J. F. HAWLEY.

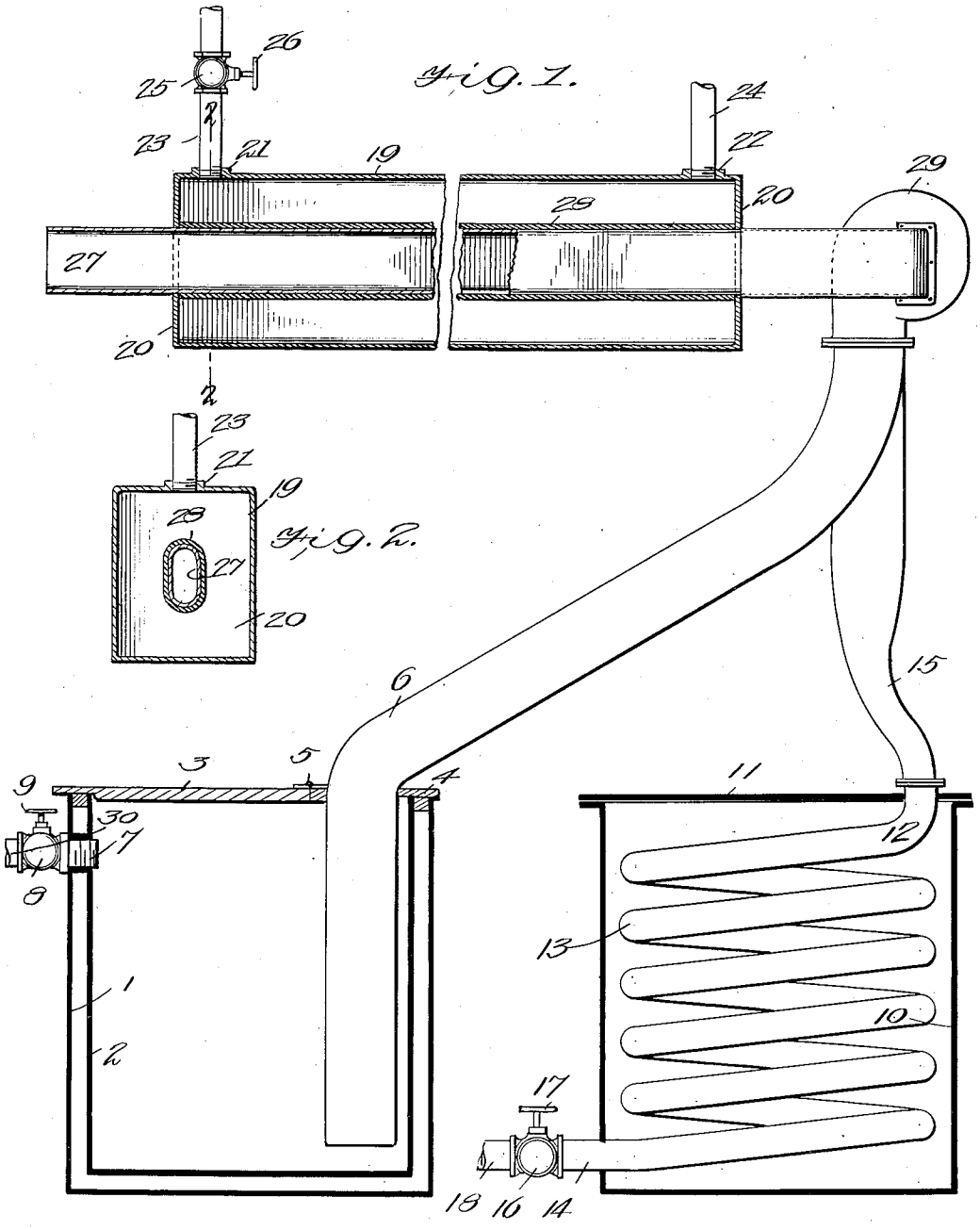
REFRIGERATING MACHINE.

APPLICATION FILED MAY 31, 1913.

1,120,481.

Patented Dec. 8, 1914.

2 SHEETS—SHEET 1.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 3.

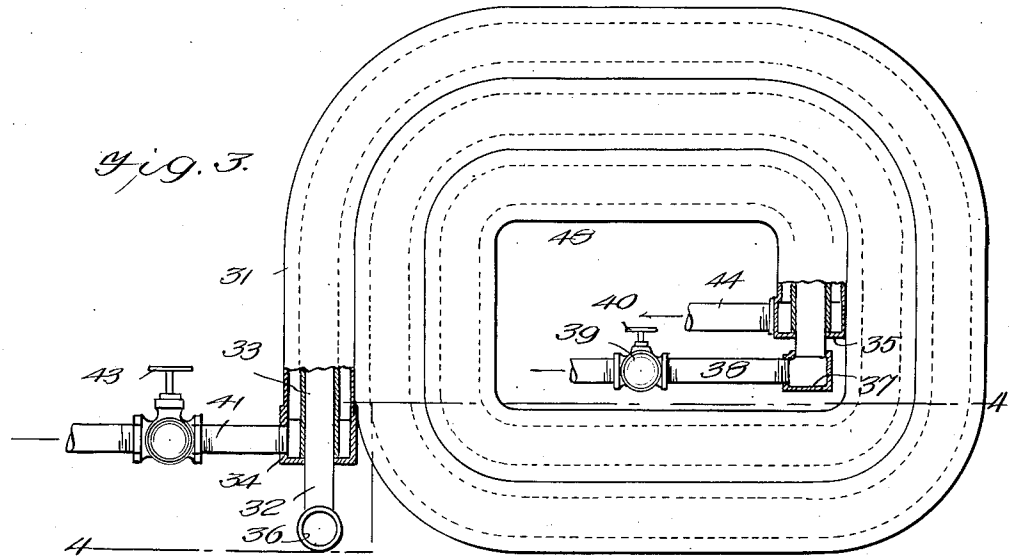


Fig. 4.

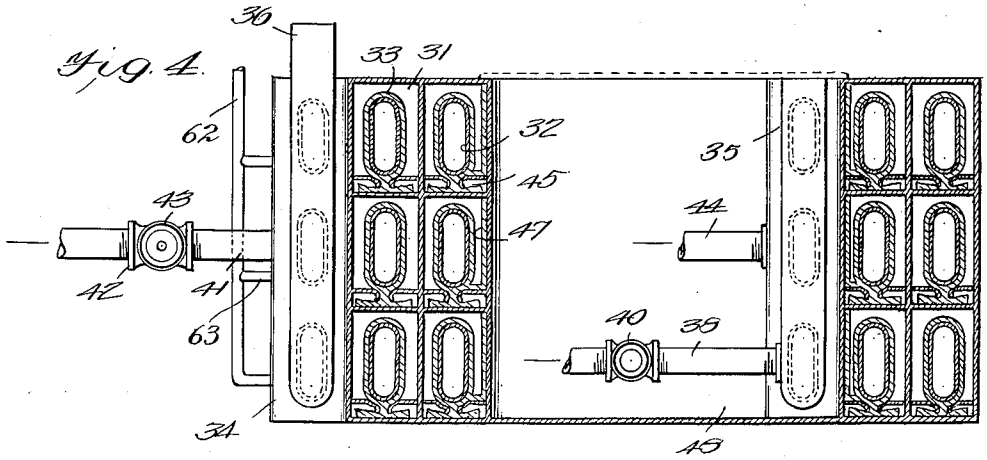
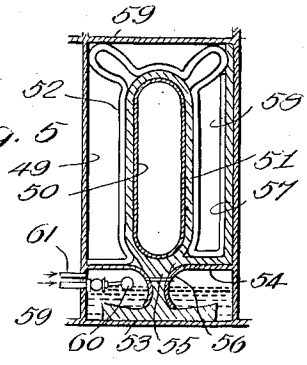


Fig. 5.



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JOHN F. HAWLEY, OF PASADENA, CALIFORNIA.

REFRIGERATING-MACHINE.

1,120,481. Specification of Letters Patent. Patented Dec. 8, 1914.

Application filed May 31, 1913. Serial No. 770,938.

To all whom it may concern:

Be it known that I, JOHN F. HAWLEY, a citizen of the United States, and a resident of Pasadena, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Refrigerating-Machines, of which the following is a specification.

My invention is an improvement in refrigerating apparatus, and has for its object to provide an apparatus of the character specified, wherein the refrigerating medium is dry air, cooled by the evaporation of water, alcohol, or other suitable volatile liquids, in accordance with the degree of refrigeration desired, and wherein the rarefied current of cooled air may be used directly or indirectly, as for instance in a container or in a cooling coil, in the usual refrigerating and ice making machine.

In the drawings:—Figure 1 is a diagrammatic view of the improved apparatus, with parts in section; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a plan view of a modified mechanism; Fig. 4 is a section on the line 4—4 of Fig. 3; and Fig. 5 is an enlarged transverse section of a form of coil.

The present embodiment of the invention is shown in connection with a box or cabinet having double walls 1 and 2, separated by a dead air space, and having a cover 3 provided with a door 4 hinged to the cover at 5, and an opening through which a pipe 6 from the refrigerating apparatus may be passed, the said pipe 6 opening near the bottom of the cabinet. An outlet pipe 7 is arranged near the top of the cabinet, the said pipe passing through both walls and having interposed therein a valve casing 8 outside the cabinet, and a valve 9 is provided in the casing for controlling the outlet.

The apparatus is further shown in connection with a casing 10, having a single wall, and a top 11 provided with an opening through which extends one end 12 of a coil 13, the other end 14 of the coil passing out at the bottom of the casing. A pipe 15 leads from the refrigerating apparatus to the upper end 12 of the coil 13, and a valve casing 16 is interposed in the end 14 of the coil, a valve 17 being provided in the casing for controlling the communication between the coil and the discharge pipe 18 connected to the outer end of the casing.

The refrigerating apparatus comprises a casing 19 of rectangular cross section, having its ends closed, as shown at 20, and the upper face of the casing is provided with nipples 21 and 22 respectively at its opposite ends, each of the said nipples being internally threaded. Pipes 23 and 24 are threaded into the nipples 21 and 22 respectively, and a valve casing 25 is interposed in the pipe 23, and a valve 26 is arranged in the casing for controlling the communication through the said pipe 23. The ends 20 of the said casing 19 have openings, and a pipe 27 of oblong or approximately elliptical cross section, passes through the casing, the ends of the said pipe extending through the openings in the end walls thereof, and a jacket 28 incloses the said pipe 27 within the casing 19. The jacket 28 extends the full length of the casing, the ends of the said jacket fitting against the inner faces of the end walls 20 of the casing.

The pipe 23 is the inlet to the casing 19, and it will be understood that the said casing 19 is shown in the particular shape as a matter of convenience, it being obvious that the said casing may be of any desired shape, size or cross section, as may also be the pipe 27 and its inclosing jacket. The pipe 24 is the outlet, and air is admitted to the casing 19 through the pipe 23, escaping through the pipe 24, the said air being previously cooled and cooling in turn the air passing through the pipe 27 to the pipes 6 and 15, and from the said pipes to the cabinet 1—2, and through the coil 13 in the cabinet 10. The amount of air passing may be regulated by means of the valve 26.

A pump of any desired character is connected with the pipe 24, for drawing the air from said casing, to create a constant circulation of cooled air through the casing, and around the pipe 27. The pipe 27 has its inlet end adjacent to the nipple 21, and the outlet end thereof is connected to an approximately cylindrical casing 29, from which lead the pipes 6 and 15 before mentioned. The pipe 27 is of thin material, and the covering or jacket 28 is of a material that may be saturated with a suitable vola-

tile liquid, such as water, alcohol, ether, gasolene or the like, which will be evaporated by the air passing through the said casing 19, and by its evaporation will cool the air passing through the pipe 17 to the place of utilization. The end of the pipe 27 adjacent to the casing 29, the said casing 29, and the pipes 6 and 15, are all preferably insulated with some non-heat conducting material, to prevent heating of the cooled air as it issues from that portion of the pipe 27 within the casing 19.

A fan or other suction apparatus, (not shown) is connected with the pipe 30 at the outer end of the valve casing 8, or with the pipe 18 at the outer end of the valve casing 16, to withdraw the air from the casing 1—2, or from the coil 13, to insure a constant circulation of air through the pipes 27, 6 and 15, and through the casing 1—2 or the coil 13. Thus a constant renewal of cooled air is delivered to the said casing 1—2, or to the coil 13, the air entering, and being cooled within the casing 18, and extracting the heat from the cabinet or from the coil, so that the interior of the cabinet 1—2 or the casing 10 is cooled to the desired point, and is retained in this condition by a constant succession of cooled air.

The operation will be evident from the description, there being a constant circulation of air through the casing 19, and in contact with the jacket or covering 28 of the pipe 27. The evaporation of the liquid with which the said covering is saturated, will cool the air passing through the pipe 27, and the cooled air will be delivered to the cabinet 1—2, or to the coil 13, and the said air will be discharged by the suction apparatus connected with the pipe 18 or the pipe 30, or both. The amount or degree of refrigeration is regulated by the valve 26, and by the liquid used upon the covering 28. It will be evident that a liquid that is slowly evaporated will not provide so high a degree of refrigeration, as will a liquid that is quickly and easily volatile, as for instance ether, and in addition the degree of refrigeration will depend upon the amount and the speed of the air passing through the pipe 27. The amount of air passing from the cabinet 1—2, or from the coil 13, may be also regulated by the means of the valves 9 or 17. By this mechanism, the degree of refrigeration may be nicely regulated to suit each and every condition. In the cabinet 1—2, the refrigeration is direct, the cooled air moving in contact with the articles therein to be refrigerated, while in the cabinet 10 the refrigeration is indirect, the air within the said cabinet 10 remaining unchanged, while there is a constant change of air in the cabinet 1—2.

In the modified construction shown in Figs. 3, 4 and 5, the principle is the same, although the arrangement is somewhat different. In this construction, a casing is provided composed of a plurality of spirally shaped chambers or compartments 31, each of which is rectangular in cross section, said chambers being three in number in the present instance, and arranged in vertical series. In each of the said compartments or chambers is arranged a pipe 32 of thin material, and of approximately elliptical or oblong shape. Each of the said pipes is inclosed or covered by a jacket or covering 33 of material capable of being saturated with the liquid to be coöperated, and the said covering or jacket extends from one end of each compartment to the other end. The said tubular compartments or casings 31 are as before stated arranged in superposed relation, and caps 34 and 35 close the respective ends thereof. The said compartments or chambers may be of integral structure, consisting of a single casing having partitions to form the chambers, or the compartments may be separate structures secured together in any desired manner. The ends of the pipes 32 extend beyond the respective caps 34 and 35, and each of the said ends is connected with a pipe 36 at the end adjacent to the cap 34. At the opposite end or adjacent to the cap 35, the said pipes 32 are connected with a tubular structure or casing 37 arranged in vertical position adjacent to the cap, the said structure 37 receiving the ends of all of the pipes 32. A pipe 38 is connected with the tubular casing 37, and a valve casing 39 is interposed in the said pipe, and a valve 40 is arranged within the casing 39, for controlling the communication through the said pipe. A pipe 41 is connected with the cap 34, and a valve casing 42 is interposed in the said pipe, and is provided with a valve 43 for controlling the communication through the pipe. A pipe 44 is connected with the cap 35, and a suitable suction device is connected with the pipe 44, for withdrawing the air from all of the tubular chambers or compartments 31. The pipe 41 is at approximately the center of the cap 34, and the said pipe is a collector with which all of the inlet ends of the compartments 31 communicate. The cap 35 is a collector at the outlet ends of the said tubular compartments, and the pipe 44 leads from the approximate center of the said collector. The pipes 32 are supported in any suitable manner at the approximate center of the collector, and the pipes support the covering or jacket 33. Each of the said jackets or covers entirely incloses the pipe, and is provided with a depending foot 45 resting upon the bottom wall of the tubular compartment.

Stays 46 are arranged on each side of the

connection between the jacket proper and the foot, for preventing lateral movement of the foot, and the said covering is preferably extended upwardly as indicated at 47, on the inner wall of the innermost portions of the chambers, as shown in Fig. 4, thus insulating the said inner wall from the outer air.

The compartment 48 that is formed within the coil may be a refrigerating chamber if desired, the cooled air passing directly into the said chamber, or the cooled air may be conducted to a distance for utilization at that point. When the said chamber is utilized for this purpose, it is necessary to insulate the wall of the chamber, as shown at 47.

It will be obvious that many different arrangements are possible, as for instance the arrangement shown in Fig. 5, wherein each tubular compartment 49 has the air pipe 50 arranged at its center, and inclosed by an insulating covering 51. The pipe 50 in this central position, by means of clips 52, bent from wire or other suitable material, and shaped as shown in Fig. 5 to engage the upper corners of the compartment and the side walls to hold the pipe in fixed position. The clips are arranged at suitable intervals, and the pipe is provided with a facing or covering 51 of insulating material, and preferably of a porous character, as for instance wicking. The covering 51 of the pipe is extended below the same, toward the bottom of the tubular compartment 49, and is then extended laterally toward both sides of the compartment, as shown at 53. Stays 54 of rigid material are arranged at intervals to hold the covering in place, and the stays are connected at opposite sides of the depending portion of the covering, by means of a rivet 56 or the like, the said rivet connecting the vertical portion of the stays and passing through the connection 55 between the foot and the body portion of the covering. The inner side wall of the compartment is also provided with an insulating covering 57, and the sheet or strip 52 of rigid material is continuous up along the inner face of the said covering, as shown at 58, to hold the said covering in place. The said strip or sheet is looped or bent outwardly, as indicated at 59, to engage the upper corners of the compartment, and the liquid is arranged in the bottom of the compartment, as shown in Fig. 5.

Any desired means may be used to introduce the liquid to the tubular compartment and to the jacket of the pipes. In Fig. 5 an inlet device 59 is shown, for introducing the liquid, the amount of liquid introduced being controlled by a float 60 which is lifted by the liquid. An air conduit 61 is provided, for permitting the escape of air to prevent any obstacle to the free inflow of the liquid. The amount of liquid introduced is thus controlled directly by the float, the said float being arranged to close the valve when lifted to a predetermined height.

The operation of the construction shown in Figs. 3 and 4 is precisely the same as that shown in Fig. 1, the air passing through the pipes 32 being cooled by the evaporation of the liquid in the compartments and on the covering. The air passes into the tubular compartment through the pipe 41, and is withdrawn from the said compartment through the pipes 44. The air to be cooled enters through the cooling pipe 36, and is discharged through the pipe 38. The amount of air passing is controlled by the valves 43 and 40.

The coverings 28, 33, 47 and 51 are intended to be made of any absorbent or porous material, capable of absorbing water and permitting it to evaporate, as for instance, asbestos wicking.

The construction shown in Figs. 3 and 4 is provided with liquid by means of a supply pipe 62, which leads from any suitable source of supply to the machine, and delivers to the several tubular compartments by means of branch pipes 63. The branch pipes lead from the pipe 62 and open directly into the compartments.

I claim:

1. A refrigerating apparatus comprising a tubular casing having at one end an inlet and at the other an outlet, a valve controlling the inlet, the outlet being adapted for connection with a suction device to cause a circulation of air through the casing, a pipe extending through the casing in spaced relation with respect to the side walls thereof, the ends of the casing being closed around the ends of the pipe, a covering on the said pipe within the casing, said covering being of absorbent material and adapted to be saturated with a liquid capable of being evaporated by the passage of air through the casing, means for supplying a liquid to the interior of the casing, a valve for controlling the said supplying means, a float operated by the liquid for operating the valve, the discharge end of the said pipe being adapted for connection with a suction apparatus, and a valve for controlling the said discharge end.

2. A refrigerating apparatus comprising a tubular casing having at one end an inlet and at the other an outlet, a valve controlling the inlet, the outlet being adapted for connection with a suction device to cause a circulation of air through the casing, a pipe extending through the casing in spaced relation with respect to the side walls thereof, the ends of the casing being closed around the ends of the pipe, a covering on the said pipe within the casing, said covering being of absorbent material and adapted to be

saturated with a liquid capable of being evaporated by the passage of air through the casing, the discharge end of the said pipe being adapted for connection with a suction apparatus, and a valve for controlling the said discharge end.

3. A refrigerating apparatus comprising a plurality of pipes, each pipe being coiled spirally with the coils of the spiral in the same plane, and the several coils being arranged in superposed relation, a casing inclosing the coils and having a spiral compartment for each coil, the coils being supported out of contact with the walls of the compartments of the casing, a covering of absorbent material for each pipe, means for supplying water to the covering for evaporation, the inclosing casing having an inlet at one end and an outlet at the other end adapted for connection with a suction apparatus to cause a circulation of air around the coils of the pipes, and a common collector at each end of the pipes to which the said ends are connected.

4. A refrigerating apparatus comprising a plurality of pipes, each pipe being coiled spirally with the coils of the spiral in the same plane, and the several coils being arranged in superposed relation, a casing inclosing the coils and having a spiral compartment for each coil, the coils being supported out of contact with the walls of the compartments of the casing, and an absorbent covering for each pipe.

5. A refrigerating apparatus comprising a spiral coil of pipe, a casing inclosing the coil and having a spiral compartment, the coil being supported out of contact with the inner wall of the spiral compartment, and an absorbent covering for the pipe.

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SOLON C. KEMON.