Aug. 8, 1961 C. P. ORR 2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Filed July 17, 1958 7 Sheets-Sheet 1

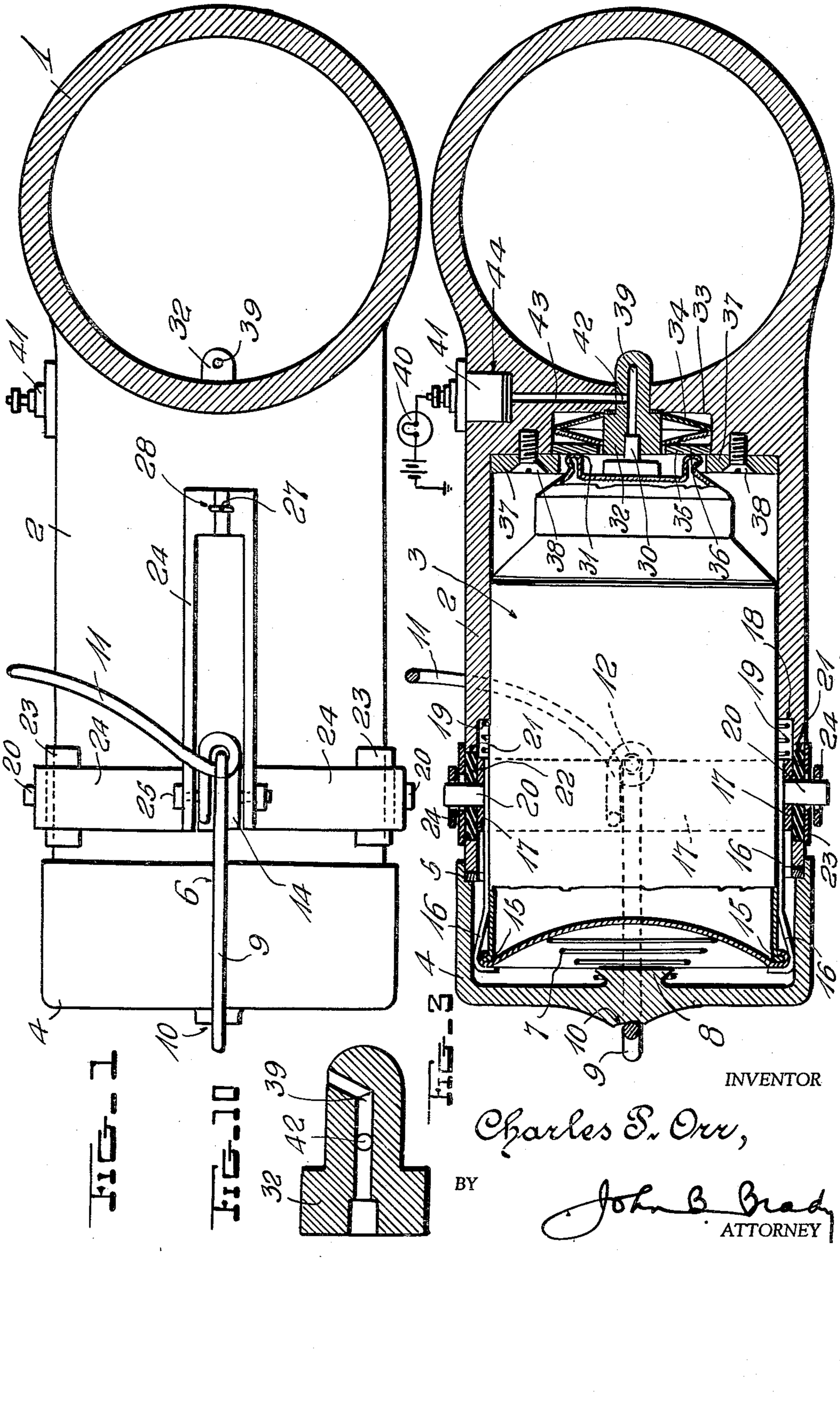


FIG. 1

FIG. 2

FIG. 10

INVENTOR

Charles P. Orr,

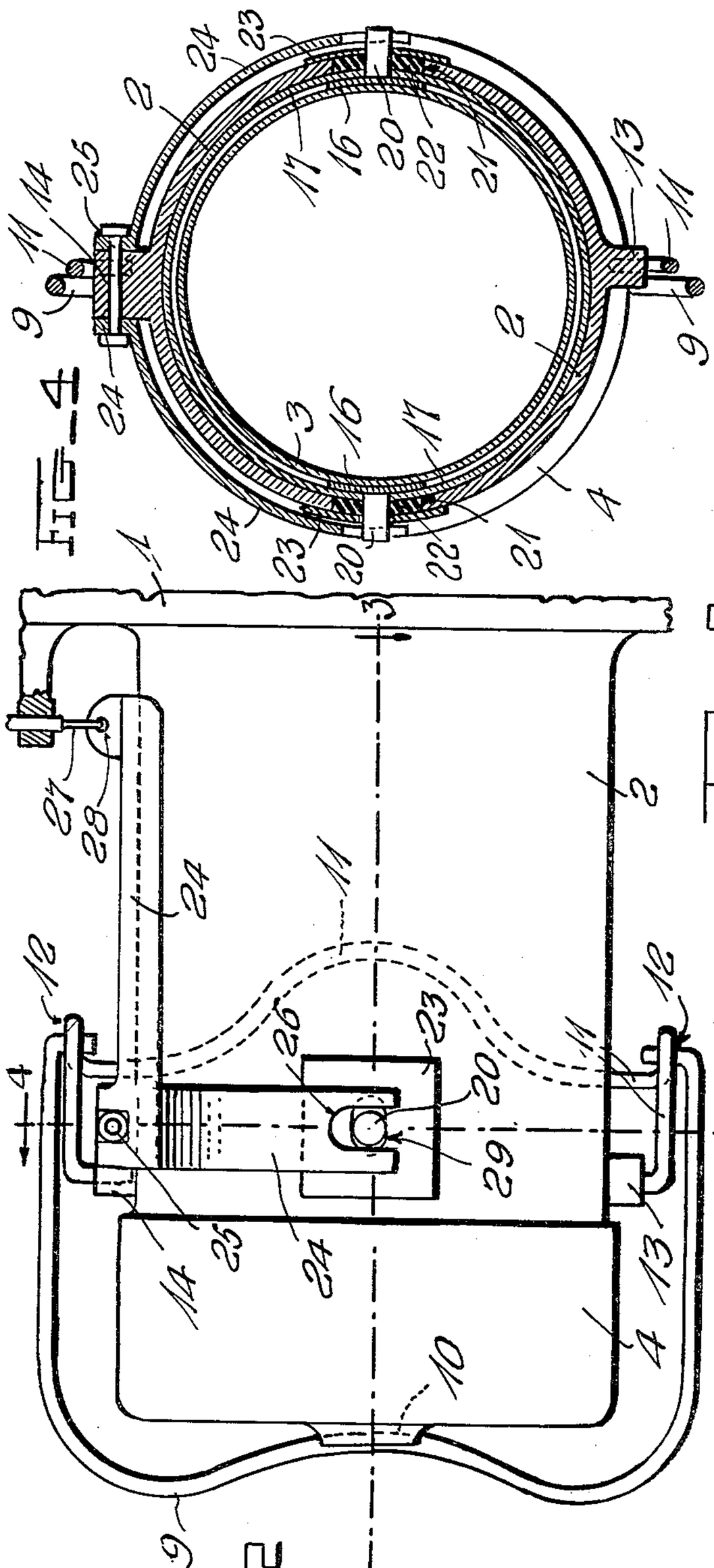
BY John B. Brady

ATTORNEY

Aug. 8, 1961 C. P. ORR 2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Filed July 17, 1958 7 Sheets-Sheet 2



Aug. 8, 1961 C. P. ORR 2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Filed July 17, 1958 7 Sheets-Sheet 3

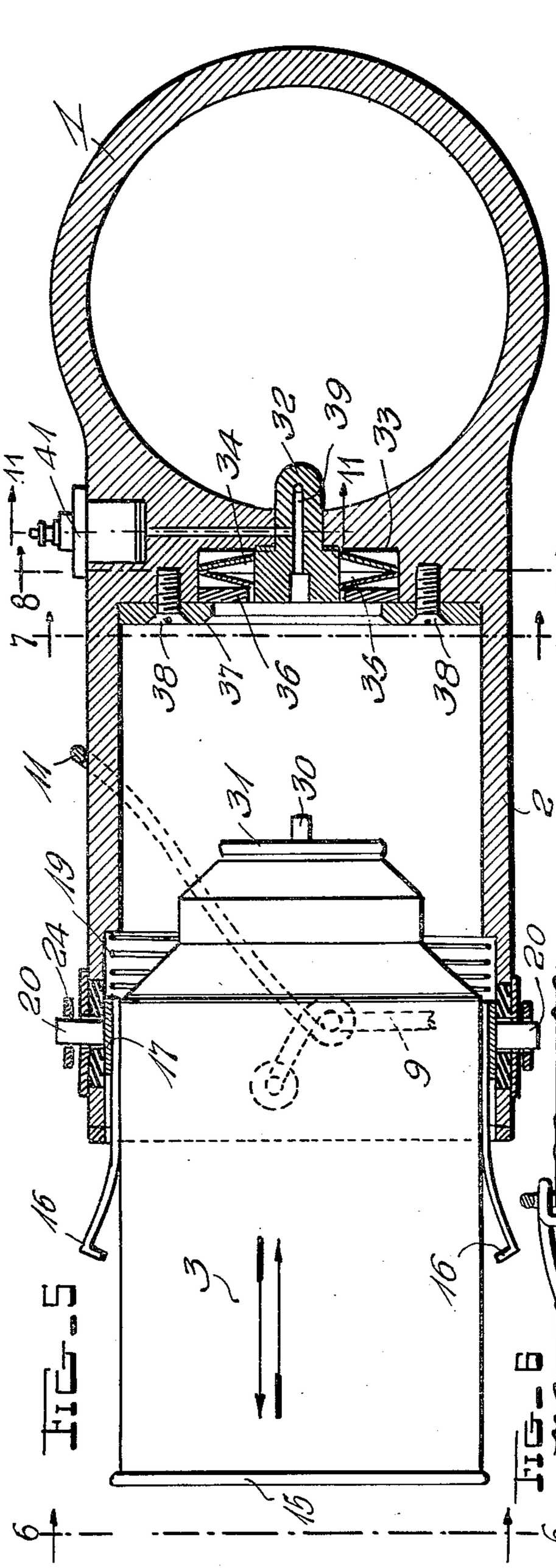


FIG. 5

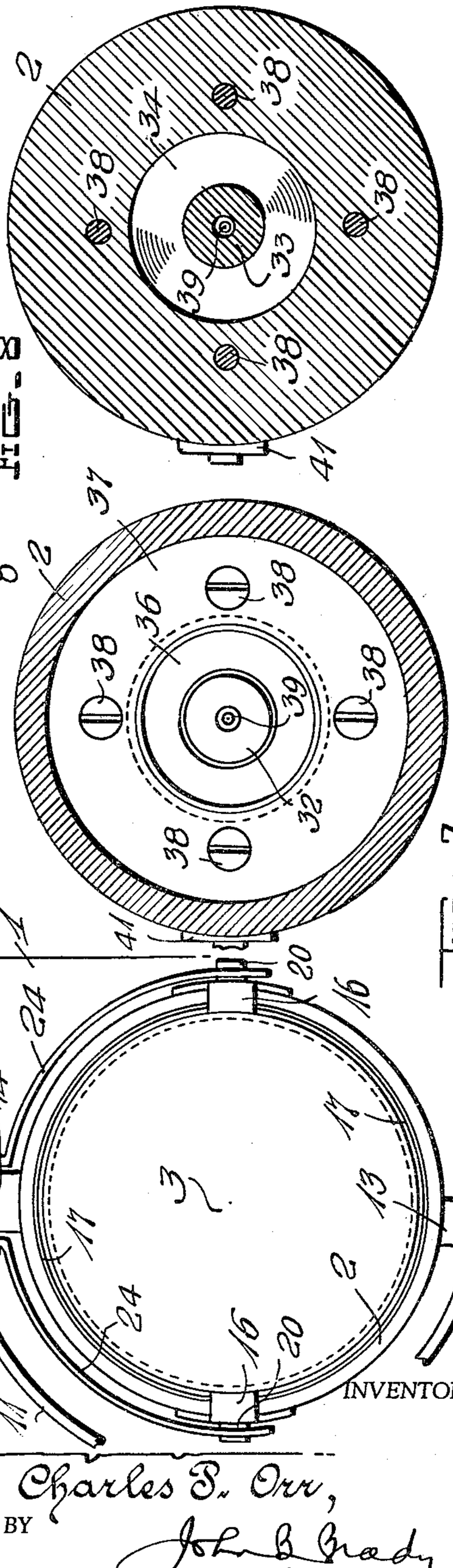


FIG. 8

FIG. 7

FIG. 6

INVENTOR

Charles P. Orr,

BY John B. Brady

ATTORNEY

Aug. 8, 1961 C. P. ORR 2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Filed July 17, 1958 7 Sheets-Sheet 4

FIG-11

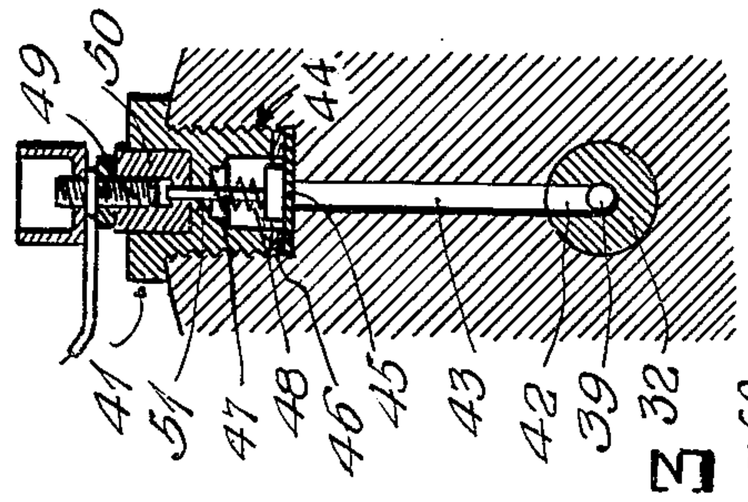


FIG-13

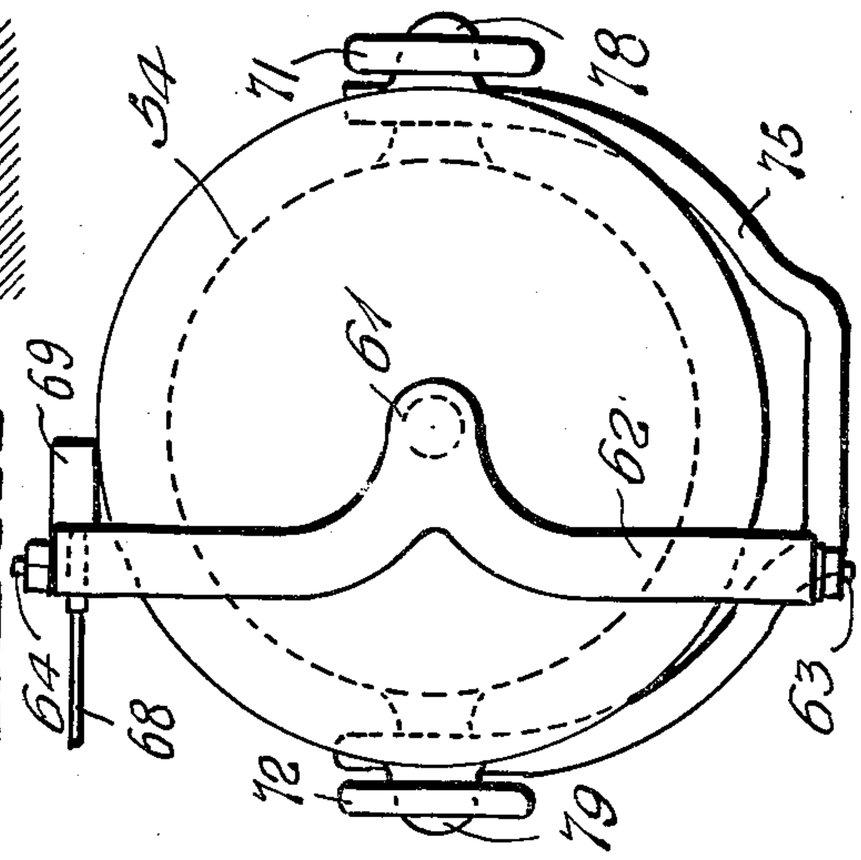


FIG-15

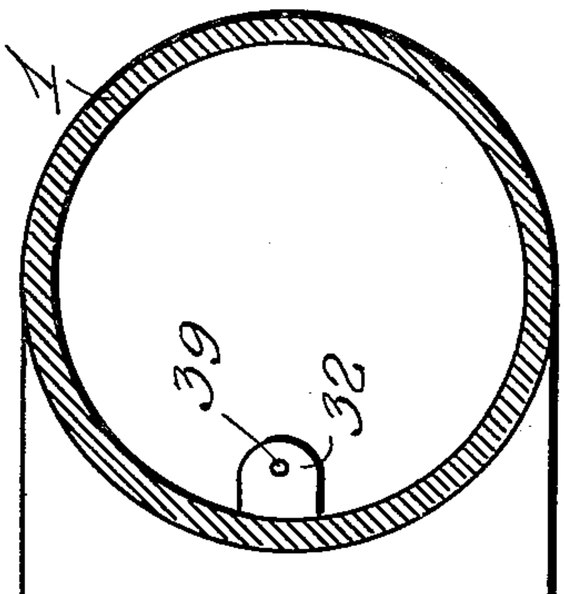


FIG-12

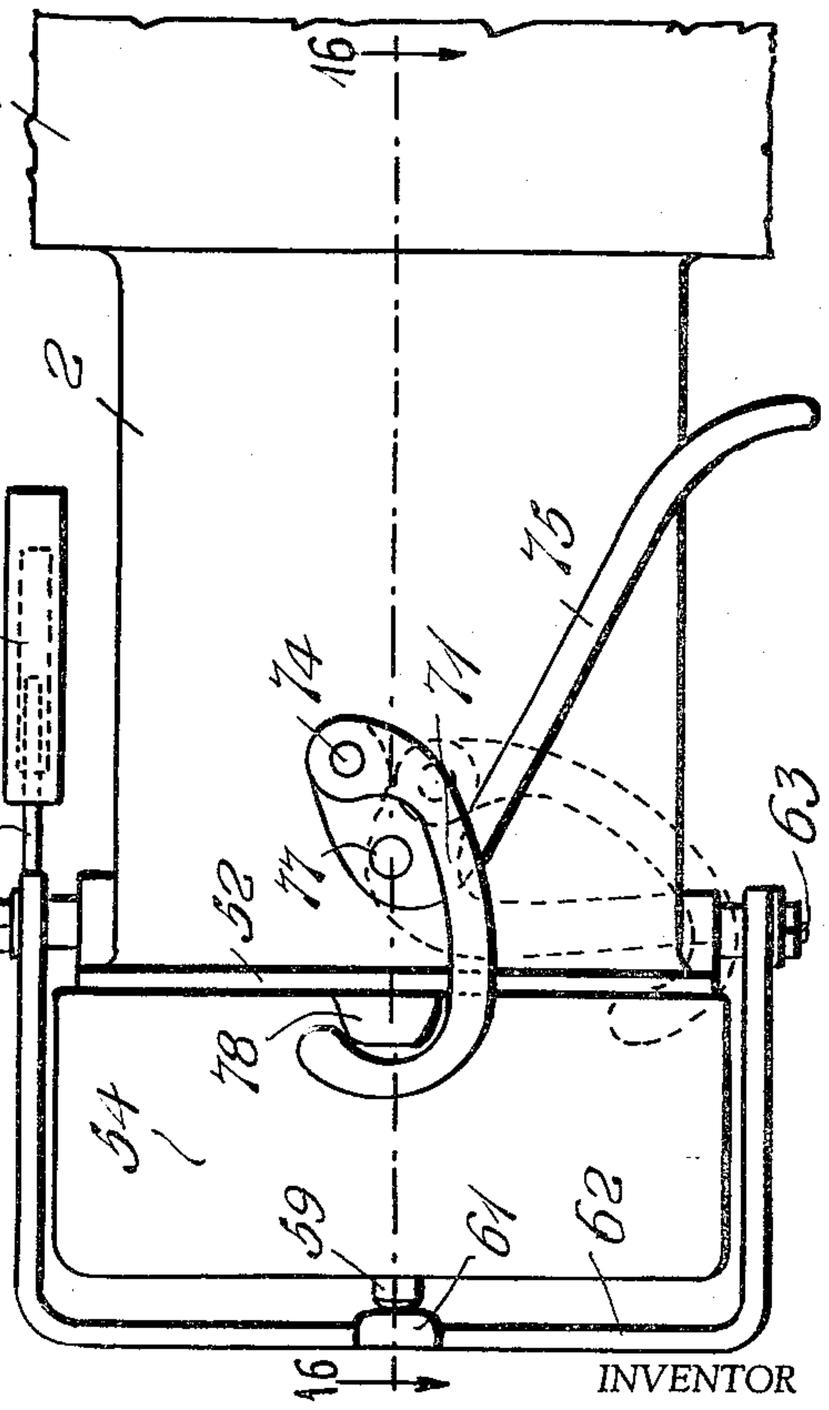
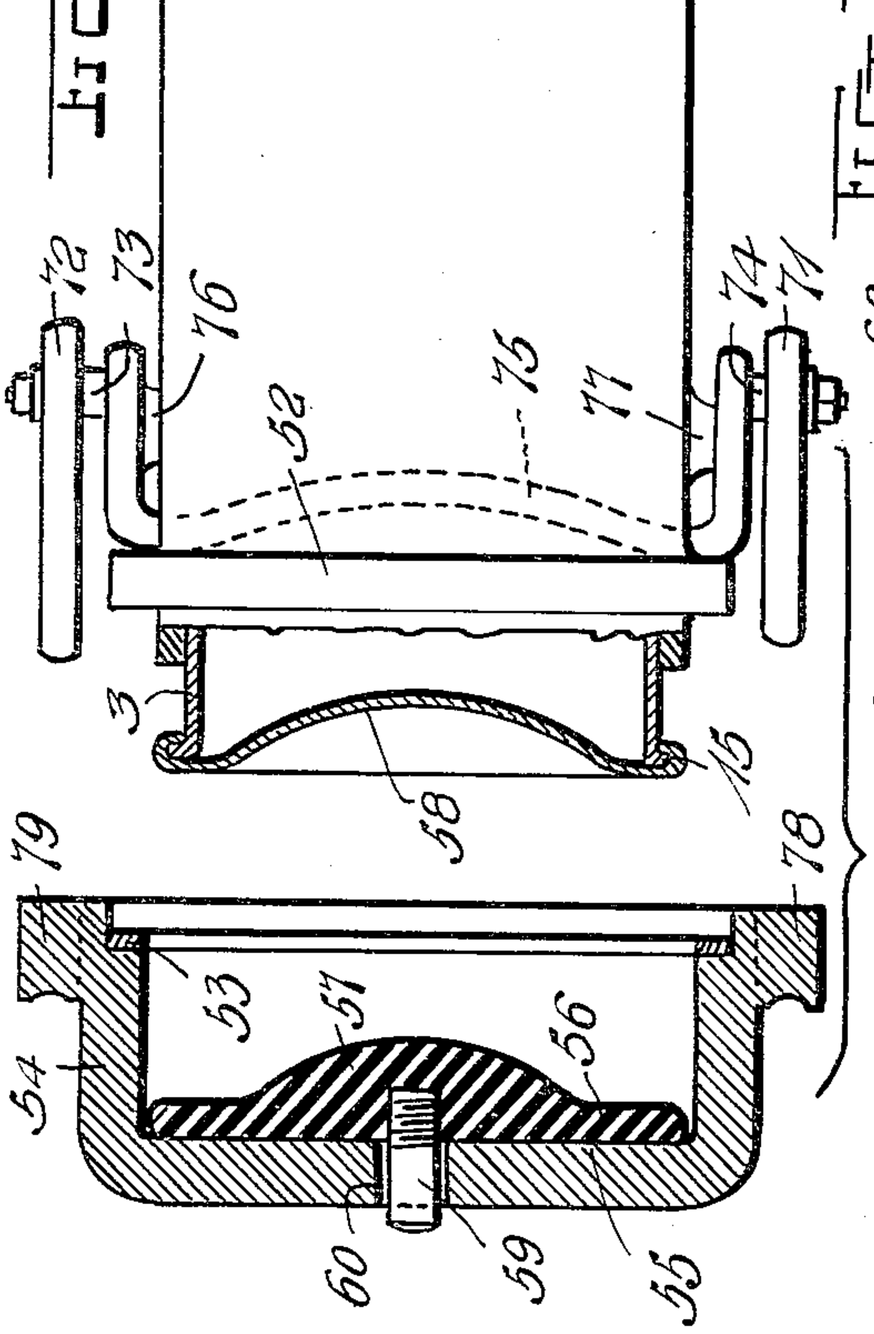


FIG-14



INVENTOR

Charles P. Orr,

BY

John B. Brady

ATTORNEY

Aug. 8, 1961 C. P. ORR 2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Filed July 17, 1958 7 Sheets-Sheet 5

FIG-17

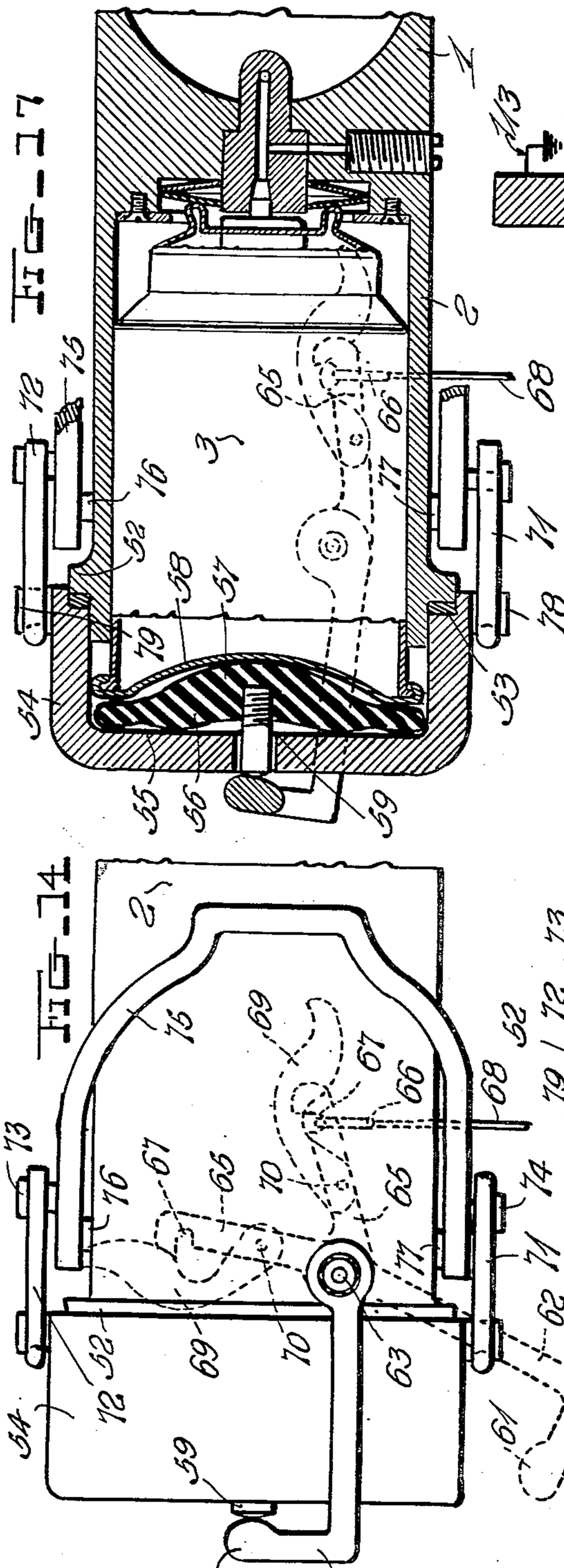


FIG-18

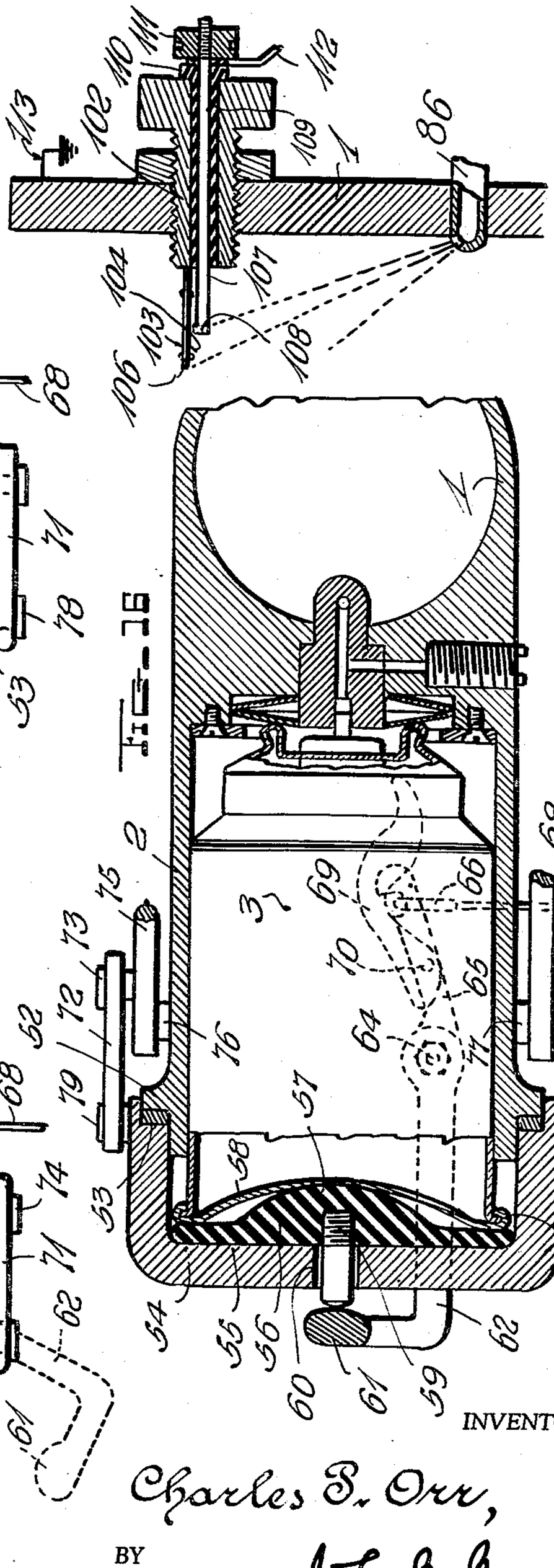


FIG-19

FIG-20

INVENTOR

Charles P. Orr,

BY

John B. Grady

ATTORNEY

Aug. 8, 1961 C. P. ORR 2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Filed July 17, 1958 7 Sheets-Sheet 6

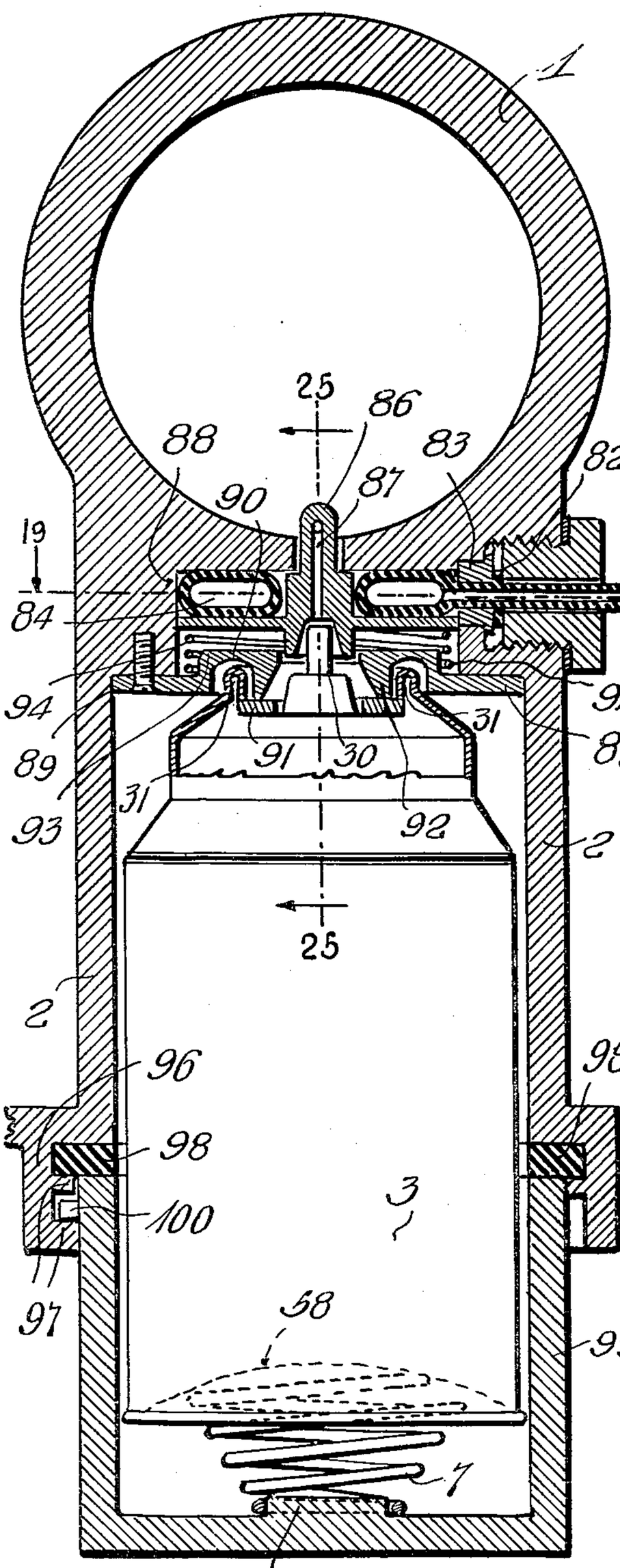


FIG. 18

FIG. 19

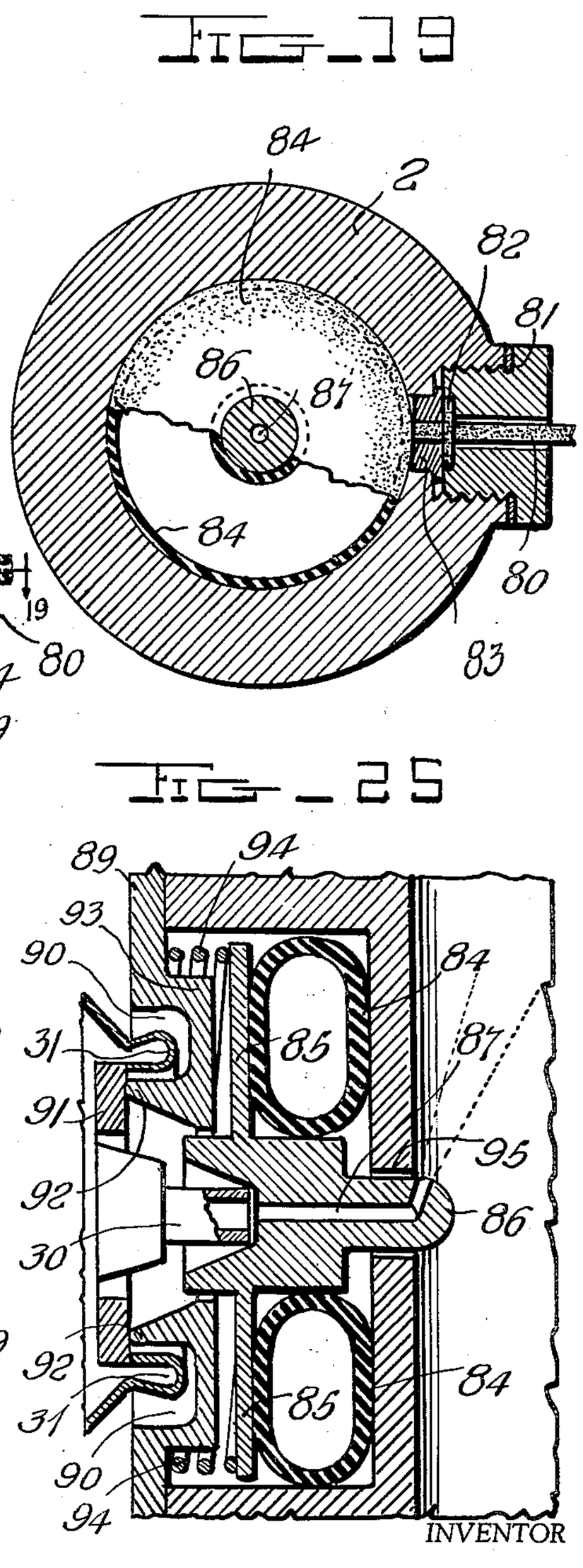


FIG. 25

INVENTOR

Charles P. Orr,

BY John R. Brady

ATTORNEY

Aug. 8, 1961 C. P. ORR 2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Filed July 17, 1958 7 Sheets-Sheet 7

FIG_21

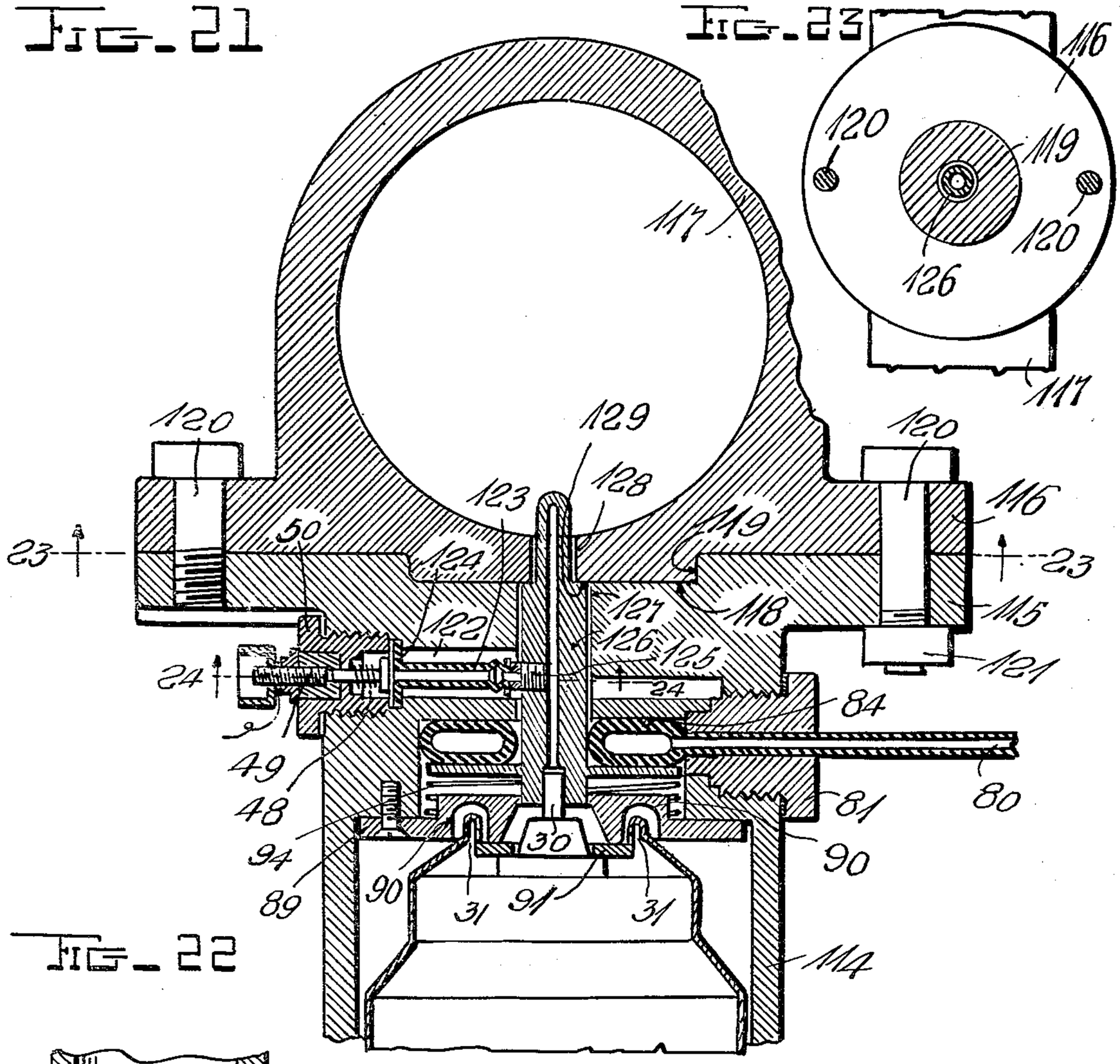
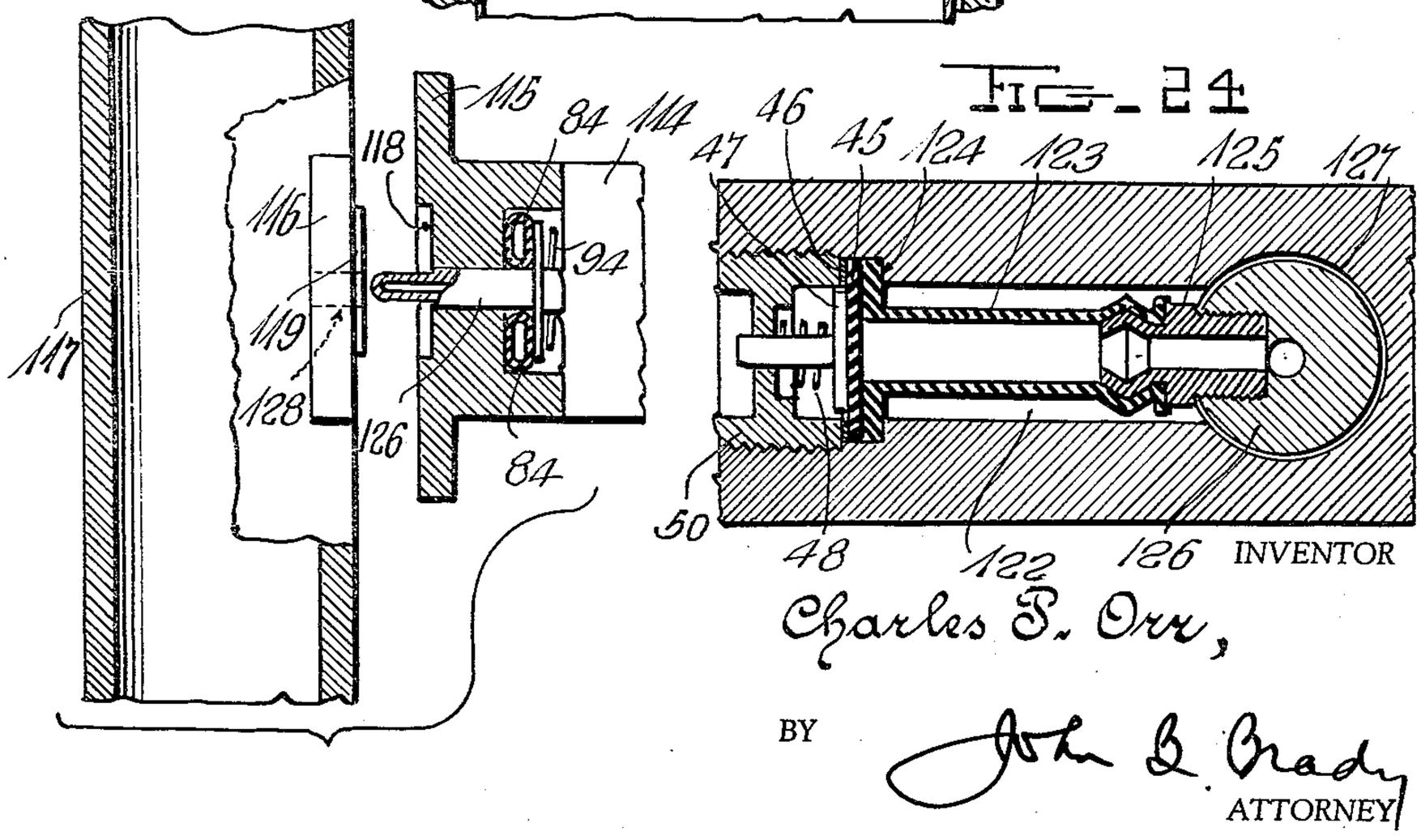


FIG_22

FIG_23

FIG_24



INVENTOR
Charles P. Orr,
BY John B. Brady
ATTORNEY

United States Patent Office

2,995,127

Patented Aug. 8, 1961

2,995,127

PRESSURIZED SPRAY APPLICATOR ARRANGEMENT FOR ENGINE MANIFOLDS

Charles P. Orr, Camden, N.J., assignor to Spray Products Corporation, Camden, N.J., a corporation of New Jersey

Filed July 17, 1958, Ser. No. 749,254
20 Claims. (Cl. 123—187.5)

My invention relates broadly to engines of the diesel and gasoline type and more particularly to a structure of compartmented manifold for receiving and utilizing a starting fluid contained in a pressurized can.

This application is a continuation in part of my co-pending application, Serial No. 522,199 filed July 15, 1955, for Fuel Atomizing Spray Device, now Patent 2,860,009, dated November 11, 1958.

One of the objects of my invention is to provide a construction of compartmented manifold for engines into which a pressurized can of starting fluid may be readily inserted and the valve of the pressurized can actuated from time to time to supply a spray of atomized starting fluid into the engine manifold when conditions require this aid in starting the engine.

Another object of my invention is to provide an arrangement of engine starting equipment where the manifold of the engine is provided with an integrally connected chamber of a size into which a standard pressurized can of starting fluid may be readily inserted and removed in a position in which the spray valve of the pressurized can is readily operated for spraying starting fluid into the engine manifold from time to time under control of the operator.

Another object of my invention is to provide a construction of compartmented manifold for engines into which the pressurized can of starting fluid may be inserted, removed, and renewed and wherein the pressurized can is selectively displaceable for effecting an actuation of the spray valve thereof for spraying atomized starting fluid into the manifold.

A further object of my invention is to provide a compartmented manifold for engines including means for fixing a pressurized can of starting fluid therein in association with means for selectively depressing the spray valve on the can for directing a spray of atomized starting fluid into the engine manifold.

A still further object of my invention is to provide a compartmented manifold for engines into which a pressurized can of starting fluid may be inserted with the spray valve thereof positioned immediately adjacent the flow path of fuel in the manifold of the engine and the valve of the pressurized can selectively actuated for delivering atomized starting fluid into the fuel flow path of the manifold with means for monitoring the valve operation to enable the operator to be informed at all times that the starting fluid is being sprayed into the manifold.

Another object of my invention is to provide an arrangement of hydraulically controlled means for operating the spray valve of a pressurized can of starting fluid for effecting delivery of an atomized spray of starting fluid into the manifold of an engine, the hydraulic means being conveniently controllable from an operator's position.

Still another object of my invention is to provide a construction of an electrical switch operative under control of a monitored portion of the spray from the spray valve of a pressurized can located in the area of the engine manifold by which the condition of spray emanating from the spray valve may be observed by the operator at all times.

Another object of my invention is to provide a construction of a thermally controlled electrical switch in

the intake manifold of an engine operative in association with the spray valve of a pressurized can of starting fluid for indicating to the operator the condition of the spray within the engine manifold which would otherwise be unobservable to the operator, particularly where the contents of the pressurized can may have become exhausted and a replacement can may be required.

Other and further objects of my invention reside in the mounting means and valve actuator for a pressurized can of starting fluid within an integral chamber attached to an engine manifold as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

FIG. 1 is a top plan view of the integral manifold starting fluid spray applicator of my invention and particularly showing the construction of one form of the actuating lever and illustrating the vertically extending portion of the manifold in transverse section;

FIG. 2 is a fragmentary side elevational view of the spray applicator of my invention;

FIG. 3 is a longitudinal sectional view taken substantially along line 3—3 of FIG. 2 showing the spray applicator in the normal unactuated position;

FIG. 4 is a transverse sectional view taken substantially along line 4—4 of FIG. 2 and particularly showing the construction of the pressurized can moving mechanism associated with the actuating lever;

FIG. 5 is a longitudinal sectional view corresponding to that shown in FIG. 3 but particularly illustrating the manner in which a pressurized can is inserted and removed from the applicator;

FIG. 6 is an end elevational view taken substantially along line 6—6 of FIG. 5;

FIG. 7 is a cross-sectional view taken substantially along line 7—7 of FIG. 5 and particularly showing the construction and mounting of the retainer ring within the can compartment of the manifold;

FIG. 8 is a cross-sectional view taken substantially along line 8—8 of FIG. 5 particularly showing the mounting of a conical shaped spring about the nipple-discharge member;

FIG. 9 is a fragmentary longitudinal sectional view corresponding to FIG. 3 but showing the relative position of the various applicator elements when the can is in the actuated position;

FIG. 10 is an enlarged longitudinal sectional view through the discharge orifice showing the discharge and the monitoring passages in the nipple-discharge nozzle;

FIG. 11 is an enlarged cross-sectional view of a fragmentary portion of FIG. 5 taken substantially along line 11—11 and particularly showing the construction of the pressure switch and the relationship thereof to the monitoring passage from the discharge nozzle;

FIG. 12 is a modified form of my invention shown in side elevation and illustrating particularly an arrangement of clamping means for mounting a pressurized can within a compartment integral with the engine manifold and showing an arrangement of actuating means for displacing the entire pressurized can for a distance sufficient to actuate the spray valve thereof for spraying atomized fluid into the engine manifold;

FIG. 13 is an end view of the modified form of my invention showing the means for effecting displacement of the pressurized can for operating the spray valve thereof;

FIG. 14 is a fragmentary schematic view illustrating the manner in which the linkage for fastening the end closure on the can receiving compartment of the engine manifold is assembled and the manner in which the actuator for displacing the pressurized can within the compartment may be moved out of position to permit removal of the end closure and replacement of an exhausted pressurized can within the compartment;

FIG. 15 is a top plan view of the compartmented manifold and showing a pressurized can partially projecting therefrom in the process of insertion or replacement and illustrating the end closure in juxta-position with respect thereto, the view showing the fluid flow portion of the manifold in transverse section;

FIG. 16 is a longitudinal sectional view through the manifold and integral chamber compartment associated therewith taken substantially on line **16—16** of FIG. 12 and illustrating the valve mechanism in elevation extending into the spray nozzle which is shown in section;

FIG. 17 is a view similar to the view shown in FIG. 16 and illustrating the pressurized can displaced within the compartmented chamber sufficiently to effect actuation of the pressurized valve for delivery of atomized starting fluid through the spray nozzle to the fuel flow path in the manifold;

FIG. 18 is a fragmentary longitudinal sectional view taken through a further modified form of my invention in which the pressurized can is mounted in fixed position in the chamber of the compartmented manifold and the spray valve thereof depressed by hydraulic control from a remote position for delivering an atomized spray of starting fluid into the fuel flow path of the manifold;

FIG. 19 is a transverse sectional view taken substantially on line **19—19** of FIG. 18 and illustrating the hydraulic operating means for controlling the actuation of the valve of the pressurized can;

FIG. 20 is a schematic view of a modified form of electrical circuit controller located within the engine manifold for indicating conditions of atomization of the starting fluid in the engine manifold, particularly with respect to whether or not the pressurized can still contains sufficient starting fluid therein to supply the required atomized spray to the engine manifold;

FIG. 21 is a longitudinal cross-sectional view through a fragmentary part of a modified form of chamber or compartment for a pressurized can of starting fluid where the chamber or compartment terminates in a flange coacting with a complementary flange formed on the manifold;

FIG. 22 is a fragmentary side elevational view partially in section of the separable chamber or compartment in juxtaposition to the manifold or intake ducting to which the chamber connects;

FIG. 23 is a transverse sectional view taken substantially on line **23—23** of FIG. 21, illustrating the manner in which a flange is formed on the manifold for attachment thereto of the chamber or compartment which receives the pressurized can of starting fluid;

FIG. 24 is an enlarged fragmentary longitudinal sectional view taken on line **24—24** of FIG. 21; and

FIG. 25 is a longitudinal sectional view through a fragmentary part of the hydraulic valve actuating mechanism employed in the form of my invention shown in FIGS. 18, 19, 21, and 22, the view being taken substantially on line **25—25** of FIG. 18 and illustrating the condition which exists when the hydraulic gasket of the hydraulic valve control mechanism is inflated for depressing the valve of the pressurized can sufficiently to effect delivery of an atomized spray of starting fluid to the fuel flow path of the engine manifold or intake ducting.

My invention is directed to the effective utilization of atomized starting fluid for starting diesel and gasoline engines under adverse conditions. I provide an engine manifold which contains a chamber or compartment into which a standard pressurized can of starting fluid may be readily inserted and renewed from time to time. I arrange the pressurized can within the chamber or compartment with the spray valve thereof directed toward the fuel flow portion of the engine manifold and provide means for either mechanically or hydraulically depressing the valve of the pressurized can for delivery of an atomized spray of starting fluid into the fuel flow path in the manifold or I mount the pressurized can so that it

is capable of slight translatory displacement longitudinally of the chamber or compartment through a sufficient distance to effect actuation of the spray valve for delivering an atomized spray to the fuel flow portion of the engine manifold. The compartment or chamber is provided with closure means which may be readily opened and closed to permit the entry of a pressurized can of starting fluid. Inasmuch as the compartment or chamber when closed precludes any observation of the condition of the starting fluid in the pressurized can I provide special means for indicating the operative condition of the atomized spray. Under certain circumstances I may employ a pressure actuated switch which is operated by a monitored portion of the atomized spray to electrically indicate the condition of operation of the atomized spray in the fuel flow portion of the manifold. Under other conditions I employ a thermally controlled switch located in the fuel flow portion of the engine manifold and subject to the spray of the atomized starting fluid. Upon failure of the atomized spray of starting fluid the temperature controlled switch operates to warn through an indicator the operator of the fact that the pressurized can of starting fluid is empty and must be replaced.

Under certain conditions I prefer to construct the engine manifold in two sections where the compartment or chamber for the pressurized can of starting fluid terminates in a flange which may be bolted to a coacting flange on the fuel flow portion of the manifold in which case the chamber or compartment for the pressurized can of starting fluid is not integral with the fuel flow portion of the manifold thus facilitating manufacture.

Referring to the drawings in more detail, the manifold is represented by reference character **1**, while reference character **2** represents the starting fluid pressurized can holder protrusion from the manifold. Pressurized can **3**, containing the starting fluid, is held in holder **2** by end cap **4** sealed with respect to the holder by gasket **5** and clamping mechanism **6**. To hold the can firmly in place and prevent it from vibrating or rattling, spring **7** is attached to a grooved raised portion shown at **8** on the interior face of end cap **4** in such a manner as to compress against the bottom surface of the can when the end cap is clamped in position as shown in FIGS. 3 and 9.

The clamping mechanism **6** can be comprised of any suitable clamping means and not necessarily restricted to the form or type shown in the drawings. In the clamping mechanism shown in the drawings, clamp bar **9** is fitted into a groove shown at **10** on the exterior end surface of end cap **4**, while the terminating ends thereof are pivoted in handle member **11** as shown at **12**. Handle member **11** is pivoted in turn in protrusions from the holder **2** as shown at **13** and **14**. The pivot points **12** of clamp bar **9** in handle member **11** are off-center with respect to the pivot points of handle member **11** in such a manner that clamp bar **9** is locked in groove **10** when handle member **11** is pulled toward the rear of holder **2**, as seen in FIGS. 1, 2, 3 and 9, and when handle member **11** is pushed toward the front of the holder, clamp bar **9** is unlocked from groove **10** since its pivot points **12** are moved toward the rear of the end cap and the bar **9** is positioned into a free swinging state as shown in FIG. 5 to permit removal of can **3** from the holder or manifold compartment.

The bottom rim **15** of the can is engaged by spring hooks **16** when end cap **4** is in position, as shown in FIGS. 3 and 9. Spring hooks **16** are fastened to movable guide ring **17** which is spring-loaded by spring **19** in groove **18** on the interior surface of holder **2**. Guide ring **17** carries an outwardly protruding fulcrum stud **20** on each side thereof which extends through longitudinal slots **21** in the side walls of holder **2**. These longitudinal slots **21** are fitted with yieldable gaskets **22** sealed in said slots and around studs **20**. The slots **21** are further sealed from entry of foreign material from the exterior thereof by cover members **23** secured to holder **2** and containing slots **29** therein to allow free longitudinal movement of

studs 20. The cover members also aid in maintaining gaskets 22 in slots 21 and also act as bearing plates for the arms of lever 24. Lever 24, of substantially T-shaped construction, pivoted about protrusion 14 by pivot bolt 25, provides openings 26 in the ends of the T cross-arm for engaging studs 20. A cable 27 is attached to the end of the main body member of the T-shaped lever 24 as shown at 28, such that, when a pulling force is applied to said cable, lever 24 pivots slightly about protrusion 14 in such manner as to apply a force to studs 20 which causes said studs, guide ring 17, connected spring hooks 16, and associated can 3 to move toward the right as viewed in FIGS. 1, 2, 3 and 9. As this action occurs guide ring 17 compresses spring 19 in slot 18 as spring hooks 16 move can 3 toward the right while spring 7 associated with end cap 4 is allowed to expand slightly. The entire movement of lever 24 is very slight, that is, lever 24 pivots just enough to impart a forward movement to can 3 through a distance of approximately 1/16 inch. The actuated position of the spray applicator showing the can moved to the forward position is shown in FIG. 8 while FIG. 3 shows the can in the normal unactuated position.

The top of can 3 carries a depressible discharge valve 30 and top rim shown at 31. When the starting fluid spray can 3 is in position in holder 2 the depressible discharge valve 30 is engaged in and abuts nipple-discharge member 32 which protrudes through the manifold wall separating the intake manifold cavity from the can holder compartment or cavity. The portion of the nipple-discharge member 32 on the can side of the partitioning manifold wall is situated in a cavity designated at 33 of smaller diameter than the can holder cavity. Conical-shaped spring members 34 and 35 and movable preloaded disc 36 are disposed in this cavity about nipple-discharge member 32 such that said conical spring members are compressible between the manifold partitioning wall and said preloaded disc 36. Preloaded disc 36, spring-loaded by conical-shaped spring members 34 and 35, is held in cavity 33 in this spring-loaded state by retainer ring 37 fastened by bolts 38 to the manifold partitioning wall. In the normal inactivated state rim 31 of can 3 projects through the center of retainer ring 37 and bears on the surface of preloaded disc 36 as shown in FIG. 3.

When can 3 is moved into the actuated position as shown in FIG. 9, rim 31 of can 3 moves preloaded disc 36 out of contact with retainer ring 37, thus compressing conical-shaped spring members 34 and 35. Since nipple-discharge member 32 is stationary and discharge valve 30 is depressible, as can 3 is moved into the actuated position, valve 30 is depressed into pressurized can 3 thus releasing, from pressurized can 3 into intake manifold 1, an atomized spray of starting fluid through discharge passage 39 of nipple-discharging member 32. As shown in FIG. 10 the end of discharge passage 39 is upwardly directed to act as a nozzle for distributing the atomized starting fluid spray throughout the intake manifold cavity.

The cable 27 by which the starting fluid applicator is actuated extends into the interior of the vehicle and is conveniently mounted within easy reach of the operator as, for example, a pull-knob on the dashboard. If the applicator is mounted on other than a vehicle the actuating cable, terminating in a pull-knob, extends to within easy reach of the engine operator. In order that the operator may know that the spray applicator is functioning correctly and that atomized starting fluid is being discharged into the air intake manifold, I provide a signal light 40 connected into a battery circuit, as shown in FIG. 3, within sight of the operator which is energized by the closing of pressure switch 41 which in turn is operated by the increased pressure in the discharge passage 39 as atomized spray is discharged from the can. Nipple-discharge member 32 contains pressure switch bleed-off or monitoring passage 42 as a branch passage from discharge passage 39. Passage 42 aligns with the main pressure switch passage indicated at 43 leading to pressure switch cavity 44

into which is threaded pressure switch 41 as shown in FIG. 11. When the atomized vapor is released from pressurized can 3 the pressure in passages 39, 42 and 43 greatly increases. This increased pressure flexes diaphragm 45, held in position by washer 46, in an upward direction, thus moving plunger member 47, which is constructed of an electrically conductive material, in an upward direction, compressing spring 48 and bringing the end of plunger 47 into electrical contact with electric contact member 49 which is connected to one side of signal light 40. Electrical contact 49 is insulated from the body of the pressure switch by insulation block 50 into which it is threaded. A hole at one end thereof allows the end of plunger member 47 to move into electrical contact with said electric contact member 49. At all times plunger member 47 is in electrical contact with ground through sliding electrical contact with the pressure switch body as indicated at 51, through spring 48 to the pressure switch body and through the pressure switch body to the manifold itself which is grounded. Therefore this pressure switch is used to close the ground circuit to the signal lamp and the switch construction is such that should there be a spark on contact of plunger 47 with contact member 49 due to a potential difference, the spark chamber is well sealed from the starting fluid vapor in passage 43, by sliding contact fit indicated at 51 and by diaphragm 45, so that there is no danger of an explosion due to vapor ignition. The pressure switch as illustrated in FIG. 11 is shown in the normal de-energized state when the signal light is off.

The compression strengths of the various springs in the spray applicator are such that atomized spray ceases to be discharged from depressible discharge valve 30 immediately upon release of cable 27. Spring 19 exerts a force of such magnitude as to restore lever 24 to the normal position while spring 7 is of slightly less compression strength than are conical-shaped springs 34 and 35, so that can 3 can be immediately restored to its normal unactuated position by the restoring forces of springs 34 and 35 immediately upon release of actuating cable 27. For example, if conical-shaped springs 34 and 35 were approximately ten pound springs then spring 7 would have a compression strength of approximately eight pounds.

FIG. 5 shows the manner in which the pressurized can 3 of starting fluid is inserted into or removed from the holder or compartment 2. The handle member 11 is moved to a position shown in FIG. 5 and the end cap 4 pushed inwardly against spring 7 releasing the clamp bar 9 from groove 10 whereupon end cap 4 may be removed as the clamp bar 9 is dropped downwardly. Upon removal of the end cap 4 the spring hook 16 releases the bottom rim 15 of can 3 as shown in FIG. 5 and can 3 is axially moved out of or inserted into the compartment or holder constituting the housing 2. Upon replacement of the pressurized can 3 with a fresh can the cap 4 is replaced on the holder 2, the clamp bar 9 fitted into groove 10 and the handle member 11 moved to the position shown in FIG. 1, whereupon the pressurized can 3 is securely confined within the holder or housing 2.

In FIGS. 12–17 I have shown a modified form of the integral manifold-starting fluid spray applicator of my invention wherein the housing or holder 2 is provided with an annular outwardly extending flange 52 thereon which serves as an annular seat for the sealing gasket 53 carried in the end cap 54. The end cap 54 has a central recess 55 therein in which there is mounted the resilient pad 56. This pad 56 has a central protrusion 57 therein which conforms with the inwardly extending bottom 58 of the pressurized can 3. A stud 59 is imbedded in the pad 56 and extends rearwardly therefrom and passes slidably through central aperture 60 in the end cap 54 and is engaged by the end 61 of the yoke 62 which is pivotally mounted at opposite ends at 63 and 64 on diametrically opposite sides of the exterior of housing or holder 2. The yoke 62 has an extension 65 on one end thereof forming an arm which

constitutes a bell crank having a slot **67** in the end thereof for the engagement or disengagement of the hook **66** connected to the control wire **68** leading to the control operator's position to facilitate connection and disconnection of the hook **66** from the slot **67** in the extension arm **65**. I provide a latchable keeper **69** pivoted at **70** on arm **65** to enable the hook **66** to be readily engaged or disengaged from the slot **67** and when engaged, maintained in position. This requirement for disengagement of control wire **68** is necessary to permit the yoke **62** to be dropped down out of obstructing position with respect to the open end of the holder **2** so that the pressurized can **3** can be inserted into or removed from the holder.

The means for maintaining end cap **54** in engagement through gasket **53** against flange **52** consists of latching levers **71** and **72** pivoted at **73** and **74** at symmetrical positions on the opposite sides of bale **75** which is pivoted at **76** and **77** in diametrically opposite positions on the exterior of the holder or housing **2**. The levers **71** and **72** have hook shaped ends which engage lugs **78** and **79** projecting from opposite sides of the end cap **54**. By raising the bale **75** to the position shown in FIG. 15 the levers **71** and **72** are moved to positions releasing the lugs **78** and **79** enabling the end cap **54** to be removed providing clear access for the insertion or removal of the pressurized can **3**. Upon insertion of a fresh pressurized can of starting fluid in the holder **2** and the latching of cover **54** in position over the holder **2** and with the control wire **68** latched in position on the arm **65** of the bell crank, the spray device is ready for remote control from the operator's position through a drawing force supplied on control wire **68**.

In FIGS. 18, 19 and 21 I have shown a further modified form of my invention wherein the spray valve on the pressurized can within the holder **2** is actuated by hydraulic means. In this arrangement a tube **80** is supplied with hydraulic fluid which passes through a guide plug **81** intermediate the holder **2** and the fuel flow portion of the manifold shown at **1**. The hydraulic tube **80** is stabilized by the flange **82** located between guide plug **81** and the cylindrical boss **83** where it terminates in a toroidal hollow gasket **84** of resilient material and which is filled with hydraulic fluid. When additional hydraulic fluid is forced through tube **80** into hollow gasket **84** this expands gasket **84** and operates to displace the circular disc **85** which is connected with the outside of the skirt of the nozzle **86**. The interior of the intake end of the nozzle **86** is recessed to receive the stem of the depressible valve **30** of the pressurized can **3** so that as the gasket **84** expands the disc **85** is displaced depressing valve stem **30** and allowing atomized starting fluid to be sprayed through bore **87** in nozzle **86** and into the fuel flow portion of the manifold **1** as hereinbefore explained in connection with the previous forms of my invention. The hollow recess **88** within which the gasket **84** operates has its open end closed by an annular plate **89** centrally apertured to permit the passage of the cylindrical end of the nozzle **86** and the free movement thereof. The plate **89** includes an annular recess **90** therein into which the rim **31** of the pressurized can **3** is adapted to be centered. A sealing gasket **91** is carried by pressurized can **3** surrounding the base of the stem of depressible valve **30** and establishes sealing contact with the annular portion **92** of plate **89** as shown. The plate **89** has a central outward projection **93** thereon which serves as a centering means for the compression coil spring **94** which maintains disc **85** in contact with resilient gasket **84**. The strength of spring **94** is selected so that hydraulic fluid introduced into gasket **84** through tube **80** will build up to a pressure sufficient to overcome the strength of spring **94** and then depress valve **30**. The nozzle **86** is slightly less in diameter than the bore **95** in the wall of the manifold **1** and as the hydraulic pressure builds up in gasket **84** nozzle **86** will be slightly retracted for a sufficient distance to effect movement of the spray valve in the pressurized can

for directing an atomized spray of starting fluid into the fuel flow portion of manifold **1**. The displacement of nozzle **86** is very slight and does not interfere with the distribution therefrom of the atomized spray into the fuel flow portion of manifold **1**.

In order to facilitate the removal of empty pressurized can **3** and the replacement of a freshly stocked pressurized can I may employ the bayonet lock type of closure shown in FIG. 18 wherein the holder or housing **2** is provided with an enlarged end portion **96** having a bayonet thread **97** therein and serving as a seat for an annular gasket **98**. In this form of my invention the end cover **99** is provided with a co-acting bayonet member **100** which in a slight twist will engage the bayonet thread **97** in the end portion **96** of the housing **2**. A coiled spring **7** as heretofore explained engages the bottom **58** of the pressurized can **3** and extends from the center portion **101** of the cover **99** for urging pressurized can **3** into housing **2** in a position in which the annular rim **31** of can **3** enters the annular recess **90** in the plate **89**. Thus the pressurized can **3** is maintained in fixed position while the spray valve **86** is moved by hydraulic pressure in gasket **84** for displacing disc **85** and actuating spray valve **30** for directing the atomized spray into the fuel flow portion of manifold **1**.

I have heretofore alluded to the precaution which I take in shielding any possible electric arcing at contacts from the highly volatile starting fluid where monitoring of the condition of operation of the spray valve is essential so that the operator will be put on notice that the spray valve is functioning and that there is no exhaustion of the contents of the pressurized can. In FIG. 20 I have shown a modified form of the electrical control for the monitoring system wherein a screw device **102** is passed through the wall of the fuel flow portion of the manifold **1** in a position immediately adjacent the atomizing nozzle **32** or **86**. The screw device **102** serves as a support for a bimetallic strip indicated at **103** consisting of a pair of thin aluminum strips **104** and **105** separated by a strip of insulation material **106**, the strips projecting into the path of the atomized spray from nozzle **86**. The screw device **102** serves to support an axially extending electrode **107** terminating in an electrical contact **108** immediately adjacent the assembly of bimetallic strips. The electrode **107** is insulated from screw device **102** by means of sleeve **109** of insulation material terminating in a flange **110**. The electrode **107** is screw threaded at the end thereof to receive the nut **111** to which an electrical conductor may be connected as represented at **112** forming one side of the control circuit to the contact **108**. The other side of the control circuit connects to the bimetallic assembly of strips through the ground connection represented at **113**. The strips **104** and **105** being located in the path of the atomized spray from nozzle **86** will be subject to change in position sufficient to control the movement of the bimetallic strips into contact with contact **108** depending upon whether or not the strip **104** is struck by the spray of atomized fuel. The atomized fuel by striking one of the strips changes the expansion characteristics thereof resulting in the displacement of the bimetallic strip assembly so that electrical contact is established between the bimetallic strip assembly and the contact **108** closing the circuit to the indicator lamp or an alarm as hereinbefore explained.

In the several forms of my invention I have referred to the integral relation between the holder or housing for the pressurized can and fuel flow portion of the manifold **1**. It is not essential that the holder or housing for the pressurized can **3** be integrally connected with the fuel flow portion of manifold **1** and in FIG. 21 I have shown a modified form of my invention in which the housing **114** terminates in a flange **115** which co-acts with a complementary flange **116** on the fuel flow portion of the manifold which I have designated at **117**. To facilitate the connection of the housing **114** to the manifold

117 I provide a circular recess 118 in flange 115 and a complementary circular projection 119 in the manifold 117. Bolts 120 and fastening nuts 121 are provided for securing flanges 115 and 116 together. In this arrangement the partition between the housing 114 and manifold 117 is somewhat wider than partitioning means in the other form of my invention and in this space I mount the monitoring switch of the type previously described and illustrated in FIG. 11 except that in the form of my invention shown in FIG. 21 I arrange a radially extending port 122 through which a short length of flexibly moulded tubing 123 extends. This tubing terminates at one end in a flange 124 located immediately adjacent the diaphragm and the electric circuit control assembly as explained in connection with FIG. 11. The other end of tube 23 connects to a stem 125 through which a passage extends into the nozzle represented at 126. Nozzle 126 is similar to the nozzle 86 described in connection with FIGS. 18 and 19 except that nozzle 126 is extended in its axial direction for the purpose of passing through the bore 127 in the partition section and projecting moveably through the bore 128 in the manifold section. The nozzle 126 carries a disc corresponding to the disc 85 in FIG. 18 and all of the other components in the assembly shown in FIG. 21 are similar to the components shown in FIGS. 18 and 19. A shoulder 129 formed on nozzle 126 limits the entry of nozzle 126 through bore 128 into the manifold section 117 but enables the nozzle to be depressed in the direction of valve 30 as hydraulic pressure is supplied to gasket 84 as explained in connection with the structure of FIGS. 18 and 19 for delivering a spray of starting fluid to the manifold.

The monitoring arrangements of my invention may be utilized for warning the engine operator of the condition of the atomized spray in the manifold so that the operator may replace the pressurized can of starting fluid. The standard can of starting fluid may last over an extended period of time depending upon the frequency of use. The can as it becomes exhausted is readily replaced to insure maximum convenience and safety in engine starting. Control of the valve for spraying the fluid contents into the manifold section is effected from the dashboard of a vehicle where the applicator is applied to a vehicle engine or from the control panel of the engine where the applicator is applied to stationary engines.

I have found the structures described herein highly effective and while I have described my invention in certain of its preferred embodiments I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

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

1. An internal combustion engine starting system comprising an intake ducting, means having a transverse section substantially the same as the transverse section of said intake ducting connected with said ducting for receiving and wholly enclosing a replaceable pressurized container of starting fluid for providing a multiple number of successive engine starts and wherein said container includes an actuating valve for selectively releasing a spray of starting fluid from the pressurized container and means for directing the spray from said valve in a confined path into said intake ducting.

2. An internal combustion engine starting system as set forth in claim 1 in which said means having a transverse section substantially the same as the transverse section of said intake ducting connected with said ducting for receiving and wholly enclosing said pressurized container extends on an axis normal to the axis of said ducting.

3. An internal combustion engine starting system comprising an intake ducting, a housing having a transverse section substantially the same as the transverse section of said intake ducting connected with said ducting, said housing having a passage leading into said ducting, a pressurized can of starting fluid for providing a multiple number of successive engine starts and having an actuating valve therein adapted to be mounted wholly within said housing and means mounted on said housing for selectively operating said valve for delivering a spray of starting fluid into said ducting through the passage in said housing.

4. An internal combustion engine system comprising an intake manifold, a chamber having a transverse section substantially the same as the transverse section of said intake manifold for a pressurized can of starting fluid for providing a multiple number of successive engine starts and projecting on said axis substantially normal to the axis thereof, a pressurized can of starting fluid insertable into and removable from said chamber, said pressurized can having a release valve on one end thereof, said chamber and said manifold being connected through a passage for directing atomized starting fluid in a confined path through said valve to said manifold and means mounted on said chamber for selectively operating said release valve.

5. An internal combustion engine starting system comprising an intake ducting terminating in a substantially vertical flange, a chamber having a transverse section substantially the same as the transverse section of said intake ducting and extending at an angle to said intake ducting and terminating in a flange aligned with the aforesaid flange and connectible thereto, a valve operating system located between said intake ducting and said chamber and a pressurized can of engine starting fluid for providing a multiple number of successive engine starts and insertable in and removable from said chamber, said can having a releasable valve in the end thereof alignable with said valve operating mechanism and engageable thereby, and means for actuating said valve operating mechanism for operating said releasable valve and directing a spray of engine starting fluid in a confined path from said chamber into said intake ducting.

6. An internal combustion engine starting system as set forth in claim 5, in which said chamber includes means mounted on said chamber and activated by the spray of engine starting fluid released by said pressurized can for indicating the continuity of the spray from the pressurized can.

7. An internal combustion engine starting system as set forth in claim 5 in which said valve operating system is constituted by a hydraulically activated device located intermediate said intake ducting and said chamber and means for remotely controlling said hydraulically activated device for selectively exerting pressure against said releasable valve for displacing said valve to spraying position.

8. An internal combustion engine starting system as set forth in claim 5 in which a spray monitoring device is located intermediate said chamber and said intake ducting and wherein said valve operating system includes a hydraulic device disposed within said chamber and means for remotely controlling said hydraulic device for displacing said releasable valve to spraying position for operating by said spray said monitoring device so long as the spray of engine starting fluid is delivered from said valve to said intake ducting.

9. An internal combustion engine starting system comprising an intake ducting terminating in a substantially vertical flange, a chamber having a transverse section substantially the same as the transverse section of said intake ducting and extending at an angle to said intake ducting and terminating in a flange aligned with the aforesaid flange and connectible thereto, a valve operating system located between said intake ducting and said chamber and a pressurized can of engine starting

fluid for providing a multiple number of successive engine starts and insertable in and removable from said chamber, said can having a releasable valve in the end thereof alignable with said valve operating mechanism and engageable thereby, means for actuating said valve operating mechanism for operating said releasable valve and directing a spray of engine starting fluid in a confined path from said chamber into said intake ducting and in which the means for actuating said valve operating mechanism for operating said releasable valve and directing a spray of engine starting fluid into said intake ducting includes a nozzle having an axial passage therein aligned with said releasable valve and extendng between said releasable valve and said intake ducting and movable into and out of said intake ducting as said releasable valve is actuated, said nozzle having a flexible tube extending from one side thereof and connected with the passage through said nozzle, and a monitoring device connected with said flexible tube for indicating the continuity of spray through the passage from the pressurized can.

10. An internal combustion engine starting system comprising an intake ducting, means forming a chamber connected with said ducting and adapted to receive a pressurized can of starting fluid having an actuating valve at one end thereof for releasing atomized starting fluid, means for substantially enclosing said pressurized can within said chamber with the valve end thereof directed toward said intake ducting, a nozzle embracing said actuating valve and having a passage therein extending between said chamber and said intake ducting, said nozzle having a portion thereof abutting with an annular shoulder intermediate said chamber and said intake ducting and means attached to said chamber for axially displacing said pressurized can of starting fluid for displacing the valve thereof with respect to said nozzle sufficiently to release an atomized spray of starting fluid from said valve through said nozzle into said intake ducting.

11. An internal combustion engine starting system as set forth in claim 10 in which said means for substantially enclosing said pressurized can within said chamber comprises a pair of diametrically opposed hook members engageable with the rim of the bottom of the pressurized can, a cover member closing the end of said chamber and in which the means attached to said chamber for axially displacing said pressurized can of starting fluid consists of a movable guide ring having diametrically extending studs projecting from opposite sides thereof through said chamber, and means engaging said studs for displacing said can axially within said chamber.

12. An internal combustion engine starting system as set forth in claim 10 in which said means for substantially enclosing said pressurized can within said chamber comprises a cover member telescopically closing the end of said chamber, a clamp bar engaging the exterior end of said cover member and resilient means for maintaining said clamp bar in position.

13. An internal combustion engine starting system as set forth in claim 10 in which said means for substantially enclosing said pressurized can within said chamber comprises a cover member telescopically closing the end of said chamber, a resilient pad carried within said cover member and engaging the end of the pressurized can as a seat, and means extending through said cover member and attached to said resilient pad for resiliently displacing said pad for correspondingly moving said pressurized can for operating said actuating valve on the end of said pressurized can.

14. An internal combustion engine starting system as set forth in claim 10 in which said means for substantially enclosing said pressurized can within said chamber comprises a cover member telescopically closing the end of said chamber, a resilient pad carried within said cover member and engaging the end of the pressurized can as a seat, means extending through said cover member and attached to said resilient pad for resiliently displacing said pad for correspondingly moving said pressurized can for operating said actuating valve on the end of said pressurized can, and means pivoted to said chamber and extending around said cover member and engaging the end of the means attached to said resilient pad and which extends through said cover member for displacing the said last mentioned means for correspondingly displacing said pressurized can.

15. An internal combustion engine starting system as set forth in claim 10 in which said means for substantially enclosing said pressurized can within said chamber comprises a cover member telescopically closing the end of said chamber, a resilient pad carried within said cover member and engaging the end of the pressurized can as a seat, means extending through said cover member and attached to said resilient pad for resiliently displacing said pad for correspondingly moving said pressurized can for operating said actuating valve on the end of said pressurized can, means pivoted to said chamber and extending around said cover member and engaging the end of the means attached to said resilient pad comprising a yoke which centrally contacts the end of said means attached to said resilient pad for displacing said pad axially and correspondingly displacing said pressurized can, a level attached to said yoke and latching means on the end of said lever for detachably confining a control wire with respect to said lever for operating said yoke, the said yoke being swingable out of the lineal path of said cover member when the control wire is detached from said lever.

16. An internal combustion engine starting system as set forth in claim 10 in which a pressure monitoring device is interposed between said chamber and said intake ducting for remotely indicating the continuity of the spray of atomized starting fluid from said nozzle.

17. An internal combustion engine starting system as set forth in claim 10 in which said intake ducting includes a temperature controlled electric switch disposed in the path of discharge of the atomized spray into said intake ducting, said switch being operative under control of the spray discharged from said nozzle.

18. An internal combustion engine starting system as set forth in claim 10 in which a pressure-operated switch containing contacts is disposed between said chamber and said intake ducting and subjected to the pressure of the spray from said nozzle, and means for shielding said switch contacts from said spray of starting fluid.

19. An internal combustion engine starting system as set forth in claim 10 in which said chamber is externally recessed at one side thereof and a pressure-operated electric switch set into said recess and wherein the passage through said nozzle has a port in one side thereof and wherein there is a passage disposed between said chamber adjacent said intake ducting connecting the port in said nozzle and the said pressure-operated electric switch, and a resilient diaphragm isolating said last mentioned passage from said switch, said resilient diaphragm operating under pressure exerted by the atomized spray through said nozzle for operating said switch.

20. An internal combustion engine starting system comprising an intake manifold, a replaceable pressurized container of starting fluid for providing a multiple number of successive engine starts, means integral with and laterally extending from said intake manifold for receiving and enclosing said container, an actuating valve for selectively releasing a spray of starting fluid from said pressurized container, resilient means carried by said first mentioned means coacting with said actuating valve and said container for releasing starting fluid therefrom, and means for directing the spray from said valve in a confined path into said intake manifold.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

2,294,236	Levernier	Aug. 25, 1942
2,364,356	Greathouse	Dec. 5, 1944
2,631,814	Abplanalp	Mar. 17, 1953
2,673,008	Ryan	Mar. 23, 1954
2,720,422	Mercur	Oct. 11, 1955
2,792,010	Schink	May 14, 1957
2,812,754	Harvey	Nov. 12, 1957
2,862,491	Burack	Dec. 2, 1958