



US 20080124060A1

(19) **United States**(12) **Patent Application Publication**
Gao(10) **Pub. No.: US 2008/0124060 A1**(43) **Pub. Date: May 29, 2008**(54) **PTC AIRFLOW HEATER**(76) Inventor: **Tianyu Gao, Shenzhen (CN)**

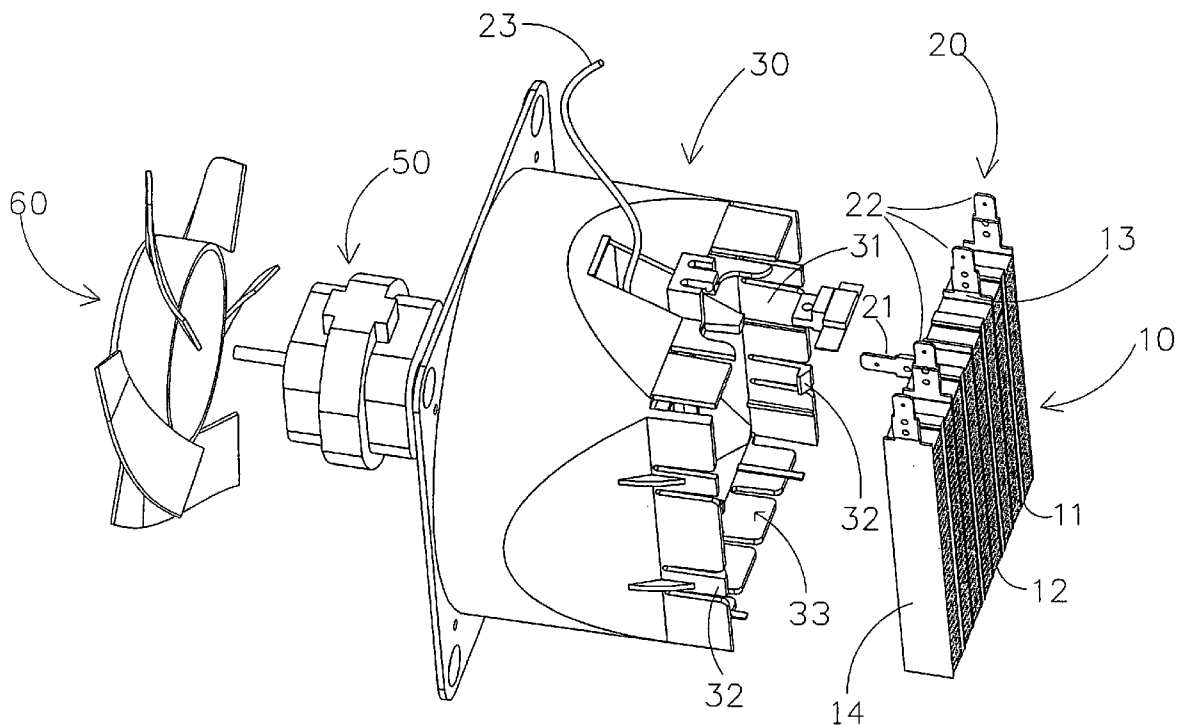
Correspondence Address:
Raymond Y. Chan
Suite 128, 108 N. Ynez Avenue
Monterey Park, CA 91754

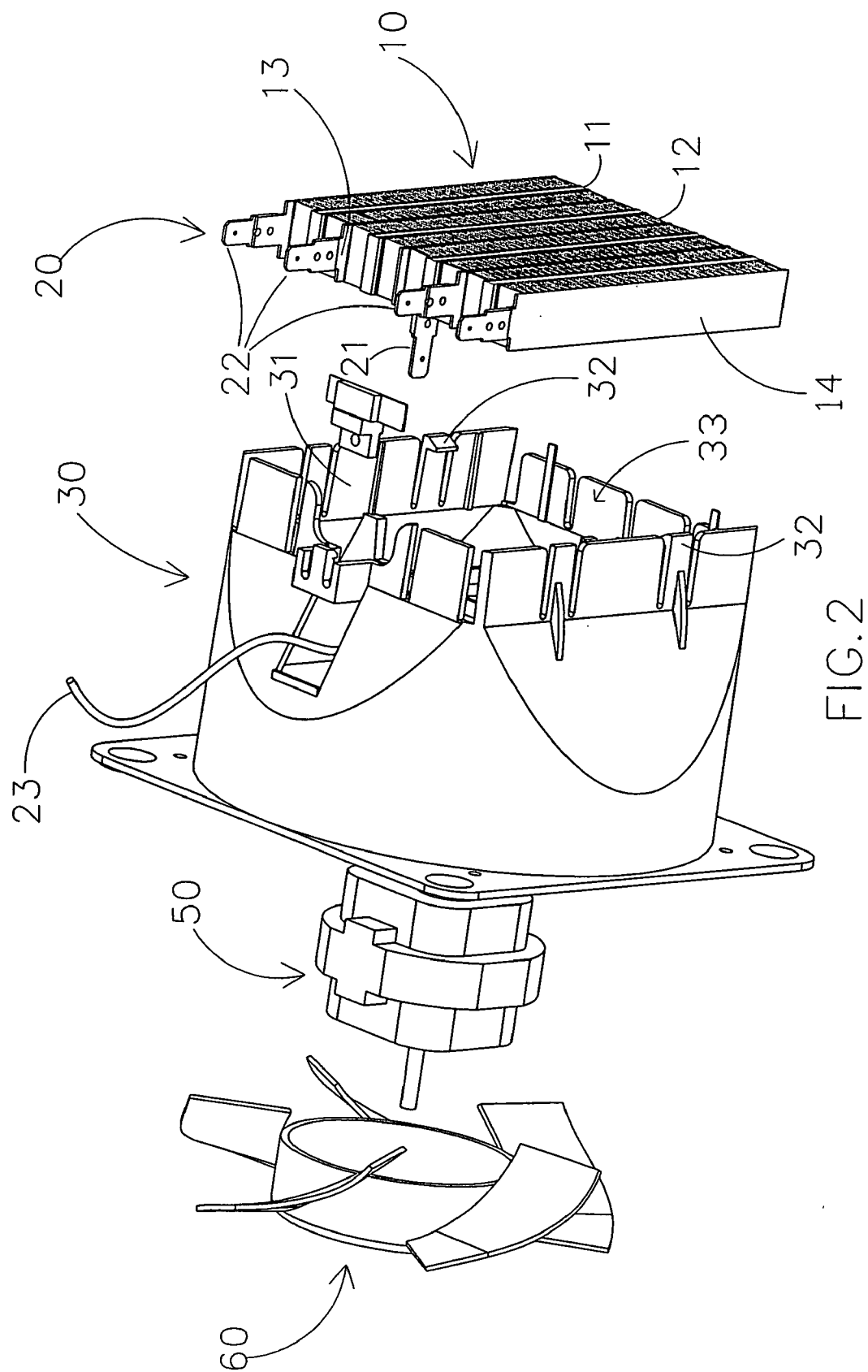
(21) Appl. No.: **11/606,708**(22) Filed: **Nov. 29, 2006****Publication Classification**

(51) **Int. Cl.**
F24H 3/02 (2006.01)
F24D 15/02 (2006.01)

(52) **U.S. Cl. 392/365**(57) **ABSTRACT**

An airflow heater includes a housing, a control arrangement supported at an upper portion of the housing, an air source for generating a flow of air, a PTC heat generator for generating heat, and a terminal unit including an upward terminal connector upwardly extended from the PTC heat generator to align with the control arrangement and a sideward terminal connector rearwardly extended from the PTC heat generator to minimize a distance between the terminal unit and the control arrangement for electrical connection. The upward terminal connector and the sideward terminal connector are electrically connected to the control arrangement. The air source and the PTC heat generator are activated by the control arrangement for generating the air towards the PTC heat generator and for generating the heat respectively, such that when the air passes through the PTC heat generator, the air is heated up before exiting the housing.





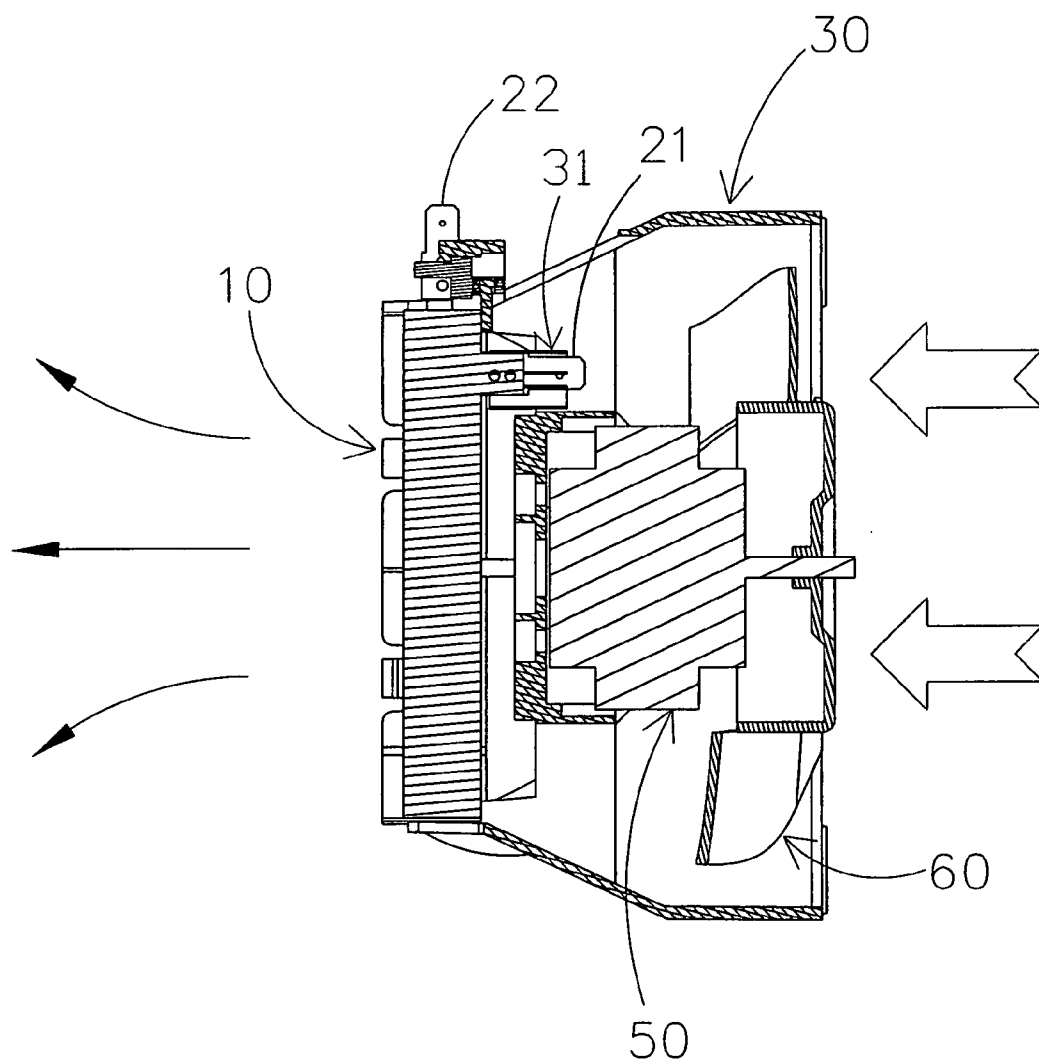


FIG. 3

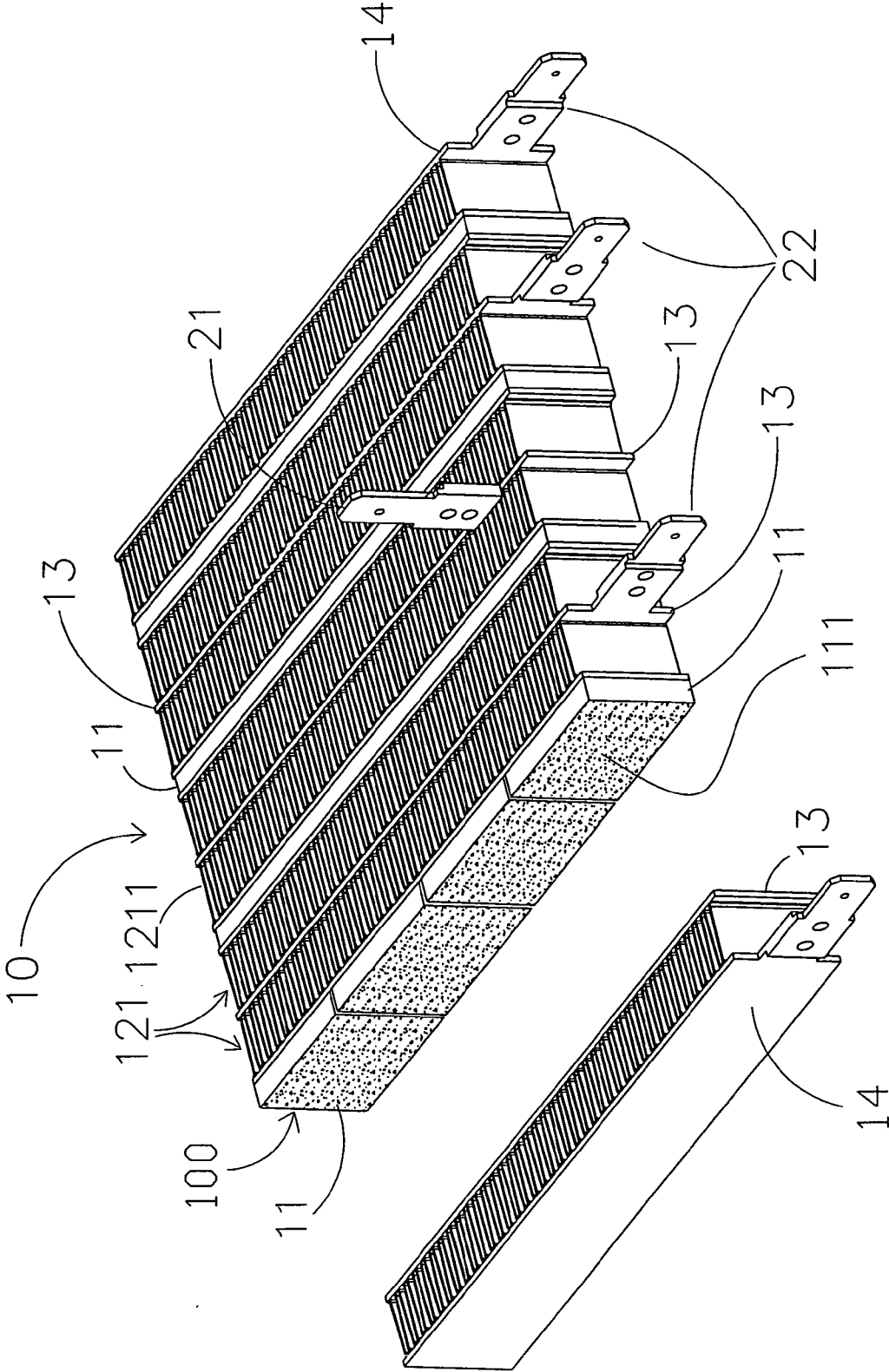


FIG. 4

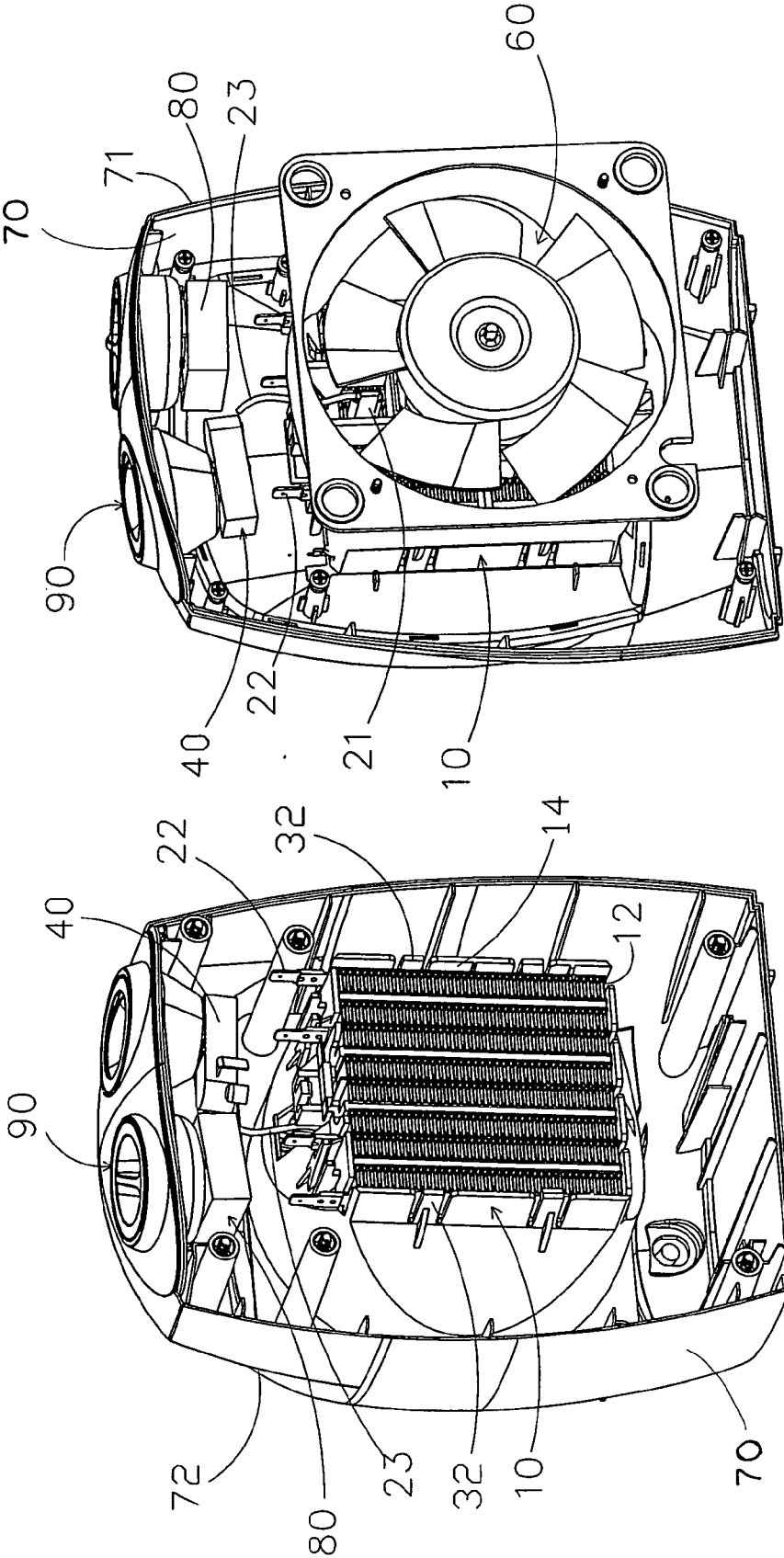


FIG. 6

FIG. 5

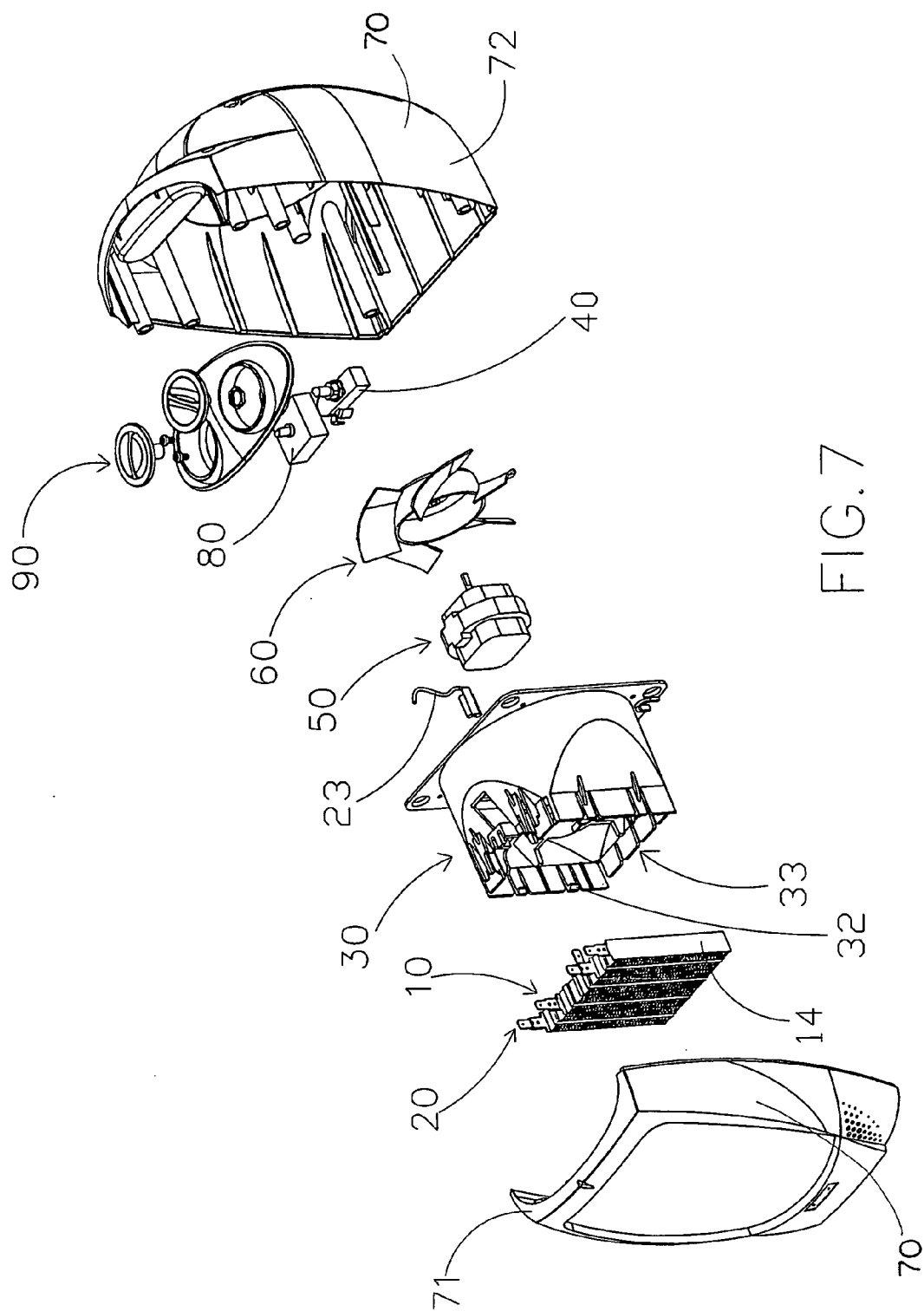


FIG. 7

PTC AIRFLOW HEATER

BACKGROUND OF THE PRESENT INVENTION

[0001] 1. Field of Invention

[0002] The present invention relates to a warmer, and more particularly to a heat airflow heater which uses an advance heat generating connector structure so as to reduce the overall material cost and to simplify the assembling configuration.

[0003] 2. Description of Related Arts

[0004] A conventional warmer, as a common house appliance, is adapted for generating a flow of heated air. Heated air is blown out to the environment such a room can be kept at a comfortable temperature. The warmer usually uses a heat generator as a heat source which embodies as one of an electric wire having a predetermined resistance, a heat generating panel, and a heat generating tube for generating heat. Such a conventional warmer does not have a heat controller function. Therefore, the life span of the warmer is relatively short and it is easy to malfunction and is not safe to use. Another type of conventional warmer uses a PTC (Positive Temperature Coefficient) heat generator and it is more efficient, reliable, and convenient. The PTC ceramic heater has a conducting function of using the positive temperature coefficient materials. Positive Temperature Coefficient (PTC) refers to materials that experience an increase in electrical resistance when the temperature is raised. Materials which have useful engineering applications usually show a relatively rapid increase with temperature, i.e. a higher coefficient. The higher the coefficient, the greater an increase in electrical resistance for a given temperature increase. Using this characteristic of the PTC, many applications of PTC heating devices can be manufactured.

[0005] Such ceramic heater uses PTC heat generator which comprises metal heat dissipating unit installed on two sides of the heat generator. When the PTC heat generator generates heat, the heat is conducted to the heat dissipating unit and is then radiated to the surrounding through the heat dissipating unit. A fan which is supported behind the heat dissipating unit, generates a flow of air towards the heat dissipating unit such that when the flow of air passes through the heat dissipating unit, the flow of air is heated to become a heated air to exit at a front side of the ceramic heater. The PTC heat generator further comprises a temperature control supported on top of the ceramic heater to control the heat generated from the PTC heat generator. Accordingly, the housing of the ceramic heater receives a control circuit and a switch to control the temperature control.

[0006] Since most of the temperature control is provided on top of the housing, the space for disposing the PTC heat generator is relatively restricted, especially for the terminal of the PTC heat generator. Therefore, the terminal of such conventional ceramic heater is installed at the bottom side of the housing to electrically connect to the temperature control via an electric wire. Since the electric wire is extended from the bottom side of the housing to the top thereof, the relatively long electric wire is needed for electrical connection. Therefore, it is a waste of the electric wire for only electrical connection and the electric wire takes the space of the housing. In other words, the housing must be designed to have a bigger space in order to incorporate with the electric wire. In

addition, such electric wire increases the failure of the ceramic heater since the electrical wire is routed.

SUMMARY OF THE PRESENT INVENTION

[0007] A main object of the present invention is to provide an airflow heater with an advanced heat generating arrangement structure so that the length of the electric wire usage can be minimized. In other words, the overall size of the housing is also reduced by minimizing the space thereof for wiring connection.

[0008] Another object of the present invention is to provide an airflow heater which is capable to provide a safe and reliable airflow output.

[0009] Another object of the present invention is to provide an airflow heater which does not involve complicated mechanical structures, so as to minimize the manufacturing cost and other related expenses of the airflow heater.

[0010] Accordingly, in order to accomplish the above objects, the present invention provides an airflow heater, comprising:

[0011] a housing;

[0012] a control arrangement supported at an upper portion of the housing;

[0013] an air source supported within the housing for generating a flow of air;

[0014] a PTC heat generator supported within the housing at a position in front of the air source for generating heat, and

[0015] a terminal unit which comprises at least an upward terminal connector upwardly extended from the PTC heat generator to align with the control arrangement and at least a sideward terminal connector rearwardly extended from the PTC heat generator to minimize a distance between the terminal unit and the control arrangement for electrical connection, wherein the upward terminal connector and the sideward terminal connector are electrically connected to the control arrangement, wherein the air source and the PTC heat generator are activated by the control arrangement for generating the air towards the PTC heat generator and for generating the heat respectively, such that when the air passes through the PTC heat generator, the air is heated up before exiting the housing.

[0016] These and other objectives, features, and advantages of the present invention will become apparent from the following detailed description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a perspective view of a PTC heat generator of a PTC airflow heater according to a preferred embodiment of the present invention.

[0018] FIG. 2 is an exploded perspective view of internal components of the PTC airflow heater according to the above preferred embodiment of the present invention.

[0019] FIG. 3 is a sectional view of the PTC airflow heater according to the above preferred embodiment of the present invention.

[0020] FIG. 4 is an exploded perspective view of the PTC heat generator according to the above preferred embodiment of the present invention.

[0021] FIG. 5 is a front perspective view of the PTC airflow heater according to the above preferred embodiment of the present invention, illustrating the PTC heat generator mounting in the housing without the front casing.

[0022] FIG. 6 is a rear perspective view of the PTC airflow heater according to the above preferred embodiment of the present invention, illustrating the PTC heat generator and the fan mounting in the housing without the rear casing.

[0023] FIG. 7 is an exploded perspective view of the PTC airflow heater according to the above preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0024] Referring to FIGS. 1 to 7 of the drawings, a PTC airflow heater according to a preferred embodiment of the present invention is illustrated, wherein the PTC airflow heater comprises a housing 70, a PTC heat generator 10 received in the housing 70, an air source supported in the housing 70 at a position behind the PTC heat generator 10 for generating a flow of air towards the PTC heat generator. The PTC airflow heater further comprises a control arrangement supported at an upper portion of the housing 70 to control the PTC heat generator 10.

[0025] As shown in FIG. 7, the housing 70 comprises a front casing 71 and a rear casing 72 mounted thereto to define a receiving cavity between the front and rear casings 71, 72.

[0026] The air source comprises a fan blade 60 and a motor 50 driving the fan blade 60 via an output shaft to rotate so as to generate a flow of air towards the PTC heat generator 10. The control arrangement comprises a control unit 80 electrically connected between a power source and the PTC heat generator 10 and a control interface 90 connected to the control unit 80 such that a user is able to manually control the control unit 80 to operate the PTC airflow heater of the instant invention.

[0027] The PTC heat generator, as shown in FIGS. 1 and 4, comprises a heat generating unit 10, a terminal unit 20, and a supporting frame 30. The heat generating unit 10 comprises a heat column 11 for generating heat, a heat dissipating arrangement 12 for dissipating the heat from the heat column 11, and a plurality of metal made retention walls 13, 14.

[0028] Accordingly, the heat dissipating arrangement 12 comprises two metal made dissipating units 121 sidewardly extended from two side surfaces of the heat column 11 such that the heat column 11 is positioned between the two dissipating units 121 to thermally conduct the heat from the heat column 11 to the dissipating units 121. Therefore, when the heat column 11 is activated to generate the heat, the heat is transmitted to the heat dissipating units 121 through the inner retention walls 13 for heat dissipation.

[0029] Two inner retention walls 13 are mounted at the side surfaces of the heat column 11 respectively. Each of the inner retention walls 13 is mounted between the heat column 11 and the respective dissipating unit 121, wherein when the heat generated from the heat column 11, the heat is thermally conducted to the dissipating units 121 through the inner retention walls 13. Two adhering films 100 are formed on two side surfaces of the heat column 11 to affix the two inner retention walls 13 at the side surfaces of the heat column 11 respectively. Accordingly, the two inner retention walls 13 are adhered to the two side surfaces of the heat column 11 via a high heat resisting adhesive to form the adhering films 100.

[0030] It is worth to mention that the length of the heat column 11 is made of PTC (Positive Temperature Coefficient) material adapted for generating the heat. In addition, the length of the heat column 11 is shorter than a length of each of the inner retention walls 13, such that two or more heat

columns 11 can be aligned to be sandwiched between the two inner retention walls 13. As shown in FIG. 4, four heat columns 11 are aligned to mount between the inner retention walls 13.

[0031] The two outer retention walls 14 are mounted at two outer sides of the heat dissipating units 121 respectively to protect the heat dissipating units 121 from physical damages.

[0032] The heat column 11 further has a plurality of electrodes 111 formed at the side surfaces thereof to electrically conduct with the inner retention walls 13. Accordingly, in order to form the electrodes 111 on the side surfaces of the heat column 11, an electrode element is coated or sprayed on the side surfaces of the heat column 11. The electrode element can be made of aluminum or silver provided on the side surfaces of the heat column 11 to form the electrodes 111 having a sharp tip such that when the inner retention wall 13 is overlapped on the respective side surface of the heat column 11, the electrodes 111 penetrate through the adhering film 100 to conductively contact with the inner retention wall 13. It is worth to mention that when the electrode element is evenly coated or sprayed on the side surfaces of the heat column 11, the respective side surface of the heat column 11 forms a rough surface that a plurality of protruding points are randomly protruded from the side surface of the heat column 11 such that the protruding points form the electrodes 111 to contact with the respective inner retention wall 13 through the adhering film 100.

[0033] Each of the heat dissipating unit 121 comprises an elongated heat dissipating element bent in a Zigzag structure to form a plurality of heat dissipating panels 1211, wherein two side edges of each of the heat dissipating panels 1211 are affixed to the inner and outer retention walls 13, 14 respectively, preferably by welding. A heat dissipating channel is defined between every two heat dissipating panels 1211 for the air passing through. Accordingly, the heat dissipating element is made of metal material having high heat transfer coefficient, such as aluminum alloy, for dissipating the heat to the surrounding. The heating dissipating channels are aligned with the fan 60 such that when the fan 60 generates the flow of air, the air is adapted to pass through the heating dissipating channels. Each of the heating dissipating channels has a triangular or trapezoid cross section such that when the air passes through the heat dissipating channels, the air is heated up when the heat dissipating panels 1211 dissipate the heat therefrom.

[0034] It is worth to mention that the heat column 11, two heat dissipating units 121, two inner retention walls 13, and two outer retention walls 14 are formed as one set of heat generating unit 10. Two or more sets can be selectively combined to enhance the heat dissipating ability of the heat generator 10. As shown in FIGS. 1 and 4, four sets are combined, including a plurality of heat columns 11, eight heat dissipating units 121, eleven inner retention walls 13, and two outer retention walls 14, to form the heating generating unit 10. It is worth to mention that the retention wall is a common wall to mount between the two heat dissipating units 121 at every two sets. Therefore, multiple sets of the heat generating unit 10 are adapted for amplifying the heat dissipating function. In other words, the multiple sets of the heat generating unit 10 have a larger heating coverage area.

[0035] The terminal unit 20 comprises at least a sideward terminal connector 21 rearwardly extended from one of the inner retention walls 13 and at least an upward terminal connector 22 upwardly extended from another inner retention

wall 13. Accordingly, the sideward terminal connector 21 and the upward terminal connector 22 are extended from a rear side and a top side of the PTC heat generator 10 respectively. The sideward terminal connector 21 and the upward terminal connector 22 are electrically coupled with the control unit 80 via electric wires. Accordingly, the control unit 80 has an "on" and "off" function to control the PTC heat generator 10 in an ON and OFF manner. The control interface 90 is connected to the control unit 80 such that the user can manually control the control unit 80 mechanically to operate the function of the present invention such as the heat intensity or the airflow rate. The power source provides power to the PTC heat generator 10 through the terminal unit 20.

[0036] Accordingly, the upward terminal connector 22 and the sideward terminal connector 21 are extended from the PTC heat generator 10 to minimize a distance between the terminal unit 20 and the control arrangement for electrical connection, wherein the air source and the PTC heat generator 10 are activated by the control arrangement for generating the air towards the PTC heat generator 10 and for generating the heat respectively, such that when the air passes through the PTC heat generator 10, the air is heated up before exiting the housing 70.

[0037] As shown in FIGS. 1 to 4, there are four upward terminal connectors 22 upwardly extended from four inner retention walls 13 respectively, wherein the upward terminal connectors 22 are upwardly extended to align with the main control 80 such that a relatively short electric wire is used for electrically connecting the main control 80 with each of the upward terminal connectors 22. Accordingly, each of the upward terminal connectors 22, which can be made of aluminum, is integrally extended from an upper edge of the respective inner retention wall 13. Alternatively, each of the upward terminal connectors 22 can be affixed, by welding or by rivet, to the upper edge of the respective inner retention wall 13. Once the control unit 80 is activated, the control unit 80 is electrically connected to the PTC heat generator 10 via the upward terminal connectors 22, such that the heat column 11 is electrically actuated through the inner retention walls 13 via the electrodes 111 for generating the heat and for thermally conducting the heat to the heat dissipating units 121.

[0038] The control arrangement further comprises a temperature control 40, which is arranged for controlling the temperature of the heat column 11, supported the upper portion of the housing 70 to operatively connect to the sideward terminal connector 21. Since the control unit 80 is supported on top of the PTC heat generator 10, the space for making a connecting between the temperature control 40 and the PTC heat generator 10 is restricted. The sideward terminal connector 21 is perpendicularly extended from a rear edge of an upper portion of the respective inner retention wall 13 at a position to align with the temperature control 40. In other words, the temperature control 40 is supported at the upper portion of the housing 70 at a position above the sideward terminal connector 21 to minimize a distance therebetween for electrically connecting to the sideward terminal connector 21.

[0039] Accordingly, the sideward terminal connector 21, which can be made of aluminum, is integrally extended from the rear edge of the respective inner retention wall 13. Alternatively, the sideward terminal connector 21 can be affixed, by welding or by rivet, to the rear edge of the respective inner retention wall 13. It is worth to mention that an electric wire

23 is electrically connected the sideward terminal connector 21 to the temperature control 40.

[0040] The supporting frame comprises a supporting bracket 30 having a front portion for the PTC heat generator 10 mounting thereto and a rear portion for the motor 50 mounting thereto such that when the motor 50 is activated to drive the fan blade 60 to rotate, the air passes through the supporting bracket 30 to the PTC heat generator 10. The supporting bracket 30 has a through guiding slot 31 formed at a position that when the PTC heat generator 10 is mounted at the front portion of the supporting bracket 30, the side terminal connector 21 is slidably passed through the guiding slot 31 to electrically connect to the temperature control 40 via the electric wire 23.

[0041] FIG. 5 illustrates the position of the PTC heat generator 10 with respect to the rear casing 72, wherein the PTC heat generator 10 is supported at a position that the PTC heat generator 10 is positioned below the main control 80. In addition, the supporting bracket 30 further has a holding cavity 33 formed at the front portion for receiving the PTC heat generator 10 and at least a clipping arm 32 formed at a peripheral wall of the holding cavity 33 to detachably engage with at least one of the outer retention walls 14. FIG. 6 illustrates the positions of the air source and the PTC heat generator 10 with respect to the front casing 71. Accordingly, the PTC heat generator 10 is supported at the front casing 71 of the housing 70 at a position that the PTC heat generator 10 is aligned with an air outlet of the front casing 71 such that when the air passes through the PTC heat generator 10, the air is heated up to become a heated air to be exited through the air outlet.

[0042] It is worth to mention that the upward terminal connectors 22 and the sideward terminal connector 21 are extended in a location close to the control unit 80 and the temperature control 40. Therefore, this design minimizes the length of the electric wires used for connecting the PTC heat generator 10 with the control unit 80 and the temperature control 40. It does not involve complicated mechanical structures so as to minimize the manufacturing cost and other related expenses of the airflow heater.

[0043] One skilled in the art will understand that the embodiment of the present invention as shown in the drawings and described above is exemplary only and not intended to be limiting.

[0044] It will thus be seen that the objects of the present invention have been fully and effectively accomplished. It embodiments have been shown and described for the purposes of illustrating the functional and structural principles of the present invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

1-20. (canceled)

21. An airflow heater, comprising:

- a housing;
- a control arrangement supported at an upper portion of said housing;
- an air source supported within said housing for generating a flow of air;
- a PTC heat generator supported within said housing at a position in front of said air source for generating heat, and
- a terminal unit which comprises at least an upward terminal connector upwardly extended from said PTC heat gen-

erator to align with said control arrangement and at least a sideward terminal connector rearwardly extended from said PTC heat generator to minimize a distance between said terminal unit and said control arrangement for electrical connection, wherein said upward terminal connector and said sideward terminal connector are electrically connected to said control arrangement, wherein said air source and said PTC heat generator are activated by said control arrangement for generating said air towards said PTC heat generator and for generating said heat respectively, such that when said air passes through said PTC heat generator, said air is heated up before exiting said housing,

wherein said control arrangement comprises a control unit supported at said upper portion of said housing at a position above said PTC heat generator to electrically connect to said upward terminal connector, and a temperature control supported at said upper portion of said housing at a position above said sideward terminal connector to electrically connect to said sideward terminal connector.

22. The airflow heater, as recited in claim **21**, wherein said upward terminal connector and said sideward terminal connector are integrally extended from a top side and a rear side of said PTC heat generator respectively.

23. The airflow heater, as recited in claim **21**, wherein said upward terminal connector and said sideward terminal connector are affixed to a top side and a rear side of said PTC heat generator respectively.

24. The airflow heater, as recited in claim **21**, wherein said PTC heat generator comprises at least a heat column having two side surfaces, at least two dissipating units sidewardly extended from said two side surfaces of said heat column, two inner retention walls mounted at said side surfaces of said heat column at a position that each of said inner retention wall is sandwiched between said heat column and said respective heat dissipating unit, and two outer retention walls mounted at two outer sides of said heat dissipating units respectively, wherein when said heat column is activated to generate said heat, said heat is transmitted to said heat dissipating units through said inner retention walls for heat dissipation.

25. The airflow heater, as recited in claim **22**, wherein said PTC heat generator comprises at least a heat column having two side surfaces, at least two dissipating units sidewardly extended from said two side surfaces of said heat column, two inner retention walls mounted at said side surfaces of said heat column at a position that each of said inner retention wall is sandwiched between said heat column and said respective heat dissipating unit, and two outer retention walls mounted at two outer sides of said heat dissipating units respectively, wherein when said heat column is activated to generate said heat, said heat is transmitted to said heat dissipating units through said inner retention walls for heat dissipation.

26. The airflow heater, as recited in claim **23**, wherein said PTC heat generator comprises at least a heat column having two side surfaces, at least two dissipating units sidewardly extended from said two side surfaces of said heat column, two inner retention walls mounted at said side surfaces of said heat column at a position that each of said inner retention wall is sandwiched between said heat column and said respective heat dissipating unit, and two outer retention walls mounted at two outer sides of said heat dissipating units respectively, wherein when said heat column is activated to generate said

heat, said heat is transmitted to said heat dissipating units through said inner retention walls for heat dissipation.

27. The airflow heater, as recited in claim **24**, wherein said upward terminal connector is upwardly extended from a top edge of one of said retention walls and said sideward terminal connector is rearwardly extended from a rear edge of another said retention walls.

28. The airflow heater, as recited in claim **25**, wherein said upward terminal connector is upwardly extended from a top edge of one of said retention walls and said sideward terminal connector is rearwardly extended from a rear edge of another said retention walls.

29. The airflow heater, as recited in claim **26**, wherein said upward terminal connector is upwardly extended from a top edge of one of said retention walls and said sideward terminal connector is rearwardly extended from a rear edge of another said retention walls.

30. The airflow heater, as recited in claim **28**, wherein said PTC heat generator further has two adhering films provided on said two side surfaces of said heat column respective to affix said inner retention walls thereto, wherein said heat column further has a plurality of electrodes formed at said side surfaces thereof to electrically conduct with said inner retention walls.

31. The airflow heater, as recited in claim **29**, wherein said PTC heat generator further has two adhering films provided on said two side surfaces of said heat column respective to affix said inner retention walls thereto, wherein said heat column further has a plurality of electrodes formed at said side surfaces thereof to electrically conduct with said inner retention walls.

32. The airflow heater, as recited in claim **30**, wherein said PTC heat generator further has an electrode element integrally affixed on said side surfaces of said heat column to form said electrodes having a sharp tip such that when said inner retention wall is overlapped on said respective side surface of said heat column, said electrodes penetrate through said respective adhering film to conductively contact with said inner retention wall.

33. The airflow heater, as recited in claim **31**, wherein said PTC heat generator further has an electrode element integrally affixed on said side surfaces of said heat column to form said electrodes having a sharp tip such that when said inner retention wall is overlapped on said respective side surface of said heat column, said electrodes penetrate through said respective adhering film to conductively contact with said inner retention wall.

34. The airflow heater, as recited in claim **32**, wherein each of said heat dissipating unit comprises an elongated heat dissipating element bent in a Zigzag structure to form a plurality of heat dissipating panels and to define a heat dissipating channel between every said two heat dissipating panels for said air passing therethrough, wherein two side edges of each of said heat dissipating panels are affixed between said two retention walls.

35. The airflow heater, as recited in claim **33**, wherein each of said heat dissipating unit comprises an elongated heat dissipating element bent in a Zigzag structure to form a plurality of heat dissipating panels and to define a heat dissipating channel between every said two heat dissipating panels for said air passing therethrough, wherein two side edges of each of said heat dissipating panels are affixed between said two retention walls.

36. The airflow heater, as recited in claim **21**, further comprising a supporting bracket, which is supported in said housing, having a front portion for said PTC heat generator mounting thereto and a rear portion for said air source mounting thereto so as to retain said PTC heat generator in front of said air source, wherein said air source comprises a motor mounted at said rear portion of said supporting bracket and a fan blade driven by said motor to rotate, such that when said fan blade is rotated to generate airflow, said air passes through said supporting bracket to said PTC heat generator.

37. The airflow heater, as recited in claim **34**, further comprising a supporting bracket, which is supported in said housing, having a front portion for said PTC heat generator mounting thereto and a rear portion for said air source mounting thereto so as to retain said PTC heat generator in front of said air source, wherein said air source comprises a motor

mounted at said rear portion of said supporting bracket and a fan blade driven by said motor to rotate, such that when said fan blade is rotated to generate airflow, said air passes through said supporting bracket to said PTC heat generator.

38. The airflow heater, as recited in claim **35**, further comprising a supporting bracket, which is supported in said housing, having a front portion for said PTC heat generator mounting thereto and a rear portion for said air source mounting thereto so as to retain said PTC heat generator in front of said air source, wherein said air source comprises a motor mounted at said rear portion of said supporting bracket and a fan blade driven by said motor to rotate, such that when said fan blade is rotated to generate airflow, said air passes through said supporting bracket to said PTC heat generator.

* * * * *