis of the mixing chamber. The arrangement of the mixing chamber and the passages causes the component materials to enter the chamber tangently and to be thoroughly and uniformly mixed by the resulting swirling action in the chamber.

The spray gun uses a rotary valve arrangement to control flow through the passages. More specifically, the gun is constructed so that the body may be rotated about the central longitudinal axis of the chamber relative to the rest of the gun whereby the other ends of the passages may be selectively placed into connection with sources of the component materials or with a source of solvent or disconnected from both the materials and solvent. A novel biasing means, utilizing, in part, the pressure of the component materials and solvent, prevents leakage between the rotatable body and the rest of the gun.

Background of the invention

This invention relates to an improved plural component materials spray gun, and more particularly, to an improved airless spray gun for spraying plural fluid component materials such as foams, thermosetting resins, epoxies, polyesters, and other rapidly reacting chemical materials as a homogeneous mixture.

In the past, various types of spray guns or spray apparatus have been used for spraying plural component materials, and generally these prior spray guns performed satisfactorily from the standpoint of spraying a homogeneous mixture.

In the prior spray guns, needle valves or ball valves were frequently used to control the flow of component material to the mixing chamber in the gun, and there was always a problem in such guns of properly adjusting the valves and valve actuating structure so that the valves opened and closed simultaneously.

Also, it was extremely difficult and time-consuming to clean the component materials from the prior guns and more particularly, from around the valves and the passages connecting the valves with the mixing chamber. Moreover, when a build-up of materials occurred because of improper or incomplete cleaning, considerable force was often required to open the needle or ball valves.

Furthermore, in the prior guns, the mixing chamber and component passages were frequently complex in design and arrangement in order to achieve the necessary homogeneous mixture of component materials, and this obviously increased the cost of the gun and the difficulty in cleaning the gun.

Summary of the invention

In contrast to the prior spray guns, the improved spray gun or spraying apparatus of the present invention may be relatively quickly and easily cleaned. Moreover, unlike the prior guns, the improved spray gun of the present invention does not use needle or ball valves, but rather, uses an improved rotary valve arrangement which requires relatively low torque to operate because of the shearing or wiping action of the valve. Also, the design and arrangement of the improved rotary valve insures that the component materials passages are always opened and closed simultaneously. Furthermore, the improved spray gun of this invention utilizes a novel mixing chamber which is extremely simple in design, yet achieves thorough and uniform mixing of the component materials.

More particularly, the improved spray gun of the present invention includes a valve body that is adapted to be rotated about the central longitudinal axis of the gun relative to the rest of the gun. The body includes a generally cylindrical mixing chamber and a pair of passages which are connected at one end with the mixing chamber. The passages are arranged so that their longitudinal axes are parallel, are disposed at an angle of approximtely four degrees with respect to the vertical plane including the central longitudinal axis of the mixing chamber, and intersect a diameter of the mixing chamber at points equally spaced from the central longitudinal axis of the chamber. Moreover, the passages are arranged so that the plane including the diameter and the longitudinal axis of one of the passages is perpendicular to the plane, including the diameter and the longitudinal axis of the other passage, and both these planes are disposed at an angle of forty-five degrees to the central longitudinal axis of the mixing chamber. This arrangement of the mixing chamber and the passages causes the component materials to enter the chamber tangently, but at diametrically opposite sides of the chamber, whereby the component materials may be thoroughly and uniformly mixed in the chamber by the resulting swirling action of the materials in and along the chamber.

The body has a first sealing surface formed on one end thereof and the other ends of the passages terminate at spaced points in this sealing surface. The gun also includes a member having a plurality of bores which are connected with sources of component material and with a source of solvent and which terminate at spaced points in a second sealing surface formed on the member adjacent to the first surface. The second surface is biased into sealing engagement with the first surface by biasing means which utilizes, in part, the pressure of the component materials and solvent upstream of the second surface.

As noted above, the body may be rotated relative to the rest of the gun, and this rotation of the body causes the first sealing surface to rotate relative to the second sealing surface. Moreover, the other ends of the passages and the ends of the bores in the gun are arranged so that when the body is rotated to a first position, the other ends of the passages are aligned with the ends of the bores connected with the component materials sources whereby the materials may flow through the passages and into the mixing chamber. Further, when the body is rotated to the second position, the other ends of the passages are aligned with the ends of the bores connected with the solvent source so that solvent may flow through the passages and into the mixing chamber thereby cleaning these passages and chamber. Lastly, when the body is rotated to a third position, the other ends of the passages are not aligned with either ends of the component material bores or the solvent bores so that the there is no flow through the passages.

Thus, in summary, the improved spray gun of the present invention provides a thoroughly and uniformly mixed spray while eliminating the problems found in the prior plural component spray guns with respect to ease of cleaning and simultaneous opening and closing of the component materials valves. In addition, the improved spray gun has a relatively simple design and construction which permits the gun to be inexpensively manufactured.

Accordingly, it is an object of the present invention to provide an improved spray gun for spraying a homogeneous mixture of rapidly reacting chemical materials in which the novel mixing chamber is of relatively simple design and arrangement and in which a rotary valve is utilized to control the flow of the component materials to the mixing chamber.

Another object of the present invention was to provide an improved spray gun for spraying a homogeneous mixture of rapidly reacting chemical material in which the adjacent surfaces of the rotary valve are urged into sealing engagement by biasing means which, in part, utilizes the pressure of the component materials and the solvent.

These and other objects and advantages of the present invention will become apparent upon reference to the following specifications, drawings, and appended claims.

Description of the drawings

FIGURE 1 is a side elevational view of the improved spray gun of the present invention.

FIGURE 2 is a partial, horizontal sectional view taken on the line **2**—**2** of FIGURE 1.

FIGURE 3 is a horizontal sectional view of the spray gun of the present invention that is similar to FIGURE 2 except that the valve body has been rotated to a position in which the component materials may flow into the mixing chamber and be sprayed from the gun.

FIGURE 4 is a vertical cross-sectional view of the spray gun of the present invention showing the valve body in a position in which solvent may flow into the mixing chamber and be sprayed from the gun.

FIGURE 5 is a fragmentary, enlarged cross-sectional view showing the details of the novel mixing chamber arrangement and the passages which are connected with the chamber.

FIGURE 6 is a fragmentary cross-sectional view taken on the line **6**—**6** in FIGURE 5.

Description of the preferred embodiment

Referring now to FIGURES 1–4, an improved spray gun embodying the principles of the present invention is shown generally at **11**. The gun **11** includes a housing **12** and a handle **13**. The handle is removably connected to the housing **12** by a threaded bolt **14**, and may be removed from the housing when, for example, the gun is to be used in a stationary installation.

Three threaded bores **15**, **16** and **17** are formed or drilled in the rear face **18** of the housing **12**, with the bores **15** and **16** being equally spaced transversely from the longitudinal center line of the housing and with the bore **17** being spaced above the longitudinal center line of the housing. Adapters **19** and **21** are threaded into the bores **15** and **16** respectively, so that the flanged ends **22** and **23** of the adapters abut the face **18** and so that the other ends **24** and **25** thereof project from the front face **26** of the housing **12**. Bores **27** and **28** with coaxial, larger diameter, counter bores **29** and **31** extend completely through the adapters **19** and **21**, respectively. Shoulders **32** and **33** are formed between the bores **27** and **29** of the adapter **19** and between the bores **28** and **31** of the adapter

21. Reducing nipples **34** and **35** are threaded into the flanged ends **22** and **23** of the adapters **19** and **21**, respectively, and axial bores **36** and **37** which extend through these nipples. The ends **38** and **39** of the nipples **34** and **35** are adapted to be connected to separate sources of component materials by means of hosing shown generally at **41** in FIGURE 1. Nipple **34**, for example, may be connected to a pressurized source of resin, while the nipple **35** may be connected with a pressurized source of catalyst.

Conventional coil spring biased, ball check valves **42** and **43** are positioned within the adapters **19** and **21**, respectively, between the shoulder **32** and the end **44** of the nipple **34**, and between the shoulder **33** and the end **45** of the nipple **35**. These check valves prevent the component materials in the spray gun from flowing back into the pressurized sources to which the nipples are connected.

As best shown in FIGURE 4, a reducing nipple **46** is threaded into bore **17**. The nipple **46** is similar in structure to the nipples **34** and **35** and has an axial bore **47** which extends therethrough. The threaded end **48** of the nipple **46** is adapted to be connected by a hose, shown generally at **49** in FIGURE 1, to a source of pressurized solvent which is capable of cleaning the component materials from the gun. The bore **17** is connected with a vertical bore **51** formed or drilled in the housing **12**. Two transverse bores **52** and **53** are drilled in the front face **26** of the housing **12** and are connected with the bore **51** at points equally spaced from the center line of the housing **12**. The bores **52** and **53** are counter bored and threaded to receive the threaded ends of the adapters **54** and **55** which include the ends **56** and **57**, respectively, that project from the front face **26** of the housing **12**. The ends **24**, **25**, **56** and **57** of the adapters **19**, **21**, **54** and **55** are similar in structure and project the same distance from the face **26**. Each of the ends **24**, **25**, **56** and **57** have a conventional sealing ring disposed in an annular groove formed in the ends, the sealing ring and groove being generally shown at **58**. It should be noted that the ends **24** and **25** and the ends **56** and **57** are formed diametrically opposite each other, with respect to the longitudinal center line of the housing **12**, with an angle of ninety degrees between each of the adjacent projecting ends. Moreover, each of the projecting ends **24**, **25**, **56** and **57** lie on a common circle; i.e., each end is equispaced from the longitudinal center line of the housing **12**.

A generally circular plate **59** has four counter bores **61** drilled in its rear face **62**. The counter bores **61** have internal diameters that are slightly larger than the outer diameters of the projecting ends **24**, **25**, **56** and **57** and are arranged, at ninety degree intervals in a circle about the longitudinal center line of the plate whereby, when the gun is assembled, as shown in FIGURES 2, 3 and 4, the ends **24**, **25**, **56** and **57** project into the bores so that the rear face **62** of the plate **59** is adjacent the front surface **24** of the housing **12**.

The front face **63** of the plate **59** has a raised, generally annular sealing surface **64** machined thereon. Two bores **65** are drilled in the surface **64** so that they are coaxial and connected with the larger diameter counter bores **61** which receive the projecting ends **24** and **25** of the component materials adapters **19** and **21**. Two other bores **66** are drilled in the surface **64** so that they are coaxial with and connected to the counter bores **61** which receive the projecting ends **56** and **57** of the solvent adapters **54** and **55**. Moreover, each of the component material bores **65** is spaced ninety degrees from each of the solvent bores **66** and all the bores **65** and **66** lie on a common circle about the longitudinal center line of the plate **59**. Shoulders **67** are formed between the ends of the bores **65** and **66** and the counter bores **61**. As shown in FIGURES 2, 3, and 4, the depth or length of the counter bores **61** is greater than the length of the projecting ends **24**, **25**, **56** and **57**, so that fluid chambers **68** are formed in counter bores **61** between the shoulders **67** and the projecting ends of the adapters **19**, **21**, **54** and **55**. Thus, when the spray gun is connected with the source of pressurized component materials and solvent, the pressure of the fluid in the chambers **68** tends to bias or move the plate **59** to the left, away from the housing **12**, with the projecting ends **24**, **25**, **56** and **57** serving as guides for this limited movement. In addition, spring washer **69**, disposed about each of the projecting ends **24**, **25**, **56** and **57** and between the front face **26** of the housing and the rear face **62** of the plate, also tend to bias or move the plate **59** to the left, away from the housing **12**. As more fully explained hereinafter, this limited movement of the plate **59** assists in sealing the gun.

An annular retainer **71** has a first and second interconnecting, generally circular openings **72** and **73** formed therein with a shoulder **74** being formed therebetween. The central longitudinal axes of the openings **72** and **73** are coaxial with the central longitudinal axis of the ring **71**, and also with the longitudinal center line of housing **12**. The diameter of the opening **73** is greater than the diameter of the opening **72** and is also greater than the external diameter of the plate **59**. The retainer **71** is secured to the front face **24** of the housing **12** by a plurality of bolts, not shown.

A valve body **75** includes a threaded forward end **76**, a reduced central portion **77** and an enlarged rear portion **78**. A flange **79** is formed on the rear portion **78** of the valve body adjacent the rear face **81** thereof, with the flange having outer diameter approximately equal to the outer diameter of the ring **59**. A portion of the flange **79**, not shown, is cut away, and this cut away portion cooperated with a radially inwardly projecting portion formed on the retainer **71**, also not shown, to limit the rotation of the body **75** to an arc of ninety degrees.

Like the face **63**, the face **81** of the valve body **75** has a raised, generally annular sealing surface **82** machined thereon. The radial dimensions of the surface **82** are equal to the radial dimensions of the surface **64**, and thus when the gum **11** is assembled, as shown in FIGURES 2, 3 and 4, the surfaces **64** and **82** abut. Moreover, because of the fluid pressure in the chambers **68** and the spring washers **69**, the surface **64** is biased or moved into tight sealing engagement with the surface **82**.

As is apparent from FIGURES 2, 3 and 4, the outer diameter of ring **59** and the outer diameter of flange **79** are greater than the diameter of the opening **72** so that when the valve body **75** is positioned as shown in FIGURES 2, 3 and 4, the shoulder **74** holds or supports the valve body in position. An annular Teflon ring **85** is positioned between the flange **79** and the shoulder **74** and when so positioned, the ring **85** acts as a thrust bearing. As noted above, fluid pressure in chambers **68** and the spring washers **69** bias the plate **59** against the body **75**, and thus, the flange **79** is biased against the ring **85**. However, because the ring **85** is made of Teflon, rotation of the valve body **75**, with respect to the plate **59**, may be achieved with a minimal application of torque to the valve body. Furthermore, wear on the Teflon ring **85** will not cause fluid leakage between the sealing surfaces **64** and **82** since as the ring **85** wears, the plate **59** will be moved to the left, as shown in FIGURES 2, 3 and 4, by the fluid pressure in chamber **68** and by the washers **69**. Therefore, the Teflon ring **85** has to be replaced only after it has been so severely worn that it can no longer function as a thrust bearing, thus minimizing maintenance work on the gun.

In order to properly locate the valve body **75** with respect to the plate **59**, a guide pin **86** is positioned between the front face **63** of the plate **59** and the rear face **81** of the body **75** so that the longitudinal center lines of the plate **59**, body **75**, and pin **86** are coaxial.

A handle assembly **87** includes an annular portion **88** which fits about the front part of the rear portion **78** of the valve body **75** and a handle **89**. The annular portion **88** is secured to the portion **78** of the valve body by means of a set screw, not shown, so that rotational movement of the handle assembly **87** results in a corresponding

rotation of the valve body **75**. The handle **89** is integrally formed with the annular portion **88** and extends to the rear of the gun adjacent to, but spaced from, the side of the retainer **71** and housing **12**, as shown best in FIGURES 1 and 2. Moreover, as shown in FIGURE 1, the outer surface of the housing **12** has the words "SOLV," "OFF" and "ON" stamped thereon adjacent to the end **91** of the handle **89**. These words "SOLV," "OFF" and "ON" are arranged so that movement of the end **91** from the word "SOLV" to "OFF," or "OFF to "ON" causes rotation of the valve body through an arc of forty-five degrees. Furthermore, movement of the handle **89** from "ON" to "SOLV" or vice versa causes the valve body to rotate through an arc of ninety degrees which, as noted above, is the maximum arc through which the valve body may be rotated. Also, as more fully explained hereinafter, the valve body **75** is constructed and arranged, with respect to the handle **89**, so that when the end **91** is pointed at the word "ON," a homogeneous mixture of the component materials is sprayed from the gun, and so that when the end **91** is pointed at the word "SOLV," solvent under pressure is sprayed from the gun. Further, when the end **91** is pointed at the word "OFF," no fluid is being sprayed from the gun.

Moreover, to prevent fluid from being unintentionally sprayed from the gun by an accidental movement of the handle **89** from the "OFF" position to the "ON" or "SOLV" positions, a latch **92** is provided. The latch **92** comprises a stepped diameter shaft **93** which is positioned within a bore **94** formed in the retainer **71**. The ends of the shaft **93** are guided in the bore **94**, for limited reciprocal movement therein, by cylindrical bearing members **95** and **96**. A handle **97** is secured to the shaft **93** and extends perpendicularly therefrom through an elongated groove **98** formed in the outer surface of the retainer **71**. A coil compression spring **99** is positioned in the bore **84** between the end of the member **96** and the large diameter portion of the shaft **93**, and surrounds the small diameter portion of the shaft **93**. The spring **99** urges the shaft **93** to the left, as shown in FIGURE 4, so that the front end of the shaft abuts the rear face **101** of the annular portion **88** of the handle assembly **87**. A recess, not shown, is formed in the rear surface **101** of the portion **88** and is so aligned with respect to the shaft **93** that when the end **91** of the handle **89** is pointed to the word "OFF," the front end of the shaft **93**, under the bias of spring **99**, projects into the recess, thereby preventing rotation of the portion **88** and thus the valve body **75**. Therefore, when it is desired to move the handle **89** to either the "SOLV" or "ON" positions from the "OFF" position, it is first necessary to retract the end of shaft **93** from the recess, against the force of the spring **99**, by means of the handle **97**.

Referring now to the valve body **75**, a generally right cylindrical mixing chamber **102** is formed therein so that the central longitudinal axes of the chamber and the valve body are coaxial. The front end **103** of the chamber is connected with a spray tip **104** that is secured to the threaded portion **76** of the body **75** by a nut **105**. An annular sealing ring **106** is positioned between the front end of the portion **76** and the spray tip **104** to prevent leakage therebetween. The spray tip **104** is of conventional design, and satisfactory performance of the gun may be obtained using either a round or elliptical pattern tip.

A pair of passages **107** and **108** are each connected at one end with the rear end **109** of the mixing chamber **102**, and as best shown in FIGURES 5 and 6, the central longitudinal axes of the passages **107** and **108** are parallel and intersect a diameter of the mixing chamber **102** at points equally spaced from the central longitudinal axis of the chamber. Moreover, a plane including the diameter and the longitudinal axis of the passage **107** is perpendicular to a plane including the diameter and the central longitudinal axis of the passage **108**. Also, the central longitudinal axes of the passages **107** and **108** each form an angle of four degrees with the vertical plane including the central longitudinal axis of the chamber **102**. Furthermore, the passages **107** and **108** are arranged so that the fluid streams emitted therefrom enter the chamber **102** tangentially to the walls of the chamber, but on diametrically opposite sides thereof and, of course, with an included angle between the entering streams of ninety degrees. Thus the component materials are thoroughly mixed within the chamber **102** by the resulting swirling action or flow of the materials in and along the chamber.

The other ends **111** and **112** of the passages **107** and **108**, respectively, terminate, one-hundred and eighty degrees apart, in the sealing surface **82** and are arranged so that they may be aligned with the bores **65** and **66** formed in the sealing surface **64** of the plate **59**. In other words, the ends **111** and **112** of the passages **107** and **108** and the bores **65** and **66** all lie on a common circle with respect to the longitudinal center lines of the plate **59** and body **75**.

It has been found that when the diameter of the passages **107** and **108** are equal to the radius of the mixing chamber **102**, satisfactory results may be obtained. More particularly, it has been found that in a spray gun wherein the diameter of the passages corresponding to passages **107** and **108** are $\frac{1}{16}$ inch and the diameter of the mixing chamber corresponding to chamber **102** is $\frac{1}{8}$ inch, a satisfactorily homogeneous mixture may be sprayed from the gun when the component materials have a viscosity of 300 c.p.c.

The operation of the gun is as follows: When the end **91** of the handle **89** is pointed to the word "OFF," the valve body **75** is arranged, as shown in FIGURE 2, so that the ends **111** and **112** of the passages **107** and **108** are not connected with either the material bores **65** or the solvent bores **66** but are disposed forty-five degrees therebetween. When the latch **92** is retracted and the end **91** of the handle **89** is pointed to the word "ON," the body **75** is arranged, as shown in FIGURE 3, so that the ends **111** and **112** of the passages **107** and **108** are aligned with the material bores **65** whereby component material may flow through the passages **107** and **108** and into mixing chamber **102** wherein the materials are thoroughly and uniformly mixed and thereafter sprayed from the gun through the tip **104**. Moreover, when the end **91** of the handle **89** is pointed to the word "SOLV," the body **75** is arranged, as shown in FIGURE 4, so that the ends **111** and **112** of the passages **107** and **108** are aligned with the solvent bores **66** whereby solvent may flow through the passages **107** and **108**, into the mixing chamber **102** and through the tip **104**, thereby thoroughly and completely cleaning the passages, chamber and tip.

From the foregoing it should be apparent that the spray gun of the present invention is a significant improvement over the prior plural component materials spray guns. The improved spray gun of the present invention has a relatively simple design, construction and arrangement which not only reduces the manufacturing costs of the gun but also permits thorough and facile cleaning of the mixing chamber and the passages interconnecting the mixing chamber with the component material valves, so that there is never build-up of the component materials in these passages and chamber and around the valves. Moreover the use of a rotary valve to control the flow of material through the spray gun eliminates the problem, heretofore found in the prior plural component materials spray guns, of adjusting the component material valves so that simultaneous actuation of these valves may be achieved. Furthermore, the use of a rotary valve permits actuation of the valve with a minimal application of torque to the valve handle.

Moreover, it should be recognized that various other modifications may be made to the spray gun of the present invention. For example, if because of the materials used thorough mixing is desired, a static mixer may, of course, be inserted in the mixing chamber to provide additional mixing.

I claim:

1. Spray apparatus for spraying plural fluid component materials as a homogeneous mixture comprising: nozzle means; a mixing chamber connected with the nozzle means so that the component materials mixed in said mixing chamber are sprayed from the nozzle means; a member having a first bore adapted to be connected with a first component material source, a second bore adapted to be connected with a second component material source, and a third bore adapted to be connected with a solvent source; a body including passage means which has one end thereof connected with said mixing chamber; and means for causing relative movement between the member and the body whereby the other end of said passage means may be selectively placed in connection with the first and second bores, in connection with the third bore or disconnected from the first, second and third bores.

2. The apparatus described in claim **1** wherein said passage means includes first and second passages each of which having one end thereof connected with said mixing chamber; and wherein relative movement between the member and the body permits the other ends of the first and second passages to be selectively placed in connection with the first and the second bores, respectively, in connection with the third bore, or disconnected from the first, second and third bores.

3. The apparatus described in claim **2** wherein the last mentioned means includes a handle attached to the body; and wherein the body may be rotated with respect to the member by movement of the handle.

4. The apparatus described in claim **2** wherein a first surface is formed on the member, and a second surface is formed on the body with the first and second surfaces being biased into sealing engagement with each other; wherein said last mentioned means includes a handle attached to the body; and wherein the body may be rotated by the handle with respect to the member about an axis substantially perpendicular to said first and second surfaces.

5. The apparatus described in claim **4** wherein the other ends of the first and second passages are spaced apart and terminate in said second surface and wherein the one ends of the first, second and third bores are spaced apart and terminate in said first surface whereby when the body is rotated selectively about said axis to a first position, the other ends of the first and second passages are adjacent to and aligned with the one end of the first bore passage and with the end of the second bore, respectively; when the body is rotated selectively to a second position, the other ends of the first and second passages are adjacent to and aligned with the one end of the third bore; and when the body is rotated selectively to a third position, the other ends of the first and second passages are not connected with the one ends of the first, second or third bores.

6. The apparatus described in claim **5** wherein fluid biasing means are utilized to urge said first and second surfaces into sealing engagement with each other; and wherein said mixing chamber is formed in the body.

7. The apparatus described in claim **5** wherein the apparatus also includes a housing having four conduit means, each of which having one end thereof projecting from one side of the housing; the first conduit means having the other end thereof connected with the first component material source, the second conduit means having the other end thereof connected with the second component material source and the third and fourth conduit means having the other ends thereof connected with the solvent source; wherein the member includes a fourth bore, the one end of which terminating in the first surface and being spaced apart from the one ends of the first, second and third bores; wherein the first, second, third and fourth bores each include a first, relatively small diameter portion adjacent the one end and a second, larger diameter portion adjacent the other end thereof, said bores being arranged so that the projecting ends of the first, second, third and fourth conduit means fit within the second portions of the first, second, third and fourth bores, respectively, with the depth of the second portions of the bores being greater than the length of the projecting ends of the conduit means whereby the pressure of the fluid flowing through the conduit means and bores urges said first surface into sealing engagement with the second surface.

8. The apparatus described in claim **7** wherein said mixing chamber is formed in the body; and wherein with respect to said axis, the other ends of the first and second passages are disposed at 180° to each other, the one ends of the first and second bores are disposed at 180° to each other, and the one ends of the third and fourth bores are disposed at 180° to each other, and are disposed at 90° to the one ends of the first and second bores, with the other ends of the first and second passages and the one ends of the first, second, third and fourth bores being equi-spaced from said axis.

9. Spray apparatus for spraying plural component materials as a homogeneous mixture comprising: a body having a first and second fluid passages and a generally cylindrical mixing chamber formed therein; nozzle means connected with said mixing chamber so that the component materials mixed in said mixing chamber are sprayed from the nozzle means, the first and second passages each having one end thereof connected with said mixing chamber, and being positioned so that the central longitudinal axes of the first and second passages each intersect a diameter of said mixing chamber at different points thereon, and so that a first plane including said axis of the first passage, adjacent the one end thereof, and said diameter, is disposed at an angle of approximately 90° with respect to a second plane including said axis of the second passage, adjacent the one end thereof, and said diameter; and valve means for controlling the flow of component materials through the first and second passages.

10. The apparatus described in claim **9** wherein the one ends of the first and second passages are connected with said mixing chamber adjacent one end thereof and wherein the nozzle means is connected with said mixing chamber adjacent the other end thereof.

11. The apparatus described in claim **10** wherein said first and second planes are each disposed at an angle of approximately 45° to the central longitudinal axis of said mixing chamber; and wherein the streams of component materials emitted from the first and second passages are directed generally toward the other end of said mixing chamber.

12. The apparatus described in claim **11** wherein said mixing chamber is a right cylinder; and wherein the diameters of the first and second passages are approximately equal to a radius of said mixing chamber.

13. The apparatus described in claim **11** wherein said axes of the first and second passages each form an angle of approximately 4° with a vertical plane including the central longitudinal axis of said mixing chamber.

14. The apparatus described in claim **11** wherein the point of intersection between said axis of the first passage and said diameter and the point of intersection between said axis of the second passage and said diameter are on opposite sides of the central longitudinal axis of said mixing chamber.

15. The apparatus described in claim **12** wherein the point of intersection of said axis of the first passage and said diameter and the point of intersection of said axis of the second passage and said diameter are on opposite sides of the central longitudinal axis of said mixing chamber; and wherein the distance between said points of intersection is approximately equal to a radius of said mixing chamber.

16. The apparatus described in claim **12** wherein said axes of the first and second passages are parallel and form an angle of approximately 4° with a vertical plane including the central longitudinal axis of said mixing chamber and wherein the point of intersection between said axis of the first passage and said diameter, and the point of intersection between said axis of the second passage and said diameter are on opposite sides of the central longitudinal axis of said mixing chamber.

17. The apparatus described in claim **13** wherein the axes of the first and second passages are parallel.

18. The apparatus described in claim **14** wherein the distance between the point of intersection of said axis of the first passage and said diameter and the point of intersection of said axis of the second passage and said diameter is equal to a radius of said mixing chamber.

19. The apparatus described in claim **14** wherein said axes of the first and second passages each form an angle of approximately 4° with a vertical plane including the central longitudinal axis of said mixing chamber.

20. The apparatus described in claim **15** wherein the axes of the first and second passages are parallel and form an angle of approximately 4° with a vertical plane including the central longitudinal axis of said mixing chamber.

21. The apparatus described in claim **19** wherein said axes of the first and second passages are parallel.

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