Feb. 11, 1958 R. M. FIANDT 2,823,291

SPACE HEATER OF THE CONVECTION CIRCULATION TYPE

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Fig. 1

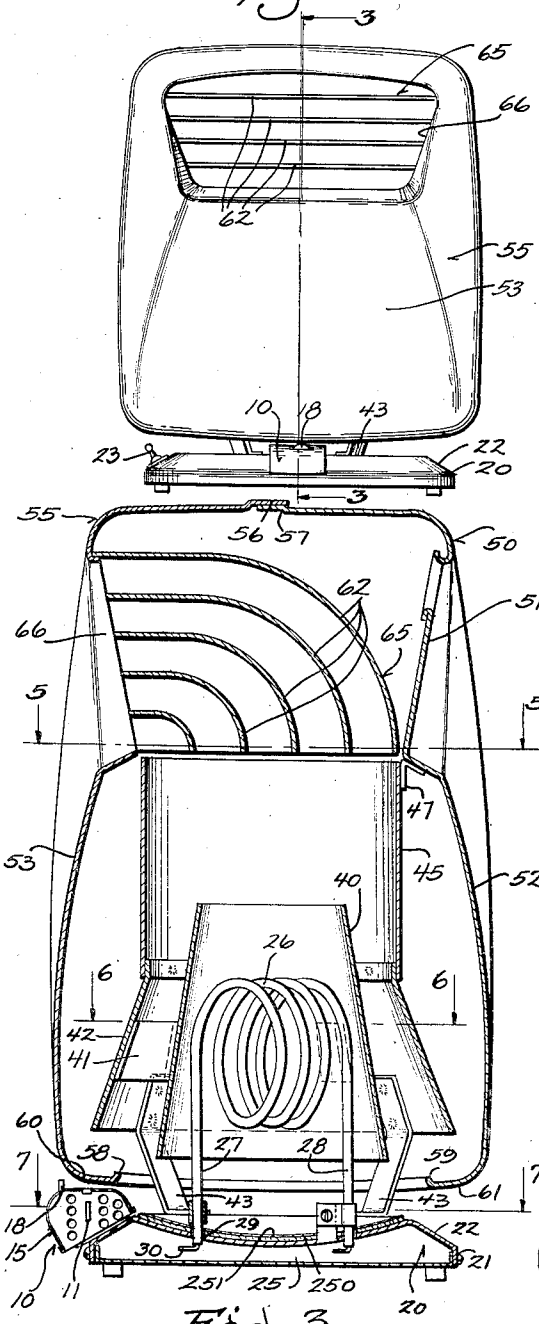


Fig. 2

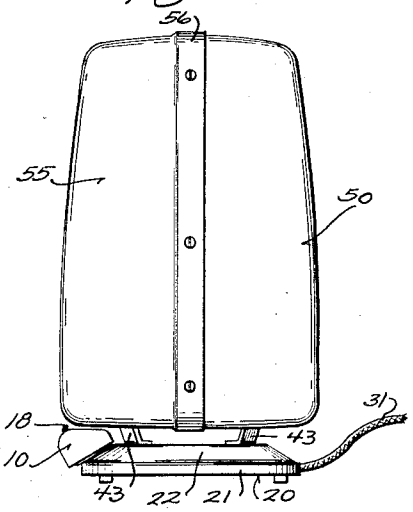


Fig. 4

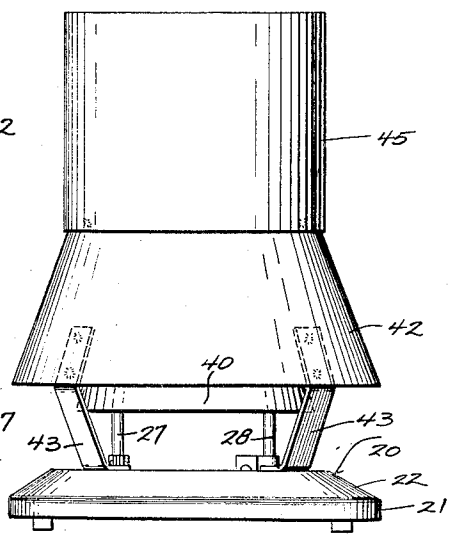


Fig. 3

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SPACE HEATER OF THE CONVECTION CIRCULATION TYPE

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Fig. 5

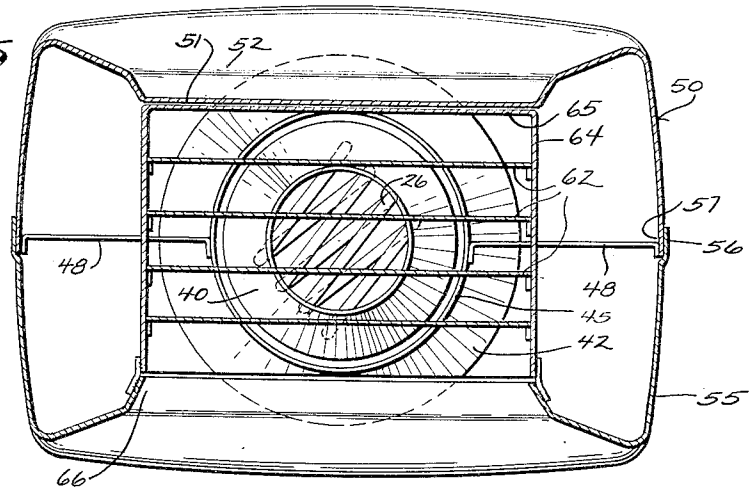


Fig. 6

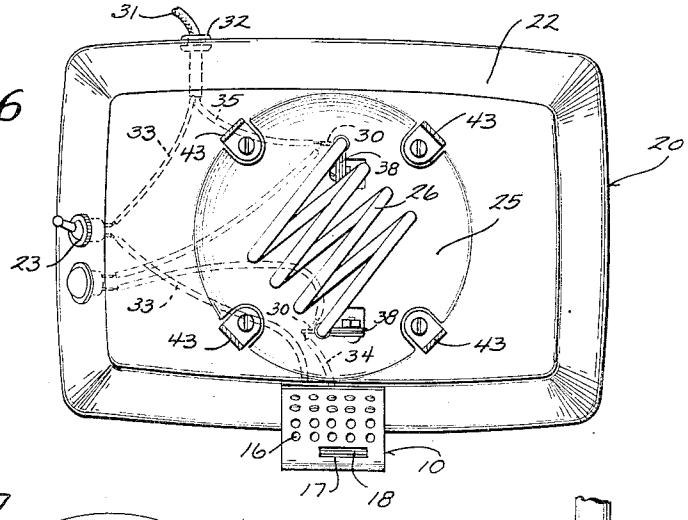


Fig. 7

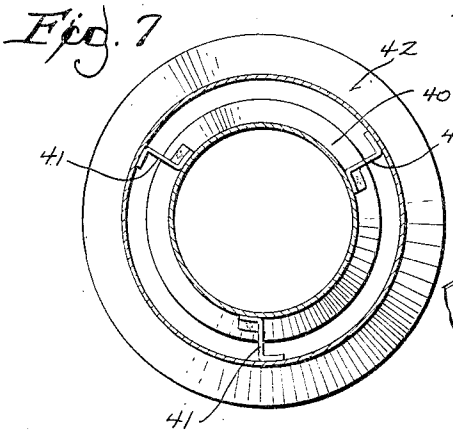
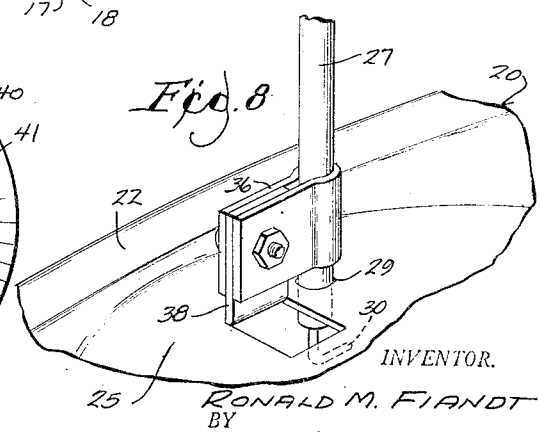


Fig. 8



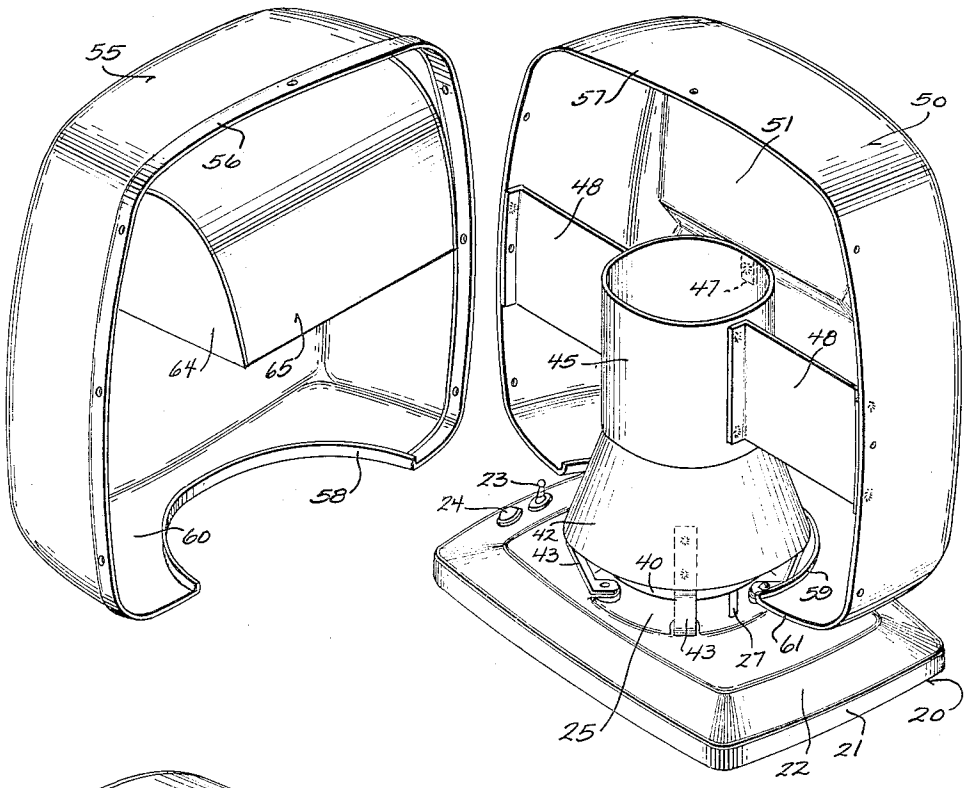
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SPACE HEATER OF THE CONVECTION CIRCULATION TYPE

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Fig. 9



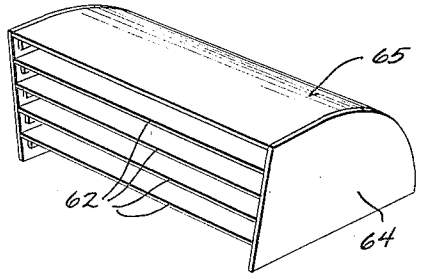


Fig. 10

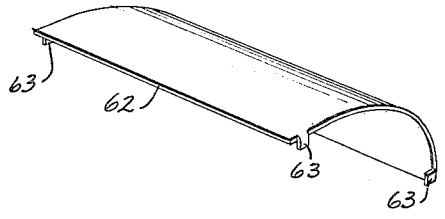


Fig. 11

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SPACE HEATER OF THE CONVECTION CIRCULATION TYPE

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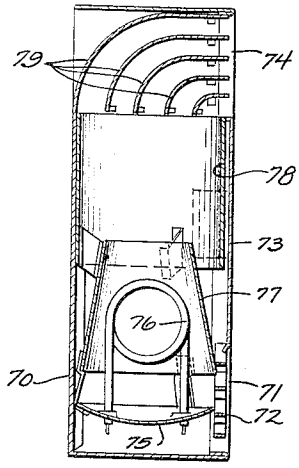


Fig. 13

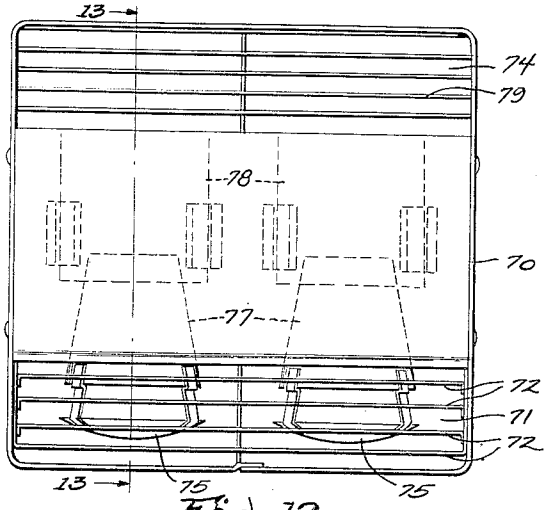


Fig. 12

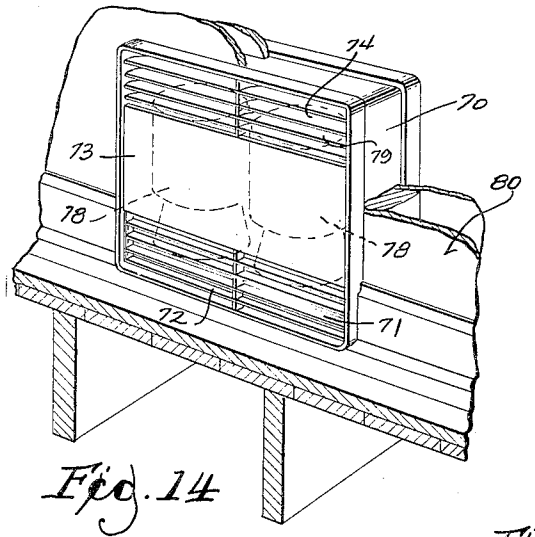


Fig. 14

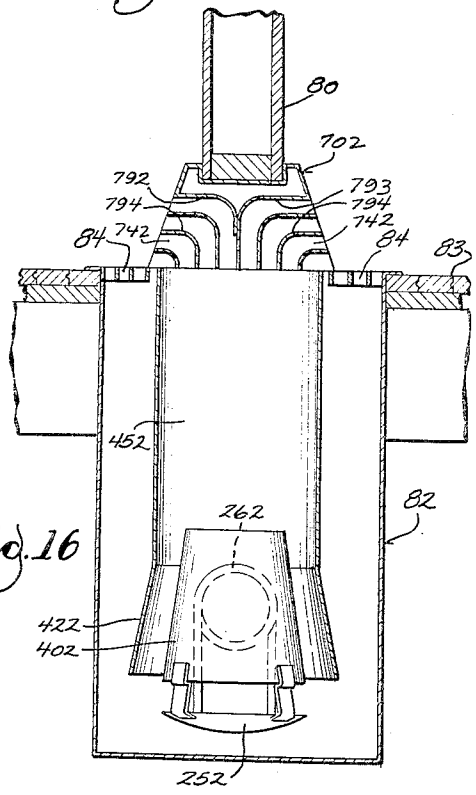


Fig. 16

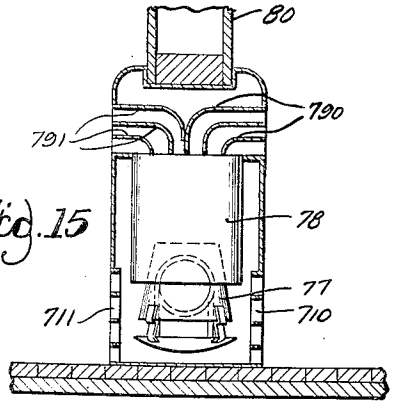


Fig. 15

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SPACE HEATER OF THE CONVECTION CIRCULATION TYPE

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Fig. 17

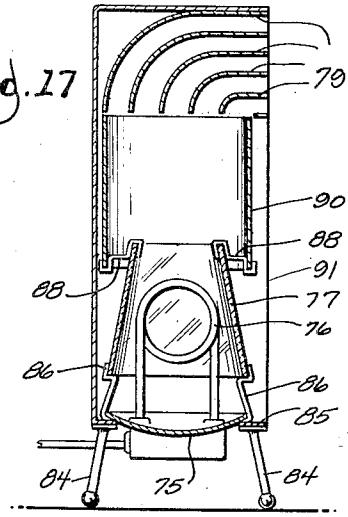


Fig. 18

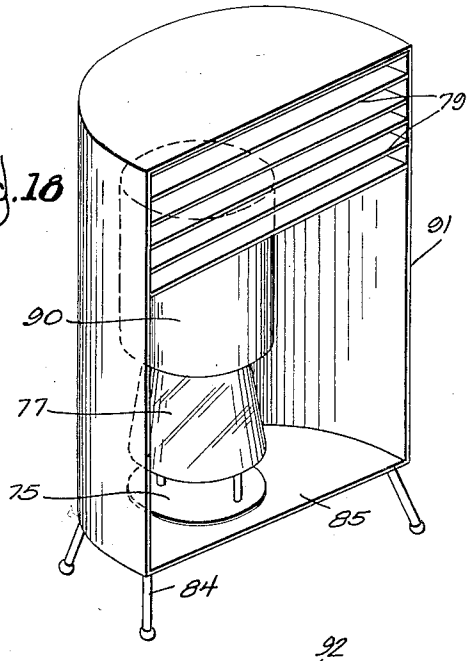


Fig. 19

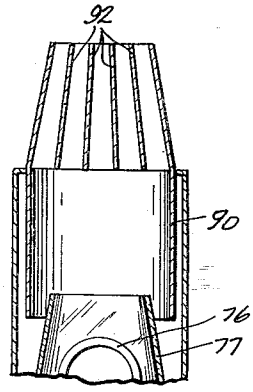
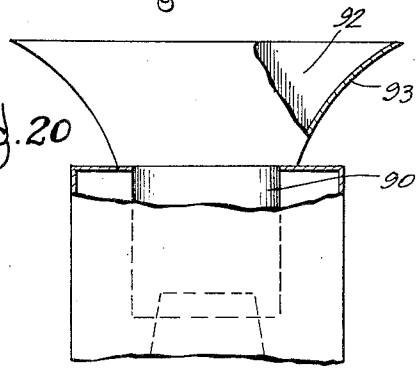


Fig. 20



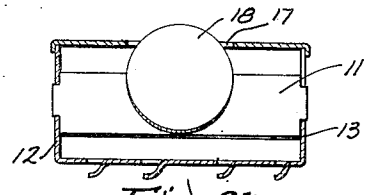


Fig. 21

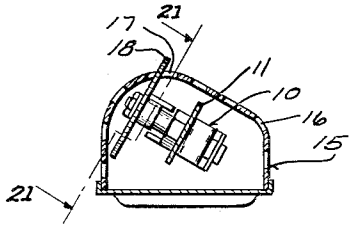


Fig. 23

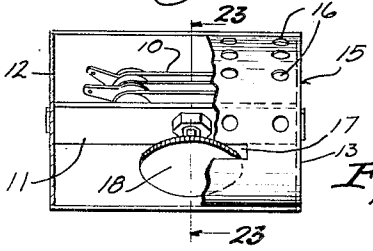


Fig. 22

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United States Patent Office 2,823,291
Patented Feb. 11, 1958

2,823,291

SPACE HEATER OF THE CONVECTION CIRCULATION TYPE

Ronald M. Fiandt, Milwaukee, Wis., assignor, by mesne assignments, to Preway Inc., Wisconsin Rapids, Wis.

Application July 21, 1954, Serial No. 444,679

17 Claims. (Cl. 219—34)

This invention relates to a space heater of the convection circulation type.

The heater uses a special jetting device and venturi stack arrangement to expedite and control air circulation. Special features include the mounting of an electrical resistance coil used as a preferred source of heat, the provision of vanes or baffles for extending the venturi effect and mixing the air and rectifying and re-directing air flow and delivering it forwardly into the room; the mounting of the parts for convenient assembly and convenient access on disassembly, many of the parts being desirably mounted on a base and others being mounted on one of two of the vertically parted elements constituting the enclosing shell, the other shell element being desirably left unencumbered and fastened to the stack and associated parts supported from the base.

In some embodiments of the invention special arrangements are made whereby either the baffles or the heating elements and stacks, or both, are used in multiples, either for increase in capacity or for delivery of air in opposite directions into two different rooms to be heated.

In all embodiments it is an object to use the available energy most efficiently for the heating of the air and acceleration of the flow thereof with a minimum of heat delivered to the shell, whereby the latter will not become so warm as to be either dangerous or uncomfortable to touch. So far as capacity is concerned, my improved heater will move more air than is moved by many heaters of equal wattage which are equipped with fans. By moving the air in large volume, I am able to heat the air of a room substantially uniformly without raising the temperature of any portion of it excessively.

In the drawings:

Fig. 1 is a view in front elevation of a heater embodying my invention.

Fig. 2 is a view in side elevation of the heater shown in Fig. 1.

Fig. 3 is an enlarged detail view taken in section on the line 3—3 of Fig. 1.

Fig. 4 is a view in side elevation of a sub-assembly comprising the base and concentric stacks used in the heater of Figs. 1 to 3.

Fig. 5 is a view taken in transverse section on the line 5—5 of Fig. 3.

Fig. 6 is a view taken in section on line 6—6 of Fig. 3.

Fig. 7 is a view taken in section on line 7—7 of Fig. 3.

Fig. 8 is a fragmentary detail view in enlarged perspective showing the mounting of one end of the heating element of the base.

Fig. 9 is a view in perspective showing in mutually separated positions the component parts of the shell of my improved heater.

Fig. 10 is a view in perspective of a sub-assembly of baffles.

Fig. 11 is a view in perspective of one of the baffles.

Fig. 12 is a view in front elevation of a duplex embodiment of the invention designed for use of the wall heater.

Fig. 13 is a view taken in section on line 13—13 of Fig. 12.

Fig. 14 is a view on a reduced scale showing in perspective a duplex wall heater serving two rooms, as it appears installed, the wall and floor being fragmentarily illustrated in section.

Fig. 15 is a view in transverse section through the wall heater of Fig. 14, the wall and floor being shown in section.

Fig. 16 is a view in transverse section through a floor heater embodying my invention shown installed beneath a partition with opposing outlets to serve two rooms, the partition and floor being also shown in section.

Fig. 17 is a view in cross section showing a modified embodiment of the invention.

Fig. 18 is a view in perspective of the device of Fig. 17.

Fig. 19 is a fragmentary detail view in section showing a modification adaptable to any of the space heater arrangements previously disclosed.

Fig. 20 is a view partially in front elevation and partially in section through the device of Fig. 19.

Fig. 21 is a fragmentary detail view taken in section on the line 21—21 of Fig. 23.

Fig. 22 is a view partially in plane and partially in horizontal section through the thermostat of Fig. 21.

Fig. 23 is a view taken in transverse section on the line 23—23 of Fig. 22.

In the portable heater shown in Figs. 1 to 11, I provide a base 20 which may have a skirt portion 21 closed by a footed bottom wall 19 which rests on the floor. The base provides a wall in which terminal connections are made. Extending inwardly and upwardly from the wall is a bevelled portion 22 upon which I may mount control switch 23, thermostat 10, if any, and pilot light 24. Suspended from the bevelled portion of the base is an upwardly concave reflector portion 25 best shown in Fig. 3. The reflector may include a layer 250 of asbestos for insulation and a reflecting layer 251 of foil, if desired, this construction being shown in Fig. 3.

While different sources of heat may be employed, it is preferred, for the purposes of this portableheater, to employ an electrical resistance coil 26 of the tubular shielded type, the legs 27, 28 of the coil being carried down through openings at 29 in the reflector portion 25 of the base where the conductor 30 is exposed for connection of the wiring. The lead wire 31 enters the base through an insulating grommet 32. One lead 33 goes to switch 23 and thermostat 10 from which lead 34 goes to one of the terminals 30 of the coil. The other lead 35 goes to the other terminal of the coil as shown in Fig. 6. The pilot light 24 may be shunted across the coil to be energized when switch 23 is closed to energize the coil. The outer sheaths of the two legs 27, 28 of the coil may be bound between the ends of a folded clamping plate 36 (Fig. 8) which are bolted to a bracket 38 mounted on the reflector portion 25 of the base.

A special mounting is desirably used for the thermostat to protect it from injury. To this end the thermostat instrument 10 may conveniently be mounted on the cross bar 11 (Figs. 21–23), the ends of which are mounted in openings provided in the end walls 12 and 13 of the housing, generically designated by reference character 15, the housing has numerous holes at 16 to facilitate air circulation about the thermostat and it has a slot at 17 through which the manually adjustable dial 18 projects.

While the heating element may be arranged in a variety of positions in the path of the circulating air, I have found the most efficiency in the arrangement disclosed in which the heating element comprises a rather open helix with its axis horizontal, the helix being rather closely confined within an upwardly tapering stack 40 as best shown in Fig. 3.

The frusto-conical stack 40 is supported in this embodiment, by generally radial brackets 41 from the inner wall of an outer guide sleeve 42, which takes the form of a skirt on stack 45. This sleeve is frusto-conical in the preferred embodiment, and of slightly greater pitch, so that it is somewhat convergent upwardly toward the top of the inner stack 40. The skirt is shorter and encircles an intermediate portion of the inner stack 40. Skirt 42 is carried by brackets 43 from the base in the manner shown in Figs. 3, 4 and 6.

As shown in Fig. 13, the skirt 42 may be omitted in the interest of compactness provided that there is enough lap between the upper and lower stacks to assure proper flow. The degree of lap should be substantially as illustrated for maximum flow.

In the Fig. 3 embodiment, the stack extension 45 is spot welded to the upper end of the sleeve 42. The extension 45 is tubular and of substantially uniform section as shown but may taper as shown in Fig. 19. At its upper end, the stack extension 45 has brackets 47, 48 (Fig. 3 and Fig. 9) supporting from the stack extension the casing shell element 50, to which the said brackets 47 and 48 are also welded.

The casing shell element 50 represents half of the entire casing shell. This particular element happens to be closed at its upper end but for the sake of appearance it may have an inwardly embossed panel at 51, as shown in Figs. 3 and 9. Its entire central portion 52 is offset inwardly from its end portions, being complementary in this respect to the central portion 53 of the complementary casing shell element 55 (Fig. 1). The two elements have telescopically lapping flanges 56, 57 (Fig. 3), element 55 being connected to element 50 and deriving its entire support therefrom.

At its bottom, each of the elements has a semi-circular flange, as shown at 58, 59, the two flanges together defining an air admission opening which encircles brackets 43 below the inner sleeve 40. The bottom wall portions 60 and 61 of the shell elements 55 and 50 are spaced above the base 20, whereby room air has free access to the bottom of the stacks 40 and 42, as well as to the space within the shell outside of stack 42 and stack extension 45.

A separately fabricated sub-assembly of baffles 62 is shown in Fig. 10. Tabs 63 at the ends of such baffles are welded or otherwise fastened to the end walls 64 of a hood 65 which is mounted on the interior of shell element 55 in registry with the air discharge opening 66 therein. Each of the several baffles 62 and the outer wall of hood 65 are curved, whereby each of these surfaces has a lower margin which is generally vertical and an upper margin which is substantially horizontal. The lower margains extend transversely across the upper end of the stack extension 45 in the manner clearly appearing in Fig. 3 and Fig. 5, and the upper horizontal margins extend transversely across the air discharge opening 66, as appears both in Fig. 1 and Fig. 3.

As will appear from comparison of Fig. 1 and Fig. 3, the clearance between the faces of the baffles 62 is progressively decreased toward the outlet whereas the width of the spaces between baffles increases. In a preferred design, the total cross section of the air passages between the baffles is about fifty percent greater at the outlet than at the outlet of stack extension 45. This allows for a part of the air expansion but does not accommodate all of the air expansion, whereby flow of air through these passages necessarily accelerates toward the discharge point.

It will be noted from Fig. 5 that the baffles are designed to receive warm air not only from the stack extension 45 but from the space about such extensions. The relatively rapidly moving air stream in stack extension 45 is forced to broaden out and, in so doing, crosses gradually and without turbulence the path of the aspirated more slowly moving stream of air rising in the space about the stack extension. This gives the desired mixing.

The hood sub-assembly, with all baffles fastened therein, is desirably welded to the shell element 55 for unitary handling therewith, as shown in Figs. 3 and 5. In assembly or disassembly, the shell element 55 and hood 65 appear as shown in Fig. 9. When the parts are assembled, as shown in Fig. 3, the shell element 55 and hood and baffle sub-assembly all are supported through shell element 50 from the stack extension 45 and thereby through outer stack 42 and brackets 43 from base 20.

It is important to note at this point that the outer shell or case, while useful mechanically and very important as a means of protecting the user against burns, and also to contribute to the appearance of the device, nevertheless has nothing to do with operation and can be completely omitted without in any way affecting the functioning of the apparatus.

In operation, heat generated in the resistance coil 26, warms the air surrounding the coil and sets up a current of air upwardly through the inner stack 40 which receives radiation and convection and becomes a secondary radiator for heating air. The flow is accelerated by the tapering form of the stack and the expansion of the air so that the air issuing from the top of the inner stack is jetted through stack extension 45 to aspirate additional flow of air outside of stack 40. The air moving upwardly is constantly replaced by fresh air admitted through the base 20 and the bottom of shell elements 50 and 55.

The fact that the air highly heated within stack 40 and the less highly heated air in stack 45 and the air which passes to the baffle 62 from the casing or shell outside of both stacks all becomes mixed in traversing the space between the baffle 62 is productive of very desirable results in that large volumes of air are moved and yet the output does not include any extremely highly heated air, such as might be objectionable. In practice, it appears that there is a thorough mixture of air at varying temperatures handled by the apparatus, with the result that all of the discharge air is substantially uniform in temperature.

The formation of the bevelled portion of the base and the bottom portions 60 and 61 of the shell elements assists in directing the flow without eddy currents into the inner and outer stacks.

To the extent that heat is radiated to the wall portions 52 and 53 of the shell elements, slower air movement will be induced within the shell elements outside of the stacks and this flow will be accelerated by aspiration of air through the curving channels within the hood and between the baffle 62.

In actual practice the air flow is unusually even throughout the entire area of the discharge opening 66, and the temperature of the air throughout such area is also unusually even due to the mixing which takes place in the various aspirating operations within the stack extension 45 and within the flow channels defined by the curving baffles 62. As above noted, this device will circulate substantially the same volume of air without a fan as is moved by other circulatory heaters having heating elements of like wattage and using fans in addition to move the air. Since so much air is circulated, none of it becomes unduly heated in any single traverse of the heater and the heater parts are kept at moderate temperatures by the rapid air circulation.

The embodiment shown in Figs. 12 to 14 is somewhat similar in principle but, being a wall heater, it is differently housed. Its outer casing 70 has an inlet opening at 71 through which air flow is rectified by baffles at 72. Above the front panels at 73, the casing has an outlet opening at 74 on the same face as the inlet opening 71. Within the casing, in front of the inlet opening 71, is a reflector 75; or, if the device is duplex as shown, there will be two such reflectors laterally spaced. Each carries a heating coil at 76 resembling that above described and each carries a stack 77 of upwardly tapering frustro-

conical form. In this instance, the outer stack and the stack extension of the previously described embodiment are united in a single tubular stack element **78** spanned by the curvilinear baffles **79** which guide the air to the discharge outlet **74**. In the duplex device shown, these baffles may be continuous across both of the heating elements and stacks. Mounted in a partition **80**, as shown in Fig. 14, this device will take in room air at floor level and discharge it at a higher level.

The device of Fig. 15 is identical except that it has two inlet ports **710** and **711** from rooms on opposite sides of partition **80**. The baffles **790** and **791** correspond to the baffle **79** of the device previously described and lead from opposite sides of the center line of the casing into the rooms at opposite sides of partition **80**.

The device shown in Fig. 16 is similar but on a larger scale, taking the form of a floor furnace, having an outer casing **82** sunk below the level of the floor **83** and below partition **80**. The registers **84** admit air from the respective rooms into the casing **82**. Within such casing there is suspended the long tubular stack extension **452** which, in turn, carries the outer stack **422**, the inner stack **402**, the reflector **252**, and the heating coil **262** mounted on the reflector. Air passes upwardly as in the embodiments previously described through the respective stacks **402** and **422**, flow through the latter being effected by aspiration. The discharge arrangement at the top comprises a shell **702** having discharge openings **742** opening to rooms at opposite sides of partition **80**, the heated air being directed to the said openings by the opposed baffles **792** and **793**, between which additional baffles may be interposed at **794** if desired. The flow characteristics of the devices shown in Figs. 12 to 16 are similar to those of the device first described.

The device of Figs. 17 and 18 is quite similar, in some respects, to that of Fig. 13 except that it is provided with legs **84** which support the base **85** upon which is mounted reflector **75** from which the heating coil **76** is carried. The brackets **85** mounts the tapered stack **77**. Although similar in form to the corresponding stack of Fig. 13, the stack **77** is desirably made of transparent heat resisting material such as pyrex glass. It may become heated enough to glow and is exposed in the open sided shell **91** which best appears in Fig. 18. At its upper end are brackets **88** which support a sleeve **90** that performs the function of an outer stack as above described, communicating at its upper end with the curved baffles **79** identical with those of Fig. 13 and desirably convergent to reduce the spacing between their faces, at the same time increasing in cross section laterally as will be apparent by comparing Fig. 17 and Fig. 18.

Fig. 19 and Fig. 20 merely demonstrate the fact that it is not necessary that the air be emitted forwardly in any of the devices herein described. Instead, the baffles **92** may converge upwardly to reduce the space between their faces while the passages between them are expanded laterally as shown by the curved walls **93** of Fig. 20. Thus, as in the device in which the heated air is delivered forwardly, there is a gradual increase in cross section despite the convergence of the several baffles.

Thus, whether the emission of air is vertical or horizontal, I achieve in each case the mixing action which results from broadening the rapidly moving stream of primary air across the path of the slower moving streams of secondary air, whereby the two streams are merged gradually and without turbulence to give a substantially uniform heated output.

I claim:

1. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced flow deflecting baffles inclined to the path of air flow and extending laterally at both sides of the outer stack and having laterally unobstructed spaces extending across the normal path of flow at both sides of the outer stack, whereby to intercept rising air both inside and outside said stack and to intermix said air within said baffles.

2. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced baffles across the tops of said stacks for mixing and guiding air flow, said baffles being convergent facially and progressively elongated laterally in the direction of flow, whereby air spaces between them become thinner and wider, the total cross section of such spaces progressively increasing, and the stream of air from the inner heating stack being thereby expanded between the baffles to broaden into the path of air ranging into said spaces from the outer stack for gradual admixture therewith.

3. The device of claim 1 in which the heating element comprises an electric resistance coil having the form of a helix with a horizontal axis extending transversely of and closely confined within the inner stack.

4. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced baffles extending laterally at both sides of the outer stack and extending across the normal path of flow whereby to intercept rising air both inside and outside said stack and to intermix said air within said baffles, said space heater being portable and having a base provided with a concave reflector, the outer stack being supported directly from the base and the inner stack having supporting brackets connecting it with the outer stack.

5. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced baffles extending laterally at both sides of the outer stack and extending across the normal path of flow whereby to intercept rising air both inside and outside said stack and to intermix said air within said baffles, said outer stack being conical and encircling an intermediate portion of the inner stack and having a stack extension leading to a point above the top of the inner stack.

6. The device of claim 1, together with a casing having an upright side wall portion provided with space around the stacks and with an air discharge opening with both of which the spaces between the baffles communicate.

7. The device of claim 6 in which the casing has its said inlet and outlet openings on the same face of the casing.

8. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced baffles across the tops of said stacks for mixing and guiding air flow, the several baffles having curved portions with margins approximately upright across said stacks and approximately horizontal at discharge, together with a casing having an upright side wall portion provided with space around the stacks and with an air discharge opening with both of which the spaces between the baffles communicate, the heating element and stacks aforesaid being duplicated side by side within a single casing and the baffles extend across both sets of stack elements to a common outlet comprising said discharge port.

9. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced

baffles extending laterally at both sides of the outer stack and extending across the normal path of flow whereby to intercept rising air both inside and outside said stack and to intermix said air within said baffles, said space heater comprising a floor furnace and having a casing with an inlet and outlet at its top.

10. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced baffles extending laterally at both sides of the outer stack and extending across the normal path of flow whereby to intercept rising air both inside and outside said stack and to intermix said air within said baffles, said inner stack being suspended from the outer stack.

11. A space heater comprising in unitary connection a heating element, an inner stack encircling the heating element and open near its bottom to receive air to be heated, an outer stack encircling the heater stack and open near its bottom to receive air, and a series of spaced baffles extending laterally at both sides of the outer stack and extending across the normal path of flow whereby to intercept rising air both inside and outside said stack and to intermix said air within said baffles, in combination with a casing comprising a base having bracket means supporting the inner stack, bracket means supporting the outer stack from the inner stack, the said casing comprising shell elements, one of which is mounted on the stack extension and the other of which is mounted on the first shell element and carries said baffles.

12. In a space heater, the combination with a casing comprising front and rear separable elements each having front, rear, side, and top wall portions, the side and top wall portions of said elements being provided with connecting means for securing said elements together and the front wall portion of the front element having an air discharge opening, of a hood connected with the front element about the opening, a series of generally parallel baffles spanning the opening and having correspondingly curved portions extending downwardly toward the bottom of the hood, and stack means and a heating element connected with the rear housing element and terminating below the level of the hood and baffles, the stack means being adapted to discharge beneath the hood streams of heated air guided between said baffles to said opening.

13. In a portable space heater, the combination with a base having stack means open at the bottom mounted thereon and a heating element disposed in the path of air circulating to and through the stack means for the heating of such air, a first casing element mounted with said stack means from said base and a second casing element detachably connected with the first casing element and unitarily provided with a hood overhanging the stack means and leading to an opening with which the second casing element is provided in its face for the discharge of heated air circulating through said stack means.

14. The device of claim 13 in which the casing elements are laterally elongated beyond said stack means thereby providing additional space for circulating air and said hood is laterally elongated to project beyond said stack means to receive air circulating upwardly through the casing externally of the stack means, said stack air and casing air being mixed in said hood.

15. The device of claim 14 in which said hood comprises a wall having a portion curving from a generally upright position to a generally horizontal position at the opening, and internal baffles having correspondingly curved portions for guiding heated air from said stack means and from the casing space external thereof to said opening in curved paths between said baffles.

16. A space heater comprising the combination with a heating means, of a stack extending upwardly above said means and having bottom and top openings for the circulation of convection currents established by the heat of said means, and spaced baffles in the path of said current and extending laterally at both sides of the stack to receive convection currents of air heated outside of the stack, said baffles being upwardly convergent whereby to cause the convection current from the stack to expand laterally into gradual mixture with convection currents arising between said baffles from outside of the stack.

17. The device of claim 16 in which the total cross section of the spaces between the baffles is substantially at least fifty percent greater than the cross section of the stack.

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