United States Patent [19]

Kunz

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[54] **ELECTRIC FAN HEATER**

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[52] **U.S. Cl.**.....**219/370**, 126/110 B, 165/122, 219/368, 219/374, 415/219 R

[51] **Int. Cl.**.....**H05b 1/02**, F24h 3/04

[58] **Field of Search**.....415/208, 209, 210, 219 R; 219/359, 363–364, 366–371, 374–377, 379–382; 126/110 AA, 110 B; 165/121, 122, 124, 126

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[57] **ABSTRACT**

An electric fan heater of the space heating type including a housing having an air inlet opening in the top wall and an air outlet opening in the front wall with a heating element close thereto. A motor driven axial flow fan is utilized to provide a centrifugal air stream path through the fan heater and a shielding member is positioned between the fan propeller and air inlet opening to partially block the air inlet opening. The shielding member covers the area between the edge of the opening and a chord line across a portion of the opening the chord line being located less than half the distance from the edge of the opening to the center and in the half of the inlet opening closest the air outlet opening thereby widening the area of air flow path through the heating element.

3 Claims, 6 Drawing Figures

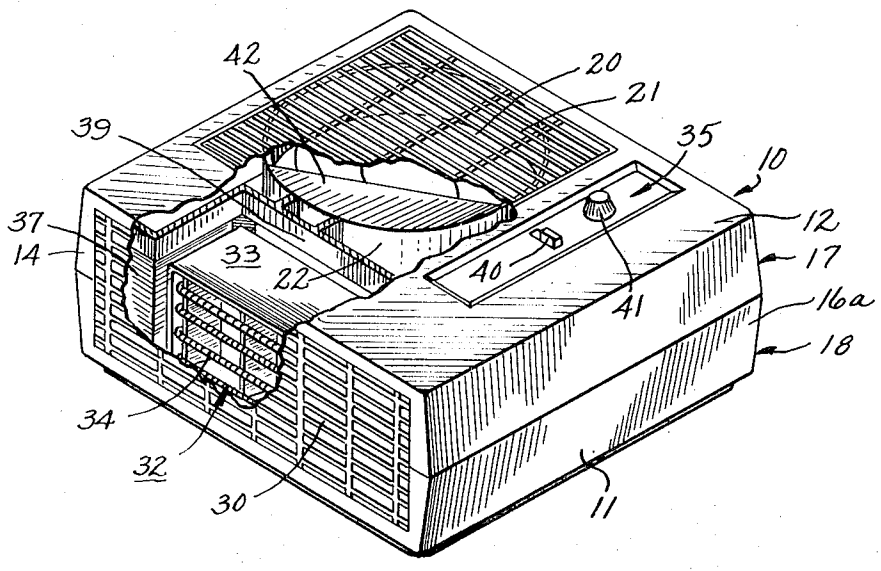
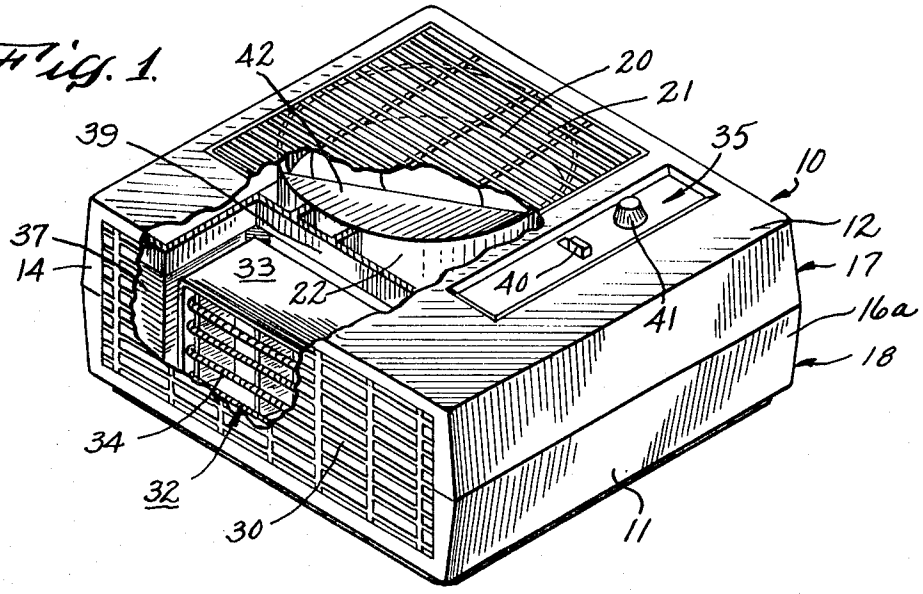


Fig. 1.



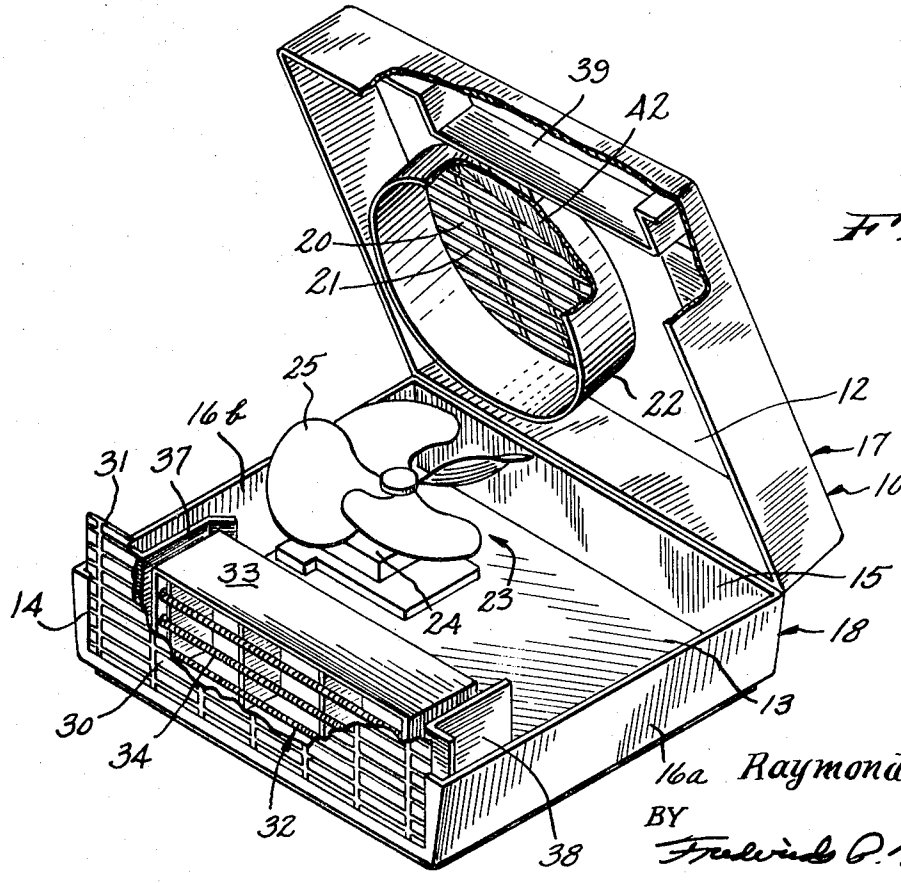


Fig. 2.

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Fig. 3 PRIOR ART

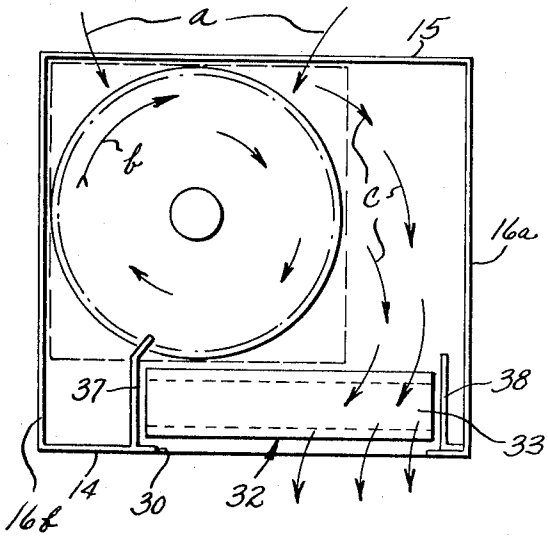
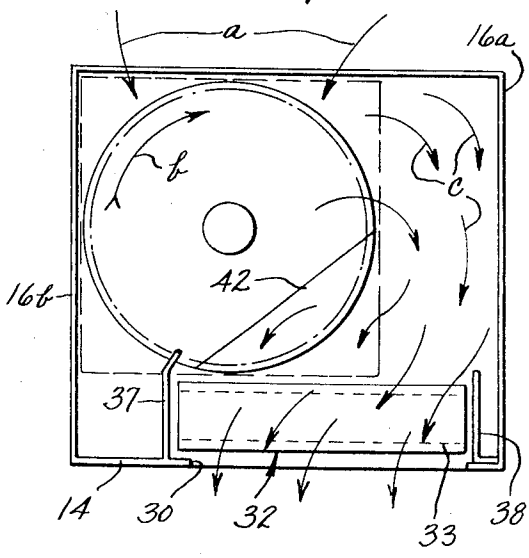


Fig. 4



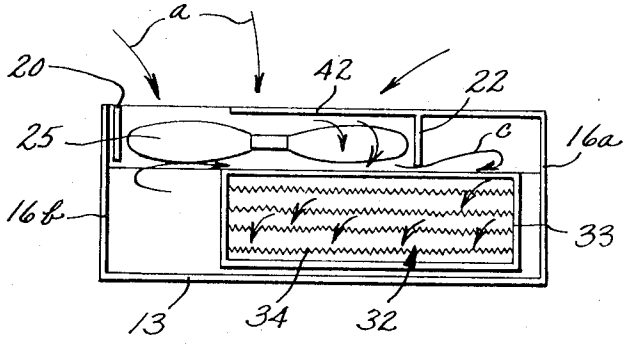


Fig. 5.

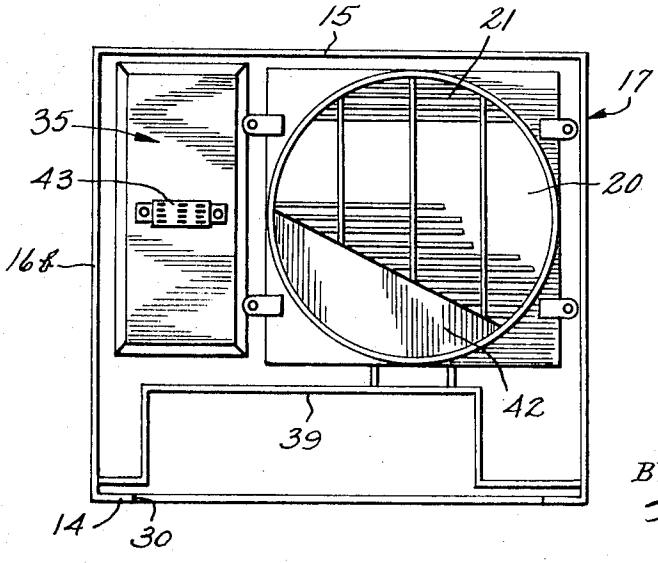


Fig. 6.

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ELECTRIC FAN HEATER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electric heaters, and more particularly to portable electric space heaters utilizing a fan propeller for producing a flow of air through the heater.

2. Description of the Prior Art

Electric space heaters utilizing a fan propeller to produce an air flow through the heater are quite common. Some of these fan heaters utilize a direct flow-through arrangement wherein air is drawn into the rear of the fan heater housing by a propeller and then through a suspended heating element for heating the flowing air then out an opening in the front of the heater. Some electric fan heaters are arranged so that the propeller draws air into the heater through the top panel or wall and then out through a front wall thus requiring the air to make a right angle turn within the heater from the inlet to the outlet. In such an arrangement the heating element is normally located near the outlet opening of the fan heater. It is this latter electric fan heater arrangement to which this invention applies particularly. One of the difficulties in this type of fan arrangement is that the air flow caused by the rotating propeller is forced through the heating element in a rather restricted area thus producing "hot spots." That is, the warm air leaving the heater is hotter in one place than another. Desirably the exiting air should be evenly heated for more comfortable use of the fan heater. This "hot spot" condition is particularly evident when the speed of rotation of the propeller is increased to increase the volume of air flowing through the fan heater. Desirably, the heating element should cover a wide area near the exit opening of the housing so that the air flow path through the heating element is correspondingly wide and evenly distributed to eliminate these called "hot spots."

By my invention, there is provided an improved electric fan heater that incorporates an arrangement for utilizing a fan propeller and widens the area of air flow path as the air passes through the heating element.

SUMMARY OF THE INVENTION

In accordance with this invention, there is provided an electric fan heater that includes a walled housing having an air intake opening in the top wall of the housing and an air outlet opening in the front wall. Between the inlet opening and outlet opening is an electric motor-driven axial fan propeller having a vertical central axis of rotation located to one side of the housing and which provides a centrifugal air flow path upon rotation. The air flow path so produced is between the housing and the fan propeller in the direction of the air outlet opening at the front of the housing. A heating element is positioned in the air flow path and is located in close proximity to the air outlet opening at the front of the housing. Overlying the fan propeller between the propeller and air intake opening is a shielding member that partially blocks the air inlet and is located between the peripheral area of the fan propeller adjacent the centrifugal air flow path. By means of this shielding member, the air pressure caused by the fan propeller beneath the propeller in the area underlying the shielding member is reduced as compared to the other areas

beneath the fan propeller thereby inducing the centrifugal air flow to deflect toward this reduced pressure area thus increasing the air flow path by widening it in the direction of the propeller. With the widened air flow path the heater may now utilize a correspondingly wider heating element and have the air flowing through the heating element more evenly heated thereby preventing "hot spot" areas in the exiting heated air flow.

It is an object of this invention to provide an improved electric fan heater.

It is also an object of this invention to provide an improved electric fan heater utilizing a propeller for pressurizing air in the heater.

It is another object of this invention to provide an electric fan heater utilizing an axial flow fan propeller that draws air in through an opening in the top wall and out a front wall wherein the outlet opening and a heating element near that opening may be increased in width and yet prevent "hot spots" in the exiting heated air flow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of my electric fan heater with a broken-away portion showing the location of the shielding member.

FIG. 2 is a perspective view of my electric fan heater with the housing opened up to show the internal construction of my fan heater.

FIG. 3 is a diagrammatic top plan view showing the air flow of a prior art fan heater.

FIG. 4 is a top plan view similar to FIG. 3 showing the air flow in my fan heater.

FIG. 5 is a front elevational view showing the air flow as in FIG. 4.

FIG. 6 is a plan view of the bottom of the top wall of my fan heater housing showing the shielding member formed integrally therewith.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is illustrated in FIGS. 1 and 2 a portable electric fan heater, generally shown at **10** and including a case or housing **11**. The housing **11** is illustrated as a rectangular housing having a top wall **12**, a bottom wall **13**, a front wall **14**, a rear wall **15**, and side walls **16***a* and **16***b*. The housing is molded from plastic material and made in two parts, a top half **17** and bottom half **18**. Formed in the top wall **12** is a circular inlet opening **20** which has a protective grid **21** covering the exterior portion of the opening. Shielding member **42**, to be described later, is shown partially blocking the air inlet opening **20**. Directed downwardly from the periphery of the inlet opening **20** is a circumferential cylindrical depending wall **22** with that wall in FIG. **2** having a broken-away portion.

Mounted on the bottom wall **13** of the housing and located to one side of the housing is a fan assembly **23** having an electric motor **24** that rotates fan propeller **25** on a vertical central axis. The fan propeller **25** and the inside diameter of the depending wall **22** are dimensioned so that when the top **17** and bottom **18** of the housing are closed, as shown in FIG. **1**, the fan propeller will be within the depending wall **22**. The front wall **14** of the housing has an exit or outlet open-

ing **30** that extends a substantial distance across the length and height of the front wall. The outlet opening **30** is covered by a protective grid **31** that is retained in place by any suitable means on the front wall. Behind and in close proximity to the outlet opening **30** is an electric resistance heating wire assembly **32** consisting of a rectangular-shaped box **33** formed of electric insulating material, such as mica board, around which is strung a coiled resistance wire **34**, which resistance wire when electrically energized provides the source of heat for heating the flowing air.

A control section **35** is provided in the top wall **12** of the housing and is located on the opposite side of the interior of the housing from the fan assembly. The control section **35** contains a high and low heat selection switch **40** for energizing various portions of the heating wire and also an adjustable thermostat **43** with a knob **41** accessible to the user for adjusting the operation of the fan heater to give the desired temperature. The thermostat also has a position to turn the fan heater off. It will be noted from FIGS. **1** and **2** that the construction of my fan heater is quite simple in that the housing is formed in two parts, a top half **17** and bottom half **18**. A partition **37** to one side of the heater wire assembly **32** and another partition **38** on the opposite side are molded into the bottom half **18** and are utilized to direct the air through the heating wire assembly **32**. A top partition **39** for the same purpose is molded into the top half **17**. Also, within the fan heater there is only an electric motor driven axial flow fan for producing an air flow through the heater and a heating wire assembly for heating the air as it is flowing through the fan heater. The necessary electrical wiring for energizing the motor and controlling the operation of the fan heater is not shown but is that which would be normally employed in such fan heaters.

With reference to FIGS. **3**, **4** and **5** there is shown diagrammatically the air flow path produced by a fan heater having the above-described internal construction and component arrangement wherein air coming into the fan heater, designated *a*, through an inlet opening in the top wall passes through the rotating fan propeller, which in this case is shown rotating clockwise as designated by arrow *b*. The air is then pressurized and forced out through the air outlet opening in the front of the fan heater. The fan arrangement utilizes a generally axial flow fan having a propeller with a plurality of blades. In this arrangement the intake opening to the fan is defined by a depending circumferential wall **22** and is so mounted that it surrounds at least the intake or rear portion of the fan. By "rear" portion it is meant that portion above a central horizontal plane through the propeller. Means are provided for effecting a pressure rise in the output flow from the fan. These means comprise the bottom wall **13** positioned directly in front and spaced from the output side of the fan propeller which bottom wall is used for diverting radially the output flow from the propeller, and a chamber formed by the fan heater housing surrounding the forward portion of the fan propeller (below the central horizontal plane). The chamber contains a body of free air and collects therein the radial flow effected by the bottom wall **13**. Upon rotation of the fan propeller, air pressure is effected due both to centrifugal forces set up as a result of the radial outward and circular movement of the air flow, and to a free stream diffusion process occuring as the air flow passes through the area between the bottom wall **13** and the depending wall **22**. Because of its change in radial direction, the air flow is directed away from the center of the fan and prevented from return and recirculation therethrough. The recirculation normally occurs because the center of the fan is "weak" whereas the peripheral area of the fan moves 75 percent of the air, which air is thrown forwardly from the tips of the blades and is thus the "strong" portion of the propeller. After the air has increased in pressure, the flow is then discharged from beneath the rotating fan propeller following a path of least resistance.

To explain the pressure rise caused by an axial flow fan in somewhat simpler language it may also be described as follows: one pressure rise is effected by the decrease in velocity of the axial flow from the fan as it is converted to radial flow by the interference of the bottom wall of the housing; and a second pressure rise is effected by the decrease in velocity of the radial flow as its centrifugal forces are resisted by the adjacent free air in the exhaust area of the chamber.

A conventional axial flow propeller fan is utilized because no appreciable static pressure is required in order to create an air flow but yet it delivers a large volume of air through the fan heater. Moreover, a propeller fan is inexpensive and occupies less space than other types of air-pressurizing means.

As can be seen in FIGS. **3**, **4** and **5**, the fan propeller is located to one side of the heater housing thus providing an air flow exhaust channel at the other side, which exhaust channel represents the path of least air flow resistance as indicated by the arrows designated *c*. Because of the pressurization of the air within the fan heater housing the air is forced out through opening **30** in the front wall **14** of the heater housing. As previously indicated, to heat the air passing through the fan heater a heating wire assembly **32** is positioned in close proximity to the outlet opening **30**. It will be noted that the heating wire assembly **32** is off center of the heater housing toward the centrifugal air flow path and is below the central horizontal plane of the fan propeller. FIG. **3** shows a prior art fan heater as described above with the air flowing through only a portion (the right side) of the heating wire assembly. This restricted air flow is due to the rather high air pressure resulting from the centrifugal force imparted by the fan propeller during rotation. The air flow area passing through the heating wire assembly **32** should be widened as otherwise the heated air exiting the heating wire assembly and fan heater has "hot spots." That is, the air flow is not evenly heated as it should be for more comfortable use of the fan heater.

FIGS. **4** and **5** represents the air flow when my invention is incorporated into a fan heater as generally described above and shown in FIG. **3**. By providing a shielding structure or member **42** to partially block the air inlet opening **20** and locating that shielding member above the fan propeller **25** and adjacent the centrifugal air stream path toward the front wall there is provided a reduced air pressure zone beneath the fan propeller directly below the shielding member **42**. With this reduced air pressure zone the air flow designated *c* seeks the path of least resistance and therefore diverges

and is widened during its exiting travel so that the air upon passing through the heating wire assembly **32** covers the entire length of the heating wire assembly.

The shielding member **43** may vary somewhat in size and shape to produce the desired widened area of air flow through the heating wire assembly. Such factors as housing dimensions, air inlet opening shapes, fan capacity, heating capacity, etc., will influence the particular size and shape of the shielding member required for a desired air flow for a given fan heater. I have found that with a circular inlet opening **20** a shielding member positioned above the fan propeller adjacent the centrifugal air stream path toward the outlet opening to partially block the opening between the edge of the opening and a chord line across the opening located less than half the distance from the edge of the inlet opening to the center of the opening works quite satisfactorily. This is the construction shown in the drawings. The shielding member **42** may be positioned by any convenient means, however, I have selected simply molding the shielding member integrally with the fan heater housing top wall **12**. The molded top wall **12** is shown in FIG. **6** as viewed from the bottom of that wall.

The foregoing is a description of the preferred embodiment of the invention and variations may be made to the fan heater without departing from the spirit of the invention, as defined in the appended claims.

I claim:

1. An electric fan heater comprising:

a. a housing, having top, side, rear, bottom and front walls,

b. a motor driven axial fan propeller within the housing, said fan having a vertical central axis of rotation to thereby provide a centrifugal air stream path within the housing,

c. a circular air inlet opening in the top wall of the housing overlying said propeller, said opening being slightly larger than the propeller diameter and having a depending circumferential downwardly directed wall extending below the central horizontal plane of the fan propeller,

d. an air outlet opening in the front wall of the housing,

e. a heating element in said air stream path and located in close proximity to the air outlet opening, and

f. a shielding member between the fan propeller and air inlet opening to partially block the air inlet opening said shielding member covering the area as seen in top plan view between the edge of said opening and a chord line across a portion of said opening, said chord line being located less than half the distance from the edge of the opening to the center thereof and in the half of the inlet opening closest the air outlet opening.

2. The electric fan heater of claim **1** wherein the fan propeller is located to one side of the housing and the centrifugal air stream path is at the other side between the housing and the fan propeller.

3. The electric fan heater of claim **1** wherein the heating element is off center of the heater housing toward the air flow path and below the central horizontal plane of the fan propeller.

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