United States Patent

[11] 3,565,289

[72] Inventor **Charles D. Erickson**
Erie, Pa.

[21] Appl. No. **762,890**
[22] Filed **Sept. 26, 1968**
[45] Patented **Feb. 23, 1971**
[73] Assignee **A. O. Smith Corporation**
Milwaukee, Wis.

[54] **SELF-PROPORTIONING FLUID DISPENSING APPARATUS**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **222/57,** 222/134; 137/100
[51] **Int. Cl.** **B67d 5/56,** G05d 11/02
[50] **Field of Search** 222/134, 57; 137/100

[56] **References Cited**

UNITED STATES PATENTS

1,985,918	1/1935	DeLancey	222/134X
2,145,114	1/1939	Gibbs et al.	137/100X
2,883,996	4/1959	Blewett et al.	222/134X
3,195,669	7/1965	Court	137/100X

FOREIGN PATENTS

690,247	7/1964	Canada	222/134

Primary Examiner—Robert B. Reeves
Assistant Examiner—Frederick R. Handren
Attorney—Andrus, Sceales, Starke & Sawall

ABSTRACT: This disclosure relates to gasoline dispensing including an intermediate grade pump interconnected to both the premium grade storage tank and the regular grade storage tank through a blending valve. The blending valve includes a pair of flow passageways. A common throttling valve inversely varies the flow through the two passageways. A manual control valve is provided to adjustably and inversely set the cross-sectional areas of the flow passageways. The throttle valve is connected to a hydraulic diaphragm actuator having pressure chambers to the opposite sides of a movable diaphragm. Signal pressure lines connect the passageways between the two valves to corresponding pressure chambers to position the diaphragm and throttling valve to establish equal pressures in the passageways.

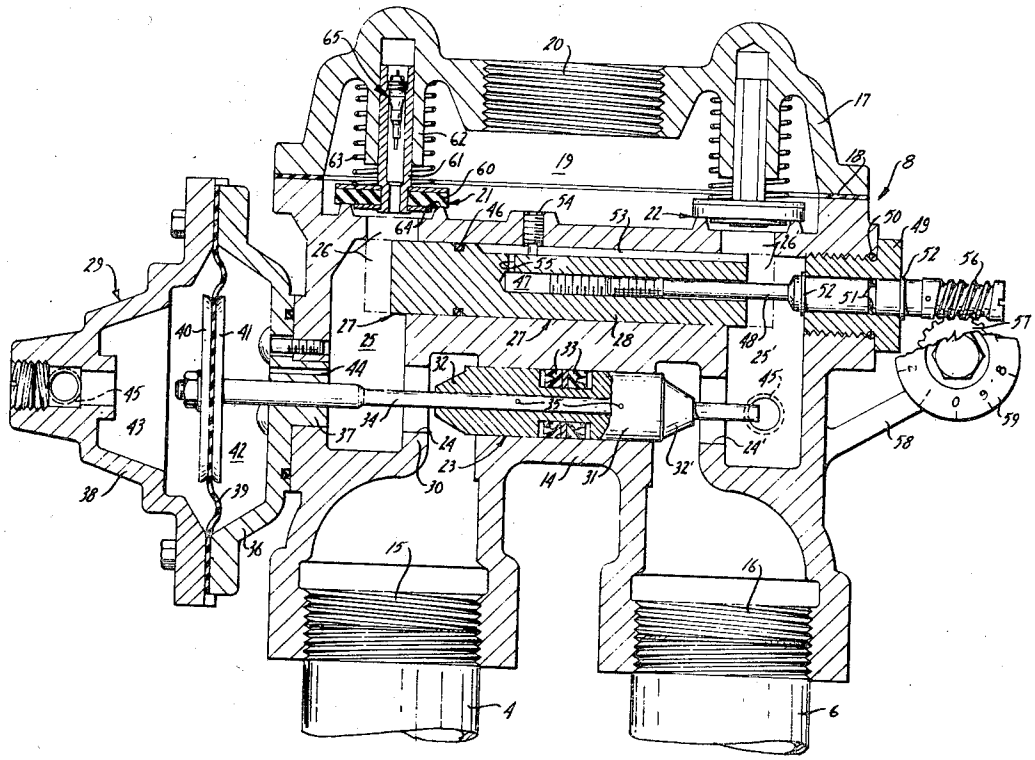


FIG_3

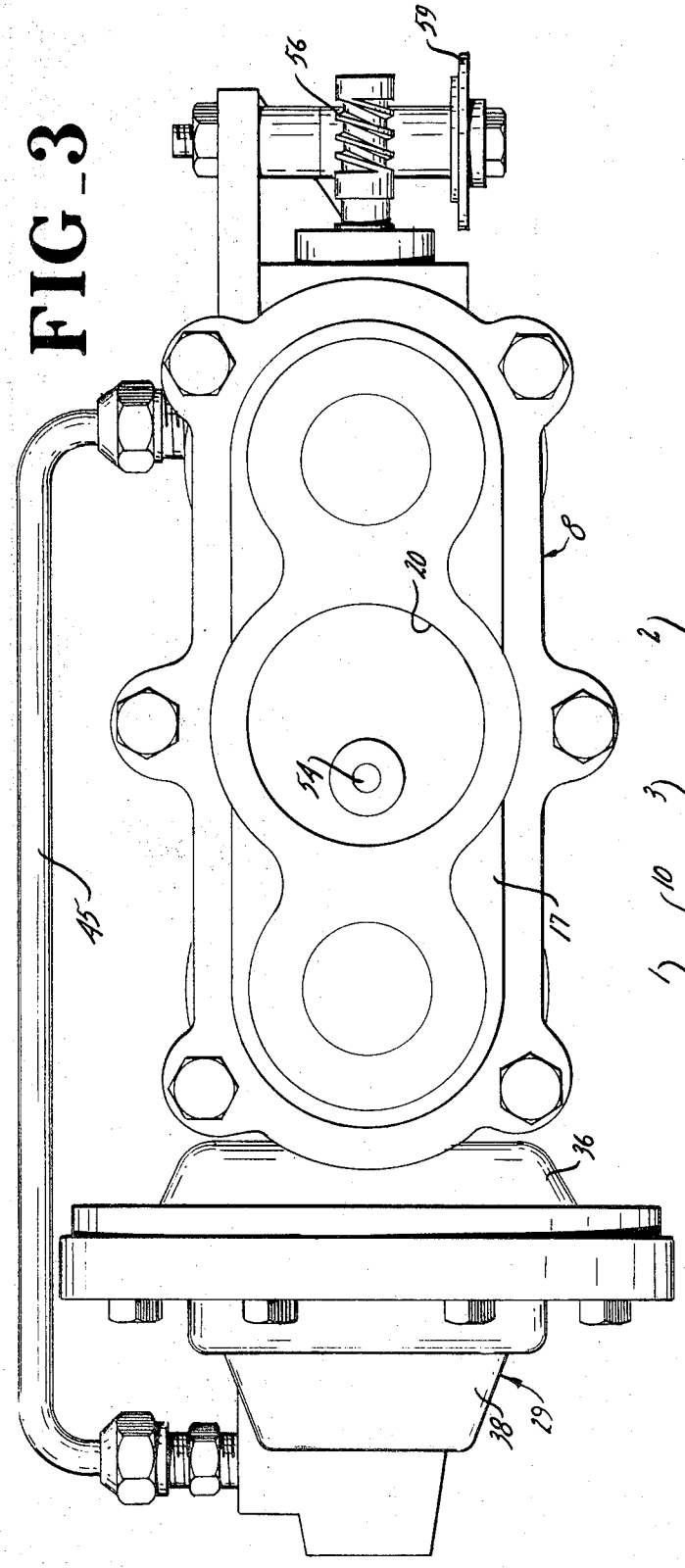
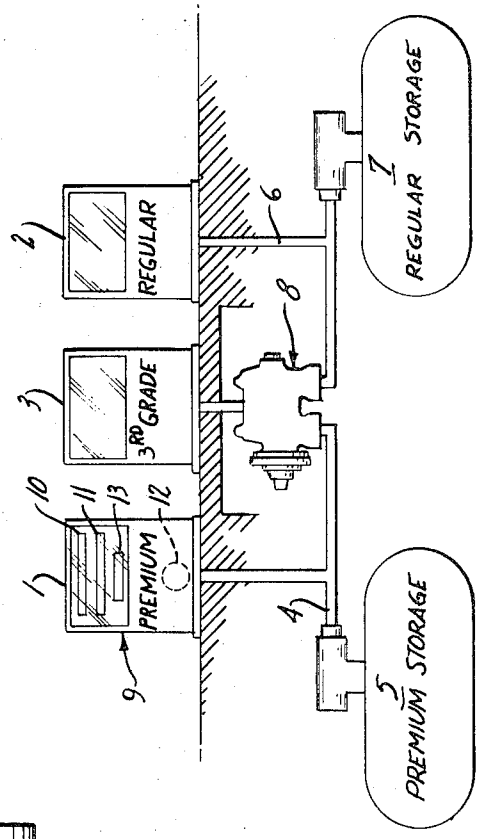


FIG_1



INVENTOR
CHARLES D ERICKSON
BY Andrus, Sceales, Starke & Sawall
Attorneys

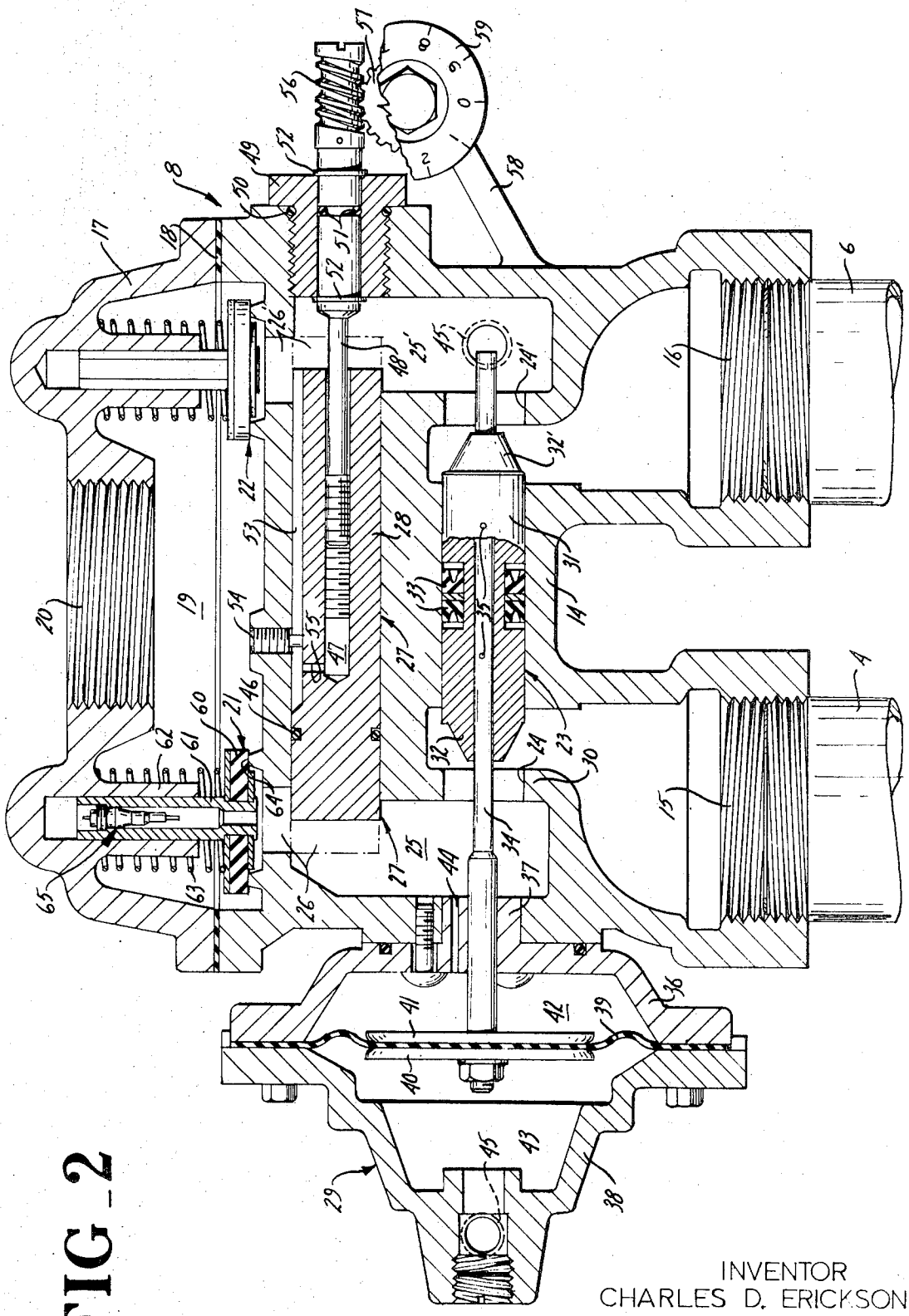


FIG_2

INVENTOR
CHARLES D. ERICKSON
BY
Andrus, Sceales, Starke & Sawall
Attorneys

SELF-PROPORTIONING FLUID DISPENSING APPARATUS

This invention relates to a dispensing system employing a blending valve means to establish a mixture of at least two materials and particularly to a gasoline dispensing system having means to dispense a selected blend of two standard grades of gasolines.

Gasoline has been generally marketed under either of two grades or octane ratings respectively identified as "regular" gasoline and "premium" gasoline. The recent development of automobiles has made it desirable to provide another octane rating intermediate the conventional regular and premium grade. Dispensing devices have been suggested which are interconnected to the storage tanks for both the regular and the premium gasolines. A manual adjustable control is provided to permit the selection of either regular or premium gasolines or some combination of such products. Such devices require relatively complicated mechanisms as each grade or blend which is dispensed must also be interconnected into the computer mechanism to provide a proper visual volume registration and visual cost registration in accordance with the volume dispensed. Individual meters for each gasoline are normally provided within each pump and interconnected through a suitable integrating means to provide a suitable register output in accordance with the quantities of the two basic gasolines dispensed. Such systems are relatively expensive to construct and to maintain.

The present invention is directed to a simplified and relatively inexpensive dispensing system wherein completely separate dispensing units which may be of identical single product dispensing construction are provided for dispensing each of the several grades of gasoline. Thus, the system for a service station may include a "regular" dispensing pump, a "premium" dispensing pump and an intermediate "of blend" dispensing pump of the same construction. The intermediate grade pump is interconnected to both the premium grade storage tank and the regular grade storage tank through a separate adjustable blending valve which is manually adjustable to establish a desired blend. The register of the intermediate grade pump is then set at a fixed price in accordance with the usual price adjustment of a pump.

In a particularly novel aspect of the present invention, the blending valve includes a pair of flow passageways from the individual liquids to a common or blend outlet. A common throttling valve means inversely varies the flow through the two passageways. A manual control valve means is provided to adjustably and inversely set cross-sectional areas of the flow passageways. The relative positions of the two valve means establishes a control pressure condition in the two flow passageways which is coupled through a suitable actuator to automatically set and hold the throttling valve in a desired position.

As applied to a service station pump, the blending valve is provided with a pair of inputs connected respectively to the premium grade storage tank and the regular grade storage tank and a common output interconnected to the two passages through a suitable check valve construction. The throttle valve means or structure is adapted to inversely vary the flow passageway from the two inlets to the single outlet. The throttle valve means is connected to a hydraulic actuator such as a diaphragm actuator having pressure chambers to the opposite sides of a movable diaphragm. The control valve means includes an adjustable means for inversely varying the apertures or openings immediately adjacent the check valves and correspondingly varying the pressure in the flow passageways to the discharge sides of the throttling valve means. The passageways between the respective throttling valve means and control valve means defines a pair of pressure chambers or cavities. Conduit means interconnect each of such pressure cavities with a corresponding pressure chamber of the hydraulic actuator to establish balancing pressures on the opposite sides of the diaphragm.

If the apertures are set for essentially equal flow rates, corresponding pressures will be established in the pressure cavities and transmitted through the passageways to the corresponding chambers of the hydraulic actuator. The movement of the hydraulic actuator will then position the throttle valve to an established equal flow. If the apertures are adjusted to increase the flow through the one passageway and correspondingly decrease the flow through the opposite passageway, corresponding pressure signals will be transmitted to the hydraulic actuator to move the throttle valve means and adjust the flow through the two inlets until equal pressures are established in the pressure cavities and in the chambers of the hydraulic actuator.

Applicant has found that accurately proportioned flow rates can readily be maintained through the respective flow passages by controlling the restriction ratio of the apertures.

In a particularly novel and satisfactory system, the check valves and apertures are mounted in laterally spaced coplanar relationship to define a pair of parallel paths within the valve to a common outlet. Each of the check valves is preferably provided with a thermal release control to prevent excessive pressure buildup downstream of the blender assembly. A valve rod is slidably mounted in the body portion between the two apertures. An adjustment shaft is threaded into the one end of the aperture adjusting valve rod and rotatably fixed within the housing. Rotation of the shaft results in longitudinal movement of the valve rod and the relative ratio of the opening of the apertures. Suitable lock means may be provided to lock the valve rod in place.

A throttle valve includes a valve member slidably mounted within the wall between the parallel paths. The opposite ends of the valve member cooperates with valve orifices in the respective parallel paths to throttle the flow therethrough. Further, the ends of throttle valve member are specially shaped to provide direct proportional changes in the orifice area with linear movement of the valve member and the diaphragm of the hydraulic actuator to prevent abrupt changes in flow with a resulting hunting or pressure oscillating condition.

It has been found that the present invention provides a simple and inexpensive system for the dispensing of gasoline products or the like.

The drawings furnished herewith illustrate the best mode presently contemplated by the inventor for carrying out the subject matter of this invention and clearly discloses the above advantages and features as well as others which will be readily understood from the following description.

In the drawings:

FIG. 1 is a diagrammatic illustration of a gasoline dispensing system constructed in accordance with the present invention;

FIG. 2 is an enlarged vertical section through a blending valve assembly constructed in accordance with the present invention;

FIG. 3 is a top elevational view of the valve assembly shown in FIG. 2.

Referring to the drawing and particularly to FIG. 1, a gasoline dispensing system is shown employing three separate dispensing pumps 1, 2 and 3 for respectively dispensing a "premium" grade gasoline, a "regular" grade gasoline and an "intermediate"or "blend" grade gasoline respectively. The "premium" grade pump 1 is connected directly by a conduit or line 4 to a "premium" grade storage tank 5. The "regular" grade dispensing pump 2 is similarly connected by a conduit 6 directly to a "regular" grade storage tank 7. The "blend" grade dispensing pump 3 is interconnected through a blending valve 8, constructed in accordance with the teaching of the present invention, to both the premium grade line 4 and the regular grade line 6. The blending valve assembly 8, which is more clearly shown in a particularly novel construction in FIGS. 2 and 3, is adapted to blend any predetermined ratio of the premium grade and the regular grade gasolines to produce an intermediate octane rated gasoline which can be sold for an intermediate price. Each of the three pumps 1, 2 and 3 is con-

structed and interconnected to discharge a single product in contrast to the approach which has heretofore been suggested wherein each of the pumps is individually interconstructed with an adjustable means to selectively discharge any one of a plurality of different octane ratings. The dispensing pumps **1**, **2** and **3** therefore may be of any well-known or any other construction such as presently widely employed in the dispensing of gasoline. Generally, each pump **1**, **2** and **3** includes a register **9** having gallonage display portion **10** and a total cost display portion **11** driven from a single meter **12**. A per gallon display portion **13** is also provided. An internal adjustment of any well-known construction permits varying of the setting of the display portion **13** with an automatic adjustment of the total cost display portion meter coupling ratio. As the structure and operation of the pumps **1**, **2** and **3** are well-known, no further description thereof is given.

Referring particularly to FIGS. **2** and **3**, the illustrated blending valve assembly **8** includes a valve body **14** having a first inlet **15** interconnected to the premium line **4** and a second adjacent valve inlet **16** interconnected to the regular grade line **6**. A head **17** is bolted or otherwise suitable interconnected to the opposite end of the valve body **14** with a sealing gasket **18** disposed therebetween to maintain a fluidtight connection. The head **17** is generally cup-shaped and when assembled with the valve body **14**, defines an output chamber **19** with an outlet **20** centrally formed therein. The output is similarly connected by corresponding check valves **21** and **22** to a pair of similar flow passageways for the two basic grades of gasoline.

The pair of parallel flow passageways leading from the respective inlets **15** and **16** to the common outlet **20** are essentially identical. Consequently, the passageway for the valve inlet **15** interconnected to the premium grade line **4** is described in detail with the corresponding elements of the opposite passageway identified by similar primed numbers for purposes of simplicity and clarity of explanation.

The valve inlet **15** extends inwardly to a throttling valve unit **23** including an orifice **24** having an axis normal to the axis of the valve inlet **15**. A pressure cavity or chamber **25** is provided to the discharge side of the throttling orifice **24**. The cavity **25** is interconnected to the common output chamber **19** in the head **17** of the valve by a control opening or aperture **26** forming a part of a control valve unit **27**.

An aperture control member **28** is slidably mounted within the valve body **14** between the two valve pressure cavities **25** and **25'** and immediately adjacent the apertures **26** and **26'**. The lateral displacement of the member **28** from the centered position shown varies the flow aperture cross-sectional area of the apertures **26** and **26'** in an inverse manner. This in turn is reflected in a variation in the pressure in the pressure cavities **25** and **25'**. The two pressures of the two parallel flow passageways are transmitted to a hydraulic diaphragm actuator **29** interconnected to position the throttling valve unit **23** in such a manner as to produce a predetermined flow ratio of the premium grade gasoline and the regular grade gasoline to outlet **20**.

More particularly, in the illustrated embodiment of the invention, the main throttle valve unit **23** is provided with the circular orifices or openings **24** in a lateral wall **30** between cavity **25** and inlet **15**. A valve member **31** is slidably disposed within an opening in the center of the valve body **14** with the end aligned with orifice **24** and constructed as a frustoconical element **32**. A pair of annular seals **33** are disposed within a central recess in the valve member **31** and slidably engage the adjacent wall of the valve body to provide a liquidtight seal preventing interchange of liquid between the two inlets. A positioning rod or shaft **34** extends through the valve member **31** and is pinned or otherwise secured thereto as at **35**. The one end of shaft **34** projects laterally through the throttle orifice **24** and the pressure cavity **25** into the hydraulic actuator **29**. The opposite end of the shaft **34** projects from the valve member **31** in the opposite direction through the throttle orifice **24'** and the pressure cavity **25'**. Consequently, with the valve member **31** centrally located within the body, the throttling valve ends **32** and the projection of the shafts **34** through the orifices **24** and **24'** provide a corresponding flow opening into the two pressure cavities **25** and **25'**.

The opposite ends of the valve member **31** terminate in the frustoconical valve ends **32** and **32'** aligned with the valve orifices **24** and **24'** respectively. Movement of the valve member **31** toward and away from the corresponding orifices directly varies the orifice area and thereby the flow path. The tapered construction results in proportional linear variation in the orifice area in accordance with the linear movement of the shaft **34** and attached member **31**.

The hydraulic actuator **29** for shaft **34** is a known diaphragm-type unit having a cup-shaped base **36** bolted or otherwise interconnected to the side of the valve body **14** immediately adjacent the pressure chamber **25**. The base **36** includes a hub **37** extending into an opening to the premium grade passageway **25** and defining a supporting bearing for the valve shaft **34**. The hydraulic actuator **29** includes an outer cup-shaped cover **38** secured to the base with a diaphragm **39** spanning the chamber and clamped completely about the peripheral edge thereof between the mating portions of the base **36** and cover **38**.

The shaft **34** extends through hub **37** and is clamped to the diaphragm **39** by a pair of opposed discs **40** and **41** on the opposite sides of the diaphragm. The position of the diaphragm **39** directly controls the position of the valve shaft **34** and the valve member **31**. The diaphragm **39** defines a first pressure chamber **42** to one side of the diaphragm and a second pressure chamber **43** to the opposite side of the diaphragm.

The first pressure chamber **42** is interconnected to the immediately adjacent flow passageway or cavity **25** by a small opening **44** provided in the hub or bearing portion **37** of the base **36**. The corresponding side of the diaphragm **39** is therefore subjected to the pressure established in the pressure cavity **25** by the flow of fluid through the throttle valve orifice **24** and the aperture **26**.

The opposite pressure cavity **25'** of the blending valve assembly is interconnected by a pressure conduit **45** to the opposite chamber **43** of the hydraulic actuator **29** to apply the corresponding pressure to the other side of diaphragm **39**. The hydraulic actuator diaphragm **39** is therefore positioned in accordance with the relative pressures in the cavities **25** and **25'** which in turn are controlled by the setting of the hydraulic valve member **31** and the control valve member **28**.

In the illustrated embodiment of the invention, the aperture control member **28** is a cylinder slidably disposed within the valve body **14** immediately outwardly of the throttle valve member **31** and projecting laterally into both of the pressure cavities **25** and **25'** with the member **28** centrally located as shown in FIG. **2**. An annular seal **46** is disposed within an encircling recess in one end of the cylinder to seal the slide opening and prevent interchange of fluid between the two cavities. A tapped opening **47** is provided in the right end of the member **28** coaxially of the member. An adjustment shaft **48** threads into the tapped opening and extends outwardly through an opening in the valve body **14**. A threaded plug **49** is secured within the opening and compresses a sealing gasket **50** to seal the opening. The shaft **48** extends through the plug **49** which is sealed by suitable O-ring seal **51**. Snap rings **52** are similarly attached in corresponding recesses in the shaft **48** to the immediate end faces of the plug **49**. This permits rotatable motion of the shaft **48** but prevents axial movement thereof.

The periphery of the cylinder **28** is provided with a longitudinal guide groove **53** in the surface immediately adjacent the exterior wall of the valve body **14**. A small guide pin **54** is threaded through an appropriate opening in the valve body and projects into the groove **53** to prevent rotation of the cylinder while permitting axial or longitudinal movement within the valve body.

A small bleed passageway **55** interconnects the inner end of the tapped opening to the groove to bleed any fluid trapped under the adjusting screw back to the corresponding right-hand passageway or cavity **25'** in the valve body **14**.

Rotation of the shaft 48 therefore results in the longitudinal movement of the cylinder 28 to thereby vary the positioning of the opposite ends of the member 28 with respect to the pressure cavities. This in turn establishes a variable aperture 26 and 26' at the discharge ends of the pressure cavities 25 and 25'. If the apertures 26 and 26' are set for equal flow rates and the throttle valve member 31 is centrally located, equal pressures will be established in the two pressure cavities 25 and 25' and apply corresponding equalized pressures to the actuator chambers 42 and 43 on the opposite side of the diaphragm 39. This will hold the throttle valve in the central location to maintain the equal flow rate.

If the adjusting or control shaft 48 is rotated to move the cylinder 28 to the right, as viewed in the drawing, it will provide for an increased flow of the premium grade product through the left passageway and cavity 25 in FIG. 2 of the drawing and a corresponding reduced flow through the opposite passageway and cavity 25'. The increased flow results from a decreased pressure in the premium pressure cavity which is transmitted through the small passageway to the diaphragm. Simultaneously the opposite pressure cavity establishes an increased pressure which is applied to the opposite side of the diaphragm via the pressure conduit. This will tend to shift the diaphragm, the attached shaft and the valve body to the right thereby increasing the opening of the premium grade orifice and closing the regular grade orifice flow in a corresponding linear manner. This tends to reverse the pressure conditions in the two passageways. The differential pressure thus is applied to the actuator until the valve body of the throttling valve is set to establish a predetermined flow ratio, at which flow equal pressures are established in the two pressure cavities 25 and 25' and applied to the diaphragm 39. At this point, the diaphragm 39 and the attached valve member 31 are held in a corresponding position to maintain the desired flow ratio. The position of control shaft 48 and member 28 therefore determine the proportion of the flow through the valve body and thereby the final blend.

In the illustrated embodiment of the invention, a worm 56 is secured to the outer end of the control shaft 48. A pinion 57 is rotatably mounted within a suitable bracket 58 projecting outwardly of the valve body 14 and located to mesh with the worm 56. An adjusting dial 59 is provided to permit manual adjustment of the position of the cylinder 28. Suitable indicia may be provided on the adjusting dial to allow convenient positioning for a desired flow ratio.

The pressure cavities 25 and 25' are connected to the common outlet chamber 19 by the similar check valves 21 and 22. In the illustrated embodiment of the invention, each check valve includes a resilient faced valve member 60 secured to a hollow stem 61 which is journaled in a hub 62 in the head 17. A coil spring 63 encircles the hub 62 and resiliently holds the valve member 60 in engagement with a suitable valve seat 64 encircling the aperture 26. A small thermal relief valve 65 is supported within the hollow stem 61 of the check valve 21. The relief valve 65 prevents excessive pressure buildup downstream of the blending valve assembly 8.

The operation of the blending valve assembly 8 is controlled by the relative pressure drops created by the adjustable apertures 26 and 26' and the adjustable throttle valve orifices 24 and 24'. The adjustable apertures 26 and 26' are inversely varied by the manual positioning of the cylindrical member 28. The dispensing pump 3 is turned on to establish pressurized flow through the valve assembly 8, causing the check valves 21 and 22 to open and discharge a blended liquid from the pump. The flow passing through the throttle valve orifices 24 and 24' and the apertures 26 and 26' creates pressure conditions within the cavities 25 and 25' related to the flow. The amount of pressure available to each cavity is directly related to the amount of flow through the adjacent aperture. With the manually set control cylinder 28 and the throttle valve member 31 centrally located, identical flow passageways are created and consequently corresponding pressure conditions exist in cavities 25 and 25' which pressures are applied to the opposite sides of the diaphragm 39 of the hydraulic actuator 29. The equal flow is established and maintained. If the ratio is to be varied, the adjusting dial 59 and attached shaft 48 are rotated to move the cylindrical member 28 in a corresponding direction. For example, movement of the cylindrical member to the left, closes the aperture 26 for the premium grade gasoline and correspondingly increases the aperture 26' for the regular grade gasoline. This will permit greater flow of regular gasoline and reduce flow of premium gasoline. The reducing or closure of the premium grade gasoline aperture or opening will increase the pressure in the cavity 25 and apply a corresponding signal to the one chamber 42 of the hydraulic actuator 29. Simultaneously the opening of the aperture 26' for the regular grade gasoline reduces the pressure in the cavity 25' and transmits the reduced pressure via the pressure conduit 45 to the opposite pressure chamber 43 of the hydraulic actuator 29. As a result, the throttle valve member 31 moves to the left in the illustrated embodiment of the invention to throttle the premium grade gasoline flow and increase the regular gasoline flow. The closing of the premium grade gasoline throttle valve orifice 24 decreases the pressure in the cavity 25 as a result of the greater drop across the throttling valve orifice 24. Simultaneously, the opening of the throttle valve orifice 24' for the regular grade gasoline increases the pressure of cavity 25'. The throttle valve member 31 is moved until a new pressure balance is obtained in the hydraulic actuator 29 at which time the valve member 31 is held stationary to provide the desired proportional flow.

The flow from the valve assembly 8 is discharged through the pump 3 and particularly meter 12 which drives the pump 3 to record the gallonage and total cost in accordance with the usual system of gasoline dispensing.

The present invention thus provides a simplified means for providing a multiple or dispensing of a blended products as well as the basic liquid products and the like.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a gasoline dispensing system having three dispensers for dispensing three grades of gasoline from a first storage tank connected to one dispenser and a second tank connected to a second dispenser, the third dispenser being connected to both tanks, a fluid mixer comprising:

a mixer body having a pair of inlets;

a common outlet connecting to the third dispenser and defining a passageway from each said inlet to the common outlet;

a throttling valve means including a valve body slidably disposed laterally in said mixer body and including a valve seat in each said passageway in axial alignment with said valve body, for inversely varying the opening through said passageways;

a control valve assembly having a control valve body slidably disposed laterally in said mixer body intermediate said throttling valve means and said outlet, and a control valve orifice disposed in each said passageway with the ends of said control valve body terminating at said control orifices;

selector means for sliding said control valve body across said control valve orifices; and

actuator means being responsive to flow through said control valve orifices for operating said throttle valve means to equalize pressure in said passageways.

2. The gasoline dispensing system of claim 1 wherein said selector means has a manually adjustable means connected to said control valve body for determining the mixture of said third grade, and said actuator means is a pressure actuator having a movable member and a pair of pressure input chambers to the opposite sides of said movable member, each chamber communicating with one said passageway, said actuator means having a connector from said movable member to said throttle means to position said valve member in accordance with the relative pressure levels in said passageways.

3. The fluid mixer of claim 1 and including check valve means for opening and closing said passageways in response to pressure in said passageways.

4. A fluid dispensing apparatus for mixing a first and second liquid in varied proportions, comprising;

a body having a central portion and defining a pair of flow passageways to either side of said central portion, said passageways having orifices at said central portion, the orifices being aligned on a first lateral axis of said body;

a throttle valve having a valve body slidably disposed in said central portion along said lateral axis, the valve body extending outward into said passageways to said orifices;

a control means for inversely varying the flow through said passageways, said control means having a control member body slidably disposed through said central portion on a second lateral axis upstream of said throttle valve, said control member being slidable into said passageways to inversely restrict the flow area of said passageways; and

pressure actuator means connected to said throttle valve and communicating with the passageways intermediate said first and second axes, for operating said throttle valve to equalize pressures in said passageways.

5. The fluid dispensing apparatus of claim 4 wherein said throttle valve includes a positioning shaft extending outwardly from one end through one of said orifices and a balancing shaft stub extending from the opposite end through the second of said orifices.

6. The fluid dispensing apparatus of claim 4 wherein the ends of said throttle valve are frustoconically shaped to produce a smooth proportional change in the orifice opening with movement of the valve member.

7. A fluid dispensing apparatus for delivery of different ratios of a first and second liquid through a pair of flow passageways, comprising:

a body portion defining said passageways;

valve means in said flow passageways for inversely opening and closing said passageways;

control means disposed in spaced relation from said valve means for varying the flow resistance of said passageways, said control means including a control shaft disposed for movement laterally of said passageways with the ends of said control shaft terminating in said passageways and inversely varying the cross-sectional flow areas thereof;

an actuator having a diaphragm and a pair of opposed pressure input means disposed to the opposite sides of said diaphragm, said input means connecting respectively to the passageways between said control shaft and said valve means;

means connecting said diaphragm to said valve means;

said control shaft having an axial end opening; and

adjusting means including a positioning rod threaded into said axial opening and rotatably mounted in said body portion for axially moving said control shaft relative to said passageways; the inner end of said axial opening having a vent to prevent trapping of fluid within said opening.