

April 27, 1965

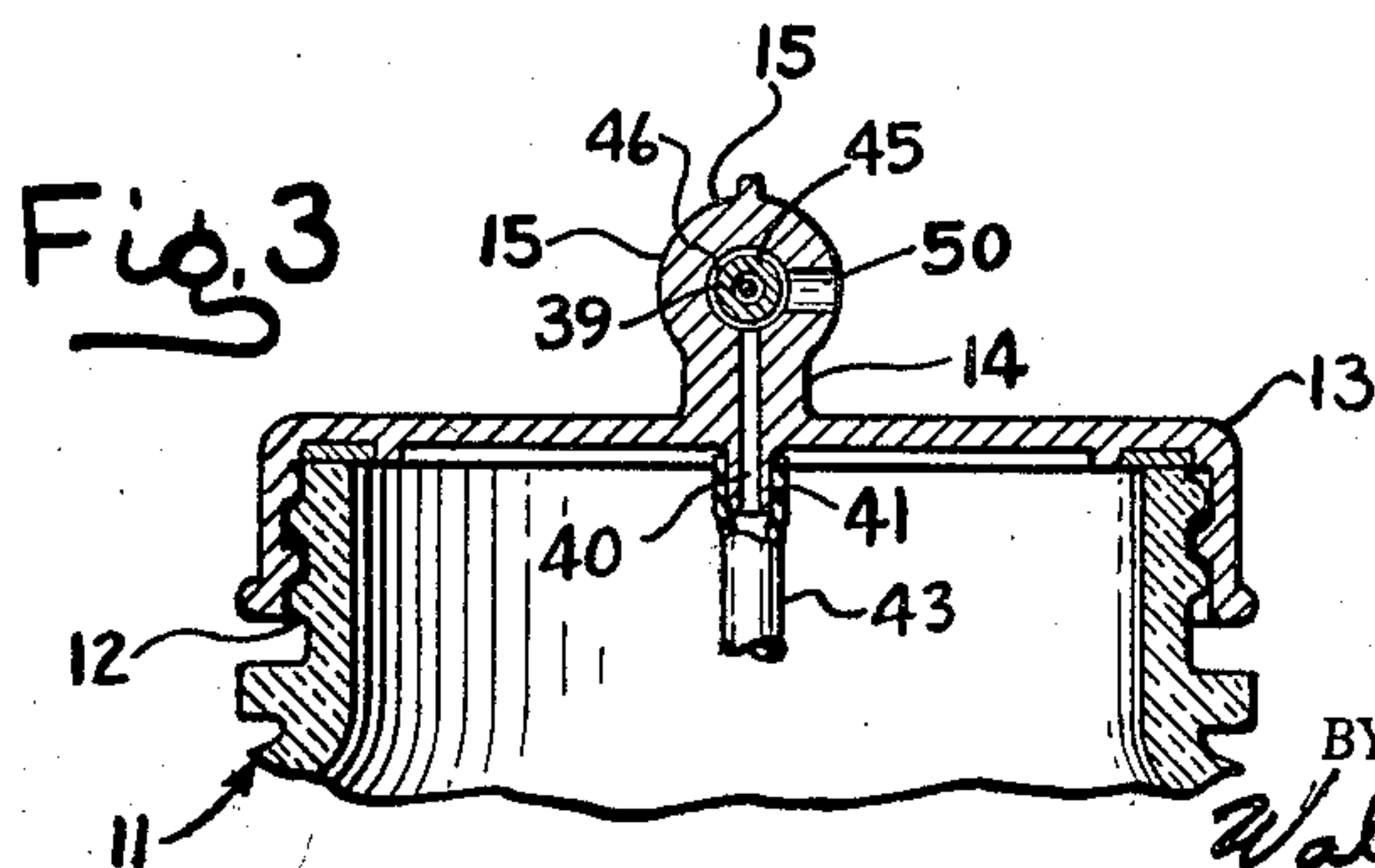
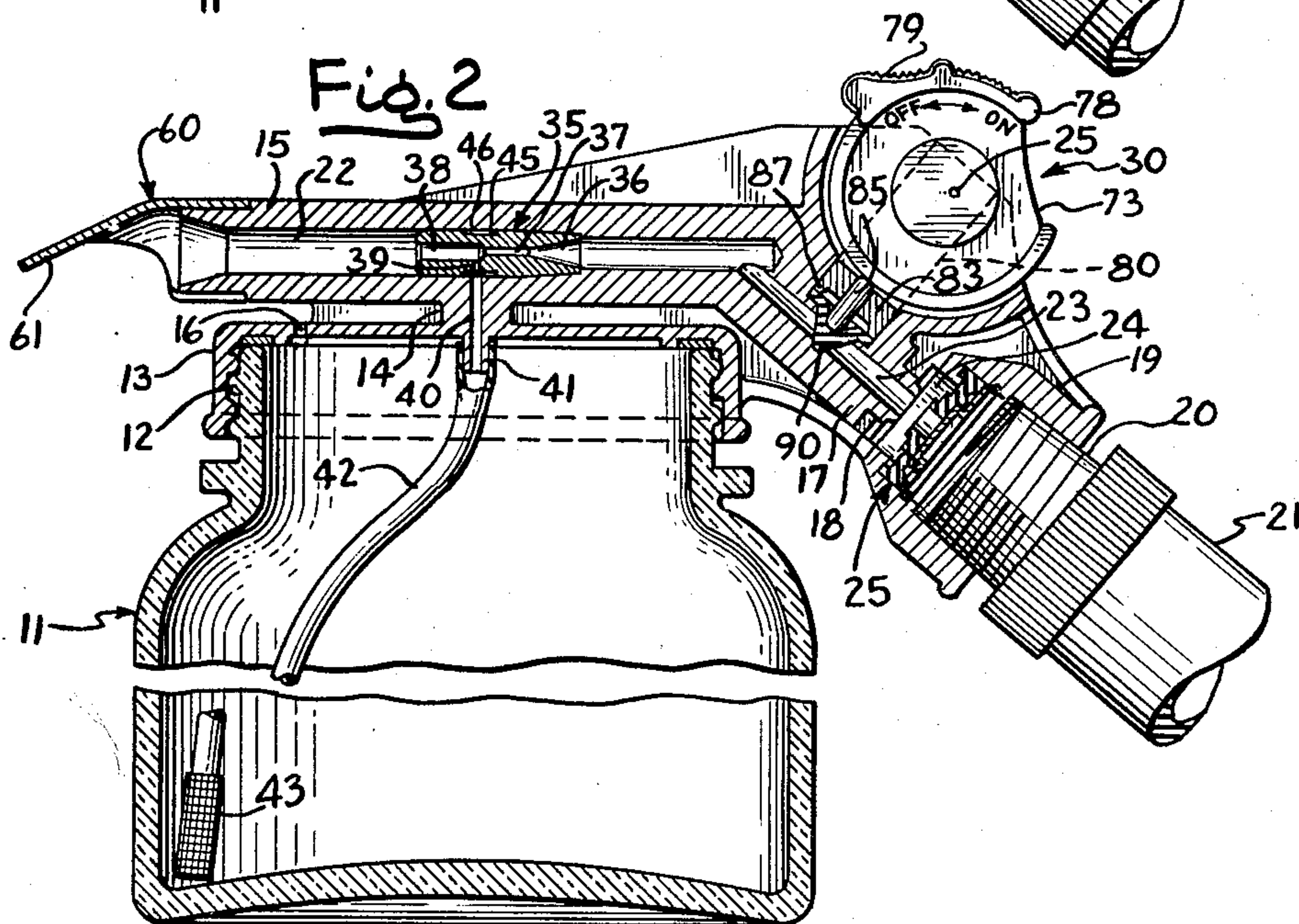
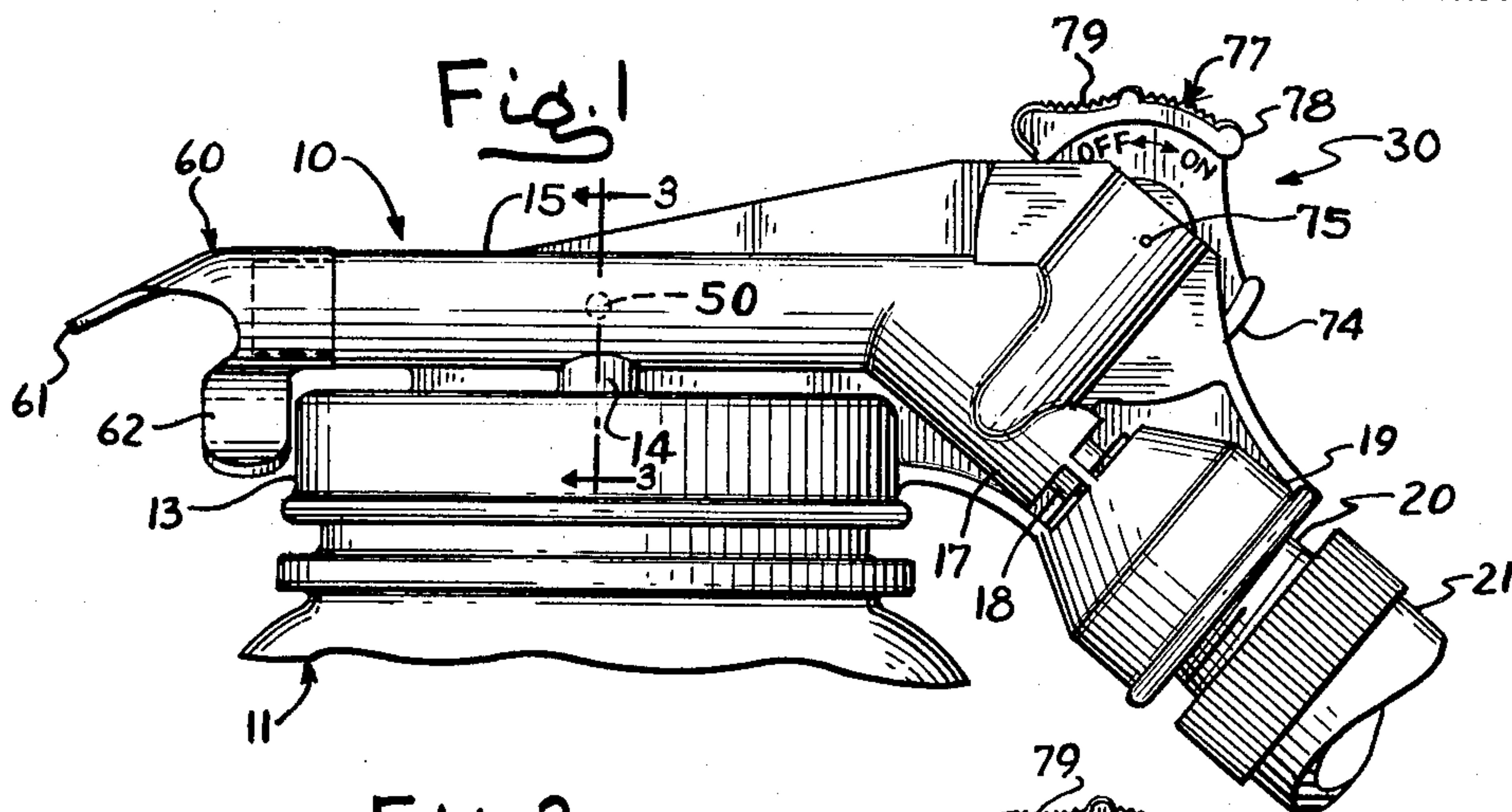
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HAND SPRAYER HAVING ON-OFF CONTROL VALVE MECHANISM

Filed Aug. 15, 1962

2 Sheets-Sheet 1



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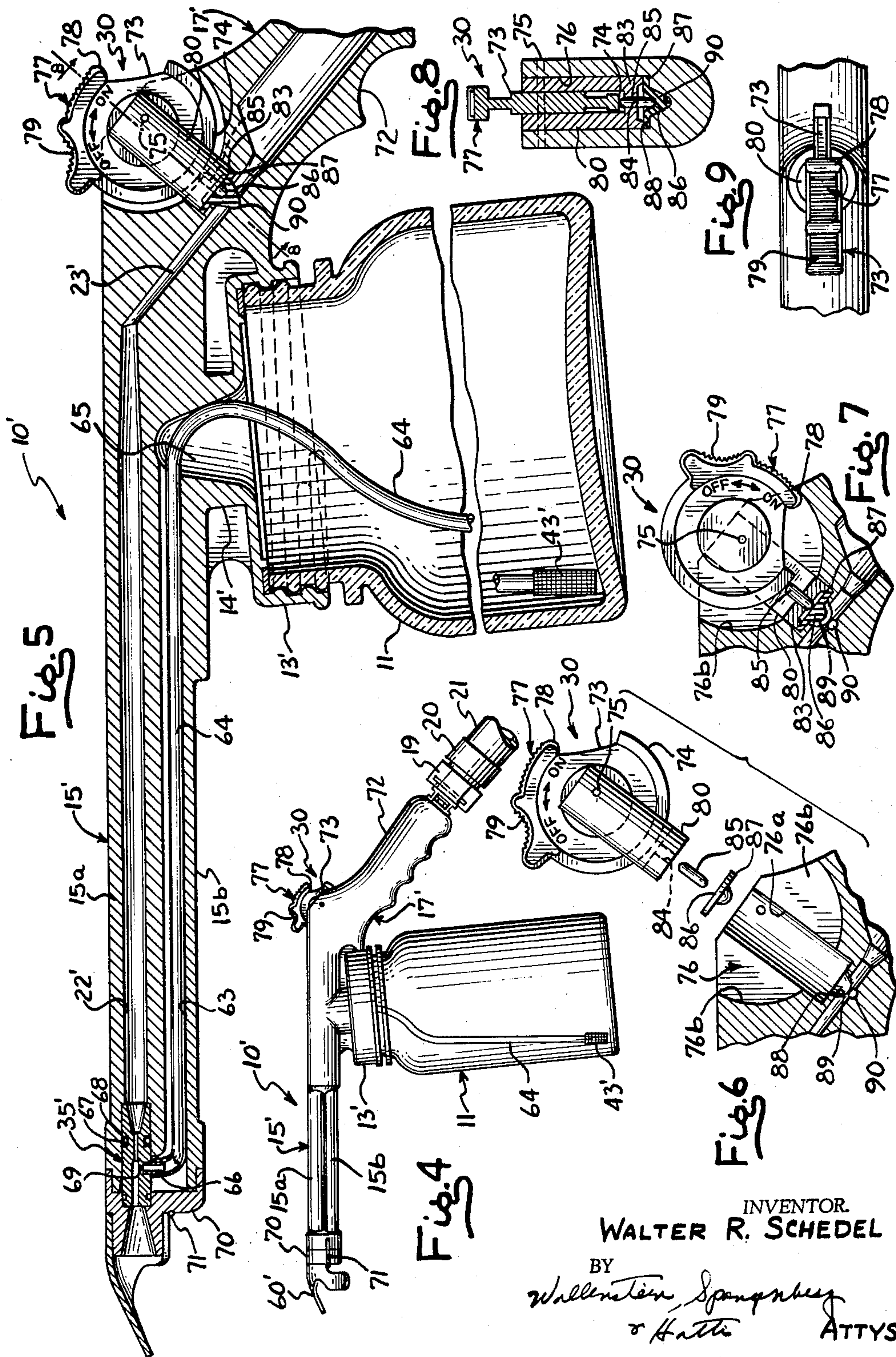
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## HAND SPRAYER HAVING ON-OFF CONTROL VALVE MECHANISM

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3 Claims. (Cl. 239-318)

This invention relates to a hand held sprayer of the type having a dispensing nozzle portion which is attachable to a source of water and to a receptacle for holding a solution to be sprayed, and which by means of a Venturi generated suction or entrainment action of a metering element within the sprayer, draws the solution from the receptacle into the water stream.

The water flow control mechanism associated with such sprayers generally is cumbersome and inconvenient to operate. Usually the operation of the on-off valve requires two hands, one to hold the sprayer firmly and the other to turn an on-off lever. There have been on-off valve lever arrangements which can be operated by the thumb of the hand holding the sprayer, but not without some difficulty.

Generally speaking, hand sprayers of conventional construction make no provision for conveniently enabling the user readily alternately to spray water and the entrained solution from the associated receptacle, and water only. In other words, conventional hand sprayers, unless the solution containing receptacle is first detached or is emptied, will always deliver a stream which contains the entrained solution. This inability of conventional devices to enable a user readily and selectively to spray either water and solution, or water alone, at an object, is a shortcoming which places limitations on the utility of such devices.

It is an object of this invention to provide an improved hand held sprayer which is provided with a convenient and efficient water flow control valve mechanism which can be actuated simply and easily to an "on" or "off" position by the same hand which grips the sprayer without releasing the grip on the sprayer. A related object of the invention is to provide a valve control mechanism as described which is rugged, and is easy to assemble and mount in the sprayer body.

It is also an object of this invention to provide an improved hand held sprayer which includes simple, effective, and convenient to use means for enabling the operator selectively to spray water alone or water with a solution entrained therein. A related object of the invention is to provide a means as just described which can be operated easily by a finger of the hand which grips the sprayer.

Another object of this invention is to provide an improved hand held sprayer which is extremely rugged and compact in construction, and which advantageously enables the user to utilize a portion of the conduit connecting the sprayer to the water supply source as a handle or gripping portion.

In accordance with one aspect of this invention, the hand sprayer is provided with a unique on-off control valve assembly which can be conveniently actuated by the thumb of the hand gripping the sprayer and which provides extremely efficient and positive regulation of water flow through the main water passageway in the nozzle body portion of the sprayer with application of only a modest thumb pressure. The actuator of the control valve is most advantageously positioned for pivotal movement about a transverse axis at the top and rear portion of the sprayer body so as to act similar to the cocking lever of a revolver. The sprayer body also preferably resembles a revolver.

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The actuator most advantageously forms a cam member which has a cam surface in eccentric relation with respect to its pivot axis, and is adapted to engage an actuating pin which desirably is urged against the cam surface by suitable resilient means, which is preferably a substantially conically shaped valve member made of rubber or similar resilient material. The cam member has flanges which are suitably anchored in place within a guide member held in a cavity in the sprayer body. The guide member has a centrally disposed bore in which the actuating pin is slidable. When the cam member is moved forward by the thumb of the operator, the cam surface is moved into a position which forces the pin against the valve member to distend and hold a conically shaped nipple portion thereof into a small notch on the side of the water passageway in the sprayer body opposite to that on which the on-off control valve assembly is mounted. In this position water flow through the water passageway in the sprayer body is cut off. When the cam member is moved rearward by the thumb, the pressure of the cam surface on the pin is relieved, enabling the combined pressure of the water and the resiliency of the valve member to move the conical nipple portion of the valve member to one side of the water passageway to allow water to flow around the valve member.

In accordance with another aspect of the present invention, a passage opening to atmosphere is provided in the sprayer body which opening communicates with the throat of a Venturi metering element inserted in the water passageway of the sprayer body. The throat of the metering element communicates with an inlet tube extending into a jar or receptacle containing the solution to be sprayed. Where the sprayer body resembles a revolver, the water passageway extends longitudinally of the barrel-like portions of the body and the outer end or opening of the passage to atmosphere as well as the Venturi metering element are located at a point on the barrel-like portion of the sprayer body which is within reach of the index finger of the hand of the operator gripping the handle of the sprayer body. By simply covering the opening of the passage with the index finger, the low pressure or vacuum developed at the throat of the Venturi metering element is permitted to develop to cause solution contained in the receptacle to become entrained in the water stream passing through the water passageway. Upon removal of the finger from the opening, the throat pressure of the metering element is brought to atmospheric pressure so that the suction action for drawing solution from the receptacle is terminated. Thus, the operator can conveniently with one hand selectively direct, for instance, a spray containing a garden insecticide or herbicide chemical in water solution or water alone at particular selected points on the garden or lawn. This aspect of the invention is also useful for washing cars and other vehicles, in which case the receptacle will contain a solution of a cleaning agent such as soap, so that the operator can selectively direct either soapy water or water alone onto the vehicle.

Other objects, advantages and features of the invention will become apparent upon making reference to the specification to follow, the claims and drawings wherein:

FIG. 1 is a side view of a hand sprayer incorporating both the spray selecting and on-off valve features of the invention and wherein the end of a water hose forms a handle for the sprayer;

FIG. 2 is a longitudinal vertical sectional view of the sprayer illustrated in FIG. 1;

FIG. 3 is a vertical sectional view taken substantially along line 3-3 of FIG. 1;

FIG. 4 is a side view of a modified hand sprayer embodying only the on-off valve feature of the invention;



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FIG. 5 is an enlarged longitudinal vertical sectional view of the sprayer of FIG. 4;

FIG. 6 is an exploded view of the on-off valve control mechanism used in the sprayers of FIGS. 1-5;

FIG. 7 is a fragmentary side view, partly in section, of the on-off valve control mechanism of FIG. 6;

FIG. 8 is a vertical sectional view of the on-off valve mechanism taken substantially along line 8-8 of FIG. 7; and

FIG. 9 is a top plan view of the on-off valve control mechanism of the present invention.

Refer now to FIGS. 1-3 of the drawings which illustrate an exemplary embodiment of the invention. The sprayer, designated generally at 10, includes a jar 11, which may be made of glass or plastic, for holding a solution of a garden chemical if the sprayer is to be used for such purpose, or a soap solution if the sprayer is to be utilized as an accessory in washing cars and the like. The jar 11 has an open top defined by an externally threaded neck 12 to which an internally threaded cap portion 13 of a cast metal, or plastic sprayer body is threadedly engaged. The cap portion 13 has a neck 14 connecting it to a barrel-shaped portion 15 of the sprayer body. In accordance with conventional practice, the cap portion 13 is provided with one or more atmospheric vents 16 (see FIG. 2). The barrel-shaped portion 15 is connected to a downwardly and outwardly inclined portion 17 having a back-flow preventing valve containing end portion 18. The end portion 18 has an internally threaded coupling 19 rigidly secured thereto which is adapted to be attached to a correspondingly externally threaded fitting 20 of a garden hose 21. The end of the hose 21 together with the inclined sprayer body portion 17 form a pistol grip handle for the sprayer and together with the barrel-shaped portion of the sprayer resemble a pistol.

The barrel-shaped portion 15 of the sprayer body is provided with a longitudinal passageway 22 which, in the embodiment illustrated, flares outwardly at the front end of the body portion 15. The opposite or inlet end of the passageway 22 communicates with a passageway 23 provided in the downwardly and outwardly inclined portion 17 of the sprayer body. The passageway 23 in turn communicates with an outlet chamber 24 which contains a back-flow valve assembly 25 of any suitable design, as, for example, shown in U.S. copending application Serial No. 197,188, filed May 21, 1962, which prevents back flow of fluid into the hose 21.

A thumb operated on-off control valve assembly 30 is provided substantially at the juncture of the barrel-shaped portion 15 and the downwardly inclined portion 17 of the sprayer body for regulating the flow of fluid through the sprayer. This valve assembly will be described in detail later on in the specification.

A metering element 35 is press fitted or otherwise secured within the passageway 22, and is provided with a series of axially aligned fluid conducting passages which operate to provide a reduced pressure or Venturi action necessary to effect a suction which draws the solution in the jar 11 into the fluid stream coursing through the passageway 22. As illustrated, the metering element has a tapered inlet or upstream passage 36 which communicates at its widest end with the passageway 22 and connects at its narrowest end with an intermediate substantially cylindrical passage 37 of reduced cross-section. The passage 37, in turn, communicates with a third, substantially cylindrical passage 38, of greater cross-section than the passage 37. The metering element has a narrow, lateral inlet passage 39 which intersects the metering element passages at a point near the low pressure point or throat of the metering element.

The inlet passage 39 is in communication with a vertical bore 40 formed in the neck portion 14 and cap portion 13 of the sprayer body. The lower portion of the bore 40 extends through a downwardly extending nipple 41 which receives in substantially water-tight sealing relation the

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discharge or outlet end of a flexible inlet tube 42 which extends down into the jar 11. The inlet tube 42 is provided with a sediment filtering screen 43 affixed to the inner end thereof.

Referring more particularly to FIGS. 2 and 3 of the drawings, a section 45 of the metering element 35 desirably is reduced to provide an annular chamber 46 between the sprayer body and the metering element approximately at the point where the metering element inlet passage 39 is located. The side of the barrel-shaped portion of the sprayer body has a horizontal transverse vent passage 50 located opposite the annular chamber 46. The vent passage extends between the annular chamber 46 and the outside of the sprayer. The metering element 35 and the related vent passage 50 are located about an index finger's distance from the top hand gripping surface of the inclined portion 17 of the sprayer body behind the on-off valve control assembly 30, so that the top of the index finger of the hand holding the sprayer can cover the opening of the vent passage 50 to isolate the inlet passage 39 of the metering element from atmospheric pressure to enable the metering element to create a suction to draw the spray solution in the jar into the metering element. As long as the vent opening 50 is uncovered the inlet passage 39 of the metering element is at atmospheric pressure so no suction is present to draw the solution in the jar into the metering element. Then only water would be sprayed.

An adjustable deflector 60 is removably mounted on the end of the barrel-shaped portion 15 of the sprayer body. The deflector has a flat outwardly and downwardly inclined fluid impinging portion 61 and an arcuate, transversely disposed handle 62. The deflector member 60 is adapted to deflect and fan out the discharge fluid leaving the passageway 22 of the sprayer. The deflector member 60 may be readily rotated on the end of the sprayer body through a complete circle to enable the spray pattern to be directed in any selected direction for a fixed position of the sprayer.

The vent hole 50 constituting one aspect of the invention may be eliminated where a mixture of the solution in the jar 11 and water or other carrier liquid is desired at all times. The sprayer 10' shown in FIGS. 4 and 5 is such a sprayer. Since there is no need for a hole 50 within the reach of the index finger of the hand gripping the sprayer, the metering element 35' thereof is more desirably located at the very end of the barrel-shaped portion 15' of the sprayer body. This portion 15' of the sprayer of FIGS. 4 and 5 is of much greater length than the corresponding portion of the sprayer 10 of FIGS. 1-3. The barrel-shaped portion 15' has a double-barreled configuration, namely an upper barrel portion 15a with a longitudinal water carrying passageway 22' and a lower barrel portion 15b with a longitudinal passage 63 containing a chemical solution carrying inlet tube 64 made of polyethylene or similar material. The inlet tube 64 extends through an inverted U-shaped recess 65 in the bottom of the sprayer body directly into the jar 11. The end of the inlet tube has a sediment screen 43' affixed thereto. The recess 65 is defined by a sprayer body neck portion 14' which joins a cap portion 13' which is similar to the cap portion 13 in the sprayer 10 previously described.

The outer end of the inlet tube 64 makes connection with a substantially cylindrical nipple 66 of the metering element 35'. The metering element 35' may be constructed like the metering element 35 and a further description thereof will not be given. Suffice it to say the nipple 66 has a passage 69 which communicates with the throat portion of the metering element so that the suction developed thereat is effective to draw the chemical solution in the jar 11 through the inlet tube 64 into the metering element. The element 35' projects slightly beyond the end of the upper barrel 15a of the sprayer body and a fluid seal is obtained between the defining wall of the bore 22' and the outer surface of the metering element by a sealing



member such as O-ring 67 retained in an annular groove 68 in the metering element. This arrangement enables the metering element to be readily removed by the user with either his fingers or a suitable tool.

The passages 22' and 63 of the upper and lower barrels 15a and 15b which open onto the front end of the sprayer body are covered by a cap member 70 releasably held thereon by a wire clip 71. The cap member 70, in turn, is adapted to receive a movable, adjustable deflector 60' similar in construction to deflector 60 hereinabove described. In removing the metering element 35' from the passage 22', the flexible inlet tube 64 attached thereto is removed simultaneously therewith, thereby enabling the user readily to remove for cleaning or replacement those portions of the sprayer which tend to become clogged.

Another feature of the sprayer shown in FIGS. 4 and 5 which is absent in the FIGS. 1-3 is that the downwardly and outwardly inclined portion 17' of the sprayer is extended in length to form a pistol grip handle 72 for the sprayer independently of the end of the water hose. The hose 21 connects to the end of the handle 72 through hose couplings 19 and 20. The handle 72 includes the back-flow valve referred to previously in describing the sprayer of FIGS. 1-3.

The sprayers of FIGS. 1-3 and FIGS. 4-5 have identical on-off control valve assemblies 30 now to be described. The assembly 30 is located substantially at the juncture of the hand gripping sprayer body portion and the barrel-shaped portion of the sprayer body.

As more clearly shown in FIGS. 6 through 9, the control valve assembly 30 desirably is mounted within a vertical cavity or recess 76 formed in the sprayer body. The assembly includes a segmental circular cam 73 having a cam surface 74 in eccentric relation to a transverse axis of rotation about a pin 75. The cam 73 is positioned within a slot formed in a cylindrical guide member 80, the pin being supported in openings in the guide member 80 and the sprayer body. The guide member 80 is press fitted or otherwise secured in a cylindrical portion 76a of the recess 76.

The cam 73 is provided with a knurled upper thumb engaging section 77, desirably of greater width than the cam 73 comfortably to accommodate the thumb of the operator. The thumb engaging section 77 has a rear shoulder 78 to facilitate movement of the cam 73 by the thumb in a forward fluid-flow cut-off direction, and a concave portion 79 to facilitate movement of the cam 73 by the thumb in the opposite direction to the "on" position. The cam 73 may be provided with suitable indicia to indicate the "on" and "off" positions of the valve 30. The sprayer body recess 76 has a narrow sequential circular section 76b to accommodate the pivotal movement of the cam 73.

The guide member 80 has a base portion 83 provided with a centrally disposed cylindrical bore 84. The bore 84 is adapted to receive in slidable relation a valve actuating pin 85, one end of which abuts against the cam surface 74 of the cam 73. The pin actuates a conically shaped resilient valve body 86 having a flange 87 sandwiched between the guide member 80 and the defining wall 88 of the inner end of the cylindrical section 76b of the valve body recess 76. The conical end of the valve body 86 extends into the water passage 23 or 23' of the sprayer body through an opening 89.

In response to the rearward movement of the cam 73, the cam surface 74 pushes the pin against the tip of the valve body 86 to distend the tip into a notch 90 in the wall of the passage 23 or 23' opposite the opening 89, whereby flow of water through the passage 23 or 23' is stopped. Forward movement of the cam 73 relieves the pressure of the cam surface 74 on the pin 85 so that the resilient valve body retracts to open the pasageway 23 or 23'.

To summarize the operation of the sprayers of the present invention, the jar 11 is first filled with a solution of the material to be sprayed. The cap portion 13 or 13' of the sprayer body is then threadedly attached to the jar 11 and the coupling 19 is connected to the hose 21 in the manner hereinabove described. The user then grips the piston grip handle of the sprayer and, when water pressure is applied to the hose, the knurled section 77 of the cam 73 is pulled rearward by the thumb of the hand holding the sprayer. As previously indicated, this action releases cam pressure on the pin 85 to open the passage 23 or 23' to flow of water around the valve body 86.

In the form of the invention of FIGS. 1-3, as soon as the index finger is placed over the vent passage 50, the flow of water passes through the passageway and the metering element 35 will generate a suction which draws the solution in the jar 11 up into the metering element. This same suction action is automatically produced in the sprayer of FIGS. 4 and 5 which omits the vent hole 50. The water, with the thus entrained solution, then passes out of the sprayer and impinges against the portion 61 of the deflector 60 or 60'. If only a water spray is desired in the form of the invention of FIGS. 1-3, the vent passage 50 is left uncovered.

Stoppage of the flow of water through the sprayer 10 is readily achieved by simply pushing the cam 73 forward with the thumb of the hand grasping the sprayer. Such movement of the cam 73 causes the cam surface 74 to urge the pin 85 in a downward direction against the tip of the valve body 86 to press the same into the depression or notch 90.

The present invention provides an exceedingly efficient, flexible and easy to operate hand sprayer. In the embodiment illustrated in FIGS. 1 and 2, savings in manufacturing costs are also realized by elimination of the handle portion and utilizing the outlet section of the garden hose as a handle. Also, this sprayer permits the selective obtainment of either a pure water stream or an entrained chemical solution in a water carrier stream by manipulation of the index finger of the hand grasping the sprayer while the thumb is free to operate the on-off control cam 73. Other advantages of the sprayer of this invention will suggest themselves to those skilled in the art.

It should be understood that numerous modifications may be made in the preferred forms of the invention above described without deviating from the broader aspects of the invention.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. In a liquid sprayer device having a horizontally extending barrel-shaped portion having a longitudinal liquid passage therein and a downwardly extending handle grip forming portion resembling the handle of a pistol at the inner end of said barrel-shaped portions, said handle forming portion having a connecting liquid passage connecting with said longitudinal passage through which liquid passes into said longitudinal passage, the improvement comprising: on-off control valve mechanism for selectively stopping and permitting liquid flow in said longitudinal liquid passage, said control valve mechanism including a thumb operable means projecting from the sprayer device where it is operable by the thumb of the hand gripping said handle grip forming portion, said thumb operable, means being an eccentric cam member oriented in a vertical plane including said barrel-shaped and handle forming portions of the sprayer device and being pivotable about a horizontal axis extending transversely thereto between extreme on-off positions, a valve operating pin having one end riding on the periphery of said cam member which moves the same between inner and outer positions as the cam member is moved between said extreme on-off positions, and a resilient sealing valve comprising a distendable member having an open end into which the other end of said pin extends and a closed end, said valve operating



pin in said inner position thereof engaging the closed end of said valve member and expanding the same into one of said passages to block the same.

2. In a liquid sprayer device for entraining a chemical solution in a carrier liquid stream, said device comprising a horizontally extending barrel-shaped portion having a longitudinal, carrier liquid passage therein, a downwardly extending handle grip forming portion resembling the handle of a pistol at the inner end of said barrel-shaped portion, metering means in said longitudinal passage of said barrel-shaped portion which metering means is capable of providing suction at a given point therein whenever liquid flows therethrough and it is isolated from atmospheric pressure, and a chemical solution inlet conduit communicating with said suction point for carrying a chemical solution to said metering means, the improvement comprising: on-off control valve mechanism for selectively stopping and permitting carrier liquid flow in said carrier liquid passage, said control valve mechanism including a thumb operable member projecting from the upper portion of the sprayer device adjacent the juncture of said barrel-shaped and handle forming portions where it is positioned to be operable by the thumb of the hand gripping said handle grip forming portion, said thumb operable member being movable between extreme on-off forward and backward positions like the cocking lever of a pistol, and a vent passage in the barrel-shaped portion of said spraying device, said vent passage communicating at its outer end with the outside of the device and its inner end with said suction point of said metering means to inhibit the development of suction when the vent passage is uncovered and to permit the development of the suction when covered, the outer end of said vent passage being within reach of the index finger of the hand gripping the handle forming portion of the sprayer device.

3. In a liquid sprayer device having a horizontally extending barrel-shaped portion having a longitudinal, liquid passage therein and a downwardly extending handle grip forming portion resembling the handle of a piston at the inner end of said barrel-shaped portion, said handle forming portion having a connecting liquid passage connecting

with said longitudinal passage, the improvement comprising: on-off control valve mechanism for selectively stopping and permitting liquid flow in said longitudinal liquid passage, said control valve mechanism including a thumb operable means projecting from the upper portion of the sprayer device adjacent the juncture of said barrel-shaped and handle forming portions where it is operable by the thumb of the hand gripping said handle grip forming portion, said thumb operable member being movable between extreme on-off positions like the cocking lever of a pistol, a valve operating member which is moved by said thumb operable means between extreme retracted and extended positions when said thumb operable means is operated between said extreme positions, and a distendable resilient sealing valve member engaged by said valve operating member, said valve operating member in its retracted position distending said sealing valve member into said connecting passage to block the passage, and in the extended position thereof permitting the sealing valve member to assume a passage unblocking position.

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