

June 16, 1931.

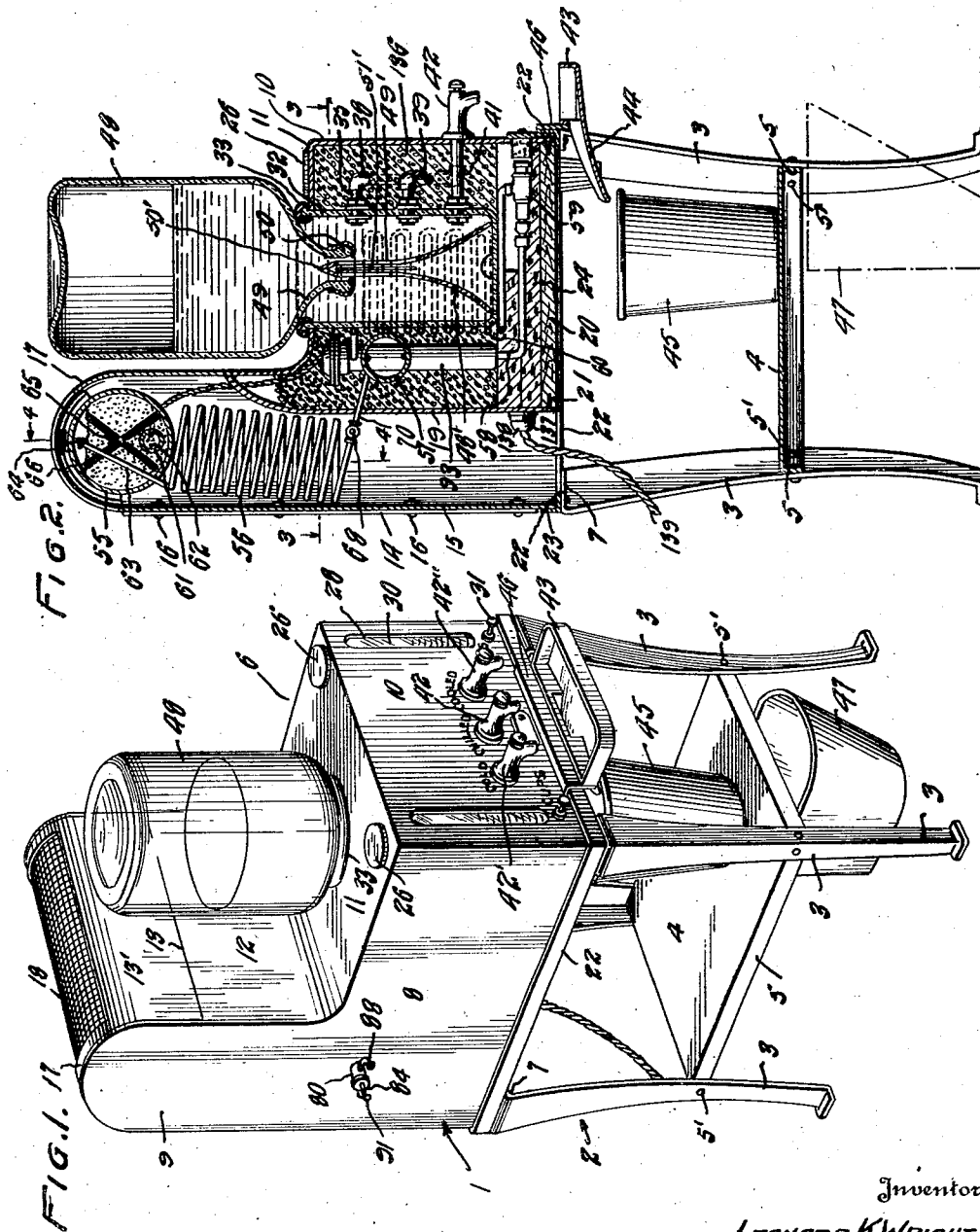
L. K. WRIGHT

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REFRIGERATION APPARATUS

Filed Jan. 27, 1928

2 Sheets-Sheet 1



Inventor

LEONARD K. WRIGHT

By

Semmes & Semmes

Attorney

June 16, 1931.

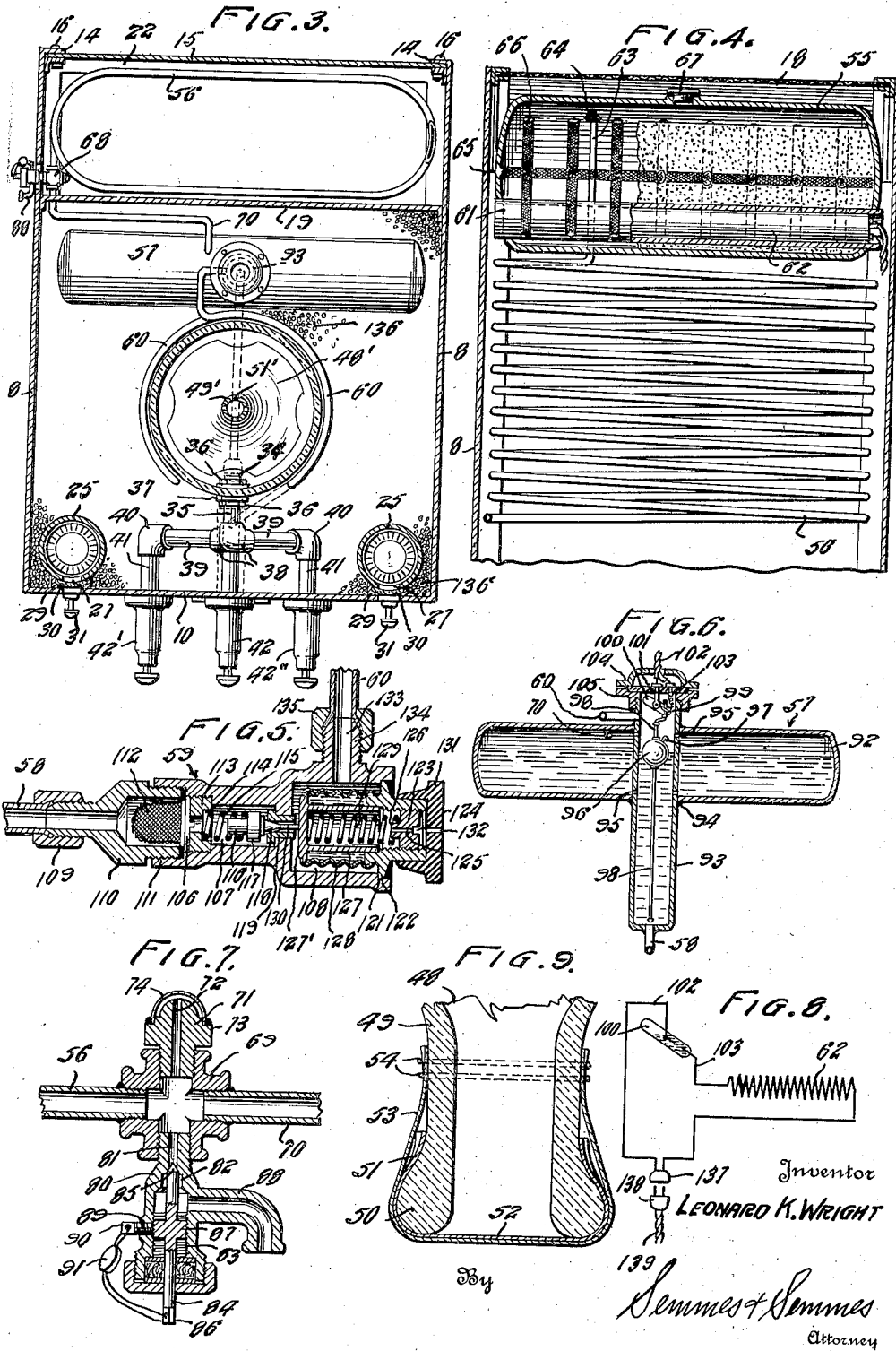
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UNITED STATES PATENT OFFICE

LEONARD KAY WRIGHT, OF JACKSON HEIGHTS, LONG ISLAND, NEW YORK

REFRIGERATION APPARATUS

Application filed January 27, 1928. Serial No. 249,949.

This invention relates to refrigeration and more particularly to a small portable unit of the absorption type.

The invention, while by no means designed exclusively for such a use, is illustrated as embodied in a water cooler. In devices of this character heretofore used the cooling of the water was accomplished by the employment of ice as the heat abstracting medium. Such devices were subjected to all of the disadvantages inhering in the use of this material. In addition to the inconvenience of refilling with ice, it often happened that the ice was not replenished as often as it should have been, with the result that in the late afternoon and evening the water in such coolers became warm and often so tepid as to be unpalatable.

Another outstanding disadvantage of the cooling systems of this character resided in the fact that unsanitary methods were necessitated, by the construction of the cooler, when it was desired to insert a new bottle or carboy of water. In such circumstances, the attendant removed the cork stopper of the bottle, placed his palm over it and inserted his hand into the water within the cooler. Such an unsanitary procedure was required so as to prevent spilling of the contents of the water bottle during replacement.

It is an object of this invention to provide an improved and simplified water cooling apparatus of this character which insures a constant supply of cooled water.

Another object is to provide a water cooler of the character described which, after first installation, requires no attention and involves but little operating cost.

Another object is to provide a cooler from which water of varying degrees of temperature may be drawn.

A further object is to provide such an apparatus as a complete, compact and easily transportable unit.

A further object is to provide a water cooler of simple design comprehending eminently sanitary features.

An additional object is to provide a novel sanitary cap for water bottles.

Yet another object is to provide a water

cooler which embodies a refrigeration unit and which is noiseless in operation and of great longevity.

Another object is to provide a water cooler adaptable for either the utilization of tap or bottled water.

With these and other equally important objects in view, the invention comprehends the provision of a water cooler comprising a replaceable bottle or piped water supply and a permanent well with which is associated, in a compact and efficient manner, a refrigeration unit of the absorption type.

To enable a ready comprehension of the underlying principles of the invention there is shown in the accompanying drawings one mechanical embodiment of it. In these drawings the same reference numerals refer to similar parts throughout the several views, of which:

Figure 1 is a perspective view of the completely assembled unit;

Figure 2 is a central cross sectional view;

Figure 3 is a top section taken on the line 3—3 of Fig. 2;

Figure 4 is a longitudinal section on the line 4—4 of Fig. 2;

Figure 5 is an enlarged sectional detail of the expansion member of the refrigerating unit;

Figure 6 is a cross sectional detail of the receiver chamber;

Figure 7 is an enlarged cross sectional detail view of one of the valves embodied in the unit;

Figure 8 is a wire diagram of the electrical units;

Figure 9 is an enlarged detail of the water bottle cap.

As shown in the drawings, and more particularly in Figs. 1 and 2, the unit comprises a cabinet 1 mounted upon a base designated generally by the numeral 2. This base includes the legs 3 formed in any suitable design, preferably of the angular metal type. Intermediate the terminals of the legs there is positioned a flat brace plate 4. This is formed with flange edges 5 through which pass the rivets or bolts, 5' securing the member to the legs and insuring increased

strength and rigidity of the structure. As shown in Fig. 2, the flanges nest within the triangular sections of the legs. If desired the base 2 may be provided with a separate top (not shown). In the particular device illustrated in the drawings the cabinet portion 6 is mounted upon upper flanges 7 of the supporting legs. It will be understood of course that in lieu of the particular supporting construction shown, any conventional form of support which will subserve the functions hereinafter set forth, may be employed.

The cabinet portion may be of any suitable style or design which will perform the results desired in the present invention. The one shown in the drawings includes a plurality of side plates 8 which are extended upwardly at their rear portions, 9, for a purpose to appear fully hereinafter. To these plates are secured, as by rivets or welds, the front plate 10 and top plate 11. If desired, the latter sections, i. e. 10 and 11, may be made up from a single piece of metal. At its rear portion the top plate is extended vertically as at 12. This vertical section may terminate in a flange 13, an appreciable distance below the top of the side sections 9. At their rear edge the side sections are formed with integral lateral flanges 14. These flanges are apertured to register with corresponding apertures in a rear closure plate 15. The plate 15 is adapted to seat against the flanges and to be detachably secured thereto by means of bolts and cooperating nuts 16. A detachable sectional cylindrical cover or dome 17 encloses the top of the cabinet. This may rest upon the rear flanges 13 and lateral flanges (not shown) on the side pieces 9. At its upper portion the cover is provided with a foraminous insert, such as a screen 18.

As will be seen from an inspection of Fig. 2, the cabinet comprises essentially two distinct sections. The forward section, which houses a water well, includes a casing having the front plate 10 and a rear plate 19. The bottom edges of sections 10 and 19 are affixed to a base plate 20. This may be composed of any suitable material; in the illustrations shown in the drawings it comprises a wooden block which receives the screws 21, holding plates 10 and 19 in position. The top portion of plate 19 may be curved and abuts the vertical plate adjacent the flange 13. It will be understood that the plate 19 is provided with an aperture to permit the passage of a connection in the refrigeration system. The cabinet may be supported on the legs 7 through the medium of a rectangular angle frame 22 which is secured to the table leg flanges by suitable means, such as the rivets 23. This frame, besides serving as a vertical support for the cabinet, provides lateral movement of the inside cabinet and in addition serves as a rigidifying stay for the legs 7.

The container defined by the side plates 8, top 11, front and rear plate 10 and 19, houses a water well and certain portions of the refrigerating apparatus. The bottom of this container is provided with a plurality of insulating slabs 24. These may comprise any of a number of insulating materials readily available on the market. I prefer, however, to utilize slab cork, i. e. granulated cork, which is cemented with a suitable adhesive and formed into a relatively dense sheet. This material has a low coefficient of thermal conductivity and not an inconsiderable amount of resiliency, both of which factors are desiderata for the present use, since it takes up the jars and shocks incident to removing and inserting water bottles as well as providing an efficient insulating medium.

The container likewise houses, preferably at each end of the front section, a plurality of metallic cup dispensing tubes 25. Each of these is provided with a cover or lid 26 which rests against the contiguous face of the plate 11. Each tube is cut out to provide a longitudinal slotted portion 27. A pair of slots 28 are cut out of the front plate 10 immediately in front of the tube slots. To the interior face of the front plate 10 are secured, preferably by spot welds, vertical angle strips 29. Inserted between these angle or lips and the vertical slots 27 is a section of transparent material 30. This may be of glass, mica, or any of the suitable phenolic condensation products. It will be appreciated that such a construction affords a view of the interior of the cup tube to determine the number of cups therein. The cups may be ejected from the tube by any suitable mechanism, indicated generally on the drawings by the plunger 31.

The water well 32 nests within the container and its bottom is firmly supported by the upper insulating slab 24. This well may be composed of any of the vitreous ceramics usually employed in such devices and is formed, in the conventional manner, with an upper terminal lip.

A resilient gasket 33 composed of rubber or a similar substance is interposed between the lip of the well 32, water bottle 48 and acts as a seal and also prevents damage through contact between the two hard brittle bodies. Tapped into the well 32 are a plurality of discharge nipples 34. The material employed for these members should have a low corrosion resistance. Chrome steel of course may be utilized but, since a high tensile strength is of no particular advantage, other materials may be used, such for example as chrome iron, Monel metal, tin and aluminum bronzes and the like. At one end of the nipples, draw off pipes 35 are secured as by a threaded engagement. The nipples 34 project through the cylindrical wall of the well and are held in place, on each side of the well,

by lock nuts 36 which are threaded thereon. In order to prevent fracture of the material of the well and to insure a fluid tight seal the rubber washers 37 are interposed between the lock nuts and vitreous wall.

At their outer end the draw off pipes 35 are connected through the elbows 38 to the pipe sections 39, which are in turn connected, through the elbows 40, to the horizontal pipes 41. The pipes 41 protrude through the front wall 10 and at their outer ends are fitted with a water cock such for example as the push button type 42. It will be understood that the pipes are all to be made of the same material, that is to say of a non-corrosive metal or alloy. It will be seen from an inspection of Fig. 2 that the several nipples are positioned at different heights of the well. As is known, when the liquid in the well is subjected to the action of a cooling medium the colder body of liquid will settle to the bottom of the container while the fluid at a higher temperature will rise toward the top. Use is made of this fact to tap off water at different temperatures. As indicated in Fig. 1, the median tap 42 withdraws the coldest water, the left hand tap 42' withdraws water at a slightly higher temperature, while right hand tap 42'' withdraws the least cold water. By means of these three push cocks water of variant temperatures may be obtained.

Secured to the front portion of the cabinet is a drip pan 43. As shown, this is drawn out rearwardly to present an integral inclined spout 44. Beneath the spout may be positioned the usual catch basin 45. The drip pan may be mounted on the frame by means of the U-shaped integral flange 46, one web of which nests between the vertical flange on the angle iron 22 and the front face of plate 10. This mounting, of course, may be accomplished by utilizing other specific structures. Positioned beneath the brace plate 4 is a bucket 47 which, it will be understood, is for the purpose of receiving waste drinking cups.

As has been intimated hereinbefore the present method of replacing a bottle or carboy of water in a cooler of the general type described has been quite unsanitary. I propose to eliminate the objectionable features inhering in prior structures by providing a novel sanitary cap for the conventional water bottle. As shown on the drawings, and particularly in Fig. 9, the bottle may be of the usual type having a cylindrical body portion 48 and a contracted neck 49. At its terminal the glass of the neck is thickened to present a rim or lip 50. Heretofore in order to seal bottles of this character it has been the practice to insert a cork or similar stopper into the neck. According to the present invention the bottle is provided with a sanitary and hermetic seal which need not be

broken or disrupted until after the bottle has been inserted in the well.

To accomplish this purpose there is provided a cap 51 formed of a ductile metal or alloy or any composition substance having similar properties. This may be placed over the neck of the bottle so that the flat portion 52 extends across the top to serve as a stopper. The edges are bent inwardly to conform to the curvature of the thickened portion 50 and thus serves to hold the cap securely in place. A band of rubber, cord, or metal may be used as a means of securely holding this cap. Positioned over the metallic or base closure 52 is a second cap 53. This may be composed of heavy paper impregnated with a suitable water-repellent substance as wax and the like. This cap abuts the adjacent metallic cap 52 throughout the major portion of the latter and is extended downwardly beyond it, as shown in Fig. 9. Surrounding the outside cap near the edges is a resilient securing means 54. This member preferably may comprise a rubber band or a plurality of rubber bands. In lieu of a rubber band a piece of resilient metal may be used to form a spring collar, holding the cap 53 securely in place.

In accordance with the principles of this invention a member is provided within the well which is adapted to open communication between the bottle and well without any danger of loss of contents of the bottle and without employing the unsanitary expedients discussed hereinbefore. As shown this comprises a conoidal or funnel shaped member 48'. This has a flared base of a diameter slightly less than the interior diameter of the well. Near its upper portion the funnel is constricted to form a hollow neck 49' which terminates in a sharp point 50'. The neck portion is cut away to present one or more longitudinal slots 51'. It will be understood that these slots extend upwardly so as to be well within the neck of the bottle when the latter is in its operative position. The width of the base of the funnel is such that it insures a centring of the pointed end 50 so that the latter is always in proper position, that is to say in axial alignment with the center of the neck of the bottle 48 when the latter is in operative position.

The operation of these associated parts will be appreciated from the foregoing description. After a bottle is filled it is sealed by emplacing and securing in position the caps 51 and 53. By means of the resilient band or collar 54 the liquid within the container is hermetically sealed and may be stored for any period of time. If desired another band may have been used to hold cap 51 firmly in place.

When it is desired to place a fresh bottle in the cabinet the outer seal 53 may be disengaged by removing the resilient holding

member 54, leaving the inner in a clean sanitary condition. The bottle is then inverted and lowered into operative position. As it descends the pointed end 50' of the funnel will pierce the soft cap closure portion 52 and the bell shaped end of the bottle will come to rest against the gasket 33. The slots 51' of the funnel extend above and below the now punctured cap and will permit fluid communication between the bottle and well, allowing the passage of liquid from the bottle to the subjacent well and permitting passage of air up to the bottle. It will be observed therefore that the replacement of the bottle may be done in such a manner that the hand of the attendant at no time comes in contact with the liquid contents of the bottle or well or the wetted portions of the neck of the bottle.

As has been indicated hereinbefore there is compactly nested within the cabinet a refrigerator associated with the water cooler. Preferably an absorption type unit is employed in which a refrigerant such as any liquid capable of vaporizing and causing a low temperature is absorbed or adsorbed with a liquid or solid, from which it is driven off by applied heat to be subsequently liquefied and then revaporized to abstract heat from the area to be cooled. This comprises essentially a generator-absorber 55 in fluid communication through a condenser coil 56 with a receiver 57. A safety valve 68 is positioned in the line adjacent the lower end of the condenser 56. The receiver is connected through a line 58 to an evaporating coil 60, the upper end of which is connected to the receiver 57.

The generator-absorber comprises a cylindrical shell. This is composed of a metal or metal alloy of sufficient tensile strength to withstand the internal pressures to which such an apparatus is subjected. Preferably it is of one piece construction. It may be made up by first forming a suitable number of sections, such as two halves, and joining these by an autogenous weld so that the completed shell will be of uniform texture throughout. The shell may be supported from the sides of the cabinet by any suitable system of brackets or chocks which have sufficient tolerance to permit the incident thermal expansion of the generator. Nested within the lower portion of the generator 55 is a tube 61. This may project slightly beyond the ends of the shell and is rigidly connected thereto by a suitable fused joint. Within this tube is received an electrical resistance 62, or any other suitable heating element, such as a steam coil, burners and the like. One or both ends of this tube may be provided with detachable closures so as to facilitate insertion of new and removal of old heating elements.

Projecting through the bottom of the gen-

erator and extending upwardly to a point closely adjacent the top is a section of tube 63. The top of this is fitted with a filter element such as a screen 64. This tube section is joined to the base of the generator shell 70 preferably by means of an autogenous weld for the purposes already indicated.

The generator also houses a system of reticulated tubing to facilitate the passage of gas or vapors to and from the absorbent or adsorbent to the upper portion of the generator. In the form shown in the drawings this comprises a central longitudinal section 65 from which radially projects the shorter sections 66. It will be seen that with such a structure a plurality of channels are provided which are highly conducive to the rapid and effective withdrawal of any gas generated or driven off within the body of material in the generator. It will be understood of course that other specific designs of the reticulated tubing may be utilized. Any design, such for instance as a cheval-de-frise type which presents a substantial number of conduits through the absorbent or adsorbent may be employed.

At its upper portion the generator is provided with a plug or closure 67. On first installation the plug may be removed to allow the admission of a charge of absorbent or adsorbent material. After the desired quantity has been admitted the container may be hermetically sealed either by interposing a lead gasket between the container and plug and screwing the latter into position or by welding the plug directly to the shell of the generator.

The generator itself, as has been said, is adapted to receive a charge of the particular absorbent or adsorbent employed. The material employed of course will depend on the particular refrigerant used. It may be, for example, water, activated silicious material, silica gel, or other flocculated colloids, calcium chloride, ammonium nitrate, ammonium sulpho cyanate, activated charcoal, carbon tetrachloride, ether, alcohols and the like. When solid materials are employed within the generator the distributing screen hereinbefore described is utilized. If a liquid medium is used instead of a solid, the screen may be dispensed with. If water is employed as the absorbent material it will be understood that a rectifier and analyzer may be added to the system.

It will be appreciated that a variety of specific refrigerants may be used in this system. Thus any one of the following may be employed: ammonia, sulphur dioxide, methyl and ethyl chloride, carbon dioxide, methyl ether, ethyl ether, propane, methylamine and the like.

The tubing 63 is extended below the generator and is convoluted in reversed bends to form the condenser coil 56. Preferably

these are so designed as to utilize the full available space between the cabinet walls 8, 14 and 19. The lower terminus of this coil is connected to the safety valve designated generally (in Fig. 2) by the numeral 68. This member, which is shown in detail in Fig. 7 comprises a cross fitting 69 into which is screwed or fastened the pipe section 56. In alignment with the pipe end 56 there is secured to the cross a short pipe section 70 which as shown in Fig. 2, leads to and communicates with the receiver 57. Screwed into the upper vertical bore of the cross is a safety rupture head 71. As shown, this is provided with central channel 72 which communicates with the central conduit comprehending the pipes 56 and 70 and the central hollow portion of the cross. Rupture head 71 is formed with an extending shoulder 73. Into this shoulder there is secured, as by a welded or soldered joint, a metallic dome 74. A material is chosen for this which will rupture at a predetermined pressure which is the maximum pressure at which the device may operate in safety. I have found that silver of a high purity serves very admirably for this purpose and for nearly all refrigerants. It will be perceived that the dome 74 is spaced from the metal of the rupture head thereby leaving a fixed pressure chamber in open communication with the main line.

To the lower portion of the cross 69 there is secured a valve body 80. This is provided with a central portion 81 which opens into an enlarged chamber 82. The lower portion of the valve casing 80 is internally threaded as at 83 and receives a spindle 84. The upper end of this spindle is drawn out to form a needle head 85, while the lower end is squared, as at 86, so as to receive a suitable turning tool. Intermediate its ends the spindle is formed with an extending collar like section 87. The periphery of this section is threaded to correspond to the internal threads on the casing. The casing body, below the seat of the needle head 85, is laterally extended as at 88 to form a central channeled nozzle. At the opposite side the casing is tapped as at 89 and the bore thus formed is internally threaded to receive a lock screw 90. The screw 90 and squared end of the spindle 84 may be apertured so as to receive the wire of a seal 91.

The operation of this safety valve will be appreciated from the foregoing description. If for any reason a pressure is generated which is above the predetermined optimum pressure at which the device will operate in safety, the dome 74 will rupture. This will be immediately seen when it is considered that the metal for the dome 74 is so chosen that it has a tensile strength which is no greater than the optimum safety pressure. The apparatus in itself, when utilizing a

solid adsorbent, is non-explosive, in that if heat be continuously applied no undue pressures will be created. Indeed, after the refrigerant has been driven out of the generator the pressure will drop, there being no appreciable amount of refrigerant gas in the generator. However the safety valve finds uses in machines employing absorbents, such as water and other liquids, or it is of use if the entire machine should be subjected to excessive heat, as if the machine were in a fire in the dwelling or office.

If it is desired to replenish or to fill the system with refrigerant a suitable conduit may be connected to the nozzle 88. After such connection is made the seal 91 may be broken and the lock screw slightly released. Upon turning the spindle 84 in the proper direction the needle point 85 will be unseated and will open communication between the nozzle 88 and the main fluid line through the pipe 81. The refrigerant may then be forced, by any suitable means, through this now open and connected series of conduits. When the desired quantity has been forced into the system the spindle may be turned in the opposite direction to reseal the needle point and to effectively seal the refrigerant therein. By screwing in lock screw 90 the spindle may be maintained in this locking position. The seal, by means of suitable indicia inscribed thereon, provides an indication of the date of last refilling and also serves to prevent unwarranted access to or tampering with the device.

The pipe section 70, as has been disclosed, leads directly to the upper portion of the receiver 57. This member comprises a cylindrical container having integral conoidal ends 92. Passing through the central portion of the receiver is a well 93, which is secured thereto by the welded joints 94. The wall of this receiver is bored or pierced as at 95, closely adjacent the shell of the receiver. It will be appreciated that when the receiver is filled with a liquid this liquid will pass through the lower apertures 95 and will fill the well up to a level corresponding to that within the receiver proper, and that since liquid passes into the well 93 through restricted openings surging of the liquid therein will be prevented. The lower end of the well communicates by the pipe 58 to the expansion member. The liquid refrigerant enters by way of the pipe 70 into the receiver and thence through the apertures 95 into the well itself. Mounted within the well is a float member 96. This may be made of any suitable material, such as metal or glass, which is impervious to any deleterious action of the refrigerant. Preferably this float is provided with a depending scavenger tube 97, which serves to prevent collapse of the bulb or float and also to withdraw any refrigerant which may, by any chance, have

entered to the interior of the bulb either by condensation or leakage.

Leading from the top of the bulb is a switch rod 98. Preferably this switch comprises a tube containing a predetermined quantity of mercury (see Fig. 8). The tube itself is pivoted centrally on the supporting post 101 and connects, through the electric conductors 102, with the heating element and a source of electric power. The post 101 and conductors 102 are supported in a plate, preferably of insulating material 103, such as bakelite. The switch and supporting members are sealed up by means of a suitable cap or closure 104 which is locked by means (not shown) to a lateral flange 105 screw-threaded on the well 93. The tube 99 may be pivoted between two posts which act as supports and also as conductors. This provides fewer holes through the insulator disc 103 and makes a stronger member.

As is shown in Figs. 2 and 6, the draw off conduit 58 passes downwardly from the well 93 and through the insulating material 24 to an expansion valve or regulating member 59. It will be understood that the slabs of insulating material are cut away near this expansion valve and a screen may be positioned above it to support the granular or slab cork which insulates the well. This expansion valve or regulating member comprises a casing having interior receiving chambers 106 and 107 and an expansion chamber 108. The pipe 58 is secured as by a compression fitting or coupling 109 to the reduced end of the nested fitting 110. This fitting is formed with a reduced portion, which portion is externally threaded and which registers with a correspondingly threaded portion 111 on the body of the valve. Within the chamber formed by the member 110 there is positioned a screen 112. The valve body 59 is also provided with a set of internal threads which engages the exterior threads on a central apertured plug 113. This plug is formed with an enlarged socket-like portion 114 adapted to receive the end of a helical spring 115. The other end of this spring encircles a valve stem 116 formed with a tapered head 118. The intermediate portion of the valve stem is formed with the collar 117 which serves as an abutment member for the other end of spring 115. This tapered end of the valve stem seats within the bushing 119 carried by the body of the valve. The bushing has a central aperture 130 which communicates with the receiving chamber 107 and the expansion chamber 108.

The expansion chamber is adapted to house an element which is responsive to variations in temperature. The thermal responsiveness of this member is utilized to actuate the valve stem so as to permit passage of the liquefied refrigerant to a relatively enlarged space wherein the thermal responsive member is

located. The expansion chamber 108 is defined by the cylindrical walls of the casing, the end of which is shouldered as at 121. Seated against this shoulder is an internally threaded plug 122. Registering with the threads is an internal adjustment nut 123 having a horizontal cut out portion 124 adapted to receive the end of a screw driver. The nut is also centrally tapped to provide a restricted fluid conduit 125. At its inner end the nut is provided with a centrally reduced projection or stud 126.

Adjacent the screw threads the member 122 is provided with a smooth bore portion within which is slidingly received a central tubular portion 127 forming a part of the bellows. At one end this tubular portion is laterally extended as at 127'. To the edges of this extension are secured the flexible bellows material 128. The other end of this material is secured about the interior portion of the plug 122, adjacent the lateral flanges. The spring 129 nests within the tubular portion 127 and one end of it fits over the stud 126. To the central portion of the end plate 127' there is secured or abutted a small rod 130. As shown in Fig. 5 this is rigidly connected at its other end to the apex of the tapered or conical valve head. It will be observed that the tension of spring 129 may be regulated by inserting a suitable tool, such as a screw driver, into the slot 124 and rotating this in the desired direction. It will also be noted that the spring 115 acts in a direction counter to spring 129 and that by properly adjusting the two a very delicate positioning of the valve 116 may be secured. These working parts are sealed off by means of a closure 131. This may be of hard rubber, bakelite or any other suitable material and is provided with a central aperture 132. It will be seen that the apertures 132 and 125 permit the entrance of atmospheric pressure to and exit from the chamber defined by the tubular section of the bellows.

The upper portion of the valve casing 59 is tapped to provide a bore 133 which communicates with the expansion coil 60. This communication may be accomplished by forming a reduced and threaded extension 134 to which the pipe 60 is locked by means of the nut 135.

As has been indicated hereinbefore the coil 60 constitutes the expansion coil of the unit. This is convoluted about the water well and extends approximately to the top thereof. As shown in Fig. 3, the tube 60 does not completely encircle the well but encloses it for substantially three quarters of its circumference.

It will be appreciated that a structure such as has been described is designed to operate over substantially indefinite periods of time. In order to obtain the maximum efficiency and to insure longevity and ease of assembly

the parts are welded together. The assemblage of the members 68 and 59 referred to is the first installation. After these have been assembled in the described manner they are formed as integral units of the system by welding or soldering together all of the exterior joints in these two devices which are shown as screw threaded.

As has been described hereinbefore the well member rests directly upon one of the insulating slabs. Since member 59 is in effect a thermostat the insulating slab is cut out adjacent this member so as to subject it to temperature changes induced by radiation from the water well. Above the valve may be positioned a screen which may rest on the edges of the insulating slab. The space between the walls of the cabinet and the contained elements is filled with an insulating material 136. I prefer to employ granular cork for this purpose. As shown in Fig. 2 when the device is assembled initially the granular cork may extend well up into the confined space defined by the vertical wall 12 and the adjacent top of the rear section 19. This constitutes a quantity of excess material and allows automatic filling of the space below when the granular cork becomes compact or settled.

Secured to any convenient portion of the device, as to the rear plate 19, is an electric socket 137. Coacting with this socket is a corresponding plug 138 which is connected through the conductor 139 to a house circuit.

The operation of the device will have been appreciated from the foregoing description. After the mechanical elements of the structure have been assembled in the manner indicated the generator absorber is charged with the absorbent or adsorbent. If a liquid is used the screening or gauze may be dispensed with. Whatever material is utilized may be admitted through the charging plug 67. The quantity of material admitted should be in excess of that amount theoretically necessary to effectively take up the quantity of refrigerant used. In charging the generator care should be taken to insure the protrusion of the upper ends of the reticulated tubing beyond the upper surface of the material.

The liquid refrigerant may be charged to the system in the manner previously described through the charging valve 68. After the calculated quantity of the refrigerant has been admitted the valve may then be sealed by means of the set screw 90 and seal 91. The water well may be filled by removing the outer bottle cap 53 and by insertion of the bottle into the well and by puncturing the light metallic cap 52 by means of the pointed end of the funnel. As described, the water will flow from the bottle into the well until the latter is filled. If now the electrical circuit is closed, current will flow through the element 62 which, due

to its high resistance, will become heated. The metal tube 61, having a relatively high coefficient of conductivity, will conduct the generated heat to the liquid or solid within the generator absorber. The heat thus applied will volatilize and drive off the refrigerant through the eduction pipe 63. The filter 64, as will be understood, permits the passage of gases or vapors while preventing the exit of any absorbent that may be entrained with them. The gas flows to the condenser coil 56. During this process the pressure within the apparatus will have increased and due to this accumulation, in conjunction with the cooling afforded by the extended radiating surface of the condenser coil, the refrigerant will liquefy. It is particularly to be observed that at this stage of the refrigeration cycle a current of cooling air is positively induced without the utilization of any mechanical devices such as a blower, fan and the like. As has been explained hereinbefore the side plates 8 and interior and exterior rear walls 19 and 14 define a flue or air passage opening at the top and bottom. As the vaporized refrigerant passes to the upper end of the cooling coil a convective current will be set up within the flue, that is to say cool air will enter the open space between the angle flanges 22 and pass upwardly and out through the screen 18.

It will therefore be appreciated that with this novel arrangement of elements a positive current of cooling air is caused to flow over the condenser coil to effect the desired withdrawal or dissipation of heat therefrom without in any manner impairing the efficiency of the generator. It is manifest that the desired cooling of the condenser coil may be increased or accentuated by increasing its surface area as by providing fins, spiral wound ribbons and the like. Likewise it is obvious that the particular design of condenser may be changed. In lieu of a helical coil a radiator of the honey comb type or any other comparable cooling conduit may be employed.

As has been intimated the refrigerant, in flowing downwardly through the condenser coils, undergoes a phase transformation, that is to say it is changed from the vapor to the liquid phase. The refrigerant therefore flows from the lower end of the condenser coil as a liquid to the top of the receiver tank through the interposed charging valve 67 and line 70. In the receiver tank it accumulates in a considerable body. This liquid passes from the receiver through restricted apertures 95 into the well 93. The well cooperates with the receiver so as to maintain the liquid within the former in a relatively quiescent state and hence prevents surging of the liquid in the receiver chamber which is incident to shocks or movements of the cabinet. As a result of this novel disposition of parts the

float member 96 accurately registers the actual liquid level of the receiver.

The receiver, as has been disclosed, is in open communication, through the line 58 with the receiving chamber of the expansion member. The liquid refrigerant therefore will flow, under pressure of hydrostatic head of the liquid in the well, to the expansion member. The screen 112 at this time serves as a strainer and prevents any solid material from passing into the valve chamber and lodging in the valve seat. It will be observed that if the valve 116 is opened, due to the expansion of the bellows, the liquid refrigerant will pass through a restricted passage between the valve and its seat into the relatively enlarged space in the expansion chamber. The passage of the liquid into an enlarged area of this sort causes vaporization of the refrigerant which passes upwardly through the expansion coil 80. This expansion of the refrigerant is accompanied by a cooling effect which, as is known, is in proportion to the latent heat of vaporization of the particular refrigerant used.

When a predetermined quantity of liquefied refrigerant flows out of the receiver the liquid level therein will drop. After a predetermined lowering of this level the float 96 will cause the mercury tube 100 to tilt so that the mercury therein will close the electrical circuit, and heat the generator absorber. The concomitant vaporization of refrigerant will then continue until the liquid level in the receiver has been raised to such a height as to actuate the mercury bulb to open the circuit.

When the heating of the generator has discontinued it will cool down and the material within it is in condition for the reception of vapors coming from the evaporating coil. In other words, the element in these circumstances will act as an absorber. The expanded vapors coming from the expansion coil, pass through the upper portion of the receiver and thence to the absorber by way of the line 56. These will pass through the reticulated tubing and thereby will be widely disseminated through the adsorbent or adsorbent material.

Under no circumstances will dangerous pressure be built up within the apparatus. As has been described hereinbefore if a pressure is generated which exceeds the maximum pressure which the safety dome 74 will withstand this latter will rupture and by allowing vapors to flow therethrough will relieve the excess pressure in the apparatus. It will be understood that while the member 74 has been described as being of silver, other metals or alloys may be employed, the choice of which will depend on the particular maximum pressure at which it is desired to operate. Similarly it is within the scope of this invention to mount a small neutralizing con-

tainer on the outside of the dome 74 so as to neutralize refrigerants which may be toxic or noxious. The particular neutralizing agents employed will of course depend on the refrigerants used.

It will now be appreciated that the device is simple and effective, comprehending as the only moving parts the valve 116 and mercury switch with its float. After assembly and installation the device operates automatically, requiring no care. The vaporized refrigerant is effectively cooled with air and hence the usual water cooler with its troublesome problems of leakage and constant supply of cooling medium is dispensed with. The novel water cap, while simple, is extremely sanitary.

While I have shown and described a particular embodiment of the invention, it is to be understood that this is for purposes of illustrating its essential features and since these may be incorporated in other specific mechanical structures I do not intend to be limited to the one shown except as such limitations are clearly imposed by the appended claims.

I claim:

1. A liquid cooler comprising a cabinet, an elongated compartment in the cabinet open at each end, a generator positioned in the upper portion of the compartment and a condenser subjacent the generator.
2. A liquid cooling device comprising a cabinet, a liquid well within the cabinet, a mechanical refrigerator unit of the absorption type associated with the well and adapted to abstract heat therefrom, an elongated compartment within the cabinet adapted to house the generator and condenser and to permit the passage of cooling air therethrough, an expansion coil positioned about the exterior of the well and in fluid communication with the condenser and generator.
3. A liquid cooling device comprising a two compartment cabinet, a well within one of the compartments, a mechanical refrigerator unit having an expansion coil embracing the well for the greater portion of its height, a generator and condenser located within the other compartment in fluid communication with the expansion coil and insulated from the well.
4. A liquid cooling device comprising a two compartment cabinet, a well within one of the compartments surrounded with insulating material, an expansion coil and a receiver within said compartment, a generator and condenser within the other compartment so arranged as to induce the flow of a cooling air through the compartment.
5. A generator absorber comprising a sealed container of substantially uniform texture throughout, a heating element within the container, an adsorbent material within the generator and reticulated tubing within

the container extending above the surface level of the adsorbent.

5 6. A generator absorber comprising a sealed container having a quantity of adsorbent material therein, reticulated tubing within the generator extending through and above the adsorbent and an eduction pipe extending through and having an opening above the level of the adsorbent.

10 7. A generator absorber comprising a sealed container having a quantity of adsorbent material therein, reticulated tubing within the generator extending through and above the adsorbent, an eduction pipe extending
15 through and having an open end above the level of the adsorbent and provided with a filter.

20 8. A generator absorber comprising a sealed container having a quantity of adsorbent material therein, means to accelerate the adsorption comprising a series of reticulated conduits extending through the material and an eduction pipe extending upwardly through and having an opening above the
25 level of the adsorbent.

In testimony whereof I affix my signature.
LEONARD KAY WRIGHT.

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