United States Patent

Higgins

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[54] PLASTIC FOAM SPRAY GUN WITH SUBSTANTIALLY INSTANTANEOUS CLEANING FEATURE

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[51] **Int. Cl.** **B05b 15/02**

[58] **Field of Search**.....239/399, 400, 401, 403, 405, 239/407, 408, 413, 416.1, 416.5, 417.3, 417.5, 428, 433, 112, 583, 414, 422

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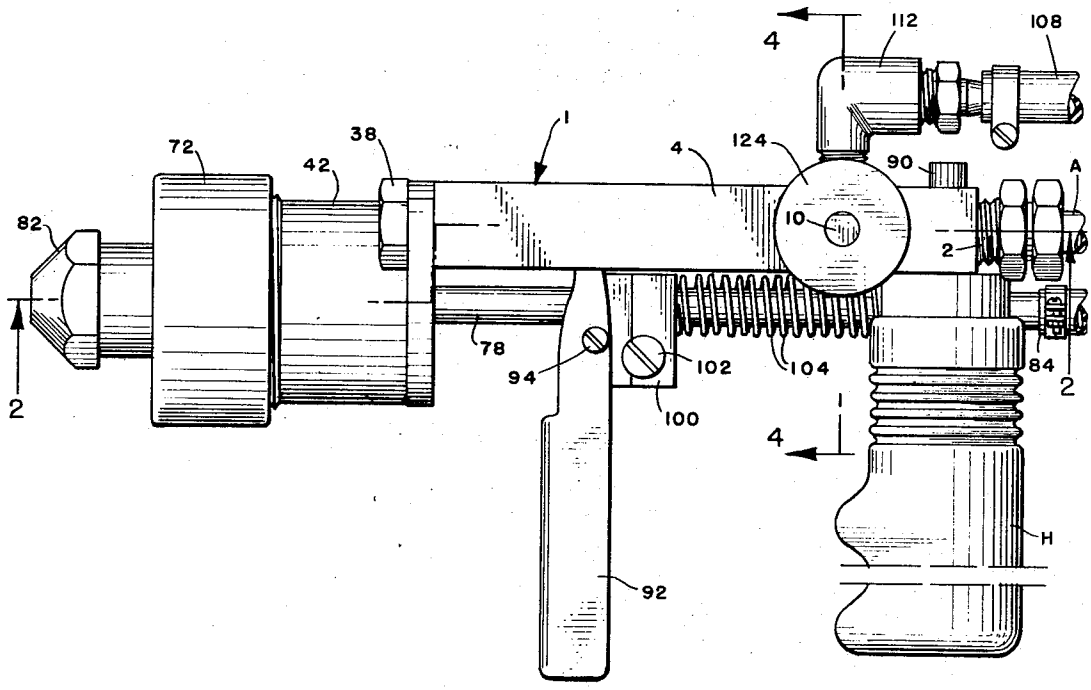
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[57] **ABSTRACT**

A plastic foam forming and spraying system which utilizes a spray gun that mixes resins and a catalyst in a mixing chamber substantially at the discharge end thereof. Provision is made for instantly cleaning the gun of the catalyst and resin mixture by passing a solvent therethrough to clean the mixture from the interior passages of the gun, and clean the outlet passages thereof by directing air and a solvent, under pressure, therethrough. A special valving arrangement enables the valves to direct a solvent into the passages without permitting the fluid to come into contact with the threads.

9 Claims, 7 Drawing Figures



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SHEET 1 OF 2

FIG. 1

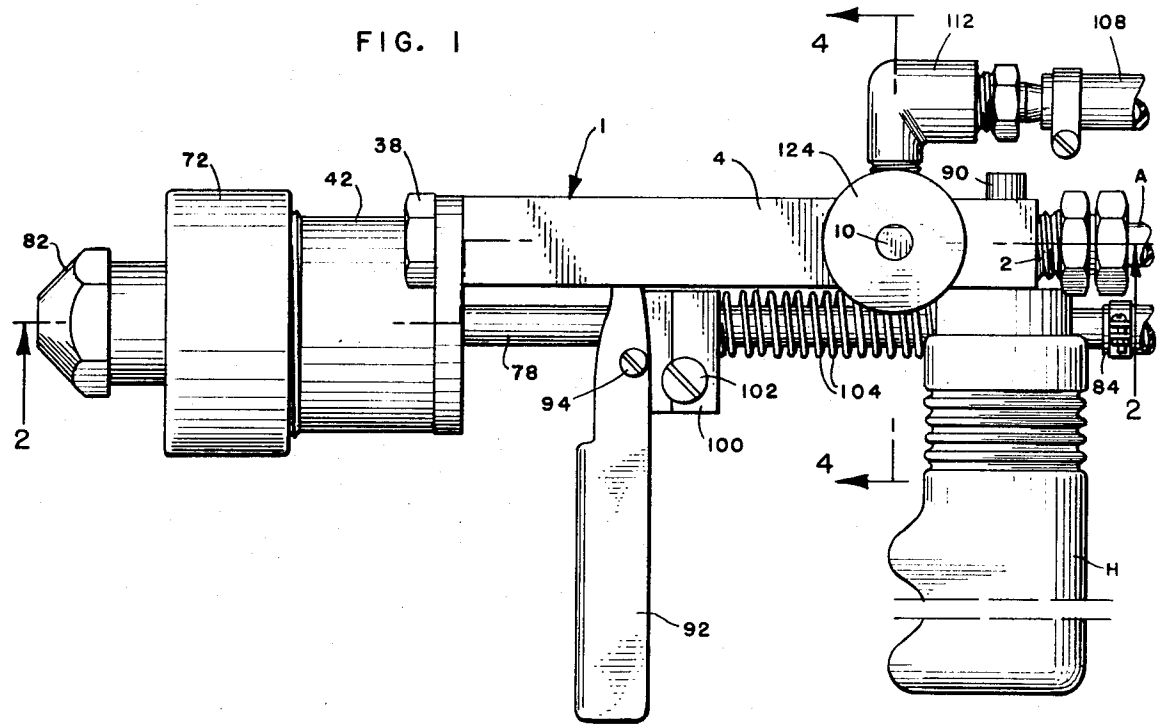
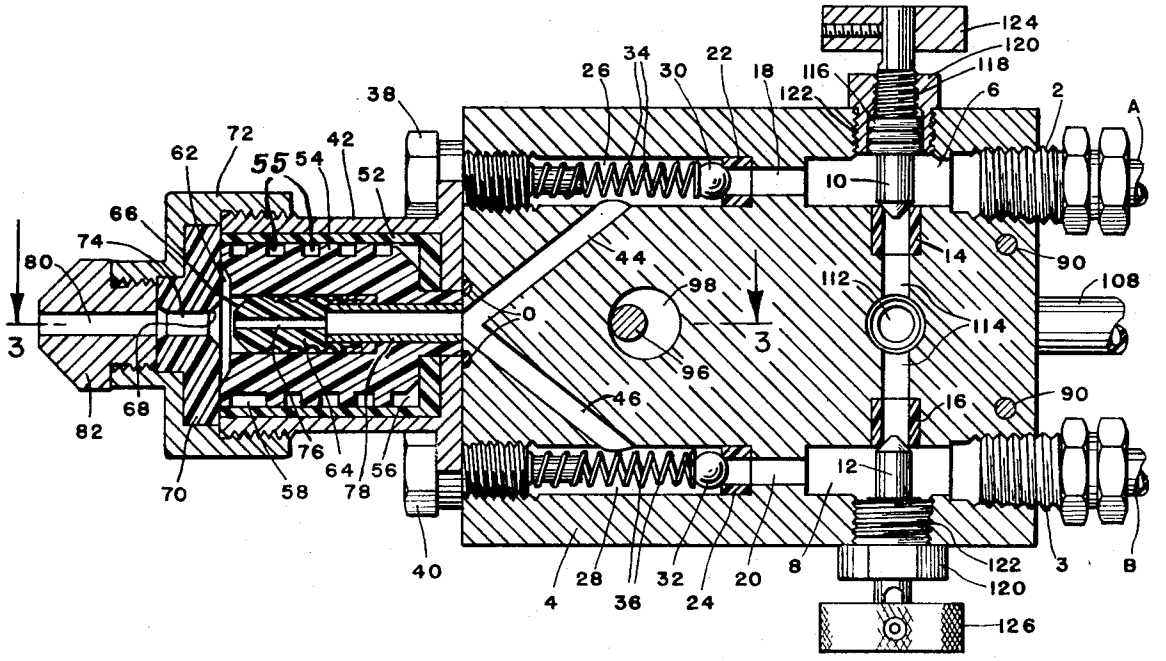


FIG. 2



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FIG. 3

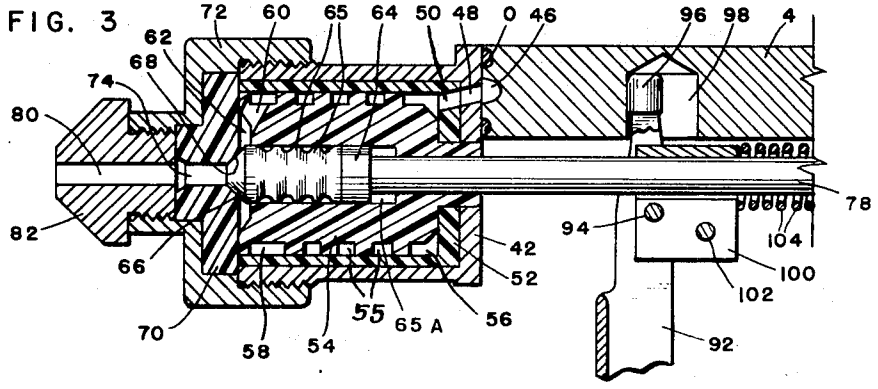


FIG. 4

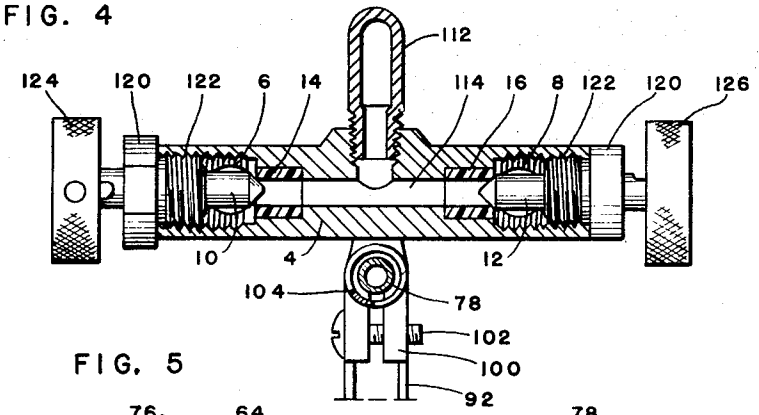


FIG. 5

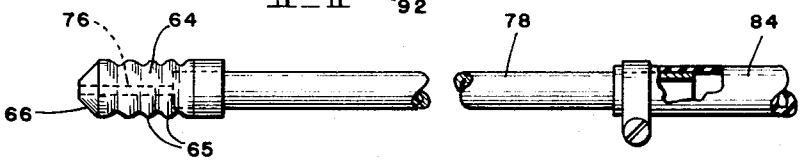


FIG. 6

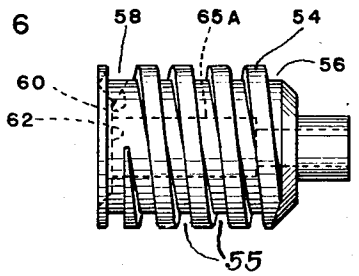
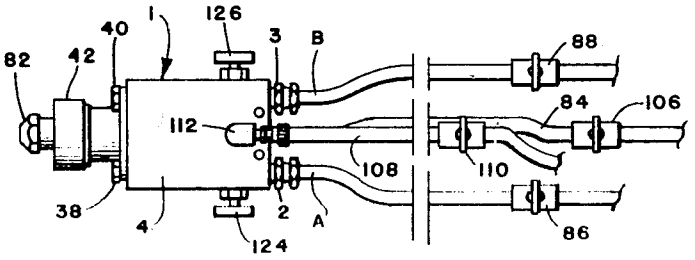


FIG. 7



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PLASTIC FOAM SPRAY GUN WITH SUBSTANTIALLY INSTANTANEOUS CLEANING FEATURE

BACKGROUND OF THE INVENTION

Various spray guns have been proposed heretofore for mixing and expanding resins into foam, by action of a catalyst and air. These, for the most part, required especially high pressures on the resin and catalyst, often pressures as much as 600 to 800 lbs. were necessary to produce expanded foam of the desired quality. This necessitated exceedingly high pressure pumps, special hose, special fittings and guns, which rendered the system quite dangerous to work around. The guns, for the most part, required dismantling after each application of foam, in order that the gun be cleaned of all material to prevent the material from hardening. Therefore, the time for operation compared with the time for cleaning the machinery made short runs of the foam unprofitable.

SUMMARY OF THE INVENTION

The present invention is so constructed that it can be used at a relative low pressure for converting resinous material and a catalyst into an expanded foam and still obtain satisfactory results. The present invention also enables the cleaning of the gun instantaneously without dismantling, thereby requiring less get ready time and quicker cleaning time.

OBJECTS OF THE INVENTION

An object of the invention is to provide a spraying device for mixing internally, within a mixing chamber adjacent the discharge nozzle in the spraying device, a plurality of materials supplied from separate sources of supply and for discharging these through a common nozzle in the form of expanded foam.

Another object of the invention is to provide a spraying system which includes a spray gun for receiving, from independent sources, a resin, an accelerator and air to form a foaming mass in a mixing chamber adjacent the discharge nozzle of the system to be discharged from the nozzle thereof.

A further object of the invention is to provide a cleaning system for cleaning the resins and catalysts, before and after they have become mixed and after they have become mixed, from the spraying device without having to dismantle the spray gun.

Still a further object of the invention is to provide a foam spraying device that is light in weight, easy to assemble and disassemble, low in the cost of manufacture and which will operate over a long period of time with a minimum of maintenance.

BRIEF DESCRIPTION OF THE DRAWINGS

With these objects in mind and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings, in which like reference characters designate like parts in the several views thereof, in which:

FIG. 1 is a side elevational view of the spray gun for converting a resin, a catalyst and air into an expanded plastic foam;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1, looking in the direction indicated by the arrows;

FIG. 3 is a fragmentary sectional view, taken on the line 3—3 of FIG. 2, looking in the direction indicated by the arrows;

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 1, looking in the direction indicated by the arrows;

FIG. 5 is a side elevational view of the regulating valve, showing an air hose attached to the tube, with a portion of the tube being broken away and shortened;

FIG. 6 is a side elevational view of a spiral unit to form a mixing chamber for mixing the expanded, foamed resin and catalyst; and

FIG. 7 is a top plan view of the spray gun for mixing and expanding the resins by catalytic action, showing the hose leading therefrom.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With more detailed reference to the drawings, the numeral 1 designates generally a spray gun used for mixing resins with a catalyst component and air to produce a foaming action to expand the plastic resin into a foam, as the foam flows from the spray gun.

Various foam spray guns have been proposed heretofore, but these, for the most part, were hard to clean, when the spraying of foam ceased. However, the present spray gun and system utilizes resin and catalyst conduits A and B, which may be in flexible hose, which hose A and B are connected to the spray gun 1, as will best be seen in FIGS. 2 and 7.

It is preferable to have constant pump pressure both on the plastic and on the catalyst, which resin and catalyst are known to the trade as compound A and compound B. Therefore, equal pressure is maintained on conduit A and conduit B, so as to direct plastic resin and catalyst components into the gun 1 through fittings 2 and 3 formed in the body 4, which fittings 2 and 3 pass fluid into openings 6 and 8 in gun 1. The passages 6 and 8 are sufficiently large for the stems of the respective valves 10 and 12 to pass therethrough and seat on the respective seats 14 and 16, which seats are made from a plastic, such as teflon or other plastic which does not react to the resin or to the catalyst being pumped through passages 6 and 8. The passages 6 and 8 are each reduced in size, within body 4, as indicated at 18 and 20, so the respective valve seats 22 and 24 fit within the outer portions 26 and 28 of the respective openings 6 and 8, which form passages, which will permit the seats 22 and 24 to pass therethrough and shoulder at the inner end of the respective passages 26 and 28. The respective valve members 30 and 32, which may be balls which form check valves, which balls are seated on the respective seats 22 and 24. The balls are held in the desired seated relation by the respective springs 34 and 36. The springs are held in place by the respective cap screws 38 and 40, which cap screws perform the functions of holding the removable spray head, designated generally by the numeral 42, in place, and of holding the springs 34 and 36 against the respective ball valves 30 and 32. Cap screws 38 and 40 also serve to plug the portions 26 and 28 of the passages 6 and 8, so as to maintain these in fluid tight relation.

The body 4 has holes 44 and 46 cross drilled thereinto, which holes intersect within the body 4, and connect with the respective passages 26 and 28. The

respective holes 44 and 46 converge into a common passage 48 in spray head 42. An O-ring seal surrounds openings 44, 46 and 48 to form a seal or gasket between the spray head 42 and the body 4. The passage 48 interconnects with a passage 50 which is within plastic liner 52 of the spray head 42. A spiral member 54 is fitted within cylindrical plastic liner 52, so, as the fluid flows from passage 50 into an annular chamber 56, the resin and the catalyst pass around the spiral mixing chamber 55, as best seen in FIG. 6, and is discharged into a second annular chamber 58, at the opposite end of the spiral member 54. Whereupon, the resin and catalyst flow through a passage 60 in the spiral member 54, into a chamber 62 which surrounds the end of a sliding valve member 64, which valve member 64 has a tapered valve face 66 to complementally seat within bevel seat 68 in plastic valve seat member 70 which is fitted within screw cap 72 on spray head 42. The sliding valve member 64 has a plurality of annular sealing ridges formed therearound, which ridges have rounded tops to perform a sealing action with the bore 65A of the spiral member 54. This sliding valve member is made of plastic, such as nylon or teflon or other plastic which is not subject to chemical action by the resin and catalyst components passing thereby. The plastic valve seat member 70 has an axial opening 74 therein, which opening is in register with an opening 76 within sliding valve member 64.

When the valve face 66 seats on said bevel seat 68, the air within tube 78, which tube is connected to hollow valve member 64, passes out through passage 74 and through passage 80 in the tip 82 of the spray nozzle. A flexible conduit or hose is attached to the tube 78 in fluid tight relation, yet it will permit sliding action of tube 78 so that the valve face 66 may be moved relative to seat 68 to permit the entrance of the resin and the catalyst components, which have been mixed in the mixing chamber 62, and into passage 74, whereupon, the air passing through tube 78 is mixed with the catalyst and resin, which causes a foaming action which expands the mixture into foam, such as polyurethane form or other foams, which are subject to catalytic action with a resin, which foam is discharged out through passage 80 into the desired container, or onto the desired surface.

The present spray gun, depending on several factors, will operate at various pressures and it has been found that it will operate with air pressure as low as 25 pounds, with plastics and catalyst being directed into the gun at pressures from 60 to 180 pounds. The present gun may be made to operate on much higher pressures, such as 600 and 800 pounds, but it will perform satisfactorily on lower pressures, thereby obviating the danger of bursting the hose and other equipment, which might result in injury to an operator and in loss of equipment.

The respective conduits A and B have the respective valves 86 and 88 therein to enable the resin and/or catalyst to be closed off from the gun, when desired. These valves may be located near the gun or at the pump, (not shown) as desired. A handle H is secured to the body 4 of the gun 1 by cap screws 90, to enable the spray gun 1 to be gripped in the hand. A trigger 92 is pivotally mounted on a screw or pin 94, for pivotal action of the trigger. The upper end of the trigger is rounded at 96, as indicated in FIGS. 2 and 3, and extends into a recess 98 in the body 4, so as to furnish a fulcrum for the trigger 92. A clamp 100 surrounds tube 78 and is held in binding relation thereto by a clamp screw 102, as will best be seen in FIGS. 3 and 4. By securing the clamp 100 at the desired place on tube 78, the trigger 92 will open the valve 66 the desired degree to control the flow of foam from the passage 80. A spring 104 surrounds the air tube 78 and is fitted intermediate the clamp 100 and the handle H so as to return the tube 78 and valve face 66 of valve 64 into seating relation on seat 68.

The normal air pressure, of about 25 lbs., is maintained on hose 84 by a compressor (not shown). A valve 106 is provided within the conduit system intermediate the spray gun 1 and the source of air pressure.

A conduit, such as a flexible hose 108, having a valve 110 therein, is connected to a fitting 112 on body 4, as will best be seen in FIGS. 1, 2 and 4, which fitting 112 connects with a cross drilled passage 114 in body 4 for introduction of a cleaning solvent into the gun at the completion of the spraying. In this manner, the gun can be cleaned substantially instantaneously without dismantling, and be ready for a subsequent spraying operation.

The valves 10 and 12 are unique in that each has O-ring sealing elements 116 intermediate the fluid being controlled by the valve and the threads 118 of the respective valves 10 and 12, which will prevent leakage of fluid into the threads which might harden therein and thereby render the valve useless. The threads 118 are within the respective packing glands 120, which packing glands each have threads 122 thereon so that the gland and valve may be removed, repaired and/or replaced with a minimum of disruption to the system. Furthermore, the valve seats 14 and 16 may be easily removed and replaced by removing valves 10 and 12. The valves 10 and 12 control the admission of a cleaning solvent, such as acetone, into the passages 18 and 20, and by utilizing the pressure on the hose 108, the acetone will flow by ball check valves 30 and 32 and will cleanse the springs 26 and 28, passages 44 and 46, and will pass into the common passage 48 and into passage 50 on the same course as followed by the resins and catalysts, thereby to cleanse the annular and spiral mixing chambers, as well as the passages 60, 74 and 80.

The valves 10 and 12 have the respective control knobs 124 and 126 thereon for controlling the flow of solvent to the respective passages 18 and 20.

OPERATION

The foam spraying gun, as shown in FIGS. 1 and 7, is supplied with well known foaming agents which, to most suppliers, are known as compound A and compound B, which are the necessary resins and a catalyst or catalysts to cause an instant reaction, which, when mixed in certain proportions, together with air which is admitted to the mixture through the opening 76 in the valve member 64 of spray gun 1, will create foam of various densities which may be directed into molds or onto a surface as a coating, to foam an insulation or for other purposes. FIG. 7 illustrates a spray gun to which a plurality of hose are attached, four in the present instance, two for admitting the respective compounds A and B through the respective hose A and B and for ad-

mitting air through hose **84**. The compound A passes from hose A into passages **6** and **18** and beneath spring pressed ball valve **30** into passage **26** and thence into passage **44**. Simultaneously, preferably at the same pressure, compound B passes from hose B into passages **8** and **20** beneath spring pressed ball valve **32** into passage **46**. Both the compounds A and B, which are primarily resins and catalysts, are liquid until after they reach the juncture of passages **44** and **46**. The liquids then pass through passages **48** and **50** into annular mixing chamber **52**, whereupon the pressure on hose A and B, together with the pressure re created by the catalyst expanding the mixture, the material is directed around spiral mixing grooves **55** to thoroughly mix the components A and B. The mixed components move into annular mixing chamber **58** at the end of the spiral grooves **55** and thence through passage **60** into a chamber **62**, which chamber surrounds valve face **66** that is complementally seated on seat **68** in plastic valve seat member **70**. Upon movement of trigger **92** rearwardly, which trigger is attached to air tube **78** by clamp **100**, the air tube moves the valve face **66** away from seat **68** which permits the mixture of compounds A and B to flow outward between the bevel faces of valve face **66** and seat **68** and with air being discharged outward through tube **78** and passage **76** in the valve **64**, the expanded plastic material is admixed with air, the resulting foam being discharged out through passage **74** and discharge opening **80** in nozzle **82**.

The trigger **92** is pivotally mounted by pin **94** on clamp **100**, which trigger has the upper end thereof rounded, as indicated at **96**, to extend into a recess **98** in body **4** and upon pulling the trigger **92** rearward, the clamp **100** will urge the round portion **96** thereof into engagement with a side of recess **98** to compress spring **104** which will permit the valve face **66** to be moved from the bevel seat **68** to cause the spraying or foaming action. Upon release of trigger **92**, the spring **104** will cause the valve face **66** to seat on the bevel seat **68**, as will best be seen in FIG. **3**.

A conduit **108** is connected with a source of acetone or other desirable solvent, under pressure, and directs the solvent through the fitting **112** into the body **4** of the spray gun, as will best be seen in FIGS. **1**, **2** and **4**. Valves **10** and **12** seat on the respective seats **14** and **16**, to normally prevent the acetone or other solvents from escaping into passages **6** and **8**, however, when it is desired to clean the spray gun, either the pumps which furnish the pressure to conduits A and B are stopped, or valves **86** and **88** are closed, or both operations are performed. This will cause compounds A and B to cease flowing through passages **6** and **8**. Then, upon opening valves **10** and **12**, the acetone will pass through passages **6** and **8**, **18** and **20** into passages **26** and **28** and through passages **44** and **46** to flow through openings **48** and **50** into annular chamber **56**, thence through spiral grooved mixing chamber **55** into an annular chamber **58** and out through passage **68** into chamber **62**. With the valve **64** open, the solvent will be discharged between the bevel face **66** of the valve **64** and the bevel seat **68** and thence out through passages **74** and **80**, which will cleanse the gun of compounds A and B from passages **6** and **8** and through passage **80** of the nozzle of the spray gun. It requires only a few seconds to accomplish this operation, which enables the cessation of work immediately, without the task of dismantling the entire gun and cleaning the individual parts and reassembling these between each operation. While this device has been described somewhat in detail with respect to foamed resins and a catalyst, it is capable of mixing any type of materials, where thorough mixing at the nozzle is needed.

The present foam spraying gun will operate on equal pressures of 60 to 180 lbs. on the compounds A and B, when making polyurethane foam, with 20 to 25 lbs. air pressure. While this device has been described somewhat in detail relative to polyurethane foam, it is to be understood that it is the mixing of the components within the discharge nozzle and being able to clean the discharge chamber and passages substantially instantly, with a solvent, regardless of what materials are used so long as the solvent admixes with the material being used in conduits **6** and **8** and can be discharged under pressure, which are some of the novel features of this device.

I claim:

1. A spray gun for converting a plurality of fluids into an expanded foam, which spray gun comprises:

a. a body,
   1. said body having a plurality of passages formed therein,
   2. conduits connected with said respective passages for directing fluids, under pressure, into and through, said body,
   3. a spray head connected to said body, which spray head has a passage formed therethrough,
   4. said passage in said spray head being in fluid communication with said passages in said body,
   5. said spray head having a mixing chamber formed therein,
   6. said spray head having a discharge opening formed therein, which opening is in fluid communication with the passage in said spray head,

b. two of said passages in said body converging into said mixing chamber in said spray head to direct two fluids thereinto for intimate mixing thereof,

c. a valve member slidably mounted in said spray head,
   1. said valve member having a longitudinal passage formed therethrough,
   2. said valve member closing the discharge opening in said spray head, when in one position, to keep said first mentioned fluids from passing therethrough,
   3. said sliding valve member being movable longitudinally to permit said first mentioned fluids to escape from said mixing chamber, and

d. a tube connected to said sliding valve member in axial relation, and being slidable therewith, for directing a further fluid therethrough and through the axial opening of said sliding valve member to simultaneously mix with said first mentioned fluids to form an expanded foam.

2. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim **1**; wherein

a. said mixing chamber extends spirally within said spray head,

b. a discharge nozzle is mounted on said spray head, and

c. said discharge nozzle has an axial opening formed therein, which opening is in fluid communication with said chamber in said spray head, when said sliding valve member is open.

3. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim 1; wherein

a. said valve member is mounted within said spray head for longitudinal movement therein,

1. said valve member having an axial opening formed therethrough,

b. said spray head having a valve seat which is in fluid communication with the axial opening in said nozzle, and

c. said sliding valve member being adapted to seat in complementary relation on said valve seat, when in one position to simultaneously close the passages leading from said body.

4. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim 1; wherein

a. said spray head has a first annular chamber formed therein, which is said mixing chamber, which chamber is in fluid communication with said converging passages in said body,

b. said spray head having a spiral chamber formed therein, which spiral chamber is in fluid communication with said annular chamber,

c. said spray head having a second annular chamber formed therein, which second annular chamber is in fluid communication with said spiral chamber, and

d. the discharge opening in said spray head being in fluid communication with said annular chamber when said sliding valve member is open.

5. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim 1; wherein

a. a further of said passages within said body is interconnected with said first two mentioned passages,

b. a conduit connected to said further passage in fluid communication, through which conduit a solvent is directed, under pressure, into said further passage, and

c. valve means within said passage to selectively control the flow of solvent into and through said first two mentioned passages and through said spray head for cleaning said passages and for cleaning the chambers of said spray head and the discharge opening thereof.

6. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim 5; wherein

a. said valve means includes two valves in axial alignment, which pass through the respective first two mentioned passages and seat in said further passage, and

1. control means on each said valve to open and close said valves.

7. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim 5; wherein

a. check valve means is positioned in each said two first mentioned passages to direct the flow of fluid in said passages in one direction only.

8. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim 3; wherein

a. a handle is mounted on said spray gun,

b. a flexible conduit is connected in fluid communication with said tube on which said sliding valve member is mounted, which tube extends longitudinally of said body, and

c. a trigger pivotally connected to said tube and to said body and being mounted a spaced distance forward of said handle for manual operation so said trigger will move said tube and said sliding valve member longitudinally of said spray head to control the discharge of foam from the discharge opening of said spray head while said trigger and said handle are manually operated.

9. A spray gun for converting a plurality of fluids into an expanded foam, as defined in claim 8; wherein

a. a spring surrounds said tube and is interposed in abutting relation between said handle and said trigger to move said tube longitudinally to seat said sliding valve member on said valve seat in said spray head, when said sliding valve member is in one position.

* * * * *