Oct. 8, 1935. J. S. FRAZER 2,016,422

HEAT EXCHANGE APPARATUS

Original Filed Nov. 5, 1931

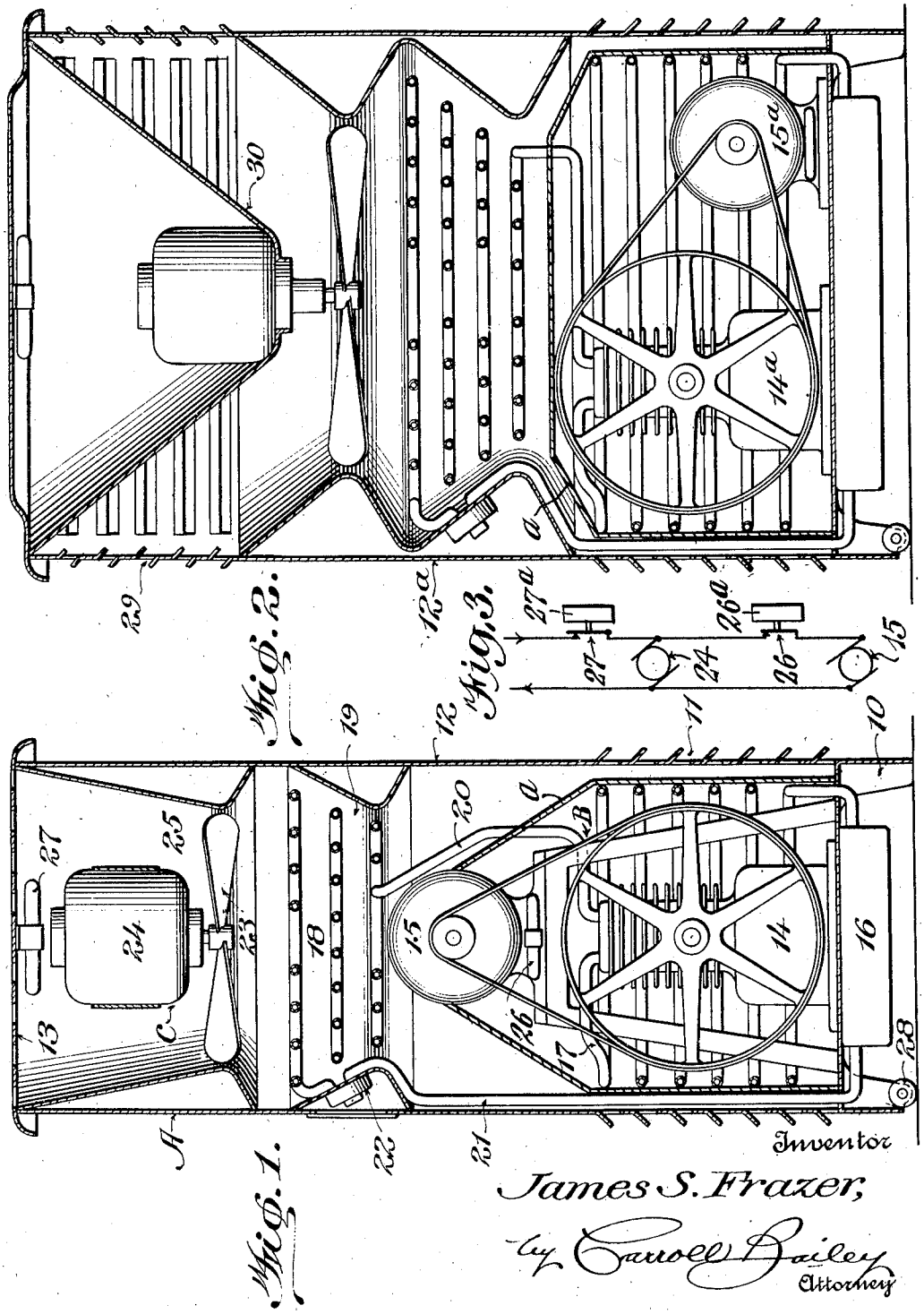


Fig. 2.

Fig. 3.

Fig. 1.

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Patented Oct. 8, 1935

2,016,422

UNITED STATES PATENT OFFICE

2,016,422

HEAT EXCHANGE APPARATUS

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Application November 5, 1931, Serial No. 573,205
Renewed May 20, 1933

14 Claims. (Cl. 62—129)

This invention relates to heat exchange apparatus, and has particular reference to a device especially adapted for use in lowering the temperature of the ambient air, as, for example, the air in the room of a dwelling, hospital or other enclosure during hot weather.

The general object of the invention is to provide a preferably portable device for the purpose stated which is of a relatively simple, inexpensive design, which is strong and durable, and which is entirely practicable and thoroughly reliable and efficient in operation.

Generally speaking, the device comprises a cabinet containing a cooling unit and means for drawing the air into the cabinet at one point, directing it over or around the cooling unit, and discharging it at another point, and in this connection a special object of the invention is to provide a construction whereby a particularly efficient circulation of the air is obtained from the energy expended in effecting the circulation.

Another special object of the invention is to provide means to render the operation of the device automatic to maintain the temperature of the ambient air substantially uniform over a long period of time, said means being adjustable so that a desired relatively low or high temperature may be obtained.

With the foregoing and other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in the novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawing and defined in the appended claims.

In the drawing:

Figure 1 is a central vertical section through a heat exchange device constructed in accordance with one practicable embodiment of the invention.

Figure 2 is a similar view illustrating a slightly alternative embodiment of the invention; and

Figure 3 is a diagram of the wiring system of the device.

Referring particularly to the embodiment of the invention illustrated in Figure 1, A designates, generally, the cabinet or housing of the device, B the cooling unit arranged therein, and C the means for effecting circulation of the air over said cooling unit.

The cabinet A, which may be formed from any suitable material into any suitable size and shape, and which may be decorated in any preferred manner so as to present an attractive appearance as an article of furniture, is illustrated in the present instance as being formed from sheet metal into vertically elongated rectangular shape, said cabinet being provided at its bottom with supporting legs 10, with louvers 11 in the side walls 12 thereof near its bottom, and with either an open top or with a top wall 13 which is suitably perforated for the egress of air from the cabinet.

The cooling unit B, which conveniently may be of any of the well known types commonly employed in household mechanical refrigerators, or of any other suitable type, is illustrated in the present instance as comprising, generally, a compressor 14, an electric motor 15 for driving said compressor, a receiver 16, a condensing coil 17 and an evaporator or cooling coil 18. According to the present arrangement the compressor 14 is disposed and suitably mounted centrally of the cabinet A near the bottom thereof, the motor 15 is suitably mounted above the compressor, the receiver is suitably mounted beneath the compressor, the condensing coil 17 which leads from the compressor to the receiver is disposed in surrounding relation to the compressor, and the evaporator or cooling coil 18 is disposed above the motor 15 and below the air circulating means C preferably within the expanding portion of a vertically extending Venturi opening 19 suitably provided within the casing, said evaporator or cooling coil 18 being composed preferably of a plurality of interconnected, vertically spaced coil elements each disposed in a horizontal plane with the turns of adjacent coils disalined vertically, and being connected at one end with the suction side of the compressor as at 20 and at its other end with the receiver 16 through a pipe 21 in which is interposed an expansion valve designated as 22.

As cooling units of the foregoing general type are well known, and since the present unit B forms, in itself, no part of the present invention, further detailed description of the same is deemed unnecessary. It may be stated, however, that while the type of refrigeration unit illustrated in the present instance is the so-called dry expansion system, the so-called flooded system is equally applicable, as is any modification of either system.

The air circulating means C is inclusive in the present instance of a fan 23 driven by an electric motor 24, said fan and motor being suitably mounted above the evaporator coil 18 of the cooling unit B with the fan disposed horizontally and within the throat of a second vertically ex-

tending Venturi opening 25 suitably provided within the top portion of the cabinet.

At 26 is designated a thermostatically operated switch which controls the operation of the condensing unit B, the thermostat (not shown in Figure 1 but designated in Figure 3 as 26a) being suitably placed in relation to the evaporator or cooling coil 18, while at 27 is designated a thermostatically operated switch which controls the operation of the fan motor 24, the thermostat (not shown in Figure 1 but designated in Figure 3 as 27a) being suitably placed so as to be responsive to the temperature of the air in the room or other enclosure in which the device may be disposed, the arrangement in this respect preferably being such as illustrated in Figure 3, that while the switch 27 for starting and stopping the fan serves also to close and open the circuit to the cooling unit motor, the latter may be started and stopped by the switch 26 while the fan motor 24 continues to operate.

Two of the legs 10 of the cabinet preferably are provided with casters or wheels 28 onto which the device may be tilted for facile transportation from one position to another, and, as is understood, the device is suitably equipped with an extension cord (not shown) having a plug for insertion in an outlet receptacle, whereby the device may be connected with a source of current.

Within the cabinet or housing A is a casing a which encloses, or substantially encloses, the compressor 14, its operating motor 15 and the condensing coil 17. This casing is suitably shaped and arranged, and if desired, is formed from heat insulating material, whereby the incoming air entering the cabinet through the louvres 11 and passing upwardly through the Venturi openings 19, 25, is protected from the heat emanating from the compressor, its operating motor and the condensing coil. Cooling of the compressor, its operating motor and the condensing coil may be effected in any desired manner, as, for example, by means of a fan driven by the motor 15, or through the medium of cooling water, provision for the circulation of which, particularly around the condensing coil, may be made in any suitable or desired manner.

The mode of operation of the device is apparent and as follows: The fan and the cooling unit motors are connected with a source of current and both operate, thereby causing the evaporator coil 18 to become cold and causing air to be drawn by the fan through the louvers 11, up through the Venturi opening 19 and over the evaporator coil 18, through the Venturi opening 25, and finally to be expelled through the open upper end of the cabinet or through the openings in the top wall 13 thereof, as the case may be. The air drawn into the cabinet through the louvers 11 is taken from the room or other enclosure in which the device may be disposed and in its travel through the cabinet is cooled by contact with the evaporator coil, so that cool air is delivered from the top of the device into the room, the temperature of which is maintained substantially uniform at any desired degree within practicable limits due on the one hand to the adjustment of the expansion valve 22 and on the other hand to the provision for automatically starting and stopping the operation of the cooling unit and the fan 24. Due to the provision of the Venturi openings 19 and 25 a particularly efficient flow of air through the cabinet is obtained.

Referring now to the embodiment of the device illustrated in Figure 2 of the drawing, it will be observed that the device is inclusive of the same major elements arranged in the same general relation as in the embodiment of the invention illustrated in Figure 1, except that the compressor 14a and its operating motor 15a are disposed in side to side relation and provision is made for egress of air from the cabinet through louvers 29 in the upper end portions of the side walls 12a thereof instead of through the top of the cabinet, a baffle element 30 of conical or pyramidical shape being disposed within the upper end portion of the cabinet with its apex directed downwardly so as to deflect the air laterally through the louvers 29.

Manifestly, according to either embodiment of the invention, a heating element may be installed in a suitable position inside the cabinet, thereby to adapt the device for raising instead of lowering the temperature of the ambient air, as for example, the air in the rooms of dwellings, hospitals and the like during cool or damp and chilly weather.

Regarding the cooperation of the Venturi tubes with the evaporator or cooling coil and the air circulating fan it is pointed out that the air in passing through the constricted portion of the lower Venturi tube and in expanding in the upper or expanding portion of said tube has a turbulent motion or atomizing effect imparted thereto, so that by locating the cooling coil in the expanding portion of said tube there is reasonable assurance of all of the air being subjected to the cooling action of the coil. On the other hand, the lower portion of the upper Venturi tube assists the fan in gathering the air from the space between the Venturi tubes and serves to prevent the formation of dead air pockets in said space, thus assisting in obtaining efficient cooling of the air by the coil. Moreover, the expanding portion of the upper Venturi tube causes the air to spread and to issue from the top of the cabinet otherwise than as a blast.

From the foregoing description considered in connection with the accompanying drawing, it is believed that the construction, operation and advantages of the invention will be clearly understood. It is desired to point out, however, that while only certain specific, more or less conventional embodiments of the invention have been illustrated and described, the novel features of combination and arrangement constituting the invention obviously are readily capable of embodiment in various other mechanical structures within the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A heat exchange device of the character described comprising a cabinet having means for the ingress and egress of air at the bottom and top thereof, respectively, means providing a pair of Venturi openings within said cabinet spaced one above the other between said air ingress and egress means, an air temperature changing unit disposed within said cabinet and inclusive of an air temperature changing coil disposed within the expanding portion of the lower of said Venturi openings, and an air circulating fan disposed within the upper of said Venturi openings.

2. A heat exchange device of the character described comprising a cabinet having means for the ingress and egress of air at spaced points, respectively, means providing a Venturi opening within said cabinet between said air ingress and egress means, means for producing a flow of air through

said cabinet, and an air temperature changing unit inclusive of an air temperature changing element disposed within the expanding portion of said Venturi opening.

3. A heat exchange device of the character described comprising a cabinet having means for the ingress of air at the bottom thereof and means for the egress of air in the sides near the top thereof, outwardly flaring baffle deflector means disposed within the top portion of the cabinet for directing air laterally outward through said air egress means, means for producing a flow of air through the cabinet, and air temperature changing means disposed within the cabinet in the path of flow of air passing therethrough.

4. A heat exchange device comprising a cabinet having spaced means for the ingress and egress of air, motor operated means for producing a circulation of air through said cabinet, motor operated means for changing the temperature of the air passing through the cabinet, the motors of said two motor operated means being connected in parallel, thermally responsive means connected in the circuit between the motors for controlling the operation of said air temperature changing means independently of the operation of said air circulating means, and another thermally responsive means connected in the circuit between the motor of the air circulating means and the source of current for controlling both motors.

5. A heat exchange device comprising a cabinet having spaced means for the ingress and egress of air, motor operated means for producing a circulation of air through said cabinet, motor operated means for changing the temperature of the air passing through the cabinet, thermally responsive means for controling the operation of said air temperature controlling means independently of the operation of said air circulating means, and thermally responsive means for controlling the operation of said air circulating means, said second mentioned thermally responsive means being also in controlling relation to the temperature changing means.

6. A heat exchange device of the character described comprising a cabinet having means for the ingress and egress of air at spaced points, respectively, means providing a pair of Venturi openings within said cabinet between said air ingress and egress means, a fan disposed within the Venturi opening nearest the air egress means for creating a circulation of air through the cabinet, and an air temperaure changing unit inclusive of an air temperature changing element disposed within the expanding portion of the other Venturi opening.

7. A heat exchange device of the character described comprising a cabinet having means for the ingress and egress of air at spaced points, respectively, means providing a pair of Venturi openings within said cabinet between said air egress and ingress means, a fan disposed within one of said Venturi openings for creating a circulation of air through the cabinet, and an air temperature changing unit inclusive of an air temperature changing element disposed within the expanding portion of the other Venturi opening.

8. A heat exchange device of the character described comprising a cabinet having spaced means for the ingress and egress of air, means providing a Venturi opening within said cabinet between said air ingress and egress means, means for producing a flow of air from the air ingress means through the Venturi opening and outwardly through the air egress means, and an air temperature changing element disposed within said cabinet between the constricted portion of the Venturi opening and the air egress openings.

9. A heat exchange device of the character described comprising a cabinet having spaced openings for the ingress and egress of air, means providing a pair of Venturi openings within said cabinet between said air ingress and egress openings, means for producing a flow of air from the ingress openings through the Venturi openings and outwardly through the air egress openings, and an air temperature changing element disposed within said cabinet in the path of flow of air passing therethrough.

10. A heat exchange device of the character described comprising a cabinet having spaced air ingress and egress openings, means for producing a flow of air from said air ingress openings through the cabinet and outwardly therefrom through said air egress openings, means providing a Venturi opening within the cabinet disposed to have the air pass therethrough during its flow through the cabinet, and an air temperature changing device disposed within the expanding portion of said Venturi opening, said air temperature changing device comprising a plurality of interconnected coil elements spaced axially of the Venturi opening with the turns of adjacent coil elements disalined in the direction of the axis of the Venturi opening.

11. A heat exchange device of the character described comprising a cabinet having spaced air ingress and egress openings, means for producing a flow of air from said air ingress openings through the cabinet and outwardly therefrom through said egress openings, means providing a Venturi opening within the cabinet disposed to have the air pass therethrough during its flow through the cabinet, and an air temperature changing device disposed within the expanding portion of said Venturi opening, said air temperature changing device comprising a plurality of interconnected coil elements spaced axially of the Venturi opening and each disposed in a plane substantially at right angles to the axis of the Venturi opening with the turns of adjacent coil elements disalined in the direction of the axis of the Venturi opening.

12. A heat exchange device of the character described comprising a cabinet having spaced apart air ingress and egress means, means for producing a flow of air from said air ingress means through the cabinet and outwardly therefrom through said air egress means, means providing a Venturi opening within the cabinet disposed to have the air pass therethrough during its flow through the cabinet, said Venturi opening having its expanding portion disposed towards the air egress means, and an air temperature changing element disposed between the constricted portion of said Venturi opening and said air egress means.

13. A heat exchange device of the character described comprising a cabinet having spaced apart means for the ingress and egress of air, means for producing a flow of air from said air ingress means through the cabinet and outwardly therefrom through said air egress means, means providing a pair of Venturi openings within the cabinet disposed serially to have the air pass successively therethrough during its flow through the cabinet, said Venturi openings being disposed with their expanding portions towards the air egress means, the air flow producing means comprising a fan disposed for cooperation with

one of said Venturi openings, and an air temperature changing element disposed between the constricted portion of the other of said Venturi openings and said air egress means.

14. A heat exchange device of the character described comprising a cabinet having means for the ingress and egress of air at spaced points, respectively, means to produce a flow of air through said cabinet, Venturi means to impart turbulence to the air within a predetermined portion of the cabinet between said air ingress and egress means, and an air temperature changing unit disposed within said portion of said cabinet.

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