

April 21, 1936.

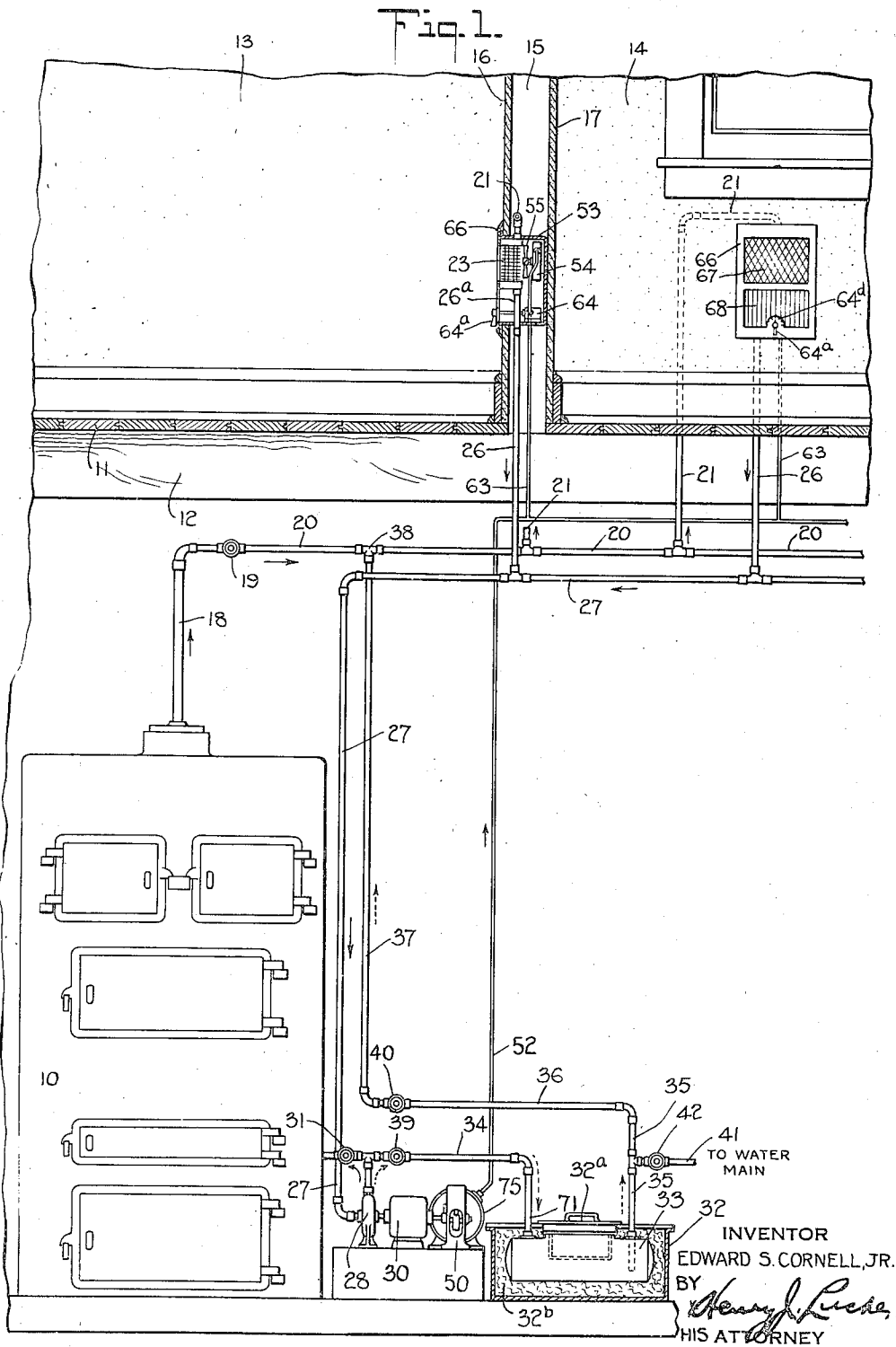
E. S. CORNELL, JR

2,038,347

AIR CONDITIONED HEATING AND COOLING SYSTEM

Filed Aug. 29, 1933

2 Sheets-Sheet 1



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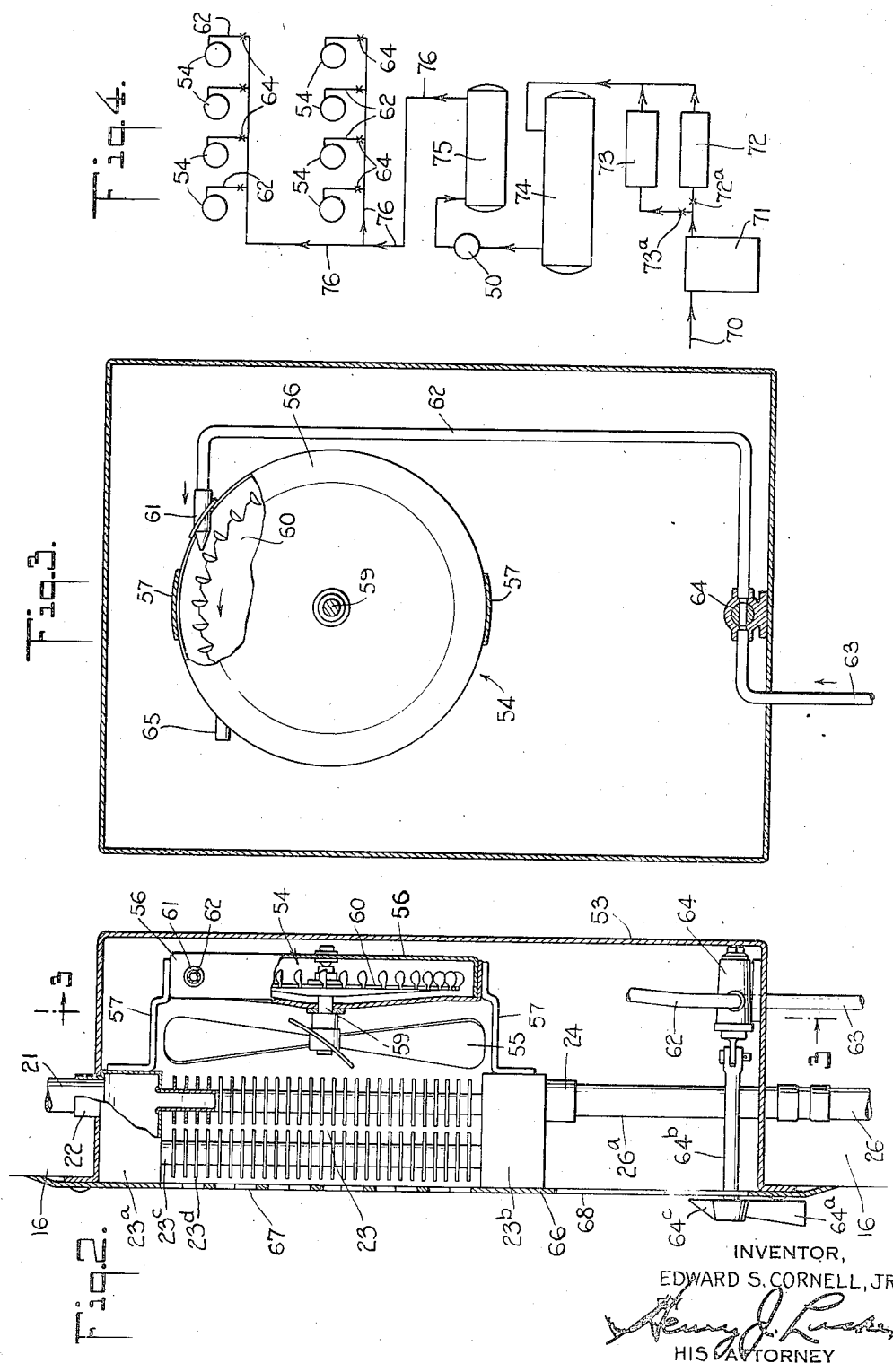
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2 Sheets-Sheet 2



INVENTOR,  
EDWARD S. CORNELL, JR.  
*Henry J. Russell*  
HIS ATTORNEY

## UNITED STATES PATENT OFFICE

2,038,347

AIR CONDITIONED HEATING AND COOLING  
SYSTEMEdward S. Cornell, Jr., Larchmont, N. Y., assignor  
to American Radiator Company, New York,  
N. Y., a corporation of New Jersey

Application August 29, 1933, Serial No. 687,376

13 Claims. (Cl. 257—8)

My present invention relates to an air conditioned thermal system.

A primary feature of my invention is the provision of suitable means for conditioning air and the supply of the same to the rooms or other enclosures or spaces of a building or other structure, in thermal exchange relation with radiator units respectively distributed in or in operative relation to such rooms or other spaces.

The nature of the thermal effect by the conditioned air supplied to each room or other space is determined by the nature of the thermal fluid supplied to the radiator unit.

Advantageously, my invention is applicable to a system of radiator units suitably interconnected by piping to a central thermal device, viz., a boiler for heating or a cooling device for cooling. Most advantageously, the radiator units and interconnecting piping are optionally connected by centrally located sub-piping and control valves to a central heating device and a central cooling device, water or other suitable fluid being employed as the thermal fluid agent, provision being made for the return flow of the thermal fluid to the heating device or the cooling device.

The more preferred forms of my invention embody a pump or equivalent for effecting a forced, that is, positive flow of the thermal agent through the radiator units and interconnecting piping.

The most preferred forms of my invention utilize fans or equivalent suitably coordinated with the respective radiator units, each fan being actuated by an air motor or equivalent in turn actuated by the conditioned air suitably compressed, the conditioned air discharged by each motor being projected by the fan in thermal exchange relation with its associated radiator unit.

For effective assembly of such fan and its associated radiator unit, the same may be installed in a suitable casing, provision being made for the discharge of the conditioned air from the air motor into the casing to effect the projection of the same in thermal exchange relation to the surfaces of the elements of the radiator unit.

An efficient type of air motor for the purpose of fan actuation is described and claimed in my co-pending application, Serial No. 555,030, filed August 4th, 1931, entitled Suction-driven prime mover, now U. S. Patent No. 1,926,527, granted September 12, 1933, and Serial No. 623,697, filed July 21st, 1932, entitled Air motor, now U. S. Patent No. 1,926,528, granted Sept. 12, 1933, which generic and specific constructions embody the advantage, inter alia, of oil-less bearings for the

actuated parts, thus preserving the pre-conditioning of the air compressedly supplied thereto.

Conveniently, the compression of the conditioned air is effected centrally as by a compressor, and most conveniently such compressor is operated in proper relation in common with the pump or equivalent, for the positive flow of the thermal fluid, as above noted.

Among the many advantages arising from my invention are that the radiator unit may be considerably reduced in overall dimensions with consequent reduction of weight, as well as in wall thickness of the effective heat exchange surfaces, and enabling the casing to be unitarily assembled with the associated motor, fan and radiator unit and to be disposed within a mural opening or elsewhere out of proximity to the floor, thus increasing the useful square footage of the floors, avoidance of obstruction on floor and wall, and lending itself to artistic effects.

Suitable form of regulation, optionally centrally or locally with respect to the radiator units, is provided as desired.

An object of my invention therefore is an improved combined heating and cooling system for buildings and the like.

An object of my invention is an improved means for heating or cooling a building or the like under forced draft.

An object of my invention is an improved means for circulating air through a heated or cooled radiator for the purpose of rapidly heating or cooling and circulating the heated or cooled air through a room or other space of a building or the like.

An object of my invention is the supply of conditioned air optionally heated or cooled or non-heated or non-cooled to rooms or other spaces of a building or other structure.

Further features and objects of the invention will be more fully understood from the following detail description and the accompanying drawings, in which

Fig. 1 is a side elevation partly in vertical section through a portion of a building illustrating a preferred form of my system;

Fig. 2 is a vertical sectional elevation, on an enlarged scale, as compared with Fig. 1, of an assembly of a casing and combined radiator unit, air motor, and fan;

Fig. 3 is a vertical sectional elevation on line 3—3 of Fig. 2; and

Fig. 4 is a schematic layout of a central air conditioning, compressing and distributing supply.

Referring to the drawings, and particularly to Fig. 1, there is indicated at 10 a boiler, furnace, electrical or other heater or other central heating device. Such heating device is ordinarily located in the basement of the building; the first floor of the building is indicated in Fig. 1 at 11, two rooms being indicated at 13 and 14. These rooms are indicated as separated from one another by a partition shown as including the usual studding 15 and plaster walls 16 and 17, respectively.

Connected to the heating device 10 is shown a riser 18 through which the thermal fluid passes; such riser is shown provided with a control valve 19. To the riser 18 are connected, as indicated in Fig. 1, the one or more horizontal pipes 20 and in turn the one or more vertical pipes 21.

Each vertical pipe 21 leads directly or indirectly to one port 22 of a radiator unit 23, see Fig. 2. To the other port 24 of each radiator unit is connected a pipe 25, leading directly or indirectly to a suitable pipe or pipes 26, 27 which extend toward the central heating device 10. Such pipes 26, 27 normally serve as the piping for the thermal fluid in return to the heating device, and preferably under positive flow conditions effective by means of a pump 28 or equivalent, connected, say, as shown in Fig. 1, to the terminus of the return pipe 27, and discharging through the indicated pipe into the water sections of the central heating device 10.

The pump 28, see Fig. 1, is shown driven by the motor 30, which may be driven by electrical power, or by any other suitable medium. The indicated return pipe is shown provided with a control valve 31.

A central cooling device is indicated, see Fig. 1, at 32, in the form of a casing enclosing a tank 33 provided with an inflow pipe 34 and outflow pipe 35; for purposes of identification, the outflow pipe 35 is shown connected to a horizontal pipe section 36, then to vertical pipe section 37 leading to the L 38 connecting with the above stated pipe 20. The inflow pipe 34 is shown provided with a control valve 39 and the outflow piping 35-36 is shown provided with a control valve 40.

The cooling device 32 may be of any suitable character. Advantageously, in temperate and cooler zones, the cooling may be effected by the employment of dry ice, natural or so-called "artificial" ice, etc. which may be charged into an insulated portion of the casing 32 by removal of its closure 32a; however, an electrical or other ice-making device may be employed for reducing the temperature of the interior of the tank 33, or equivalent. At 32b is indicated suitable insulation effectively surrounding the tank 33 within the casing 32, for reducing heat losses.

The piping 41 indicates piping connected to the domestic or other water supply, having a valve 42 for supplying water to the heating-cooling system when desired.

During the stage of operation of the above described radiator unit system for heating the thermal fluid by the boiler 10 or equivalent, the valves 19 and 31 are opened and the valves 39 and 40 are closed; during the stage of cooling of the thermal fluid by the cooling device 32, the valves 39 and 40 are opened and the valves 19 and 31 are closed. In the alternative stages of heating or cooling, the pump 28 or equivalent serves to positively effect flow of the thermal fluid through the respective heating device 10 or the cooling device 32.

The effective supply of heat or cold to the in-

dividual rooms or other spaces is had by and simultaneously with the supply of conditioned air.

As embodied in the system indicated in Fig. 1, the conditioned air is drawn into and compressed by the compressor 50, or equivalent, advantageously driven in common and in proper operative relation to the thermal fluid pump 28, or equivalent, by the motor 30, usually intermediate gearing 51, preferably adjustable, being intercoupled, as, for example, and as shown in Fig. 1, between the motor 30 and the compressor 50.

The compressor 50, or equivalent, is suitably connected to the respective rooms or other spaces for the supply of conditioned air, preferably positively projected by a fan or equivalent, driven by an air motor actuated by the compressed conditioned air, in thermal exchange with an associated radiator unit.

A typical assembly of an associated radiator unit, air motor and fan is illustrated in Fig. 2.

A casing 53 advantageously encloses in common a radiator unit 23, an air motor 54 and thereby actuated fan 55. Preferably, as shown in Fig. 2, the casing 56 of the air motor is attached to and supported by brackets 57 to the upper and lower headers 23a, 23b, of the illustrated type of radiator unit, the fan 55 being directly attached to and supported by the shaft 59 of the rotor 60 of the air motor. The flange of the port 22 and the piping 26a connected to the flange of the port 24, of the radiator unit are preferably secured in fixed relation to the casing 53, whereby each set of associated air motor, fan, radiator unit and casing is unitarily assembled, thus simplifying manufacture, shipment, handling and installation.

The particular type of radiator illustrated in Fig. 2 comprises hollow tubes 23c provided with fins 23d, the respective tubes 23c extending advantageously in vertical direction and interconnecting the upper header 23a with the lower header 23b.

The air motor may be of any suitable construction. An efficient type of air motor is disclosed in my aforesaid co-pending applications, Serial No. 555,030, now U. S. Patent No. 1,926,527, as aforesaid, and Serial No. 623,697, now U. S. Patent No. 1,926,528.

The inflow port of the illustrated air motor 50 is indicated at 61, to which the pipe 62 leads; the pipes 62 of the respective air motors are connected to the piping 63 suitably connected to the compressor 50.

A valve 64 is provided, for individual regulation of the flow of compressed air, and consequent actuation of the fan 59. Preferably, the valve 64 is located within the casing 53, and is set in desired position by any suitable means, such as a hand lever 64a, connected by a stud 64b to the movable valve member.

The discharge port of the air motor is indicated at 65 which may be located, as shown, in substantial alignment with the axis of the inlet nozzle 61, and to discharge the released conditioned air at one side of motor casing 56 into the assembly casing 53.

The front of the casing 53 is preferably closed by a fret plate 66, desirably of ornamental design. The perforations 67 in the plate 66 afford passage of the heated or cooled conditioned air discharged from the assembly. The opening 68 in the front plate 66 of the casing serves for the inflow of air into the casing 53 from the interior of the room or other space, and in general for the circulation of air.

The front plate 66 may be impressed or otherwise bear indications, 64d, see Fig. 1, correlated with the pointed or index end 64c of the setting member 64a of the valve, to indicate "full", "medium," "off" and/or other stages of heating or cooling, or supply of conditioned air.

Upon setting the member 64a to an open position, the rotor 60 of the air motor is correspondingly actuated, thereby rotating the fan 59 to project the air in the assembly casing 53, inclusive of the discharged conditioned air, in thermal exchange relation with the thermal surfaces 23c, 23d, of the radiator unit 23, through the perforations 67 into the room or other space.

By reason of the efficiency of such air projection arrangement, the radiator unit may be considerably reduced in overall dimensions, enabling the conditioned air supply and radiator unit assembly and enclosing casing to be located in a recess or the like of limited dimensions, as in a wall, 14, see Figs. 1 and 2, the front plate 66 of the casing desirably being substantially flush with the exposed face of such wall and suitably dimensioned to conceal any clearances between the sides of the casing and the side faces of the mural recess.

Upon setting the setting member 64b to "off" or equivalently designated position, the air motor and fan are brought to rest, thus shutting off the supply of conditioned air and therewith the supply of projected heat or cold to the interior of the room or other space.

As is disclosed in my aforesaid co-pending applications, my air motor preferably has oil-less bearings for the rotor, such as bearings of alloys or other metallic or other suitable material or arrangement which is substantially non-frictional, thus preserving the conditioned status of the air supplied to, passing through, and discharged from the motor casing into suitable proximity of the fan or equivalent device actuated by the compressed air and projected through the radiator unit.

The movable valve members of the air control valves 64 may be operated individually or combinedly under thermostatic control.

Fig. 4 illustrates schematically a suitable system of supply of conditioned air and associated air motors.

The air may be originally drawn from the outer atmosphere, or from any other suitable original supply, through a conduit 70 by the compressor 50, or equivalent, and suitably conditioned pursuant to standard or other approved practice, as through a filter device 71 to remove dirt, foul gases and other foreign substances, thence optionally through a humidifier 72 or dehumidifier 73, controlled by the respective valves 72a, 73a, dependent upon the moisture content of the outer atmosphere or other air source. The thus conditioned air may then be led to a reservoir tank 74 from which it is directly drawn into the inflow port of the compressor 50 and thence discharged under proper regulated compression into an expansion tank 75, from which it is supplied by suitable piping 76 to the individual air motors 54. If desired, the expansion tank may be supplied with an adjustable pressure regulating discharge valve. The applied arrows indicate the directions of flow of the air through such system typified by Fig. 4. The particular steps of conditioning and equipment employed will be governed by the objects and economies desired in individual installations.

The indicated multiple connection of the re-

spective pipes 63 having individual valves 64, affords individual independent regulation of the respective air motors and consequent individual independent control of the joint supply of conditioned air and the heating or cooling of the respective rooms or other spaces of the building or other structure.

Adjustable orifice valves, such as is disclosed in my co-pending application, Serial No. 674,326, filed June 5th, 1933, entitled Orifice valve, now U. S. Patent #2,007,036, granted July 2, 1933, may be employed in the branch or other air lines for the purpose of equalizing or otherwise controlling the pressure of the conditioned air delivered to the individual air motors.

My system is applicable to existing heating systems, particularly of the so-called "hot water" types, supplemented by my compressed conditioned air supply and air motor-fan system coordinated with the respective radiator units.

An advantage of my system lies in the feature of the supply of the conditioned air in compressed status, thus affording, inter alia, the use of pipes or equivalent of relatively small diameter or other cross-sectional dimension, for the conduction of the conditioned air to the respective radiator units.

My invention is applicable to the supply of conditioned air in coordination with a system of radiator units serving solely for heating purposes, whereby conditioned air is supplied jointly with the heating of the respective rooms or other spaces.

My invention is applicable to the supply of conditioned air in coordination with a system of radiator units or equivalent operated solely for cooling purposes.

If desired, individual valves may be provided for the effective connection and disconnection individually of the respective radiator units, suitable provision being made by piping for by-passing the thermal fluid relative to the disconnected radiator unit or units for the circulation of the thermal fluid to and through the connected radiator unit or units.

During the period of non-operation of the heating or cooling or heating-cooling system, a supply of conditioned air is had by setting the air control valve to an operating position, such supply being circulated by the action of the fan or other air projecting device operated by the motor.

Whereas I have described my invention by reference to specific forms thereof it will be understood that many changes and modification may be made without departing from the spirit of the invention.

I claim:

1. In an air distributing heating and cooling system the combination of a plurality of radiator units, a central heating device, a central cooling device, piping interconnecting said radiator units including piping and central means for optional connection with said central heating device and said central cooling device, an air motor associated with each of said radiator units, a fan for each air motor, each air motor having a discharge disposed in proximity to said fan, each fan being operatively disposed to project air in thermal exchange relation to its associated radiator unit, and means for supplying compressed air to said air motors.

2. In an air distributing thermal system the combination of a plurality of radiator units, a central thermal device, piping interconnecting said radiator units with said central thermal de-

vice, an air motor associated with each of said radiator units, fan means for each air motor, each fan means being operatively disposed to project air in thermal exchange relation to its associated radiator unit, and central means for supplying compressed air to said air motors.

3. In an air conditioned distributing heating and cooling system the combination of a plurality of radiator units, a central heating device, a central cooling device, piping interconnecting said radiator units including piping and central means for optional connection with said central heating device and said central cooling device, an air motor associated with each of said radiator units, a fan for each air motor, each air motor having a discharge disposed in proximity to said fan, each fan being operatively disposed to project air in thermal exchange relation to its associated radiator unit, and means for supplying compressed conditioned air to said air motors.

4. In an air conditioned distributing thermal system the combination of a plurality of radiator units, a central thermal device, piping interconnecting said radiator units within said thermal device, an air motor associated with each of said radiator units, a fan for each air motor, each fan being operatively disposed to project air in thermal exchange relation to its associated radiator unit, and central means for supplying compressed conditioned air to said air motors.

5. In an air distributing heating and cooling system the combination of a plurality of radiator units, a central heating device, a central cooling device, piping interconnecting said radiator units including piping and central means for optional connection with said central heating device and said central cooling device, an air motor associated with each of said radiator units, a fan for each air motor, each air motor having a discharge disposed in proximity to said fan, each fan being operatively disposed to project air in thermal exchange relation to its associated radiator unit, regulating valve means for each of said air motors and means for supplying compressed air to said air motors.

6. In an air distributing heating and cooling system the combination of a plurality of radiator units, a central heating device, a central cooling device, piping interconnecting said radiator units including piping and central means for optional connection with said central heating device and said central cooling device, means for positively effecting circulation of the thermal fluid through said piping, an air motor associated with each of said radiator units, a fan for each air motor, each air motor having a discharge disposed in proximity to said fan, each fan being operatively disposed to project air in thermal exchange relation to its associated radiator unit, means for supplying compressed air to said air motors, said compressed air supply means including a compressor and common means for actuating said compressor and said thermal fluid circulation effecting means.

7. In an air distributing thermal system for a plurality of rooms or other spaces of a building or the like, the combination of a plurality of radiator units disposed respectively in thermal relation to said spaces, a central thermal device, piping interconnecting said radiator units including piping for connection with said central thermal device, means disposed respectively in said spaces for supplying air to said spaces, and means respectively operated by said air supplying means for circulating air of said spaces respectively, each said air circulating means comprising an air motor asso-

ciated with a radiator unit, a fan for said air motor, said air motor having a discharge disposed in proximity to said fan, said fan being operatively disposed to circulate air of the associated space and to project air in thermal exchange relation to its associated radiator unit, and central means for supplying compressed air to said air motors.

8. In an air conditioned distributing thermal system for a plurality of rooms or other spaces of a building or the like, the combination of a plurality of radiator units disposed respectively in thermal relation to said spaces, a central thermal device, piping interconnecting said radiator units including piping for connection with said central thermal device, means for positively effecting circulation of the thermal fluid through said piping, means disposed respectively in said spaces for supplying conditioned air to said spaces and for circulating air of its associated space, each said air circulating means comprising an air motor associated with a radiator unit, a fan for said air motor, said air motor having a discharge disposed in proximity to said fan, said fan being operatively disposed to circulate air of its associated space and project air including the discharged conditioned air in thermal exchange relation to its associated radiator unit, and means for supplying compressed conditioned air to said air motors.

9. In an air conditioned distributing thermal system for a plurality of rooms or other spaces of a building or the like, the combination of a plurality of radiator units disposed respectively in thermal relation to said spaces, a central thermal device, piping interconnecting said radiator units including piping and central means for connection with said central thermal device, means for positively effecting circulation of the thermal fluid through said piping, means for supplying conditioned air to said spaces, and means respectively operated by said air supplying means for projecting air in thermal relation with said radiator units, said air projecting means including an air motor associated with each of said radiator units, a fan for each air motor, each fan being operatively disposed to project air in thermal exchange relation to its associated radiator unit, central means for supplying compressed conditioned air to said air motors, and means for jointly actuating said compressed air supply means and said circulation effecting means.

10. In an air conditioning thermal system for a room or other space of a building or the like, the combination of thermal means disposed in such space, a casing enclosing said thermal means, said casing having an open front of an area exceeding the planar area of said thermal means to afford entry of air from such space through the open front of said casing about said thermal means, means operated by compressed air for projecting air in thermal exchange relation with said thermal means and for effecting the inflow of air from such space through the open front of said casing to circulate and thermally treat the air of such space, said air projecting means having a discharge communicating with such space for discharging compressed air into such space, and piping leading from a suitable source of compressed air to said air projecting means.

11. In an air conditioning thermal system for a room or other space of a building or the like, the combination of thermal means disposed in such space, a casing enclosing said thermal means, said casing having an open front of an

area exceeding the planar area of said thermal means to afford entry of air from such space through the open front of said casing about said thermal means, means, operated by compressed  
 5 conditioned air for projecting air in thermal exchange relation with said thermal means and for effecting the inflow of air from such space through the open front of said casing to circulate and thermally treat the air of such space, said air  
 10 projecting means having a discharge communicating with such space for discharging compressed conditioned air into such space, and piping leading from a suitable source of compressed conditioned air to said air projecting means.

15 12. In an air conditioning thermal system for a room or other space of a building or the like, the combination of thermal means disposed in such space, a casing enclosing said thermal means, said casing having an open front of an  
 20 area exceeding the planar area of said thermal means to afford entry of air from such space through the open front of said casing about said thermal means, means operated by compressed air for projecting air in thermal exchange relation with said thermal means and for effecting  
 25 the inflow of air from such space through the open front of said casing to circulate and ther-

mally treat the air of such space, said air projecting means having a discharge communicating through the interior of said casing with such space for discharging compressed air into such space, and piping leading from a suitable source  
 5 of compressed air to said air projecting means.

13. In an air conditioning thermal system for a room or other space of a building or the like, the combination of thermal means disposed in such space, a casing enclosing said thermal means,  
 10 said casing having an open front of an area exceeding the planar area of said thermal means to afford entry of air from such space through the open front of said casing about said thermal means, means operated by compressed condi-  
 15 tioned air for projecting air in thermal exchange relation with said thermal means and for effecting the inflow of air from such space through the open front of said casing to circulate and thermally treat the air of such space, said air pro-  
 20 jecting means having a discharge communicating through the interior of said casing with such space for discharging compressed conditioned air into such space, and piping leading from a suitable source of compressed conditioned air to said  
 25 air projecting means.

EDWARD S. CORNELL, JR.

**CERTIFICATE OF CORRECTION.**

Patent No. 2,038,347.

April 21, 1936.

**EDWARD S. CORNELL, JR.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 24, claim 4, for the words "within said thermal" read with said central thermal; and page 5, first column, line 4, claim 11, after "means" second occurrence, strike out the comma; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of June, A. D. 1936.

Seal)

**Henry Van Arsdale**  
**Acting Commissioner of Patents.**