

April 27, 1926.

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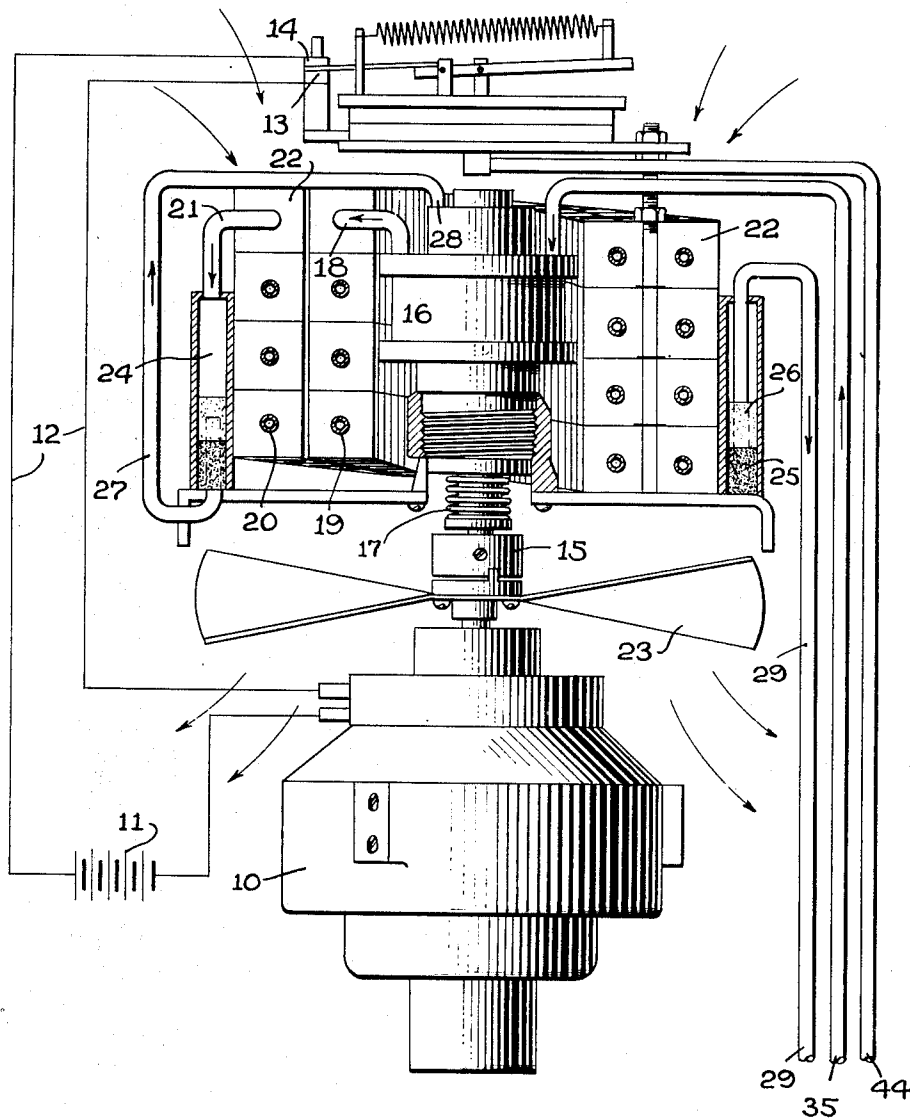
J. D. STROBELL

COOLING APPARATUS

Filed Jan. 25, 1922

3 Sheets-Sheet 1

Fig. 1



John D. Strobell Inventor

By his Attorneys
Emery, Varney, Blair & Hoquet

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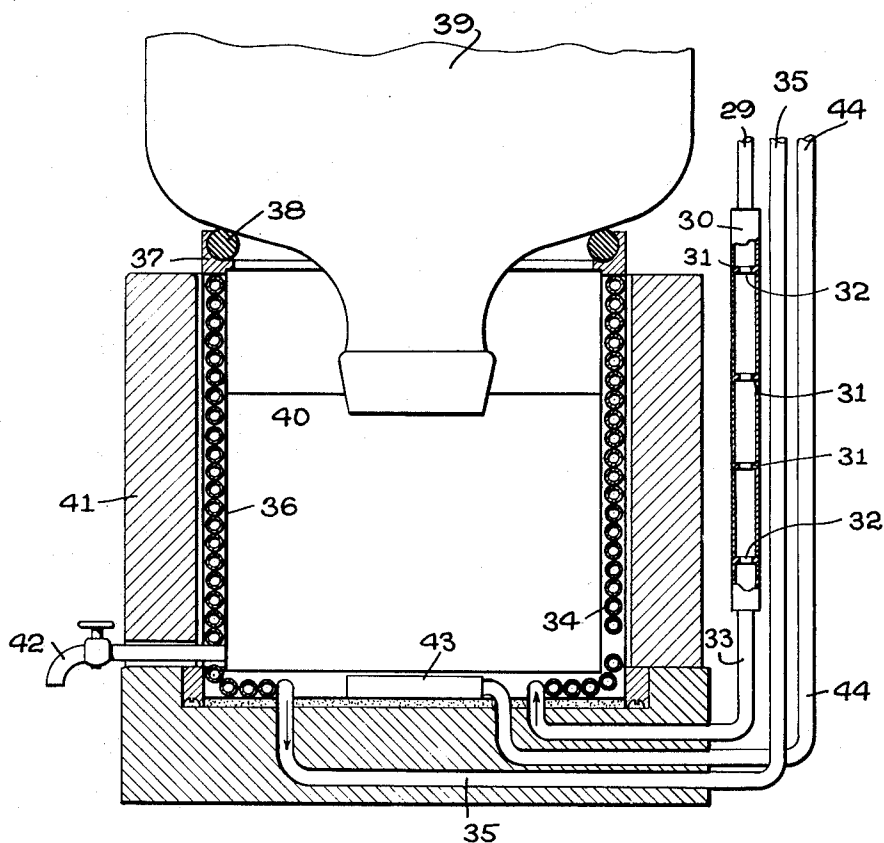
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Fig. 2



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Fig. 3

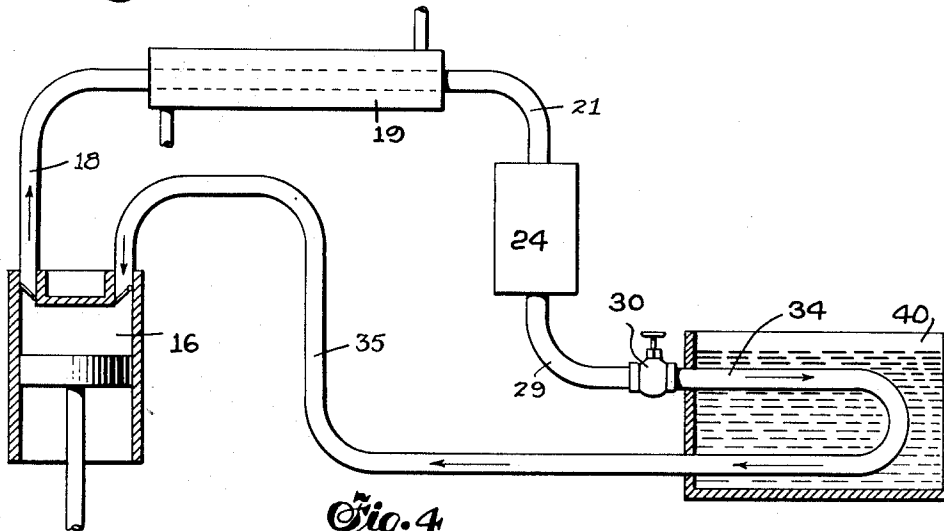
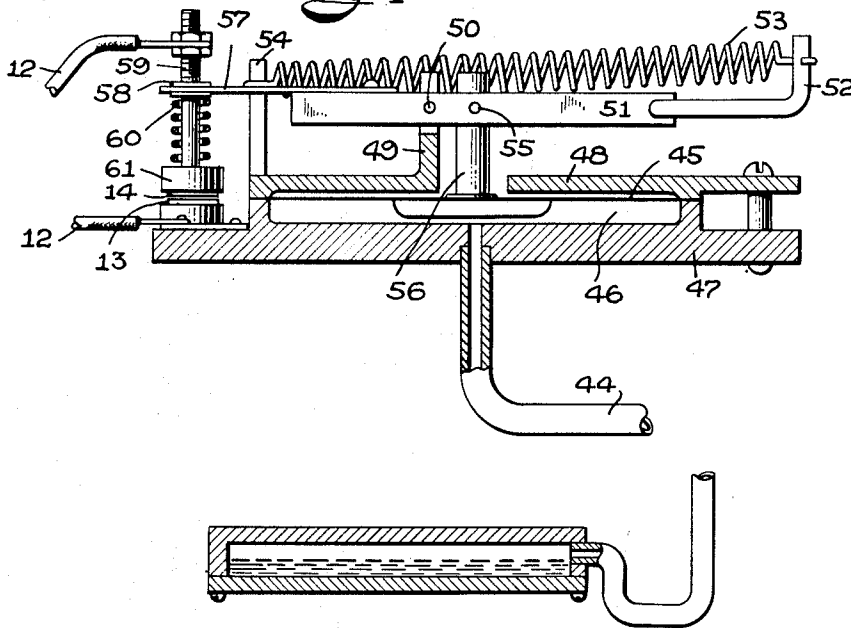


Fig. 4



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UNITED STATES PATENT OFFICE.

JOHN D. STROBELL, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE SAFETY CAR HEATING & LIGHTING COMPANY, A CORPORATION OF NEW JERSEY.

COOLING APPARATUS.

Application filed January 25, 1922. Serial No. 531,578.

To all whom it may concern:

Be it known that I, JOHN D. STROBELL, a citizen of the United States, and a resident of New Haven, in the county of New Haven and State of Connecticut, have invented an Improvement in Cooling Apparatus, of which the following is a specification.

This invention relates to cooling apparatus and, as to most of its features, more particularly to apparatus for cooling drinking water and the like. One of the objects thereof is to provide practical apparatus of the above type characterized by simplicity of construction and efficiency of action. Other objects are to provide apparatus of the above type, the various elements of which are compactly disposed and so related as to achieve most effective action. Other objects are to provide apparatus of the above nature characterized by economy in the use of materials and energy. Other objects are to provide apparatus of the above nature of dependable action under long periods and free from the necessity of adjustment or skilled supervision. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement 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 drawings in which is shown one of various possible embodiments of this invention,

Figure 1 is an elevation partially in section of a compressor and related parts;

Figure 2 is a similar view of a reservoir and related parts;

Figure 3 is a diagrammatic elevation illustrative of certain features of the apparatus; and

Figure 4 is a sectional elevation of a thermostatic device on an enlarged scale.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to Figure 1 of the drawings there is shown at 10 an electric motor which may be connected with any suitable source of current, as the battery 11, the circuit through

the wires 12 being controlled by the contact or separation of the contact members 13 and 14, the position of which is governed by a thermostatic device as hereinafter described.

Driven from this motor, the shaft of which is preferably vertically disposed and the power from which is transmitted through a suitable coupling 15, is a rotary compressor 16. A suitable packing gland indicated generally at 17 is provided for making fluid-tight the connection between the shaft of the compressor and the compressor casing.

The construction of the compressor 16 may be of any type suitable to perform the functions herein described, and on being driven is adapted to compress a volatile and condensible gas such as sulphur dioxide. The gas, discharged under high pressure through the tube 18, is led throughout an inner coil 19 and outer coil 20 up to the discharge pipe 21. Fitted about these coils are a series of thin copper sheets 22 which are spaced from one another and preferably radially disposed, and as they contact the tubing passing therethrough they serve as cooling fins or flanges. It is to be understood that the tubing as well as these sheets, is preferably so formed and disposed as substantially to enclose the compressor 16.

The device last described forms a condenser for the highly compressed gas and being cooled by a current of air drawn downwardly thereover by means of the fan 23 on the shaft of the motor, serves to condense the compressed gas into liquid form. In this form it passes outwardly through the tube 21 into an annular receiver 24 which surrounds the condenser, as indicated in the drawings.

In the receiver the liquid is permitted to accumulate and inasmuch as the compressor for most efficient action must be generously lubricated, a considerable amount of excess lubricant will pass off with the gas. The lubricant and condensed gas are of different specific gravities, however, and in the receiver, assuming sulphur dioxide to be used, the condensed gas will separate by gravity into a lower stratum 25, the lubricant accumulating in an upper stratum 26. From the accumulated lubricant a return pipe or conduit 27 leads to the inlet of the compres-

sor at 28 and is thus returned for repeated service.

From the lower stratum of condensed or liquid sulphur dioxide, the outlet conduit 29 leads to an expansion device 30 shown in Figure 2 of the drawings.

Reference to Figure 1 clearly shows that the tube 21 through which the condensed fluid passes into the receiver 24 from the condenser 18 and the tube 29, through which the condensed and separated fluid passes from the receiver to the expansion coil 34 are connected to the annular receiver 24 at substantially diametrically opposite points. The receiver thus provides a plurality of paths of flow for the mixed lubricant and condensed fluid, thus insuring a low velocity of flow and thus permitting adequate time for the separation of lubricant from the condensed liquid.

This expansion device 30 comprises a plurality of orifice members 31 respectively provided with orifices 32. These openings or orifices are preferably fixed, and being serially disposed in the direction of flow of the fluid, permit a series of quickly successive expansions. Assuming that there are four of these orifices, the expansion from the pressure in the receiver to the pressure in the cooling coil hereinafter described, takes place in four stages; and at each stage, that is, between the opposite sides of each expansion member, there is a correspondingly small drop in pressure. For this reason with a given efficient rate of flow of fluid, much larger expansion orifices may be employed than would be required for efficient action if the entire expansion took place through a single orifice. The increased size of these orifices tends to prevent them from becoming clogged with dirt or other foreign matter and insures a dependable as well as efficient action of this portion of the apparatus.

From the lower side of the expansion device 30 the conduit 33 leads to a coil 34 which in turn terminates in a pipe or conduit 35 connected as shown in Figure 1 of the drawings, to the inlet side of the compressor.

The coil 34 is mounted within a thin annular sheet metal container 36 which supports a collar 37 at its upper end. Mounted within this collar is a rubber ring 38 in which may be rested an inverted water bottle 39 from which the water will accumulate in the tank or reservoir 40 to the desired level.

The container 36 is mounted within an outer casing 41 of any desired construction and preferably of heat insulating material. Through the casing 41 and leading into the tank 40 is a faucet or cock 42 by which the contents of the tank may be withdrawn as desired.

In order to prevent excessive cooling of the contents of the tank, there is provided

in the lower walls of the inner container, a thermostatic vessel 43 from which a tube 44 leads to the underside of a diaphragm 45 which encloses an expansion space 46 formed in a bed-plate 47. Removably holding this diaphragm in position is a cover member 48 provided with an upwardly extending arm 49 to which is pivoted as at 50 a lever 51, referring to Figure 4 of the drawings. This lever 51 is provided with an upwardly extending tail 52 to which is secured a tension spring 53 anchored at its other end as to the post 54. Lever 51 is pivoted at 55 to a post 56 secured to the diaphragm 45. When the diaphragm is in its upward position as shown in Figure 4 of the drawings, the spring 53 tends to retain it in such position, but upon the diaphragm moving downwardly, as hereinafter described, the pull of spring 53 crosses the pivotal point and snaps it quickly into a position in which its right end is materially lower and its left end materially higher. The left end of lever 51 is provided with an extension 57 secured to a collar 58 slidably mounted on a pin 59. This collar 58 is secured to the upper end of a spring 60, the lower end of which is connected with the contact holder 61 formed on the lower end of the pin. This contact member 61 holds the contact 14 hereinbefore described co-acting with the contact 13. Thus as the lever 51 is snapped into its alternative position with the extension member 57 raised, it pulls contact 14 away from contact 13 suddenly snapping these parts out of contact-making relation. If however the lever 51 is returned to normal position, it yieldingly forces the contacts together.

Considering now the action of this apparatus, reference is first made to the diagram Figure 3 in which the parts diagrammatically illustrated bear the same numbers as the corresponding elements in the actual apparatus hereinbefore described. Assuming the compressor 16 to be in action as by reciprocation of the piston, it sucks gas from the cooling coil 34 in the tank 40. This gas is compressed and condensed in condenser 19 and collected in the receiver 24. From the latter it flows through the expansion device 30 to the cooling coil 34 in which it expands, drawing heat from the contents of the tank proportional to its latent heat of vaporization. Obviously so long as the compressor 16 is maintained in action this cooling process would be continued. Such is the general connection of the apparatus hereinbefore described.

Referring now however to the details of the action of this apparatus, the compressor 16 draws the vapor from the cooling coil as hereinbefore described as long as the electric motor 10 is in action. It is amply lubricated and cooled by the draft of the fan 23 thus insuring the most efficient and dependable

performance of its functions. The condenser which receives this highly compressed gas, in this case sulphur dioxide, is provided with an extremely large radiating surface directly positioned and exposed to the draft of the fan, and hence the heat due to compression is quickly carried away. This high pressure with the abstraction of heat reduces the sulphur dioxide to liquid form in which condition it is received in the receiver 24 and segregated from the lubricant by gravity as hereinbefore described. Passing from the receiver which is compactly disposed with respect to the condenser and also positioned in the draft of the fan, the condensed fluid travels from the expansion device 30 through which by a plurality of stages the pressure is relieved and it passes into gaseous form. This evaporation requires heat which is extracted from adjacent bodies and as it is in best heat-conducting relation with the contents of the tank 40, the latter is quickly cooled. The return of the fluid to the condenser as well as the prevention of accumulation of pressure in the cooling coil, is brought about by the conduit 35 leading to the suction side of the compressor.

The thermostatic cell 43 is provided with a suitable fluid such as liquid ethylchloride, the vapor of which at such temperatures as it is desired to maintain the drinking water will be below atmospheric pressure and will vary considerably with slight changes in temperature. By the adjustment of the springs of the thermostatic device, the vapor pressure beneath the diaphragm 45 may be made to permit the spring 53 to snap the lever 51 into circuit-closing position whenever the temperature of the tank contents reaches what is considered the highest permissible limit, such as for example forty-six degrees Fahrenheit. This action will start the motor 10 and bring the cooling apparatus into operation. The temperature of the water will then be quickly lowered and when it reaches a certain lower desired limit, such as forty-one degrees Fahrenheit, the vacuum in the cell 53 will so increase as to draw the diaphragm 45 downwardly and snap the lever 51 into circuit-breaking position. It is to be understood that other fluids might be used in the thermostatic cell and that a variable positive pressure instead of vacuum might be employed if desired.

In this manner the control of the apparatus is automatic and the temperature of the water may be maintained within any desired range, thus preventing excessive cold or warmth or undue waste of energy.

It will thus be seen that there is provided apparatus in which the various objects of this invention are achieved and in which the advantages hereinbefore described are, among others, attained. It will also be seen that this apparatus is characterized by ex-

treme simplicity and cheapness of construction and yet it is economical and dependable in action to a marked degree.

As various possible embodiments might be made of the above invention and as various changes might be made in the embodiment set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings 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 compressor, a condenser adapted to receive compressed fluid and lubricant from said compressor a receiver of substantially annular shape having a connection to receive condensed fluid and lubricant from said condenser and adapted to permit the condensed fluid and lubricant to separate by gravity into two layers, an expansion device, a connection for discharging lubricant from said receiver and for conducting it to said compressor, and a connection for discharging condensed fluid from said receiver and for conducting it to said expansion device, the said connection of the condenser to the receiver and the said connection of the expansion device to the receiver being made at substantially diametrically opposite points in said annular receiver.

2. In apparatus of the nature of that herein described, in combination, a compressor, a condenser adapted to receive compressed fluid and lubricant from said compressor and shaped to extend about said compressor, a receiver of substantially annular shape fitted about said condenser having a connection to receive condensed fluid and lubricant from said condenser, said receiver being adapted to permit the condensed fluid and the lubricant to separate by gravity into two layers, an expansion device, a connection for discharging lubricant from said receiver and for conducting it to said compressor, and a connection for discharging condensed fluid from said receiver and for conducting it to said expansion device, the said connection of the condenser to the receiver and the said connection of the expansion device to the receiver being made at substantially diametrically opposite points in said annular receiver.

3. In apparatus of the nature of that herein described, in combination, a compressor, a condenser extending about said compressor and connected to receive condensed fluid therefrom, and a receiver extending about said condenser and connected to receive condensed fluid therefrom and an outlet for said receiver, said receiver being shaped to provide a plurality of paths of flow for condensed fluid between the connection thereof with said condenser and said outlet.

4. In apparatus of the nature of that here-

in described, in combination, a compressor, a condenser extending about said compressor and connected to receive condensed fluid therefrom, a receiver extending about said
5 condenser and connected to receive condensed fluid therefrom, a motor connected to drive said compressor, and a fan driven from said motor and mounted to move air over said compressor, condenser and receiver. 10

In testimony whereof, I have signed my name to this specification this fourteenth day of January 1922.

JOHN D. STROBELL.