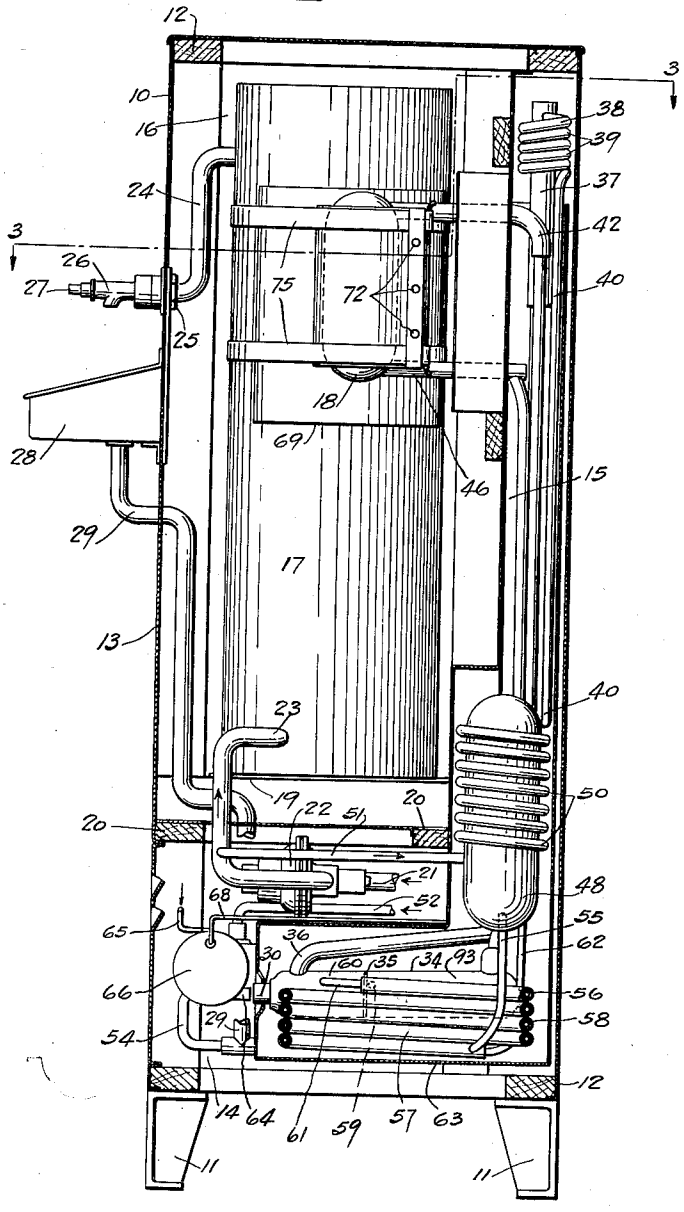
Sept. 8, 1931. R. S. TAYLOR 1,822,250

REFRIGERATION

Filed July 23, 1928 6 Sheets-Sheet 1

Fig. 1.



INVENTOR
Robert Seth Taylor
BY

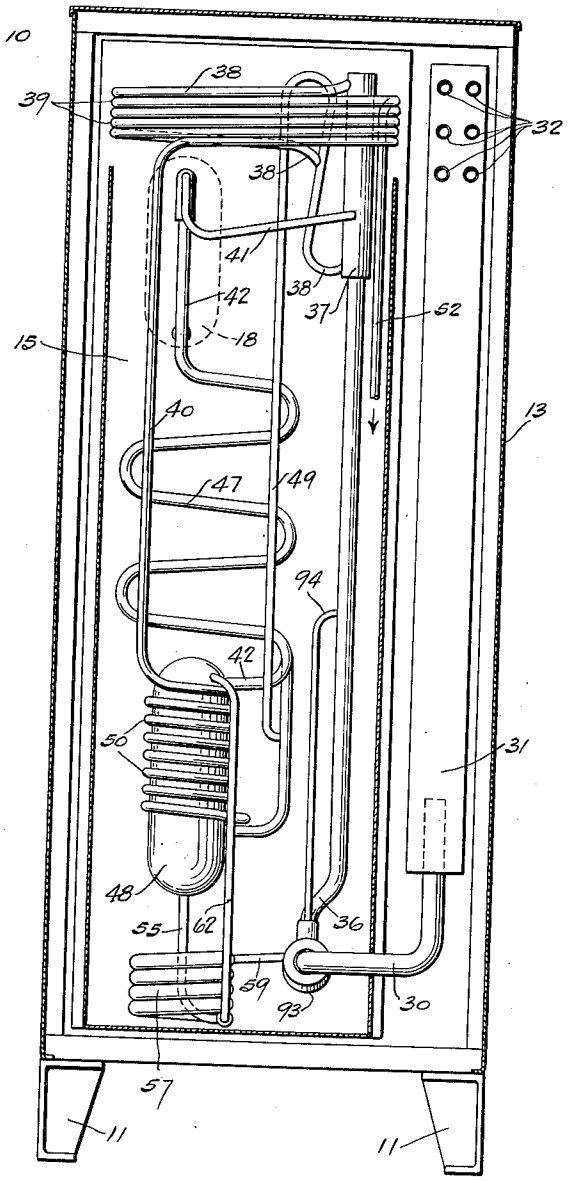
Wm. K. Redlund
ATTORNEY

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REFRIGERATION

Filed July 23, 1928 6 Sheets-Sheet 2

Fig. 2.



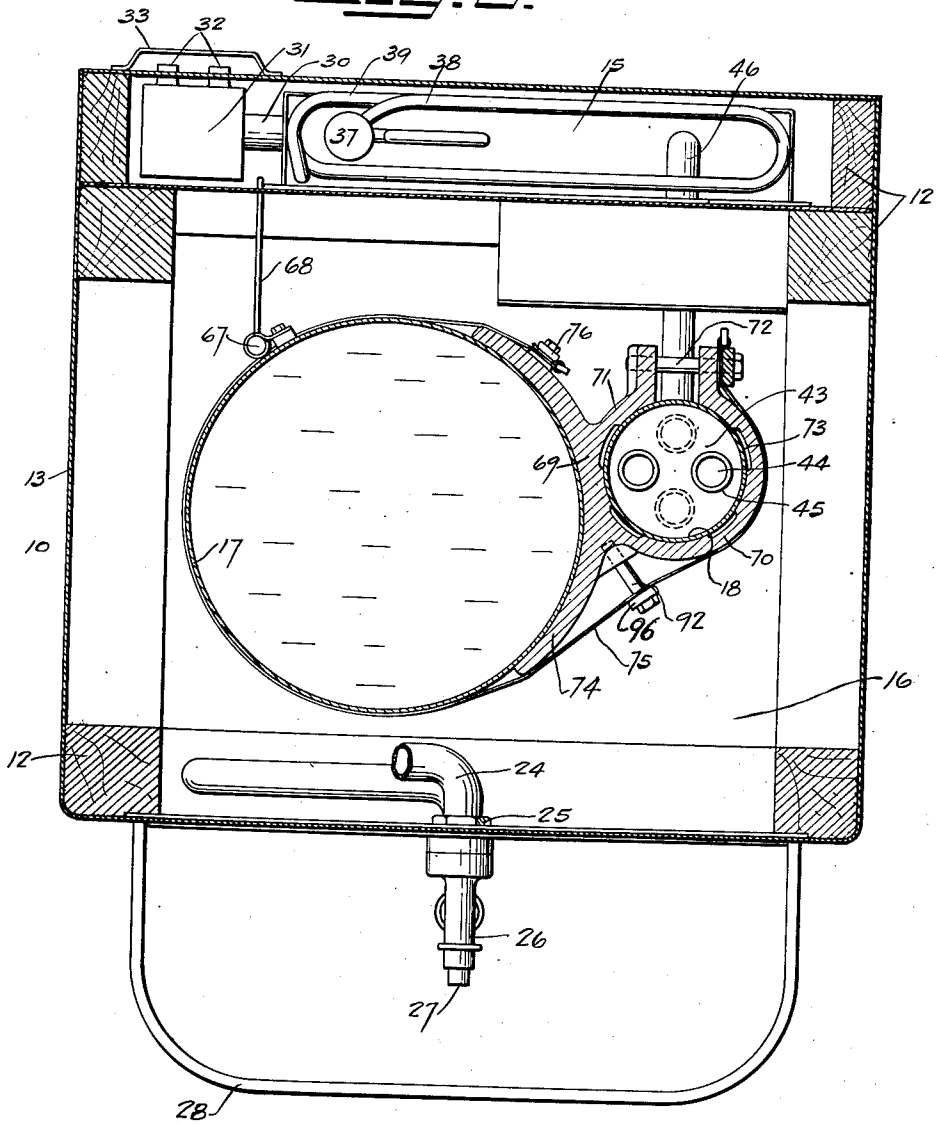
INVENTOR
Robert Seth Taylor
BY
W. J. Nedlund
his ATTORNEY

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REFRIGERATION

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Fig. 3.



INVENTOR
Robert Seth Taylor
BY

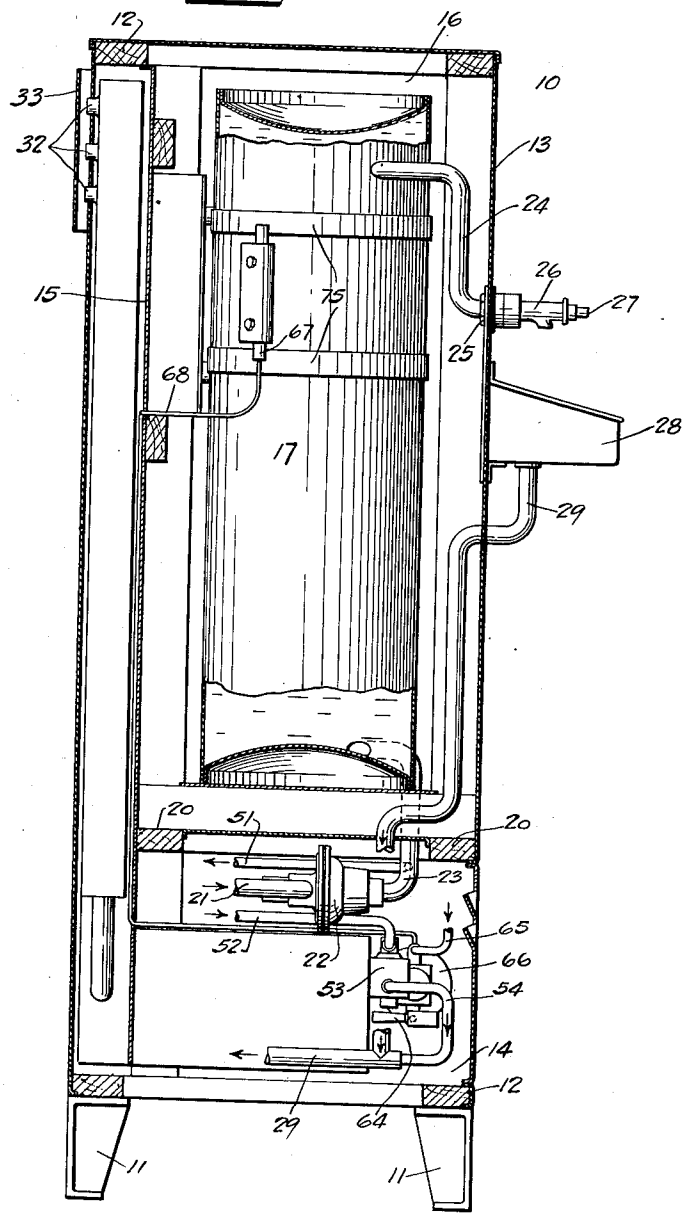
ATTORNEY

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REFRIGERATION

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Fig. 4.



INVENTOR
Robert Seth Taylor
BY

ATTORNEY

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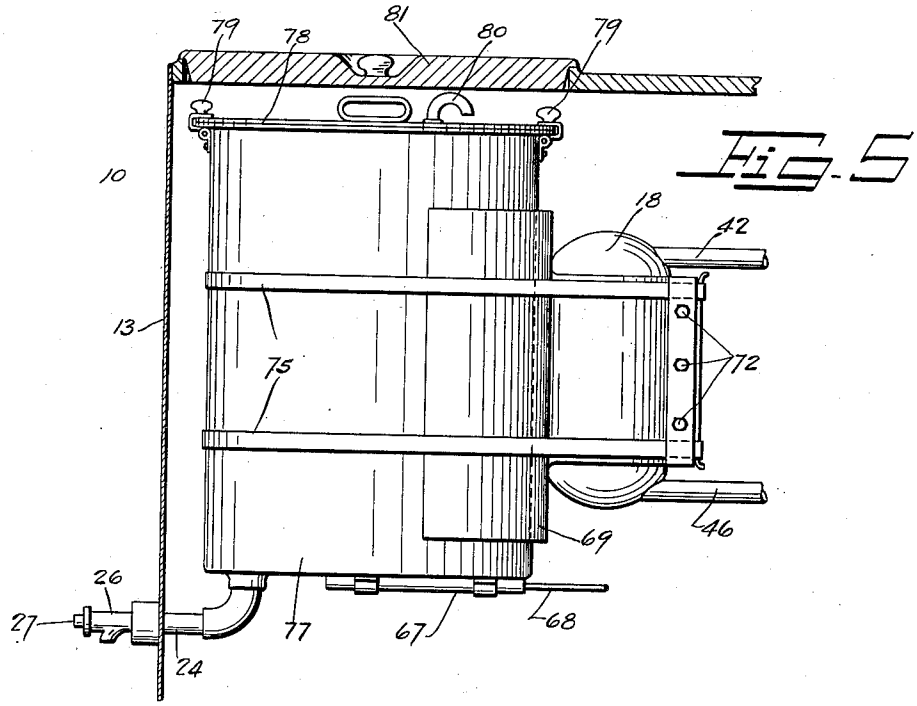


Fig. 5

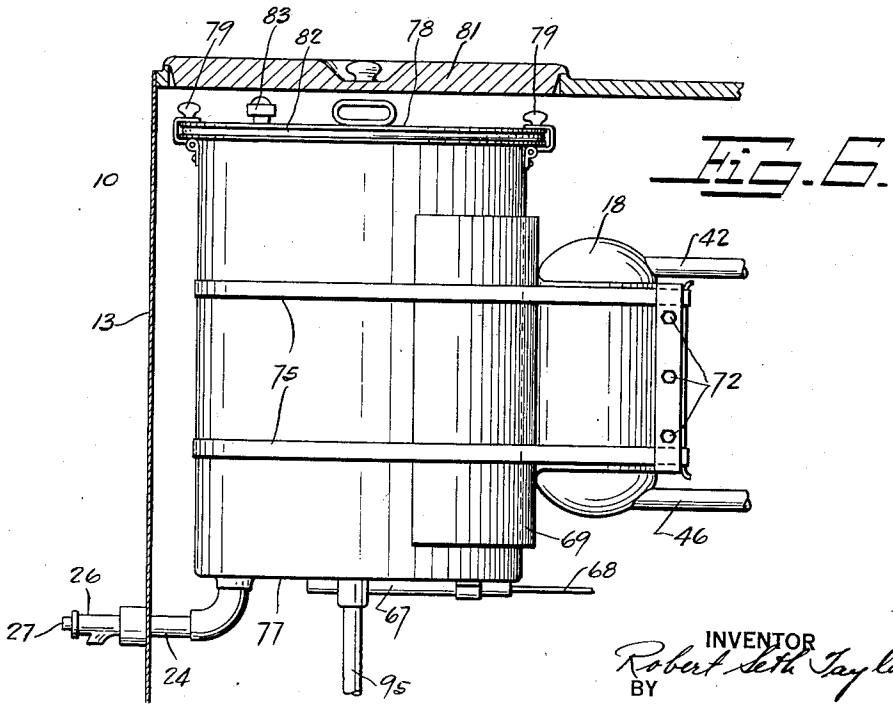


Fig. 6

INVENTOR
Robert Seth Taylor
BY
Wm. T. Hedlund
his ATTORNEY

Sept. 8, 1931. R. S. TAYLOR 1,822,250

REFRIGERATION

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Fig. 7.

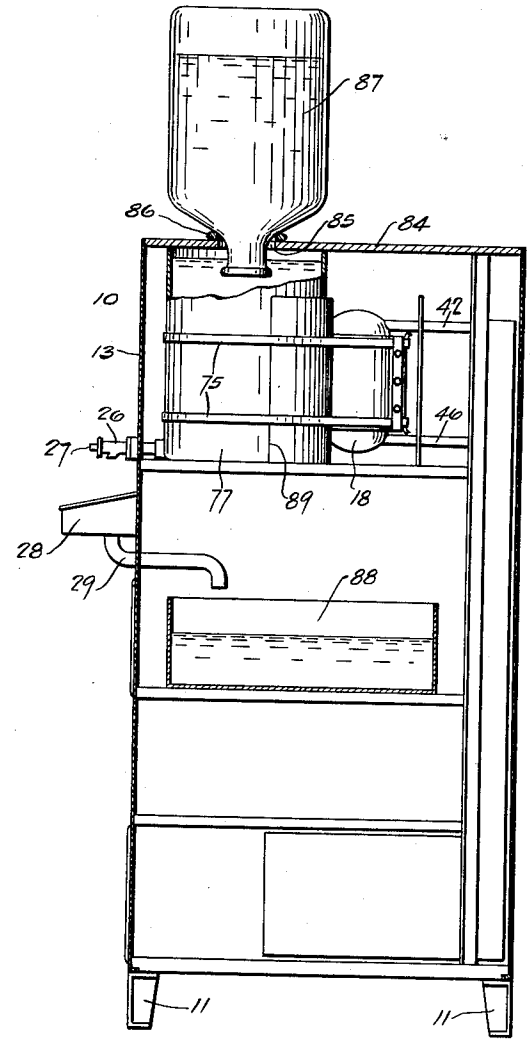
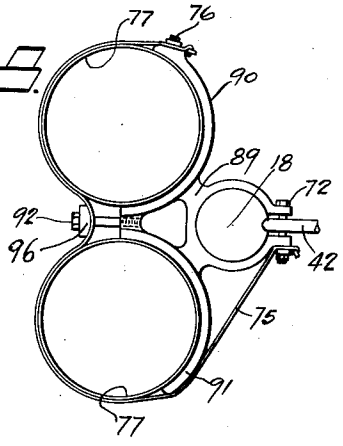


Fig. 8.



INVENTOR
Robert Seth Taylor
BY
Wm J. Nedlund
His ATTORNEY

Patented Sept. 8, 1931 1,822,250

UNITED STATES PATENT OFFICE

ROBERT SETH TAYLOR, OF NEW YORK, N. Y., ASSIGNOR TO ELECTROLUX SERVEL CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

REFRIGERATION

Application filed July 23, 1928. Serial No. 294,816.

My invention relates to the art of refrigeration and particularly to refrigerating apparatus intended and arranged primarily for the cooling of drinking water or other liquids in bulk.

My invention preferably contemplates the adoption for this purpose of an absorption refrigerating apparatus, particularly one of the type wherein a constant pressure throughout the apparatus is made possible by the use of an inert gas.

An object of my invention is to provide such a liquid cooler in a unitary structure, the entire apparatus being included within a single cabinet which may be placed in any convenient place and moved from place to place as occasion demands.

A further object of my invention is to arrange the parts making up my improved cooler so that they will occupy a minimum space for a given cooling capacity.

Still another object is to so locate the parts of the refrigerating unit that they will occupy space in the cabinet otherwise useless and thus permit the use of a liquid cooling tank of maximum size for a given sized cabinet.

A still further object accomplished by my invention is to provide improved means for securing the evaporator of the refrigerating unit to the liquid cooling tank whereby an extremely rapid transfer of heat between them is obtained and also to provide means to automatically maintain the temperature of the liquid to be cooled at a predetermined value.

My invention further contemplates a liquid cooler of the pressure type, the barometric inverted bottle type, the tank type or one that may be used for carbonated liquids.

These, as well as other objects and advantages, will be apparent from the following description taken in conjunction with the accompanying drawings, of which:

Fig. 1 is a side view, partially in cross-section, of a preferred embodiment of my invention in a cooler of the pressure type;

Fig. 2 is a back view, partially in cross-section, of the apparatus shown in Fig. 1;

Fig. 3 is a top cross-sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a side view, partially in cross-section, showing the opposite side of the apparatus from that shown in Fig. 1;

Fig. 5 is a side view, partially in cross-section, of my invention embodied in a cooler of the tank type;

Fig. 6 is a side view, partially in cross-section, of my invention embodied in a liquid cooler to be used for carbonated liquids;

Fig. 7 is a side view, partially in cross-section, of a preferred embodiment of my invention in a liquid cooler of the barometric inverted bottle type; and

Fig. 8 is a top cross-sectional view of part of the apparatus shown in Fig. 7.

Referring more particularly to Figs. 1 and 2 reference character 10 designates generally a cabinet which may be conveniently mounted on supporting legs 11. Cabinet 10 may be of any approved construction and in the embodiment shown comprises a wooden frame work 12 which supports a metal exterior 13. Cabinet 10 is partitioned off so as to form a lower apparatus compartment 14, a rear apparatus compartment 15 and a compartment 16 which contains a liquid cooling tank 17 and an evaporator 18. The remaining space in compartment 16 not occupied by tank 17 or evaporator 18 is filled with a suitable heat insulating material, such as cork board. Tank 17 is supported within compartment 16 on a suitable platform 19 which is in turn supported by transverse members 20 comprising a part of the frame work 12.

In the embodiment shown in Figs. 1 through 4, water is supplied from the city mains, or other source of supply, through a conduit 21 to a pressure reducer 22. Pressure reducer 22 may be one of various well-known types. It serves to reduce the pressure of the water from that existing in the mains to a predetermined constant value of about 15 lb/sq. in. gage. It comprises a diaphragm operated valve which is responsive to the water pressure on the low pressure side of the valve and is independent of the

pressure and variations therein of the water on the high pressure side.

A conduit 23 connects pressure reducer 22 with the lower part of tank 17. A conduit 24 communicates with the upper part of tank 17 and passes through the front wall of the cabinet to which it is secured by means of a coupling 25. A faucet 26 is connected to the end of conduit 24. Faucet 26 is preferably of the type through which flow is caused by manually pressing a button 27 which is automatically restored to its original position upon withdrawal of pressure, thereby preventing undue waste of water. The use of pressure reducer 22 makes the employment of this type of faucet possible as such a faucet cannot be used satisfactorily with high pressures. The faucet is located on the cabinet at such a height as will be convenient for one wishing to fill a glass therefrom. A sink-like receptacle 28 is affixed to the front wall of the cabinet at a suitable distance below faucet 26 and serves to catch any waste water from the faucet. A drain conduit 29 communicates with the bottom of receptacle 28, extends within the cabinet and passes out therefrom at a point in the rear lower part of the cabinet to a suitable place, such as a sewer.

The preferred form of absorption refrigerating unit is similar in construction and operation to that shown in co-pending application Serial #232,237 of Alvar Lenning It will, however, be described more or less in detail so as to clearly bring out the space relation of the various members with regard to themselves and other parts within the cabinet.

Reference character 93 designates a generator centrally through which extends a flue 30 which is extended beyond one end of the generator to communicate with a larger rectangular flue 31. Flue 31 extends the entire height of the cabinet in order to secure a maximum draft and is provided at its upper end with several short horizontal tubes or passages 32 extending through the back of the cabinet. A guard plate 33, open at top and bottom, is provided around tubes 32 so that the warm products of combustion will not be discharged directly against the adjacent wall of the building.

Generator 93 is divided into two separate generator chambers 60 and 34 by a partition 35 (shown in Fig. 1 in dotted lines). A conduit 36 extends upwardly and rearwardly from the upper part of chamber 60 and thence upwardly through rear apparatus compartment 15. The upper portion of conduit 36 passes within a rectifier jacket 37 and opens thereinto near the top of the jacket. A condenser conduit 38 communicates with the upper part of jacket 37 and is formed in a coil in heat exchange relation with a cooling water coil 39 which is supplied with cooling water through a conduit 40. The lower end of conduit 38 communicates with the lower part of rectifier jacket 37. A conduit 41 communicates with jacket 37 at a point preferably slightly below its central point, extends downwardly, then upwardly and thence horizontally within a conduit 42 and opens into the upper part of evaporator 18.

Evaporator 18 comprises a closed cylindrical shell in which are posited a series of disks 43 (Fig. 3) provided with apertures 44 surrounded by raised rims 45. Adjacent disks are preferably so positioned that their respective apertures are not in alignment. A conduit 46 communicates with the lower part of evaporator 18 and extends horizontally to within rear apparatus compartment 15. Within compartment 15 conduits 42 and 46 are welded or otherwise secured together to form a serpentine gas heat exchanger 47. The lower end of conduit 46 communicates with the lower part of an absorber 48. A conduit 49 communicates with conduit 38, extends upwardly and thence downwardly to communicate with conduit 46 as is clearly shown in Fig. 2.

Absorber 48 comprises a closed cylindrical shell which contains disks which may be similar to disks 43 in evaporator 18. A cooling water coil 50 is formed around absorber 48 and preferably welded thereto in order to obtain a good heat transfer there between. Cooling water is supplied to coil 50 through a conduit 51 which is branched off from conduit 23. Conduit 23 conveys water at a reduced pressure from pressure reducer 22 to tank 17 and therefore the water supplied to conduit 51 is likewise at a reduced pressure. The other end of coil 50 is connected to conduit 40 which supplies cooling water to condenser cooling coil 39. The water is finally discharged from coil 39 through a conduit 52 the other end of which is connected to an automatic temperature regulated water valve 53. This type of valve is known per se and functions so as to retain the water in coils 50 and 39 until it reaches a predetermined maximum temperature whereupon the valve opens and allows flow there through until the temperature of the water passing the valve falls to a predetermined minimum. While such a valve operates satisfactorily under high pressure a still better operation is obtained under the low pressure made possible by the pressure reducer as hammering is eliminated. The water discharged from valve 53 is conducted through a conduit 54 to drain 29. Thus it is seen that only two water connections are required to install the entire unit, for one supply pipe provides water both for drinking purposes and for cooling the heat-giving parts of the apparatus while one drain pipe carries

away both the waste water from the drinking faucet and the heated cooling water.

Conduit 42 establishes communication between the upper part of absorber 48 and the upper part of evaporator 18 and, as was previously pointed out, forms parts of gas heat exchanger 47.

A conduit 55 communicates with the lower part of absorber 48 and extends downwardly and communicates with outer conduit 56 of a liquid heat exchanger designated generally by reference character 57. Heat exchanger 57 comprises a coil made up of an inner conduit 58 which is substantially concentric within outer conduit 56. A conduit 59 connects the upper end of conduit 56 with a generator chamber 34. A thermo-syphon conduit 94 extends from within generator chamber 34 and communicates with conduit 36 at a point above the top of absorber 48. A conduit 61 communicates with generator chamber 60 and with one end of inner conduit 58 while the other end of conduit 58 is connected to the upper part of absorber 48 by means of a conduit 62. Conduit 62 is brought into heat exchange relation with cooling water coil 50 by welding or otherwise.

Generator 93 and heat exchanger 57 are preferably surrounded by a suitable heat insulating material, not shown, which may be held in place within a metal container 63.

Generator 93 is shown as heated by a gas burner 64 which projects a flame into flue 30. Illuminating gas is supplied through a conduit 65 to an automatically regulated valve 66 which controls the supply of gas to the burner. Valve 66 is regulated by a thermostatic bulb 67 which is in good thermal-conductive relation with tank 17. The fluctuations in pressure within bulb 67 are transmitted to valve 66 through a conduit 68 and serve in known manner to automatically vary the size of the opening through the valve.

A novel but simple means is employed to obtain a good heat transfer between evaporator 18 and tank 17 by the use of a metal casting 69 (see particularly Fig. 3). Casting 69 is formed with two arcuate arms 70 and 71 which embrace the cylindrical evaporator. Arms 70 and 71 have sufficient resilience so that they may be drawn together by means of bolts 72 and thus tightly grip the evaporator. In this way the casting is held securely in place and an excellent transfer of heat between the casting and the evaporator is obtained. Arms 70 and 71 are provided with a plurality of vertically extending grooves 73 which aid in giving good contact.

Integral with arms 70 and 71 is an arcuate member 74 the inner surface of which has substantially the same radius as the outer surface of tank 17. Member 74 is held in close contact with tank 17 by means of one or more bands 75 of suitable material the ends of which are anchored to casting 69 by bolts 72 and the bolts 76. Bands 75 are placed under tension by means of bolts 92 which may be screwed varying distances into casting 69 and pass at right angles through the bands and bearing members 96 which bear against the bands, as is clearly shown in Fig. 3.

In Fig. 5 is shown my invention embodied in a liquid cooler of the tank type into which the liquid to be cooled is poured from a bottle or the like instead of being piped under pressure. It is particularly adapted for cooling fruit juices. Only so much of the apparatus is illustrated as is necessary to show wherein it differs from the embodiment shown in Figs. 1 through 4. The chief difference lies in the construction of the cooling tank. Tank 17 is replaced by a tank 77 which is provided with a removable cover 78 held in place by thumb screws 79. Tank 77 is preferably lined with porcelain so as to resist the effects of acid in the fruit juice. Cover 78 is provided with an air vent 80 which prevents the formation of a partial vacuum within tank 77 when the liquid is withdrawn therefrom. Conduit 24 communicates with the bottom of tank 77 instead of near the top so that the liquid may flow there through solely by gravity, as the liquid is not under pressure. Thermostatic bulb 67 is placed in contact with the bottom of tank 77 so as to be affected by the temperature of the liquid which is about to be withdrawn. An aperture, normally closed by a cover 81, is formed in the top of the cabinet in order to give access to the top of tank 77 for the purpose of filling same.

Fig. 6 shows a liquid cooler to be used for refrigerating carbonated liquids. It differs from the cooler shown in Fig. 5 in that a gasket 82 is provided between the top of tank 77 and cover 78 to prevent leakage therebetween inasmuch as the tank contains liquid under pressure of the carbon dioxide used to carbonate it. Cover 78 is provided with a safety valve 83 to prevent the pressure of the carbon dioxide in the tank reaching a dangerous value. A conduit 95 supplies tank 77 with carbon dioxide under a moderate pressure and thus carbonates the liquid within the tank.

Fig. 7 shows an embodiment of my invention in a barometric inverted bottle type of liquid cooler. Tank 77 need have no cover other than the top 84 of cabinet 13. Top 84 is provided with a circular opening 85 concentric with tank 77. Around opening 85 is placed a ring-shaped piece of rubber or other resilient material 86 which supports a bottle 87 in an inverted position. The liquid in bottle 87 is retained therein by atmospheric pressure acting on the surface of

the liquid in the tank and flows out in sufficient quantities to maintain the surface at approximately the level of the opening in the bottle.

In this embodiment waste pipe 29 is shown as discharging into a removable receptacle or pan 88 instead of being connected to a sewer. This may be preferable in some instances, particularly if the refrigerating unit is air cooled and hence has no waste cooling water to discharge.

Fig. 8 shows an arrangement to be used in connection with the apparatus of Fig. 7 if it is desired to cool the contents of two bottles. It comprises a casting 89 which differs from casting 69 in that it has two arcuate members 90 and 91 to embrace two liquid cooling tanks 77. Casting 89 is tightly secured to evaporator 18 by means of bolts 72. Tanks 77 are bound to members 90 and 91 by means of bands 75 the ends of which are fastened to member 90 by bolts 76 and to the rear of the casting by bolts 72. Bolts 92 are provided, which pass between the two tanks to tighten bands 75.

In the various modifications shown in Figs. 5 through 8 the refrigerating unit employed is similar in all respects to that described in connection with the first four figures and it is not necessary to illustrate and describe it again. The operation of this unit is as follows:

A solution of the refrigerant, for instance ammonia, dissolved in an absorption medium, such as water, is contained in generator 93. The application of heat to the generator by gas burner 64 serves to drive the ammonia out of solution in both chambers 60 and 34. From the former the ammonia vapor passes upwardly through the liquid in conduit 36 and is joined by the vapor from the latter chamber which passes upwardly through conduit 94 carrying liquid with it. In that portion of conduit 36 which is within rectifier jacket 37 any entrained water vapor is condensed and returns to the generator. The now dry ammonia vapor passes into condenser conduit 38 where it is liquefied due to abstraction of heat by the cooling water in conduit 39. The liquid ammonia flows into jacket 37 and thence through conduit 41 to evaporator 18.

In the evaporator the liquid ammonia evaporates in the presence of and diffuses into a gas inert with respect to ammonia, for instance hydrogen, which is introduced through conduit 42. The evaporation abstracts heat from the evaporator shell which in turn abstracts it from the liquid to be cooled, the heat passing through the tank 17 and the casting 69.

The gaseous mixture of ammonia and hydrogen has a greater specific weight than the relatively pure hydrogen which enters through conduit 42 and hence passes downwardly through apertures 44 in disks 42 within the evaporator. The mixture passes from the lower part of the evaporator 18 through conduit 46 to the lower part of absorber 48. In the absorber the mixture comes in contact with absorption liquid relatively weak in ammonia. The ammonia gas is absorbed thereby while the lighter hydrogen passes from the top of the absorber through conduit 42 to the upper part of the evaporator. In its passage through conduit 42 the hydrogen is pre-cooled before entering the evaporator by being brought into heat exchange relation with the cold mixture in conduit 46.

The strong solution of ammonia in water formed in absorber 48 passes therefrom through conduit 55 to outer conduit 56 of liquid heat exchanger 57 and thence through conduit 59 to generator chamber 93. In chamber 93 the application of heat drives some of the ammonia out of solution in the form of a gas which passes upwardly through thermo-syphon conduit 94 to conduit 36. The liquid discharged into conduit 36 passes downwardly there through to generator chamber 60 where further heating drives out more ammonia. The weakened solution passes from the generator through conduits 61, 58 and 62 to the upper part of the absorber. In liquid heat exchanger 57 the hot weak liquid passing from the generator to the absorber is cooled by the cool strong liquid passing in the reverse direction which, of course, is heated.

Thus it is seen that the operation of the refrigerating unit is continuous and hence serves to maintain a substantially constant temperature of the liquid to be cooled. Variations in load requirements are taken care of by the thermostat 66 which varies the heat supplied by burner 64 which in turn varies the refrigerating effect produced in evaporator 18. There is, however, no continuous fluctuation of temperature which is an inherent characteristic of an intermittent refrigerating machine.

Where it is desired to improve the capacity of a water cooler during a certain period of time, say eight hours, storage of ice in the tank 17, Fig. 1 can be resorted to, said ice being frozen at night and used up in cooling water during the day. The amount of ice formed when the cooler stands idle for any length of time is governed by the location of the thermostat bulb 67 and the adjustment of the thermostat 66. If desired a fixed adjustment thermostat, such as a thermostat actuated by the change in volume when water freezes can be used. This can then be placed at any point in the tank, say the center, and will prevent the contents of the tank from freezing beyond this point.

While I have shown and described various more or less specific embodiments of my invention, it is to be understood that I am not to be limited thereby but that the scope of my invention is to be determined by the appended claims considered in the light of the prior art.

Having thus described my invention, what I claim is:

1. In a water cooler refrigerated by an absorption refrigerating apparatus, a generator, a condenser, an evaporator, an absorber, means interconnecting said generator, condenser, evaporator and absorber, means to cool said condenser and absorber, a tank in heat exchange relation with said evaporator, means to supply water to said tank at a reduced pressure and means to supply water to said cooling means at the same reduced pressure.

2. In a water cooler refrigerated by an absorption refrigerating apparatus, a generator, a condenser, an evaporator, an absorber, means interconnecting said generator, condenser, evaporator and absorber, means to cool said condenser and absorber, a tank in heat exchange relation with said evaporator and means to supply water to said tank and to said cooling means at a reduced pressure.

3. In a water cooler refrigerated by an absorption refrigerating apparatus, a generator, a condenser, an evaporator, an absorber, means interconnecting said generator, condenser, evaporator and absorber, means to cool said condenser and absorber, a tank in heat exchange relation with said evaporator, means to supply water to said tank and to said cooling means at a reduced pressure and means to convey waste water from said tank and said cooling means.

4. In a water cooler refrigerated by an absorption refrigerating apparatus, a generator, a condenser, an evaporator, an absorber, conduits interconnecting said generator, condenser, evaporator and absorber to form a closed system, means to cool said condenser and said absorber, a tank in heat exchange relation with said evaporator, a water supply conduit, a pressure reducer in said conduit and means to supply said tank and said cooling means with water at a reduced pressure.

5. A liquid cooler comprising a cabinet, a tank in the upper part of said cabinet, means to supply liquid to and withdraw liquid from said tank, an apparatus compartment, an absorption refrigerating apparatus comprising a generator, an absorber and a condenser housed in said apparatus compartment, an evaporator in heat exchange relation with said tank, and said generator, absorber, condenser and evaporator interconnected to form a closed system.

6. In a liquid cooler, in combination, a tank, a refrigerating apparatus including a cylindrical evaporator and a condenser, a casting in thermal relationship with said evaporator and said tank, cooling means for said condenser, means to supply water to said tank and to said cooling means at a reduced pressure and means to withdraw liquid from said tank.

7. In a liquid cooler, in combination, a tank, means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including a cylindrical evaporator, a casting in thermal relationship with said evaporator and said tank, said casting comprising a plurality of arcuate arms tightly clamped around said evaporator and an arcuate member in contact with said tank and a series of bands binding said arcuate member to said tank.

8. In a liquid cooler, in combination, a tank, means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including a cylindrical evaporator, a casting in thermal relationship with said evaporator and said tank, said casting comprising a plurality of arcuate arms tightly clamped around said evaporator and an arcuate member in contact with said tank, a series of bands binding said arcuate member to said tank and tensioning means for the bands.

9. In a liquid cooler, in combination, a tank, means to withdraw liquid from said tank, a refrigerating apparatus including a cylindrical evaporator, a casting in thermal relationship with said tank, a removable cover for said tank and means to admit air to said tank.

10. In a liquid cooler, in combination, a tank, means to withdraw liquid from said tank, means to supply gas under pressure to said tank, a refrigerating apparatus including a cylindrical evaporator, a casting in thermal relationship with said evaporator and said tank, a removable cover for said tank, means to prevent leakage between said cover and said tank and means to prevent an excess pressure in said tank.

11. In a liquid cooler, in combination, a tank, a refrigerating apparatus comprising a generator, a condenser, an evaporator and an absorber, said evaporator being in thermal relationship with said tank, cooling means for said absorber, means to supply water to said tank and to said cooling means at a reduced pressure and means to withdraw liquid from said tank.

12. In a liquid cooler, in combination, a tank means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including an evaporator, a casting in thermal relationship with said evaporator and said tank, a series of bands binding said casting to said tank, a series of bolts screwed into said casting, said bolts

passing through said bands and serving to place said bands under tension.

13. In a liquid cooler, in combination, a tank, means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including a generator, a condenser, an evaporator and an absorber, said tank being in thermal relationship with said evaporator, a horizontal flue extending through said generator, a vertical flue extending parallel to said tank, communication between said flues, a series of horizontal tubes or passages communicating with the upper portion of said vertical flue and a guard plate around the open ends of said passages.

14. In a liquid cooler, in combination, a tank, means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including an evaporator, a casting in thermal relationship with said evaporator, means for binding said casting to said tank comprising a flexible member attached to said casting and passing around said tank and means for exerting a force at right angles to said flexible member to increase the binding effect.

15. In a liquid cooler, in combination, a tank, means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including an evaporator, a casting in thermal relationship with said evaporator, means for binding said casting to said tank comprising a flexible member attached to said casting and passing around said tank and means for exerting a force at right angles to said flexible member to increase the binding effect, said last mentioned means comprising a bolt passing through said flexible member and screwed into said casting.

16. In a liquid cooler, in combination, a tank, means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including an evaporator, a casting in thermal relationship with said evaporator, means for binding said casting to said tank comprising a plurality of flexible members attached to said casting and passing around said tank and means for exerting force at right angles to said flexible members to increase the binding effect.

17. In a liquid cooler, in combination, a tank, means to supply liquid to and withdraw liquid from said tank, a refrigerating apparatus including an evaporator, a casting in thermal relationship with said evaporator, means for binding said casting to said tank comprising a plurality of flexible members attached to said casting and passing around said tank and means for exerting force at right angles to said flexible members to increase the binding effect, said last mentioned means comprising a plurality of bolts passing through said flexible members and screwed into said casting.

In testimony whereof I have affixed my signature.

ROBERT SETH TAYLOR.