Sept. 25, 1956 E. F. CHANDLER 2,763,994

FLUID COOLING AND CARBONATING DEVICES

Filed July 30, 1952

3 Sheets-Sheet 1

Fig. 1

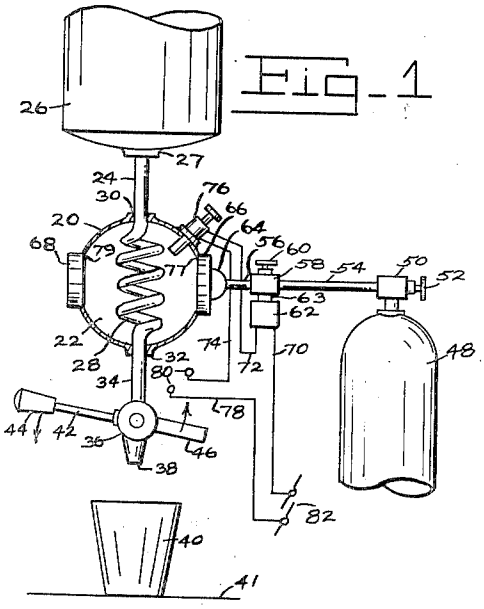


Fig. 2

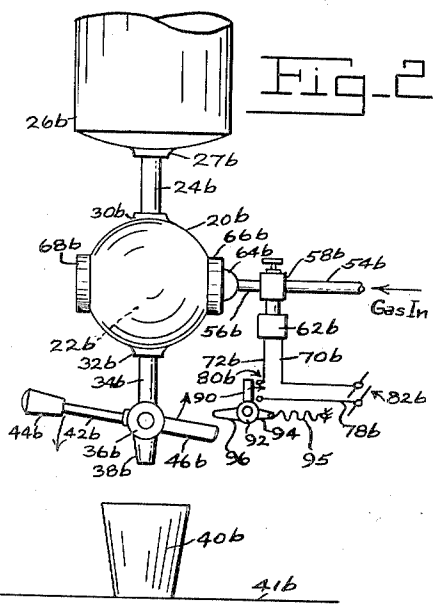


Fig. 3

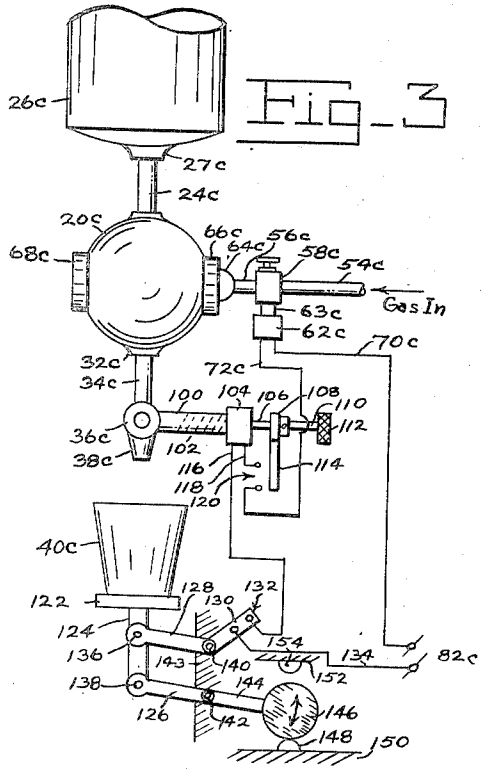
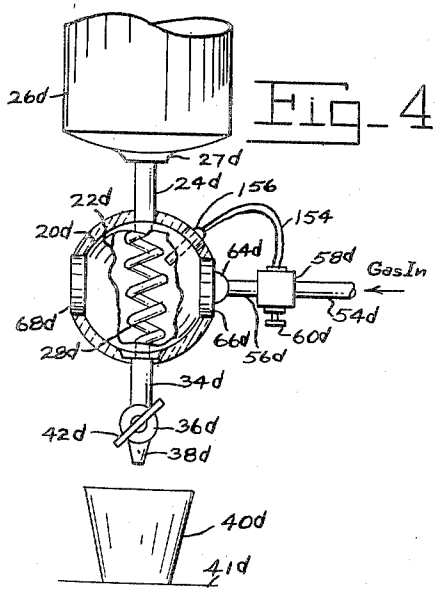


Fig. 4



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FLUID COOLING AND CARBONATING DEVICES

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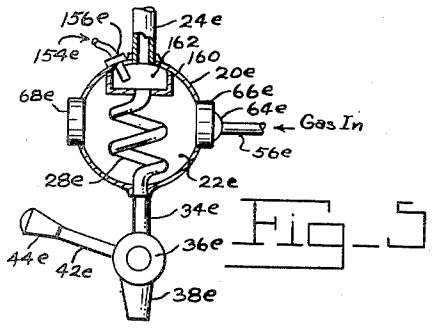


Fig_5

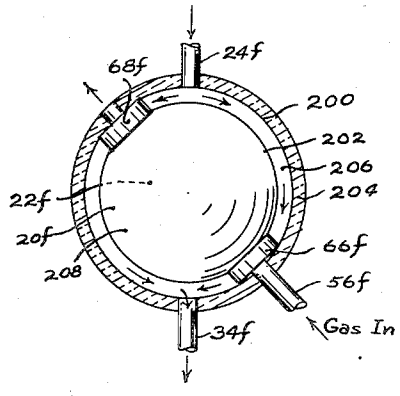


Fig_6

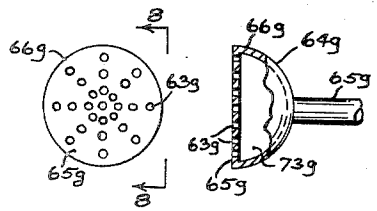


Fig_7 Fig_8

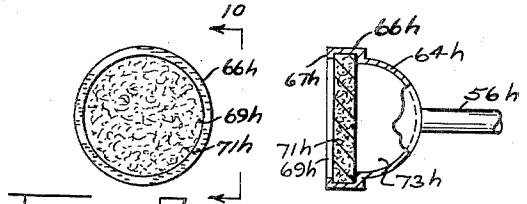


Fig_9 Fig_10

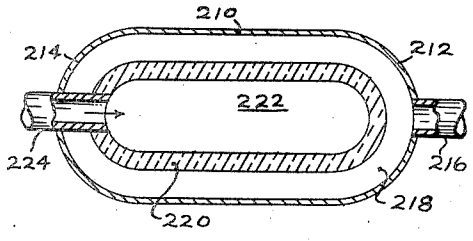


Fig_11

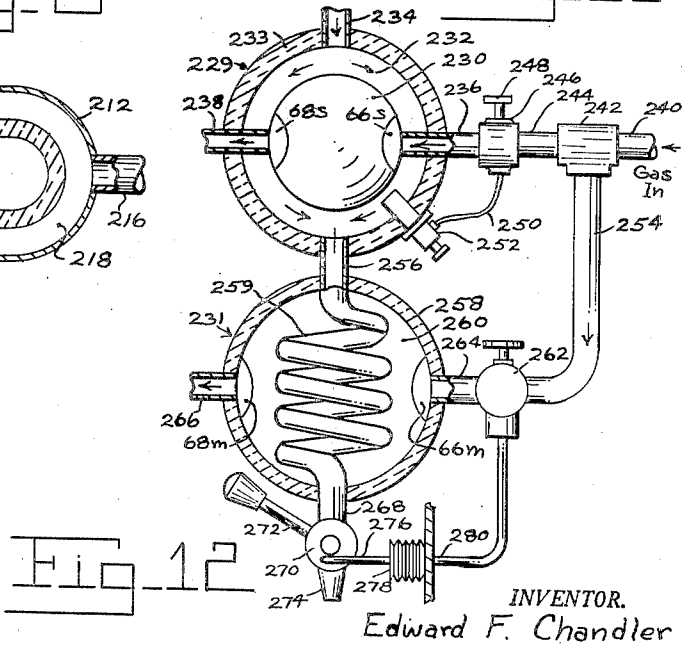


Fig_12

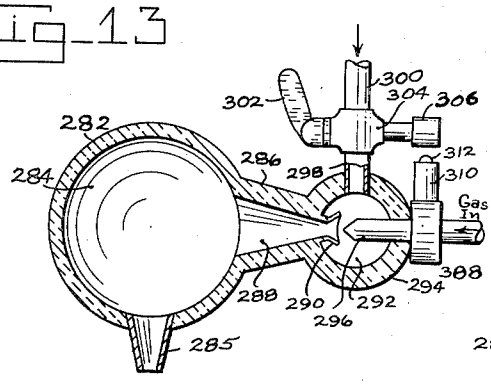
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FLUID COOLING AND CARBONATING DEVICES

Filed July 30, 1952 3 Sheets-Sheet 3

Fig_13



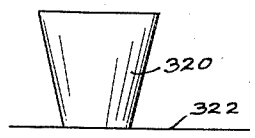


Fig_14

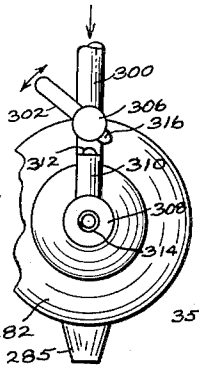
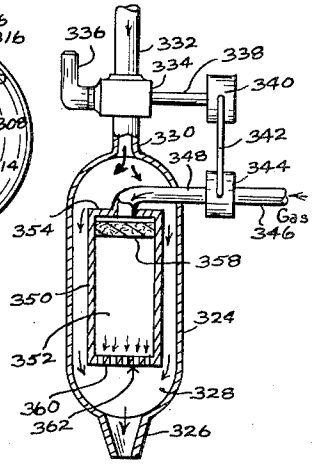
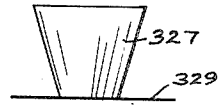


Fig_15





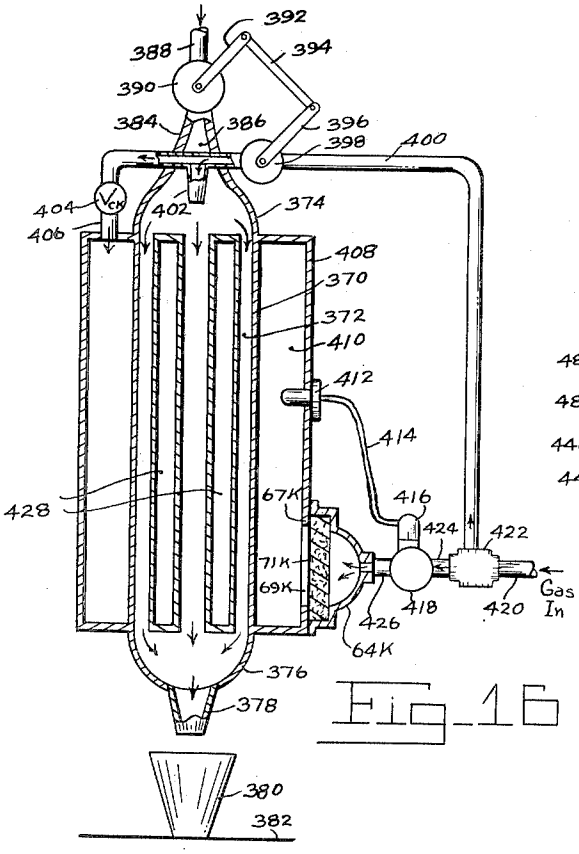


Fig_16

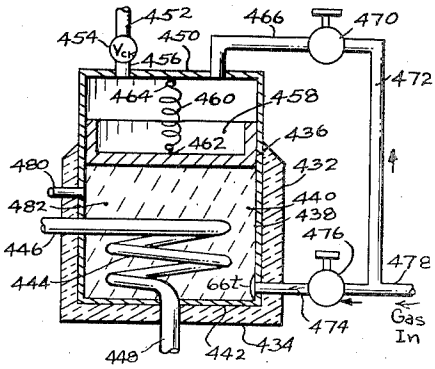


Fig_17

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United States Patent Office 2,763,994 Patented Sept. 25, 1956

2,763,994

FLUID COOLING AND CARBONATING DEVICES

Edward F. Chandler, New York, N. Y., assignor of thirty-three and one-third per cent to Peter Fries, Jr., New York, N. Y.

Application July 30, 1952, Serial No. 301,739

6 Claims. (Cl. 62—7)

This invention relates to improvements in methods and apparatus for cooling and dispensing fluids.

An object of the invention is to provide a novel and improved apparatus for and methods of cooling and dispensing fluids.

Another object of the invention is to provide a novel and improved method of treating a fluid while in the course of being dispensed, so as to condition the same, cooling it as needed, without any time lag substantially, during said cooling and conditioning process.

A further object of the invention is to provide a novel and improved method and apparatus for cooling a liquid beverage by non-mechanical refrigeration means, and which is especially adapted for cooling a beverage at the time it is being drawn for consumption.

Still another object of the invention is to provide a novel and improved method and apparatus for refrigerating or cooling a liquid beverage such as beer, ale, malt drinks, carbonated flavored or unflavored soft drinks, milk, or other drinks, all of which may have been standing at substantially room temperature immediately prior to being drawn from the apparatus, and into a receptacle such as a drinking glass, for consumption by the patron.

Still a further object of the invention is to provide apparatus and a method for instantaneously cooling or chilling a beverage by simple means and steps, employing a coiled beverage conduit conducting the beverage from a supply tank to the tap, the conduit passing through a cooling chamber, with provision made for allowing gaseous carbon dioxide or the like to expand into the cooling chamber so as to be crystallized into a snow-like form, absorbing a large quantity of heat in the expansion process and hence cooling intensely any contents of the cooling chamber, including the beverage flowing through the coiled beverage conduit.

Still another object of the invention is to provide apparatus and a method for serving a cooled beverage, by allowing liquid or gaseous carbon dioxide to expand from a highly compressed source into a cooling chamber through a permeable wall or valve, in such manner as to be transformed from the liquid or gaseous state directly to the crystallized powder-like state or snow, with intense cooling of the chamber, and whereby fluid flowing through or in a cooling coil in the chamber is quickly cooled to a considerable degree, as needed, within a short period of time, so as to be accomplished substantially instantaneously.

Another object of the invention is to provide a novel and improved method and apparatus for regulating the intensity and duration of the cooling effect in accordance with the needs of the system, so as to achieve optimum and maximum efficiency and convenience.

A further object of the invention is to provide a novel and improved apparatus and method for minimizing the escape of carbon dioxide gas which has not been converted into solid state.

Still another object of the invention is to provide a novel and improved device wherein carbon dioxide snow, resulting from the expansion of carbon dioxide into the solid state or snow state, is compressed into a dense cake or body, and which is of very low temperature, and capable of providing a sustained and continuous, and/or deferred cooling effect as needed.

Another object of the invention is to provide a method and apparatus for vastly improving the cooling effect of expansion of gases of the character or carbon dioxide, nitrous oxide and other gases having similar characteristics, while passing from the liquid or gaseous state into the solid state.

A further object of the invention is to provide a novel and improved method and apparatus for cooling fluids, which is simple in design, inexpensive to manufacture and carry out, and highly effective, efficient and convenient in use.

These and other objects and advantages of the invention will become apparent from the following description of a preferred embodiment thereof as illustrated in the accompanying drawings, forming a part hereof, and in which,

Figure 1 is a partly schematic and diagrammatic view of a first form of beverage cooling and dispensing device, the cooling housing being sectioned substantially on a vertical plane.

Figure 2 is a partly schematic and diagrammatic view of a modified form of the beverage cooling and dispensing device shown in Figure 1.

Figure 3 is a partly schematic and diagrammatic view of another modified form of the beverage cooling and dispensing device according to the invention, with automatic types of controls.

Figure 4 is a partly schematic and diagrammatic view of a further modified form of the beverage cooling and dispensing device according to the invention, including non-electrical control means, the cooling housing being sectioned as shown.

Figure 5 is a fragmentary partly schematic and diagrammatic view of another modified form of the beverage cooling and dispensing device according to the invention, outer portions being omitted from the view for clarity only.

Figure 6 is a partly schematic and diagrammatic vertical sectional elevational view in fragment of another modified form of the invention, showing a cooling housing and adjacent to its spherical surface, a cooling passage for fluid.

Figure 7 is a front elevational view of an inlet gas port device as seen facing the apertured front plate, and of a type which may be employed in various modifications of this invention shown in the various views.

Figure 8 is a right side elevational view of the inlet gas port device shown in Figure 7, the view being as seen on plane 8—8 of Figure 7, and partly broken out.

Figure 9 is a front elevational view of a gas port device employing a felt pad or other porous material, for use in various forms of this invention, to produce CO_2 snow, and the like.

Figure 10 is a right side elevational view as seen on plane 10—10 of Figure 9, the device being shown partly broken out for clarity.

Figure 11 is a sectional elevational longitudinal view of another modified form of cooling housing, employing a porous cell of ceramic material within the housing.

Figure 12 is a schematic and diagrammatic partly vertically sectioned view showing a two-stage liquid cooling device and system, being another modified form of the invention.

Figure 13 is a schematic and diagrammatic sectional elevational view showing another modified form of the invention, for dispensing cooled beverages into a glass or container.

Figure 14 is a right side elevational view of the device shown in Figure 13.

Figure 15 is a sectional elevational view of another modified form of cooling and dispensing device.

Figure 16 is a sectional elevational view of another modified form of cooling and dispensing device according to the invention, for dispensing a cooled drink of beverage.

Figure 17 is a sectional elevational view of still another modified form of cooling and dispensing device according to the invention, including means for compressing carbon dioxide snow into a mass or cake inside the cooling housing.

The present invention deals with the problems encountered in providing means for quickly chilling a relatively small quantity of liquid, a beverage, for example, at the time it is dispensed for consumption by the glass or other container, in the usual manner of serving beer, ale, soft drinks, at the bar, over the counter, or by automatic liquid dispensing apparatus. It also seeks to provide a simple, inexpensive, refrigerating means for this purpose, which normally is inert, non-mechanical, but which is adapted to function to produce a desired degree of cooling at the moment a liquid is drawn and dispensed.

When carbon dioxide is expanded in a suitable manner into a chamber having a restricted vent means, crystallized carbon dioxide snow is formed and a very intense cold is produced. The snow-like mass evaporates very slowly, prolonging the duration of the said cooling effect. In the present invention, I take advantages of these principles in producing a simple, efficient and economical means for cooling beverages and other liquids or fluids in which the desired low temperatures are obtained by the expansion of a suitable gas stored under pressure in a suitable flask, or container, in gaseous or liquid form.

This application is copending with my patent application, Serial No. 141,324, filed January 30, 1950, for Method and Apparatus For Making Ice Cream, which has now matured into Patent No. 2,713,253.

By the means shown, it is possible to have a fluid or beverage dispensing system by which only a single glass of cooled beverage is served, if desired, or more than one such glass, or a large number of glasses, all according to the demand by the consumer or consumers. However, due to the novel construction of the device, it is not necessary to maintain any part of the device at other than ambient temperature, that is, the temperature of the normal surrounding atmosphere, regardless of what it may be, or how it may fluctuate, since the temperature of the parts may be allowed to vary freely in accord therewith. However, when a glass of cooled beverage is to be drawn off into a glass or other container, then and only then, is it necessary to produce refrigeration and only for the purpose of cooling the interior of the cooling housing, and the beverage flowing therethrough, whereupon, after the beverage is cooled and drawn off, the cooling or refrigerating effect may be halted, and the entire system allowed to resume its inert or rest position at which no refrigerating effect is produced.

Since no mechanical pumping means are needed for the operation of the device, and the number of parts is limited it is seen that the initial cost of the device is quite low, and further its cost of operation and maintenance are similarly low. The device may be operated manually altogether, or, if desired, various control devices may be employed at one or more control points, for partial or total automatic operation, and it may also be coin controlled if desired.

In order to understand clearly the nature of the invention, and the best means for carrying it out, reference may now be had to the drawings, in which like numerals denote similar parts throughout the several views.

Referring now to Figure 1, it is seen that there is a container or reservoir **26** in which is stored a quantity of the liquid beverage to be dispensed from the device, and which is to be cooled after leaving the reservoir **26**. A cooling housing **20**, shown in the form of a sphere, although according to modified forms of the invention other shapes may be used, has a spherical interior chamber **22** or chilling chamber, in which is positioned the pipe coil **28**, the upper end of which is connected through boss **30** and feed pipe **24** to the outlet end **27** of the liquid supply reservoir or container **26**. At its lower end, the pipe coil **28** is connected through boss **32** and delivery pipe **34**, to the tap **36**, so that when the handle **44** mounted on stem **42**, is turned in a suitable direction, the tap opens and allows some of the beverage to flow therethrough, being discharged by spout or nozzle **38**, into the glass or container **40**, resting on the surface **41**.

At **48** is shown a suitable flask or cylinder of a suitable gas, such as carbon dioxide or other gas having similar cooling properties upon expansion, the gas in the cylinder **48** be highly pressurized in well known manner, the gas being either in liquid or gaseous form, or combination thereof. A pipe **54** is adapted to deliver the gas from flask **48**, through valve **50** which is manually controlled by handle **52**, acting as a shut-off valve when needed, the gas being delivered to the interior of the cylinder or sphere chamber **22** when valve **58** is opened, the gas flowing through means **64** into chamber **22**. In this manner a measured quantity of carbon dioxide gas may be conveyed or allowed to enter the chilling compartment **22** and to expand therein.

The gas under pressure and flowing through pipe **56** is thus allowed to pass through means **64** and **66**, two forms of which are shown in some detail in Figures 7, 8, 9 and 10, with the suffix "*g*" or "*h*" added after the numerals for clarity of illustration only, and either form being suitable for this use as means **64** and **66**. As the gas passes through means **64** and **66**, the latter serve to restrict its passage as by passing through a plurality of small holes **63***g* in plate **65***g* of the embodiment of Figures 7 and 8, on entering the dome housing chamber **73***g*, or in passing through the fibrous interstices in the pad of felt or other ceramic or similar porous medium **71***h* seen in Figures 9 and 10. In the latter form, the gas under pressure enters the dome chamber **73***h* in entrance housing **64***h*, and flows through the felt pad or the like **71***h* which is shown in the form of a disc seated in the annular space formed under the annular lip **67***h* of the ring **66***h*, defining the opening **69***h* through which the gas flows leftwardly as seen in Figure 10.

A suitable opening is formed at **77** as seen in Figure 1, in the wall of the spherical chilling housing **20**, to allow the gas leaving means **66** to expand in chamber **22**, chilling the pipe coil **28**, and its beverage contents. On the other side of the chamber **22** there is another opening **79** in which is disposed vent means **68**, which may be similar in construction to either of the forms of means **64***g* and **66***g* shown in Figures 7 and 8, or the form shown in Figures 9 and 10, and may be preferably reversed, that is, turned through one hundred eighty degrees if desired, to allow the device to fit over the opening **79**, in which event the pipe shown at **56***g* or **56***h* would be merely an exit stub through which any remaining gas is allowed to escape through the constriction of the perforated plate **65***g* or the felt pad **71***h* and thence through the stub outlet if used.

For purposes of illustration only, valve **58** is shown as electrically operated, as by the magnetic solenoid means **62**, which is connected through wires **70** and **72** to a source of current **82**. A temperature-responsive thermostatic switch **76** has its sensitive end inserted through the wall of housing **20** into the chilling chamber **22** to react to the temperature therein, and is adjustable to respond to any desired temperature therein. Lead wires **72** and **74** connect to thermostatic switch **76** as shown, and thence wire **74** connects to one of the switch terminals **80**, the other of which is connected by wire **78** to current source

82. A switch blade 46 is carried by the valve stem 42 and movable about the axis of the cock 36 as the tap is turned to open position, the switch blade then moving upwards in the direction of the arrow, to close the circuit between contacts 80, completing the circuit, and actuating solenoid 62 to open valve 58. From this it will be seen that to draw a glass of beverage into glass 40, the beverage handle 44 is pulled down, opening valve 36, and this operation moves switch blade 46 upwards, closing switch 80. If the temperature within the chilling chamber 22 is above the preselected degree, the circuit in the temperature responsive thermostat 76 will be closed, and therefore the closing of the circuit 80 by means 46 will cause means 62 to be energized, pulling valve plunger 60 downwards, from its normally closed position, and opening the valve 58, allowing gas from cylinder 48 to flow through means 64 and 66, into chamber 22, expanding into chamber 22, with a considerable drop in temperature inside chamber 22 due to the expansion of the gas and the formation of carbon dioxide snow therein, and thus cooling the coils 28 and the liquid flowing or standing therein.

However, if the temperature in chilling chamber 22 is at or near the preselected desired low degree, thereby holding thermostatic switch 76 open, as may be the case when the apparatus is in more or less continuous use, then in that event no current from source 82 will flow when the beverage is drawn, and hence no gas will be released by valve 58 until the temperature in chamber 22 rises above the temperature for which thermostatic switch 76 is set. In this way, gas is conserved, and the residual cold in the chamber 22 serves to cool the required beverage if the quantity is not too great.

Referring now to Figure 2, in which the arrangement is substantially the same and similar parts have the same numbers except for the addition of the suffix "*b*," a measured charge of gas from source 48 and pipe 54*b* is expanded through valve 58*b* and means 64*b* and 66*b* into chilling chamber 22*b* inside housing 20*b*, each time a glass of beverage is drawn off into glass 40*b*. In this embodiment, there is a bell-crank lever type switch 92 which is pivoted centrally as shown, and has a switch blade 90 which serves to close the contacts 80*b* when the leg 96 is moved upwards upon depression of cockhandle 44*b*, the leg 46*b* of the cock serving to trigger the switch to closed position, completing the circuit through solenoid 62*b*, to open the normally closed gas valve 58*b*, allowing the gas to enter chamber 22 through means 64*b* and 66*b*, expanding therein to chill the same, producing carbon dioxide snow and allowing some of the gas to expand through means 68*b* to atmosphere. The switch blade 90 is normally held in open position as shown, by the spring 95 secured at one end to some stationary fixture, and at the other to the lever 94 which turns with the legs 90 and 96, so that the returning of the handle 44*b* to the closed position shown in Figure 2 will allow the switch 90 to open, shutting off the flow of gas and of beverage.

Figure 3 shows another embodiment of the invention, having some similarity to that of Figures 1 and 2, similar parts bearing the same numbers to which the suffix "*c*" has been added to link it with this view. This is an automatic system which is actuated by pressing the button 112 carried on the end 110 of shaft 106, a switch blade 114 being mounted at 108 on the shaft 106 for movement therewith, so that the blade 114 will close contacts 120. Ultimately the pressing of the button 112 will open the cock 36*c*, permitting beverage to flow through nozzle 38*c* into the glass 40*c* which is mounted or carried on depressible platform 122. Pressing the button 112 closes the circuit at 120, through wires 72*c*, 118 and 116, energizing magnet switch 104 which holds the valve 36*c* open by suitable plunger means 102 inside pipe 100, until the glass 40*c* is filled. The glass 40*c* is retained in position as shown, by the counterweight 146 carried on the outer end of lever 144—126 and pivoted at 142 in stationary wall 143, the inner end of the lever 126 being pivoted at

138 to the lower end of post 124 which supports platform 122.

As seen also in Figure 3, another lever 128 is pivoted at one end 136 to post 124 and has its intermediate portion pivoted to wall 143 at 140, so that movement of lever 128 causes corresponding movement therewith of the bell crank lever switch blade 130 which is secured thereto for movement therewith. When the glass 40*c* is empty and the platform 122 is in the position shown in Figure 3, it is seen that the switch blade 130 is in normally closed position, closing the stationary contacts 132 in wires 116 and 134. When the glass is filled, depressing its platform 122, and turning lever 128, the switch blade 130 moves counterclockwise to open position, opening the circuit between wires 116 and 134 to power source 82*c*, and thus de-energizing the magnet 104 which is the holding magnet, permitting valve 36*c* to close, cutting off the supply of beverage to the glass. As shown in this modification, the gas inlet valve 58*c* is held open, during the filling of the glass. The supply of gas may be governed by a temperature-responsive means to provide more or less gas according to the need for cooling and/or to prevent the flow of gas when the cooling temperature of the chamber 20*c* and/or the beverage is sufficiently low. As seen, the counterweight 146 moves in between the bumpers 148 and 154, carried by walls 150 and 152, as the glass is filled or empty.

Referring now to the embodiment shown in Figure 4, it is seen that it is in large degree similar to Figure 1, with certain differences, similar parts bearing similar numbers, with the suffix "*d*" to identify this view. However Figure 4 has certain major differences, since it is for use of non-electrical control means. In this construction, there is a bulb 156 filled with thermally responsive liquid which extends inside the cooling chamber 22*d* inside chilling housing 20*d*, the bulb 156 being connected by tube 154 with means responsive to expansion or contraction of the thermally responsive liquid in bulb 156 for actuating the valve 58*d* to open and close the same or to govern the degree of opening or closing thereof, to measure or meter the quantity of gas released from the source through pipe 54*d* and means 64*d* and 66*d* into the expansion chamber 22*d* to cool the beverage coil 28*d* therein, in response to cooling requirements. The cock 36*d* may be actuated by handle 42*d* to discharge cooled beverage from spout 38*d* into the glass 40*d*.

Figure 5 shows another modified form of the invention, the similar parts of which bear similar numbers to those of the other views with the suffix "*e*" added to identify this view. This construction is similar especially to that of Figure 4, in that thermally responsive means 156*e* like that shown at 156 in Figure 4 may be employed to actuate a valve like valve 58*d* in Figure 4, and in the manner therein described, through expansion of fluid in pipe 154*e*. However, instead of locating the device 156 in chamber 22*d*, it may be disposed elsewhere, such as in an entrance vestibule chamber 162 in a vestibule housing 160 through which the beverage flows from pipe 24*e* and the source to pipe coil 28*e*, so that the gas is admitted in accord with the temperature of the beverage in chamber 162, to provide cooling effect in chamber 22*e* as needed. The arrangement may also be such that the chamber 160 is at the lower end of the coil 28*e* instead of the upper, if desired.

Figure 6 shows another modified form of the invention, in which the cooling coil 28*e* is omitted, and the liquid to be cooled is circulated around the outer surface of the spherical chilling housing 20*f*. In this form, the carbon dioxide gas is brought in through pipe 56*f* from the cylinder such as 48, and allowed to expand into the chilling chamber 22*f* through means 66*f* such as shown in Figures 7 to 10, producing a cooling effect inside the chamber 22*f* and surplus gas escaping at 68*f* to atmosphere through the vent opening formed through the insulating spherical outer casing 204. The insulating outer casing 204 encloses

the cooling housing 20*f*, and is spaced therefrom to define a spherical passageway or chamber 206 between the inner surface 200 of the insulating casing 204 and the outer surface of the housing 20*f*. The beverage to be cooled enters through pipe 24*f* from a source such as 26, flowing in the directions of the arrows generally, in chamber 206, being cooled by contact with the chilled casing 20*f*, and then flowing downwards and out through pipe 34*f* to a tap for being dispensed into a glass or other container as a chilled beverage.

The devices of Figures 7 to 10 have been discussed fully hereinabove, at column 4 lines 29–64 and various other points.

Figure 11 shows another modified form of the invention, showing an elongated porous cell or casing 220 which is shown with cylindrical side walls and spherical end walls, defining a chamber 222, with a gas inlet pipe 224 leading therein from a gas cylinder or other source of carbon dioxide or the like. The porous cell 220 may be made of porous ceramic material through which the carbon dioxide may pass, in restricted fashion, and expand into the chamber 218 formed inside the outer casing 210 and between its end walls 212 and 214, producing a chilling effect therein and some carbon dioxide snow or so-called Dry Ice, any excess gas flowing out through the outlet pipe such as at 216. In either case, suitable inlet port and vent means would be provided. Accordingly, liquid conveying means, in the form of a coiled pipe, ducts or other means, subject to cooling, may be placed in space 218, and conducted therefrom to a glass or other receptacle. Or, if desired, the liquid to be cooled may be caused to flow over the outside surface of casing 210, being cooled by contact therewith.

Figure 12 shows another form of the invention, which is a two-stage liquid cooling system. An object of the multi-stage method of operation is to increase the overall economy of a system of the order herein disclosed. Because of the relatively small difference between the normal temperature which a liquid beverage may acquire under usual operating conditions and the temperature at which it is dispensed, it has been found to be more economical, in certain cases, to cool the liquid to the desired end temperature in a series of steps rather than in a single chilling operation.

Assume for example, that it is desired to dispense a beverage at an average temperature of 40 degrees Fahrenheit, and to obtain this temperature during the time the beverage is being drawn to fill, an eight ounce glass, for example. In that event, the quantity of heat which must be extracted from the beverage during the dispensing period will depend upon the quantity of heat present in the liquid at that time. Now, for example, if the temperature of the beverage being delivered to the last or dispensing stage, has been reduced in one or more previous stages to say about 50 degrees Fahrenheit, or less, the temperature reduction at the time of dispensing same will be ten degrees or less accordingly.

Figure 12 shows one possible arrangement of a staged system of cooling a fluid, in which 229 represents one stage and 231 the final or dispensing stage. A liquid beverage from a stored supply enters the system at 234, passing through spherical cooling chamber 232 inside the insulating casing 233 spherical, enclosing and spaced from the chilling chamber 230 which corresponds to chambers 20 and 22 in the other views, the gas expanding therein to produce the chilling effect. The gas is led from a cylinder through pipe 240 and 236, through means 66*s* as in Figures 7 and 10, expanding in chamber 230, and excess gas escaping to the left through means 68*s* as in Figures 7 to 10 and out through vent 238. A valve 246 regulates and controls the flow of gas through pipe 236, its plunger 248 being regulated by the temperature responsive element or thermostat 252 which extends into chamber 232 and is coupled by means 250 to the valve 246.

The liquid having been cooled by flowing through chamber 232 flows downward through pipe 256 and cooling coil 259, to pipe 268 and the tap 270. The coil 259 extends through the chilling chamber 260 in second stage spherical housing 258, being cooled by the expansion of gas from coupling 242, pipe 254 and 264 and valve 262, expanding through means 66*m* to produce snow, excess gas escaping through means 68*m* and vent 266. In this form, the temperature of the liquid in the first stage in chamber 232 is maintained substantially at a preselected set temperature by said control means 252 and 246. When cock 270 is opened by turning its handle 272, for dispensing liquid beverage from its nozzle 274, the turning of the cock causes bellows 278 through lever 276, to be compressed, for example, forcing the liquid in the bellows to flow through pipe 280 to exert opening pressure on valve 262, opening said valve, and permitting gas to enter and expand in the chamber 260. It is apparent that by this construction, relatively small quantities of liquid beverage may be quickly chilled in a manner permitting the frequent dispensing thereof in measured quantities, such as by the glass full, or, when desired, in a continuous stream.

Figures 13 and 14 illustrate schematically one possible embodiment of the inventive idea in which 314 is a supply pipe connected with a store of gas under pressure, and 300 is a pipe connected with a store of a liquid beverage to be cooled while being served into glass 320 on table 322. 304 is a valve controlling the delivery of the beverage, while 308 is a valve controlling the gas supply. By suitable means, such as the cam hub 306 and cam 316 movable with the handle 302 of the liquid valve, so as to depress the cam end 312 of the plunger 310 to open valve 308 to allow gas to flow, it is seen that gas flows at the same time that the beverage is flowing, whereupon simultaneously with the delivery of the beverage, gas enters through nozzle 296, the throat of the Venturi tube 290 causing a vacuum therein which draws beverage from chamber 292 in housing 294 and intermixes it with the gas, the gas with which the finely divided beverage is admixed passing through the outwardly tapered portion 288 of the neck 286, to expand in chamber 284 in housing 282, where the beverage is chilled as the carbonating gas expands. The beverage emerges from the expansion chamber 284 through nozzle 285 and flows into the glass 320, suitably cooled. In this embodiment, there is utilized the chilling effect of the low temperature which occurs during the expansion of a gas such as carbon dioxide while said gas is also serving to carbonate the beverage, whereby it is possible to serve a carbonated drink at a desired low temperature.

Figure 15 schematically represents another embodiment of the invention, in which a gas entering at 346 is led by pipe 348 into a housing 350 through end wall 354, and allowed to expand through a suitable member 358, which may be a pad of felt, porous metal or ceramic disc, or a disc bearing a number of small apertures, into expansion chamber 352, forming carbon dioxide snow, excess gas flowing out through apertured plate holes 362 in plate wall 360 of housing 350. A beverage is supplied through pipe 332 under control of valve 334, and is adapted to flow through duct 330 and through chamber 328 of the housing 324 enclosing casing 350, being thus in contact with the chilled surface of housing 350 and cooled thereby. The liquid flows out through spout 326, into glass 327 supported on table 329, being carbonated by the gas escaping through the perforations in plate 360 as it is served into the glass. Valve 334, when opened to serve the beverage on turning its handle 336, causes gas control valve 344 to be opened also to permit the required quantity of gas to be delivered to the housing 350 for the dual purpose of cooling and carbonating the liquid. The valve stem 338 turns member 340 which is coupled by link 342 to gas valve 344 for actuating the same at the same time. The arrangement may be such that valve 344 continues to permit gas to flow as long as valve 334 is open, or, the

opening of the valve 334 may cause valve 344 to deliver a limited, measured charge of gas instead of a steady stream of gas. For example, said charge of gas may be sufficient to chill and carbonate a preselected quantity of liquid beverage, such as an eight ounce glass may hold.

Figure 16 shows another modification of the invention in which there is a vertically elongated beverage flow casing 370 formed with upper and lower domes 374 and 376, beverage entering through pipe 388, flowing through valve 390 and chamber 384 into opening passage 386, inside dome 374 and in the direction of the arrows, through the small constricted passages around walls 428, through lower dome 376 and out through spout 378 into a glass 380 on table 382. Gas such as carbon dioxide enters through pipe 420 and coupling 422, passing through valve 418 and pipes 424 and 426, into housing 64*k*, expanding through felt disc 71*k* and opening 69*k* into annular expansion and chilling chamber 410 in housing 408.

As seen in Figure 16, the chilling of chamber 410 cools the liquid flowing through housing chamber 372 as it flows to the glass 380. At the same time, gas escaping through duct 406 and check valve 404 enters nozzle 402 to carbonate the beverage, the nozzle 402 opening into dome 374. A thermostatic element 412 extends into chamber 410 and is coupled by means of pipe 414 to valve actuator 416 and valve 418, regulating the flow of gas for the desired cooling effect. Gas is also carried by pipe 400 and valve 398 to nozzle 402, so that, through lever linkages 392, 394 and 396, turnable with valves 390 and 398, the opening of valve 390 to dispense liquid causes gas to flow through valve 398 and nozzle 402 to carbonate the liquid. Snow accumulating in chamber 410 maintains a considerable cooling effect.

Figure 17 shows another modified form of the invention, designed to compress the carbon dioxide snow into a cake which is dense, thus causing it to last longer as a cooling agent. In this form, there is a cylindrical housing 438 with top and bottom walls 450 and 442, the lower portion of which is enclosed in insulating housing 432 and bottom wall 434 which is also insulating. Gas such as carbon dioxide enters from a source and pipe 478, flowing through valve 476 and pipe 474 through means 66*t* like Figures 7 to 10 and expands into chamber 440, producing carbon dioxide snow 482, excess gas escaping at vent 480. Beverage may be led from a source through pipe 446 and through coil 444 to be cooled and thence flow through duct 448 to a glass or receptacle. A piston 458 is slidable in cylinder 440, being biased upwardly by spring 460 secured at one end to the piston at 462 and at the other end to lug 464 on wall 450. Pipe 472 conducts gas through valve 470 and duct 466 into chamber 440 above the piston when valve 470 is open.

As seen in Figure 17, first valve 476 is opened to form carbon dioxide snow in chamber 440, and then valve 476 is closed manually or automatically. Valve 470 is then opened, pressurizing the piston 458 from above and pushing it down, so as to compress the carbon dioxide snow 482 into a dense cake, of long life, whereupon the valve 470 is closed, allowing spring 460 to return the piston upwards to initial raised position, excess gas escaping through vent pipes 425, 456, and check valve 454.

Although I have described my invention in specific terms, it will be understood that various changes may be made in size, shape, materials and arrangement without departing from the spirit and scope of the invention as claimed.

I claim:

1. A fluid cooling and dispensing device comprising a housing having a chamber formed therein, with first and second openings in said chamber, a source of compressed gas in the nature of carbon dioxide and the like, first duct means connecting said first opening with said source of compressed gas for conducting gas to said chamber, porous diaphragm wall means interposed in said first opening so that said gas permeates through said porous wall means in expanding into said chamber, producing a cooling effect and lowering the temperature therein, porous second diaphragm wall means interposed in said second opening and providing escape means for some of said gas where present, a source of fluid to be cooled, second duct means connected to said source of fluid and extending through said chamber for conducting fluid therethrough, tap means connected to the outlet of said second duct means for delivering fluid therefrom, and control means for regulating the flow of said gas and said fluid, and for thus controlling the flow of cooled fluid and its temperature.

2. The construction according to claim 1, wherein said second duct means comprises a coil of substantial surface area extending through said chamber, sufficient to absorb substantial cooling effect from the interior of said chamber to cool said fluid therein as needed.

3. The construction according to claim 1, wherein said control means comprises valve means interposed in said first duct means for regulating the flow of gas therethrough, and means brought into operation on opening said tap means, for actuating said valve means.

4. The construction according to claim 1, wherein said control means comprises valve means interposed in said first duct means for regulating the flow of gas therethrough, temperature responsive valve actuating means engaging the interior of said chamber and coupled to said valve means for actuating said valve means in response to temperature variations in said chamber, for maintaining such flow of gas thereto as will provide a predetermined temperature in said chamber, and switching means interposed in the coupling between said valve means and said temperature responsive valve actuating means, and constructed and arranged so that said coupling is complete only when said tap means is moved to such position as to call for dispensing of said fluid, whereby said fluid is delivered in cooled condition.

5. The construction according to claim 1, wherein said control means comprises temperature responsive means engaging an interior portion of said second duct means within said chamber so as to be actuated responsive to temperature variations of liquid or fluid therein, valve means interposed in the said first duct means for regulating the flow of gas to said chamber, and coupling means coupling said temperature responsive means with said valve means, whereby the flow of gas is regulated so as to maintain a predetermined temperature range in said second duct means at the location of said temperature responsive means.

6. The construction according to claim 1, wherein said tap means is normally closed, tap means actuating means engaging said tap means for opening the same for dispensing fluid therefrom into a receptacle or the like, and shut-off means brought into action and constructed and arranged to function upon filling of said receptacle or the like to a predetermined depth or degree, for causing said tap means actuating means to close said tap means, cutting off further fluid flow.

References Cited in the file of this patent

UNITED STATES PATENTS

1,859,229	Bonine	May 17, 1932
1,965,836	Heath	July 10, 1934
1,969,643	Fuchs	Aug. 7, 1934
2,062,827	Ruppricht	Dec. 1, 1936
2,086,000	Roren	July 6, 1937
2,096,088	Copeman	Oct. 19, 1937
2,621,901	Wheeler	Dec. 16, 1952