Oct. 13, 1953 G. STEINGRUBER 2,655,587

WALL-MOUNTABLE ELECTRIC HEATER AND HOUSING ASSEMBLY THEREFOR

Filed May 11, 1951 2 Sheets-Sheet 1

FIG. 1.

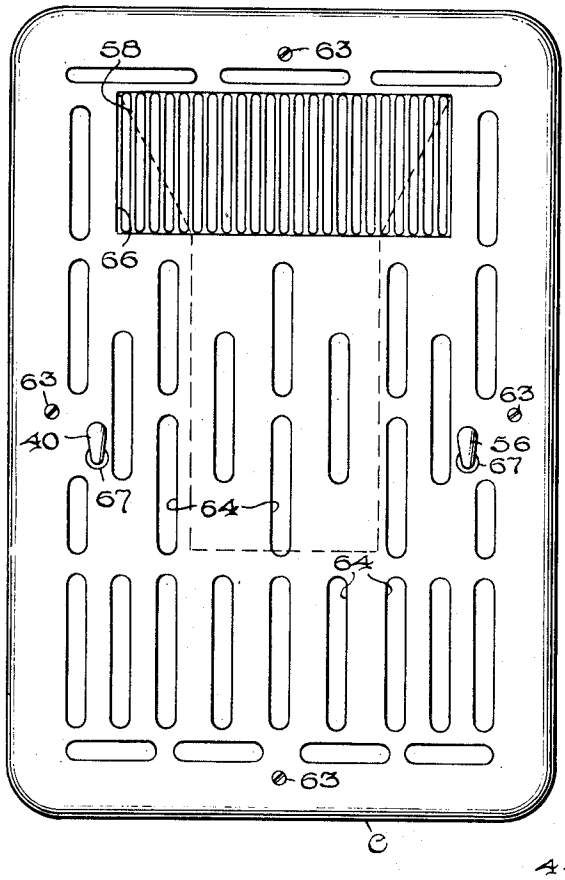
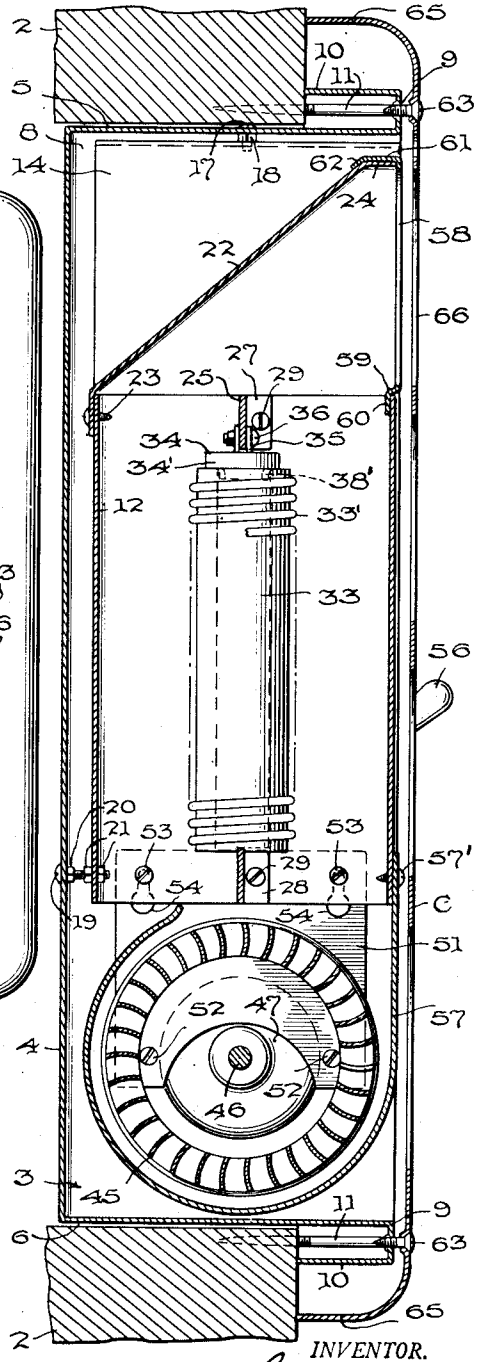


FIG. 3.



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2 Sheets-Sheet 2

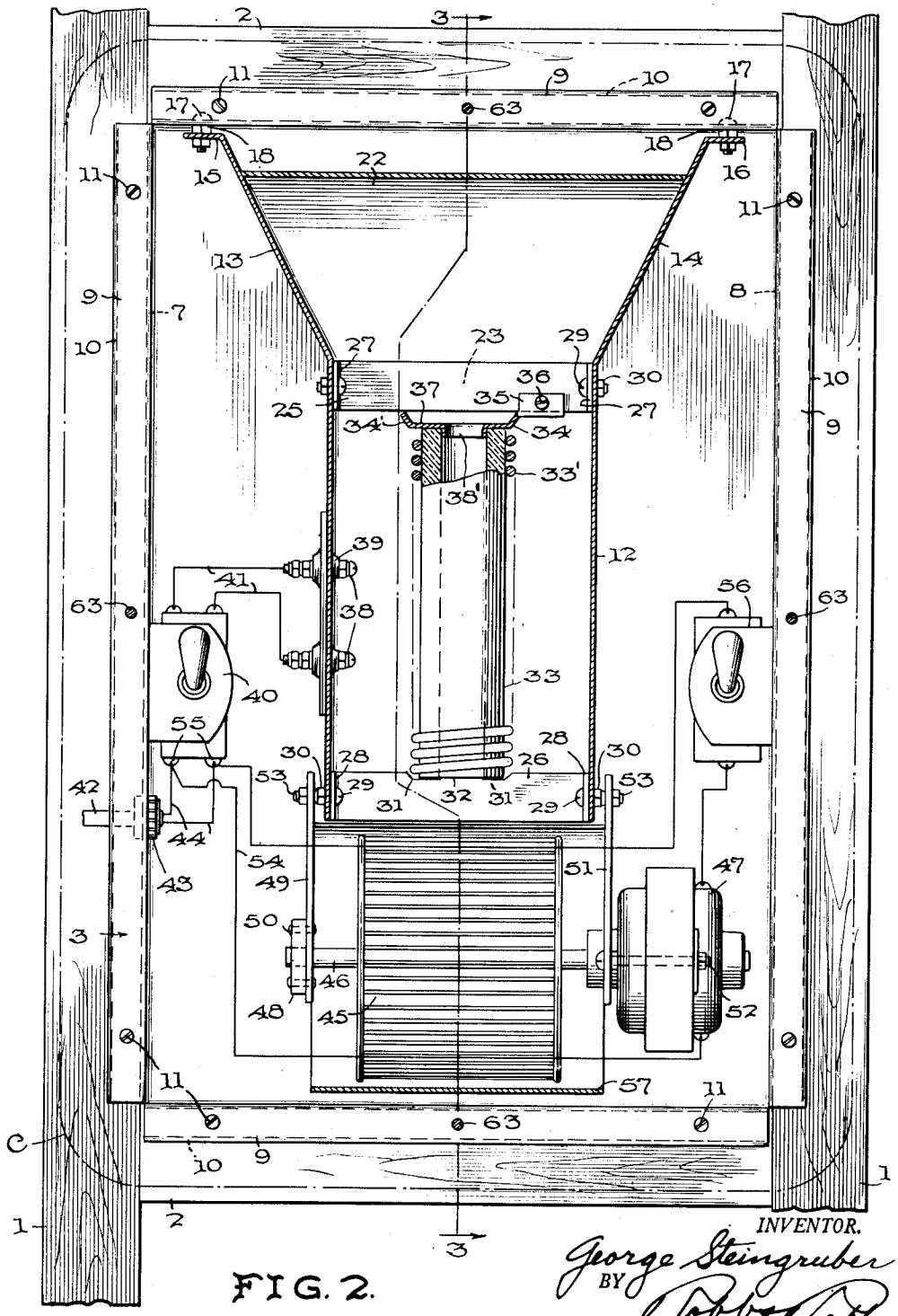


FIG. 2.

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2,655,587

UNITED STATES PATENT OFFICE

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WALL-MOUNTABLE ELECTRIC HEATER AND HOUSING ASSEMBLY THEREFOR

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10 Claims. (Cl. 219—39)

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The present invention relates to space heaters of the electrically heated, forced air-circulating type, and more particularly to a space heater adapted to be mounted in the wall of a building.

Small electric heaters have been found to be highly desirable for purposes of supplementing the conventional heating system with which most buildings are provided, or for heating the desired rooms of buildings located in the warmer sections of the country, and which are often lacking in proper or adequate heating facilities during unusually cold weather.

It is not always desirable or practical to have a heater of the conventional portable type in each room of a house, apartment or the like, due to the fact that these heaters do not always blend with the furnishings of every room, or there is not ample space in the room for an additional piece of furniture.

Accordingly, it is a primary object of the present invention to provide an electrically operated air-circulating space heater which is so compactly constructed as to be readily mountable in an existing building wall, partition or the like, and which will not project any substantial or unsightly distance into the room.

A further object is to provide a wall-mountable electric space heater of improved construction which is both compact and efficient, and which is neat and attractive in appearance, as well as exceedingly simple in form, so as to be relatively inexpensive in cost of production and cost of operation.

In carrying out the foregoing general aims of the invention, my improved heater is so constructed as to utilize to maximum advantage the combination of radiated, reflected and circulated heat in such a manner as to produce a continuous flow of warm air in sufficient volume to heat a room of substantial size.

In addition to producing circulation of heated air by convection currents in substantial and effective volume, I also preferably provide for forced circulation of the heated air by a power-driven fan which is so constructed as to occupy a minimum of space, and which is so arranged with respect to the heater construction that the cool air drawn into the heater will act to prevent overheating of the power source for the fan.

A further object is to provide a space heater having the foregoing advantages and which may be utilized as an air-circulating fan without heating the air, for use in warm weather, thus avoiding any necessity for a separate circulating fan,

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as is particularly desirable in the warmer sections of the country.

Still another object is to provide a novel and improved heater casing of sheet metal construction, together with a novel and improved assembly of air-circulating and heating elements within the casing, which attain the objects and advantages aforementioned.

Other and further objects and advantages of the invention will be hereinafter described, and the novel features thereof defined in the appended claims.

In the drawings:

Figure 1 is a view in front elevation of a space heater made in accordance with the present invention;

Figure 2 is an enlarged view, partly in front elevation and partly in section, with the front cover-plate shown in broken lines, and showing one illustrative installation of the heater in a building wall, partition or the like; and,

Figure 3 is a view in vertical section, as taken on the line 3—3 of Figure 2, but with the front cover-plate shown in full lines.

Like reference characters designate corresponding parts in the several figures of the drawings, wherein 1 generally denotes a pair of longitudinally extended, spaced, parallel wall or partition studs having a pair of transversely extended, parallel frame members 2 disposed therebetween to form a substantially rectangular, framed opening adapted to receive a heater construction therein.

The heater construction, for purposes of illustration, comprises a substantially rectangular, recessed outer housing or casing having a rear wall 4, parallel top and bottom walls 5, 6 respectively, and parallel side walls 7, 8 respectively, this housing preferably being formed from a single piece of sheet metal. The outer marginal edges of the walls 5, 6, 7 and 8 of the housing 3 are turned outwardly at approximately a right angle to form marginal attachment flanges thereon, as indicated at 9, and are retroverted, as at 10, to reinforce the attachment flanges, and butt up against the studs or frame members 1, 2 in order to properly position the housing 3 within the opening defined thereby. The attachment flanges 9 are provided with a suitable number of openings therethrough which are adapted to receive a corresponding number of anchor fasteners 11 for securing the housing 3 within the frame members 1, 2.

Located within the housing 3 is an inner casing or shell 12 which is preferably substantially

square or rectangular in horizontal section and defines an air heating chamber, the lateral sides of the shell being extended above the front and rear sides thereof and diverging upwardly to form a pair of hanger plates 13, 14 having their upper marginal edges turned outwardly to form flanges 15, 16 which are secured to the top wall 5 of the housing 3, as by means of a suitable number of fasteners 17, but slightly spaced therefrom to provide an air space between the inner shell and the top wall 5 of the outer housing 3, the fasteners 17 being preferably locked to the wall 5 by means of lock nuts 18.

Adjacent to the lower end thereof, the inner shell 12 is rigidly anchored by means of a screw fastener 19 which is locked to the rear wall 4 of the housing 3 by a lock nut 20, the fastener 19 extending through the rear wall of the shell 12 which is clamped between the clamp nuts 21 in spaced relation to the rear wall 5 of the housing 3 to provide an air space therebetween.

An air-directing or deflecting top plate 22 is secured to the upper rear edge of the shell 12, as at 23, and extends angularly upwardly toward the front of the housing 3 to a point just below the uppermost flanges 15, 16 on the sides 13, 14 of shell 12, the free end of the deflector plate 22 having a horizontally disposed flange 24. The lateral edges of the deflector plate 22 diverge at an angle towards the flange 24 so as to be in contact with the upwardly diverging sides 13, 14 of the inner shell 12, thus completing a hollow open-ended air tube or heating chamber which is adapted to direct air out into a room in a manner which will hereinafter become more apparent.

A pair of transverse struts 25, 26 are respectively extended across the upper and lower ends of the body of the inner shell 12, the opposite ends of each of the struts 25, 26 being offset as at 27, 28 and attached to the shell 12 by means of screw fasteners 29 which project through the ends 27, 28 of the struts and through the walls of the shell 12, with nuts 30 clamping these parts together.

The lower strut 26 centrally thereof is provided with a pair of spaced notches 31 and an intermediate lug 32 adapted to support one end of a hollow porcelain or other insulated tube 33. The upper strut 25 has a resilient member 34 secured thereto adjacent one end thereof, the member 34 preferably being formed from a single piece of resilient metal so as to provide a U-shaped end 35 adapted to straddle the strut 25 and to be secured thereto by means of a screw fastener 36 or the like. Projected downwardly from the plane of the strut 25 and horizontally extended from the U-shaped end 35 of the member 34 is a flat plate 37 having its center so punched out as to form an annular bead 38 adapted to engage the upper end of the porcelain tube 33, as is best seen in Figure 2, the free end 34' of the member 34 being turned upwardly to within a short distance of the lower edge of the strut 25, or into firm engagement therewith as may be preferred.

The advantages of the just-described tube supporting construction are manifest, since the porcelain tube 33 may be readily removed for replacement by merely lifting the same against the pressure of the resilient member 34 a sufficient distance to lift the bottom end of the tube free of the centering lug 32 and the notches 31 of the lower strut 26 and then pulling the tube from between the struts, as is apparent. Furthermore, the resilient member 34 absorbs any shocks to the tube 33 during transportation of the heater

assembly to a point of installation, but at the same time, the resilient member 34 holds the tube in place and against displacement due to such shocks. Still further, the tube 33 is subject to expansion and contraction when the heater is turned on and off respectively, and the resilient member 34 compensates for such expansion and contraction to prevent damage to the tube 33.

Disposed about the outer periphery of the porcelain tube 33 is an electric heating or resistance coil 33' which is connected to a pair of connectors 38 which are suitably insulated from the shell 12 in which they are secured in a suitable manner, as at 39, the connectors 38 being in turn electrically connected with a suitable switch 40 by a pair of wires diagrammatically shown at 41. The switch 40 is connected to a source of electric current supply by an extension cord 42. The extension cord 42 is suitably secured in the side wall 7 of the housing 3, as at 43 and is connected to the switch by a pair of lead wires 44. Thus, the electric circuit through the heating coil or resistance 33' may be selectively completed or broken by the switch 40, as is readily apparent upon reference to Figure 2.

Coming now to the means for forcing circulation of air through the shell 12, I provide a so-called squirrel cage or centrifugal fan 45 having a coaxially extended shaft 46 disposed beneath the inner shell 12. The shaft 46 is operatively connected at one end with a suitable power source or electric motor 47, the opposite end being journalled in a bearing 48. The bearing 48 is suitably mounted on a hanger bracket 49 as at 50, and the motor is mounted in axial alignment with the bearing 48 on a second hanger bracket 51, by means of bolts 52 or the like. The hanger brackets 49, 51 are each detachably supported at the lower end of the inner shell 12 by means of screws 53 or the like extending through the opposed lateral walls of the inner shell 12, the upper ends of the hanger brackets each being provided with a pair of bayonet slots 54 for quick mounting and demounting of the fan-motor assembly.

The use of a centrifugal fan for forcing circulation of air is one important feature of the present invention, since this type of fan requires a minimum of space, but will circulate a maximum of air for the space utilized, the space limitations for wall-mounted heaters being quite small, usually about 3 to 4 inches, due to the relatively shallow depth of building walls and partitions. Thus, a fan of any substantial size would necessitate a housing that projects a substantial distance outwardly from the wall in which the heater is mounted. On the other hand, if a conventional fan having radial blades were to be utilized in the maximum space required by the heater of this invention, the fan would not be capable of circulating a sufficient volume of air. My heater projects into a room only a slight distance, viz. the depth of the front cover plate C which will be hereinafter described, this cover plate being preferably about one inch in over-all depth.

As seen in Figure 2, electric current is supplied to the motor by way of the conductors diagrammatically indicated at 54, which are connected in parallel with the switch 40 and the heater coil 33', as at 55. A second switch 56 mounted on the side wall 8 of the housing 3 is interposed in the motor circuit for selectively completing or breaking the motor circuit as is apparent.

While the electric circuits for energizing the heater coil 33' and the motor 47 have been dia-

grammatically shown as being in parallel, it will be readily apparent to those skilled in the art that the circuits may be varied without departing from the spirit of this invention.

For directing the maximum volume of air circulated by the fan upwardly through the shell **12**, there is provided a baffle or director plate **57** which is secured to the lower end of the shell **12**, as at **57'**, and extends downwardly beneath the fan **45**, and thence upwardly on the other side of the fan to a position closely adjacent to the lower end of the shell **12** (see Fig. 3 particularly).

At the upper end of the inner shell **12**, I provide a removable grill or closure **58** for the shell **12**, this grill having a portion of its lower edge offset slightly to form a shoulder **59** adapted to engage the upper edge of the inner shell **12**, and a flange **60** adapted to engage behind the upper edge of the shell **12**, as is best seen in Figure 3. The upper side of the grill **58** is bent inwardly at a right angle to the body of the grill to form a flange **61** having a marginal flange **62** thereon directed slightly downwardly, the flanges **61**, **62** forming means for engaging the flange **24** of the deflector plate **22** to releasably secure the grill **58** in the position shown in Figures 1 and 3. The grill **58** is easily applied by merely placing the shoulder **59** and flange **60** in engagement with the shell **12** and then snapping the upper flanges **61**, **62** over the flange **24** of the deflector plate **22** as permitted by the inherent resilience of the sheet metal parts.

A front cover plate C is secured to the attachment flanges **9** of the housing **3** by means of a suitable number of sheet metal screw fasteners **63** or the like. This cover plate comprises a flat front portion having a desired number of openings **64** therethrough arranged to provide any desired aesthetic effect and allowing free flow of air therethrough. The marginal edge of the cover plate C is turned rearwardly to form a flange **65** therearound which is adapted to butt up against the wall in which the heater is mounted, as is best seen in Figure 3. Adjacent to the upper end thereof, the cover plate C is provided with a relatively large opening **66** which substantially conforms in size and shape with the removable grill **58**, and the cover plate C is further provided with a pair of openings **67** through which the operating arms of the switches **40**, **56** project so as to be readily accessible.

The operation of the space heater will now be described.

Assuming that the switches **40**, **56** are each closed to energize the heater coil **33'** and the fan motor **47**, the fan **45** will draw cool air into the housing **3** through the openings **64** in the cover plate C, this air being, for the most part, drawn into the fan at its ends due to the curved baffle plate **57**, thus maintaining the motor **47** cool during prolonged periods of operation. The air is then directed into the lower end of the inner shell **12** and upwards therethrough where it is heated by the heat radiated from the element **33'**, as well as by the heat reflected from the side walls of the shell **12**. The air is then deflected by the plate **22** and directed outwardly through the grill **58**. Since cool air is free to enter the housing throughout its entire height, this cool air, in being drawn into the fan, will pass through the air spaces between the housing **3** and the inner shell **12** in such a manner as to avoid any pocketing of excessive heat therebetween.

It should be understood that when less heat is desired, electric current to the fan may be cut off and warm air will continue to circulate due to convection currents within the inner shell **12** in sufficient volume to warm a room under moderate temperature conditions or to warm a small room. Therefore, it is apparent that, if desired, the heater of this invention may be availed of for some installations, minus the fan, without departing from the spirit of the invention.

Moreover, if desired, the fan may be operated independently of the heating means to provide for circulation of unheated air, and accordingly, this invention may be availed of for some installations, minus the heating instrumentalities without departing from the spirit thereof.

While the specific details of one embodiment of the invention have been herein shown and described, the invention is not confined thereto as changes and alterations may be made without departing from the spirit thereof as defined in the appended claims.

I claim:

1. A space heater of the class described, comprising a housing, a unitary inner shell mounted in said housing and forming an inner air-heating chamber, said shell being spaced from said housing on all of its sides, air-heating means mounted in said chamber, air-circulating means disposed beneath the inner shell for forcing circulation of air through said chamber, means at the upper end of said chamber for directing air forced through the chamber to the exterior of said housing, and said housing having means for directing relatively cool air into the same responsive to the circulating means, said air-circulating means comprising a centrifugal fan-motor assembly supported by said inner shell, said fan motor assembly comprising a pair of spaced brackets connected to said shell, a centrifugal fan having a shaft rotatably journalled at one of its ends in one of said brackets, the opposite end of said shaft being operatively connected with an electric motor, said motor being supported on the other of said brackets, and means for supplying electric current to said motor.

2. A space heater of the class described, comprising a housing, a unitary inner shell mounted in said housing and forming an inner air-heating chamber, said shell being spaced from said housing on all of its sides, air-heating means mounted in said chamber, air-circulating means disposed beneath the inner shell for forcing circulation of air through said chamber, means at the upper end of said chamber for directing air forced through the chamber to the exterior of said housing, and said housing having means for directing relatively cool air into the same responsive to the circulating means, said air-directing means at the upper end of said chamber including a pair of side members on said inner shell extended upwardly beyond the body of the shell, said side members being secured to the housing aforesaid and constituting hanger supports for said shell.

3. A space heater of the class described, comprising a housing, a unitary inner shell mounted in said housing and forming an inner air-heating chamber, said shell being spaced from said housing on all of its sides, air-heating means mounted in said chamber, air-circulating means disposed beneath the inner shell for forcing circulation of air through said chamber, means at the upper end of said chamber for directing air forced through the chamber to the exterior of said housing, and said housing having means for

directing relatively cool air into the same responsive to the circulating means, said air-directing means at the upper end of said chamber including a pair of side members on said inner shell extending upwardly beyond the body of the shell, said side members being secured to the housing aforesaid and constituting hanger supports for said shell, and said air-directing means at the upper end of said chamber also including air-deflecting means disposed between said pair of side members and in spaced relation to said housing to provide a free air space therebetween.

4. A space heater of the class described, comprising a housing closed at its opposite sides, back, bottom and top, and provided with an opening at its front, a front cover plate disposed across said opening and being provided with a plurality of openings therethrough, a unitary shell defining a heating chamber disposed within said housing in spaced relation to the sides, back, bottom, and top of the latter to form an air space between the shell and the housing, an electric heating element disposed within the shell, a deflector plate at the top of the shell, a fan-motor assembly carried by said shell beneath the same for forcing air upwardly through the inner shell so as to be heated therein and for drawing relatively cool air into the housing, at least some of the air being drawn through the air space between the housing and shell, the heated air being deflected outwardly from said housing by said deflector plate, and means for selectively energizing the heating element and fan-motor, said fan-motor assembly including a centrifugal fan having a fan-bladed rotor of the squirrel-cage type.

5. A space heater of the class described, comprising a housing closed at its opposite sides, back, bottom and top, and provided with an opening at its front, a front cover plate disposed across said opening and being provided with a plurality of openings therethrough, a unitary shell defining a heating chamber disposed within said housing in spaced relation to the sides, back, bottom, and top of the latter to form an air space between the shell and the housing, an electric heating element disposed within the shell, a deflector plate at the top of the shell, a fan-motor assembly carried by said shell beneath the same for forcing air upwardly through the inner shell so as to be heated therein and for drawing relatively cool air into the housing, at least some of the air being drawn through the air space between the housing and shell, the heated air being deflected outwardly from said housing by said deflector plate, and means for selectively energizing the heating element and fan-motor, said fan-motor assembly including a centrifugal fan having a fan-bladed rotor of the squirrel-cage type, said inner shell being provided at its lower end with means for directing air from the fan into said shell.

6. A space heater of the class described, comprising a housing closed at its opposite sides, back, bottom and top, and provided with an opening at its front, a front cover plate disposed across said opening and being provided with a plurality of openings therethrough, a unitary shell defining a heating chamber disposed within said housing in spaced relation to the sides, back, bottom, and top of the latter to form an air space between the shell and the housing, an electric heating element disposed within the shell, a deflector plate at the top of the shell, a fan-motor assembly carried by said shell beneath the same for forcing air upwardly through the inner shell so as to be heated therein and for drawing relatively cool air into the housing, at least some of the air being drawn through the air space between the housing and shell, the heated air being deflected outwardly from said housing by said deflector plate, and means for selectively energizing the heating element and fan-motor, said fan-motor assembly comprising a pair of spaced hanger brackets detachably secured to the lower end of said shell, a centrifugal fan having a shaft rotatably journalled at one of its ends in one of said brackets, the other end of said shaft being operatively connected with a motor, and said motor being supported on the other of said brackets.

7. A space heater housing assembly of the class described, comprising a housing adapted to be recessed in a wall of a room, said housing being closed at its opposite sides, bottom, top, and back, and being open at the front, an inner shell defining an air-heating chamber mounted within the housing in spaced relation to the sides, bottom, top, and back of the housing and forming an air space between the shell and the housing, air deflecting means at the upper end of the shell for directing air through the open front of the housing, means for supporting an electric heater element within said shell, means for supporting an electric motor-operated fan within said housing below the shell, and a front cover plate secured on said housing, said housing including an attachment flange disposed about the housing and adapted to be secured in a framed opening in the wall of a room, said cover plate being secured to said attachment flange and having its marginal edge turned rearwardly for abutting contact against the wall when the assembly is installed.

8. A space heater housing assembly of the class described, comprising a housing adapted to be recessed in a wall of a room, said housing being closed at its opposite sides, bottom, top, and back, and being open at the front, an inner shell defining an air-heating chamber mounted within the housing in spaced relation to the sides, bottom, top, and back of the housing and forming an air space between the shell and the housing, air deflecting means at the upper end of the shell for directing air through the open front of the housing, means for supporting an electric heater element within said shell, means for supporting an electric motor-operated fan within said housing below the shell, and a front cover plate secured on said housing, said housing being provided with a marginal attachment flange turned at a right angle to the side, bottom, and top walls respectively thereof, the marginal flange being retroverted to provide reinforcing means for the attachment flange.

9. A space heater housing assembly of the class described, comprising a housing adapted to be recessed in a wall of a room, said housing being closed at its opposite sides, bottom, top, and back, and being open at the front, an inner shell defining an air-heating chamber mounted within the housing in spaced relation to the sides, bottom, top, and back of the housing and forming an air space between the shell and the housing, air deflecting means at the upper end of the shell for directing air through the open front of the housing, means for supporting an electric heater element within said shell, means for supporting an electric motor-operated fan within said housing below the shell, and a front cover plate secured on said housing, said inner shell including a pair of upwardly extended sides secured to the top of the housing for supporting the shell therein, said air deflecting means comprising a forwardly in-

clined plate extending forwardly and upwardly from the top rear wall of the shell and transversely spanning the upwardly extended sides of the shell to form an air outlet between the top edge of the shell and the deflector plate.

10. A space heater housing assembly of the class described, comprising a housing adapted to be recessed in a wall of a room, said housing being closed at its opposite sides, bottom, top, and back, and being open at the front, an inner shell defining an air-heating chamber mounted within the housing in spaced relation to the sides, bottom, top, and back of the housing and forming an air space between the shell and the housing, air deflecting means at the upper end of the shell for directing air through the open front of the housing, means for supporting an electric heater element within said shell, means for supporting an electric motor-operated fan within said housing below the shell, and a front cover plate secured on said housing, said inner shell including a pair of upwardly extended sides, means securing said upwardly extended sides to the top of the housing

for supporting the shell therein, said air deflecting means comprising a forwardly inclined plate extending forwardly and upwardly from the top rear wall of the shell and transversely spanning the upwardly extended sides of the shell to form an air outlet between the top edge of the shell and the deflector plate, and a removable grill disposed across said air outlet, said grill being detachably interengaged with the upper edge of the shell and the forward end of the deflector plate.

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