Feb. 26, 1963 T. C. FARRELL ETAL 3,078,875

TWO STAGE VALVE

Filed Aug. 12, 1958 4 Sheets-Sheet 1

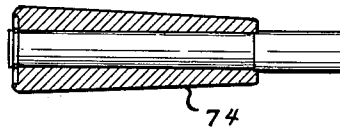


Fig. 2

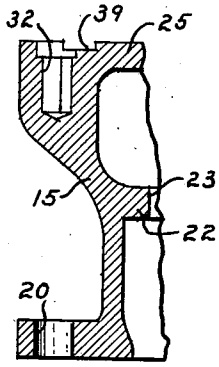


Fig. 3

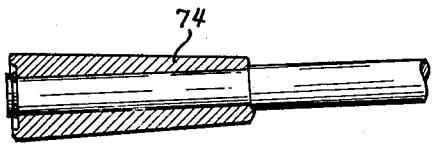


Fig. 1

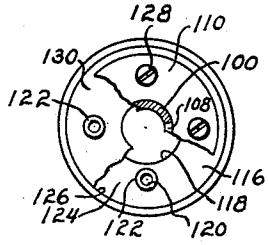
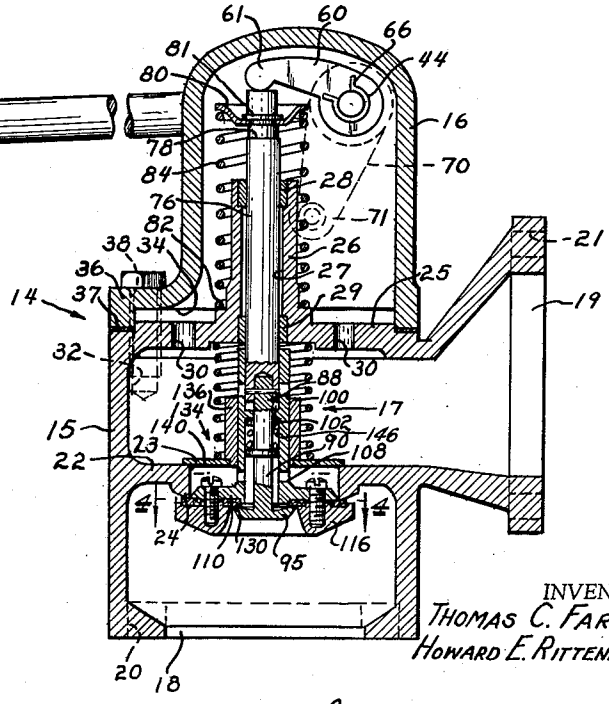


Fig. 4



INVENTORS
THOMAS C. FARRELL
HOWARD E. RITTENHOUSE

BY Strauch, Nolan + Neale

ATTORNEYS

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Fig. 6

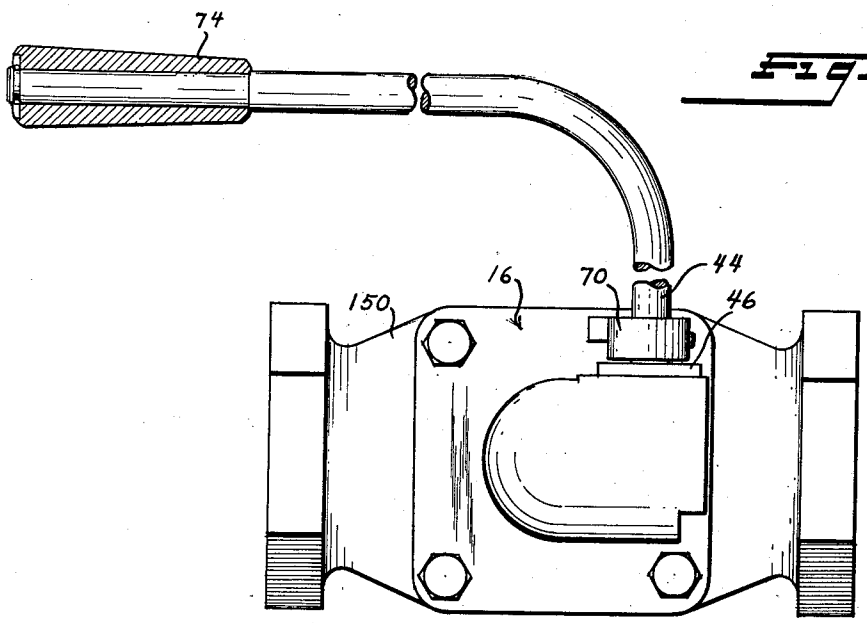
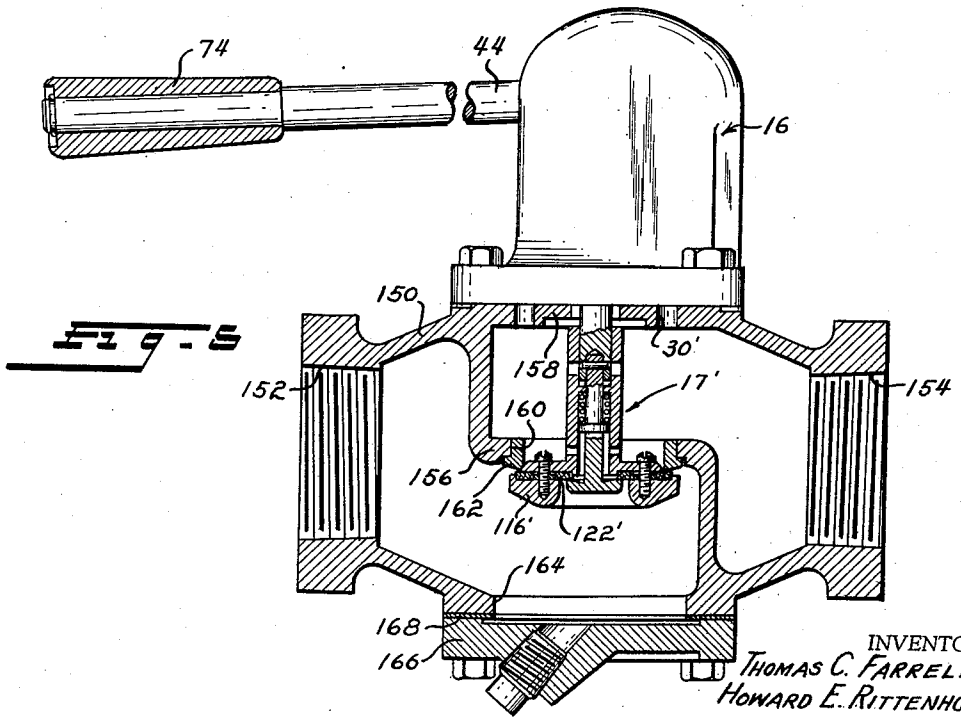


Fig. 5



INVENTORS
THOMAS C. FARRELL
HOWARD E. RITTENHOUSE

BY Strauch, Nolan & Neale

ATTORNEYS

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TWO STAGE VALVE

Filed Aug. 12, 1958 4 Sheets-Sheet 3

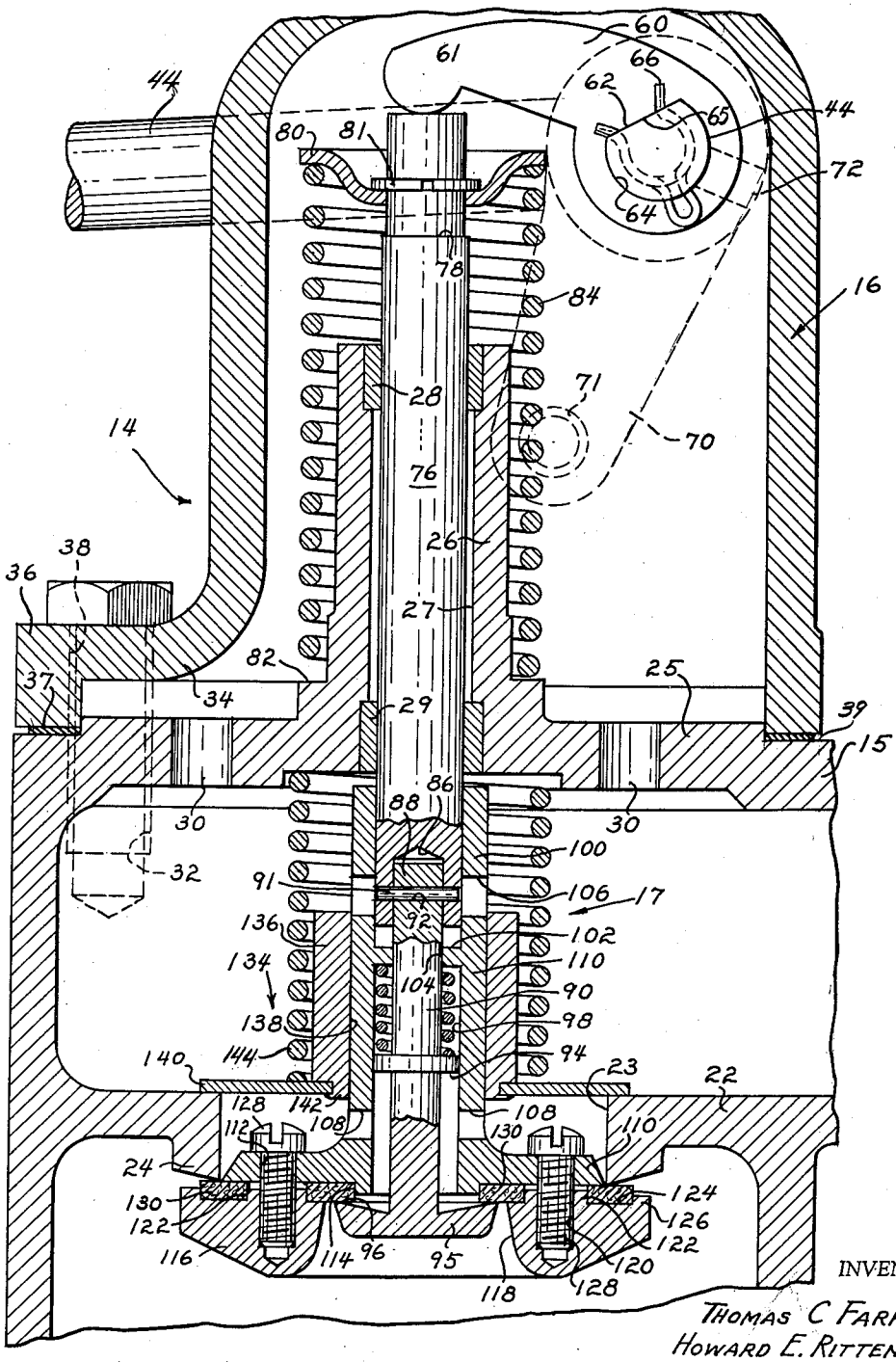

Fig. 1

INVENTORS
THOMAS C FARRELL
HOWARD E. RITTENHOUSE

BY Strauch, Nolan + Neale
ATTORNEYS

Feb. 26, 1963 T. C. FARRELL ETAL 3,078,875

TWO STAGE VALVE

Filed Aug. 12, 1958 4 Sheets-Sheet 4

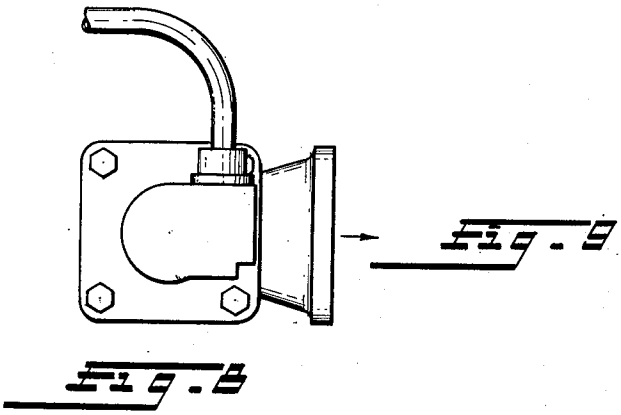

Fig. 8

Fig. 9

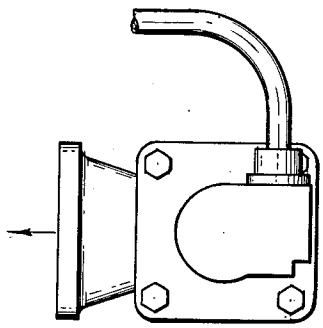

Fig. 10

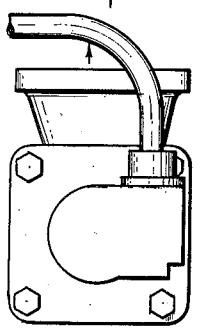

Fig. 11

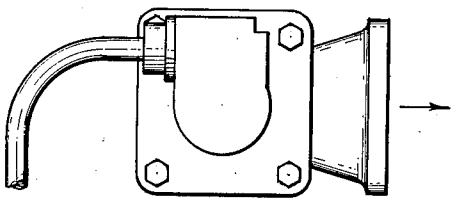

Fig. 12

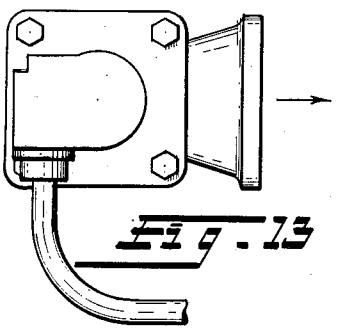

Fig. 13

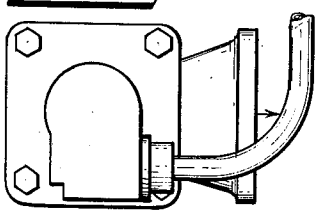

Fig. 14

INVENTORS
THOMAS C. FARRELL
HOWARD E. RITTENHOUSE

BY Strauch, Nolan & Neale
ATTORNEYS

United States Patent Office 3,078,875 Patented Feb. 26, 1963

3,078,875

TWO STAGE VALVE

Thomas C. Farrell, Glenshaw, Pa., and Howard E. Rittenhouse, Statesboro, Ga., assignors to Rockwell Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Aug. 12, 1958, Ser. No. 754,661
15 Claims. (Cl. 137—630.15)

This invention relates to two stage valves and particularly to quantity control valves having a two-stage coaxial closure useful in predetermining flow operations.

Two stage quantity control valves are known in the prior art. However, there is a continuing demand in the valve industry and from users of valves for improved simple, inexpensive, and reliable construction in this type of valve. At the same time it is desired to have versatility in the installation of such valves.

The present improved valve invention has been developed with such factors in mind and provides an inexpensive basic construction in which, among other things the pilot, or auxiliary stage, valve operating stem is utilized as a guide for the main valve member, a single sealing seat disk is utilized as the common seat for both the pilot and the main valve, and an auxiliary back pressure valve can be provided with simple guide means cooperating with the main valve guide stem. Three cast parts, together with other components which can be made inexpensively with conventional machine tools, provide a simplicity of construction enabling inexpensive production and maintenance. The cast structures, in one of the hereinafter described embodiments, enables convenient installation positions to be obtained merely by shifting the positions of a valve cover member and/or a body casting without requiring readjustment of operating components. The inter-relationship of components parts provides a compact overall unit of a plural stage valve and a back pressure valve, all valve closures being coaxial.

Accordingly a principal objective of this invention resides in the provision of a novel two stage quantity control valve of inexpensive construction.

A further object of this invention resides in providing a novel compact two stage control valve having coaxial valve control members for both valve heads and utilizing a sealing seat disk to provide a common seat for both valve stages.

Another object of this invention resides in the provision of a novel two stage control valve in which the operating stem of a first stage closure member serves as a guide post for a main valve sleeve guide. In connection with this object still another object resides in providing a novel plate type back pressure valve seated on the opposite side of the valve control port and guided for coaxial reciprocation on the main valve guide sleeve.

A still further object resides in providing a novel two stage quantity control valve with a main body casting including an axial inlet, a ported wall transverse to the axial inlet and a radical outlet; a two stage valve assembly reciprocably mounted in the main body casting with a main stage seated on the wall over the port; a casing cover assembly including operating controls, adapted to be mounted on the main body casting in a plurality of positions in which the controls cooperate with the two stage valve assembly in operative relationship, and the main body casting being adaptable for a plurality of mounting positions on an inlet coupling whereby the radial outlet and/or control members can be disposed as desired.

Still another object resides in providing a novel multiple valve closure assembly which includes a main valve guide sleeve, a composition valve seating disk, and a

cast retainer ring maintaining the disk on the main valve sleeve with an outer peripheral portion of the seating disk serving as a seat for one stage of closure and the inner peripheral opposite side portion of the seating disk serving as a seat for a second stage closure.

Further novel features and objects of this invention will become apparent from the following detailed description, discussion and the appended claims taken in conjunction with the accompanying drawings showing preferred structures and embodiments, in which:

FIGURE 1 is a sectioned side elevation illustrating an exemplary embodiment of a valve assembly constructed in accord with the present invention;

FIGURE 2 is a partially sectioned top plan view of the valve assembly shown in FIGURE 1 illustrating the construction and assembly of the operating control arm;

FIGURE 3 is a section view taken on line 3—3 of FIGURE 2 illustrating the flange mounting holes and cover mounting holes in the valve body;

FIGURE 4 is a detail partially broken away, section view taken on line 4—4 of FIGURE 1 illustrating main valve head details;

FIGURE 5 is a partially sectioned side elevation view of a second valve assembly embodiment in accord with the concepts of this invention and in which the valve body inlet and outlet are disposed in alignment;

FIGURE 6 is a top plan view of FIGURE 5 valve assembly with aligned inlet and outlet utilizing the same cover and control assembly as shown in FIGURE 2;

FIGURE 7 is an enlarged detailed section elevation showing both stages of valve closure, the valve control assembly and the coaxial back pressure valve; and

FIGURES 8 through 14 are diagrammatic illustrations showing some of the valve outlet and control lever positions obtainable by means of a simple repositioning of the cover and/or main body components.

Referring now to the drawing figures for a detailed description of the invention, it will be noted that the primary distinction between the two embodiments (FIGURES 1 and 5) is in the main body component of each valve assembly, the actual valving components in each embodiment being essentially the same except for some details which will be hereinafter described. Accordingly, where appropriate, similar reference numerals are used to identify similar elements.

FIGURES 1 and 2 illustrate a valve unit **14** with an axial inlet and a lateral (or radial) outlet. The valve unit **14** consists of a main body **15**, a cover **16** and a valve assembly **17**. The body **15** and cover **16** can be readily made by well known casting methods.

Shown in FIGURE 1, the main body **15** has a bottom inlet opening **18** and a side outlet opening **19** at right angles thereto. Each of openings **18** and **19** has an integral peripheral coupling flange with bolt receiving holes at **20** (see FIGURE 3) and **21** respectively. Intermediate the inlet and outlet openings is a transverse integral partition wall **22** having a main valve opening **23** which is coaxial with the inlet **18**. Circumscribing the valve opening **23** is a short, beveled, annular rim **24** which projects axially toward the inlet **18**. The beveled rim **24** provides a narrow circular seat surrounding the valve opening **23**.

An integral end wall **25** of valve body **15**, on the end opposite the inlet **18**, includes a center, exterior, sleeve-like extension **26** with its through bore **27** concentric with the openings **18** and **23**. Both ends of bore **27** are counterbored to receive guide bearings **28** and **29** (FIGURE 1). Radially disposed around the extension **26** and spaced 90° apart in the body end wall **25** are four holes **30**. These holes, which may be drilled or formed during casting and which may be more or less

than four, are provided to assure that any of the fluid product conveyed through the valve which passes upwards along the valve stem and enters the cavity of the casing cover can drain from the cover while the valve is closed. The holes **30** allow an old product to drain from the upper cover chamber before a new product is passed through the system to which the valve is connected.

The end wall portion of body **15** also has a threaded hole **32** in each of its four corners enabling attaching of the valve body cover **16**. Referring to FIGURES 1, 2, 5 and 6 the cover **16** is hollow and has an open lower end **34** surrounded by an integral rectangular, radially disposed flange **36** with four corner holes **38** which can be aligned with the threaded holes **32** in the main body **15** in all four cover positions (see FIGURES 8–11). An annular gasket **37** is disposed in a groove **39** around the upper end of body **15** and is clamped between cover **16** and the body to provide a fluid tight fit. In the vertical side wall of cover **16**, FIGURE 2, adjacent its upper closed end, is a threaded opening **40** and in the opposite sidewall of cover **16** is a blind bore **42** concentric with threaded opening **40**.

A combined handle and operating rod **44** passes through an axial bore **45** in a hex head gland bushing **46** which is threadedly disposed within the threaded cover opening **40** against a gland gasket **47**. Bushing **46** has a shallow counterbore **50** at the inner end of its bore **45** within which is placed an O-ring seal **52**. This O-ring **52** surrounds, engages and seals the operating rod **44** interiorly of the cover **16**. A second annular bushing **54** is mounted on rod **44** so that its reduced diameter end face **56** will compress O-ring **52** within groove **50**, when the control components are assembled.

A valve operating lever **60**, FIGURES 1 and 7, having a radially projected arm **61** is non-rotatably mounted over a milled flat **62** near the inner end of the operating rod **44**. As can be seen in FIGURE 2, the operating lever **60** has an opening **64**, the circular periphery of which is interrupted by a straight wall **65** corresponding to the flat **62** in the rod **44**. Both the bushing **54** and the lever **60** are held against axial movement on operating rod **44** by a retainer clip **66** in an annular groove adjacent the inner end of rod **44**. A reduced diameter inner end **68** of rod **44** adjacent the groove **67** is journalled in the aforedescribed blind bore **42** in the sidewall of cover **16**. Disposed on rod **44**, exterior of the cover **16**, is a lever member **70**, utilized for automatic valve control. Lever **70** is non-rotatably secured to the rod **44** adjacent bushing **46** by means of a set screw **72**. The outer portion of the operating rod **44** is curved to form a hand lever and on its end is a suitable handle **74**, as seen in FIGURES 1 and 2.

With specific reference to FIGURE 7, a reciprocable valve operating stem **76** is slidably received within the spaced bearings **28** and **29** of the body end wall extension **26**. Near its upper end, the stem **76** is slightly reduced in diameter to provide an annular shoulder **78**. An annular spring retainer **80** is disposed on the stem end against shoulder **78** and is retained on the reduced end of stem **76** by a spring clip **81** disposed in a groove. In compression between the retainer **80** and an annular shoulder **82** formed on body end wall **25** at the base of the extension **26**, is a coil spring **84** which pushes upward on the stem carried spring retainer **80** to bias the valve operating stem in an upward direction.

At its lower end, the operating stem **76** has a blind axial bore **86** into which is fitted the stem end **88** of a pilot or auxiliary valve element **90**. A retaining pin **91**, pressed into a diametrical bore **92** in the valve stem **88** and an aligned diametrical bore in operating stem **76**, normal to the blind bore **86**, secures pilot valve element **90** to the operating stem. The substantially cylindrical pilot valve stem **88** has an intermediate annular shoulder **94**, the diameter of which is essentially the same as the diameter of operating stem **76**. The closure end **95** of the pilot valve element **90** is mushroomed and suitably flared to form a peripheral valve closure seat **96**.

Both the pilot valve stem **88** and the lower end of the valve operating stem **76** are slidably received within the axial bore **98** of a main valve guide sleeve **100**. The bore **98** is interrupted by an integral intermediate annular web **102** having a coaxial circular opening **104** through which the stem **88** of the pilot valve element **90** is slidably disposed. Two sets of diametrically opposed openings **106** and **108** are provided in the cylindrical wall of the main valve guide sleeve **100**. Openings **106** permit insertion of the stem and pilot valve element securing pin **91** during assembly and openings **108** provide first stage flow passages. The outer periphery of the guide sleeve **100** is interrupted near the lower end by a relatively large diameter annular flange **110** which has four equally spaced circular holes **112** on a concentric bolt circle. At the extreme lower end of the guide sleeve **100** and adjacent the inner periphery of flange **110** is an axially disposed annular lip **114** around the end of bore **98**.

FIGURES 1, 3 and 6 illustrate a die cast annular main valve ring member **116** secured on the sleeve guide flange **110** and having a central circular opening **118** larger than the pilot valve head **95**. Four equally spaced threaded holes **120**, within associated upstanding bosses **122**, surround the opening **118** in ring member **116**. The plane upper surface **124** of the ring member **116** has an outer peripheral lip **126**.

The main valve disc **116** is secured to the flange **110** of the valve guide sleeve **100** by four screws **128**, clamping a valve seat member **130** therebetween. Valve seat member **130** can be made from substantial rigid composition gasket material, is annular and has four equally spaced holes, the diameters of which are equal to the diameter of the bosses **122** on main valve disc **116**, so the seat member **130** fits over the ring member bosses **122**. The inside diameter of valve seat member **130** is equal to the outside diameter of the inner peripheral lip **114** on the lower end of the main valve guide sleeve **100** and the outside diameter of valve seat member **130** is equal to the inside diameter of the outer peripheral lip **126** on main valve ring member **116**. In FIGURE 4 items **122'** are sleeves, four of which are used in place of the bosses **122** to adapt a sand cast disc **116'** to be used at the lower end of valve guide sleeve **100**. The preferred construction of ring member **116** is shown in FIGURES 1 and 7.

Valve guide sleeve **100** also acts as a pilot for a spring biased back pressure valve **134**. The back pressure valve **134** is a plate type valve consisting of a cylindrical guide member **136**, which has an axial bore **138**, and an annular valve washer **140** which is rigidly secured on a reduced diameter end **142** of the guide member **136** by spinning the end of the guide. The back pressure valve assembly **134** is slidably mounted on the cylindrical portion of the valve guide sleeve **100**, as clearly shown in FIGURE 7. The outer diameter of the valve washer **140** is larger than the diameter of the main valve opening **23** enabling the outer edge of valve washer **140** to rest on a machined flat periphery of the valve body partition wall **22** and completely cover the opening **23**. A coil spring **144** fits over the guide cylinder **136** and is compressed between the valve washer **140** and the end wall **25** of the main body **15** adjacent the bore **27** of extension **26**. Movement of the back pressure valve **134** is not directly effected by movement of, or spring force against, the other movable components of the valve assembly **17**. Fluid passing through opening **23** must be under a pressure of at least 3 p.s.i., to lift the back pressure valve **134** from the position shown in FIGURE 1.

Dispensing and measuring systems include a meter in the flow line, generally located ahead of the quantity

control valve and, to assure accurate metering of the fluid, an air eliminator unit is normally provided. To provide most efficient operation of the air eliminator unit, the fluid in the line behind the control valve should be pressurized and the aforementioned 3 p.s.i. back pressure is considered sufficient.

The aforesaid valve embodiment was conceived for use in a predetermined dispensing system to be installed on tank trucks, and in such installations the dispensing nozzle is relatively near the quantity control valve hence the need for a valve to assure proper back pressure on the meter and air eliminator. To serve this purpose, back pressure plate valve **134** is provided in a compact simple installation together with the other valving components.

In an installation of this valve embodiment in a tank truck dispensing system, the outlet pipe from the system meter (not shown) is fastened to the inlet end **18** of valve body **15** by bolts received in the holes **20** at the corners of the inlet flange. In predetermining installations, a rod (not shown) extends from a predetermining register latch box to the valve control arm **70** and is fastened thereto at pivot connection **71**. When the handle **74** of operating rod **44** is depressed, the valve operating stem **76** will be forced downward by the extending arm **61** of the internal valve lever **60**. Initial downward movement of operating stem **76** will cause only the pilot valve **90** to move downward from its seat, permitting passage of fluid into the opening **23** by way of the guide sleeve bore **98** and the radial openings **103** in the wall of the valve guide sleeve **100**. A coil spring **146**, which is compressed between the shoulder **94** of the pilot valve stem **88** and the web **102** of the main valve guide sleeve **100**, will hold the main valve closed even after pressure on both sides of the main valve equalizes until the lower end of the operating stem **76** strikes the guide sleeve web **102** and forces guide sleeve **100** down to open the main valve.

The rod from the latch box will hold the valve control lever **70** against return rotation to its position in FIGURE 1 under the biasing force of the spring **84**. After a predetermined quantity of fluid has passed through the dispensing meter, the latch box will release the control arm **70** for a limited amount of return rotation. The spring **84** raises the valve operating stem **76** until it is no longer abutting the web **102** of the main valve guide sleeve **100**. The inner spring **146** will then raise the guide sleeve **100** and close the main valve. After a few more gallons have passed through the meter, the latch box will allow the control arm **70** to complete its return and the operating stem **76** will be raised under bias of spring **84**, resulting in closing of the pilot valve **90** and a complete shutoff of flow through the valve.

The relative positions of the latch box control arm and the meter outlet are, of necessity, generally fixed in a tank truck installation. However, there are four different positions possible for the main valve body **10** for any given position of the control arm **70**. For example, FIGURE 8 shows an installation with the control arm **70** disposed toward the top of the sheet, and FIGURES 9, 10 and 11 illustrate the same position of the control arm **70**, but the main body has been rotated in either direction 90° or 180° from the position shown in FIGURE 8 to another position of alignment of bolt holes **38** and **32** without changing the position of the unit within a limited space such as is the case in tank truck service.

FIGURES 12, 13 and 14 illustrate three other positions of the control arm **70** which can be obtained by shifting the cover 90° in either direction or 180° from the position shown in FIGURE 8. In each of FIGURES 8, 12, 13 and 14 the valve outlet is disposed in the same direction and for each of the cover positions of FIGURES 12, 13 and 14 there are three additional valve body positions corresponding to FIGURES 9, 10 and 11. Thus it is seen that installation of this valve is extremely versatile and enables considerable flexibility for use in different tank truck installations.

The use of the valving components of this invention can be applied to other services besides tank trucks. In this respect FIGURES 5 and 6 show an embodiment which adapts the valve to other services. The main difference is in the body casting **150**. The cover **16**, control linkage carried thereby and valve assembly **17** of this embodiment, excepting for the differences in the main valve disc **116'** and small sleeves **122'** as previously described, are the same as the cover, control linkage and valve assembly **17** hereinbefore fully described.

Although the back pressure valve **134** is not shown in FIGURES 5 and 6, one can be used if desired and necessary. It is omitted from FIGURES 5 and 6 because of the different conditions encountered in services other than on a tank truck. In most other services, the product may pass through many feet of piping before it reaches the dispensing point. Also, the fluid might travel to a higher point than the location of the control valve. At any rate, the required 3 p.s.i. back pressure is normally inherently present downstream of the control valve and the back pressure valve need not be used.

Valve body casting **150** provides aligned inlet and outlet openings **152** and **154** which for purposes of this description will be described as being in horizontally aligned disposition. A horizontal partition wall **156** is disposed midway of the top and bottom walls of the main body **150** and provides inlet and outlet chambers. Upper body wall **158** is comparable in details to the end wall **25** of valve **14**, having drain holes **30'** and a central extension (not shown) with a bore **27'**.

The partition wall **156** is provided with an opening **160** into which a seat ring insert **162** is disposed and sealingly retained by suitable means, such as sweating or brazing. Valve assembly **17'** can be placed in position through bottom opening **164** in body **150** which is closed by a bottom cover plate **166** and sealing gasket **168**.

In comparison with the previously described embodibodiment, the embodiment of FIGURES 5 and 6 is more logical for general installations. However, as previously described, where there are very definite spaced and dimensional limitations, as in tank truck installations, the first described embodiment is the more practical valve embodiment.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicative by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A quantity control valve comprising: a valve body having an inlet and an outlet, an apertured interior wall partition between said inlet and outlet, peripheral seat means around the partition aperture, and a boss integral with a wall of said valve body spaced from the outlet side of the partition wall having a through bore coaxial with said partition aperture; a valve operating stem reciprocably guided in and projecting through said bore; a first resilient biasing means between said body and said operating stem biasing said stem away from said partition; a main valve closure guide sleeve within said body having a coaxial through bore with a radially disposed exterior flange at one end, a radially disposed interior flange intermediate its ends, and flow passage apertures in the guide sleeve wall intermediate the said two flanges, the end of said sleeve opposite said exterior flange being reciprocably guided on the end of said operating stem projecting into said body; a main valve retaining ring secured to said exterior flange; a pilot valve closure including a stem having one end projected into

said guide sleeve, through said interior flange and fastened to said operating stem, a head on the other end larger in diameter than the sleeve bore and an intermediate flange on said stem slidably disposed in the guide sleeve bore between said guide sleeve apertures and said interior flange; an annular seat disc clamped between said exterior flange and said retaining ring providing both a main valve seat and a pilot valve seat; second resilient means between said pilot stem flange and said interior flange biasing said guide sleeve interior flange toward engagement with said one end of said operating stem; and control means on said valve body to reciprocate said operating stem to sequentially move said pilot valve head, said guide sleeve and said seat disc away from valve seated engagement.

2. A quantity control valve as defined in claim 1, wherein a back pressure valve means is guided on said guide sleeve and means, having a low pressure biasing force, engage and urge said back pressure valve means to sealingly engage the periphery of the outlet chamber side of said aperture.

3. A quantity control valve as defined in claim 1, wherein said valve body comprises an integral member having said inlet at one end, said outlet disposed in a direction transverse to said inlet, and said partition wall aperture is essentially coaxial with said inlet.

4. A quantity control valve as defined in claim 1, wherein said valve body comprises an integral member having said inlet and outlet in aligned disposition, the axis of said partition wall aperture being substantially transverse to the axis of said aligned inlet and outlet, and an assembly opening larger than said retaining ring in the wall of the inlet side of said valve body and essentially aligned with said boss and said aperture; and a cover removably secured to said assembly opening.

5. A quality control valve as defined in claim 1, wherein said control means comprises a cover member journalling an operating rod and means are secured to said operating rod for engaging and reciprocating said operating stem against the biasing force of said first resilient means; and means securing said cover member to said valve body in any one of a plurality of positions coaxial with the axis of the valve operating stem, in each of which positions said means secured to said operating rod can engage and reciprocate said operating stem in an identical manner.

6. A quantity control valve as defined in claim 5, wherein said valve body has means at the inlet end enabling said body to be secured to a pipe conduit end coupling in any of a plurality of positions coaxial with the axis of said valve operating stem.

7. A quantity control valve comprising: a valve body having an inlet and an outlet, an apertured interior wall partition between said inlet and outlet, peripheral seat means around the partition aperture, and means integral with a wall of said valve body spaced from the outlet side of the partition wall providing a through bore coaxial with said partition aperture; a valve operating member reciprocably guided in said through bore; a first resilient biasing means biasing said operating member away from said partition; a main valve closure guide member having as its sole guide structure, a central sleeve member with a coaxial through bore enabling said sleeve member to be reciprocally slidably disposed on said operating member with said sleeve member projecting through said partition aperture, said guide member also being provided with a radially disposed exterior flange at one end, and apertures from the bore to the exterior of said guide member adjacent said flange; a main valve retaining ring secured to said exterior flange; a pilot valve closure including a stem having one end projected into the bore of said guide member and fastened to said operating member, and a head on the other end larger in diameter than the guide member bore; said guide member being retained and solely reciprocably guided for limited movement on said operating member by said pilot valve closure and said operating member; an annular seat disc clamped between said exterior flange and retaining ring providing a main valve and pilot valve seat; second resilient means between said pilot stem and said guide member biasing said guide member toward a limit position against said operating member; and control means on said valve body to reciprocate said operating member to sequentially move said pilot valve head and guide member and seat disc away from valve seating engagement whereby fluid may flow through each of said valves from the inlet to the outlet of the valve body.

8. A quantity control valve as defined in claim 7 wherein a back pressure valve means has a central member reciprocably mounted and guided on the exterior of said guide member sleeve member and means having a low pressure biasing force engage and urge said back pressure valve means to sealingly engage the periphery of the outlet chamber side of said aperture.

9. A two stage quantity control valve comprising: a main body member including an axial inlet, a radial outlet and a ported partition wall disposed transverse to said inlet intermediate said inlet and said outlet; a two stage coaxial valve head assembly, with a single reciprocable operating stem, reciprocably mounted in said main body member solely by said stem, and having a coaxially ported main stage seating on said partition wall over the port and an auxiliary stage seating over the port in said main stage whereby fluid from said inlet may communicate with said outlet through each of said stages; a casing cover assembly, including operating control components and a cover member mounting said operating control components; fastening means removably securing said cover member on said main body member with a portion of said control components separate from and adapted to coaxially operatively engage with said stem of said two stage coaxial valve head assembly, said fastening means enabling said cover member to be solely so secured in a plurality of positions coaxial with the two stage valve assembly in which the control components are disposed in operative relationship to said two stage valve assembly; and said main body member having coupling mounting means adjacent said inlet enabling a plurality of coupling mounted positions coaxial with said two stage valve assembly.

10. A quantity control valve comprising: a valve body having an inlet and an outlet, an apertured partition wall between said inlet and outlet dividing the interior of said housing into inlet and outlet chambers, beveled periphery seat means disposed around the partition aperture on the inlet chamber side of said partition, and a boss integral with a wall portion of the outlet chamber side of said valve body having a bore coaxial with said partition wall aperture and containing reciprocable guide bearing means; a valve closure operating stem reciprocably guided in said bearing means with one end projected into said outlet chamber; first resilient biasing means between said body and said operating stem biasing said stem out of said body; a hollow valve closure guide sleeve with an outwardly projected radial flange at one end, an inwardly projected radial flange intermediate its ends, and flow passage apertures in the guide sleeve intermediate the said two flanges; the end of said sleeve opposite said one end being reciprocably guided on said one end of said operating stem; an apertured valve seat disc having an outer diameter larger than said partition aperture and an inner diameter approximately equal to the bore in said guide sleeve on the opposite side of said outer annular flange from said inner annular flange and disposed adjacent the inlet side of said partition wall; a main closure ring, with outer diameter at least equal to the outer diameter of said seat disc and an inner diameter greater than the inner diameter of said seat disc, rigidly secured to said outer annular flange and clamping said seat disc on said outer annular flange; a pilot valve closure including a stem

having one end projected through said inner annular flange and fastened to said operating stem, a head on the other end larger in diameter than the inner diameter of said seat disc and an intermediate flange on said stem slidably disposed in the guide sleeve bore between said guide sleeve apertures and said inner annular flange; second resilient means disposed between said pilot stem flange and said inner annular flange biasing said inner annular flange and guide sleeve toward engagement with said one end of said operating stem; and control means secured on said valve body to engage and reciprocate said operating stem against the bias of said first resilient means to sequentially first move said pilot valve closure away from seating engagement with said seat disc and then engage and move said guide sleeve and seat disc away from seating engagement with said partition seat means.

11. A quantity control valve as defined in claim 10, wherein the exterior of said guide sleeve is cylindrical and a plate type back pressure valve means is reciprocably guided on said guide sleeve and is biased to effectively sealingly engage between the periphery of the outlet chamber side of said aperture and said guide sleeve.

12. A quantity control valve as defined in claim 11, wherein said back pressure valve means comprises an apertured disc with a concentric guide boss slidably fitting over the cylindrical guide sleeve and a compression coil spring disposed over said guide boss and engaging the valve body to resiliently bias the check valve against the valve body partition.

13. In a quantity control valve having a main valve body comprising inlet, outlet and an intermediate ported partition wall, a multiple valve closure assembly reciprocably mounted in said body comprising: an elongate main valve guide member smaller in cross section than the port in said partition wall, disposed so that it projects completely through said partition wall port with a large continuous radial clearance and having a through bore, a radially outwardly disposed annular end flange on said guide member, a substantially rigid annular valve seat, a main valve retainer ring maintaining said annular valve seat on said guide member end flange with an outer peripheral portion of said annular valve seat adapted to engage and seat against the periphery of the port in said wall to serve as one stage of closure and the inner peripheral opposite side portion of said annular valve seat providing a seat for a second stage of closure.

14. In the valve as defined in claim 13 said retainer ring including an annular series of pilot bosses disposed in matched openings in said annular valve seat and fastening means connect between said end flange and said bosses to clamp said end flange, said annular valve seat and said retaining ring as a unit.

15. Flow control valve assembly permitting two stage opening and closing of the flow area, comprising: a main valve body with inlet, outlet, and an interior partition wall disposed between said inlet and said outlet provided with a valve seat forming an aperture; a second wall spaced from said partition wall and having a boss with a bore coaxial with said partition wall aperture, a valve assembly cooperating with the valve seat of the partition wall including an operating stem being reciprocably mounted in said bore, said valve assembly further including outer and inner coaxial valve members, means directly connecting said inner valve member to said operating stem, said outer valve member having a sleeve projection with a central through bore, said sleeve solely being reciprocably mounted for sliding movement on said operating stem and said inner valve member and being adapted to seat on the periphery of the valve seat of said partition wall and a portion of said central bore enabling fluid communication between said inlet and said outlet, said central bore being surrounded by a valve seat cooperating with said inner valve member, said outer valve member further having a radially inwardly directed flange means located intermediate the ends of said central bore, adapted to be abutted by said operating stem upon reciprocation of said operating stem, a resilient biasing means disposed between said inner valve member and said flange urging said inner valve member in an opening direction and urging said outer valve member in a closing direction, said flange being so arranged that upon movement of the operating stem in the opening direction, the outer valve member remains first in its closing position and is entrained and reciprocally moved by said operating stem only when the inner valve member has already opened.

References Cited in the file of this patent

UNITED STATES PATENTS

844,946	Lowe	Feb. 19, 1907
1,850,063	Pepper	Mar. 15, 1932
2,630,137	Krone	Mar. 3, 1953
2,822,000	Daniels	Feb. 4, 1958

FOREIGN PATENTS

251,392	Great Britain	May 6, 1926
287,719	Great Britain	Mar. 29, 1928
309,335	Germany	Nov. 18, 1918
409,145	Italy	Feb. 5, 1945
1,053,722	France	Sept. 30, 1953

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,078,875 February 26, 1963

Thomas C. Farrell et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 41, for "spaced" read -- space --; column 7, line 36, for "quality" read -- quantity --.

Signed and sealed this 22nd day of October 1963.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWIN L. REYNOLDS

Acting Commissioner of Patents