

May 26, 1936.

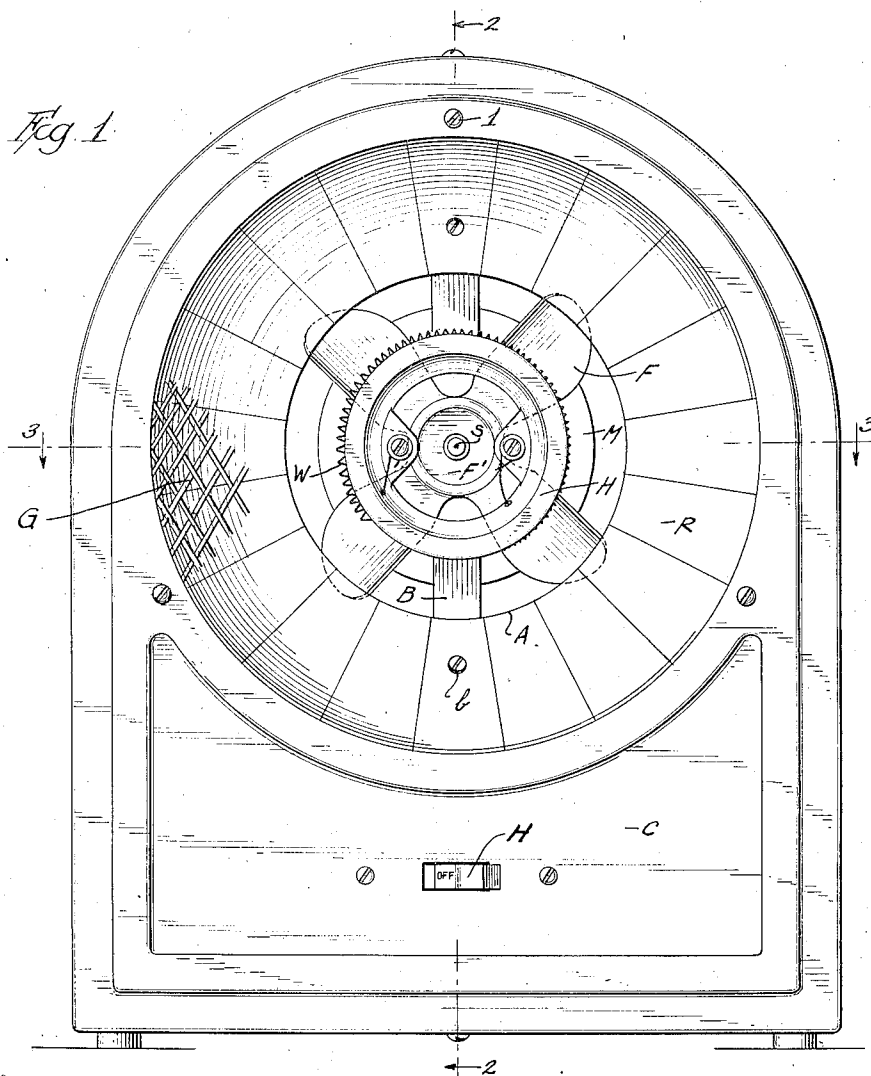
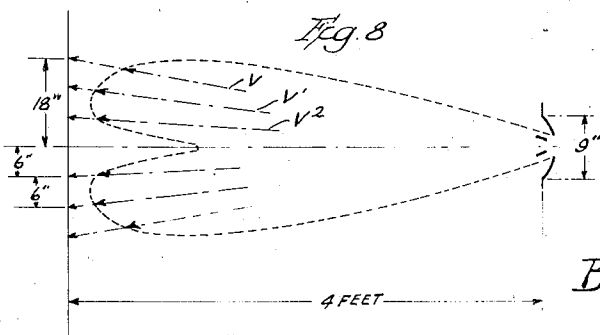
B. A. BENSON

2,041,897

FAN HEATER

Filed Aug. 31, 1935

3 Sheets-Sheet 1



Inventor:

Bernhart A. Benson

by Albert Scheidt

Atty.:-

May 26, 1936.

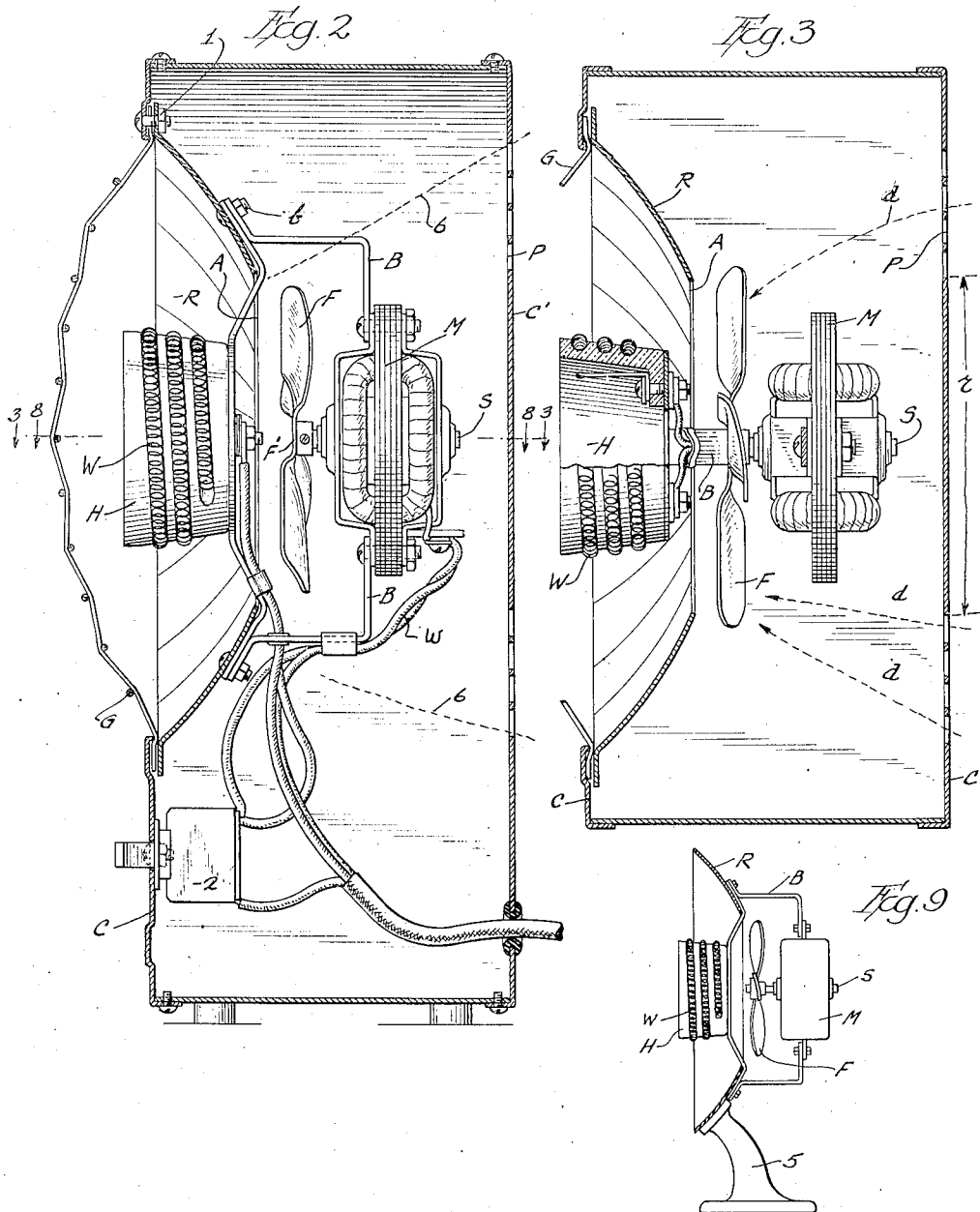
B. A. BENSON

2,041,897

FAN HEATER

Filed Aug. 31, 1935

3 Sheets-Sheet 2



Inventor:

Bernhart A. Benson

by Albert Scheille

Atty:

May 26, 1936.

B. A. BENSON

2,041,897

FAN HEATER

Filed Aug. 31, 1935

3 Sheets-Sheet 3

Fig. 4

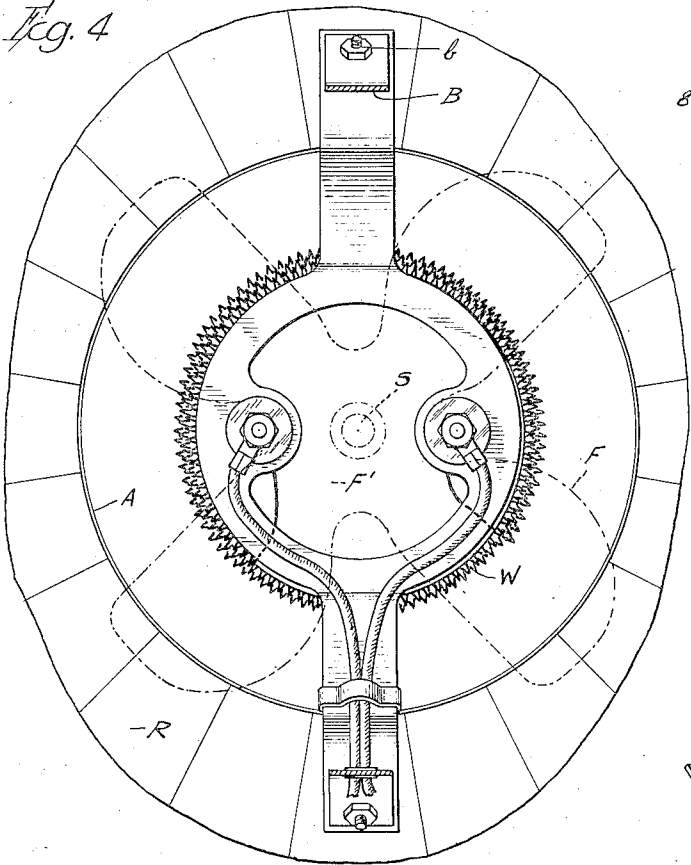
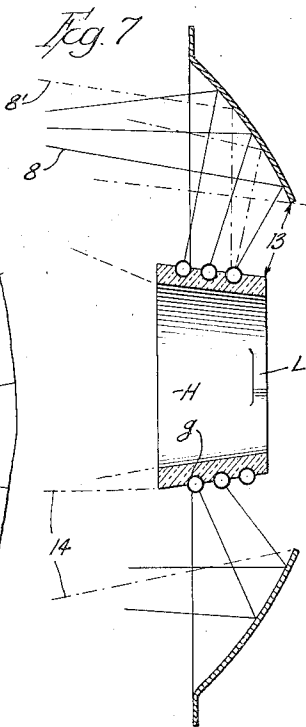


Fig. 6

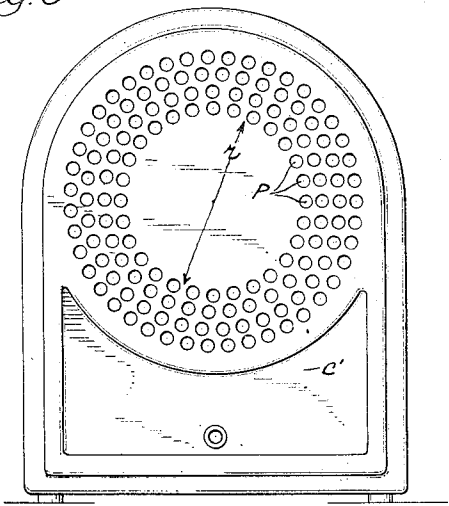
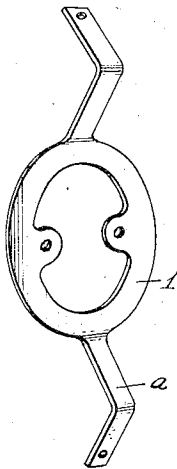


Fig. 5



Inventor:

Bernhart A. Benson

by Albert Scheille

Atty:

UNITED STATES PATENT OFFICE

2,041,897

FAN-HEATER

Bernhart A. Benson, Chicago, Ill., assignor to
Chicago Electric Manufacturing Company,
Chicago, Ill., a corporation of Illinois

Application August 31, 1935, Serial No. 38,830

16 Claims. (Cl. 219—39)

My invention relates to an electric fan and heater combination, particularly suitable for use in bath rooms, for warming air and projecting the warmed air in a diverging blast of a relatively small cone angle.

Generally speaking, the objects of my invention are those of providing a relatively inexpensive, easily manufactured and efficient combination of an electric fan with a glow heater of the type in which rays of heat are forwardly deflected and somewhat concentrated by a forwardly concaved bowl-shaped reflector within which an electric heating unit is disposed.

Moreover, my invention aims to provide a so-called "fan-heater" of this class in which the electric heating unit does not materially obstruct the movement of air by the fan, in which the fan is disposed behind the heating unit and arranged for blowing part of the air forcibly over the heating element of the heating unit, and in which glow of the red hot heating element will be reflected by the forward surface of the reflector so that a visualizing of the apparently glowing reflector will have the psychological effect of enhancing the warming action of the warmed and forwardly projected air.

Moreover, my invention aims to provide a heater-fan in which a minor portion of the propelled air, adjacent to the axis of the heating unit, will be warmed to a less extent and propelled less forcibly than the surrounding part of the air; and in which the various parts are so arranged and proportioned that the said axial part of the propelled air and the surrounding warmed air will intermingle into a stream of air in which the central portion is substantially as warm as the air further from the axis of the said stream.

So also, my invention aims to provide an efficient fan heater which will afford the needed warming effect at a considerable distance from the heater and over an area of considerable diameter.

In addition, my invention aims to provide a fan heater of the above characteristics, in which all parts can readily be within a single casing and adequately guarded against having a child reach the hot heating element with its fingers, in which all of the cooperating parts can be assembled as a unit on the front of the casing, and in which the casing will not become unduly heated.

Illustrative of my invention,

Fig. 1 is a front elevation of a fan heater, with the major portion of the frontal wire guard broken away.

Fig. 2 is a central, vertical and longitudinal sec-

tion taken along the line 2—2 of Fig. 1, with the electric heating unit, fan, motor and switch shown in elevation.

Fig. 3 is a horizontal section taken along the line 3—3 of Fig. 1 or Fig. 2, with some portions shown in elevation.

Fig. 4 is an enlarged and fragmentary front elevation of the central portion of the reflector and parts adjacent thereto.

Fig. 5 is a perspective view of the stamping which supports the heating unit from the reflector.

Fig. 6 is a reduced rear elevation of the fan heater.

Fig. 7 is a central and vertical section taken along the line 7—7 of Fig. 1 through the reflector and the heating unit, with full lines showing the reflection of radiated heat from the reflector and with dotted lines showing how the tube of air propelled past exterior of the heating unit increases forwardly in thickness.

Fig. 8 is a diagram showing the effective distribution of the warmed air when my fan heater is in operation and the relative velocity of different portions of the warmed forwardly propelled air.

Fig. 9 is a reduced vertical section allied to Fig. 2, showing a modified embodiment in which a simple pedestal is substituted for the casing.

In Figs. 1 to 3, my fan heater includes a casing having its front C provided with a circular opening corresponding in diameter to the outside diameter of the annular and forwardly concaved reflector R which extends behind the said casing front, and which reflector has a peripheral flange fastened to that front by bolts which also fasten the peripheral portion of a wire guard G to the casing front.

Supported forwardly of the vertical plane of the aperture A in the reflector is an electric heating unit comprising a forwardly flaring tubular insulating body H having an exterior spiral groove G for definitely positioning a coil of high-resistance wire W wound on the said insulating body. This body or wire carrier is desirably supported from the reflector by a stamping (formed as in Fig. 5) which includes a flat ring I bolted to lugs L on the said wire carrier and two arms a fastened respectively to diametrically opposite portions of the reflector R, and preferably by the same bolts b which fasten the motor-supporting brackets B to the reflector.

Moreover, the tubular body or wire carrier B of the heating unit is considerably smaller in diameter than the aperture A of the reflector, and

the bracket arms *a* of the said stamping are preferably shaped so as to dispose the rear end of the said wire carrier forwardly of the plane of the said aperture, as shown in Figs. 4 and 7.

Thus arranged, the recited assembly affords an annular air outlet between the aperture of the reflector and the rear end of the wire carrier of the heating unit, and leaves the bore of this wire carrier open so that air can flow through it also from the interior of the casing.

Disposed within the casing *C* behind the reflector *R*, and supported by two brackets *B* each of which is fastened to the reflector (desirably by the same bolts *b* which secure the heating-unit-supporting bracket arms *a* to the reflector) is an electric motor, generally designated as *M*, having its shaft *S* coaxial with the reflector. Fastened to the forward portion of the motor shaft, and freely spaced rearwardly from the plane of the reflector aperture *A*, is a fan *F* which has each blade thereof presenting its major portion behind the said annular air outlet between the reflector aperture and the rear end of the wire-carrying body *B* of the heating unit, the fan also having an imperforate portion *F'* connecting the inner ends of its blades.

In practice, I desirably also employ one of the motor-supporting brackets *B*, as shown in Fig. 2, for supporting the circuit wires *w* which lead to the motor, which desirably is in series with the heating wire *W*, the current supply for both being controlled by a switch *2* presenting its handle *10* in front of the casing.

When this switch is closed, the operation of the fan blows air forcibly through the said annular space between the bore the reflector aperture and the exterior of the rear end of the body *B* of the heating unit; but, since the generally imperforate central portion *F'* of the fan has an area almost equalling that of the rear end of the bore of the body *B* of the heating unit, air will move quite slowly through that bore, thereby subjecting this part of the air to heat radiation from the bore of the heating unit for a much longer period of time than the air which is forcibly propelled over the exterior of the said unit.

When arranged as heretofore described, namely with the reflector, motor, heating unit and control switch all supported by the casing front *C*, my fan-heater could be used without completing the casing, by merely providing means for supporting this sheet metal front in an upright position, as shown in Fig. 9. However, I preferably provide a complete casing (as in Figs. 2 and 3) both as a housing for the fan motor assembly and the switch, and for enabling me to control the volume and the direction of the entering air.

For this purpose, the drawings show the casing as including an upright back *C'* freely spaced rearwardly from the motor *M*, this casing back being imperforate except for a plurality of air ports *P* which preferably are uniformly distributed over an annular area coaxial with the fan shaft *S*, the reflector aperture *A* and the body *B* of the heating unit. This annular area preferably has its inner radius (*r* in Fig. 3) larger than the exterior of any part of the motor, and desirably fully as large as the diameter of the reflector aperture *A*. Moreover, the total area of the air ports *P* is preferably somewhat larger than that of the reflector aperture, to allow for the additional air which moves at a relatively slower rate through the bore of the heating unit.

When current flows through the heating wire *W*, rays of heat from this wire coil and from the

wire-carrying body *H* which also becomes hot, will be redirected by the reflector, as shown partly by full lines *8* and partly by dotted lines *8'* in Fig. 7, so that the reflector would concentrate the heat within a tube area not much greater than the outside diameter of the reflector, (if the fan was not running).

Consequently, a user standing a few feet from a reflector of say 10 inches diameter would have a warming effect concentrated over an area not much more than a foot in diameter.

However, when the fan of my appliance is running, most of the air drawn towards it into the casing, as for example along lines such as *d* in Fig. 3, will be propelled forwards nearly parallel to the axis of the fan through the annular space *13* between the heater body *H* and the bore of the reflector, a small portion of which air directly engages the heating wire while other parts of it brush the hot exterior of the heater body. Consequently, the major part of the air will be propelled as a tubular stream of air, which stream increases forwardly in thickness and exterior diameter as shown by the dotted lines *4* in Fig. 7.

Still another and relatively small part of the indrawn air is propelled much more slowly by the radially inner portions of the fan blades, which, as shown in Fig. 1, present only small areas behind the bore of the said wire carrier. This air portion issues as a quite slowly moving current of air of circular section and gradually merges into the bore of the said tubular stream of more forcibly propelled air to form a conical air stream which increases in diameter as it moves forwardly. Consequently, with a suitable proportioning of the parts of my fan-heater, I can readily produce an adequate warming effect of considerable area at a distance of three or four feet from my appliance, instead of having this effect undesirably concentrated.

Since my construction conveniently allows the reflector to support the heating unit and the electric fan, these three major parts could be similarly assembled and used without the illustrated casing, as shown for example in Fig. 9, by supporting the reflector on a pedestal *5*. However, since this will allow the air to be drawn towards the fan from a wide area farther from the fan axis than the dotted lines *6* in Fig. 2, I have found the resulting effect (with exactly the same reflector, heating unit and electric fan) to be much less advantageous than it is when I also provide a casing which admits air only through a limited annular area in the back of the casing, as heretofore described.

That is to say, the air will then move at so high a velocity through the bore of the heating unit that the central part of the blast of air will not be materially heated, and the relatively trivial heating of the inner portion of the projected air will contrast uncomfortably with the warming effect of air farther from the axis of the said air blast. Moreover, the suction of the propelled air then will also move entirely unheated air forwardly past the periphery of the reflector, thereby increasing the uncomfortableness of the result on any one standing in front of the reflector. For these reasons I preferably provide a casing having a limited air-port area for admitting air and presenting this area in an annular formation behind the fan.

For example, I have found my fan heater adequate at a distance of four feet from the user for spreading adequate warmth over an area fully three feet in diameter, and with a fairly uniform

air velocity in the annular outer portion of this area, as indicated by the velocity lines V , V' and V'' in Fig. 8.

I have also found that while the velocity of the warmed air is considerably less in a relatively small central portion of this area, the warming effect of this central portion of the stream of heated air on skin exposed to it may be fully as great as the surrounding portion of the air, which I assume to be because the air closest to the axis of the stream moved so slowly through the bore of the hot wire carrier as to have ample time for absorbing heat from the latter.

When my fan-heater is in operation, the movement of air through the casing keeps the latter from overheating, so that it can freely be touched even by a child, thus making it safe for household use. Moreover, when the heating wire is of the desirable resistance which causes it to glow when hot, this glow is reflected by the reflector, and all the more impressively so when the latter is paneled as shown in the drawings. Consequently, the reflection of this glow also has a psychological effect—after the manner of a hearth fire—of stimulating the feeling of warmth in a user who faces the reflector.

By mounting the entire operating parts on the casing front, I simplify and cheapen the assembly; and by placing my heating coil on a tubular carrier which has many times greater exterior as well as interior heating-radiating surface and moving air over these surfaces at the above described decidedly different velocities, I obtain an approximately uniform distribution, over a considerable cone angle, which I have been unable to obtain with fan heaters of heretofore proposed constructions.

However, the proportioning of numerous parts of my fan-heater, as well as the shape of the reflector, may be considerably varied, and with a heating unit of higher wattage the cone angle of the projected stream of warm air may be increased (from the approximate 30 degree angle of Fig. 8) to about 40 degrees. So also, it will be obvious that other changes may be made without departing either from the spirit of my invention or from the appended claims.

I claim as my invention:

1. A fan heater comprising an annular and forwardly concaved reflector having a substantially unobstructed bore; an electric heating unit substantially housed by the reflector, the said unit comprising a tubular body coaxial with the reflector and of smaller exterior diameter than the bore of the reflector, the said body having its rear end generally freely spaced from the said reflector bore, and a high resistance wire supported on the periphery of the said body; and an electric fan disposed behind coaxial with the reflector for blowing air through the bore of the reflector and through the bore of the heating unit; the fan including a bladed member freely spaced rearwardly from both the reflector and the said body and rotating about the axis of the reflector, and presenting the major part of the area of each of its blades behind the space between the bore of the reflector and the rear end of the said tubular body.

2. A fan heater as per claim 1, in which the bladed member of the fan also presents blade portions directly behind the bore of the tubular body, the area of which blade portions is a minor fraction of the area of the blade parts disposed behind the said space.

3. A fan heater as per claim 1, in which the said body has a rearwardly tapering frusto-conical peripheral surface and in which the heating wire is a coil of high-resistance wire wound spirally and peripherally around the said body, the said body having its rear end spaced forwardly from the plane of the bore of the reflector by a distance less than the radial spacing of the periphery of the said rear end from the said reflector bore.

4. A fan heater as per claim 1, and in which the electric fan includes a motor and a fan-blade member rotated by the motor; the fan heater including an upright casing having its front provided with an aperture spanned by the reflector, the said casing housing the entire electric fan, and the back of the casing having air-admitting provisions distributed over an annular area coaxial with the reflector and fan, the bore of the said area being approximately equal to the bore of the annular reflector.

5. A fan heater as per claim 1, including an upright casing having its front provided with an aperture spanned by the reflector, the said casing housing the entire electric fan, and the back of the casing having air-admitting provisions distributed over an annular area coaxial with the reflector and fan; the bore of the said area being approximately equal to the bore of the annular reflector, and the total area of the said air-admitting provisions being not less than the area of the annular space between the bore of the reflector and the rear end of the body of the electric heating unit.

6. A fan heater as per claim 1, including an upright casing having its front provided with an aperture spanned by the reflector, the said casing housing the entire electric fan, and the back of the casing having air-admitting provisions distributed over an annular area coaxial with the reflector and fan; the electric fan and the said tubular body being both supported by the said front of the casing, and the fan being freely spaced forwardly from the back of the casing.

7. A fan heater as per claim 1, including an upright casing member having an aperture spanned by the said reflector, the reflector being supported by the said casing member and the electric fan being supported by the reflector.

8. A fan heater comprising an annular and forwardly concaved reflector having a substantially unobstructed bore; an electric heating unit comprising a tubular body of insulating material coaxial with and substantially housed by the reflector, the said body having its rear end of smaller exterior diameter than the bore of the annular reflector so as to leave an annular space between the said rear end and bore; an electric heating member supported on the periphery of the said tubular body; and means behind the said body for simultaneously blowing air forwardly through the said annular space and also propelling a relatively much smaller volume of air, at a minor fraction of the velocity of the aforesaid air forwardly through the bore of the said tubular body.

9. A fan heater as per claim 8, in which the tubular body is a rearwardly tapering frusto-conical tube, the rear end of the bore of the said tube being larger in diameter than the width of the said annular space.

10. A fan heater as per claim 8, including a casing having a frontal aperture spanned by the said reflector and having a back provided with air ports disposed radially outward of a circular and imperforate casing back area coaxial with the

reflector, the diameter of the said area being not materially less than that of the bore of the annular reflector.

11. A fan heater as per claim 8, in which the parts are proportioned so that the air blown propelled through the bore of the tubular body is warmed to approximately the same temperature, by heat radiation from the said body, as the temperature to which the air blown through the said annular space is warmed conjointly by contact with the heating member, by radiation from the said body and through the reflection of radiated heat by the reflector.

12. A fan heater as per claim 1, in which the said bladed member has a central and effectively imperforate portion of a diameter at least equal to the radius of the bore of the rear end of the said tubular body.

13. A fan heater comprising a tubular and axially horizontal electric heating unit; means for propelling a tube of air at considerable velocity coaxial with and contiguous to the exterior of the said unit, and simultaneously therewith causing air to flow in the same direction through the bore of the said unit at a small fraction of the aforesaid velocity; and means for reflecting heat radiated by the heating unit in directions radially outward of that unit, the heat-reflecting means being arranged for reflecting the said heat in a tubular formation coaxial with the said unit and in the aforesaid general direction.

14. A fan heater comprising an axially horizontal tubular wire carrier, a coil of heating wire supported on the periphery of the wire carrier, and an electric fan disposed behind and near the said wire carrier and including a blade member coaxial with the wire carrier and having the major portion of each blade farther from the axis of the wire carrier than the radius of the rear end of

the said carrier; an annular reflector coaxial with the said carrier and having an unobstructed bore of a diameter intermediate that of the peripheral reach of the blades and of the rear end of the wire carrier; and means for supplying current to the electric fan, and to the heating wire at such a rate as to cause the latter to glow, the reflector being formed for forwardly reflecting the said glow and the fan being arranged for blowing air forwardly.

15. A fan heater comprising a forwardly flaring tube of insulating material disposed with its axis horizontal; a coil of high resistance wire wound spirally on the periphery of the said tube; a forwardly concaved annular reflector coaxial with and substantially housing the said tube; the reflector having a bore diameter considerable larger in diameter than the rear end of the said tube and having its bore portion in a plane spaced rearwardly from the said rear tube end; and an electric fan disposed behind the reflector and including a blade member coaxial with the said reflector and tube; the blade member being formed so that by far the greater part of the air propelled by the blades will flow at considerable velocity through the annular space between the rear of the said tube and the bore of the reflector at a much higher velocity than that at which the remaining portion of the air is propelled through the bore of said tube.

16. A fan heater as per claim 8, in which the said means comprise a rotating fan coaxial with the reflector and spaced rearwardly from the plane of the aperture in the reflector by a distance less than the radial spacing of the rear end of the said body from the bore of the said aperture.

BERNHART A. BENSON.