

# United States Patent

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[56]

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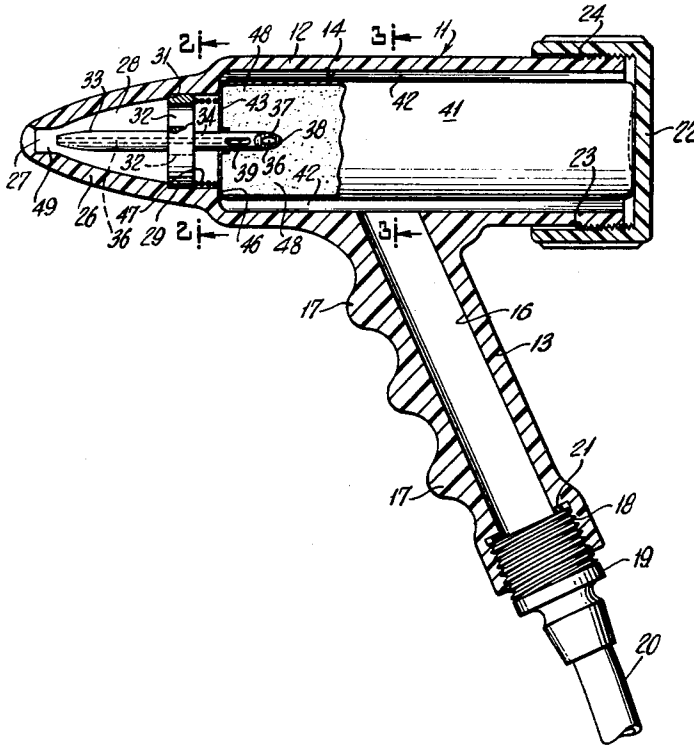
[54] **SPRAY GUN WITH REPLACEABLE CARTRIDGES**  
 13 Claims, 8 Drawing Figs.

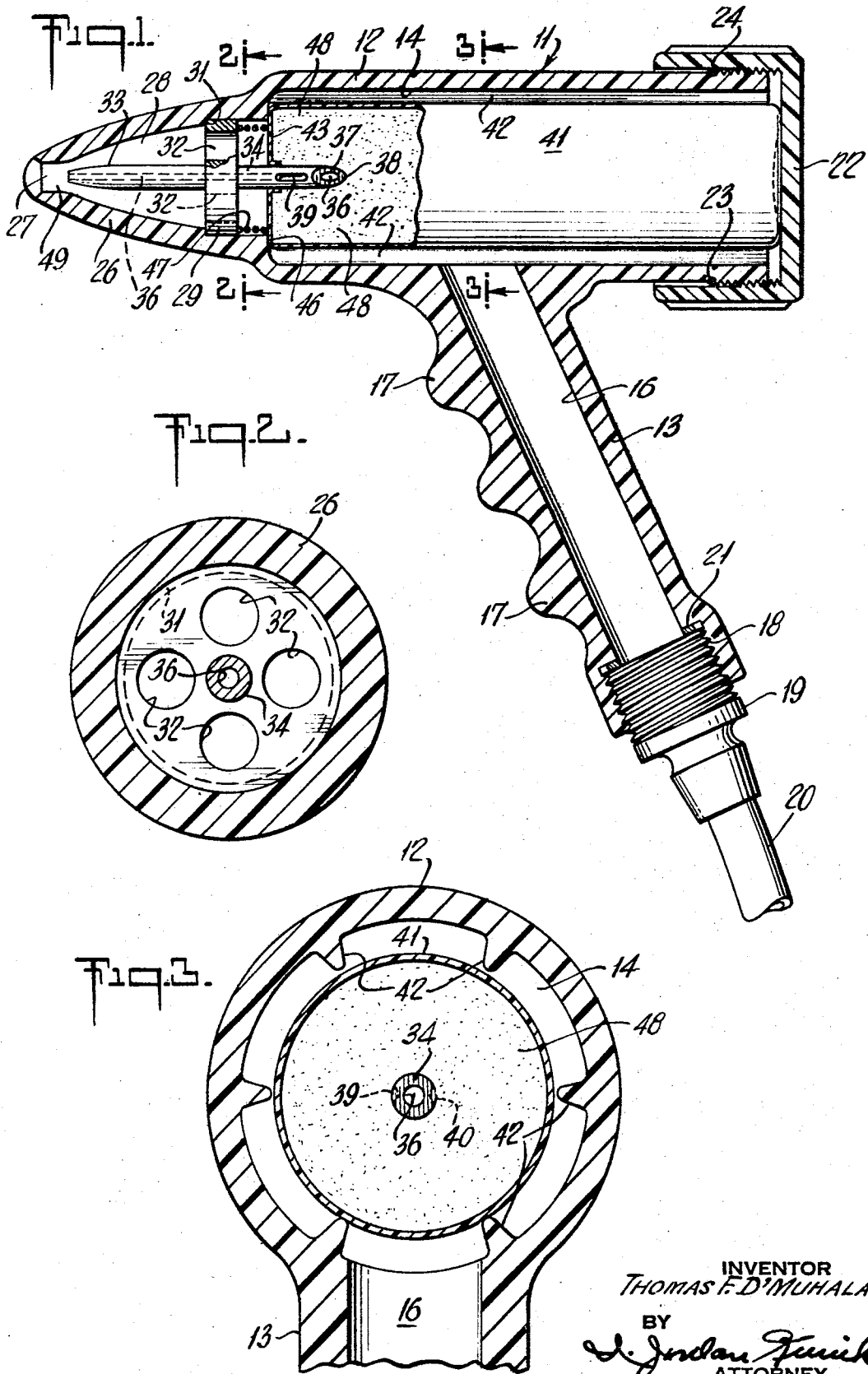
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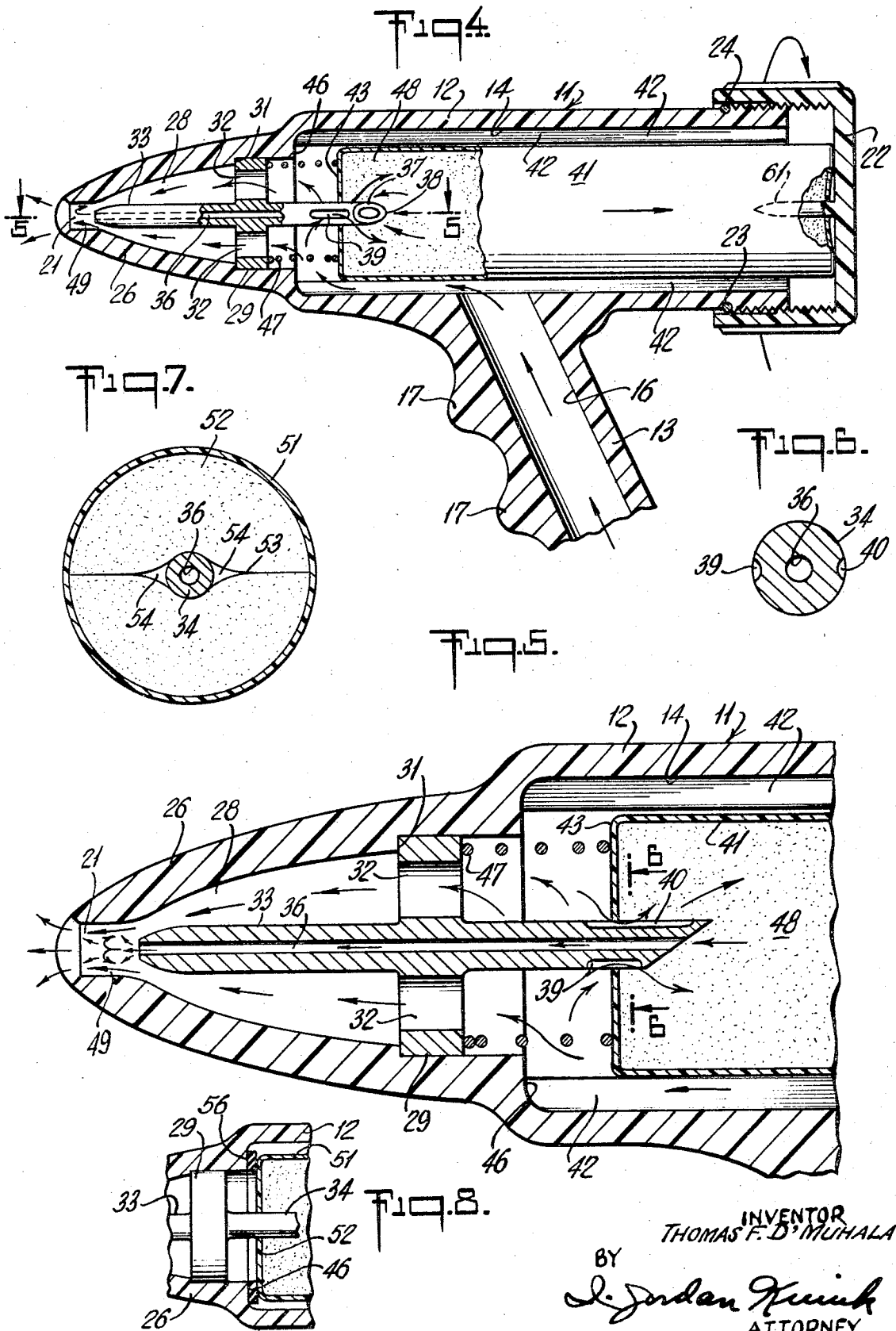
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**ABSTRACT:** A handheld spray gun accommodating a removable cartridge insert and a combined aspirator-piercing element for piercing the cartridge and permitting the contents thereof to flow by aspirating means through the nozzle of the spray gun when water under pressure is transmitted through said spray gun.





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## SPRAY GUN WITH REPLACEABLE CARTRIDGES

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates to spray apparatus and, more particularly, to a handheld spray gun which accommodates removable, pierceable, cartridges containing various types of solids, suspensions, solutions, or other liquids that are suitable for such purposes as fertilizers, weed killers, automobile washing and waxing materials, engine cleaners, concrete and driveway cleaners, and the like. The spray gun is attachable to a source of a fluid medium such as water or gas under pressure whereby the contents of the cartridge are mixed with the water in the nozzle of the spray gun and then emitted upon the object to be treated.

#### 2. Description of the Prior Art

Various types of spray devices, dispensers, and cartridge-piercing devices have been disclosed in the following U.S. Pats., for example: 1,811,572; 1,814,573; 2,337,149; 2,394,415; 2,536,221; 2,593,552; 2,761,562; 2,907,528; 3,162,194 and 3,255,824. None of these patents disclose the combination of features that are embraced within the present invention. Some of the prior art devices are not conveniently held in the hand; other devices are not capable of metering the flow of the contents of the cartridge to a controlled degree; and still other devices do not provide for the proper aspiration of the cartridge contents nor the proper mixing of the cartridge contents with the fluid under pressure before being emitted from the spray gun nozzle.

### SUMMARY OF THE INVENTION

The present invention comprises a nozzled spray gun which removably accommodates a pierceable cartridge with means in the spray gun housing for aspirating the cartridge contents by the action of water under pressure conducted through the spray gun housing. The aspirator-piercing means has a unitary channel which terminates a short distance behind the exit slot of the nozzle whereby the water under pressure is mixed with the contents of the cartridge within the nozzle before it is emitted therefrom. Further means are provided for causing the cartridge body or cap to act as a seal between the cartridge housing portion of the spray gun and the nozzle portion thereof. The cartridge body is pierced by a hollow needle or the like when a threadable cap is closed upon the spray gun housing. The threaded cap urges the cartridge body into the sealing position so that the conveying medium under pressure supplied to the spray gun housing is sealed off from the nozzle portion of the spray gun until the operator chooses to retract the spray gun cap, at which time a spring element causes the retraction of the cartridge from its sealing position. Thereafter, the cartridge contents are aspirated by the action of the medium flowing from the cartridge housing into and through the nozzle of the spray gun. Still further means are provided for equalizing the pressure between the interior and exterior of the cartridge whereby aspiration of the contents of the cartridge is facilitated when the water under pressure flows through the nozzle portion of the spray gun.

By providing replaceable cartridges of uniform size filled with different types of materials, a householder with a single spray gun is enabled to perform a variety of tasks such as fertilizing a garden, weeding a lawn, washing and polishing his automobile, cleaning the sidewalks and driveways, washing aluminum siding, and the like.

Each replaceable, disposable cartridge is filled with a sufficient amount of material that is designed for the particular job and which has a sufficient quantity to fulfill the average householder's requirements. In the case of greater requirements, additional disposable cartridges may be utilized.

The handheld spray gun is made of a strong and tough plastic material that is virtually indestructible and will withstand long usage. The spray gun is conveniently connectable to a garden hose which supplies the water as a medium which is to be mixed with the cartridge contents within the

nozzle chamber of the spray gun prior to discharge through the nozzle slot in the direction in which the gun is pointed by the operator.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical central cross section view, partly in elevation and partly broken away, of one embodiment of the apparatus of the present invention with the cartridge inserted in a position prior to the operation of said apparatus;

FIG. 2 is an enlarged view taken on line 2-2 of FIG. 1;

FIG. 3 is an enlarged view taken on line 3-3 of FIG. 1;

FIG. 4 is a fragmentary view similar to FIG. 1 showing the manner in which the rear cap and the cartridge are in the retracted position for operation of the apparatus;

FIG. 5 is an enlarged fragmentary view taken on line 5-5 of FIG. 4;

FIG. 6 is a view taken on line 6-6 of FIG. 5;

FIG. 7 is an end view of another embodiment of the cartridge and a section view of the piercing element illustrating another embodiment of the invention; and

FIG. 8 is a fragmentary section view of a portion of the device embodying auxiliary sealing means, some parts being omitted.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in detail, there is shown a spray gun, generally designated 11, made of a suitable molded plastic material such as nylon, Bakelite, or the like, said gun comprising a cylindrical housing 12 having a downwardly and rearwardly extending integrally formed tubular handle 13. Chamber 14 of housing 12 communicates with longitudinal channel 16 of handle 13.

The forward external portion of handle 13 is provided with integrally molded, spaced apart rounded bosses 17 to form between them finer recesses to serve as a convenient hand grip for the operator of the apparatus. The interior of the lower end portion of the handle 13 is threaded at 18 to accommodate the correspondingly threaded fitting 19 of a garden hose 20, or the like, for supplying a flow of water under pressure through channel 16 of handle 13 into chamber 14 of housing 12. An O-ring 21 of resilient material such as rubber or the like is provided at the interior end of threading 18 to form a suitable liquidtight seal for the coupling between handle 13 and hose 20.

Where desired or required, it is possible to interpose an adapter, not shown but commercially available, between threading 18 and fitting 19, said adapter incorporating an "on" - "off" valve to permit the operator to shut off or turn on the water supply at will from hose 20.

The rear end portion of housing 12 threadably accommodates a removable circular end cap 22. The outer surface of cylinder housing 12 has an annular recess 23 which accommodates O-ring 24 which provides a liquidtight seal between the interior wall of cap 22 and the surface of cylinder housing 12. The forward end of cylinder housing 12 terminates in an integrally formed tapered nozzle 26 at the outer tip of which is formed a narrow flat slot 27, said slot being aligned either vertically or horizontally, as may be required or desired.

Nozzle 26 encloses an aspirating chamber 28 which accommodates, by friction fit, a support ring 29 whose forward peripheral area bears against an interior annular shoulder 31 formed in the interior of nozzle 26. Ring 29 has at least one or a plurality of apertures 32 which permits fluid to flow from the rear to the forward portion of nozzle 26.

Mounted securely in, or formed integrally with, the center portion of ring 29, is a combination hollow aspirator piercing element, the forward aspirator portion 33 of which extends longitudinally and axially within nozzle 26 and terminates a short distance behind slot 27. The rearward piercing needle portion 34 extends rearwardly toward and partially into chamber 14 of housing 12. Both aspirator 33 and needle 34 have a common longitudinal axial channel 36 that extends

from one end to the other of the aspirator-piercing combination which may be formed of a unitary tube made of aluminum, steel, or other suitable metal or a durable plastic such as nylon. At its rear end, piercing portion 34 has a beveled terminus 37 which provides a sharp needle point 38 whose function will be described hereinafter. The rear portion of piercing portion 34 also has on the surface thereof one or more longitudinal recessed grooves 39 and 40 whose function will also be described hereinafter. See FIG. 5.

Removably accommodated within chamber 14 of cylinder housing 12 is a cylindrical cartridge 14 made of a suitable metal or plastic material such as nylon, polyvinyl chloride, polyethylene, or the like. Said cartridge 41 is axially aligned and spatially maintained within chamber 14 by means of integrally formed, inwardly extending, radially spaced longitudinal centering ribs 42 which are at least three in number. If only three ribs 42 are provided, they are radially spaced approximately 120° apart.

Cartridge 41 may be filled with any one of a number of solids, suspensions, solutions, or other fluid materials, including such substances as waxing products, washing products, lawn fertilizers, weed killers, driveway cleaners, engine cleaners, and automobile cleaners and polishers.

### OPERATION

With cap 22 removed from housing 12, cartridge 41 is inserted into chamber 14 after which said cap is threadably closed to bear against the rear end of said cartridge whereby the latter moves forward in said chamber to the extent that forward wall 43 of said cartridge is pierced by needle point 38 producing an aperture 44 in said end wall that moves over needle 34. The rotation of cap 22 is continued to cause end wall 43 to be urged against annular shoulder 46 formed at the juncture between chamber 14 and chamber 28. The firm abutment of end wall 43, which is somewhat flexible, against annular shoulder 46 provides a liquidtight seal between chamber 14 and chamber 28. By virtue of this liquidtight seal, water flowing up through channel 16 in handle 13 and into chamber 14 will be prevented from entering nozzle chamber 28.

As shown in FIG. 1, piercing needle element 34 substantially seals aperture 44 in the forward end wall of cartridge 41. Cartridge 41 is sufficiently long so that it protrudes at least slightly from the rear end of housing 12 to ensure that it will be engaged by cap 22 to cause the sealing abutment between formed end wall 43 and shoulder 46.

The foregoing operation is performed before water under pressure is introduced from hose 20 into channel 16 of handle 13.

The apparatus is now ready for operation, at which time water under pressure is introduced into channel 16 and thence into chamber 14 of housing 12. The liquidtight abutment of end wall 43 against annular shoulder 46 serves as a closure valve to prevent water in chamber 14 from flowing into nozzle chamber 28.

Thereafter, cap 22 is rotated manually so that it moves rearwardly from housing 12 as shown in FIG. 4. A coil spring 47 encircling needle element 34 is located in chamber 14, one end of said spring bearing against the rear wall of ring 29, and the other end bearing against the forward end wall 43 of cartridge 41. When cap 22 is partially retracted from housing 12, the action of spring 47, previously compressed as in FIG. 1, causes the rearward movement of cartridge 41 (FIGS. 4 and 5), whereby the forward end wall of cartridge 41 becomes located in the region of grooves 39 and 40. A suitable mark may be scored on the outer surface of housing 12 to serve as an index with which the tubular end of cap 22 may be aligned to indicate the extent to which said cap is to be retracted to achieve the result.

Water is now permitted to flow from housing chamber 42 into nozzle chamber 28 and out through nozzle slot 27. As the water flows past the forward end of aspirator element 33 into and through slot 27, the liquid solution or suspension 48 from

the interior of cartridge 41 is drawn through the common channel 36 of needle element 34 and aspirator element 33 by aspirating action. The water and cartridge contents become blended in a mixing area 49 between slot 27 and the forward end of aspirating element 33 after which the mixture is discharged or projected through slot 27 in the direction of the subject to be treated in accordance with the operator's handling of the spray gun apparatus.

Grooves 39 and 40 in piercing element 34 perform the function of equalizing pressure obtaining both on the interior and exterior of cartridge 41 whereby the aspirating action can take place for the flow of the contents 48 of cartridge 41 through channel 36.

In some embodiments, grooves 39 and 40 of needle element 34 may be omitted by utilizing a cartridge 41 that is made of a rigid molded material such as propylene. As shown in FIG. 7, said cartridge 51 has a forward end wall 52 in which is formed a mold line 53 produced by heat sealing or the like. When said mold line 53 is pierced by needle element 34, said end wall is split slightly on said mold line to produce an aperture 54 on one side or both sides of needle 34, which permits pressure equalization to occur between the interior and exterior of cartridge 51 whereby the aspirating action is facilitated.

The embodiment shown in FIG. 7 enables the operator to meter the flow or output from slot 27 of nozzle 26 by determining the extent to which the forward end wall 52 is retracted from shoulder 46 in accordance with the distance to which cap 22 is threadably retracted from housing 12. Thus, the forward end wall 52 of cartridge 51 acts as a valve in relation to annular shoulder 46 which acts as a valve seat, whereby the quantity or speed of flow of water from housing chamber 14 into nozzle chamber 28 and thence through slot 27 is controlled as may be desired or required. The farther that cartridge 51 is permitted to become retracted from shoulder 46, the greater will be the volume and speed of the flow of the spray mixture from nozzle slot 27, assuming sufficient fluid pressure is provided from hose 20.

As shown in FIG. 8, for example, it is sometimes advantageous to provide an O-ring 56 interposed between the forward end wall 52 of cartridge 51 and end wall 46 within housing 12, said O-ring being made of a resilient compressible material such as rubber or the like which will yieldably cooperate with the peripheral area of the forward end wall to provide a liquidtight seal when cap 22 is threadably rotated to cause the cartridge to move towards said shoulder. Said resilient O-ring 56 will serve to conform to any possible irregularity in shape of the forward end wall of the cartridge and of shoulder 46 so that a liquidtight seal will be ensured.

In some embodiments, equalization of pressure between the interior and exterior of cartridge 41 may be facilitated by the incorporation of a needle element 61 mounted on the interior of cap 22. See FIG. 4. By puncturing the rear end of cartridge 41, needle 61 produces a sufficient aperture around its periphery in the rear end wall of said cartridge to provide for equalization of pressure. It is also noted that when needle element 34 punctures the front end wall of cartridge 41, even though there may not be a mold line therein, a sufficient opening is formed in said end wall around the periphery of said needle element to provide for equalization of pressure between the interior and exterior of the cartridge. It is also to be noted that the exit slot or opening 27 may be other than rectangular in shape as, for example, oval or circular, or whatever shape is desired or required to produce the necessary spray pattern emitted by the gun.

Although the present invention has been described with reference to particular embodiments and examples, it will be apparent to those skilled in the art that variations and modifications can be substituted therefor without departing from the principles and true spirit of the invention.

I claim:

1. A spray gun comprising a housing, a nozzle on said housing, an exit slot at the outer end of said nozzle, a cartridge chamber in said housing, a nozzle chamber in said nozzle axi-

ally aligned with said cartridge chamber, an aspirator needle element mounted between said cartridge chamber and said nozzle chamber, said element being axially aligned within said housing and having a unitary axial channel therein, the aspirator portion of said element extending within said nozzle chamber and terminating near said slot, said needle portion extending partially into said cartridge chamber, a threadable cap on the rear end of said cartridge chamber, an annular shoulder formed in said housing between said cartridge chamber and said nozzle chamber, a spring mounted at the juncture between said nozzle and cartridge chambers and extending partially into said cartridge chamber, a tubular cartridge movable longitudinally within said cartridge chamber, said cartridge being urged into firm abutment with said annular shoulder against the action of said spring by the threading engagement of said cap with said housing, said action causing said needle portion to pierce the forward end wall of said cartridge to enter into the interior thereof, and a tubular handle element on said housing, the interior channel of said handle communicating with the interior of said housing whereby fluid flowing from said handle into said housing flows thereafter into said nozzle when said cartridge is retracted from said shoulder.

2. A spray gun according to claim 1 and further comprising means at the end of said handle for attaching a pipe connected to a suitable source of water under pressure.

3. A spray gun according to claim 1 wherein the aspirator portion of said element terminates a short distance behind said slot within said nozzle and wherein fluid under pressure is caused to flow from said housing and through said nozzle whereby said fluid mixes with the contents of said cartridge in the area between the end of said aspirator portion and said slot before said mixture is emitted from said slot.

4. A spray gun comprising a housing, a nozzle on said housing, a cartridge removably inserted into said housing, means between said housing and said nozzle to puncture and enter the interior of said cartridge to provide a channel for the contents of said cartridge to flow by aspiration through said puncturing means into said nozzle, pressure means for causing said cartridge to move into a position where it makes a liquidtight seal between said housing and said nozzle, biasing means causing said cartridge to move away from said sealing position when said pressure means are retracted, and means for introducing liquid under pressure into said housing around said cartridge and to flow into and out of said nozzle when said cartridge is retracted.

5. A spray gun according to claim 4 and further comprising grooved means on said puncturing means to equalize pressure on the interior and exterior of said cartridge to permit the contents of said cartridge to flow into said nozzle when said cartridge is retracted to a suitable distance from said sealing position.

6. A spray gun according to claim 4 wherein said cartridge is made of a sufficiently stiff material whereby the puncturing thereof by said puncturing means produces at least one aperture in said cartridge by which pressure is equalized between the interior and exterior of said cartridge to permit the con-

tents thereof to flow into said nozzle.

7. A spray gun according to claim 4 and further comprising a handle on said housing, the interior of said handle communicating with the interior of said housing, said handle being attachable to a source of fluid under pressure.

8. A spray gun according to claim 4 and further comprising a plurality of inwardly extending longitudinal ridges on the interior walls of said housing, said ridges supporting said cartridge in a spaced relationship to the interior walls of said cartridge to permit fluid flow around said cartridge.

9. A spray gun according to claim 4 and further comprising a yieldable, resilient O-ring interposed between said cartridge and said housing, said pressure means causing said cartridge to be urged against said O-ring to produce a watertight seal between said cartridge and said housing.

10. A spray gun according to claim 4 wherein said puncturing means comprises a support mounted in the area between said housing and said nozzle, at least one aperture in said support to permit fluid flow from the interior of said housing into the interior of said nozzle, a hollow puncturing element on said support extending at least partially into said housing, an aspirating tube on said support extending toward the exit end of said nozzle, said hollow puncturing element and said aspirating tube having a common unitary channel, the flow of water under pressure from the interior of the housing through the interior of said nozzle causing the movement by aspiration of the contents of said cartridge through said puncturing element and said aspirating tube, said fluid and said contents being mixed in said nozzle just prior to emerging therefrom.

11. A spray gun comprising a housing, a nozzle on said housing, means in said housing for removably accommodating a cartridge, means in said housing for piercing said cartridge, aspirator means connected to said piercing means for conducting the contents of said cartridge through said nozzle, a unitary channel in said piercing and aspirating means, and means for transmitting fluid under pressure through said nozzle to produce the aspirating action through said aspirator and piercing means whereby said fluid and the contents of said cartridge are mixed before being discharged from said nozzle.

12. A spray gun comprising a housing, a nozzle on said housing, means in said housing for removably accommodating a cartridge, means in said housing for piercing said cartridge to equalize the pressure between the interior and exterior of said cartridge, aspirator means mounted in said housing for conducting the contents of said cartridge through said nozzle, and means for transmitting fluid under pressure through said nozzle to produce the aspirating action through said aspirator whereby said fluid and the contents of said cartridge are mixed before being discharged from said nozzle.

13. A spray gun comprising a housing, a nozzle on said housing, means in said housing for removably accommodating a cartridge, means for conducting the contents of said cartridge into the interior of said nozzle, means for transmitting fluid under pressure into said nozzle and to mix said fluid with the contents of said cartridge within said nozzle before said mixture is discharged therefrom.

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