

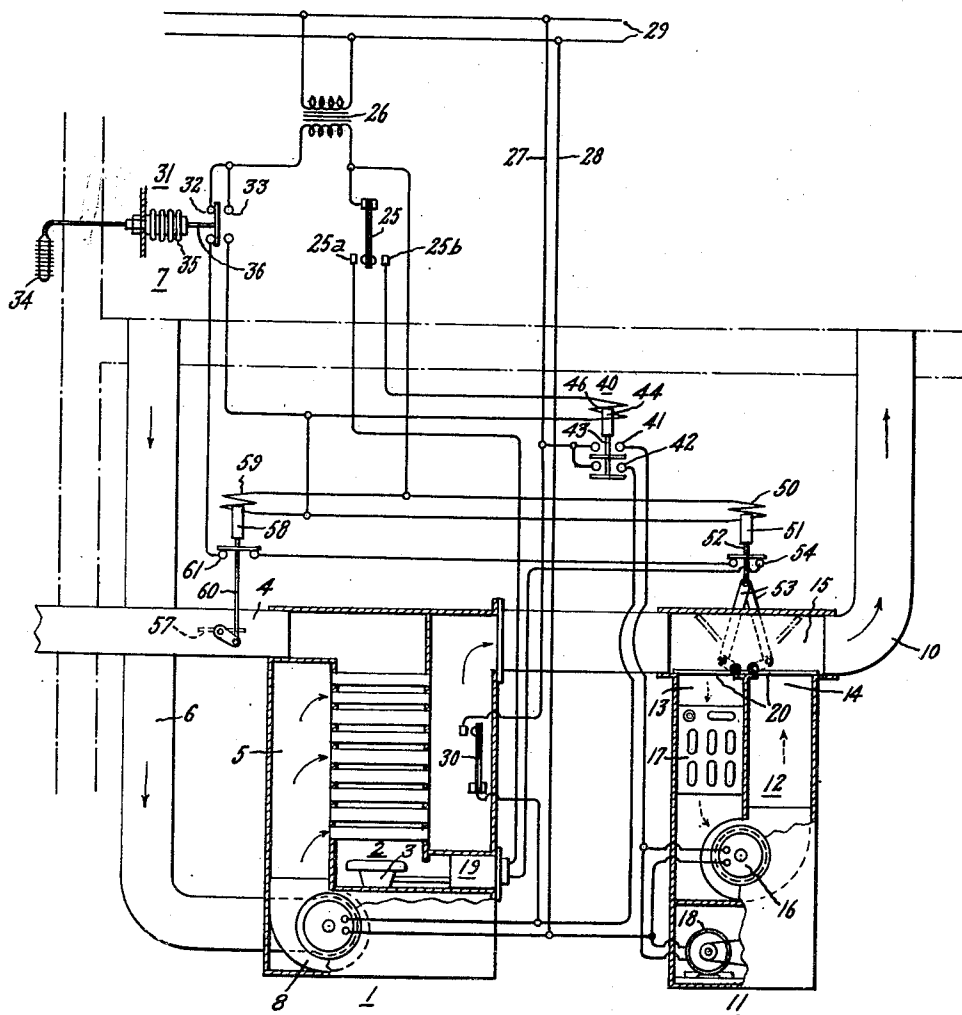
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S. J. LEVINE

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AIR-COOLING ATTACHMENT FOR WARM AIR FURNACE SYSTEMS

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Inventor:
Samuel J. Levine,
by *William A. Edwards, Jr.*
His Attorney.

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AIR-COOLING ATTACHMENT FOR WARM
AIR FURNACE SYSTEMSSamuel J. Levine, West Orange, N. J., assignor to
General Electric Company, a corporation of
New York

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The present invention relates to a cooling unit for attachment to a warm air furnace system.

In general, economics indicate that as compared to the number of domestic furnace installations for winter air conditioning, the number of installations required for conditioning air over an entire twelve-month period are relatively small. For those home owners needing or desiring summer air conditioning, suitable air cooling apparatus should be provided for use in connection with existing heating installations with the cooling means of a design such that it will not interfere with the operation of the heating installation but which can be operated in conjunction therewith to provide air cooling when desired.

Accordingly, the present invention has as its principal object the provision of a cooling unit adapted to be added as a supplement to a domestic warm air furnace and to operate in conjunction therewith to provide a combination for year around air conditioning of a home.

A further object of the present invention is to provide a cooling unit for summer air conditioning which can be employed in conjunction with existing warm air furnaces but which is of such construction as to be easily by-passed when not in operation.

Another object of the invention is to provide a low-cost, compact, cooling unit supplement for a warm air furnace.

A further object of the invention is to provide an automatic air conditioning installation comprising a warm air furnace and a separate cooling unit and means for controlling the seasonal operation of said units to obtain the maximum degree of efficiency from both.

Additional objects and features of the invention will become apparent from the following description taken in connection with the accompanying drawing in which the single figure diagrammatically illustrates the mechanical and electrical arrangement of air conditioning apparatus constructed in accordance with the present invention.

Referring to the drawing, there is shown a typical warm air furnace 1 comprising a combustion chamber 2, an electrically controlled oil or gas fired heating means 3 in the combustion chamber and a flue 4 for the discharge of the

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combustion products from the combustion chamber. Surrounding the combustion chamber 2 is an air heating chamber 5 connected by means of a return duct 6 to an enclosure 7 served by the furnace and containing an electrically driven fan 8 for drawing air from the enclosure 7 and passing it through the furnace in heat exchange contact with the combustion chamber 2. In a normal operation of such warm air furnace, the conditioned air is discharged from the chamber through the supply portion of the duct system to the enclosure 7.

In accordance with the present invention, there is provided a cooling unit attachment 11 adapted to be connected into the existing duct system of a warm air furnace and to operate in connection therewith. Preferably, the cooling unit is connected into the downstream of the supply portion of the warm air duct system as is shown in the drawing. The cooling unit 11, as illustrated, comprises a U-shaped cooling chamber 12 having an inlet 13 and an outlet 14 communicating directly with a passageway 15 which is connected into and forms part of the supply duct system 10 for the warm air furnace 1. Suitably mounted within the cooling chamber 12 is a cooling chamber fan 16 for drawing air through the chamber and a cooling unit 17 positioned in the path of the air flow and supplied with a suitable cooling medium by means of a motor-driven compressor and evaporator system positioned in the lower part of the unit, the motor being indicated by numeral 18.

Means for controlling the path of flow of air through the cooling unit 11 includes dampers 20 adapted in their normal position, that is during the heating season, to close inlet 13 and outlet 14 of the cooling chamber so that the air flowing from the warm air furnace 1 by-passes the cooling chamber through passageway 15. For summer air conditioning, the dampers 20 are raised to the dotted line position, shown in the drawing, so that the air drawn from enclosure 7 and forced through the duct system passes through the cooling chamber 12 where it is suitably cooled before being delivered to the enclosure 7.

While the apparatus of the present invention can be controlled manually, an automatic or semiautomatic control is preferred, both from

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the standpoint of convenience and as will become more apparent more fully hereinafter, and in order to provide against the improper operation of the furnace and cooling unit assembly during either the heating or cooling seasons.

In the illustrated modification of the invention, the control system is electrically operated and comprises in part the usual electrical control system employed in connection with the operation of a typical warm air furnace. The electrical control means 19 for the heating unit 3 is connected in series with a bimetal thermostat 25 positioned within the enclosure 7 and a transformer 26 for providing a low-voltage current for operating the control means. Thermostat 25 includes both an enclosure heating contact 25a and an enclosure cooling contact 25b, the first-mentioned contact being connected to the circuit now being described and controlling the energization of the heating means circuit. The electrically driven furnace fan 8 is connected through supply conductors 27, 28 to a source of electrical power 29 with a thermostat-operated bonnet switch 30 connected in series with the fan driving means. The bonnet switch 30 is adapted to close the fan motor circuit only when the temperature of the air within the heating chamber 5 exceeds a predetermined minimum temperature.

For operating the furnace in conjunction with the cooling unit attachment 11, the heating means circuit is modified by the inclusion therein of a thermally operated switch mechanism 31 which is shown as including two interconnected switches 32 and 33 so arranged that only one switch may be closed at one time. The operation of these switches is controlled by a thermostat including a bulb 34 positioned outside the enclosure operatively connected to bellows 35 which by means of stem 36 controls the operation of the switches. As bulb 34 is surrounded by the outside atmosphere, switch 32 is normally closed during the heating season, i. e., when the outside temperature is at or below a predetermined maximum.

The circuits for the operation of the combined equipment during the cooling season comprise a power circuit for the cooling unit controlled by relay 40, comprising two switches 41 and 42. The cooling chamber fan 16 and compressor motor 18 are serially connected through switch 41 to the power supply conductors 27 and 28, while the warm air furnace fan 8 is similarly connected to the supply conductors in series with switching means 40. Switches 41 and 42 are interconnected by and connected to the solenoid 44 by stem 43. By this arrangement when relay coil 46 is energized, both the warm air furnace fan 8 and the cooling unit are jointly operated in series in the air circuit during the cooling season so as to deliver the increased air flow ordinarily required for cooling purposes and to provide the increased pressure necessary to overcome the higher pressure drop as a result of the passage of air through the cooling chamber 12, the fan 16 acting as a booster in the air circulating system.

The control circuit for summer operation of the system includes switch 33 connected in series with transformer 26, with the coil 46 and through the high temperature contact 25b on the enclosure thermostat 25. By this arrangement, when the temperature of the outside air surrounding bulb 34 exceeds a certain predetermined temperature, switch 33 is closed and at

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such time as the air surrounding the room thermostat 25 also exceeds a predetermined temperature, the control circuit including these elements is energized whereby switches 41 and 42 are closed to provide for the operation of both the cooling unit and the furnace fan 8. It will be noted that both switches 32 and 33 and the switches controlled by thermostat 25 are open at temperatures intermediate those which call for the operation of the heating equipment and those which call for the operation of the cooling equipment. For example, the thermally responsive switch 31 and thermostat 25 can be so regulated that the heating circuits are energized for outdoor temperatures below 65° F. and enclosure temperatures below 70° F., while the cooling circuit is energized when outdoor temperatures exceed 80° F. and room temperatures exceed 75° F. At intermediate outdoor or enclosure temperatures, both circuits are de-energized.

Electrically operated means for controlling the by-passing dampers 20 comprise a solenoid 51 connected by stem 52 to the damper control lever arms 53 in such a manner that when coil 50 surrounding the solenoid is energized, the dampers are raised from their normal position to the dotted-line position to direct the air through the cooling chamber 12. The coil 50 is connected to transformer 26 through switch 33 and is in parallel with thermostat 25 and relay coil 46 so that coil 50 is energized whenever switch 33 is closed. To guard against the operation of the furnace heating means 3 at any time at which the dampers are in the raised position, there is provided in conjunction with the damper operating solenoid, a switch 54 in the heating means control circuit and operated by the solenoid so as to open that circuit when the dampers are raised to their upper or air cooling position.

The cooling unit 11 is preferably connected into the downstream or supply duct system of the warm air furnace as otherwise the cool air from the cooling attachment would chill the heat transfer surfaces of the warm air furnace resulting in the unnecessary condensation thereon and in excessive corrosion of the heating unit. As the continued circulation of air through the furnace during the cooling season can result in a circulation of air downwardly through the warm air furnace flue 4 and into the combustion chamber 2, there is provided in the flue 4 a damper 57 which is adapted to be in its open position during the heating season with the operation thereof controlled in the same manner as damper means 20 by means of a solenoid 58 and stem 60 including a coil 59 in parallel with coil 50. Switching means 61, also operably connected to stem 60, is connected into the heating means circuit and provides against operation of the heating means 3 when the damper 57 is closed.

From the above description, it will be seen that there has been provided a simple and inexpensive air conditioning system for use with or including an ordinary domestic warm air furnace. There has also been provided means for automatically controlling the operation of the system to obtain the maximum efficiency from both the furnace and the cooling unit attachment. During the colder seasons when the outside temperature is below a predetermined maximum, thermostat controlled switch 32 in the heating means circuit is closed and switch 33 opened. As the cooling unit control circuit is therefore de-energized, switches 54 and 61 are also closed and switches 41 and 42 open so that the heating

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means control circuit is controlled by the operation of thermostat 25 with respect to contact 25a and the power circuit for the cooling unit is also de-energized. Whenever the outside temperature exceeds the predetermined minimum, thermostat 7 operates to open switch 32 and until such time as the outside temperature approaches a temperature at which switch 33 is closed, both the heating means circuit and cooling circuits are de-energized regardless of the position of thermostat 25. During the summer months when the outside temperature exceeds that at which thermostat 7 closes switch 33, the energization of coils 50 and 59 causes damper 57 to close and the cooling unit dampers 20 to open to direct the air passing through the duct system through the cooling chamber 12. As this condition maintains so long as switch 33 is closed, damper 57 closes the flue 4 and substantially prevents any down draft of outdoor air through the flue which would result in corrosion of the combustion chamber and the heating unit. It is to be noted that the operation of the damper 57 is independent of thermostat 25. Also, under these conditions since the heating means control circuit is open, the temperature within the warm air chamber 5 is always below that which will effect operation of bonnet thermostat 30 so that the furnace fan motor supply circuit including the bonnet thermostat continues to be de-energized.

Obviously the safety switches 54 and 61 act, respectively, to prevent operation of the heating unit when the stack damper is closed and operation of the cooling unit when the heating unit is in operation and the cooling unit is in the heated air circuit. Either of these conditions might otherwise arise should the respective one of the dampers 57 and 20 become stuck in its actuated position and fail to return after de-energization of the actuating solenoids 50 and 59.

Whenever, under the warm weather conditions, the temperature within the enclosure 7 reaches the point where the cooling unit control circuit including contact 25b is energized by operation of the thermostat 25, switches 41 and 42 are closed due to the energization of coil 46 in series with contact 25b and power is supplied by these switches to both the cooling unit and to the furnace fan 8. By providing for the joint operation of fans 8 and 16 during the cooling season, the furnace fan need be no larger than would otherwise be required for normal heating purposes and the cooling unit fan need be only sufficiently powerful to provide the increased air circulation ordinarily desired for cooling purposes and the increased pressure necessary to overcome the added pressure drop through the cooling coil. Since the cooling unit is completely bypassed during the heating season, by-pass passageway 15 is in effect merely a continuation or part of the normal air duct system for the furnace and the furnace for all practical purposes functions as a standard warm air furnace.

While certain specific embodiments have been shown and described, it will, of course, be understood that various modifications may be made without departing from the invention. The appended claims are, therefore, intended to cover any such modifications within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a warm air furnace including an electrically controlled heating means, an air heating chamber and means including an

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electrically driven fan for drawing air from an enclosure through said chamber, a separate cooling unit including a cooling chamber and an electrically driven cooling unit fan for circulating air through said cooling chamber, air conduit means connecting said cooling chamber with said heating chamber and with said enclosure, electrically operated means for by-passing said cooling chamber, and control means for controlling the operation of said heating means and said fans and said by-passing means, said control means including a two-position switching means adapted to interrupt the circuit for said heating means when the outside temperature exceeds a predetermined temperature and to interrupt the circuits controlling the operation of said cooling fan and by-passing means when the outside temperature is below a second predetermined temperature higher than the first predetermined temperature.

2. In combination, an air heating furnace including electrically controlled heating means and an electrically driven fan operable to discharge a stream of air through said furnace, a separate cooling unit including a cooling chamber, an electrically driven discharge fan and cooling means in said chamber, means for conducting the stream of air discharged from said furnace to said cooling chamber and from said chamber to an enclosure, an air passageway in said cooling unit by-passing said cooling chamber, electrically controlled damper means for directing the flow of said air stream through said cooling unit, said damper means normally directing the air flow through said passageway, damper control means operable to move said damper means to a position directing the air flow through said cooling chamber, a power circuit for the heater fan, a second power circuit for the joint operation of the heater fan and cooling unit fan and cooling means, control means for controlling the operation of said heating means and fans and damper means and including an outdoor thermostat-operated switching means and an enclosure thermostat-operated switching means each adapted to interrupt the circuit for said heating means when the ambient temperatures respectively exceed predetermined minimum temperatures and to interrupt the circuits controlling the operation of the cooling unit fans and cooling means and said damper control means when the ambient temperatures are respectively below predetermined temperatures higher than said predetermined minimum temperatures.

3. An air conditioning system for heating and cooling the air in an enclosure comprising a hot air furnace having a main fan for circulating air therethrough and for discharging hot air therefrom, a conduit for conveying the discharged air to the enclosure to be conditioned, an air cooling unit having a fan for circulating air therethrough, means for by-passing the air in said conduit through said cooling unit whereby said furnace and said unit are connected in series in the path of air flowing to the enclosure, and means effective upon operation of said by-passing means for rendering said furnace ineffective to heat the air and for maintaining both said fans in operation to circulate air to said enclosure through said cooling unit whereby said cooling fan acts as a booster for said main fan.

4. An air heating and cooling system for an enclosure comprising a heating unit and conduit means connecting said unit to supply heated air to the enclosure, a heating fan for forcing air

through said unit and conduit means, a cooling unit having a fan therein for forcing air there-through to cool the air, means for connecting said cooling unit in the path of air flowing from said heating unit through said conduit means, heating control means for said system arranged to effect operation of said heating fan and to prevent passage of air through said cooling unit, and cooling control means for said system arranged to prevent operation of said heating unit and to effect operation of both said fans and to circulate air through said heating and cooling units in series whereby said cooling fan is effective as a booster to said heating fan.

SAMUEL J. LEVINE.

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