Aug. 8, 1961 C. A. MANETTA ET AL 2,995,345

AIR CONDITIONING APPARATUS

Filed Nov. 20, 1957 3 Sheets-Sheet 1

FIG. 1

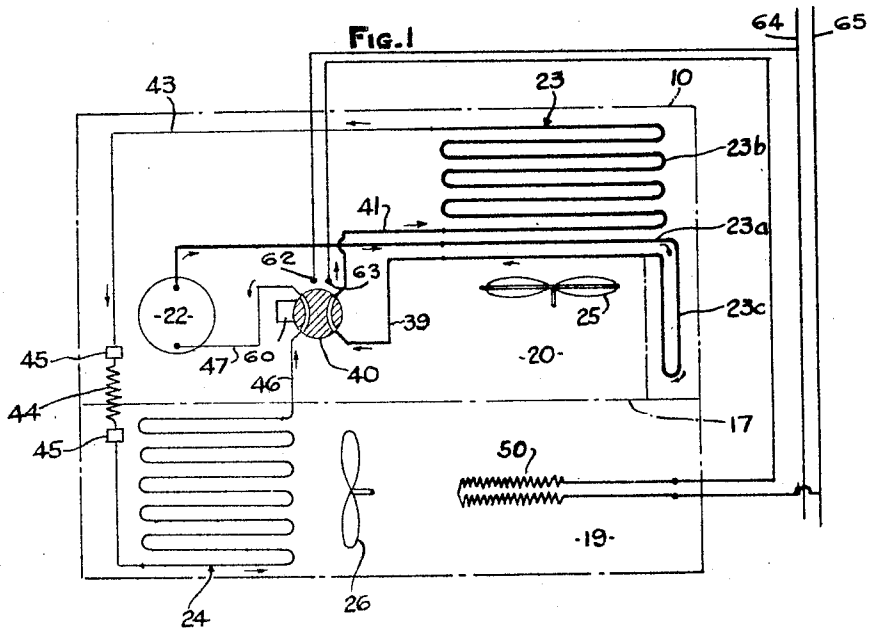
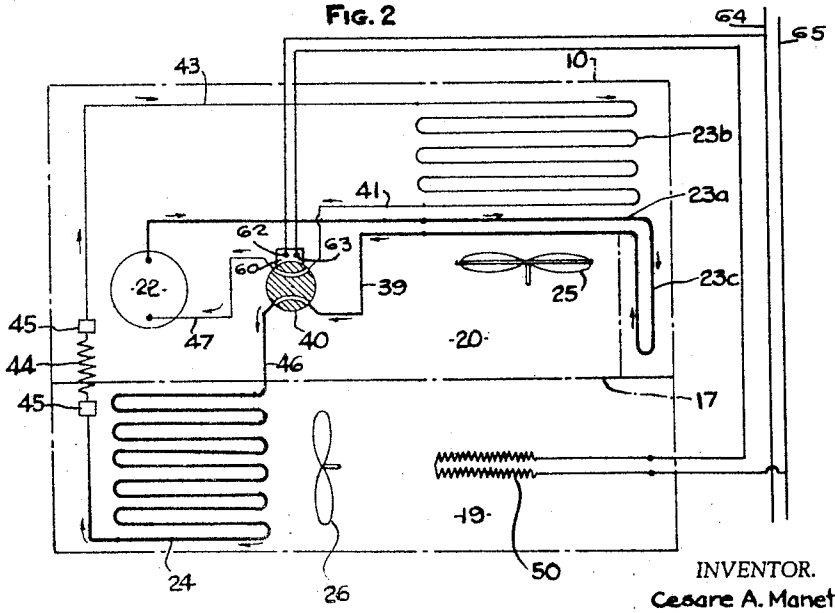


FIG. 2



INVENTOR.
Cesare A. Manetta
Walter W. Weiss

BY Joseph D. Lear
Atty.

Aug. 8, 1961 C. A. MANETTA ET AL 2,995,345

AIR CONDITIONING APPARATUS

Filed Nov. 20, 1957 3 Sheets-Sheet 2

FIG. 3

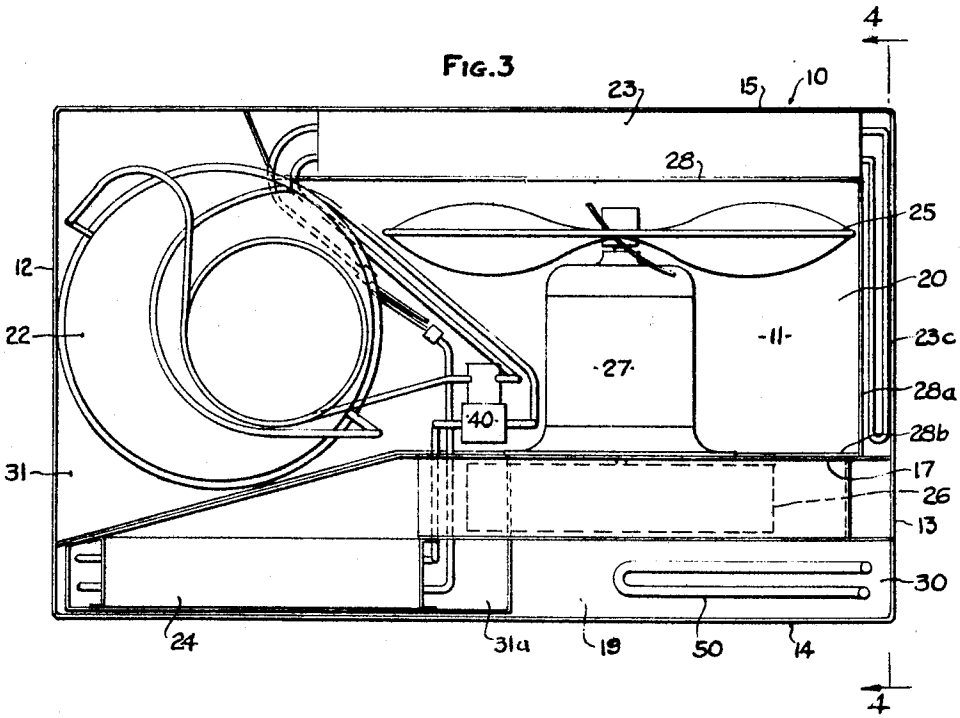
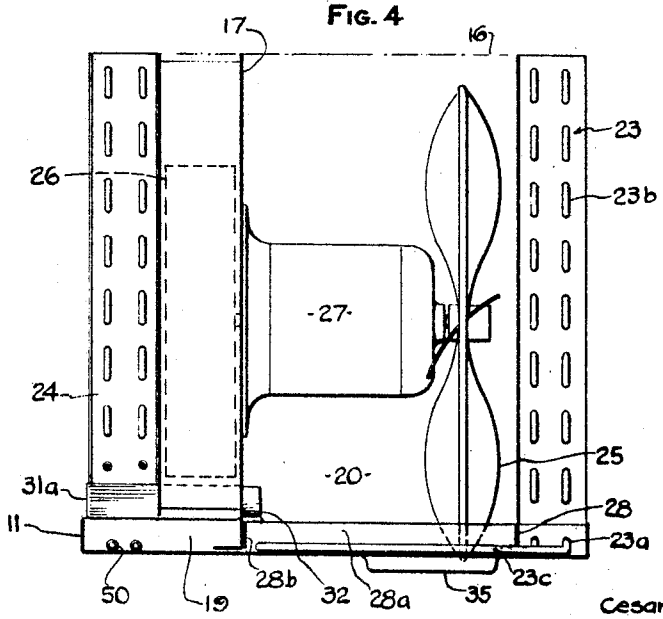


FIG. 4



INVENTOR.
Cesare A. Manetta
Walter W. Weiss

BY

Joseph D. Liar
Atty.

Aug. 8, 1961 C. A. MANETTA ET AL 2,995,345

AIR CONDITIONING APPARATUS

Filed Nov. 20, 1957 3 Sheets-Sheet 3

FIG. 6

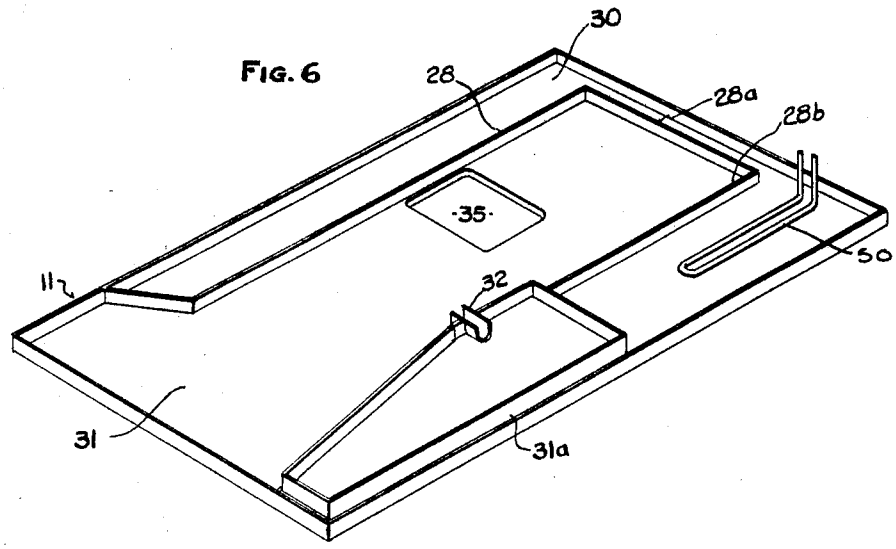
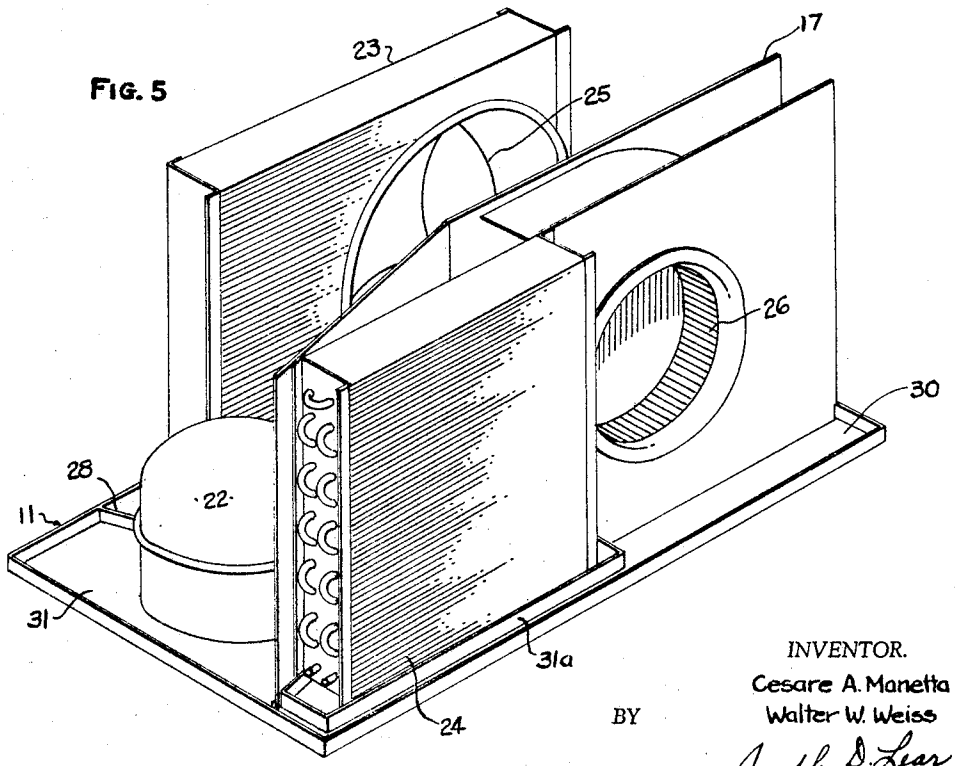


FIG. 5



INVENTOR.
Cesare A. Manetta
Walter W. Weiss
BY Joseph D. Lear
Atty

United States Patent Office 2,995,345
Patented Aug. 8, 1961

2,995,345

AIR CONDITIONING APPARATUS

Cesare A. Manetta, Kenmore, and Walter W. Weiss, Tonawanda, N.Y., assignors to Fedders Corporation, Maspeth, N.Y.

Filed Nov. 20, 1957, Ser. No. 697,617
6 Claims. (Cl. 257—271)

This invention relates to air conditioning units which utilize a refrigeration system of the reversible cycle or heat pump type.

With particular reference to the application of the heat pump principle to systems of the smaller type such as in room coolers, much effort has been expended without marked success in attempting to provide a unit that would be trouble-free throughout the entire outside air temperature range. Such systems have been characterized by increased circuit and control complexity bordering on the impractical and resulting in decreased efficiency reflected either in current consumption beyond prescribed limits, or in partial failure at certain critical points in the outside temperature range.

The problems encountered have broadly been the maintenance of the required capacity in the entire temperature range in the face of the impeding influence of frosting and ice formation all within the relatively small confines and environment of a unit cooler. More specifically, the often severe frosting of the outside coil when on the heating cycle has raised the attendant problem of defrosting and water disposal which has resulted in water overflow and icicle formation together with the more dangerous ice accumulation on fan blades. The defrosting in such instances has been under control of a defrosting thermostat, which obviously did not solve the above problems, but simply reversed the circuit periodically, and in so doing, reflected an inefficiency of the total system with the concurrent deficiencies of improper compressor and motor operation and objectionable noise levels as the result of such frequent stoppages.

It is an object of the present invention to provide a defrosting method that will function properly either on the room heating or cooling cycles under any outside temperature and/or humidity condition, and in accomplishing this result, to utilize or recover the energy so expended for heating or cooling. Additionally, at low outside temperatures, when humidification is greatly desired, the waste defrost waters are flashed into steam and advantageously used for humidifying, while the fan is isolated entirely from the dangers of ice accumulation. On the cooling cycle, the unit is reversed automatically to conventional cooling operation without control or functional complication.

Other features of the invention will be more clearly understood by perusal of the specifications and accompanying drawings wherein:

FIG. 1 is a diagrammatic view of the circuit of the present invention when on a cooling cycle.

FIG. 2 is a diagrammatic view of the same circuit when on a heating cycle.

FIG. 3 is a plan view of an air conditioning unit with the casing top removed.

FIG. 4 is a section on the line 4—4 of FIG. 3.

FIG. 5 is a perspective view of the unit with the top and sides of the casing removed.

FIG. 6 is a perspective view of the base of the unit.

The invention is shown organized with a rectilinear cabinet **10** of the window mounted type having a flanged base **11**, vertical side, walls **12** and **13**, perforated front and rear walls **14** and **15** respectively, and a top **16**. The cabinet is provided with an interior vertical wall **17** which divides the space therein into an inside compartment **19**, and an outside compartment **20**

communicating respectively with the room to be conditioned and the outside of the dwelling.

The elements of a heat pump system are carried on the base **11** of the cabinet **10** including a compressor **22** and outside coil **23** located in the outside compartment **20** and an inside coil **24** disposed within the inside compartment **19**. A fan **25** of the slinger type located adjacent the face of the coil **23**, and a coaxial blower wheel **26** in compartment **10** are driven by a common motor **27** carried adjacent the wall **17**.

It is proposed to isolate the water drainage from each coil **23** and **24** into separate receivers or sumps, and referring to FIG. 3 and the base structure illustration in FIG. 6, it will be seen that the bottom of the outside coil **23** is encompassed by a low wall **28** secured in liquid-tight relation to the base **11**. The wall **28** is continued with an angularly extending portion **28***a* to the wall **17** and then is formed with an extension **28***b* contiguous with the wall **17**. Thus, the wall **28** together with the flanged base **11** provides a sump **30** which is roughly U shaped in outline and which has portions within both compartments **19** and **12** within the areas of the outside coil **23** and inside blower **26**. The remaining area of the base **11** as defined by the wall **28**, **28***a*, **28***b*, provides a second sump **31** within which are located the compressor **22** and the outside fan **25**. The area beneath the inside coil **24** is occupied by a pan or sump **31***a* which in effect may be considered a part of the sump **31** since it communicates therewith through an overflow weir **32**.

In FIG. 4, it will be seen that the pan **31***a* is elevated from the base **11**, thus, water deposited from the overlying coil **24** in the pan **31***a*, will drain through the weir **32** into the sump **31**. The base **11** contains a depressed pocket **35** in the sump **31**, which is entered by the rim of the fan **25** so that water may be lifted thereby and flung over the wall **28** against the outside coil **23** (FIG. 4).

As thus far described, the structure and components of the system with the exception of the described sump arrangement are of a familiar type. In FIG. 1, the refrigerant circuit is shown during a cooling cycle, wherein the compressor **22** delivers compressed refrigerant to outside coil **23** which acts as a condenser. It will be noted that this coil consists of two independent sections **23***a* and **23***b* (FIG. 5), the former or lower section **23***a* having one end directly connected to the compressor **22** and its remaining end leading through a tube **39** to a four way valve **40**, whence it is connected to the remaining section **23***b* by a tube **41** so that on the cooling cycle, the sections **23***a* and **23***b* are connected in series and in effect comprise a single coil. Loop **23***c* of the coil section **23***a* projects at right angles from the coil **23** and lies within the confines of the angularly extending portion of the sump **30**.

Continuing the description of the cooling circuit, the free end of the coil section **23***b* is connected to the inside coil **24** by a tube **43**, in which is interposed a suitable control device such as a capillary tube **44** having filters **45** at each extremity thereof. The remaining end of the coil **24** leads through tube **46** to the four way valve **40** which in the position shown in FIG. 1 connects the coil **24** to the suction side of the compressor **22** through a tube **47**.

During this cycle of operation, condensation from the cold inside coil **24** will deposit into the underlying pan **31***a* and thence be directed to the pocket **35** of the sump **31** for dissipation against the coil **23** as previously mentioned.

On the reverse or heating cycle (FIG. 2), the four way valve **40** is operated to reverse the cycle and deliver compressed refrigerant to the inside coil **24**. It will be seen in FIG. 2 that the refrigerant first passes through

the lower section 23*a* of the outside coil 23 before being directed by the valve 40 to the inside coil 24 via tubes 39 and 46. After passing through the coil 24, the refrigerant is directed through the tube 43 where it is metered by the capillary control 44 to the outside coil, section 23*b*, and thence to the valve 40 and back to the suction side of the compressor 22 through tube 47.

It will be observed that the lower section 23*a* including loop 23*c* of the coil 23 has been placed in series with the inside coil 24 and accordingly is in effect a part of the condenser portion of the system. In FIG. 2, the hot or condenser portions of the circuit have been shown in heavy lines to accentuate this point. Since the condensate from the outside coil 23 is deposited only in the sump 30, such water is brought in direct contact with the relatively hot coil sections 23*a* and 23*c* and thus it is prevented from freezing in its flow under the wall 17 and into the portion of the sump 30 in the inside compartment 19, where it is subjected to the moving air stream passing into the blower 26 and eventual evaporization.

In sections of the country subjected to more severe winter conditions, it has been found advantageous to provide an electric heater 50 disposed in the inside compartment portion of the sump 30 (FIG. 6). The heater 50 is located on the base 11 and it evaporates the entering water into steam, and, since it is located in the suction zone of the blower 26, such steam is entrained with the air in its direction through the inside coil 24 and into the heated spaces of the dwelling. It is proposed to energize the heater 50 only on the heating cycle of operation by any suitable control means, for example, when the valve 40 is of the solenoid operated type, its operation will also energize the circuit for the heater 50. This can be accomplished in numerous manners, for example the valve 40 may carry a switch 60, which when moved with the valve from the inoperative position of FIG. 1 to the position of FIG. 2 connects terminals 62, 63 to complete a circuit for the coil 50 to a power source, 64, 65. Another example of mechanism capable of automatically effecting energization of the heater when the valve is turned from cooling to heating position, is found in U.S. Patent No. 608,100, issued July 26, 1896, to J. L. Bixby, which discloses a valve and switch combination generically equivalent to the one herein employed.

In the operation of the unit in normal cold weather conditions, it has been observed that the tempering influence of the coil section 23*a* has discouraged frost formation on the overlying coil 23 and has caused a condition where a constant flow of water is directed to the water evaporating means 50. Under more severe conditions, the effect of coil sections 23*a* and 23*c* is adequate to prevent the water in the sump 30 from freezing, and evaporation of such water will continue until the coil 23 is completely ice blocked, necessitating a defrosting operation, whereupon after such operation, the large quantities of water are easily received in the sump 30 without the danger of freezing. It will be understood that the heat energy expended by the coil 50, supplements the heating effect of the inside coil 24, and therefore, rather than being a waste of power, may be considered a booster heater, which supplies extra heat when it is most needed and which additionally acts as a humidifying means for water received from the outside coil 23. During such heating cycle operations, the sump 31 and the pocket 35 under the fan 25 are maintained in a completely dry condition, and thus even under the most severe temperature conditions, the fan 25 is protected against ice accumulation, which has been prevalent in prior art structures.

It will be understood that the foregoing description is directed to a principle of operation, which although

shown applied to a specific type of air conditioning unit, may obviously be broadly used in other types of units without departing from the inventive concept as set forth in the following claims.

We claim:

1. In an air conditioning unit, a cabinet having inside and outside compartments, a reversible cycle refrigeration system in said cabinet including a coil and an air moving means therefor in each compartment, a pair of separate condensate drainage sumps each extending from an area in one compartment under the coil therein to an area closely adjacent the air moving means of the coil in the other compartment, an electric heating element in said inside compartment disposed to heat the portion of the sump adjacent the air moving means therein, and means for selectively controlling the operation of said system for producing either a heating or a cooling cycle, said last-mentioned means being effective to render said element operative only when said system is on a heating cycle.

2. Apparatus according to claim 1, additionally comprising a supplemental coil constantly connected to said system as a part of the condenser portion thereof and underlying the coil in the outside compartment and effective to add icing-preventing heat to the outside coil and the sump underlying the same during heating cycles and effective to augment the condensing capacity of the system during cooling cycles.

3. Apparatus according to claim 2, said supplemental coil having an extension closely thermally associated with the sump portion connecting the area under the coil in the outside compartment to the area adjacent the air moving means in the inside compartment to prevent freezing of condensate in said connecting sump portion during a heating cycle.

4. In an air conditioning unit, a cabinet having inside and outside compartments, a reversible cycle refrigeration system in said cabinet including a coil and an air moving means therefor in each compartment, a pair of separate condensate drainage sumps each extending from an area in one compartment under the coil therein to an area closely adjacent the air moving means of the coil in the other compartment, means for selectively controlling the operation of said system for producing either a heating or a cooling cycle in the coils thereof, and a supplemental coil constantly connected to said system as a part of the condenser portion thereof and underlying the coil in the outside compartment and effective to add icing-preventing heat to the outside coil and the sump underlying the same during heating cycles and effective to augment the condensing capacity of the system during cooling cycles.

5. Apparatus according to claim 4, said supplemental coil having an extension closely thermally associated with the sump portion connecting the area under the coil in the outside compartment to the area adjacent the air moving means in the inside compartment to prevent freezing of condensate in said connecting sump portion during a heating cycle.

6. Apparatus according to claim 4, said cabinet additionally comprising a pan-like base having raised wall-like portions defining said sumps and defining a laterally disposed relatively narrow channel connecting the area under the outside coil to the area closely adjacent the air moving means in the inside compartment, and said extension of said supplemental coil lying in and along said channel.

References Cited in the file of this patent

UNITED STATES PATENTS

2,806,674	Biehn	Sept. 17, 1957
2,811,023	Lathrop	Oct. 29, 1957