The present invention relates to a novel apparatus which is particularly useful for providing hot drinks and the like, and more particularly to a novel apparatus which may be installed in a motor vehicle so as to provide the vehicle passengers with means for mixing themselves a hot beverage.

As is well known, persons traveling in motor vehicles frequently feel the need for a refreshing beverage such as coffee, hot cocoa, tea and the like, and it is a usual practice for such persons to stop at a roadside restaurant to obtain the desired beverage. There are many occasions when such stops are undesirable since they will unduly delay the trip and on other occasions, it may be impossible to locate a convenient satisfactory restaurant. Therefore, it is an important object of the present invention to provide a novel apparatus for installation in motor vehicles for dispensing hot beverages for the use of the vehicle passengers.

Another object of the present invention is to provide a novel apparatus of the above described type which utilizes the engine heat or energy for heating the liquid of the beverage.

A further object of the present invention is to provide a novel apparatus for dispensing and heating a predetermined measured quantity of liquid.

A more specific object of the present invention is to provide a novel apparatus of the above described type which is constructed so that the temperature to which the liquid is heated may be easily controlled.

A further object of the present invention is to provide a novel dispensing apparatus particularly adapted for use in motor vehicles, which apparatus may be easily operated by the vehicle driver so that the driver is not unduly distracted from the road.

Other and more specific objects of the present invention will become apparent from the following description and the accompanying drawings wherein:

Fig. 1 is a diagrammatic view showing an apparatus embodying the principles of this invention installed in an automobile;

Fig. 2 is a sectional view showing the means for pumping and measuring a predetermined quantity of beverage liquid to be dispensed;

Fig. 3 is a sectional view showing the discharge nozzle of the apparatus;

Fig. 4 is a diagrammatic view showing an apparatus embodying a modified form of the present invention;

Fig. 5 is a sectional view showing the pumping and measuring means of the apparatus of Fig. 4;

Fig. 6 is a diagrammatic view showing another modified form of the present invention and;

Fig. 7 is a sectional view showing the pumping and measuring means of the apparatus shown in Fig. 6.

Referring now more specifically to the drawings whereinafore are designated by the same numerals throughout the various figures, an apparatus 20 embodying the principles of this invention is diagrammatically shown in Fig. 1 as installed on a motor vehicle having an engine 22 with an intake manifold 24, a water pump 26, a firewall 28 between the engine and passenger compartments and a dashboard 30. In general, the apparatus 20 includes a container 32 adapted to contain a body of liquid to be dispensed, a hot water jacket 34 surrounding the container for the purpose described below, pump means 36, a valve assembly 38, a heat exchanger 40, a dispensing nozzle 42, means 44 for containing and dispensing various beverage ingredients, and suitable conduits connecting various of the above mentioned elements together.

The container 32 is preferably in the form of a flexible rubber or plastic bag so that in the event the vehicle is to be operated in cold climates, the container will not be injured if the water or the liquid therein should freeze during periods when the vehicle is idle. In this connection the hot water jacket 34 is provided around the container to prevent the liquid in the container from freezing while the vehicle is in operation and to thaw any frozen liquid within the container after the vehicle has been idle. Hot water is directed into the water jacket 34 from the water jacket of the engine through a conduit or hose 46 and is discharged from the jacket 34 through a conduit 48. The conduit 48 is, in turn, connected with a conduit 50 which communicates with the inlet of the pump 26. As will be understood, the liquid in the engine cooling system and, therefore, flowing to and from the jacket 34 may be water or a suitable coolant that will not freeze at temperatures to which the vehicle may be subjected when idle. The container or bag 32 is constructed so that it may be sealed after it is filled with the liquid or fresh water so as to prevent the surrounding atmosphere from contaminating the water.

As shown in Fig. 1, a tube 52 is provided for extending substantially to the bottom of the container or bag 32, which tube is connected with the central passageway 54 in the valve assembly body 56. Liquid or water which is drawn from the container or bag by the pump means in the manner described below passes up through the tube 52 past a spring biased ball type check valve 58 and into the passageway 54. From the passageway 54 the fluid flows through a passageway 60 and a conduit or hose 62 to the pump means. The liquid returning from the pump means flows back through the hose 62 and into the passageway 54. The check valve 58 prevents returning fluid from flowing back into the container so that the fluid must flow past another spring biased ball type check valve 64 into a passageway 66 and then into a conduit or hose 68.

The hose 68 is connected with a pipe or tube 70 which extends through the heat exchanger and is connected with the nozzle 42. Preferably, the heat exchanger includes a cylinder 72 which surrounds a portion of the tube 70 and provides a water jacket. One end of the cylinder is connected with the conduit 50 and the opposite end is closed. A conduit 74 is connected to the cylinder adjacent the closed end thereof and is also connected by coupling means 76 with the outlet of the engine water jacket so as to direct the heated engine coolant into the heat exchanger.

Referring specifically to Fig. 2, the beverage liquid measuring and pumping means 36 will be described in detail. This means includes a pump housing 80 having a pair of opposed cup-shaped members 82 and 84 with inner locking peripheral flanges 86 and 88. The housing is divided into chambers 90 and 92 by a flexible diaphragm 94 which has its periphery clamped between the flanges 86 and 88. The central portion of the diaphragm is clamped between a pair of dish-shaped members 96 and 98 which form a piston-like assembly and which are provided with central apertures for receiving an...
upper threaded end portion 10b of a guide rod 102. The dish-shaped members are fixed on the guide rod and are clamped together by means of nut members 104 and 106 which are threaded onto the rod. Preferably, washers 108 and 110 are disposed between the nut members and the dish-shaped piston members. The guide rod 102 extends through an aperture 112 in the end of the pump housing member 82 and into the tube 62. In order to permit the beverage liquid to flow freely between the tube 62 and the chamber 90, the guide rod 102 is provided with an axially extending slot 114. It will be appreciated that when the piston assembly and diaphragm are moved upwardly so as to expand the chamber 90, the beverage liquid will be drawn into the chamber, and when the piston assembly and diaphragm are moved downwardly, the beverage liquid will be expelled from the chamber. In accordance with the present invention, the piston assembly and diaphragm are formed and actuated so that upon each downward stroke, a predetermined measured quantity of the beverage liquid is expelled from the chamber 90, forced through the heat exchanger and ejected from the discharge nozzle. This predetermined quantity of liquid may, for example, be sufficient to fill one beverage cup.

In order to actuate the piston assembly, a compression spring 116 is provided for shifting the piston assembly downwardly through collapsed chamber 90, and members 120 provided for evacuating the chamber 92 so as to cause the piston assembly to shift upwardly against the action of the spring 116. This last named means includes a vacuum line 118 which has one end connected to the engine intake manifold 24 and an opposite end connected with a valve assembly 122 which may be mounted on or beneath the dashboard 30. In addition, the vacuum line 118 is connected with a valve assembly 122 on the pump housing by branch vacuum line 124. The valve assembly 122 includes a cylindrical body member 160 having a closed end 162 and a peripheral flange 164 which is secured to the pump housing member 84 and provides chambers 174 and 176. The chamber 174 is connected with the chamber 92 in the pump housing by the tube 178 and a chamber 176 is separated from the chamber 92 by a flexible diaphragm 180 which is between the pump housing member 84 and the flange 164. In order to establish communication between the chamber 174 and the vacuum line 128, passageway means 162 and 184 are formed in the valve body members. A valve seat 186 surrounds the passageway 184. A valve member 188 is disposed within the chamber 174 and is shiftable to and from the broken and solid line positions for alternate cooperation with the valve seats 170 and 180. The valve member 188 is fixed on a valve stem 190 which is slidable mounted in the body member 172 and which has a threaded end portion 192 extending through a sealed aperture in the flexible diaphragm 180. For a purpose to be described below, a cap 194 is threaded onto the valve stem portion 192 and carries on a chamber interior 196. Another cap 198 is slidable disposed on the lower end of the pin 196 and a compression spring 200 is disposed between the two caps, so that they are resiliently urged apart. The cap 198 is held in assembled relationship with the pin by a sheet metal clip member 202 which is welded or otherwise fixed to the cap 198 at 204 and which has a hook portion 206 extending beneath a shoulder on the cap 198. It should be noted that the clip member is constructed so that when the cap 198 is in its lowermost position in engagement with the hook 206, the bottom end of the pin 196 and the bottom of the bore in the cap 198 are spaced apart a predetermined amount.

The measuring and pumping means described above functions to dispense a predetermined quantity of beverage liquid in the following manner. The valve members 140 and 188 are normally held against the valve seats 132 and 170 respectively, since there is a vacuum or reduced pressure in the lines 118 and 124, and atmospheric air is admitted behind these valves through the port or vent 140. To dispense the beverage liquid, the operator has depressed the button or knob 144 to cause the piston assembly to shift the valve member 140 away from the valve seat 132 and against the seat 152. Substantially instantaneously, vacuum or reduced pressure is established in the line 138, the passageways 182 and 184, the chamber 174, the tube 178 and the pump chamber 92. This causes the piston assembly of the pump to start its upward movement, and at the same time this causes the flexible diaphragm 180 to shift from the broken line position to the solid line position. As the flexible diaphragm 180 is drawn into the chamber 92, it draws with it the valve stem 190 and valve member 188 so that communication is established directly between the vacuum line 124 and the tube 178. When this is accomplished, the pushbutton 144 may be released, and in actual practice it is only necessary for the operator to apply momentary pressure to the push-button. When the push-button is released, the valve 140 again shifts against the valve seat 132 to block the vacuum line 118 and the line 138 is again vented to the atmosphere. However, the line 138 is blocked from the chamber 174, the tube 178, and the pump chamber 92. The valve seat 186 is pulled down against valve seat 186 by the flexible diaphragm 180. Therefore, the reduced pressure is maintained in the pump chamber 92 even after the push-button 144 has been released, so that the piston assembly continues to rise and the beverage liquid or water con-
continues to be drawn into the pump chamber 90. When a predetermined quantity of water has been drawn into the pump chamber 90, the chamber 92 is vented to the atmosphere so that the spring 116 functions to actuate the piston assembly 226 to discharge the liquid to the chamber 90. The venting of the chamber 92 to the atmosphere is accomplished by shifting the valve member 180 at a predetermined instant away from the valve seat 186 and against the valve seat 170 so as to establish communication between the chamber 92 and the vent port 148 through the tubes 178 and 138 and the valve assemblies. The valve member 188 is shifted in response to movement of the piston assembly, and this is accomplished by engagement of the nut member 106 with the lower end of the cap 198. Thus, as the piston assembly rises, the nut member 106 forces the cap 198 upwardly, so that the spring 200 is compressed. When the cap member 198 has been raised to the point where the lower end of the pin 196 engages the bottom of the bore in the cap, further upward movement of the piston assembly and the cap 198 positively shifts the valve member 188 from the seat 186. With the vacuum chamber in the chamber 92 thus broken, the spring 200 functions to shift the valve member 188 against the valve seat 170 to block the vacuum line 124.

It will be appreciated that the temperature to which the beverage liquid is exposed is determined to a considerable extent on the length of time the liquid is within the heat exchanger 40 or in other words, on the rate of flow of the liquid through the heat exchanger. The rate of liquid flow through the heat exchanger may be controlled by turning the knob 144 to vary the size of the vent or port 148. This varies the rate at which atmospheric air may flow to the pump chamber 92 and thus the rate at which the reduced pressure in the chamber is relieved so that the spring 116 may force the piston assembly downwardly and maintain positive control of the rate of beverage liquid flow may be obtained by utilizing the discharge nozzle structure shown in detail in Fig. 3. More specifically, the discharge nozzle structure 42 includes a body member 210 having an inlet port 212 connected with the tube 70 and communicating with an axially extending bore 214. The nozzle body is also provided with a transverse outlet orifice 216 which communicates with the bore. A needle valve 218 is provided for controlling the effective size of the inlet port 212 and thus the pressure of beverage liquid flow. The needle valve is secured to or made integral with a stem 220 which is threaded into the nozzle body and which is provided with a knob 222 at its outer free end for easy adjustment. An O-ring 224 is provided for preventing escape of any of the beverage liquid around the needle valve stem. It is important to note that with the beverage liquid flows through the heat exchanger in a direction opposite to the direction of flow of the heated engine coolant through the tube 72. With this arrangement, the beverage liquid may be heated to substantially the same temperature as the engine coolant leaving the engine water jacket, if desired. It should be noted that, as shown in Fig. 1, the tubes 70 and 68 are inclined downwardly from a discharge nozzle 42. In addition, a check valve assembly 226 is connected with the tube 70 at the lower end thereof. The check valve assembly 226 has an outlet port 228 which may be connected to a drain line 228, if desired, and has a ball valve 230 which is spring biased so as normally to establish communication between the drain line and the tube 70. Thus, after each dispensing operation the beverage liquid remaining in the tubes 70 and 68 flows through the check valve and out the drain line. This prevents liquid from being overheated in the heat exchanger between dispensing operations and also eliminates the possibility of liquid remaining in the tubes 70 and 68 which might freeze and injure the tubes. It is understood, of course, that when the beverage liquid is forced through the tube 68 under pressure during the dispensing operation, the check valve is closed by the liquid pressure. If desired, a holder assembly 232 may be provided for positioning a cup 234 beneath the discharge nozzle to receive the beverage liquid dispensed. The holder assembly includes a scoop-shaped member 236 adapted to receive and support a cup as shown in Fig. 1, and pivotally mounted to any suitable support such as the firewall by bracket means 238. A tension spring 240 is provided between the upper edge of the scoop member and a suitable anchor pin so that when the cup is removed, the scoop member is tilted upwardly. A drain line 242 is connected with the bottom of the scoop member as shown in Fig. 1, so that any beverage liquid splashing from the cup during the dispensing operation or dripping from the nozzle after the dispensing operation is collected by the scoop member and is discharged through the drain line. In Figs. 4 and 5 there is shown a modified form of the present invention which, except for the measuring and pumping means, 250, is substantially identical to the above described apparatus as indicated by the application of like reference numerals with the suffix a added to corresponding elements. The measuring and pumping means 250 includes a cylinder 252 having an end 254 with a nipple 256 connected to the beverage liquid conduit 262, and an opposite closed by a valve body member 258. The cylinder is divided into two chambers 250 and 260 by a central partition 264. Pistons 266 and 268 are respectively slidably disposed in the chambers 260 and 262 and are rigidly interconnected by a rod 270 which slidably extends through an aperture in the partition. This aperture is sealed by an O-ring 272 or any other suitable packing means. It will be appreciated that the pistons also provide in combination with the partition, chambers 274 and 276. In this embodiment, the pistons are reciprocated to draw a measured quantity of beverage liquid into the chambers 260 and then expel the liquid from the chamber by alternately connecting the chambers 262 and 276 with the vacuum line 118g and with a vent to the atmosphere. The valve body 258 is provided with a central bore 278 which is intersected at axially spaced points by ports 280 and 282. These ports are connected with the vacuum line by a tube 284. In addition, the valve body 258 is provided with a port 286 which is connected with the pump chamber 276 by a conduit 288 and with another port 290 which is vented to the atmosphere through tubes 292 and 294. Another vent port 296 is also connected with the tube 294 by a branch tube 298. The pump chamber 274 is continuously vented to the atmosphere by a tube 300 which is preferably also connected with the tube 294, and the tube 294 is connected with a filter 302. Preferably, the filter is enclosed in a housing or heat exchanger adjacent the engine exhaust manifold or exhaust pipe so that all of the air entering the pump will be filtered and sterilized. Slidably disposed in the bore 278 of the valve body member 258 is a valve member 304 which is connected to a stem 306 adapted to extend through the firewall and provided with a button or knob 308 so that it may be manipulated by an operator within the passenger compartment of the vehicle. The valve member 304 is provided with a central passageway 310 which is intersected by ports 312, 314 and 316. In addition, the valve member is provided with another axially extending passageway 318 which opens into the pump chamber 262 and which is intersected by a port 320. A plurality of O-rings 322 are spaced along the valve holder assembly in the axially spaced ports from each other. A rod 324 having a groove 326 therein is slidably disposed in the bore or passageway 318 and is resiliently urged toward the extended position shown by a compression spring 325. For a purpose to be described below, the valve member 304 is provided with a groove or notch 330 which is adapt-
ed to receive a finger 332 of a pivotally mounted lever member 334. A compression spring 336 acts against an arm 338 of the lever member for resiliently urging the finger portion to a position for cooperation with the groove 330.

The operation of the measuring and pumping means 250 is as follows. The pistons and the valve member 304 are normally in the positions shown in Fig. 5, at which positions the pump chamber 276 is connected with the vacuum line through the conduit 288, the ports 286 and 314, the passage 310, and the tube 284. At the same time, the pump chamber 262 is vented to the atmosphere through the groove 326, the passageway 318, and the ports 320 and 290. In order to initiate the dispensing operation, the operator merely presses inwardly on the push-button 308 so that the valve member 304 is shifted toward the left as viewed in Fig. 5. This causes the ports 312 and 316 in the valve member to become aligned respectively with the vent port 296 and the port 286 so that the pump chamber 276 is vented to the atmosphere. At the same time, the port 334 is connected to the passage 212 so that the pump chamber 262 is connected with the vacuum line. The finger 332 of the lever member enters the groove 350 to hold the valve member 304 in the shifted position. As the pressure in the chamber 262 is reduced, the pistons shift toward the right so that the beverage liquid is drawn into the chamber 260. As the pistons near the end of their movement toward the right, the piston 266 first engages the end of the rod 324 and shifts the rod into the passageway 312 to compress the spring 338, then the piston 268 engages the arm 338 of the lever member and pivots the lever member so as to draw the finger 332 from the groove 330 and release the valve member 304. When this occurs, the spring 328 acting against the piston through the rod 324 shifts the valve member 304 back to the position shown in Fig. 5 so that the pump chamber 276 is again connected with the vacuum line, and the chamber 262 is again vented to the atmosphere. This causes the pistons to shift back toward the left and force the beverage liquid from the chamber 260. In order to control the rate at which the beverage liquid is forced from the chamber 260 and thus through the heat exchanger, a restricted orifice 340 is provided in the vent tube 292 and an adjustable needle valve 342 is provided for controlling the effective size of the orifice. Furthermore, the discharge nozzle 422 shown in Fig. 4, which is a simple nozzle, may be replaced by the above-described nozzle structure 420 so that the rate of liquid flow through the heat exchanger may be more positively controlled.

In Figs. 6 and 7 there is shown another modified form of the present invention which, except for the measuring and pumping means 350, is similar to the above described apparatus as indicated by the application of identical reference numerals with the suffix b added to corresponding elements. Another modification is found in the fact that, instead of the above described flexible bag or container for holding a supply of the beverage liquid, this embodiment may be provided with a rigid tank 32b having a hermetically sealed closure 352. This container is preferably vented to the atmosphere by a line 354 which is connected with a filter 356. Preferably, the liquid entering the vent line is also heated and sterilized in the manner described above. As will be understood, the tank 32b may be replaced by a flexible beverage liquid container of the type described above.

The measuring and pumping means 350 is especially adapted to be used in vehicles having engines such as diesel engines which do not have an intake manifold with sufficient reduced pressure or vacuum for operating the above described measuring and pumping device. More specifically, the measuring and pumping means 350 is adapted to be actuated by air under pressure that is supplied thereto through a line 358. If the vehicle is provided with air brakes, the line 358 may be connected with a pressure line of the brake system, but, if desired, the line 358 may be connected with a pressure tank 360 having check valve means 362 for permitting charging thereof. When the pressure tank 360 is used, it may be periodically filled or charged with compressed air at automobile service stations.

Referring particularly to Fig. 7, it is seen that the measuring or pumping device 350 includes a housing having an elongated tubular section 364, a cup-shaped member 366 secured to and closing one end of the tubular section, and an air cylinder 368. A flexible diaphragm 370 is clamped between the flanges of the housing members 364 and 366 to provide a chamber 380. A valve body 382 is mounted on the end of the housing member 366 and contains a pair of check valves 384 and 386. The beverage liquid line 620 is connected with the pump chamber 380 through the check valve 384 and the liquid line 680 is connected to the pump chamber through the check valve 386. Thus, when the diaphragm 370 is shifted to expand the pump chamber, liquid will be drawn into the chamber from the line 625 and through the check valve 384, and when the diaphragm is shifted to collapse the chamber, the liquid will be expelled through the check valve 386 and into the line 680. In order to actuate the diaphragm 370 toward the right, a piston 406, a rod 388, and the pump chamber 380, the diaphragm is connected with a rod 388 by means of nut members 390 and 392 threaded on the rod and clamping the disks 394 and 396 against the diaphragm, and a compression spring 396 which is backed up by an annular plate 400 biasing the rod toward the right by acting against a disk-shaped washer 402 fixed on the rod. The rod 388 and therefore the diaphragm, is shifted toward the left to pump the beverage liquid from the chamber 380 by the compressed air which is directed into the cylinder 368 through a tube 404 and acts against a piston 406 on the rod.

Operation of the measuring and pumping device is controlled by valve means 408 which includes a body member 410 conveniently mounted on the housing member 364 and having an inlet port 413 connected with the pressure line 358 and an outlet port 414 connected with the tube 404. The valve body is also provided with a central bore 416, a larger counterbore 418 surrounded by a valve seat 420 and a still larger counterbore 422 which has its outer end closed. A vent passage 424 connects the port 414 and the counterbore 418. A valve member 428 mounted on a slidable valve stem 430 is provided for engaging the valve seat 420 and blocking the pressure inlet port 413 from the outlet port 414. In order to vent the air atmosphere when the valve member 428 is sealed against the valve seat 420, the valve body 410 is provided with a vent passageway 432 which intersects the bore 416 and which is then connected with the counterbore 418 by a passageway 434. An elongated valve member 436 is fixed to and removable with the valve member 428 for blocking the vent passageway 432 when the valve member 428 is open. However, when the valve member 428 is closed, a reduced diameter portion 438 of the valve member 436 registers with the vent passageway 432 so that the air under pressure may pass from the cylinder 368 through the tube 404, the port 414, and the passageways 426, 434, and 432 to the atmosphere.

The air pressure normally holds the valve member 428 against the valve seat 420 so that the normal position for the diaphragm 370 is that shown in Fig. 7. In order to initiate the dispensing operation, the operator pulls on a handle 440 which may be conveniently mounted on the dashboard and which is connected with the valve stem 430 by a cable 442 that passes through a guide pulleys 444 and 446. When the operator pulls on the handle 440, the valve member 428 is shifted to the position shown in Fig. 7, so that air under pressure is admitted into the cylinder 368 and acts against the piston 406 to shift the rod 388 and the diaphragm toward the
left. The distance which the rod 388 may shift toward the left, and therefore the amount of beverage liquid dispensed, is controlled by providing means for automatically shifting the valve member 428 back against the valve seat 420 after the rod 388 has shifted a predetermined amount. This control means includes a collar 448 adjustably fixed on the rod 388 by a set screw 450 and adapted to engage and actuate a lever 452 that is pivotally mounted at 454. The lever has an upper bifurcated end portion 456 that carries a cup-shaped member 458 having a central aperture through which the valve stem 430 extends. An opposite cup-shaped member 460 is fixed on the valve stem 430, and a compression spring 462 is disposed between the cup-shaped members. When the collar 448 on the rod 388 initially engages the lever 452, the lever is pivoted in a clockwise direction as viewed in Fig. 7 so that the spring 462 is compressed between the cup-shaped members 458 and 460. However, the force of the spring is insufficient to shift the valve member 428 away from the seat 464 against which the valve is held by the air pressure. The spring 462 continues to be compressed until the cup-shaped collar 448 positively engages the cup-shaped member 460. When this occurs, the valve member 428 is positively shifted away from the seat 464 so that the seal therebetween is broken and a spring 462 functions to shift the valve member 428 rapidly against the seat 420, so that the pumping stroke of the apparatus is terminated. Of course, when the valve member 428 has been shifted back against the seat 420, the spring 398 returns the diaphragm 370 to the position shown so that another charge of beverage liquid is drawn into the pump chamber 380.

From the above description, it is seen that the present invention has provided a novel apparatus with which the passenger in or the operator of a motor vehicle may easily prepare a hot beverage without unduly diverting his attention from the road. While various beverages may be prepared merely by placing suitable ingredients in the dispensing means 44, the preparation of a cup of hot coffee will be described for the purpose of illustrating the present invention. Of course, the dispensing means 44 will normally be filled with the beverage ingredients before the trip is started. When the operator desires a cup of coffee, he pushes a cup 324 beneath the dispensing nozzle of the dispensing means 44 to dispense a measured amount of coffee into the cup. Then he removes the cup from the dispensing means 44 and places it beneath the liquid dispensing nozzle 42 and momentarily presses the push-button 144. Then a predetermined measured quantity of hot water will be dispensed automatically from the nozzle in the manner described above, and at a relatively high velocity so that the water will thoroughly mix with the beverage ingredients in the cup.

While the preferred embodiments of the present invention have been shown and described herein, it is obvious that many structural details may be changed without departing from the spirit and scope of the appended claims. The invention is claimed as follows:

1. A dispensing apparatus for use on an engine driven vehicle comprising a container for a supply of liquid to be dispensed, conduit means connected with said container for directing the liquid to a point of discharge, heat exchanger means associated with a portion of said conduit means for heating the liquid in said conduit means, pump means connected with said conduit means for forcing the liquid through the conduit means, said pump means including a housing, reciprocable pumping means in said housing and providing a pumping chamber, pneumatic means for actuating said reciprocable pumping means, a control valve shiftable in a de-energizing and de-energizing position after a predetermined measured quantity of the liquid has been forced through the conduit means to said point of discharge.

2. A dispensing apparatus for use on a vehicle comprising a container for a supply of liquid to be dispensed, conduit means connected with said container for directing liquid to a point of discharge, heat exchanger means associated with said portion of said conduit means for heating liquid in said conduit means, pump means connected with said conduit means for forcing the liquid through said conduit means, said pump means including a housing, flexible reciprocable diaphragm means disposed within said housing and providing a substantially sealed chamber which is connected with said conduit means, spring means engaging said diaphragm means for resiliently biasing said diaphragm means to collapse said chamber and force liquid therefrom, a pneumatic line adapted to be connected with a source of reduced pressure, means including first control valve means connecting said pneumatic line with said housing behind said diaphragm means, means including a second control valve means connecting pneumatic line said housing behind said diaphragm means and by-passing said first control valve means, said first control valve means being manually operable to an open position for establishing communication between said housing and said pneumatic line and resiliently biased to a closed position, means for shifting said second control valve means from a closed position to an open position in response to opening of said first control valve means and to maintain said second control valve means in said open position after said first control valve means has been returned to its closed position, and said second control valve means being operable in response to a predetermined movement of said diaphragm means to its closed position whereby said pump means functions to deliver a predetermined measured quantity of liquid each time the first control valve means is manually operated.

3. A dispensing apparatus for use on an engine driven vehicle comprising a container for a supply of liquid to be dispensed, a heat exchanger, conduit means connected with said container and having a portion extending through said heat exchanger to a point of discharge, pump means connected with said conduit means for forcing a predetermined measured quantity of liquid through said conduit means and to said point of discharge, and normally open check valve means connected with said conduit means between said heat exchanger and said container, which check valve means closes when the liquid in said conduit means is under pressure from said pump means, said control means being inclined downwardly with respect to the horizontal from said point of discharge to said check valve means so that the liquid will drain therefrom through the check valve means after a dispensing operation.

4. A dispensing apparatus for use on an internal combustion engine driven vehicle comprising a container for a supply of liquid to be dispensed, conduit means connected with said container for directing liquid to a point of discharge, pump means connected with said conduit means for forcing liquid through said conduit means, said pump means including reciprocally operable reciprocable pumping means, a pneumatic line connected with said pump means and connectable with a source of air under a pressure lower than atmospheric control valve means in said pneumatic line, manually operable means for actuating said control valve means to energize said pump means to draw liquid from said conduit means for holding said control valve means in said energize position after the withdrawal of manual force from said manually operable means, and means operable in response to predetermined movement of said reciprocable pumping means for actuating said control valve means to de-energize said pump means.
5. A dispensing apparatus for use on an engine driven vehicle comprising a container for a supply of liquid to be dispensed, conduit means connected with said container for directing liquid to a point of discharge, pump means connected with said conduit means, a pumping member in said pump means responsive to pneumatic pressure for drawing a predetermined measured quantity of liquid from said container into said pump means, a pneumatic line adapted to connect said pump means with a source of reduced pressure, control valve means in said line shiftable to and from positions for energizing and de-energizing said pump means, manual means for shifting said control valve means toward said energizing position, means for holding said control valve means in said energizing position, and means operable by said pumping member for shifting said control valve means from said energizing position toward said de-energizing position.

6. A dispensing apparatus for use on an engine driven vehicle comprising a container for a supply of liquid to be dispensed, conduit means connected with said container for directing liquid to a point of discharge, pump means connected with said conduit means, a pneumatic line connected with said pump means and adapted for connection with a source of air under a pressure lower than atmospheric pressure, a pumping member in said pump means responsive to pneumatic pressure for drawing a predetermined measured quantity of liquid from said container with said pump means, control valve means movable in response to manual pressure to a first position to co-ordinately open said pneumatic line and close said vent, said control valve means being moved to a second position by movement of said pumping member to a predetermined position wherein said pneumatic line is closed co-ordinately with the opening of said vent, and means urging said pump members in a direction to discharge liquid from said pump means.

7. A dispensing apparatus for use on an engine driven vehicle comprising a container for a supply of liquid to be dispensed, conduit means connected with said container for directing liquid to a point of discharge, pump means connected with said conduit means, a pneumatic line connected with said pump means and adapted for connection with a source of air under a pressure lower than atmospheric pressure, a pumping member in said pump means responsive to pneumatic pressure for drawing a predetermined measured quantity of liquid from said container with said pump means, an atmospheric vent connected to said pump means, control valve means movable in response to manual pressure to a first position to co-ordinately open said pneumatic line and close said vent, said control valve means being moved to a second position by movement of said pumping member to a predetermined position wherein said pneumatic line is closed co-ordinately with the opening of said vent, and means associated with said control valve means for varying the effective size of said vent.

8. A dispensing apparatus for use on an engine driven vehicle comprising a container for a supply of liquid to be dispensed, conduit means connected with said container for directing liquid to a point of discharge, pump means connected with said conduit means for forcing liquid therethrough, a movable pumping element in said pump means movable in a liquid intake direction in response to a source of vacuum, manually operable means controlling a vacuum line in communication with said pump means for energizing said pump means, and means actuated directly by said pumping element for automatically de-energizing said pump means in response to a predetermined movement of said movable pumping element.

References Cited in the file of this patent

UNITED STATES PATENTS

- 1,004,650 Hilton Oct. 3, 1911
- 1,165,907 Riddle Dec. 28, 1915
- 1,228,982 Laun June 5, 1917
- 1,282,310 Strasburger Oct. 22, 1918
- 1,524,855 Shutterly Jan. 27, 1925
- 1,866,015 Davey July 5, 1932
- 1,916,037 Carsen June 27, 1933
- 1,920,146 Huber et al. July 25, 1933
- 2,004,993 Karsel et al. June 18, 1936
- 2,122,695 Podwyszynski July 5, 1938
- 2,558,581 Horton June 9, 1942
- 2,432,224 Card July 1, 1947
- 2,535,752 O'Connell Dec. 26, 1950
- 2,602,694 Richardson July 8, 1952
- 2,634,166 Sacchini Apr. 7, 1953
- 2,649,332 Rapp Aug. 18, 1953
- 2,661,015 Alfred et al. Dec. 1, 1953
- 2,669,251 Jackson Feb. 16, 1954