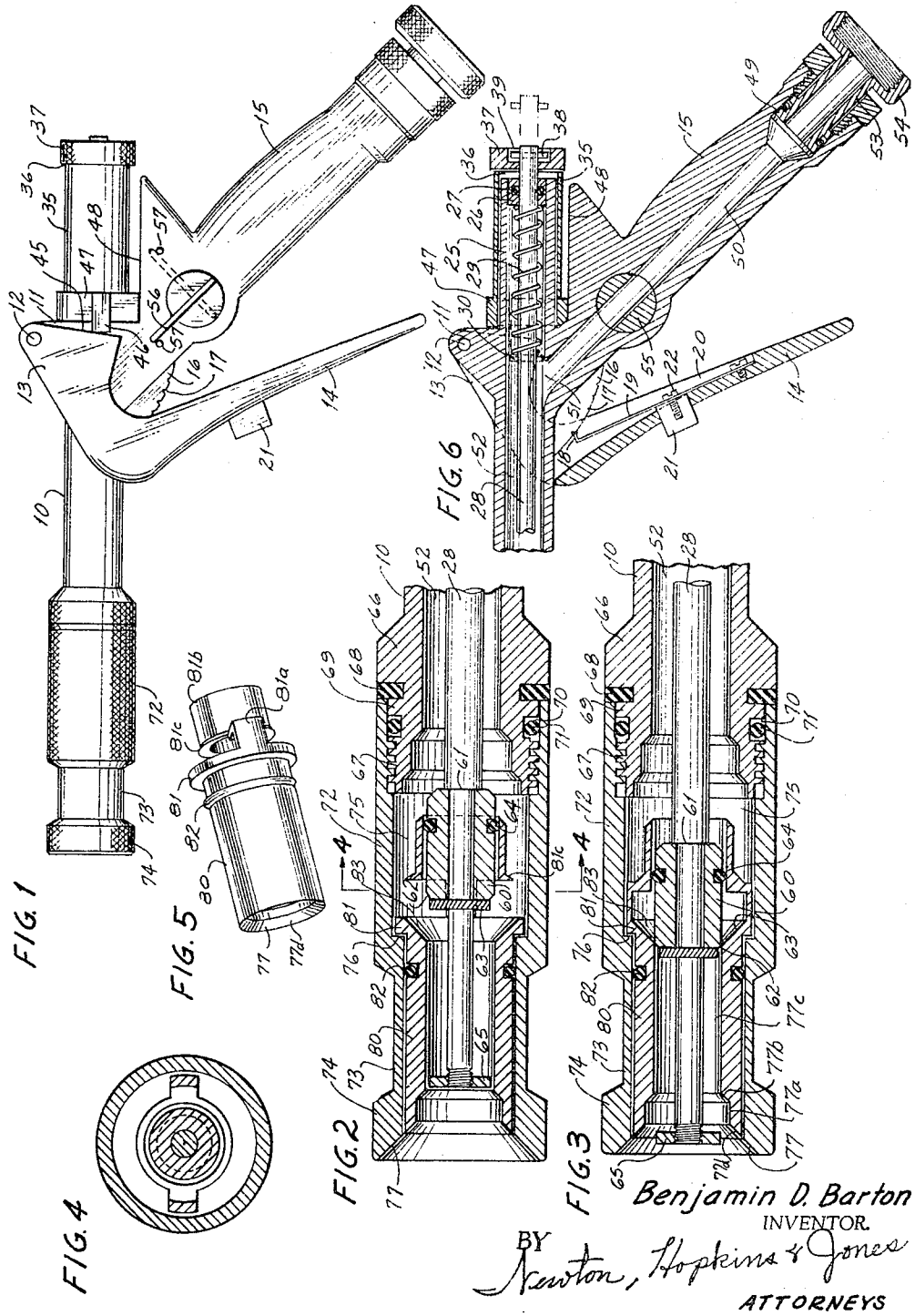
Nov. 1, 1966 B. D. BARTON 3,282,511

SPRAY GUN FOR FIRE APPARATUS AND THE LIKE

Filed June 30, 1964 2 Sheets-Sheet 1



Benjamin D. Barton
INVENTOR.
BY Newton, Hopkins & Jones
ATTORNEYS

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FIG. 7

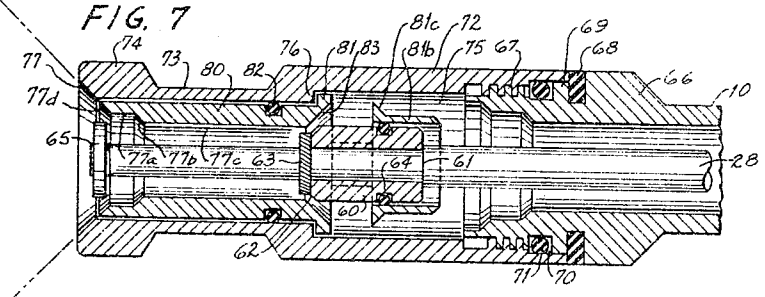


FIG. 8

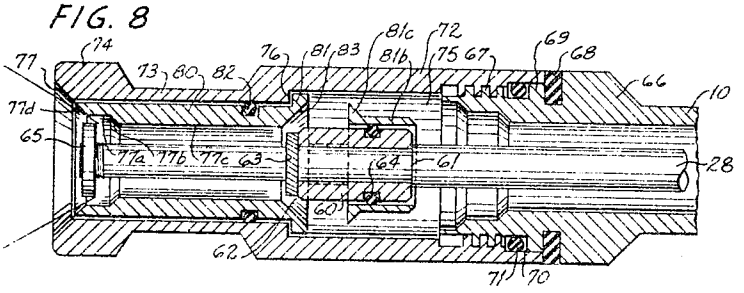


FIG. 9

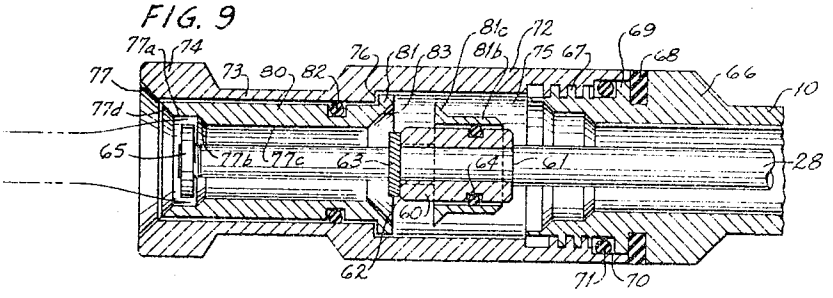


FIG. 10

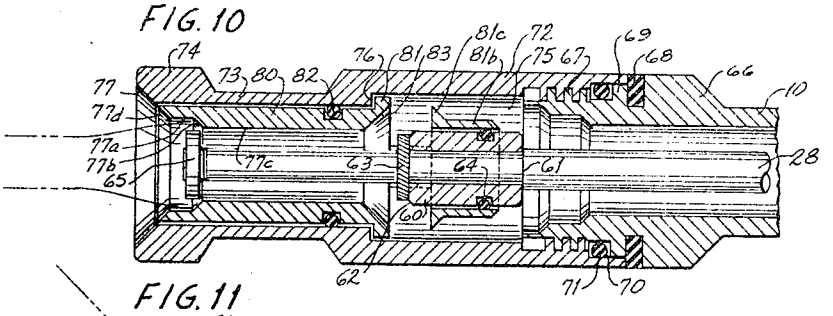
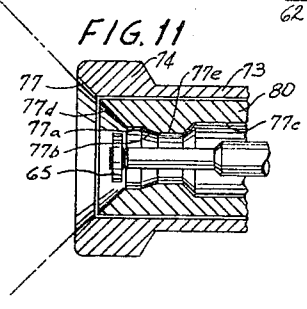


FIG. 11



Benjamin D. Barton
INVENTOR.

BY Newton, Hopkins & Jones
ATTORNEYS

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SPRAY GUN FOR FIRE APPARATUS AND THE LIKE

Benjamin D. Barton, 2626 Rose St., Sarasota, Fla.

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3 Claims. (Cl. 239—459)

This invention relates to spray guns for fire apparatus and the like, and the invention partakes of certain objects, features and advantages set forth in my prior patents, 2,520,824, issued August 29, 1950; 2,609,239, issued September 2, 1952; 2,621,076, issued December 9, 1952; and, 2,681,831 issued June 22, 1954. The present invention is an improvement over said prior patents, which are herewith incorporated by way of reference to provide for a comparative consideration of the state of the prior art, the trend of developments in this field and to emphasize the distinguishing features and improved construction and operation of the present invention. This application is a continuation-in-part of my prior filed copending application, Serial No. 226,826, filed September 28, 1962, now abandoned, Spray Gun for Fire Apparatus and the Like.

Of primary concern with respect to the design, construction and assembly of liquid discharge nozzles in general, and particularly of the type hereinbefore set forth, is simplicity of construction and assembly with due regard for effective and efficient operation, as well as economy of manufacture. Among problems not heretofore solved to complete satisfaction, is that of achieving a single nozzle, easily controlled means for effecting a multiple variety of discharge patterns and volumes. In this respect prior art devices have failed to provide positive volume control functioning independently of pattern variations. A further problem arises where swirl elements are employed, to affect the type and character of spray pattern, with respect to means for effectively withdrawing the swirl element from the liquid flow path or diverting the fluid flow from effective contact with the swirl element when its effect is not required or may be objectionable. Problems are also encountered with respect to structural features such as effective and efficient intermediate guidance or bearing for valve rods or stems. The provision of separable or individually constructed nozzle elements for both simplicity and economy of manufacture as well as to provide facility of assembly, inspection and repair, particularly where the nozzle may include a valve seat, heretofore has not been entirely satisfactory.

Another problem is the provision of a construction and arrangement of parts such that the nozzle may be readily disassembled for cleaning, inspection, and repairs, preferably without the use of tools, and without the necessity of disconnection of the nozzle from its normal source of pressure liquid. A further problem which has received the attention of professional engineers and designers in this field, is that of providing means for draining liquid from the nozzle and/or the hose through which the liquid is normally supplied to the nozzle, so as to free the same from entrapped liquid which may freeze and prevent normal operation and/or injure the internal parts of the device. In the present device, these problems have been solved without resorting to undue multiplicity of parts, delicacy of construction, excesive manufacturing cost, or sacrifice of effective and efficient operation over a long serviceable life.

Thus, it is among the primary objectives of the present invention to provide a device of the character set forth, simple in construction and operation, readily controllable to provide a wide variety of types of flow, both as to volume and spray pattern, easily dismantled for cleaning or the like without the use of tools, capable of being readily drained after use, and providing a robust structure capable of long life of utility without sacrifice of efficiency or effectiveness, while providing for economy of manufacture.

It is further among the important objects of the invention to provide a dual diameter flow passage under the control of a single element whereby alternative flow volumes may be readily selected. It is also an object of the invention to provide a swirl element and means for rendering such element ineffective when a straight stream is desirable. Another object is to provide novel, simple and relatively stationary guide means for the movable elements of the combination. Numerous other objects, features and advantages of the present invention will be apparent from a consideration of the following specification, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevation of one presently preferred form of the present invention;

FIG. 2 is a vertical longitudinal section of the front end of the barrel illustrating a fully retracted position of the valve, swirl producing element and diffuser with the valve set to produce a straight unswirling stream of minimum flow volume;

FIG. 3 is a view similar to FIG. 2, illustrating a horizontal section of the front end of the barrel with the valve in fully closed position;

FIG. 4 is a transverse section through the forward end of the barrel taken on the lines 4—4 of FIG. 2.

FIG. 5 is a perspective view of the dual passage nozzle element of the device;

FIG. 6 is a central vertical section through the grip trigger liquid supply end of the device;

FIG. 7 is a view similar to FIG. 3 showing the valve in its initial opening position whereby the nozzle produces a swirling wide angle fog;

FIG. 8 is a view similar to FIG. 3 showing the valve in further retracted position from FIG. 7 whereby the nozzle produces a swirling fog of lesser angle than produced by the valve position of FIG. 7;

FIG. 9 is a view similar to FIG. 3 with the valve further retracted from the position of FIG. 8 whereby the nozzle will produce a straight unswirling stream of maximum volume and distance;

FIG. 10 is a view similar to FIG. 3 with the valve further retracted from FIG. 9 to produce a straight stream of intermediate volume and distance; and,

FIG. 11 is a view similar to FIG. 9 illustrating the double dissimilar internal diameters to accommodate a flow of lesser volume than that for which the nozzle configuration of FIGS. 3 through 10 are designed.

Concerning the accompanying drawings and the detailed description of the structure and operational characteristics of the present device, it will of course be understood that while the invention is primarily intended for, and is referred to, as a "spray gun for fire apparatus and the like," numerous inventive features herein set forth, are broadly applicable to nozzles intended for a wide variety of uses, both as to spray and solid streams, and that the inventive concepts herein disclosed are not necessarily limited to fire fighting apparatus. Further, with respect to the present construction, it will be understood that the specific details of design are disclosed by way of generally indicating one preferred embodiment of the inventive concepts and that such concepts are capable of broad application without being constricted to slavish adherence to details of design.

Generally speaking, the present invention may be broadly defined an including a body, presenting a straight elongate hollow fluid flow barrel, preferably formed with a convenient hand grip and valve control trigger, the grip being conveniently formed integral with the barrel as by

single casting. One feature of the trigger mechanism is the provision of means for retaining the trigger in a predetermined position without requiring constant pressure on the trigger by the operator. Within the barrel and protruding through the head portion of the grip, there is provided a spring urged valve rod with readily releasable means retaining the rod under spring tension. This arrangement is such that the rod may be readily withdrawn from the barrel to facilitate disassembly for inspection, cleaning or repairs. Another feature of the valve rod is the provision thereon, at an intermediate point, within an extension of the barrel or nozzle housing of a valve body rigidly secured to the rod for movement therewith, together with a fluted swirl producing element preferably secured to the front face of the body. At the outer end of the rod a diffusing disc is mounted for controlling both spray patterns and flow volumes dependent upon the relative position of the rod with respect to the nozzle. A sealing O-ring is fitted between the nozzle and housing.

Referring now to the drawings, it will be seen that the physical structure of that form of the invention herein shown by way of example, includes a long, straight, hollow barrel **10**. At the rear portion of the barrel **10** there is provided a preferably integral upstanding transversely apertured boss **11**. Through the transverse aperture of the boss **11**, there is provided a pivot pin **12** protruding on either side of the boss to receive the upper furcated end **13** of an elongate trigger **14**. On the under side of the barrel, slightly forward of the boss **11** and engaging the upper forward face of the hand grip **15**, there is provided an arcuately faced latch plate **16**. The arcuate face of the latch plate is provided with spaced notches **17**, adapted to receive and retain the inturned latch tooth **18** of a spring latch **19** mounted within the inner hollow portion **20** of the trigger. Protruding forwardly through an aperture at a generally mid-portion of the trigger, there is provided a latch engaging operator **21** secured by a screw **22** to the latch **19**. This arrangement is such that when the trigger is depressed to control a desired position, the member **21** may be depressed to force the latch **19** inwardly by which movement the tooth **18** will engage a registering notch **17** in the member **18** to retain the trigger in a selected position. It will be understood that the latch member **19** is normally out of the path of contact with the member **16** so that the latch will not be engaged unless the member **21** is depressed, but when depressed and engaging with the notch, it will be retained in that position though the trigger be released since the trigger is under spring tension biasing it to full forward position representing a closing of the nozzle valve. Thus, after engagement by the latch member, should the trigger be subsequently depressed because of counterclockwise pivotal motion, the latch will be released from the notch and thus returned to its normal position out of contact with the plate **16**, so that the trigger may thereafter be actuated at will.

Rearwardly of the boss **11** of the barrel, there is provided a hollow extension **25**, closed at its outer end by a fixed internal centrally apertured closure plug **26**, which mounts a sealing O-ring **27** through which the valve rod **28** of the gun is slidable. The valve rod is biased towards a forward position by a spring **29** bearing against the front face of the member **28** at the rear thereof and forwardly engaging a transverse pin **30** extending through an intermediate rear aperture of the rod **28**, as more clearly shown in FIG. 6. Thus the spring **29** is confined witthin the rear extension **25** of the barrel.

Slidably mounted over the rear extension **25** of the barrel there is provided a cylinder **35**, the rear open end **36** of which is engaged by a centrally recessed and apertured terminal stop block **37**. The terminal end of the rod **28** is transversely apertured to receive therethrough a pin **38**, which is normally received in the recess **39** of the stop block **37**, and is yieldably retained therein by the pressure of the spring **29**. However, when it is desired to fully disassemble the gun, the valve rod **28** may be forced rearwardly against the force of the spring **29**, thus forcing the rear terminal end outwardly from the stop block to the dotted line position of FIG. 6, in which position a transverse pin **38** may be withdrawn to permit the rod to be completely dissambled by forward motion in the barrel.

For moving the valve rod **28** in response to inward depression of the trigger, there is provided at the upper pivotal bifurcated end of the trigger, parallel pairs of substantially vertical camming surfaces **45**, which surfaces contact the forwardly spring urged cylinder **35** through the medium of cam bosses **46**. The bosses **46** are mounted on a forward laterally extending head **47** of the cylinder **35**. The lower face of the head **47** is preferably flattened to be supported upon and slide over a rearwardly extending guide shelf **48** of the grip **15**. Thus it will be seen that with the trigger **14** in relaxed position, the valve rod **28** is urged to its full forward position under the force of the spring and with the stop block engaging the outer end of the member **35**, and that when the trigger is depressed the cam engagement thereof will force the cylinder **35** rearwardly against the force of the spring **29** to retract the valve rod **28**.

The grip **15** is formed with an axially extending bore **50** through which the liquid to be discharged from the nozzle passes, and which therefore communicates as at **51** with the internal bore **52** of the barrel **10**. The outer end of the grip **15** is counterbored as at **49** and is internally threaded to receive the external threads of a generally conventional coupling, which coupling receives therethrough a relatively rotatable hollow sleeve **53** of an internally threaded member **54** to which a conventional hose may be threadedly engaged. Intermediate the ends of the grip there is provided a rotatable auxiliary valve **55** to be operated by a projecting plate **56**, motion of which is limited by stops **57**. It is, of course, to be understood that the specific coupling and the specific auxiliary valve herein referred to are presented merely by way of illustration, the invention being in no way limited to the suggested structures of either.

Fixedly mounted on the valve rod **28**, intermediate the ends thereof, there is provided a valve body **60** of generally cylindrical outer configuration and secured against a shoulder **61** of the valve rod. The forward end of the valve body **60** is provided with a frusto-conical valve surface **62** and seated against the forward face of the valve body there is provided an externally fluted swirl-producing element **63**. At the rear end of the body **60** there is provided a groove to receive therein a flexible O-ring **64**. It will be noted that a slight clearance is provided between the body **60** and the inward extension of the nozzle **80** at cylindrical portion **81***b*. The O-ring **64** serves as a spacer which bridges this clearance to accommodate relative movement of the nozzle with respect to the valve plug, thus to provide a more positive alignment of the parts of greater accuracy than can be obtained by manufacturing methods with metal to metal contact. At the extreme forward end of the reduced front portion of the valve rod, there is mounted a diffusing plate **65**. For purposes of assembly and adjustment the plate **65** may be threadedly engaged on the end of the rod. However, it is to be understood that the plate will be fixedly secured in permanent position after suitable adjustment is provided in the original assembly.

The forward end of the barrel **10** is formed with a head **66** externally threaded as at **67**. The forward face of the head **66** forms a seat for a stop ring **68** which is retained in position by a flange **69**. Forwardly of the flange **69** between the threads **67** and the flange **69** there is provided a groove **70** in which is mounted an O-ring **71**. Threadedly engaging the outer end of the barrel **10** there is provided an exterior nozzle housing **72** preferably of exterior knurled configuration to provide ease in threadedly connecting and disconnecting the nozzle section of the barrel **10** by manual manipulation without requiring

the use of the tools. The outer end of the nozzle housing is reduced forwardly of the rear knurled section, as at **73** and its extreme end is enlarged and knurled as at **74** to further facilitate the manual disassembly of the housing from the body **10** for thread adjustment with respect thereto without the use of tools. The inner configuration of the nozzle housing forms an enlarged fluid chamber **75** forwardly of which the internal diameter of the nozzle housing is reduced to provide an internal rearwardly facing shoulder **76**. The outer end of the nozzle housing is flared outwardly as at **77**. The angularity of the flair at the end of the nozzle housing is not critical. It is to be noted, however, that a variation of this angularity will have its effect upon the conical angularity of the fogging sprays produced by the relative position of the parts illustrated in FIGURES 7 and 8. Within the nozzle housing there is provided an internal cylindrical nozzle **80** which includes an outwardly extending shoulder **81** which is seated against the internal shoulder **76** of the nozzle housing.

An important feature of the invention is that the nozzle is of an external diameter slightly less than the internal diameter of the forward portion of the nozzle housing and a resilient O-ring **82** encircles the forward cylindrical portion of the nozzle to engage the internal wall of the forward portion of the nozzle housing, the arrangement being such that the cylindrical nozzle is thus retained in yieldable fashion so that there is permitted restrained movement of the intermediate conical valve seat portion **83** against which the valve surface may seat. The blended lateral movement of the valve seat by this construction insures a firm seating of the valve, compensating for expansion or contraction, wear, and eliminating the need for precise fits which might otherwise increase manufacturing costs and assembly techniques. Rearwardly of the valve seat **83** the valve nozzle is extended by provision of a cutaway housing extension terminating in a reduced cylinder, which fits over the valve body and engages the O-ring **64**. The inner portion of the nozzle **80** inwardly beyond the shoulder **81** is formed with rearwardly extending diametrically opposed fingers or spiders **81***a*, the rear terminals of which extend inwardly to secure a rear cylindrical portion **81***b* of reduced diameter to engage the O-ring spacer **64** of the valve body **60**. A further important feature of the inward extension of the nozzle is the provision of the outwardly tapered diverting flange **81***c* at the outer end of the extension **81***b* where the fingers **81***a* are joined. This flange is so arranged that as the valve body is withdrawn rearwardly of the nozzle and deep within the reduced cylindrical extension **81***b*, the flange **81***c* acts to divert the liquid flow in a path spaced outwardly from the swirl-producing element **63** and thus, in the relative positions of FIGS. 3, 9 and 10 the stream delivered from the end of the nozzle is a solid central stream without swirl and thus without fogging characteristics.

In the operation of the device, as the trigger **14** is depressed to withdraw the rod **28** rearwardly, the valve **60** opens with respect to the valve seat **83** of the nozzle **80** from the closed position of FIG. 4 to the first or minimum opening of FIG. 7. In this position the fluid is directed by the conical valve seat of the nozzle toward the swirl-producing element **63** which imparts a rotary fog-producing swirl as the fluid passes forwardly in the nozzle. In combination with the inward movement of the rod, the diffusing plate **65** moves toward but does not enter the outer terminal counter bore **77***a* of the nozzle next adjacent its outward flair **77***b*, which latter merges with the surface **77** of the nozzle housing. The combined action of the swirl-producing element and the impingement of the swirling fluid against the inner face of the diffuser produces a wide angled fog. The effect of this fog is to form an umbrella-like protection with a central axis as determined by the position of the gun, thus to protect a fire fighter against the heat and flame as he approaches a conflagration.

From the position of FIG. 7 a further inward movement of the valve rod produces a relation of parts substantially as indicated in FIG. 8. In this position the swirl-producing element is still effective to cooperate with the diffuser in producing a swirling fog. However, it will be noted that the diffuser has now moved into the cylindrical counter bore **77***a*, thus restricting the flow volume and at the same time decreasing the angularity of the conical fog discharge. It is to be noted that with the relation of parts indicated in both FIGS. 7 and 8, the swirl element and the diffuser cooperate in effecting type of discharge. Further, it will be noted that in the action of the device in the positions of FIGS. 7 and 8, the deflector **81***c* is not effective in causing the fluid to by-pass the swirl-producing element as is the case in FIGS. 9 and 10.

FIG. 9 shows the rod more fully withdrawn with the deflector wholly within the cylindrical counter bore **77***a* and with the swirl element almost fully withdrawn from the plane of the valve seat of the nozzle. In this position, the deflector **81***c* imposes an outward path of travel on the liquid, so that its main flow is along the conical valve seat of the nozzle, which does not in this instance drive the fluid toward the swirl-producing element. The deflector, being wholly within the counter bore, spreads the fluid, which after passage thereby unites to form a straight forwardly projecting solid stream of maximum carrying distance and force.

A further withdrawal of the rod produces a similar non-swirling solid straight central stream as indicated in FIG. 10, of intermediate volume, penetrating ability and flight distance. In this instance the deflector has moved inwardly to the plane of the inner conical surface juxtaposed inwardly from the counter bore **77***a*. That relationship of parts depicted in FIG. 3 shows the rod fully withdrawn and with the diffuser in the throat **77***c* of the nozzle **80**, thus producing a minimum volume of flow as a straight central solid stream but with the least volume.

Throughout the various positions of the diffuser with respect to the outer counter bore of the nozzle in FIGS. 3, 9 and 10, it will be noted that the relationship of the diffuser with respect to the counter bore is the sole controlling factor of the volume flow.

FIGURE 11 discloses a design wherein the counter bore **77***a* and the frusto conical area **77***b* are of less diameter than the major barrel **77***c* being provided therebetween. This arrangement is such as to accommodate the device for the use of smaller diameters of fluid supply associated with the coupling **54**.

It will be understood that in the various features of the invention herein set forth, the practice of the invention is not limited nor confined to structural details, and that in the practice of the invention numerous changes, modifications and the full use of equivalents may be restored to without departing from the spirit or scope of the invention as outlined in the appended claims.

What is claimed as invention is:

1. A spray gun for fire fighting apparatus including a nozzle housing defining therein a substantially cylindrical valve chamber, a nozzle member within said nozzle housing defining a valve seat, an integral valve guide, and a fluid flow passage, an operating rod extending through said chamber and into said nozzle member, valve means on said operating rod operatively engageable with said valve seat in response to axial movements of said rod, and a flow pattern control disk on said rod moveable within said fluid flow passage of said nozzle member, said guide maintaining alignment of said valve means with respect to said valve seat and alignment of said flow pattern control disk with respect to said nozzle flow passage despite relative movement of said nozzle housing and said nozzle member, whereby movement of the flow pattern control disk within the passage of the nozzle with movement of said valve means will alter the flow pattern as the valve means is moved to approach and recede from

said valve seat, thus providing coordinated volumetric flow control and flow pattern control.

2. The spray gun as set forth in claim 1 in which a swirl producing element is fixedly mounted on said operating rod in juxtaposition in advance of said valve means for cooperation with said valve seat to induce a swirling motion to liquid delivered by said gun as the valve body approaches said valve seat.

3. The spray gun as set forth in claim 1 in which the fluid flow passage of the nozzle member defines co-axial bores of dissimilar diameter each greater than the diameter of said fluid flow pattern control disk and in which said

disk is moved with said rod and valve body through and from said bores in its pattern control responsive to movements of the valve means with respect to said valve seat.

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EVERETT W. KIRBY, *Primary Examiner.*