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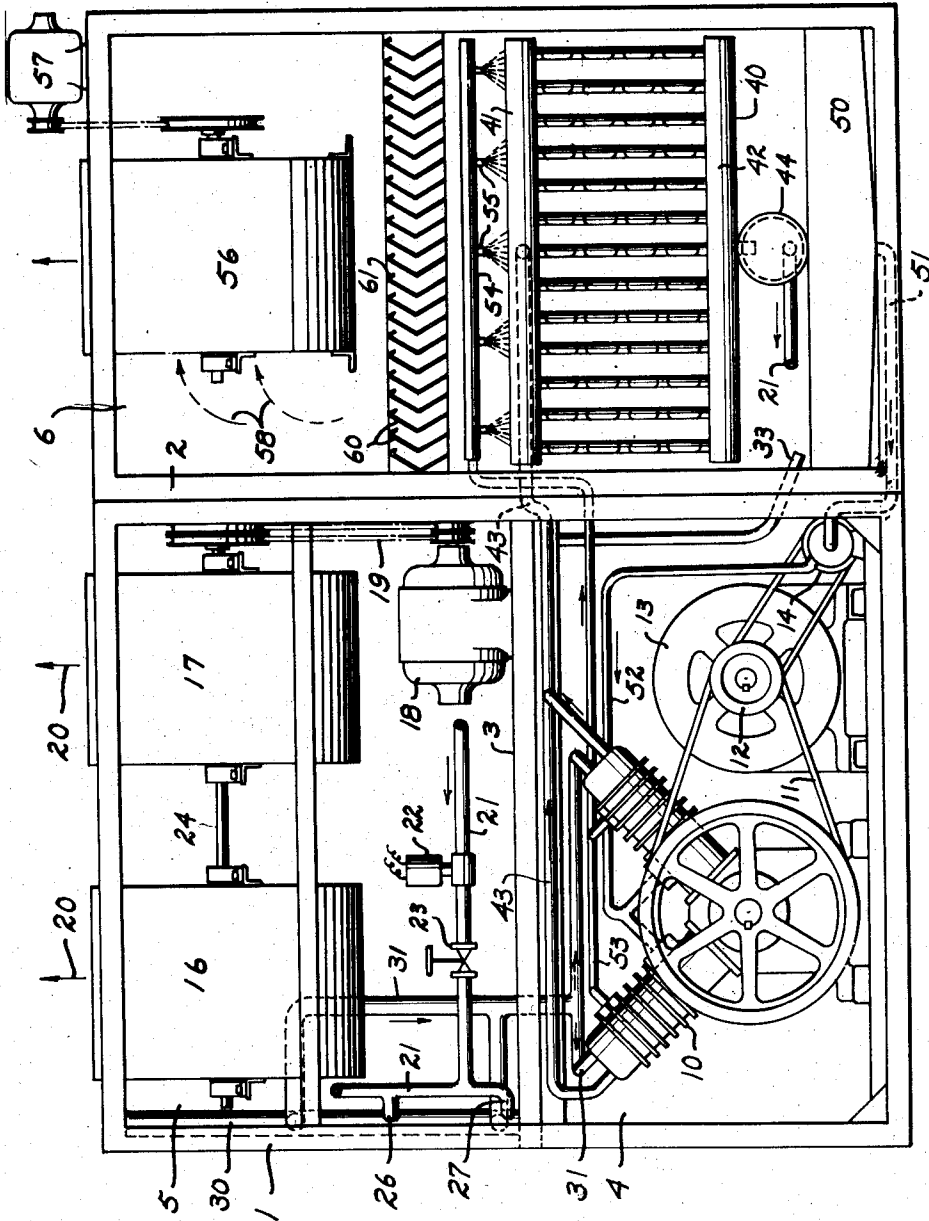
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2,297,928

AIR CONDITIONING UNIT

Filed May 17, 1940

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

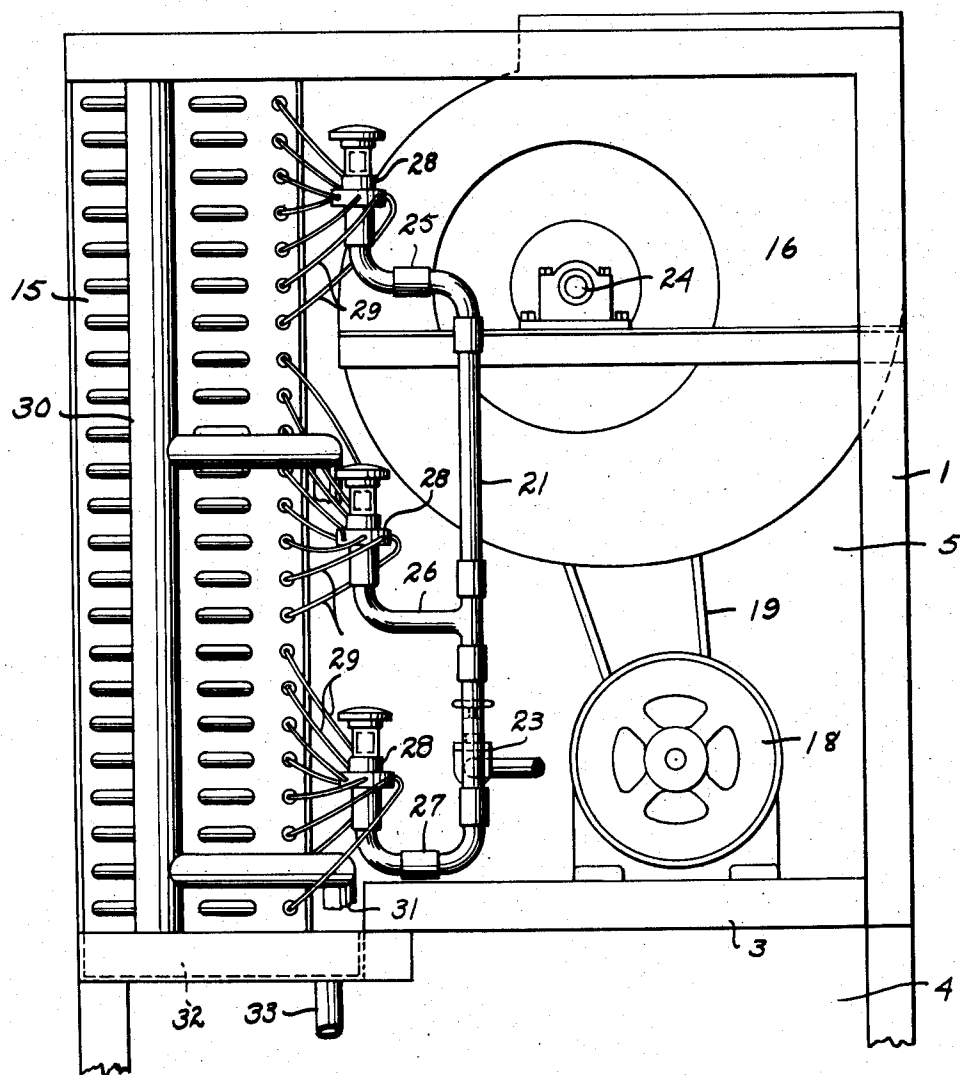


Fig. 2.

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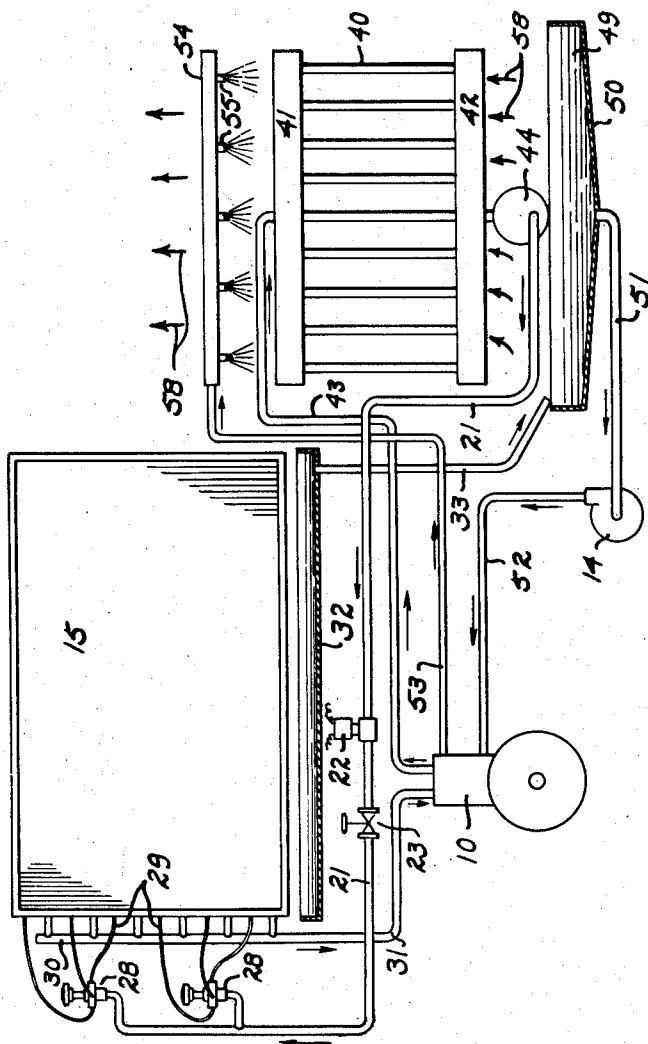


Fig. 3.

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UNITED STATES PATENT OFFICE

2,297,928

AIR CONDITIONING UNIT

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Application May 17, 1940, Serial No. 335,757

2 Claims. (Cl. 62-140)

This invention relates to air conditioning apparatus of the single unit type and more particularly to a composite unit which is highly efficient and which embodies novel constructional features and functions.

The primary object of the invention is to provide new and improved air conditioning unit of the type described.

Another object is to provide a device of the class described which requires a minimum of installation expense.

Still another object is to provide a novel construction for maintaining the desired operating temperature of the compressor and also effecting the desired cooling of the refrigerant after heat has been abstracted thereby.

A further and more specific object of the invention is to provide an air conditioning device having an evaporative condenser unit which includes a condenser coil to receive compressed refrigerant from the compressor, liquid being sprayed over the condenser coil and air being circulated counter current to the liquid and in contact with the liquid on the coil so that the liquid and refrigerant are cooled.

Another object is to provide for adequate cooling of the compressor unit by circulating the cooled liquid through cylinder cooling jackets as such liquid is conveyed from beneath the condenser coil to the spray nozzles thereabove.

Other objects and advantages will, together with the foregoing, be apparent from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a side elevation of an illustrative embodiment of the invention, such view showing the respective elements of the unit mounted within a frame from which the covering panels are removed so the structure and arrangement of parts are more clearly illustrated;

Fig. 2 is an end elevational view of the expander and cooling section of the unit;

Fig. 3 is a diagrammatic view showing the arrangement of the components parts of the device and the system for circulation of the refrigerant and the coolant.

The illustrated embodiment of the invention shown in the drawings comprises a frame 1 having a vertical frame member 2 and a horizontal frame member 3 which separate the construction into a compressor section 4, a cooling section 5 and evaporative condenser section 6.

Mounted within the section 4 is a compressor 10 which is driven by means of a multiple V-belt 11 from the pulley 12 on the compressor motor 13. A second V-belt drive from the pulley 12 is also used for driving a centrifugal pump 14 to serve a purpose which will more fully appear.

Within the section 5 there is mounted a finned cooling coil 15 within which the compressed re-

frigerant is expanded in order to abstract heat from air to be conditioned such air being drawn thru the cooling coil by means of centrifugal blowers 16 and 17 mounted upon a common shaft 24 driven by a motor 18 through V-belt 19. It is to be understood that the section 5 is enclosed by means of suitable side walls on the frame 1 except for an opening to the finned cooling coil 15 so that air which is forced from the fans 16 and 17 in the direction indicated by the arrows 20, will be drawn thru such cooling coil and heat will be abstracted therefrom.

Liquid refrigerant is conducted to the cooling coil 15 thru a conduit 21 which is provided with solenoid valve 22 connected to the electric control circuit for the unit so that such flow line will be closed when for any reason the unit is de-energized. A manually operated valve 23 is also provided to enable manual control of the flow of the refrigerant thru the conduit 21. Branch connections 25, 26 and 27 from the conduit 21 conduct the refrigerant to a plurality of multi-port refrigerant expansion valves 28 from which the refrigerant is conducted through tubes 29 to the interior of the expansion or cooling coil 15, whereby desired expansion of and consequent heat absorption by the refrigerant is brought about.

The cooling coil 15 is provided with a return header 30 thru which the expanded gases are collected and are conducted thru conduit 31 and returned to the compressor 10.

The evaporative condenser section 6 comprises a condenser coil 40 having upper and lower headers 41 and 42. The compressed refrigerant from the compressor 10 is conducted to the upper header 41 thru the conduit 43. The refrigerant thence moves downwardly thru the condenser coil 40 and is collected in a cylinder 44 in liquid form, whence it is conducted thru the pipeline 21 to the expansion and cooling coil 15 as already indicated.

Below the condenser coil 40 is provided a tank 50 from which liquid is drawn thru the pipeline 51 by the centrifugal pump 14. This liquid is conducted thru the conduit 52 to the cylinder cooling jackets on the compressor 10 and is exhausted from these jackets thru the conduit 53 to a header 54 positioned above the condenser coil 40 and having a plurality of downwardly extending jets 55 which cause the cooling liquid from the tank 50 to be sprayed upon the condenser coil 40. As this cooling liquid moves downwardly over the condenser coil, air is drawn upwardly counter current to the movement of the cooling liquid by the operation of the circulating fan 56 mounted within the evaporative condenser section 6 of the unit. This fan is driven by means of electric motor 57 mounted on the top of the unit. Intermediate the condenser coil 40

and the exhaust opening from the housing surrounding the evaporative condenser section of the unit are mounted a plurality of baffle plates 50 having recurved ends as shown at 61, such construction being designed to entrap any liquid particles which tend to move upwardly and be carried from within the evaporative condenser section by the stream of air passing therethru.

It is to be understood that the housing surrounding section 6 is provided with suitable side openings proximate the lower portion of the condenser coil whereby cool air which is drawn therethru counter-current to the movement of the cooling liquid will provide adequate cooling of the condenser coil so that liquefaction of the refrigerant takes place and also the cooling liquid, preferably water, is sufficiently lowered in temperature to serve the desired purpose of cooling the compressor and thereafter being returned to the condenser coil.

Mounted within the cooling section 5 and beneath the cooling coil 15 is a pan 32 which is adapted to collect condensed moisture from the coil 15. Such moisture is conducted to the body of liquid 49 in the tank 50 by way of the drain pipe 33 which extends from the pan 32 to the tank 50. By means of this arrangement moisture is removed from the air which is drawn through the cooling coil 15 and such moisture is thereafter utilized, together with the body of water 49 maintained in the tank 50, for effecting desired cooling action upon the compressor and the compressed refrigerant within the condensing coil 40.

The operation of the device as above described will be apparent from reference to Fig. 3 of the drawings in which the principal elements of the device already described are shown. The refrigerant is compressed by the compressor 10 and is conducted thru the conduit 43 to the upper header 41 of the condenser coil 40. The refrigerant is cooled within the condenser coil whereby liquefaction takes place and the liquid refrigerant is collected in the chamber 44 whence it is conducted thru the conduit 21 to the multiport expansion valves 28 and the tubes which are instrumental in bringing about the desired expansion of the refrigerant within the cooling coil 15. The expanded refrigerant is conducted from the cooling coil 15 thru the header 30 and returned thru the conduit 31 to the intake of the compressor 10 whereupon a repetition of the cycle of the refrigerant takes place.

A cooling liquid, preferably water, is maintained at a desired level in the tank 50 and is constantly withdrawn therefrom thru the conduit 51 by means of the centrifugal pump 14. This liquid is exhausted from the pump 14 thru the conduit 52 to the cooling jacket of the cylinders of the compressor 10 and is thence conducted thru the pipe 53 to the header 54 and is sprayed thru nozzles 55 upon the condenser coil 40, whence it moves downwardly under gravity and is returned to the tank 50.

Air is drawn into the evaporative condenser housing below the condenser coil 40 and moves upwardly therethru as indicated by the arrows 58. In this manner a portion of the cooling liquid is evaporated and heat is abstracted from the condenser coil. At the same time cooling of the liquid takes place preliminary to reuse of such liquid in the cooling system in the manner just described.

While the foregoing description is directed to specific apparatus, it is to be understood that such construction is merely illustrative of the

invention. Broadly the invention comprehends a novel construction and combination whereby the objects of the invention are realized.

What is claimed is:

1. An air conditioning system of the unit type comprising the combination of, a frame, means separating said frame into a compressor section in a lower portion of the frame and at one end thereof, an air conditioning section above said compressor section, and an evaporative condenser section extending vertically adjacent said compressor and said air conditioning sections, refrigerating means in said frame and comprising a motor and a compressor operatively interconnected and mounted within the compressor section, a condensing coil within the evaporative condenser section, a conduit connected to the outlet of the compressor and said coil to conduct the compressed refrigerant to the coil, a tank for coolant liquid below said coil, a pump operatively connected to said motor, a pipe line from said tank to said pump, means including a plurality of spray nozzles for conducting liquid from the exhaust port of the pump and spraying the coolant liquid upon said condensing coil, an exhaust fan within the frame above the coil for circulating air over the coil counter current to the movement of the coolant liquid, an expansion coil in said air conditioning section of the frame, an outlet conduit from said condensing coil to the expansion coil and including a plurality of expansion valves for admitting the compressed refrigerant to the cooling coil, and fan means mounted within said cooling section for circulating air from the exterior of the frame through said cooling coil whereby such circulated air is conditioned.

2. An air conditioning system of the unit type comprising the combination of, a frame, means separating said frame into a compressor section in a lower portion of the frame and at one end thereof, an air conditioning section above said compressor section, and an evaporative condenser section extending vertically adjacent said compressor and said air conditioning sections, refrigerating means in said frame and comprising a motor and a compressor operatively interconnected and mounted within the compressor section, a condensing coil within the evaporative condenser section, a conduit connected to the outlet of the compressor and said coil to conduct the compressed refrigerant to the coil, a cylinder comprising a refrigerant chamber connected to the lower end of said condensing coil to receive the cooled refrigerant from the coil, a tank for coolant liquid below said coil, a pump operatively connected to said motor, a pipe line from said tank to said pump, means including a plurality of spray nozzles for conducting liquid from the exhaust port of the pump and spraying the coolant liquid upon said condensing coil, an exhaust fan within the frame above the coil for circulating air over the coil counter current to the movement of the coolant liquid, an expansion coil in said air conditioning section of the frame, an outlet conduit from said condensing coil to the expansion coil and including a plurality of expansion valves for admitting the compressed refrigerant to the cooling coil, and fan means mounted within said cooling section for circulating air from the exterior of the frame through said cooling coil whereby such circulated air is conditioned.

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