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APPARATUS FOR MIXING AND DISPENSING FLUIDS OF DIFFERENT DENSITIES

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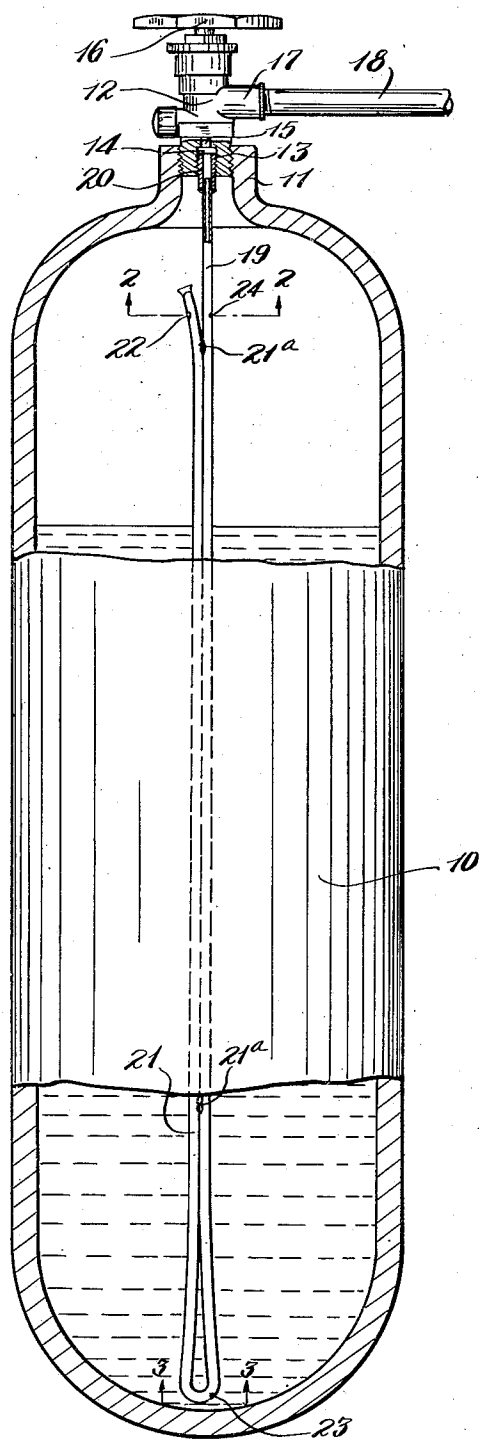


FIG. 1

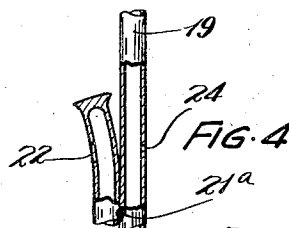


FIG. 4

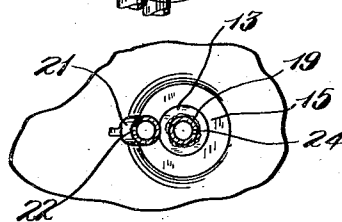


FIG. 2

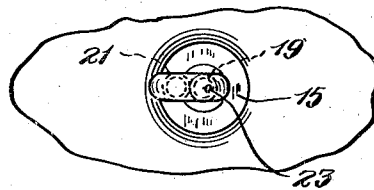


FIG. 3

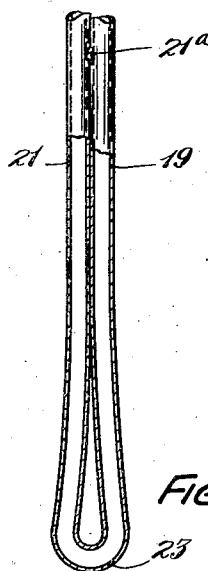


FIG. 5

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APPARATUS FOR MIXING AND DISPENSING
FLUIDS OF DIFFERENT DENSITIESDonald J. Conway, Cleveland, Ohio, assignor to
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6 Claims. (Cl. 62-1)

This invention relates generally to an apparatus for obtaining a definite proportional mixture of two fluids differing in density and boiling points and for continuously dispensing the definite proportional mixture thus obtained for use in the industrial arts.

More particularly, the invention relates to an apparatus including a tank or cylinder wherein two fluids, capable of being admixed for use in metal operations (such as welding, cutting and the like) but differing in respect to their densities and boiling points, may be mixed in definite proportions and delivered continuously in such proportions to the point of use until the contents of the cylinder shall have been exhausted.

Still more limitedly, my invention contemplates an apparatus of the character described wherein the fluid fuels consist of propane and ether, the propane being charged into the cylinder under a pressure of approximately 100-110 pounds per square inch whereby it will be largely converted into a liquid and, in such form, will be admixed with the ether of higher density in the bottom of the cylinder and, by means of a tube leading from the bottom of the cylinder, a mixture of these liquids will be delivered through the customary valve in the top of the cylinder.

Attempts have been made heretofore to dispense from cylinders a mixture of predetermined proportions of these fluids and to maintain such predetermined proportions throughout the entire range of operation until the contents of the cylinders should be exhausted, utilizing for this purpose tubes communicating with the bottoms of the cylinders and the valves in the tops of the same, but all such attempts with which I am familiar have resulted in failure. This failure has been due to the physical properties of the propane which, as the pressure within the cylinders containing the same is reduced, tends increasingly to assume a gaseous or vaporous form as the mixture is withdrawn from the cylinders, with the result that a relatively large proportion of ether remains in the cylinders after the exhaustion of the propane.

Due to the construction of the tube which communicates with the cylinder valve and to the manner in which the vaporous and liquid fuel elements are admitted therinto, I am enabled to obtain a mixture of definite predetermined proportions of the fluid fuel ingredients and to insure that this definite mixing and proportioning shall be automatically maintained so long as the pressure of the atmosphere within the

tank is capable of delivering mixture through the said tube.

I accomplish these objects by means of the apparatus shown in the accompanying drawing, wherein Fig. 1 represents a view, partly in section and partly in elevation, of a cylinder having liquids of different densities therein and provided with a mixing and dispensing tube constructed in accordance with my invention; Fig. 2 an enlarged detail in section taken on the line 2-2 of Fig. 1 looking in the direction of the arrows; Fig. 3 an enlarged detail in elevation, taken on the line 3-3 of Fig. 1 and looking in the direction of the arrows; Fig. 4 an enlarged detail in section of the upper portion of the mixing and dispensing tube; and Fig. 5 an enlarged detail in sectional elevation of the lower end of the dispensing tube.

Describing the various parts by reference characters, 10 denotes a cylinder which is provided with a neck 11 within which there is threaded the lower end of a valve body 12 of the type usually provided for cylinders such as are employed for dispensing gases under pressure. The threaded lower end 13 of the valve body is provided with a chamber 14 from which a port 15 leads to the usual valve seat (not shown) and with which the usual valve (not shown), having an operating handle 16, cooperates. The valve body is provided with an elbow 17 to which a dispensing pipe 18 is connected.

19 denotes the delivery branch of a tube, the upper end of which is connected, as by soldering or brazing, with the bottom of a tubular connector 20, the upper end of said connector being shown as threaded into the threaded lower end 13 of the valve body. It will be noted that this construction provides an expansion chamber between the delivery end of the branch 19 and the valve seat. The tube is bent upon itself to provide a close return bend or loop adjacent to the bottom of the cylinder, with the delivery branch extending upwardly therefrom to the connector 20 and with the other branch 21 extending upwardly, and preferably in close proximity to the branch 19, to a point well above the level of the liquids as charged into the cylinder. In practice, I prefer to unite the two branches of the tube by means of silver solder, as indicated at 21^a, the application of which makes the metal of which the tube is composed more ductile and less liable to crystallize and break off within the cylinder under rough usage. This manner of bending the tube also enables the latter to be

inserted through the neck of the cylinder, when the valve is screwed thereinto.

The upper end of the branch 21 is shown as closed and an inlet opening 22 is provided therein adjacent to the closed end thereof. 23 denotes an inlet opening slightly above the bottom of the looped lower end of the tube and located substantially axially beneath the portion of the branch 19 extending thereabove. An inlet opening 24 is provided in the delivery branch 19 above the level of the liquid and approximately in the same horizontal plane as the center of the inlet opening 22.

In utilizing the apparatus thus described for dispensing a mixture of ether and propane, with an initial pressure in the cylinder of approximately 100 to 110 pounds at 70° F. atmospheric temperature and with the dispensing tube $\frac{3}{8}$ inch internal diameter and the inlet openings 23 and 24 made with a #69 drill and the inlet opening 22 of larger cross sectional area than the inlet openings 23 and 24, employing a cylinder 38 inches high by 12 inches internal diameter having therein a charge of up to 7 pounds of ether and 50 pounds of propane, I have been able to produce and to deliver through the cylinder valve a uniform mixture of predetermined definite proportions of ether and propane until the level of the liquid falls below the inlet opening 23. Satisfactory results have been obtained where the inlet opening 22 has been of a size such as made by a #30 drill and also where it has been equal to the cross sectional area of the interior of the tube.

It is believed that when the cylinder valve is opened the liquid in the bottom of the cylinder is delivered in a jet into the ascending branch 19 of the tube and that in so doing it is admixed with the vaporous contents of the cylinder entering the descending branch of the tube through the inlet opening 22, the liquid delivered through the inlet opening 23 exercising an aspirating or ejector action upon the vapor. I have found that the inlet opening 24 serves to balance the pressure between the gaseous or vaporous atmosphere in the tank and the mixture within the tube. When the valve 16 is opened slightly, so as to deliver the mixture slowly through the branch 19, a back pressure will be created within the tube which will be balanced by the pressure of the atmosphere above the liquid level transmitted through the inlet opening 24. However, when the valve is opened wide and the mixture is being withdrawn rapidly from the tube, the pressure in the tube is reduced and the inlet opening 24 serves to admit atmosphere from the cylinder into the portion of the tubular branch 19 thereabove, the net result being that the apparatus described herein delivers at all times a homogeneous mixture of the two fuels, admixed in constant, definite proportions; and this delivery of such definite proportions persists until the level of liquid within the cylinder falls below the inlet opening 23. Furthermore, with the parts constructed and arranged as described, the pressure within the cylinder falls very slowly, as compared with the conditions which exist in cylinders in which it has been attempted heretofore to obtain a satisfactory operation of producing and delivering a constant definitely proportioned mixture of propane and ether.

Quite satisfactory results have also been obtained where, with a tube of the same diameter as that shown and described herein and with the inlet openings 22 and 23 of the respective sizes

previously stated, the size of the inlet opening 24 has been increased by forming the same with a #62 drill and with a #54 drill. When, due to the operation of dispensing the mixture, the pressure within the cylinder was insufficient to effect any further delivery therefrom, only $\frac{1}{4}$ pound of ether remained therein in the former case and approximately 1 pound of ether remained in the latter case.

Obviously the size of the inlet openings for the admission of liquid and vapor into the tube will vary with the cross sectional area of the tube employed and, while satisfactory results have been obtained by the use, in the particular apparatus described herein, of an inlet opening of the size made by a #30 drill in the branch 21 of the tube, the size of this opening may be reduced considerably but without preventing the constant delivery of a satisfactory mixture of the vaporous and liquid contents of the cylinder and, therefore, without avoiding the spirit of my invention.

Where one of the fluids within the cylinder remains in a liquid condition throughout the entire operation of producing and delivering a mixture of fluids and the other fluid remains in a gaseous condition throughout such entire operation, the opening 24 may be omitted.

Having thus described my invention, what I claim is:

1. An apparatus for the purpose specified including a cylinder for dispensing under pressure a mixture of liquids differing widely in volatility and at least one of which exists normally in a gaseous condition, the said cylinder being provided at its top with a delivery valve body, a tube comprising a delivery branch connected to and extending downwardly from the said valve body to a point in close proximity to the bottom of the cylinder and a branch connected with the former branch and extending upwardly from the latter to a point above the liquid level of a normally full charge of liquids within the cylinder, the delivery branch being provided with an inlet in the bottom thereof arranged for delivering liquid substantially axially into the said delivery branch and being provided with an inlet of substantially the same size above the said level and the opposite branch of the tube being provided with a relatively large inlet also located above the said level.

2. An apparatus for the purpose specified including a cylinder for dispensing under pressure a mixture of liquids differing widely in volatility and at least one of which exists normally in a gaseous condition, the said cylinder being provided at its top with a delivery valve body, a tube comprising a delivery branch connected to and extending downwardly from the said valve body to a point in close proximity to the bottom of the cylinder and a branch connected with the former branch and extending upwardly from the latter to a point above the liquid level of a normally full charge of liquids within the cylinder, the delivery branch being provided with an inlet in the bottom thereof arranged for delivering liquid substantially axially into the said delivery branch and being provided with an inlet of substantially the same size above the said level and the opposite branch of the tube being provided with a relatively large inlet also located above the said level, there being an expansion chamber provided between the upper end of the delivery branch of the said tube and the seat for the valve.

3. A dispensing apparatus of the type set forth

in claim 1, wherein, with a tube of the order of 3/16 inch internal diameter, the inlet in the bottom of the delivery branch has a cross-sectional area of approximately the size of a hole made by a #69 drill, the inlet in the other branch having a cross-sectional area not materially less than that of a hole made by a #30 drill and the inlet in the portion of the delivery branch which is above the said liquid level having a cross-sectional area of approximately the size made by utilizing a drill within the range of from #54 to #69.

4. A dispensing apparatus of the type set forth in claim 1, wherein, with a tube of the order of 1/8 inch internal diameter, the inlets in the delivery branch each have a cross-sectional area of approximately the size of a hole made by a #69 drill and the inlet in the other branch has a cross-sectional area not materially less than that of a hole made by a #30 drill.

5. A dispensing apparatus of the type set forth in claim 2, wherein, with a tube of the order of 1/8 inch internal diameter, the inlets in the delivery branch each have a cross-sectional area of approximately the size of a hole made by a #69 drill and the inlet in the other branch has a cross sectional area not materially less than that of a hole made by a #30 drill.

6. An apparatus for the purpose specified including a cylinder for dispensing under pressure a mixture of fluid elements differing widely in volatility, one of said elements existing normally in a gaseous condition, the said cylinder being provided at its top with a delivery valve body, a tube comprising a delivery branch connected to and extending downwardly from the said valve body to a point in close proximity to the bottom of the cylinder and a branch connected with the former branch and extending upwardly from the latter to a point above the liquid level of a full charge of fluids within the cylinder, the delivery branch being provided with an inlet in the bottom thereof arranged for delivering liquid substantially axially into the said delivery branch and the opposite branch of the tube being provided with a relatively large inlet located above the said liquid level, the first-mentioned inlet, in a tube wherein the delivery branch is approximately 3/16 inch internal diameter, having a cross sectional area of approximately the size of a hole made by a #69 drill.

DONALD J. CONWAY.