

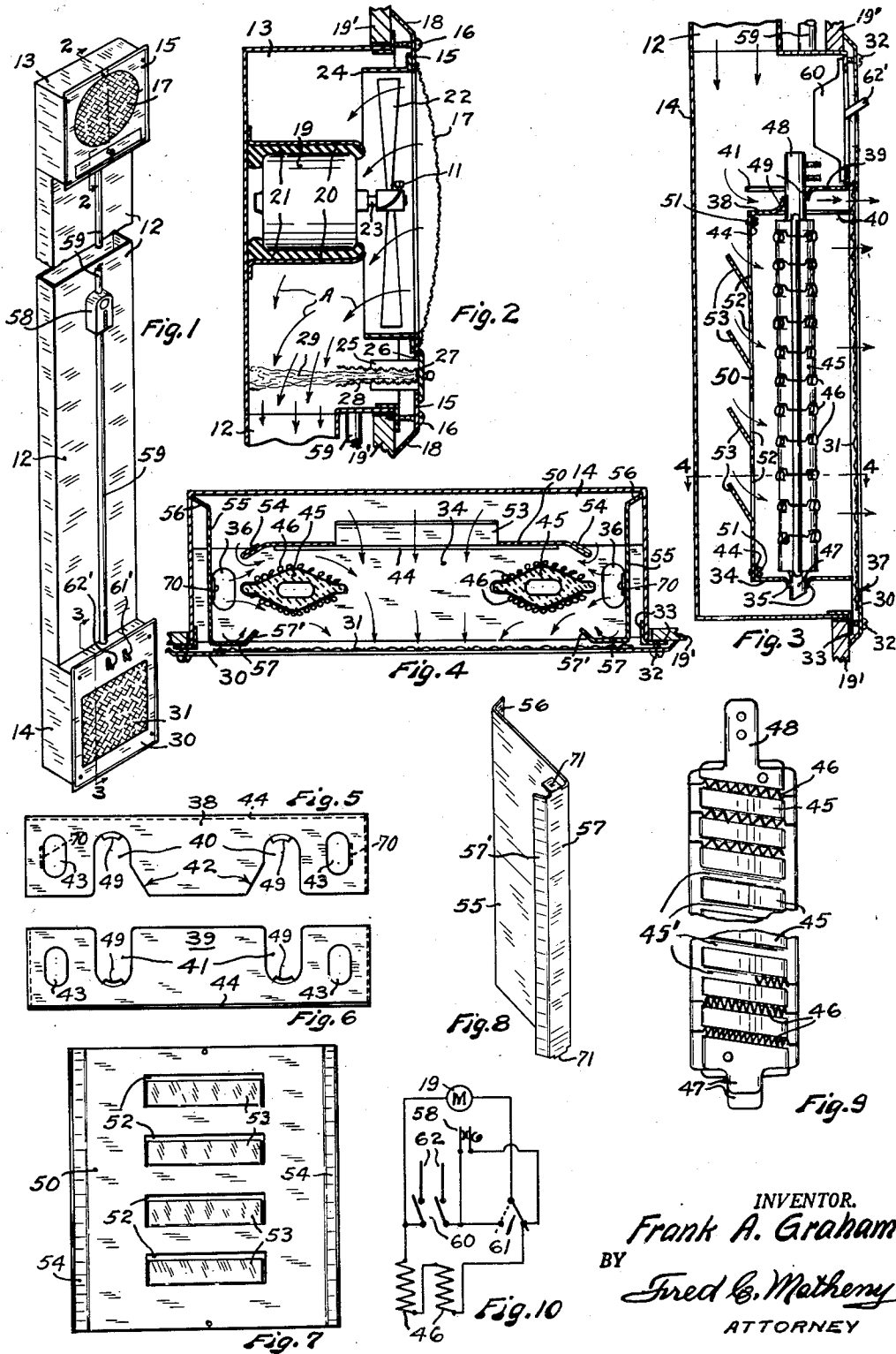
Nov. 7, 1950

F. A. GRAHAM

2,528,650

WALL TYPE ELECTRIC AIR HEATER AND CIRCULATOR

Filed Aug. 18, 1949



UNITED STATES PATENT OFFICE

2,528,650

WALL TYPE ELECTRIC AIR HEATER AND CIRCULATOR

Frank A. Graham, Seattle, Wash.

Application August 18, 1949, Serial No. 111,029

7 Claims. (Cl. 219—39)

1

This invention relates to a wall type electric heater and air circulator.

An object of this invention is to provide an electric air heater and circulator of simple and compact construction which is adapted to be installed within the wall of a room and which is adapted to both circulate and heat the air in a room or to circulate such air without heating the same.

Another object is to provide a wall type electric air heater and circulator which can be operated either to draw air from a location adjacent the ceiling and discharge it adjacent the floor or to draw air from a location adjacent the floor and discharge it at a location adjacent the ceiling.

Another object is to provide a wall type electric air heater and circulator which has electric heating element means disposed within a receptacle near the floor level and which has highly efficient heat reflectors and air deflectors disposed back of and to the sides of said heating element means to direct the heated air outwardly in such a manner as to best heat a room and to avoid too rapid rising movement of such heated air.

Another object is to provide an electric heater which can be operated to discharge heated air substantially horizontally at a location adjacent the floor and which is provided with means for simultaneously discharging a thin layer or blanket of cooler air just above the heated air which is issuing from the heater so that the said layer of cooler air helps to prevent the heated air from rising too rapidly in the room and in this way helps to maintain an even temperature in all parts of the room.

Other objects are to provide an electric air heater and circulator which is highly efficient in operation, is economical as respects the amount of current consumed and which will quickly heat a room and will maintain a complete and even circulation of air in a room from floor to ceiling, without producing unpleasant drafts or hot or cold areas in any part of the room.

Other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings.

In the drawings Figure 1 is a fragmentary perspective view, with parts broken away, showing an electric air heater and circulator constructed in accordance with this invention.

Fig. 2 is a vertical sectional view of the upper end portion of said electric air heater and cir-

2

culator, taken substantially on broken line 2—2 of Fig. 1 and on a larger scale than Fig. 1.

Fig. 3 is a vertical sectional view, taken substantially on broken line 3—3 of Fig. 1 and on a larger scale than Fig. 1 and showing the bottom end portion of this electric air heater and circulator.

Fig. 4 is a cross sectional view taken substantially on broken line 4—4 of Fig. 3.

Figs. 5 and 6 are detached plan views on a smaller scale than Figs. 3 and 4 showing two plates used in this heater for supporting the upper end portions of the heater elements.

Fig. 7 is a detached front elevation, on a smaller scale than Figs. 3 and 4, showing a reflector and baffle plate used back of the heating elements in this heater.

Fig. 8 is a detached perspective view of an air deflecting side plate used in this heater.

Fig. 9 is a fragmentary view in front elevation of one of the electric heating elements used in this heater.

Fig. 10 is a wiring diagram showing a preferred manner of electrically wiring this device up so that it can be used to both circulate and heat air or to circulate the air without heating it.

Like reference numerals designate like parts throughout the several views.

This electric heater comprises a wall duct 12 preferably of rectangular cross section and of a suitable width and thickness to fit within the wall of a frame building between the usual two by four inch studding. A fan compartment 13 is communicatively connected with the upper end portion of the duct 12 and a heater compartment 14 is communicatively connected with the lower end portion of said duct 12. Preferably the parts 12, 13 and 14 are constructed of sheet metal and are made separable from each other and can be assembled in the manner shown in Fig. 1. Obviously the length of the duct 12 can be varied to meet different requirements.

The fan compartment 13 is of greater thickness or depth than the duct 12, is open at the front or outer side and is adapted to have a removable front member 15 secured thereto as by screws 16. The major portion of this front member 15 is cut away to provide an opening through which air may pass. A grill 17 of expanded metal or metal screen is provided over this air passageway. Preferably this grill 17 is convexed outwardly, as best shown in Fig. 2, to give it a more pleasing appearance. Preferably the marginal portions 18 of the front member

15 are inclined inwardly as shown in Fig. 2 so they will engage with the face of a wall 19' in which the fan compartment 13 is installed and support the front member 15 in slightly spaced relation from the front of said fan compartment 13. This provides some additional room between the front and back of the fan compartment 13.

An electric motor 19 is supported within the fan compartment 13 as by bracket means 20 which may be secured to the rear wall of said fan compartment. Sound deadening and vibration absorbing means, such as rubber, is indicated by 21 and is used between the motor 19 and the bracket 20. A fan 22 is removably secured to the shaft 23 of the motor, as by a set screw 11. This fan 22 is operatively disposed within an inwardly extending tubular collar 24 which is carried by the front member 15 of the fan housing. The arrows A shown in Fig. 2 indicate that the fan 22 is designed so that when it is in operation it will draw air into the fan compartment 13 and drive this air downwardly through the wall duct 12. This represents one mode of operation of this air heater and circulator. Another mode of operation of the same is provided by replacing the fan 22 by a fan having blades pitched in an opposite direction so that when the fan is in operation it will draw air inwardly through the heater compartment 14 and upwardly through the duct 12 and will discharge this air from the fan compartment 13 through the grill 17.

If the collar 24 around the fan 22 is not used it has been found that the fan 22 is liable to build up air pressure in the fan compartment 13 to such an extent that some air will be forced back outwardly through the peripheral portions of the grill 17 at the same time that air is being drawn in by said fan. The use of the collar 24 prevents this from occurring.

Preferably air cleaning means is provided for use in connection with the fan compartment 13. The air cleaning means shown in Fig. 2 comprises slide means 25 which is adapted to be inserted through an opening 26 in the front member 15 of the fan compartment and this slide means includes a front plate 27 having a U-shaped screen member 28 secured thereto. Suitable porous air cleaning material 29, such as steel wool, is held in the U shaped screen member 28 and forms an air cleaning screen extending entirely from front to rear and side to side of the fan compartment. All air passing in either direction between the fan compartment 13 and the duct 12 will have to pass through this air cleaning material 29. This air cleaning material is loosely arranged so as not to appreciably retard the passage of air there-through.

The electric heater compartment 14 is of greater thickness or depth than the duct 12 and is preferably of rectangular shape and has a removable front member 30. The front member 30 has a centrally located opening over which is an open work grill 31 of expanded metal or screen wire. Preferably screws 32 are used to secure the front member 30 to flanges 33 on the front of the compartment 14. Preferably the flanges 33 on the lateral and bottom edges of the heater compartment 14 are formed of separate angle shaped pieces, as shown in Figs. 3 and 4, to facilitate assembly of parts.

A lower plate 34, see Figs. 3 and 4, is disposed within the heater compartment 14 a short distance from the bottom thereof and is secured to the walls of said compartment 14. This plate 34

has two spaced apart heater elements receiving openings each of which has marginal downturned tab portions 35, see Fig. 3. The plate 34 further has two air circulation openings 36, Fig. 4, positioned near the opposite ends thereof. Preferably the opening in the front cover member 30 of the heater compartment 14 extends a short distance below the front edge of the lower cross plate 34 to provide a passageway 37, Fig. 3, through which air may flow into or out of the space below said lower cross plate 34. This prevents trapping heat in the space below the lower plate 34.

Two upper cross plates 38 and 39, Figs. 3, 5 and 6, are secured within the heater compartment 14 in relatively spaced apart relation with the plate 39 approximately flush with the upper edge of the opening in the front member 30 of said heating compartment 14 and the plate 38 spaced below the upper edge of said opening in the front member 30. This provides between the two plates 38 and 39 a long narrow horizontal air passageway for purposes hereinafter described. The cross plate 38, Figs. 3 and 5, has two spaced apart U shaped heater element receiving notches 40 extending from its forward edge rearwardly. The cross plate 39, Figs. 3 and 6, has two complementary heater element receiving notches 41 extending from its rear edge forwardly. Preferably the notches 40 are beveled as at 42, Fig. 5, to facilitate assembly of parts hereinafter described. Two air circulation openings 43 are provided in each of the plates 38 and 39 adjacent the respective ends of these plates. Preferably one edge portion of each of the plates 34, 38 and 39 is bent at right angles to the plate to provide a reinforcing flange 44 on each plate and to facilitate assembly and securing in place of these plates and parts connected therewith.

Two transversely spaced apart electric heaters, each comprising a core 45 of refractory material having a coiled heating element 46 wound thereon, are supported by the plates 34, 38 and 39. An integral stem 47 on the lower end of each core 45 projects into the openings in the plate 34 and is supported by the resilient tabs 35. A longer integral stem 48 on the upper end portion of each core 45 is received within the slots 40 and 41 in the respective plates 38 and 39 and is firmly held by resilient tabs 49. The tabs 49 can be integral parts of the plates 38 and 39 and can be formed and bent outwardly from said plates 38 and 39 in the process of making the notches 40 and 41.

Preferably the electric heater cores 45 are of oblong cross section, as shown in Fig. 4, and have narrow lateral edge portions over which the spirally coiled heater element wire 46 will fit and with which said element wire 46 will firmly engage when it is wound on the cores 45. Also preferably grooves 45' are provided in the front and rear convex portions of the cores 45 for receiving the coiled wire heating elements 46. The gripping of the narrow lateral edge portions of the core 45 by the element wire and the provision of the groove 45' to receive the coils of this element wire cooperate to prevent displacement of this element wire on the coils and minimize the danger of this wire sagging and short circuiting.

Preferably the high resistance wire 46 of which the heating elements are formed is of relatively large diameter and preferably the two elements 46 are electrically connected in series, as diagrammatically shown in Fig. 10. This provides electric heating elements which do not become incandescent when in use and which are high in

heating efficiency and which minimize fire hazards.

Preferably the electric heating elements 46 are spirally coiled so that the convolutions of the wire are closer together near the lower ends of the cores, see Fig. 9, than they are near the upper ends of said cores. This provides more heat near the bottom end of the heating compartment 14 and has been found to be more efficient in heating a room.

A combined heat reflector and baffle plate 50, Figs. 3, 4 and 7, herein referred to as a back plate, is secured, as by screws 51 to the rear edge portions of the cross plates 34 and 38. This back plate 50 has spaced apart horizontal slots 52 provided therein and has air deflecting plates or louvers 53 extending upwardly and rearwardly therefrom with the lower edges of the louvers 53 joined to the back plate 50 along the lower edges of the slots 52. The two upright lateral edge portions 54 of the back plate 50 are inclined forwardly, as shown in Fig. 4, and constitute inclined heat reflecting flanges. These edge portions or flanges 54 are preferably bent double so as to reinforce and strengthen the back plate 50. The reverse bending of these flange portions 54 minimizes the danger of the back plate 50 buckling or warping and coming in contact with the heating elements 46.

Two side plates 55 of similar construction, see Figs. 3, 4 and 8, are provided in spaced apart relation from the side walls of the heater compartment 14. Each side plate 55 has an outwardly inclined rear edge flange 56 which spaces the side plate from the adjacent side wall of the compartment 14. Also each side plate 55 has a hook shaped or trough shaped forward edge portion including a part 57 which is positioned adjacent to and approximately parallel to the front of the compartment 14 and a rearwardly bent terminal edge part 57' which extends toward the adjacent heater. Two inwardly bent tabs 70 are provided on the top and bottom ends of the parts 57 to engage with the plates 34 and 38 and help support the side plates 55. Other tabs 71 are provided on the plates 34 and 38 to help guide and position these side plates 55. The side plates 55 can be inserted from the front of the compartment 14, in assembling the several parts. Preferably the side plates 55 and the back plate 50 are made of aluminum whereby these plates will pick up and give off heat readily.

Preferably thermostatically controlled switch means 58 is mounted on the duct 12 at a substantial distance above the heater compartment 14. Conduit means 59 for electric circuit wires connects this thermostatic switch 58 with both the fan compartment 13 and the electric heater compartment 14. This thermostatically controlled switch 58, together with the fan motor 19, the electric heating elements 46, a double pole switch 60 and a single pole double throw switch 61 are diagrammatically shown in Fig. 10.

In accordance with the showing in Fig. 10 electric current is supplied to switch 60 by way of source of supply wires 62. If switch 60 is open no current can reach the elements 46 or fan motor 19. If switch 60 is closed and switch 61 is in the position shown by full lines in Fig. 10 then the thermostat switch 58 will control the supply of current to both the heater elements 46 and the fan motor 19 so that the fan and the heater elements will all be energized at the same time and de-energized at the same time. The thermostatically controlled switch 58 can be manually opened

in the manner common to such switches and if said thermostatically controlled switch 58 is open and the switch 60 closed then the circuit to the heating elements 46 will always be broken but the fan motor 19 can be energized and the fan operated to circulate air without heating such air by moving the switch 61 to the position shown by dotted lines in Fig. 10. The switch 61 is a two position switch which can not be left open or caused to remain in an open position and for this reason it is not possible to leave the switch 61 in a position which will break the circuit to the fan motor 19 while energy is being supplied to the heating elements 46. The provision of the switch 61 and circuit as shown in Fig. 10 makes it possible to use this device as an air circulator without using it as an air heater.

Preferably the switches 61 and 60 are positioned within the upper portion of the heater compartment 14, as shown in Fig. 3, and are adapted to be manually controlled by switch levers 61' and 62' respectively which are accessible from the exterior of said compartment 14.

This electric heater and circulator can be installed in a wood frame building in a wall of the usual thickness and construction and will not obstruct the space in the room it is used to heat. Preferably the fan 22 is constructed and operated so that it will take air in through the upper grill 17 and will force this air downwardly through the duct 12 and outwardly over around and past the heating elements and heated parts in the compartment 14 and outwardly through the lower grill 31. When this mode of operation is used some downflowing air will be deflected by the louvers 53 and directed outwardly through the slots 52 and between the heating elements 46 substantially in a horizontal direction while some downflowing air will either pass through the openings 36 and 43 in the plates 34, 38 and 39 or around the inclined edge portions 54 of the back member 50 and this air will pass transversely over the heating elements 45-46 and mix with the stream of air which is moving outwardly between said heating elements. This mixing of the streams of air from the sides and back of the compartment 14 equalizes the temperature of all of this air. The velocity of the outwardly moving stream of air causes all of the air to move out into the room and is conducive to an even distribution of heat in the room and helps to prevent the heated air from following a short ascending path directly back to the intake compartment 13. The tendency of the heated air to rise is further retarded by providing for the outward flow of a layer or blanket of cooler air through the passageway between the plates 33 and 39. This layer of cooler air immediately above the heated air tends to prevent the heated air from rising too rapidly.

If the fan 23 is designed and arranged so that it will discharge air through the upper grill 17 then cool air may be drawn from a location near the floor and heated air discharged at a higher location in the room.

Obviously the fan compartment 13 may be positioned adjacent the ceiling of a room or at any desired distance down from the ceiling. Usually the heater compartment 14 is positioned near the floor.

If two or more of these heaters are installed in different parts of a room then some of said heaters may be arranged to draw air from near the ceiling and deliver this air near the floor and

other heaters may be arranged to draw air from near the floor and deliver it near the ceiling.

The foregoing description and accompanying drawings clearly disclose a preferred embodiment of this invention but it will be understood that this disclosure is merely illustrative and that changes may be made within the scope and spirit of the following claims.

I claim:

1. In an electric heater an air circulation duct adapted to be installed in a wall of a room and having an intake opening positioned near the ceiling of the room; an electric heater receptacle communicatively connected with the lower end portion of said duct, said heater receptacle having an air discharge opening in the front side thereof; fan means providing a flow of air downwardly through said duct; two spaced apart upright electric heating elements in said receptacle; two vertically spaced apart horizontal plates extending across said receptacle adjacent the upper and lower edges respectively of said air discharge opening and supporting said electric heating elements; and an upright back plate positioned back of said electric heating elements in spaced relation therefrom, said back plate having spaced apart horizontal slots therein and said back plate having inclined air deflecting members extending upwardly and rearwardly from the lower edges of the respective slots adapted to direct downwardly moving air forwardly between said electric heating elements and outwardly through said front opening of said heater compartment.

2. In an electric heater a wall type air circulation duct shaped to fit within a wall of a room and having an air inlet opening communicating with the room; fan means operable to draw air in through said air inlet opening and move said air downwardly through said duct; an electric heater receptacle communicatively connected with the lower end portion of said duct, said heater receptacle having an air discharge opening in the front side thereof; two spaced apart upright electric heating elements in said receptacle; two vertically spaced apart horizontal plates extending across said receptacle adjacent the upper and lower edges respectively of said air discharge opening and supporting said electric heating elements; an upright back plate positioned back of said electric heating elements in spaced relation therefrom, said back plate having spaced apart horizontal slots therein; inclined air deflecting members joined to said back plate adjacent the lower edges of said horizontal slots and extending upwardly and rearwardly from said back plate and adapted to direct downwardly moving air forwardly through said slots and between said electric heating elements and outwardly through the front opening of said heater compartment; and air deflector means at the sides of said back plate operable to direct air sidewise across said heater elements and into the forwardly moving stream of air which is passing between said electric heater elements.

3. The apparatus as claimed in claim 2 in which the front wall of the heater compartment has a narrow opening extending from side to side thereof above the uppermost horizontal plate said opening being positioned to discharge a relatively thin layer of cool air immediately above the forwardly moving stream of warm air which is discharging from the front of the heater compartment.

4. The apparatus as claimed in claim 2 in

which the front wall of the heater compartment has a narrow opening extending from side to side thereof below the lowermost horizontal element supporting plate providing air circulation and preventing trapping of heat below said lowermost horizontal element supporting plate.

5. In an electric heater a wall type air circulation duct vertically disposed and having an air intake opening adjacent its upper end; means operable to move air downwardly through said duct; an electric heater receptacle connected with the lower end portion of said duct and having an air discharge opening in its front side; two vertically spaced apart horizontal plates in said heater receptacle adjacent the upper and lower edges respectively of said discharge opening; two upright spaced apart electric heating elements supported by said plates; two upright back plate positioned back of said electric heating elements and having spaced apart horizontal slots therein; inclined rearwardly and upwardly extending air deflecting members attached to said back plate along the lower edges of the respective horizontal slots adapted to direct downwardly moving air forwardly; forwardly inclined edge flanges on said back plate spaced from the side walls of said heater receptacle; and air deflecting side plates in said heater receptacle in spaced relation from the outer sides of the respective heating elements.

6. The apparatus as claimed in claim 5 in which a hook shaped flange is provided on the forward edge of each air deflecting side plate and extends toward the adjacent heater element in spaced relation from the element.

7. In an electric heater an upright wall type air circulation duct having an air intake opening adjacent its upper end; means operable to move air downwardly through said duct; an electric heater receptacle connected with the lower end portion of said duct and having an air discharge opening in its front side; two upright spaced apart electric heating elements in said heater receptacle in spaced relation from the side walls thereof; two vertically spaced apart horizontal plates extending across said receptacle adjacent the upper and lower edges respectively of the air discharge opening in the front side thereof and supporting said electric heating elements, each of said horizontal plates having two air circulation openings positioned near the respective ends of the plates and outwardly from said electric heating elements; an upright back plate positioned back of said electric heating elements and having spaced apart horizontal slots therein; inclined air deflector members carried by said back plate and positioned to direct downwardly moving air forwardly through said horizontal slots; and air deflecting side plates positioned at the sides of said back plate and outwardly therefrom to direct air sidewise across said heater elements and into the forwardly moving stream of air which is passing through the horizontal slots in said back plate.

FRANK A. GRAHAM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,007,102	Wallace	July 2, 1935
2,337,518	Young et al.	Dec. 21, 1943
2,471,784	Seifner et al.	May 31, 1949