This invention relates to a fluid dispenser for mixing a liquid concentrate with a pressurized liquid and employs a novel means for obtaining a proper proportioning of the mixing fluids. In particular, this invention relates to a dispenser having a Venturi throat for developing an initial mixing action and an adjustable bypass dilution valve for readily proportioning the mixing fluids.

The use of liquid concentrates has made a variety of beverages readily accessible to the average household. However, the refrigeration and storage of already-diluted concentrates is not practicable in view of the considerable quantity of liquid involved. This is particularly true when several different beverages are to be provided.

A liquid dispenser has therefore been developed for being employed directly within a household refrigerator which dilutes liquid concentrates from a standard household metered supply and dispenses the resulting beverage in one action. In this way, many beverages are made available with minimum storage obstacles.

A principal concern in connection with the design of such dispensers, however, is in obtaining a proper proportioning of the dispersed fluids. Dispensers are characteristically achieved by using a Venturi throat for drawing the liquid concentrate through a suction tube disposed axially of the Venturi and upstream thereof with a chamber defined by a wall converging to the throat area. It has been found that the ratio of liquid concentrate to the dispensed beverage is dependent upon the relative position the suction tube occupies relative to this converging wall portion. As a consequence, liquid dispensers have been developed which vary the strength of the dispersed liquid by altering the relative positioning of the converging wall portion and the concentrate suction tube. It is known, however, that a given relationship between the Venturi structure and the associated suction tube produces optimum suction and mixing of the associated liquids. Also, varying the beverage strength by adjusting the Venturi action has a limited range of dilution possibilities.

Accordingly, it is an object of this invention to provide a liquid dispenser operating on the Venturi principle and providing an improved means for efficiently and readily adjusting the strength of the dispersed beverage.

It is also an object of this invention to provide a liquid dispenser utilizing a Venturi action to mix a liquid concentrate and a pressurized fluid and having a means for adjusting the strength of the resulting beverage independent of the Venturi mixing element.

It is another object of this invention to provide a beverage dispenser for mixing and dispensing a liquid concentrate together with a pressurized fluid having a fixed mixing element and a variable mixing element.

It is a further object of this invention to provide a liquid dispenser operating on the Venturi principle and employing a Venturi bypass having a dilution valve formed therein for varying the strength of the dispersed liquid.

It is an additional object of this invention to provide a liquid dispenser having a Venturi mixing structure and a readily adjustable dilution valve formed downstream of the Venturi elements. These and other objects, features and advantages of the present invention will be understood in greater detail from the following description and the associated drawings wherein reference numerals are utilized in designating a preferred embodiment and wherein:

FIG. 1 is a top view of a preferred embodiment of this invention showing the relative positioning of the Venturi elements and the bypass dilution valves;

FIG. 2 is a partially sectional view taken along the lines 2—2 of FIG. 1 and illustrating the structure of the Venturi and dilution valve elements;

FIG. 3 is a top elevational view of an alternate embodiment of this invention; and

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 3 showing the Venturi and dilution valve structures.

A preferred embodiment of this invention is shown generally in FIG. 2 as comprising a Venturi operated dispenser having a dilution valve for altering the strength of the dispersed beverage. While the preferred embodiment shown in the drawings accompanying this application is primarily intended to be a beverage dispenser, it should be understood that the principles described in conjunction with the preferred embodiment are equally applicable to non-beverage type dispensers such as dispensers for handling bleach, fabric conditioner or rinse additive type fluids. In particular, a liquid concentrate is maintained within a storage chamber 10 for being drawn eventually through a suction tube 11 by the pressure reducing effect of a fluid passing through a Venturi 12. Upon leaving the suction tube 11, the concentrate commingles with the surrounding pressurized fluid and hence a first mixture occurs. This mixture is, however, relatively fixed due to the immobility of the relationship between the suction tube and the associated Venturi. In contrast, a second mixture occurs at an outlet passageway 13 due to the provision for a bypass 14 and a dilution valve 15.

The first mixture, occurring at the Venturi, will be carried to the vicinity of the outlet passageway 13 where pressurized fluid from the bypass will be introduced via the dilution valve 15. The dilution valve 15 is provided to be readily adjustable, thereby offering a means for easily changing the strength of the resulting beverage or other fluid being dispersed.

In this way any desired proportioning can be achieved to suit the specifications of the concentrate maintained within the storage tank 16. Furthermore, once the dilution valve is set for a given proportioning, that proportioning will remain constant for all changes in pressure of the bypass fluid. This is due to the fact that the bypass fluid is directly communicable with the Venturi fluid. Therefore, increases in flow through the bypass 14 will generate corresponding increases in flow to the Venturi 12 for maintaining constant proportioning.

Referring to the internal features of the dispenser of this invention, FIG. 2 shows a dispenser body 16 which together with the suction tube 11 and a concentrate inlet housing 17 is fixedly mounted by means of a mounting boss 22 within a cover plate 18 associated with the storage tank 16. The cover plate 18 has a peripheral flange 19 which is suitably secured to the upper face 20 of tank sidewalls 21 for being readily removable therefrom. In this way, the respective elements may be cleaned, repaired or replenished.

Liquid concentrate will be drawn to the Venturi through a sleeve 23 extending to the base 24 of the tank 10 and having a series of suction ports 25 formed at the lower extremity thereof. The sleeve 23 is fitted internally of a vertical portion 26 of the concentrate inlet housing 17. A pressure seal 27 is provided between the sleeve 23 and the vertical housing portion 26 to assure that a loss of suction will not occur above the level of liquid concentrate within the tank 10.

Also, to assure that the liquid concentrate flows unidi-
resectionally from the tank to the Venturi a check valve 29 is provided internally of the vertical housing portion 26. The check valve constitutes a valve seat 29 and a spherical valve head 30 floating intermediate the seat 29 and obliquely inwardly 32 guiding stop arms 31 and 32. Attempts to force fluid from the dispenser body 16 to the tank 10 will cause the seating of the spherical head 30 at the valve seat 29 to close the suction sleeve 23. During operation of the dispenser, liquid concentrate is drawn from the tank 10 through the sleeve 23 for urging the spherical head 30 in a position at the upper extremities of the inwardly extending valve stops 31 and 32. Fluid will be allowed to extend around the stops 32 and past the spherical head 30 to the upper regions of the dispenser body.

The inlet housing 17 has a horizontal portion 33 for receiving the suction tube 11 internally thereof and for receiving the dispenser body 16 externally thereof. The suction tube 11 consists of a straight tube 34 having a radially enlarged base portion 35 for being held within the horizontal sleeve portion 33.

The inlet housing 17 is provided with a port 36 connecting the vertical or horizontal portions thereof and the base 35 of the suction tube 34 has a similar port 37 aligned with the port 36 for communicating the interior of the suction tube with the interior of the sleeve 33 via the check valve 28. Also, a rubber seal 38 is fitted about the exterior of the base 35 to prevent leakage of liquid concentrate from the inlet housing 17 to the pressurized fluid regions of the dispenser body.

The interior of the suction tube 11 tapers from a large diameter at the base 35 to a substantially reduced diameter at the tube extremity 39. Also, the outer surface of the suction tube 11 tapers as at 40 for being complementary with the Venturi 12.

The dispenser body 16 is fitted about the horizontal housing portion 33 and is provided with a rubber seal 41 to provide a pressure-tight junction therebetween.

The dispenser body has a Venturi 12 consisting of a converging wall portion 42, a throat portion 43 and a diverging wall portion 44. The diverging wall portion conducts directly to the outlet passageway 13 and hence to the spigot 45. It may be noted that the converging wall portion is provided to be substantially complementary with the tapered end 40 of the suction tube 11. In addition, the suction tube 11 and the Venturi 12 are provided to have a given positional relationship as will experimentally provide the most efficient suction and mixing functions.

A bypass 14 extends from the annular passageway 46 leading to the Venturi 12 and conducting from a fluid pressure inlet 47. The inlet 47, shown dotted in FIG. 2, is communicable directly with a pressure feed line 48 which will characteristically be a household water supply line.

The bypass 14 communicates with the annular passageway 46 at a point 49 and conducts to the outlet passageway 13 via the dilution valve 15. The dilution valve 15 comprises a valve seat 50 formed at the upper extremity of a vertical section 51 of the bypass 14.

The valve head which is cooperable with the seat 50 comprises an adjustable plug 52 threaded within an upwardly extending boss 53 of the dispenser body 16 at a point 54. The plug 52 has a shaft portion 55 slidable received within a valve chamber 56 formed internally of the boss 53. The plug 52 has a circumferential groove 57 for receiving a rubber seal 57 to provide fluid pressure connections between the shaft and the cooperable walls of the valve chamber 56. The actual contacting surface of the dilution valve 15 takes the form of a tapered face 58 extending within the vertical section 51 of the bypass 14. Also, the dilution valve 15 is being adjusted by a standard screwdriver or the like.

In operation, fluid received under pressure through the water line 48 at the inlet 47 passes through the annular passageway to the Venturi 12 and simultaneously through the bypass 14 to the dilution valve 15 and hence to the outlet passageway 13. The movement of the fluid pressure through the bypass 14 creates a suction zone at the extremity 39 of the suction tubing 11 for drawing the liquid concentrate from the tank 10 through the sleeve 23 and the interior of the tubing 11 to commingling within the Venturi throat 43 with the moving pressurized fluid. The combined fluid then moves beneath an aeration passageway 67 formed slightly behind the discharge end of the passageway 13. The aeration passageway 67 allows air to mix with the outgoing liquid for avoiding the flat taste characteristic of beverages lacking suitable air exposure.

While the first mix occurs at the Venturi throat 12, a second mix occurs at the outlet passageway 13 which is variable by changing the setting of the dilution valve 15. By adjusting the valve plug 52 and raising or lowering the tapered valve head 58 from the cooperative seal 51, the quantity of pressurized fluid, in this case, water passing through the bypass 14 can be altered. Therefore, the strength of the resulting beverage is affected within the outlet passageway 13 by the relative positioning of the dilution valve.

Through the provision for the bypass 14 and the dilution valve 15 a stationary positioning of the Venturi 12 and the suction tube 11 can be achieved for most efficient operation of these cooperating parts. At the same time, proper proportioning of the liquid concentrate and pressurized fluid can be achieved which will be constant for substantially all fluid pressures. This derives directly from the communicability of the bypass 14 and the annular passageway 46 conducting to the Venturi 12.

In FIGS. 1 and 2 the dispensing assembly is shown to comprise two units 60 and 61 mounted at a common tank 63. These units are provided with a single principal inlet 48 and are actuated by means of a T-arm 63 pivoted about a locking stud 64 formed centrally of the connecting dispenser housing 62.

Separate valves are provided at opposite ends of the connecting dispenser body 62 and have actuator buttons 65 and 66 disposed at opposite sides thereof for being actuated by the T-arm 63 at depending actuator tabs 67. By moving the lever portion of the arm 63 in either direction toward the dispensing units 60 or 61, the corresponding actuation tab 67 will engage the proper valve button 65 or 66 for initiating the flow of pressurized fluid through the principal inlet 48 of the dispenser body to be actuated. Therefore, the single T-arm 63 actuates both units 60 and 61, and a compact refrigerator assembly results.

Another form of this invention is shown in FIGS. 3 and 4 as comprising first and second mixing structures having similar functional characteristics. Essentially, the dispenser body 70 has a straight pressure flow path 71 and a suction tube 72 which is formed integrally with the valve body and which is disposed perpendicular to the straight pressure flow path 71. This structure is in contrast to that shown in FIG. 2 where the suction tube was provided to be substantially coaxial with the pressure fluid path.

In FIG. 4, a venturi 73 is formed in the straight path 71 and has a converging wall portion 74, a dual throat portion indicated by numerals 75 and 76 and a diverging wall portion 77. Through the use of the converging wall portion a high speed fluid is achieved at the throat region 75 which upon passing through the second throat region 76 creates a suction in the perpendicular suction path 72.

As in the previous example, the suction path 72 is connected via a check valve assembly 78 and a sleeve 79 to the base 80 of a liquid concentrate storage chamber or tank 81. The suction the depicted at the perpendicular path 72 draws fluid from the storage tank 81 through the sleeve 79 to the throat portion 76. At this point, the liquid concentrate and the pressurized fluid become commingled and pass through the diverging wall portion 77.
through an outlet passageway 82 to a nozzle or spigot 83. However, the flow through the outlet passageway 82 is increased due to the presence of a dilution bypass 84 consisting of a right angle passage 85 connecting from the straight passage 71 to a longitudinal passage 86 and a second right angle passage 87 forming a junction with the outlet passage 82. Intermediate the longitudinal passage 86 and the second right angle passage 87, a dilution valve 88 is provided for regulating the flow of pressurized fluid through the bypass to the outlet passageway 82.

The dilution valve 88 consists of a valve seat 89 formed at the end portion of the longitudinal passage 86 and a tapered valve head 90 which is cooperative with the seat 89 for controlling the flow of fluid therethrough. The tapered head 90 is formed integrally with a threaded stem 91 which is received within a horizontal arm 92 of the valve body 70. The threaded stem 91 and hence the valve head 90 is provided to be operated by a dilution knob 93 extending adjacent to the associated nozzle or spigot 83. A reduced diameter portion 95 of the threaded shaft 94 is slidably received within a valve chamber 96, which constitutes a radially enlarged section of the longitudinal passage 86. The reduced diameter portion 95 has a circumferential groove for maintaining a rubber seal 97 contiguous with the inner wall of the valve chamber 96. The seal 97 prevents pressurized fluid from passing the threaded shaft 94 to the outside of the liquid dispenser. A third diameter associated with the threaded stem 91 is a valve pin 98 which has its extremity formed into the tapered valve head 90. The valve pin 98 is reduced in diameter from that of the valve chamber 96 to allow the flow of fluid from longitudinal passage 86 about the valve pin 98 to the right angle passage 87 and, hence, to the outlet of the dispenser.

The resulting structure of the liquid dispenser as shown on FIGS. 3 and 4 is substantially equivalent to that shown in FIGS. 1 and 2 and to that degree reference numerals have been transferred to these figures. It may be noted that like FIGS. 1 and 2 the unit shown in FIGS. 3 and 4 is a twin dispenser which is substantially symmetrical about a longitudinal center cross section. Essentially, by bringing two equivalent units into a single valve body refrigeration space can be conceived. Also, this enables the use of a single inlet as at 48 and a single valve actuating T-arm 62.

It will be understood that various modifications may be suggested by the embodiment disclosed, but I desire to claim within the scope of the patent warranted hereon all such modifications as come within the scope of my invention. I claim as my invention:

1. A dispenser for proportioning and mixing liquids of different viscosities comprising:
   a proportioner body having an inlet for connection to a source of pressurized liquid, an outlet extending therefrom, and a mixing passageway connecting said inlet and said outlet.

suction zone at the end of said suction tube to draw liquid therethrough from said liquid chamber, a post-mixing passageway conducting a portion of said source of pressurized liquid from said mixing passageway at a point upstream of said converging throat to said mixing passageway at a point downstream of said diverging throat.

2. A dispenser for proportioning and mixing liquids of different viscosities comprising:
   a proportioner body having an inlet for connection to a source of pressurized liquid, an outlet extending therefrom, and a mixing passageway connecting said inlet and said outlet.

   said mixing passageway having a straight throat portion, a portion converging in a downstream direction to said throat portion, and a portion diverging in a downstream direction from said throat portion.

   suction tube disposed within said mixing passageway in spaced relation from the inner walls thereof and terminating within said converging portion at the vicinity of said throat, said suction tube extending through a wall of said mixing passageway for being immersed within a liquid chamber apart from said source of pressurized liquid, means applying said source of pressurized liquid to said mixing passageway along the exterior of said suction tube and through said throat for creating a suction zone at the end of said suction tube to draw liquid therefrom through said liquid chamber, a post-mixing passageway conducting a portion of said source of pressurized liquid from said mixing passageway at a point upstream of said converging throat to said mixing passageway at a point downstream of said diverging throat.

References Cited

UNITED STATES PATENTS

1,481,535 1/1924 Burdett
1,769,266 7/1930 Lusker
2,125,251 7/1938 Thompson
2,222—193

2,690,717 10/1954 Goodrie
2,993,214 7/1961 Franco
3,016,916 1/1962 Kraft
3,113,725 12/1963 Packard et al.
3,250,476 5/1966 Kenk

FOREIGN PATENTS

872,914 4/1953 Germany.

ROBERT B. REEVES, Primary Examiner.
RAFAEL M. Lupo, Examiner.