

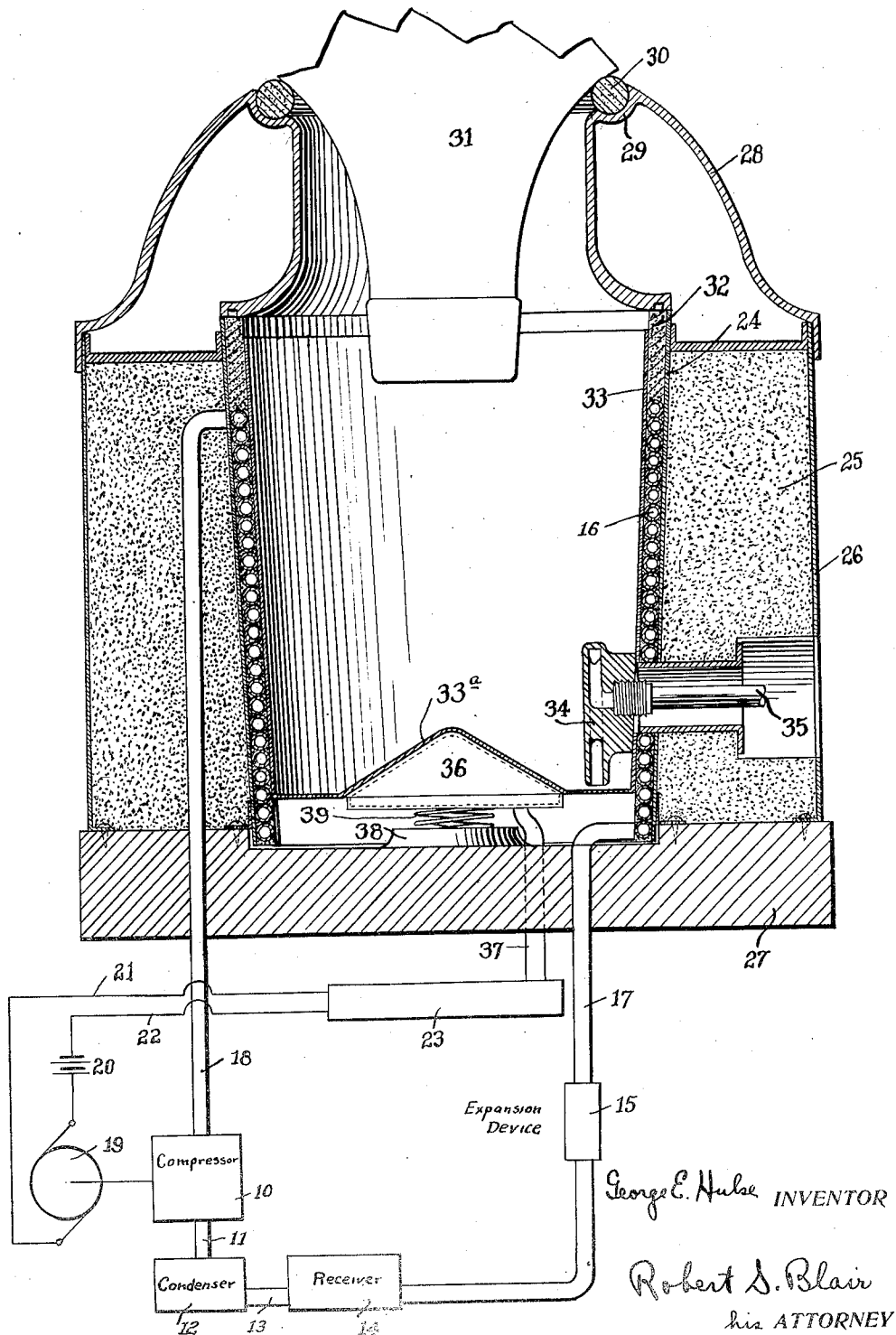
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COOLING APPARATUS

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UNITED STATES PATENT OFFICE.

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COOLING APPARATUS.

Original application filed February 8, 1922, Serial No. 534,878. Divided and this application filed December 4, 1924. Serial No. 753,925.

This invention relates to cooling apparatus and more particularly to apparatus for cooling drinking water and the like.

One of the objects of this invention is to provide a practical and rugged apparatus of the above type and one which will be of thoroughly reliable and efficient action. Another object is to provide an apparatus of the above-mentioned character which will be of simple construction, capable of operating at high thermal efficiency, and, moreover, conducive to a high degree of cleanliness and sanitation when in actual use. Another object of this invention is to provide a water-cooling apparatus of automatic action throughout and in which assembly or disassembly, particularly with respect to certain of the automatic control devices therein, may be rapidly and conveniently brought about. Another object is to provide apparatus of the above-mentioned nature in which thermal interchange between the drinking water or the like to be cooled and the cooling fluid may be maintained at high efficiency and in which an intimate thermal relation between the above-mentioned substance undergoing cooling and the thermally responsive control device may be automatically maintained and assured. Other objects will be in part obvious or in part pointed out hereinafter.

This application is a division of my application Serial No. 534,878, filed February 8, 1922.

The invention accordingly consists in the features of construction, combinations of elements and arrangements of parts which will be exemplified in the structure hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, the single figure is a vertical central sectional view of the water-cooling apparatus, certain parts being, for simplicity and greater clarity, shown diagrammatically.

As conducive to a clearer understanding of certain features of this invention, it may at this point be noted that the water-cooling

apparatus herein disclosed is adapted to be used with many peculiar advantages in connection with a low-temperature producing apparatus, such as one of the evaporative type, a specific embodiment of which is disclosed in my above-mentioned parent application. In order, therefore, that certain of the features of this invention may be more clearly understood, there is diagrammatically indicated at 10 in the drawing herein a compressor adapted to compress any suitable volatile and condensable gas, such as, for example, sulphur dioxide. The compressor 10 discharges the compressed gas through the conduit 11 into a condenser 12 wherein the compressed gas is cooled and reduced to a substantially liquefied state. Any suitable means may be utilized to cool the condenser. From the condenser a conduit 13 leads the liquefied gas to a receiver 14, whence it is passed through a suitable expansion device, diagrammatically indicated at 15, the evaporation of the gas in changing from liquid form to gaseous form resulting in a substantial drop in temperature. The expanded gas, thus reduced in temperature, is then passed into and through the coil 16 by way of the conduit 17, a conduit 18 connected to the other end of the coil of tubing 16 returning the gas to the intake side of the compressor 10. The compressor 10 may be operated from any suitable source of energy, the latter preferably taking the form of an electric motor 19 operated from any suitable source, diagrammatically indicated at 20 in the form of a battery. The circuit of the motor 19 includes the conductors 21 and 22 and also a suitable pressure-controlled switch indicated diagrammatically at 23 and the operation of which will be more clearly herein after described.

Considering now more specifically the features of this invention, the coil of tubing 16 is mounted within a suitable sheet metal container 24 insulated upon its exterior by means of a suitable insulating material 25. The latter is supported and maintained in the desired relation about the con-

tainer 24 by means of an outer sheet metal casing 26 in turn supported upon a suitable base 27. The sheet metal container 24 and the casing 26 support at their upper ends a collar 28 formed at its upper end, as at 29, with a suitable seat within which rests a rubber ring 30. These parts are adapted to receive and support an inverted water bottle, indicated fragmentarily at 31, it being noted that the neck or outlet of the bottle 31 extends downwardly into the upper portion of the container 24.

The container 24 is preferably tapered, as is clearly shown in the drawing, and snugly receives therein the cooling coil of tubing 16 which is tapered to a like degree as the taper of the container 24. The coil of tubing 16 is, however, encased in a suitable material of relatively high heat conductivity, such as, for example, lead. As is clearly seen in the drawing, the coil 16 is thus imbedded or packed in this metal of high heat conductivity, the latter being indicated at 32, and this lead packing thus forms an interior lining for the container 24 which presents a substantially smooth and unbroken interior surface for the effective container 24. Moreover, it will be seen that this interior smooth lining is also tapered and preferably to a degree similar to the taper given the container 24. By this construction there is thus formed a chamber whose thermal action, as will be clearly seen hereinafter, is of great efficiency, and in avoiding the spaces that would otherwise occur between the turns of the coil 16 accumulation of foreign matter is effectively precluded and a high degree of sanitation achieved.

The tapered chamber thus formed, as above described, is adapted to receive therein a substantially similarly tapered receptacle 33, the latter thus snugly fitting therein so that the walls of the receptacle or container 33 are in snug contact with the highly heat-conductive lining 32 in which the coil 16 is imbedded. From the water bottle 31 the water will accumulate in the receptacle 33 and will be automatically maintained at the desired level therein. At a suitable point in the lower portion of the walls of the receptacle 33 there is provided a bushing 34 adapted to receive the inner threaded end of the outlet conduit 35 passing through a suitable opening provided in the lining 32, the container 24, the casing 26 and the heat-insulating material interposed therebetween. Upon the outer end of the tube 35 there may be mounted a suitable faucet for withdrawing the water as desired from the receptacle 33. The faucet with its connecting tube 35 may be readily removed by unscrewing the bushing 34 upon the interior of the receptacle 33 thus permitting the ready removal of the latter to

permit cleansing of both the receptacle itself and the interior part of the cooling apparatus.

In order to maintain the cooling action of the apparatus substantially uniform and to maintain such action within desirable limits, there is mounted in the lower part of the container 24 a thermostatic vessel 36 whose construction is preferably substantially conical in shape, as will be clearly seen from the drawing. The substantially conically shaped vessel 36 provides a suitable interior chamber from which a tube 37 leads to the pressure-controlled switch 23 hereinbefore mentioned. The latter is adapted to control the circuit, and hence the operation of the motor 19, and hence the operation of the compressor 10. More specifically, the circuit of the motor will be opened or closed in accordance with the fall or rise, respectively, of the temperature of the water within the receptacle 33, between predetermined limits.

As the details of the thermostatically controlled switch 23 form no part of this invention, the switch has been merely diagrammatically illustrated; and, as for a possible embodiment which this switch may take, reference may be had, for example, to the switch disclosed in my co-pending application Serial No. 536,611, filed February 15, 1922. It may be briefly noted, however, that the switch 23 is adapted to be responsive to changes in pressure of a suitable fluid, such as ethyl chloride, for example, these changes in pressure being brought about by reason of the changes in temperature which take place within the thermostatic vessel 36. Thus, a rise in the temperature of the water in the receptacle 33 is communicated to the thermostatic vessel 36, the vapor tension of the ethyl chloride confined in the system of which the vessel 36 is a part is raised, and the resultant increase in pressure is effective to operate the switch 23 to close the circuit to the motor 19 and initiate the operation of the condenser and associated expansion apparatus. Thus the circulation of cooling fluid through the cooling coil 16 may be initiated. Similarly, the subsequent attainment of the desired low temperature in the water in the receptacle 33 causes a reduction in the pressure of the vapor in the system of which the vessel 36 is a part, thus permitting the opening of the switch 23 and the cessation of operation of the compressor and of the associated refrigerating apparatus. The circulation of the cooling fluid through the coil 16 may thus be halted.

According to one of the features of this invention, means are provided for insuring a reliable and dependable control of the refrigerating apparatus in accordance with the temperature changes which the water in the receptacle 33 may undergo. As already

above noted, the thermostatic vessel 36 is of conical exterior shape, and it will be seen that the bottom of the receptacle 33 is also given a substantially conical form, as at 33^a, the one being thus adapted to snugly fit into the other.

The vessel 36 is supported upon a suitable abutment 38 on the base 27 and to this abutment 38 is connected a spring 39 tending to urge the vessel 36 in an upward direction. The tube 37 which connects the pressure-operated switch 23 with the interior of the vessel 36 may be of any suitable flexible construction to permit the movement of the vessel 36 to take place, when necessary, in response to the action of the spring 39.

When the receptacle 33 is placed in assembled relation with respect to the remaining parts, as by inserting it into the lined container 24, the receptacle 33 is first placed in intimate thermal contact with the lining 32 in which the cooling coil 16 is imbedded, and, since the coating walls are tapered, a snug contact and engagement thereof is assured, thus to bring the parts into intimate thermal relation; secondly, upon the insertion of the container 33 into the apparatus, the thermostatic control vessel 36 is automatically seated within the cone-shaped bottom 33^a of the receptacle 33 and is held, not only in such seated position permanently, but also in close contact with the bottom 33^a of the receptacle 33 in response to the action of the spring 39. The thermostatic vessel 36 will thus be seen to be reliably maintained in intimate thermal contact with the water to be cooled so that the action of the switch 23 may be accurately and reliably controlled thereby.

It will thus be seen that there has been provided in this invention an apparatus in which the several objects above set forth, as well as others, are attained and in which many thoroughly practical advantages are successfully achieved. It will be noted that the apparatus is of rugged construction throughout, may be readily assembled, and that with such assembly may be achieved automatically an intimate thermal relation between the several parts, including also the thermostatic control unit. The apparatus, moreover, will also be seen to be of a thoroughly sanitary construction throughout, may be readily disassembled for repair or replacement of parts or even for cleansing; and it will be seen that these and many other advantages are achieved without detrimentally affecting the efficient thermal relation of the several parts one to another.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted

as illustrative and not in a limiting sense.

I claim as my invention:

1. In apparatus of the nature of that herein described, in combination, a heat-abstracting device comprising a tapered container having associated with the tapered walls thereof a coil of tubing, a receptacle substantially similarly tapered adapted to be removably fitted within said tapered container and to be placed in thermal contact with the tapered walls thereof, said receptacle having a substantially cone-shaped bottom, and a yieldingly mounted, substantially cone-shaped thermostatic vessel within said container and adapted to be seated within said cone-shaped bottom for controlling the circulation of a cooling fluid through said coil.

2. In apparatus of the nature of that herein described, in combination, a heat-abstracting device comprising a container having a coil of tubing disposed about its interior surface, a receptacle having a substantially cone-shaped bottom adapted to be mounted within said container and in thermal contact with said coil of tubing, a substantially cone-shaped thermostatic vessel adapted to be responsive to changes in temperature and to control the circulation of cooling fluid through said coil of tubing mounted within said container and adapted to register with the bottom of said receptacle, and automatic means for maintaining said vessel in registry with said bottom and in thermal contact with said receptacle.

3. In apparatus of the nature of that herein described, in combination, a heat-abstracting device comprising a coil of tubing, a receptacle adapted to be placed within said coil of tubing and in thermal contact therewith, a thermostatic vessel adapted to be responsive to changes in temperature and to control the circulation of a cooling fluid through said coil, and automatic means operative upon said vessel for maintaining it in thermal contact with said receptacle.

4. In apparatus of the nature of that herein described, in combination, a heat-abstracting device comprising a coil of tubing, a receptacle adapted to be placed within said coil of tubing and in thermal contact therewith, said receptacle having a portion thereof shaped to be outwardly concave, and a thermostatic vessel adapted to be responsive to changes in temperature and to control the circulation of a cooling fluid through said coil, said vessel having an exterior portion outwardly convex and adapted to be fitted into the concave portion of said receptacle.

5. In apparatus of the nature of that herein described, in combination, a receptacle adapted to receive therein a substance to be cooled, means forming a circulating path for a cooling fluid and adapted to extract heat

from the substance within said receptacle, said receptacle having a portion thereof shaped to be outwardly concave, and thermally responsive means adapted to control the flow of cooling fluid through said circulating path and including a member shaped to be outwardly convex, said outwardly convex member being fitted into the outwardly concave portion of said receptacle.

6. In apparatus of the nature of that herein described, in combination, a receptacle adapted to receive therein a substance to be cooled, means forming a circulating path for a cooling fluid and adapted to extract heat from the substance within said receptacle, said receptacle having a portion thereof shaped to be outwardly concave, thermally responsive means adapted to control the flow of cooling fluid through said circulating path and including a member shaped to be outwardly convex, said outwardly convex member being fitted into the outwardly concave portion of said receptacle, and means for automatically holding said concave and convex members in thermal contact one with the other.

7. In apparatus of the nature of that herein described, in combination, a receptacle having the bottom thereof formed with an outwardly concave portion and adapted to receive the substance to be cooled, means forming a circulating path for cooling fluid and adapted to extract heat from the substance within said receptacle, and thermally responsive means for controlling the flow of cooling fluid through said circulating path, including a member having a portion outwardly convex in shape and adapted to be fitted within the outwardly concave portion of the bottom of said receptacle.

8. In apparatus of the nature of that herein described, in combination, a receptacle adapted to hold therein a substance to be cooled, means forming a container and adapted to receive and support therein said receptacle, means forming a circulating path for a cooling fluid and adapted to extract heat from the substance within said receptacle, and thermally responsive means for controlling the flow of cooling fluid through said circulating path, including a member mounted upon the bottom of said container and formed to have an outwardly convex shape, said receptacle having its bottom shaped to be outwardly concave and to receive therein said outwardly convex member.

9. In apparatus of the nature of that herein described, in combination, a receptacle adapted to hold therein a substance to be cooled, means forming a container and adapted to receive and support therein said receptacle, means forming a circulating path for a cooling fluid and adapted to extract heat from the substance within said recep-

tacle, thermally responsive means for controlling the flow of cooling fluid through said circulating path, including a member formed to have an outwardly convex shape, and means for yieldingly supporting said outwardly convex member upon the bottom of said container, said receptacle having its bottom shaped to mate with said outwardly convex member.

10. In apparatus of the nature of that herein described, in combination, a receptacle adapted to receive therein a substance to be cooled, means for supporting said receptacle comprising a container having a coil of tubing imbedded in the walls thereof, means for supplying said coil of tubing with a cooling fluid, and thermally responsive means for controlling the flow of cooling fluid through said coil of tubing, including a member formed to have an outwardly convex shape and mounted upon the bottom of said container, said receptacle having its bottom shaped to mate with said outwardly convex member.

11. In apparatus of the nature of that herein described, in combination, a receptacle adapted to receive therein a substance to be cooled, means for supporting said receptacle comprising a container having a coil of tubing imbedded in the walls thereof, means for supplying said coil of tubing with a cooling fluid, thermally responsive means for controlling the flow of cooling fluid through said coil of tubing, including a member formed to have an outwardly convex shape, and means for yieldingly mounting said member upon the bottom of said container, said receptacle having its bottom shaped to mate with said outwardly convex member.

12. In apparatus of the nature of that herein described, in combination, a receptacle adapted to contain a substance to be cooled and having tapered side walls, a container for receiving and supporting said receptacle and having tapered side walls, means forming a circulating path for cooling fluid associated with the tapered side walls of said container, thermally responsive means for controlling the flow of cooling fluid through said circulating path, including a member formed to have an outwardly convex shape, and means for yieldingly mounting said member upon the bottom of said container, said receptacle having its bottom shaped to mate with said outwardly convex member.

13. In apparatus of the nature of that herein described, in combination, a receptacle adapted to contain a substance to be cooled and having tapered side walls, means for receiving and supporting said receptacle and having tapered side walls with which the side walls of said receptacle interfit, means forming a circulating path for cool-

ing fluid associated with the side walls of said last-mentioned means, thermally responsive means for controlling the flow of cooling fluid through said circulating path, 5 said thermally responsive means including a member positioned adjacent the bottom of said receptacle and adapted to contact with the bottom thereof, and means for urging said member upwardly against the bottom of said receptacle to maintain said member 10 in thermal contact therewith.

In testimony whereof, I have signed my name to this specification, this 21st day of November, 1924.

GEORGE E. HULSE.