United States Patent [19]

Lehnert

[11] **3,837,575**

[45] **Sept. 24, 1974**

[54] **SPRAY GUN**

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[73] Assignee: **The Upjohn Company,** Kalamazoo, Mich.

[22] Filed: **Aug. 27, 1973**

[21] Appl. No.: **391,928**

[52] **U.S. Cl.** **239/112,** 239/414, 239/527

[51] **Int. Cl.** **B05b 7/04**

[58] **Field of Search** 239/112, 415, 414, 527, 239/528; 137/512, 539, 609; 251/78, 243, 313, 251

[56] **References Cited**

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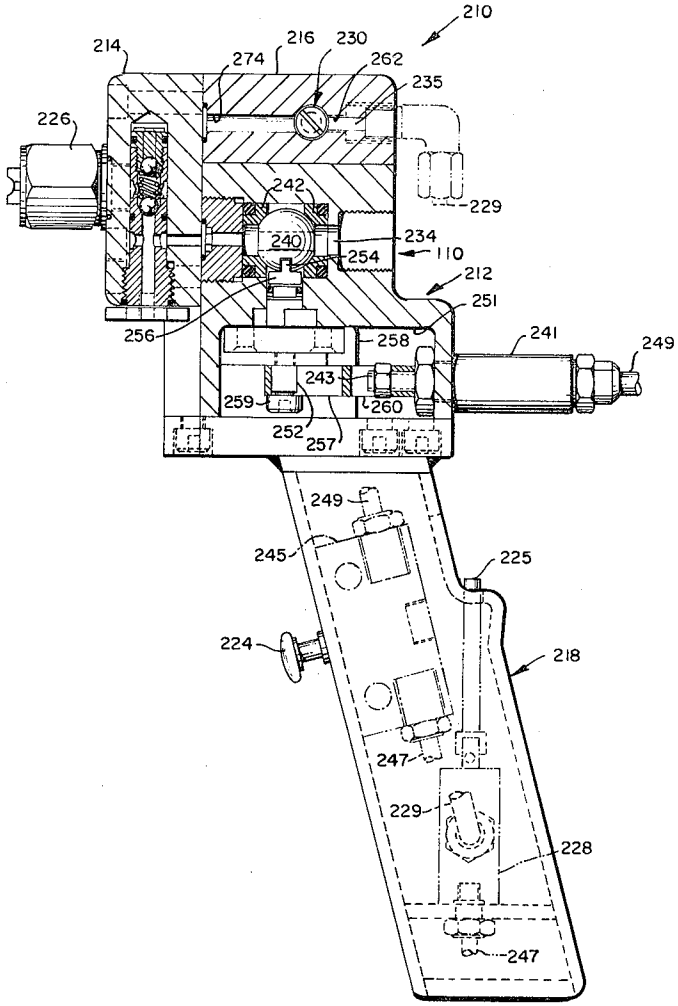
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Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—John J. Love
Attorney, Agent, or Firm—Steward & Steward

[57] **ABSTRACT**

A spray gun is disclosed for use in admixing and spraying, as a homogeneous mixture, two or more chemically reactive fluid components, more especially catalyzed polymerizable resin coating materials such as polyurethanes, epoxides, polyesters and other thermosets, either of the self-foaming or film-forming type. Because of the high rate of reactivity of the fluid components involved, the gun is designed to restrict actual admixture of them to a relatively small region within the gun body located immediately upstream of the spray discharge orifice so that application to the surface occurs as promptly as practical after admixture. Flow rate control and check valve means are provided in the gun for the several fluid components; in addition a solvent flush system is also incorporated for purging the gun after use. The flow rate control valves are of special ball design, affording greater mechanical simplification and better sealing maintenance than conventional poppet or needle valves. The check valve means are likewise designed to facilitate gun maintenance by the provision of a unitized cartridge, design, making them easily removable from and replaceable in the gun body and giving easier and more complete access to the interior of the gun in connection with periodic major maintenance servicing of it.

9 Claims, 19 Drawing Figures



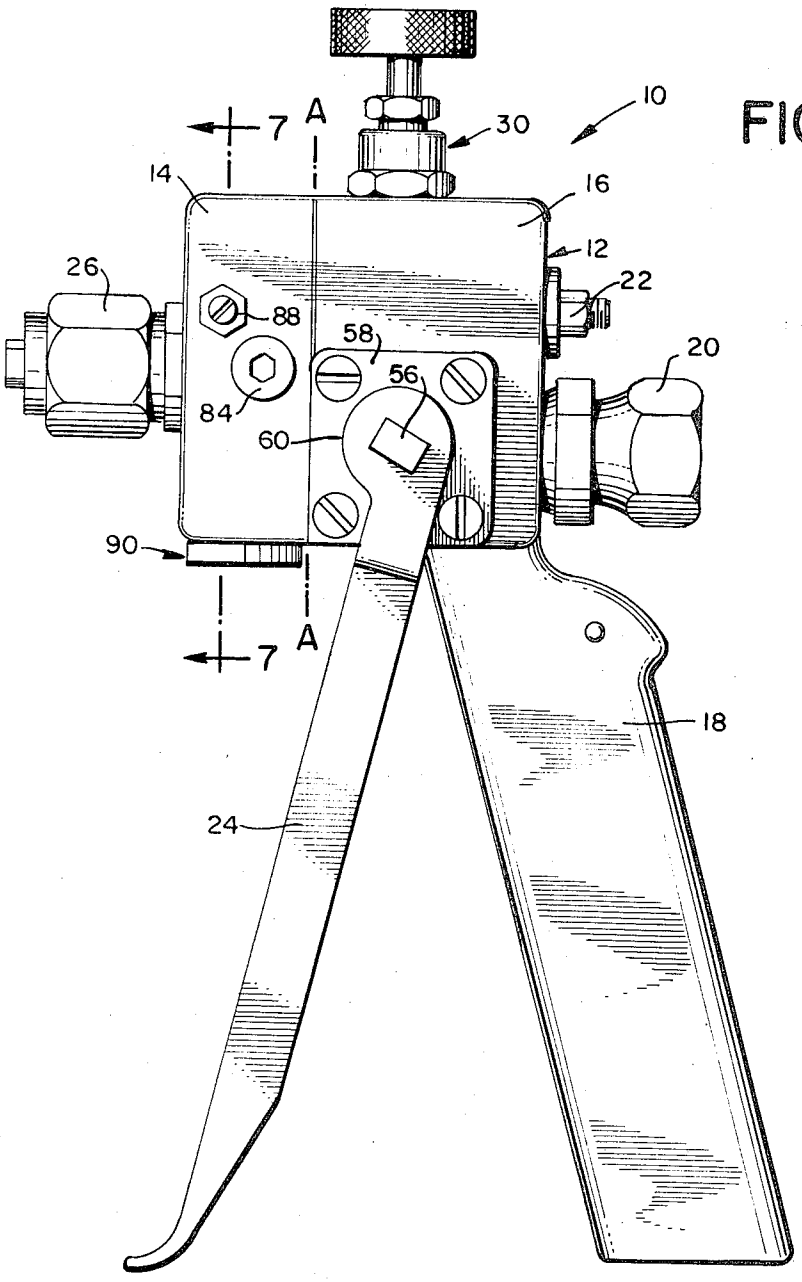


FIG. 1

FIG. 2

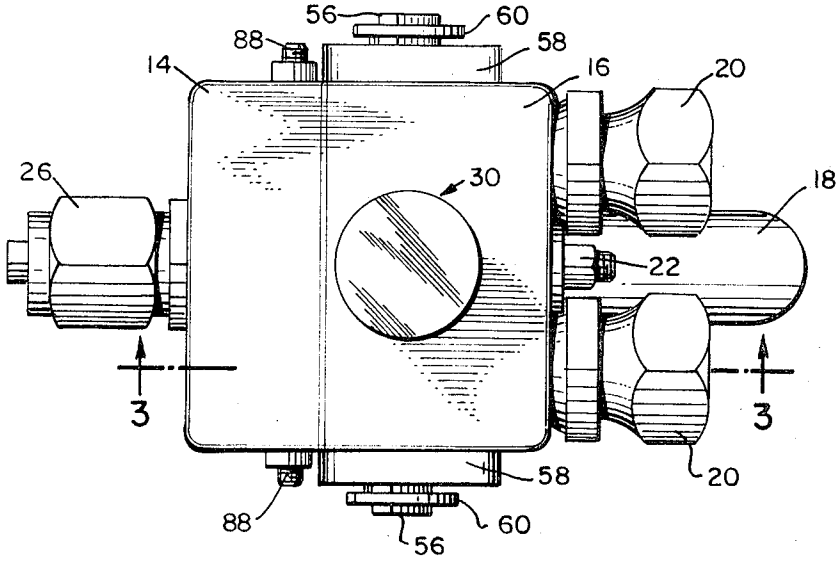


FIG. 3

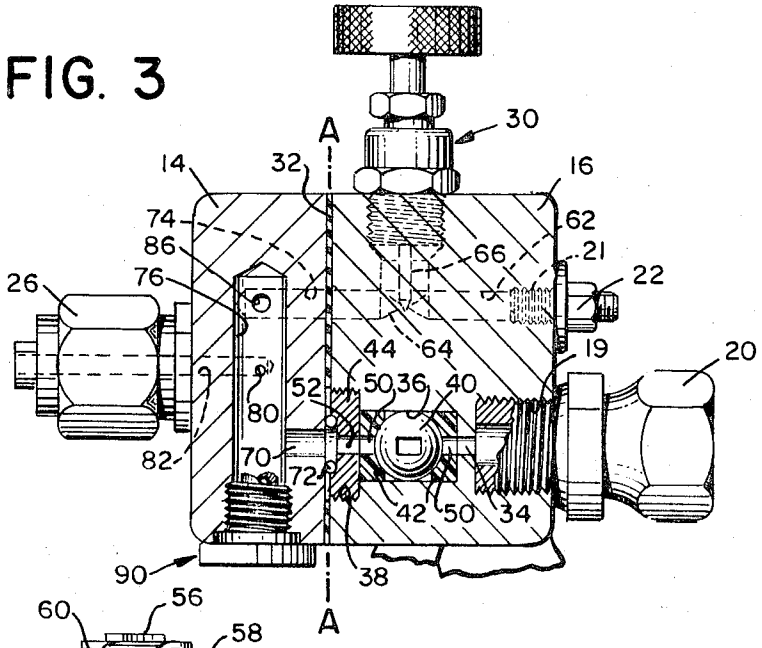


FIG. 4

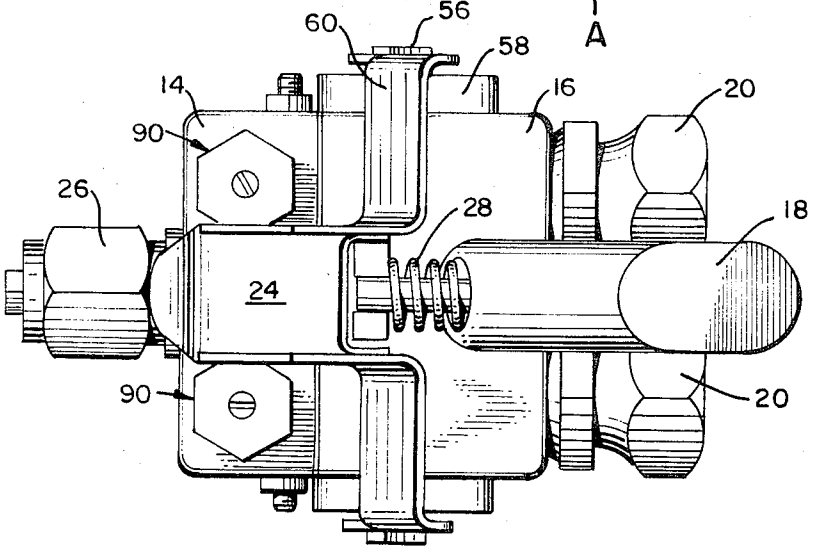


FIG. 5

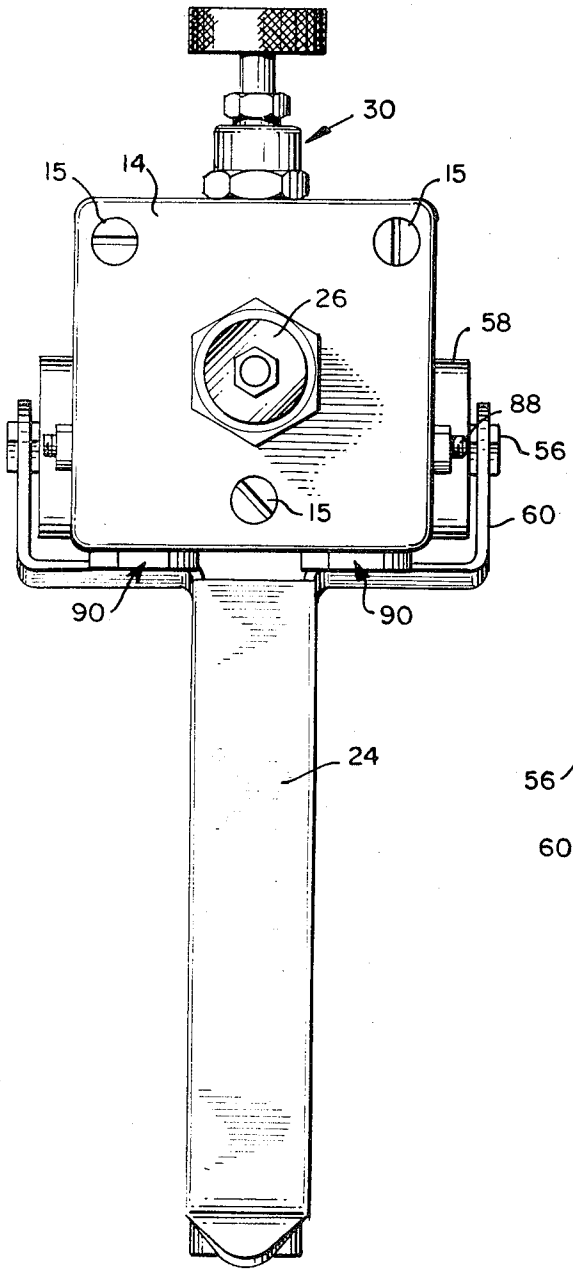

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FIG. 6

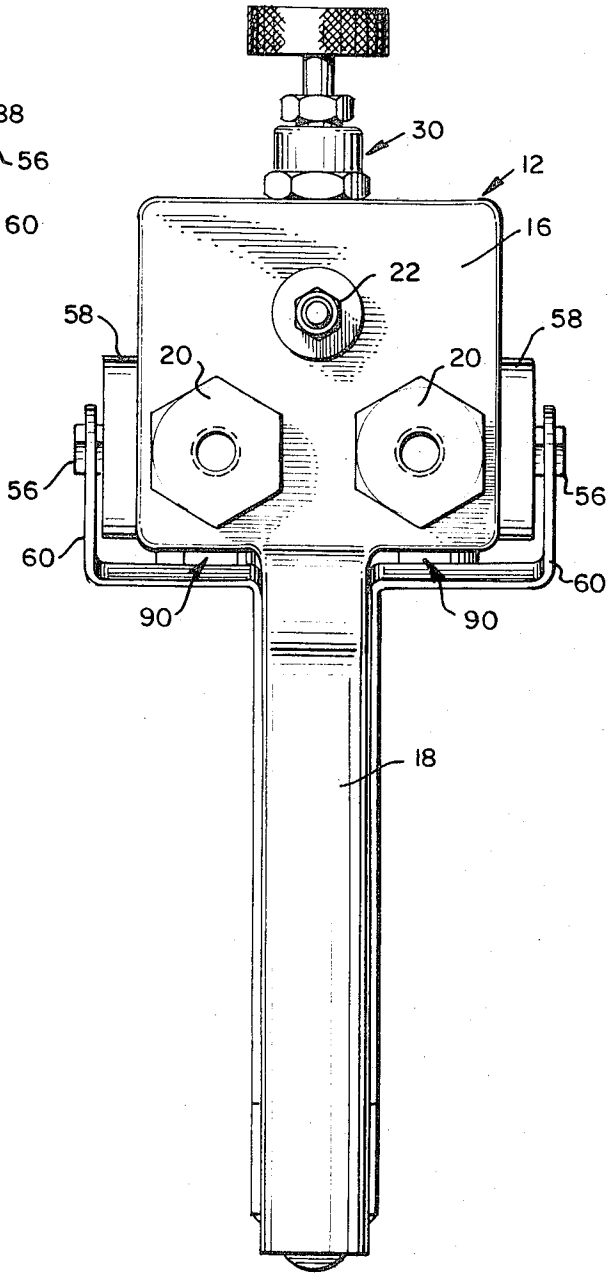

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FIG. 7

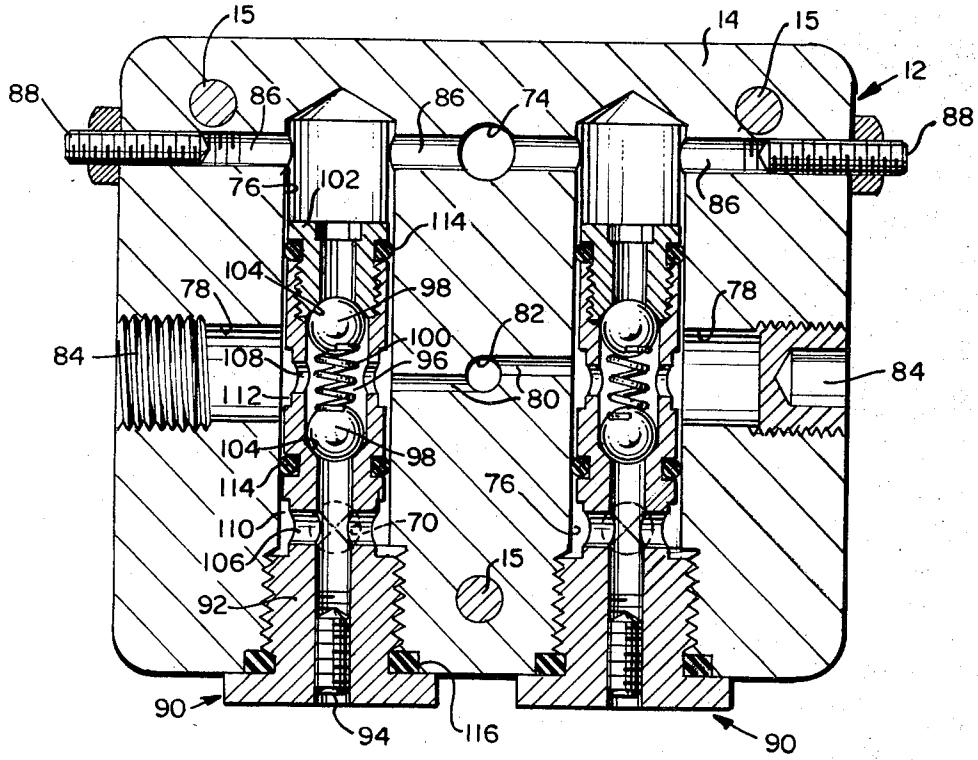


FIG. 8

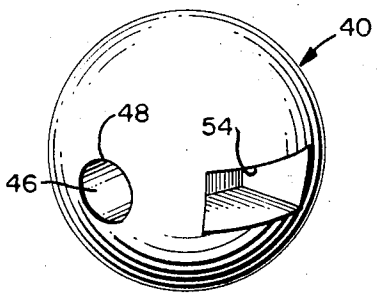


FIG. 9

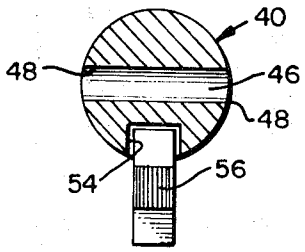


FIG. 10

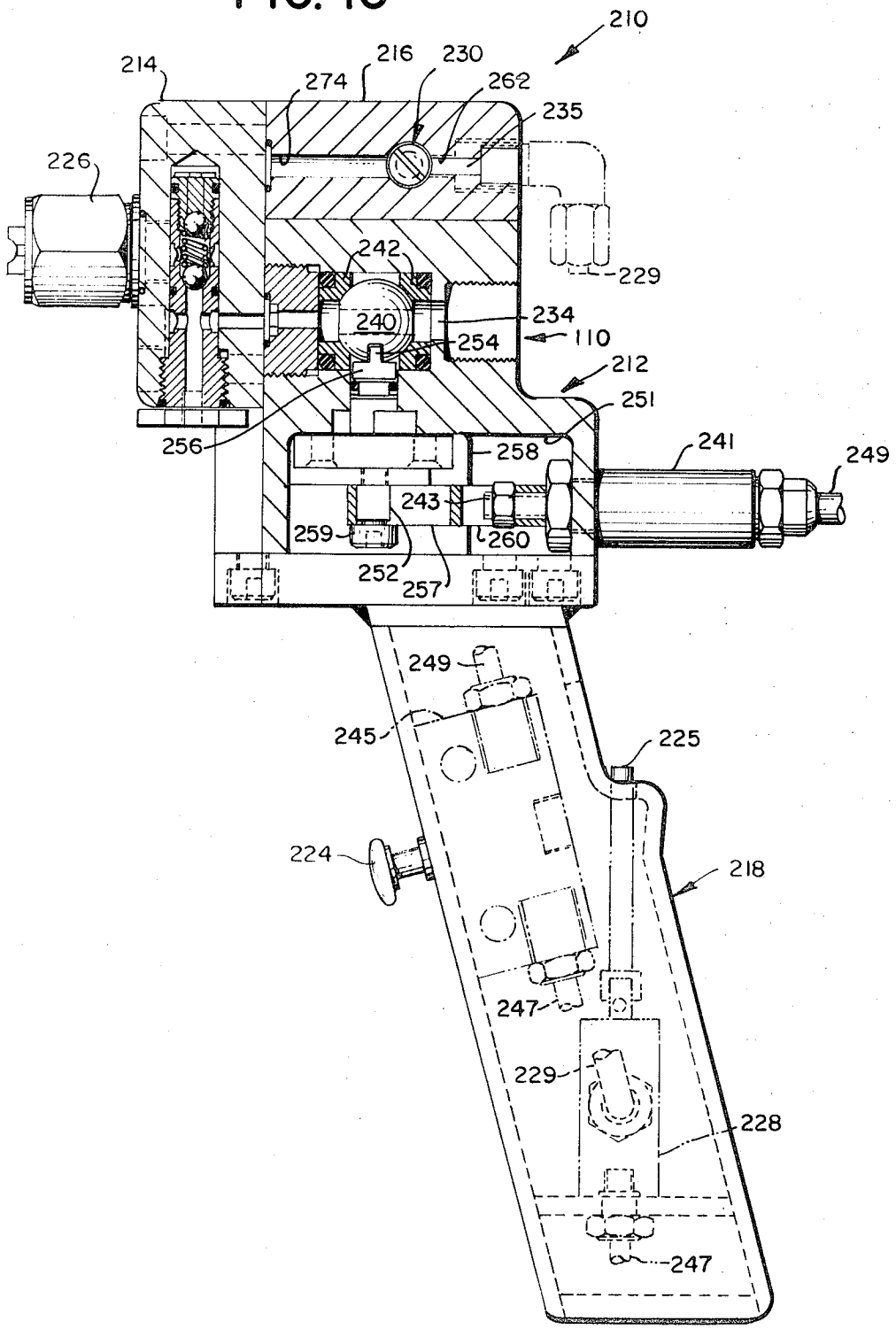

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FIG. 11

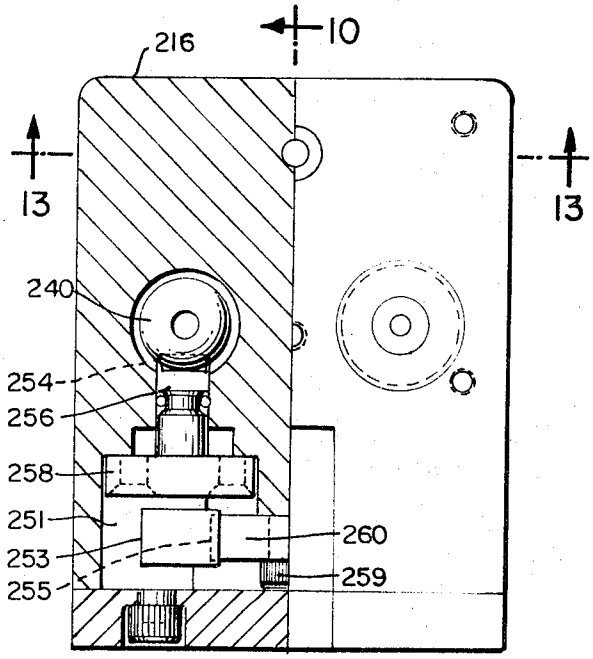
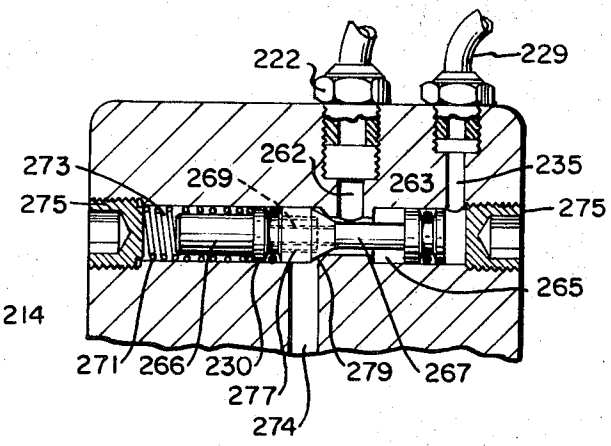


FIG. 13



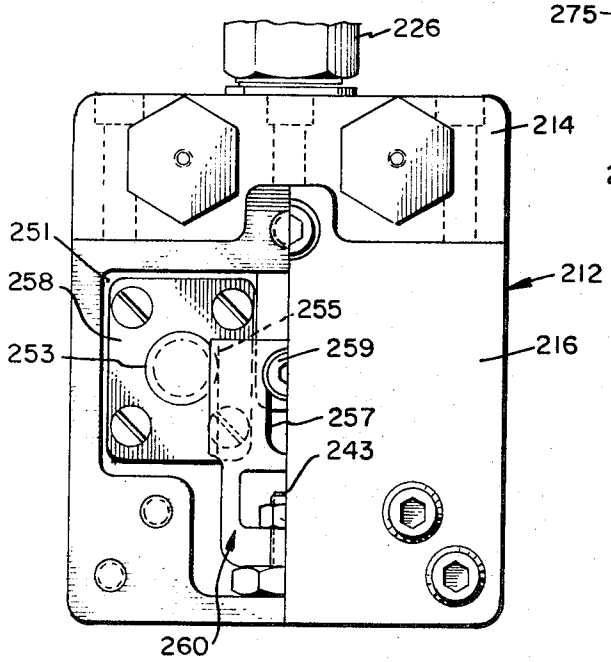
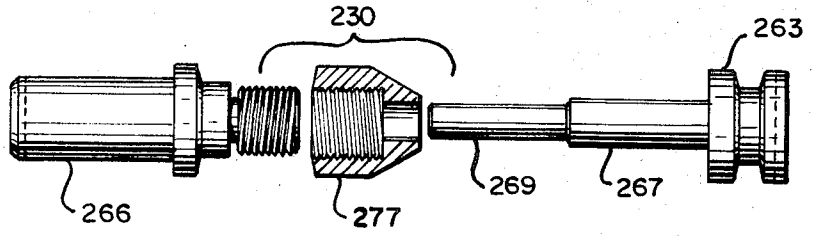


FIG. 12

FIG. 14



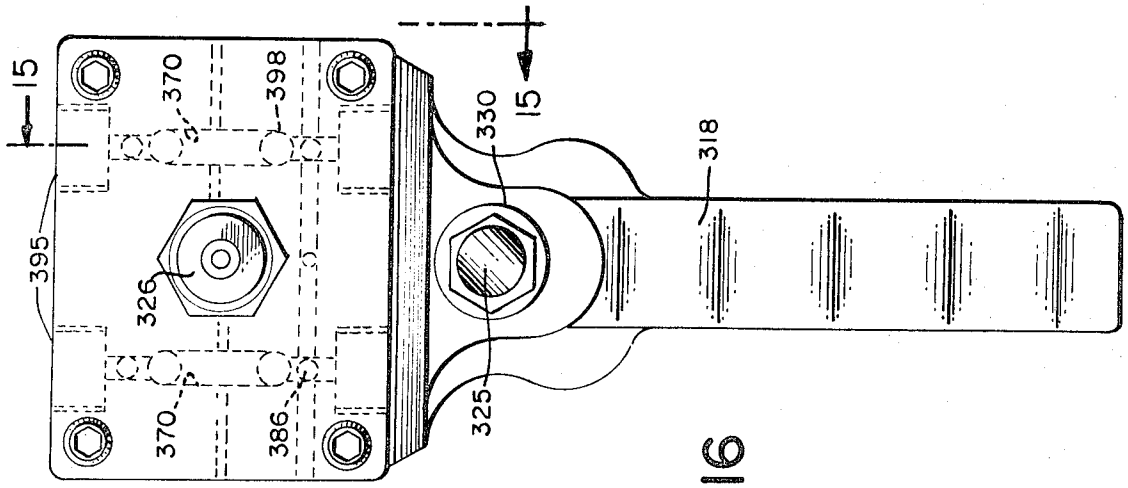

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FIG. 16

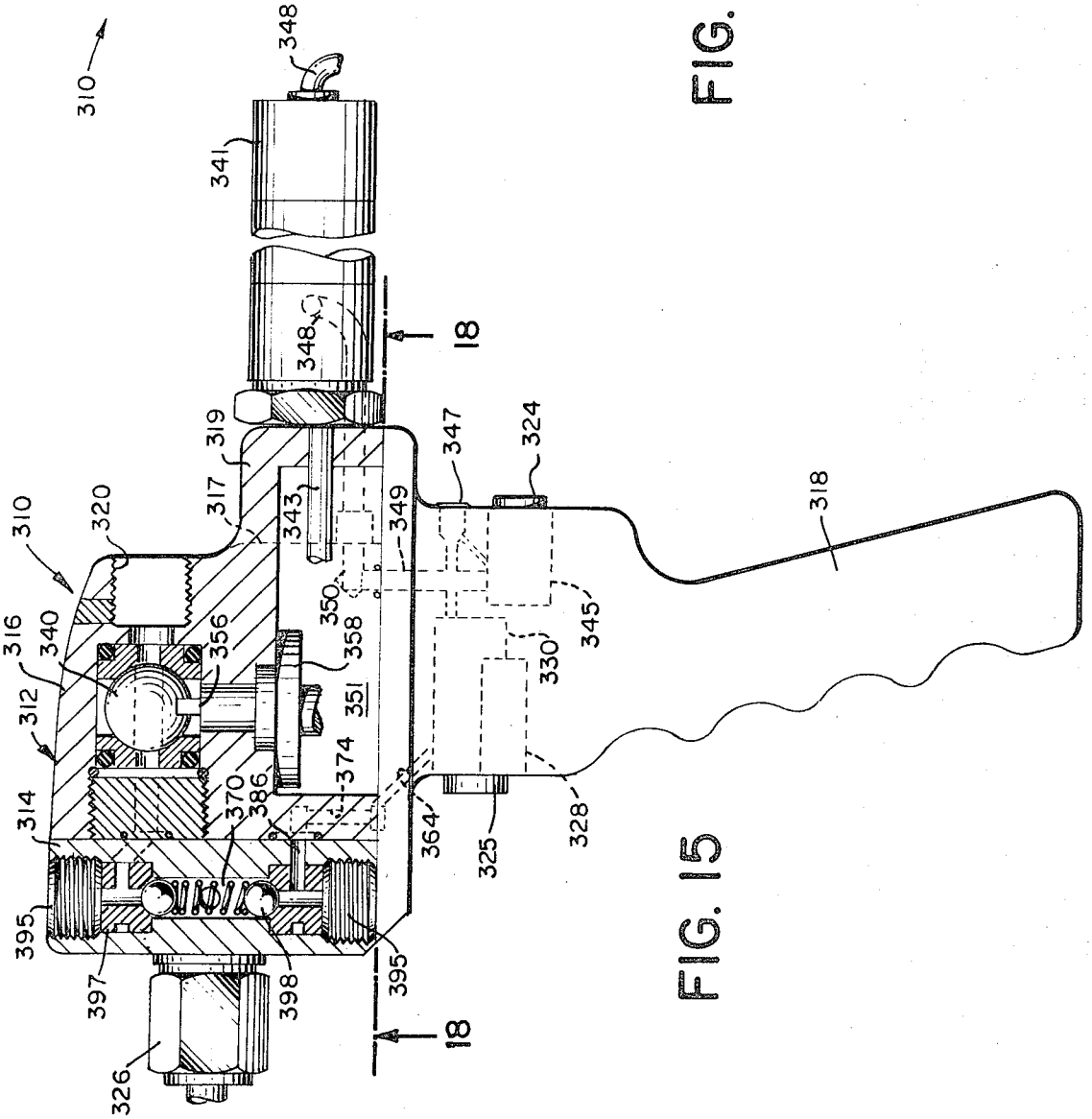

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FIG. 15

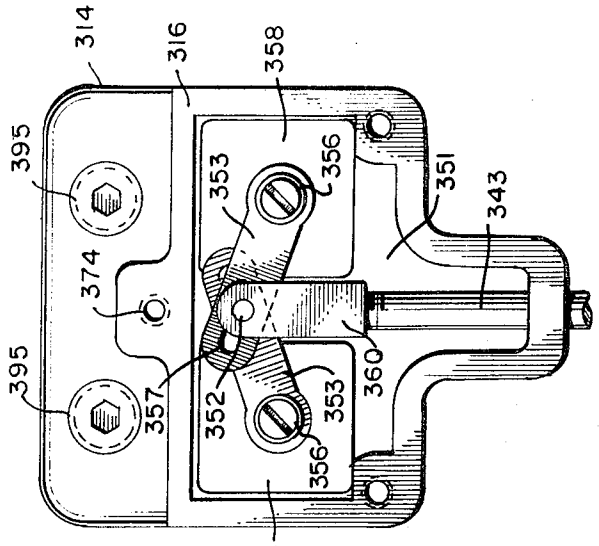


FIG. 19

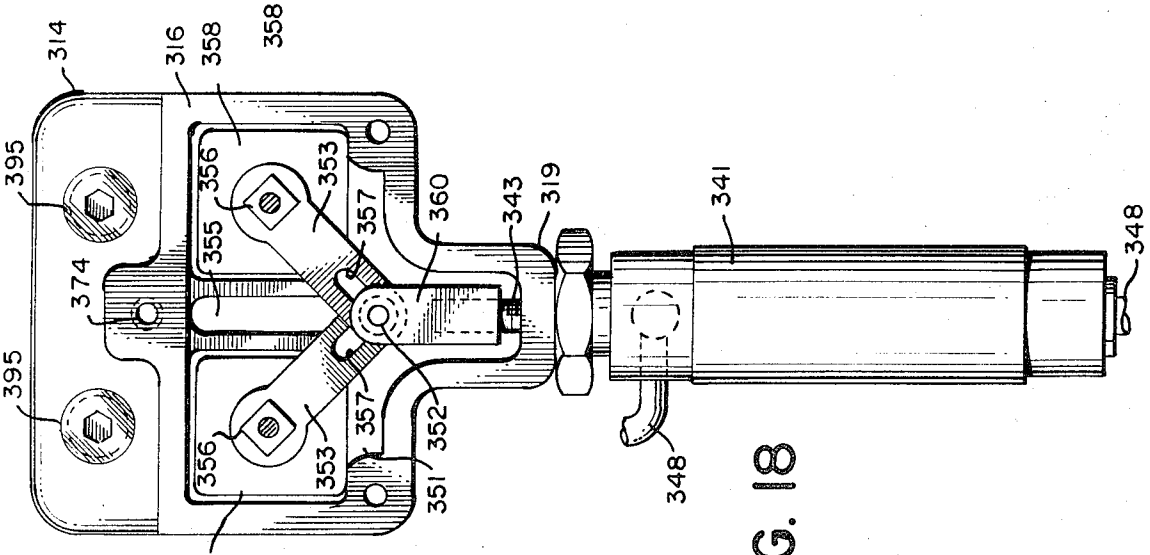


FIG. 18

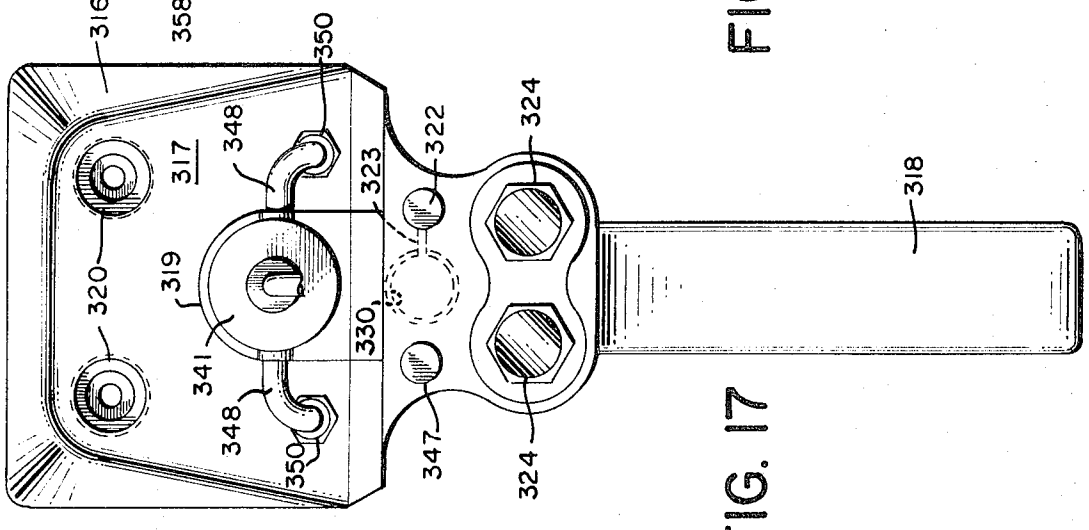


FIG. 17

SPRAY GUN

BACKGROUND OF THE INVENTION

This invention relates to spray or applicator guns for coating materials, and more particuarly is concerned with improvements in airless spray guns used to spray a variety of polymerizable resin coating materials of either the film-forming of foam-forming type.

Guns of this general character are of course well known and are used extensively in commerical applications. Their use involves ducting, by suitable flexible hose connections from external supply pumps and tanks, two or more fluid components which, when admixed, react to form a self-curing or settting coating composition. Typical examples are admixtures of polyols and isocyanates incorporating a suitable catalyst and, if desired, a foaming agent, to produce polyurethane films or foams. Because of the highly reactive nature of the liquid components when admixed, provisions must be made to restrict initial contact between the components to a point as closely adjacent the surface to be coated as possible. However, adequate admixing of the components is essential in order to get a film or foam of suitably homogeneous characteristics and as a consequence some actual admixing of the several components within the applicator gun itself is a practical necessity. With extended use of the applicator, and particularly with intermittent use over extended periods, there is a tendency for buildup of reacted material to occur in the gun body and at the point of spray discharge, even with frequent purging. Periodic major maintenance of the gun is therefore essential to satisfactory operation. Some form of valve means is of course required to control the operation of the gun, and this introduces joints and seals providing crevises in which a certain amount of fluid is trapped inescapably and must be purged periodically, especially when changing from one type of coating to another. Mechanical design simplicity of the valve members and especially of the fluid seals is thus highly desirable from a maintenance standpoint, as well as from the standpoint of minimizing restriction of fluid flow and tendency to trap and retain portions of the several fluid components. Numerous attempts have been made to simplify the design and maintenance problems encountered in the use of such applicator guns.

SUMMARY OF THE INVENTION

It is a principal objective of the present invention to provide an applicator or spray gun of improved design for use in the type of spray gun coating applications generally described above. The improved spray gun, of which three embodiments are described herein, is comprised of a main body formed of a two-part cast metal block. This is provided with an appropriate hand-hold or pistol grip by which the spray operator can manipulate the gun. The gun body is bored to provide separate fluid ducts leading from hose nipples at the rear of the gun, to which the fluid supply hoses are connectable, to a spray nozzle at the front of the gun. A mixing chamber is formed in the gun body immediately adjacent the nozzle, where the several reactive liquid components are mixed for the first time and then discharged immediately through the nozzle which completes the mixing and produces a desired spray pattern. Ball type flow control valves interposed in the respective fluid passages are ganged for simultaneous operation either directly by a lever or trigger which projects adjacent the pistol grip, or indirectly through an air actuator controlled by a trigger on the pistol grip. Both embodiments are designed to allow one-hand operation of the gun by an operator. The gun body also incorporates readily removable cartridge type double-acting check valve means interposed in each of the fluid passages, downstream of the flow control valves but upstream of the mixing chamber and discharge nozzle. These serve to prevent backflow of one liquid component into another within the gun body and are easily removable as a unit, simplifying maintenance. A solvent purge system is also provided, whereby those portions of the spray gun ducts which come in contact with admixed reactive liquid material can be flushed without disassembly of the gun. The gun design also incorporates removable clean-out plugs simplifying periodic major maintenance operations on it by giving greater access to the various fluid passages, and to facilitate manufacture of the gun body.

In general, therefore, the objective of the invention is to provide an applicator or spray gun of simplified mechanical design which is not only more economical to manufacture but is easier to maintain.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view in side elevation of one form of the spray gun;

FIG. **2** is a top plan view of the gun seen in FIG. **1**;

FIG. **3** is a vertical cross sectional view taken on line **3—3** of FIG. **2**;

FIG. **4** is a plan view looking at the bottom of the gun as seen in FIG. **1**;

FIGS. **5** and **6** are, respectively, front and rear elevational views of the gun;

FIG. **7** is a cross sectional view on line **7—7** of FIG. **1**;

FIG. **8** is a perspective view of a ball valve member;

FIG. **9** is a cross sectional view of the ball valve member of FIG. **8**, on a reduced scale.

FIG. **10** is a sectional view on line **10—10** of FIG. **11**, showing a modified form of the spray gun in which remotely controlled air actuators are used to operate the flow control and purge valves;

FIG. **11** is an end elevational view, partially in section, looking from the right in FIG. **10**;

FIG. **12** is a plan view, partly in section, on line **12—12** of FIG. **10**,

FIG. **13** is a sectional view on line **13—13** of FIG. **11**;

FIG. **14** is an exploded detailed view of a purge valve construction;

FIG. **15** is a view in side elevation, partly in section on line **15—15** of FIG. **16**, of a further modification of the invention;

FIGS. **16** and **17** are front and rear elevationl views, respectively, of the structure seen in FIG. **15**;

FIGS. **18** and **19** are sectional views on line X—X of FIG. **15**, looking in the direction of the arrows, showing alternative positions of portions of the device.

Referring to the embodiment of FIGS. **1–6** more specifically, spray gun **10** comprises a block-like main body **12** which is composed of complementary front and rear sections **14**, **16**, preferably aluminum alloy

castings for example. Machine screws **15** (FIGS. **5, 7**) are provided for securing sections **14, 16,** together. A handle or pistol grip **18** is suitably secured to the rear section **16** at the underface thereof, and the rear face of this body section is bored to form threaded sockets **19** which each receive a hose coupling **20** for connection to flexible fluid lines (not shown) through which the reactive liquid components are separately delivered from a suitable source of supply. A socket **21** is likewise provided in the rear face of section **16,** in which a threaded nipple **22** is received for the attachment thereto of a hose for delivering cleaning solvent to the gun.

A trigger **24** is pivotally mounted on body section **16** to depend generally along handle **18,** trigger **24** controlling a pair of flow control valves, presently to be described, located in the body of the gun. These valves are used to admit the separate liquid resin components to a mixing chamber located in front section **14** of the gun. A discharge or spray nozzle **26** mounted in the forward face of section **14** is in communication with the aforesaid mixing chamber, and this nozzle completes the admixing of the liquids and shapes the pattern of spray discharged from the gun. Trigger **24** is normally biased, as by a compression spring **28** (see FIG. **4**), to position the flow control valves in closed position. Admission of solvent to the gun from nipple **22** is manually controlled by a needle valve assembly **30** mounted on top of the rear section **16** of the gun body.

The two sections **14, 16** of the gun body are clamped together in face-to-face relation by machine screws **15** so that the abutting faces define a parting plate A—A (FIGS. **1** and **3**) disposed substantially perpendicular to the axis of the discharge orifice **27** in nozzle **26.** A gasket **32** is interposed between the body sections **14, 16** to provide a seal between them. Each hose coupling **20** is threaded into a socket **19** formed in the rear wall of the body section. Each of these sockets in turn communicates with a respective internal duct or passage **34** in the body section which intersects the parting plane A—A. Each passage **34** is counterbored to provide an enlarged valve chamber **36** and a stepped recess **38** which latter opens onto the abutting face of body section **16.** A ball member **40** is disposed in each chamber **36** and is sandwiched between a pair of annular seals **42** held in embracing relation to ball member **40** by a threaded retainer ring **44** to provide inlet and outlet seals for each valve member. Each ball member **40** is provided with a diametric bore **46** (FIGS. **8, 9**) whose intersections with the ball face form oppositely disposed ports **48.** In the open position of the valve, ports **48** are concentrically aligned with apertures **50** of seals **42** and aperture **52** of retaining ring **44** to provide open communication through rear body section **16** of the gun.

Each ball member **40** is provided with a socket **54** which receives the inner end of a stub shaft or stem **56** non-rotatively. Each ball member **40** is so positioned in its respective valve chamber **36** as to cause its stem **56** to project through an aperture in the adjacent sidewall of housing section **16** so that the respective shafts **56** are coaxially aligned. Shafts **56,** respectively, extend through removable housings **58** (FIGS. **1, 2**) which form a bearing support and seal for the shafts. The outer end of each shaft is squared and is received in a mating socket of a yoke arm **60** forming the upper end of trigger **24.** As mentioned, trigger **24** is spring biased in a direction away from handle **18,** in which position the respective ball members **40** are rotated so that ports **48** in them are out of communication with the respective inlet and outlet apertures **50** of the valve chambers. Fluid entering the respective ducts **34** thus cannot pass through the gun body until trigger **24** is squeezed toward handle **18** to cause the ball members to be rotated sufficiently to bring about communication of the respective ports **50** and valve chamber inlets and outlets **48.**

Body section **16** of the gun is also provided with a duct **62** extending through the gun from nipple **22** to the abutting face of the body section. The duct is formed with a typical double-coned restriction **64,** and needle **66** of needle valve assembly **30** is manually adjustable in restriction **64** to control the flow of solvent through the duct.

Referring now more particularly to FIGS. **3** and **7,** front body section **14** is provided with a pair of ducts **70** intersecting the abutting face and registering, respectively, with apertures **52** in retaining rings **44** of the rear section **16.** An O-ring **72** is disposed in the plane of abutment, being seated in a small recess of retainers **44** to provide a fluid tight seal across the interface. Similarly a duct **74** is provided to make communication with solvent duct **62** of the complementary body section, and similar seal means (not shown) is provided at the interface.

Body section **14** is formed with a pair of blind bores **76** disposed substantially parallel to the plane of abutment, which open onto the underface of the body section. Bores **76** are spaced so as to intersect, respectively, ducts **70** for communication therewith. As seen in FIG. **7,** bores **76** also intersect, respectively, bores **78** which extend inwardly of body section **14** from opposite side faces thereof. In addition, drilled passages **80** extend from a centrally located discharge duct **82** in tangential relation into intersection with bores **76.** Passages **80** constitute, in effect, continuations of bores **78** through which they are accessible when closure plugs **84** are removed.

Finally, a drilled passage **86** extends completely through body section **14,** from side-to-side, to intersect both bores **76** adjacent their blind ends, also intersecting solvent duct **74** intermediate the bores. Plugs **88** normally close the outer ends of drill passage **86.**

Bores **76** constitute check valve chambers and are adapted to threadedly receive identical cartridge type double acting check valve assemblies, indicated generally at **90** (FIG. **7**). Each such assembly consists of a hollow sleeve member **92,** open at its inner end and closed at its outer end by a plug **94.** At its inner end, check valve assembly **90** is counterbored to form a central chamber **96** within which there is disposed a pair of check balls **98** and a compression spring **100.** An annular retainer sleeve **102** is threaded into the inner end of sleeve **92.** Oppositely facing conical valve seats **104** are formed internally in the sleeve and retainer members against which check balls **98** are normally seated.

Each sleeve **92** is transversely drilled at spaced points along its extent to provide inlet and outlet ports **106, 108,** respectively. These ports are so positioned on sleeve **102** that the respective inlet ports **106** communicate with the inlets of ducts **70** to bores **76,** while outlet ports **108** communicate with the respective outlets formed by intersection of ducts **80** with bores **76.** Out-

let ports 108 are positioned intermediate check balls 98 in the sleeve so that reverse flow from duct 80 cannot enter either the component inlet 70 or solvent inlet 86. Peripheral recesses 110, 112, respectively, are machined about sleeve 92 at the locations of the respective ports 106, 108, to provide a fluid passage around the sleeve in the area of the ports. O-ring seals 114 are disposed about the sleeve on either side of ports 108 in order to prevent liquid bypassing along the sleeve. Another O-ring 116 is placed about the sleeve 92 adjacent its outer end to prevent liquid from leaking onto the external face of the gun.

In use of the gun, admission of the reactive liquids delivered under pressure to couplings 20 is controlled by the position of valve members 40 through trigger 24. Squeezing the trigger opens these valves and allows the two fluid components to enter by way of ducts 70 the respective check valve chambers formed by bores 76 in the region of ports 106. The respective fluids then pass interiorly through sleeve 92 to the first set of check balls 98, which unseat against the pressure of springs 100. But the fluids cannot bypass the second set of balls 98 seated against retaining sleeves 102. Thus fluid must pass out through the respective ports 108 into drill passages 80 for delivery to the discharge duct 82. Mixing of the two liquid components thus takes place primarily in this discharge duct. However some intermixing of the liquid components inherently occurs upstream of discharge duct 82 and downstream of the inlet check balls 98 at the termination of each spraying operation. It is important therefore that this region be flushed periodically with solvent to prevent clogging of the gun. Such flushing is accomplished by opening needle valve assembly 30 to allow aolvent to be introduced into the inner ends of bores 76 and to retainers 102, to unseat the respective outlet check balls 98, providing acess of the solvent to the tangential ducts 80 and outlet passage 82. For interim servicing maintenance this is sufficient; but where the gun will not again be used for an extended period of time, or where a change in reactive components is made, it will usually be necessary to perform a more thorough cleaning of the gun. In the design here disclosed, this is greatly facilitated by the cartridging of the check valve assemblies, since the removal of these and the plugs 84 will provide a very free access to those regions of the passages in the gun where any contact between the reactive liquids is likely to occur. Further access to the interior can be obtained by removing plugs 84 from lateral bores 78, which is particularly helpful in gaining access to the tangential feed ducts 80.

The spray gun illustrated in FIGS. 10 through 13 is of generally similar construction, but is modified to provide for remotely controlled actuation of the component flow valves and solvent purge valve instead of the manual operation of these required in the foregoing example.

Gun 210, like its counterpart 10, is composed of a main body 212 having complementary front and rear sections 214, 216, respectively, similar to the corresponding components of the previously described unit. In fact the front section 214 of the gun, including nozzle 226 is identical and interchangeable with the corresponding section 14 and nozzle 26 of the unit described above. Also this second embodiment uses ball type flow control valves 240 and cooperating annular seals 242, corresponding to the same parts of the first described unit. However, in place of the manual arrangement for actuating flow valves 240, the present unit employs a remotely controlled actuator arrangement. In like manner purge valve 230 is remotely controlled through an actuator instead of manually. The operator controls for both of these operations are provided on handle 218 which is attached to the gun body 212. Finger button 224 on the forward face of the handle, when depressed, causes actuation of the flow control valves 240, while depressing thumb button 225 at the rear face of handle 218 operates solvent control valve 230.

Referring to FIGS. 10–13, each flow valve ball member 240 is provided with a socket 254 within which there is keyed a stub shaft 256. Each shaft 256 projects downwardly from its respective ball member in spaced parallel alignment to the other shaft, extending into a chamber 251 formed in the lower portion of rear body section 216 of the gun. The shafts are carried in separate bearing blocks 258 which also act as retainers to maintain the shafts in engagement with the respective ball members 240. Blocks 258 are mounted in chamber 251 by any suitable means, such as machine screws. A pinion gear 253 is keyed to the depending free end of each shaft, and a slide 260 is mounted for reciprocation between pinions 253. The opposite side faces of the slide are formed to provide toothed racks 255 which engage with the respective pinions, causing them to rotate as the slide is moved forward and backward. Slide 260 is centrally apertured to provide an elongated guide slot 257 which receives a roller 252 journalled on a headed retaining screw 259. Retaining screw 259 is tapped into the roof of chamber 251 of the rear body section 216, the head being oversized with relation to guide slot 257 to retain the slide but allow it to be reciprocated. Thus slide 260, upon being reciprocated between stub shafts 256, rotates the ball members 240 between open and closed positions.

Reciprocation of the slide 260 is accomplished by a conventional air actuator 241 whose plunger 243 is secured to the slide. Operation of the slide is controlled by a commercial three-way air valve 245 mounted in handle 218, and is controlled by finger button 224. Air supply under pressure is introduced by duct 247 to the valve, and on depressing trigger button 224 pressure is transmitted from the valve by duct 249 to actuator 241. Actuator 241 is of the spring-return type, and operating air pressure is therefore exhausted back through duct 249 to atmosphere on release of button 224.

A similar arrangement is provided for controlling purge valve 230. Thumb button 225 at the rear of handle 218 actuates a cartridge valve 228 in the gun handle. Air under pressure is supplied to this valve, also by means of duct 247, and duct 229 leads from the valve to air piston 263 located in the upper portion of the rear section 216 of the gun body.

As best seen in FIG. 13, piston 263 is received in a bore 265, making a sliding fit therein, and an air inlet passage 235 in body section 216 communicates the rear face of piston 263 with air supply duct 229. Piston 263 has a stepped cylindrical stem 267 projecting axially from the piston head, of which the outer length 269 is of reduced diameter. This reduced section 269 is telescopically received in the forward end of a spring-loaded needle valve assembly. The assembly consists of a needle valve member 266 shouldered to engage a compression spring 271 retained in bore 273 of the housing by plug 275 which also serves to close that end

of the bore. An identical plug is located in the opposite end of coaxial bore **265.** Needle valve **266** carries on its nose a Teflon tip **277** having a fusto-conical surface. Bore **273** in the spray gun housing is formed to provide a valve seat **279** against which valve tip **277** is normally held by spring **271.** A drilled passage **262** intersects bore **273** upstream of seat **279,** while another drilled passage **274** intercepts the bore downstream of the seat. Passage **274** corresponds to duct **74** of the embodiment seen in FIGS. **3** and **7,** leading to the forward body section of the gun housing contaiing the double-acting check valves. Solvent is supplied by a flexible line terminating in nipple **222** threaded into a socket at the rear face of the gun into which passage **262** leads. Solvent pressure tending to unseat needle valve **266** is opposed by spring **271,** maintaining the seating of valve tip **277** against seat **279** under normal conditions. However, upon depressing thumb button **225** of the spray gun, air pressure is introduced to the rear face of piston **263,** overcoming the pressure spring **271** and opening needle valve **266** to permit passage of solvent into duct **274.**

A further modification of the spray gun is shown in FIGS. **15–19,** in which a toggle is used to provide actuation of the flow control valves. The toggle arrangement gives somewhat greater mechanical advantage than the rack and pinion embodiment described in the preceding spray gun design, thus affording the advantage of requiring smaller actuating forces. In addition, a positive air-actuated return is employed for the flow valve actuation, in place of the spring-biased return arrangement previously discussed. Finally, a more compact gun body design and arrangement for connection of supply lines to the gun is provided to make for easier handling of the gun by the spray operator.

Referring to FIGS. **15–17,** a spray gun **310** again consists of main body **312** having complementary front and rear sections **314, 316,** respectively, similar to the corresponding components of the previously described design. Flow control valve **340,** corresponding to the ball valves previously described, control entry of reactive polymer components which are supplied under pressure to sockets **320** at the rear face of the gun by flexible hoses and suitable couplings (not shown). In order to obtain an initial balancing of initial supply pressures of the respective components of the polymer mix, bleed passages **319** are bored to intersect each socket **320** and a plug **321** is threaded into each passage. Either plug **321** can be partially removed at the start up of operation to allow the pressure of the component in that supply line to be brought into balance with the other. An unbalanced pressure condition will tend to cause mixing and foaming of the reactive components too far ahead of the discharge nozzle.

Actuating stems **356** of the respective ball valves **340** are secured to the valves in the same manner as previously described and are journalled in bearing blocks **358** to project downwardly in spaced alignment into chamber **351** of housing section **316.** Within chamber **351** a toggle link **353** is secured to each stub shaft. Each link has an elongated slot **355** adjacent its free end, and such end of each link is disposed to intersect and overlap the other, as best seen in FIGS. **18** and **19.** Links **353** are interconnected by pin **352** which passes through slots **355.** Pin **352** in turn is carried by a clevis **360** secured to plunger **343** of air actuator **341,** and is guided in a track **355** formed in housing **316.** Reciprocation of plunger **343** produces simultaneous pivoting of shafts **356** through the lost motion toggle connection provided. The leverage arrangement is such that good mechanical advantage is obtained, enabling an air actuator **341** of small size to be employed.

Control of air actuator **341** is effected by a double-acting air valve **345** incorporated in the upper portion of handle **318** of the gun. Air valve **345** is manually operated between ON and OFF positions by trigger buttons **324** at the back face of the handle where they can be conveniently controlled by the spray operator's thumb. Air pressure supply from flexible hose (not shown) is connected into the gun at socket **347** at the upper rear face of handle **318,** and makes internal connection to valve **345.** Duplicate sets of internal passages **349, 350** (of which one set can be seen in FIG. **15**) are formed in handle **318** and gun body **316,** respectively. Such passages terminate at the rear face **317** of the gun body on either side of a central boss **319** on which air actuator **341** is mounted, as seen in FIG. **17.** Connection is made between the termination of ducts **350** and the opposite sides of the actuating piston of actuator **341** by external air lines **348.** Thus actuator **341** is positively actuated in each direction under the control of buttons **324.**

Control of introduction of solvent to the interior of gun **310** is essentially identical with that described in connection with the proceeding embodiment, except for rearrangement of the air operated solenoid valve and associated ducts to dispose these below, rather than above, the ball type flow control valves. A spray gun of lower profile and greater compactness is thus obtained, making it less tiresome for the spray operator to manipulate over extended periods of operation.

In this instance, the solvent supply line is connected into gun **310** at socket **322** from a flexible supply hose, not shown, at the rear face of handle **318** above trigger buttons **324,** and laterally adjacent sockets **347** for the air supply. It will thus be seen that the flexible hoses needed to supply the polymer mix components, solvent and air can be concentrated in a cluster when connected into the gun. Less tangling of the lines and greater ease of manipulation of the gun by the operator is thus obtained.

Control of solvent injection to the gun is provided by trigger button **325** at the forward face of handle **318.** This controls a single acting air valve **328** which is connected internally of the gun handle to air supply socket **347.** Air output from valve **328** passes internally of the gun handle to solvent control valve **330.** This is mounted, as best seen in FIG. **16,** in the upper central portion of handle **318,** at the forward side thereof. Ducting **323** (FIG. **17**) internally of the handle connects solvent supply inlet **322** with solvent valve **330,** and an internal passage **364** (FIG. **15**) in the body of handle **318** interconnects with a further series of internal passages **374, 386** in the respective body sections **316, 314** at the several interfaces of the body members and handle. O-ring seals are provided at each interface. Passage **386** leads to the upstream side of solvent check valve **398.** Solvent valve **330** is identical with its counterpart described in connection with gun **210,** and admits solvent to the interior of bore **370** between the check valves. This area is communicated, as previously described, with discharge nozzle **326.**

In place of the cartridged check valve assembly of the type illustrated in the foregoing designs, the assembly

here consists of separate ball valves **398** held against opposed seat members **397** by compression spring **396.** Opposed closure plugs **395** are removably threaded in opposite ends of the check valve chamber in the housing to provide access for replacement or other maintenance.

The foregoing illustrates presently preferred sepcific embodiments of the novel combination of features in design of the gun. It will be apparent that other modifications can be made that are not essential to the novel combination as defined in the appended claims, and such modifications and equivalents are also therefore intended to be comprehended by the claims.

What is claimed is:

1. A spray gun for admixing reactive liquids and discharging the admixture as an atomized spray, which comprises a gun body and handle means therefor; a mixing chamber in said body and ducts formed in said body for separately receiving said reactive liquids from an external source and conducting them to said mixing chamber; a discharge orifice in said gun body which communicates said mixing chamber to atmosphere; a flow control valve chamber interposed in each of said ducts and forming at the points of intersection an inlet and an outlet in said flow control valve chamber, a variable position control valve disposed in each such chamber, each such control valve comprising:

a. a ball member, a bore extending through said ball to form opposed ports, at the points of intersection with its surface, registerable with said inlet and outlet of said valve chamber;

b. operating means for said ball;

c. seating means for said ball, comprising a pair of annular seals, one each disposed about said duct inlet and outlet, and being disposed to embrace said ball surface in concentric alignment respectively with said opposed ports therein in the open position of said control valve;

said gun including means interconnecting said ball operating means for simultaneous rotary displacement of said ball members to positions of respective non-alignment of said ports and annular seals; said gun body comprising a composite structure including a pair of complementary blocks, and means securing said blocks together in face-to-face relation wherein the abutting faces define a parting plane disposed substantially perpendicular to the axis of said discharge orifice, said plane intersecting each of said reactive liquid ducts in said body, one of said blocks carrying said handle means and being counter-bored in its aubtting face concentrically with said ducts to provide said control valve chambers; said discharge nozzle being mounted in the exposed end face of the other of said body blocks.

2. A spray gun as defined in claim **1,** wherein lever means are provided for interconnecting said ball stems, said lever means comprising a hinged yoke forming an operating lever depending from said gun body generally coextensive with said handle, and means for biasing said lever away from said handle.

3. A spray gun as defined in claim **1,** which further includes check valve means located in each said reactive liquid duct between said flow control valve and said discharge orifice, said other body block having sockets opening onto a lateral face and extending inwardly thereof generally parallel to said parting plane, each of said sockets respectively transversely intersecting a reactive liquid duct to form internal inlet and outlet means for said socket, said inlet and outlet being displaced axially along said socket, and means for removably retaining said check valve means in each said socket to close the open end thereof.

4. A spray gun as defined in claim **3,** wherein said check valve means each comprises a cartridge type double-acting check valve assembly removably received as a unit in said socket, each such check valve assembly comprising:

a. a hollow sleeve member open at its inner end and closed at its outer end;

b. annular seals making fluid tight fit with the socket wall on either side of said socket outlet, and adjacent the outer end of said sleeve;

c. ports formed in said sleeve member between each of two adjacent annular seals, a first of said ports communicating the interior of said sleeve member with said socket inlet and a second of said ports communicating the interior of said sleeve member with said socket outlet;

d. a first check member positioned interiorily of said sleeve member intermediate said socket inlet and outlet and biased in a direction to prevent flow through said sleeve to said socket inlet, and a second check member positioned interiorily of said sleeve member intermediate said socket outlet and the inner end of said sleeve member and biased in a direction to prevent flow through said sleeve member to the inner end thereof, said first and second check members straddling said socket outlet and said second sleeve port.

5. A spray gun as defined in claim **4,** which further includes flushing solvent ducting in said gun body for introducing solvent from an external source and conducting it to the inner ends of the respective check valve sleeve members, and a flow control valve located in said solvent ducting.

6. A spray gun as defined in claim **1,** wherein said operating means for said ball comprises a non-circular socket let into the surface thereof, and projecting stem means in non-rotative engagement with said socket; said operating stems being disposed to project in spaced parallel relation to each other, and actuating means disposed between said projecting stems and operatively interconnecting them to effect rotation of said ball members; and remotely controlled piston means connected to said actuating means.

7. A spray gun as defined in claim **6,** wherein said actuating means for said ball members comprise pinion gears on said stems and reciprocable rack means positioned between and in operative engagement with said pinions.

8. A spray gun as defined in claim **6,** wherein said actuating means for said ball members comprises toggle means interconnecting the stems of said ball members and reciprocable plunger means having a lost motion connection to said toggle means.

9. A spray gun for admixing liquid components and discharging the admixture as an atomized spray, which comprises a gun body; a mixing chamber in said body and ducts formed in said body for separately receiving said liquid components from an external source and conducting them to said mixing chamber; a discharge orifice in said gun body which commmunicates said mixing chamber to atmosphere; blind bores let into said gun body from an exterior surface thereof to form

check valve chambers, one each such bore intersecting each of said liquid component ducts to form an inlet and an outlet for said bore spaced axially therealong;

a cartridge type double-acting check valve assembly removably received as a unit in each of said bores and closing the outer ends thereof, each such check valve assembly comprising:

a. a hollow sleeve member open at its inner end and closed at its outer end;

b. O-ring seals forming fluid tight fit between said bore on either side of said bore outlet and adjacent the outer end of said sleeve;

c. ports formed in said sleeve member between each of two adjacent O-rings, a first of said ports communicating the interior of said sleeve member with said bore inlet and a second of said ports communicating the interior of said sleeve member with said bore outet;

d. a first check member positioned interiorily of said sleeve member intermediate said bore inlet and outlet and biased in a direction to prevent flow through said sleeve to said bore inlet, and a second check member positioned interiorily of said sleeve member intermediate said bore outlet and the inner end of said sleeve member and biased in a direction to prevent flow through said sleeve member to the inner end thereof, said first and second check members straddling said bore outlet and said second sleeve bore; and solvent flush ducting formed in said gun body for introducing solvent from an external source and conducting it to the inner ends of said sleeve members in said bores.

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