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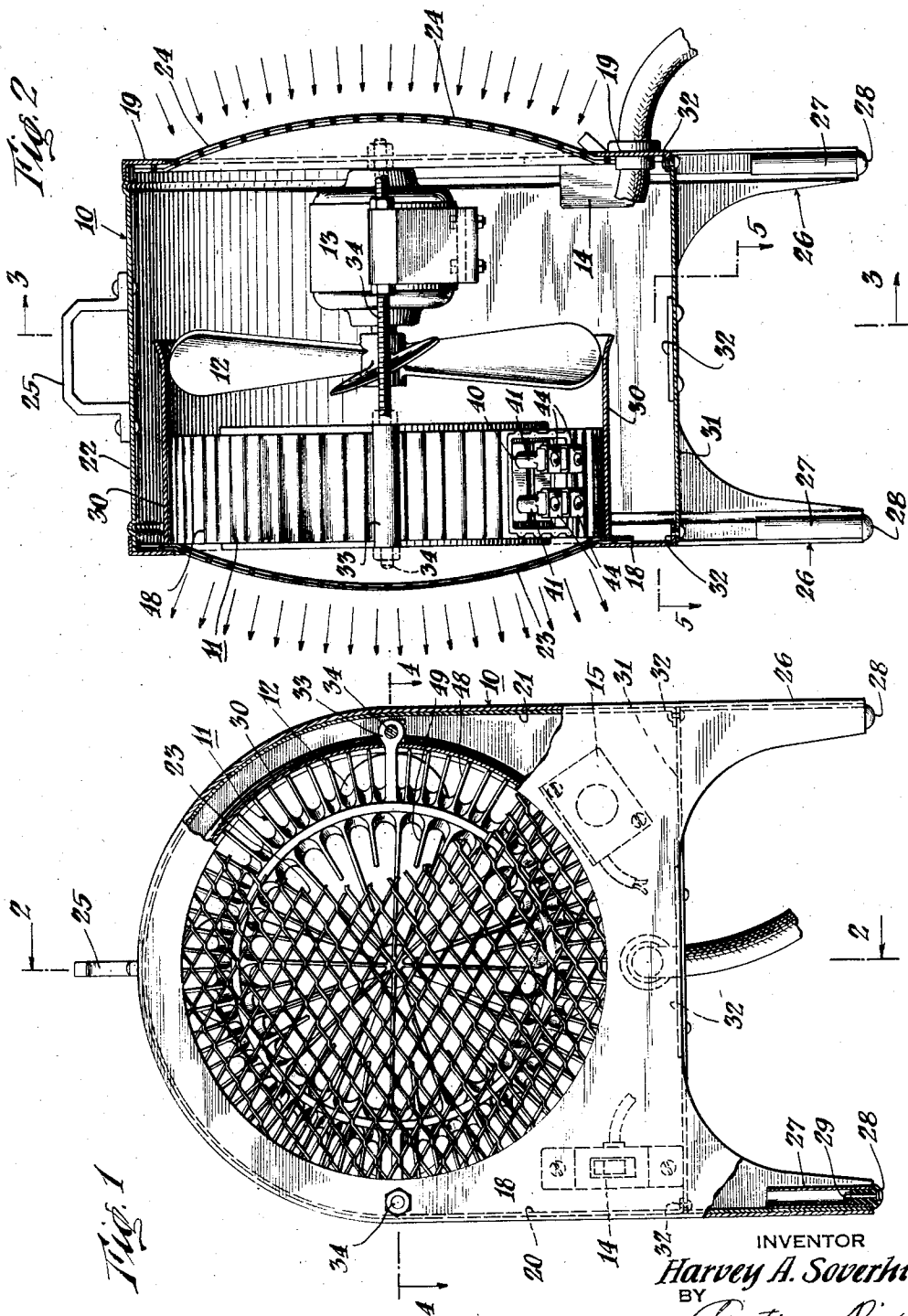
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2,109,279

ELECTRIC HEATER

Filed July 6, 1935

3 Sheets-Sheet 1



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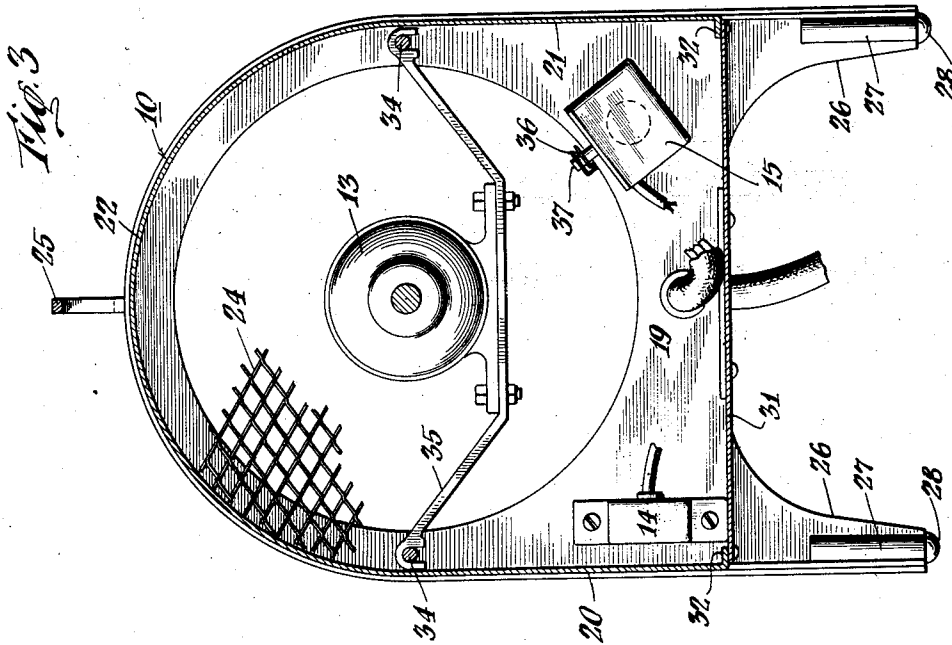
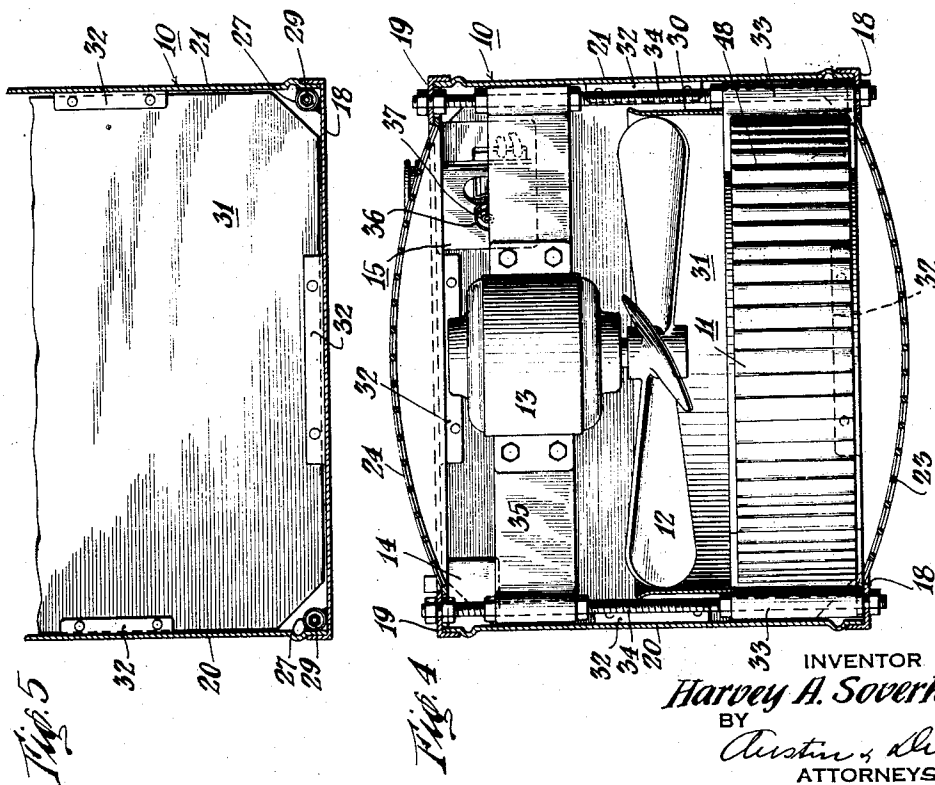


Fig. 5

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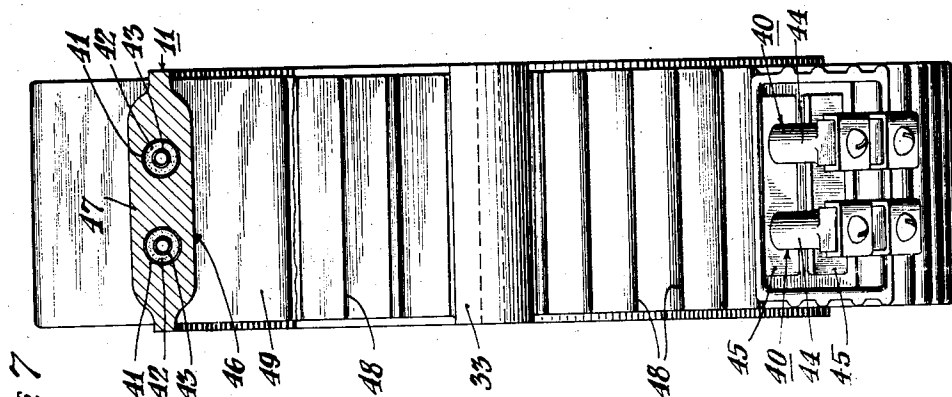
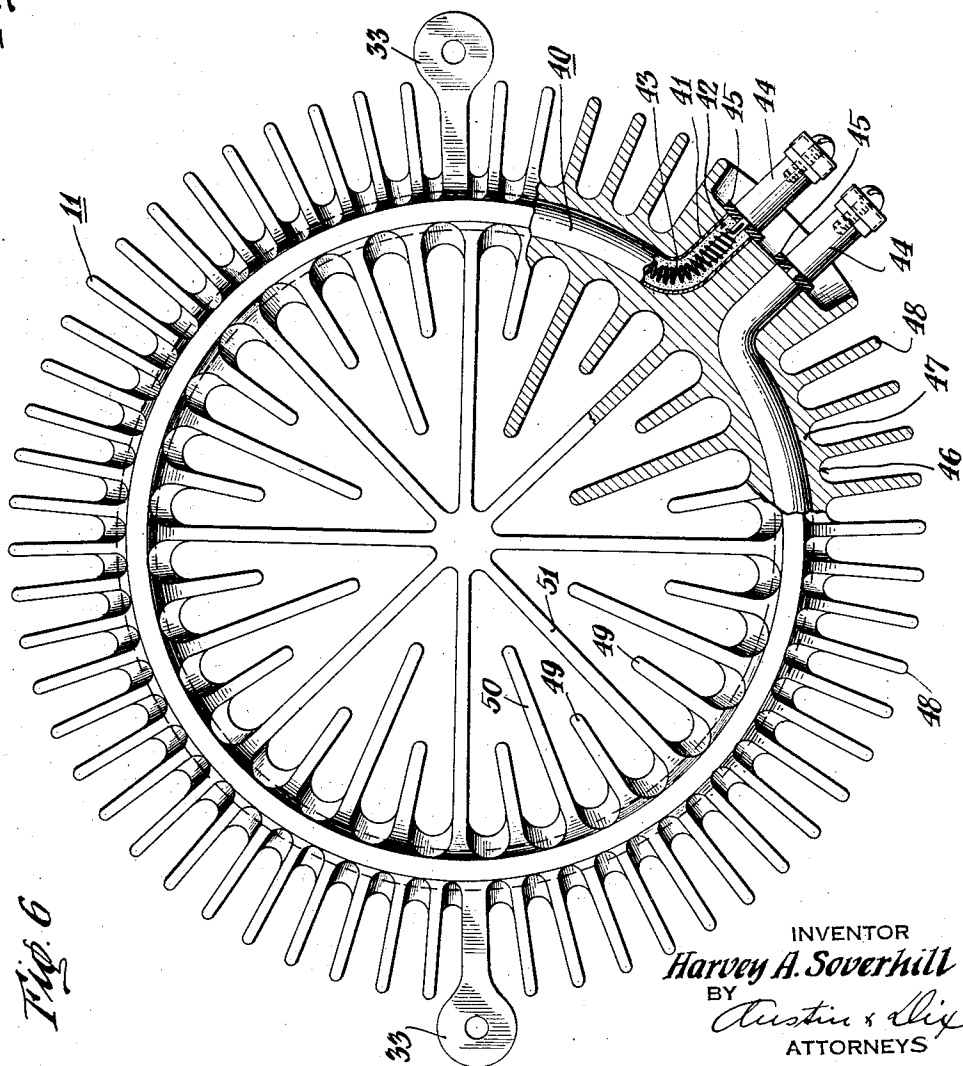
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ELECTRIC HEATER

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,109,279

ELECTRIC HEATER

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Application July 6, 1935, Serial No. 30,067

9 Claims. (Cl. 219—39)

The invention relates to electric heaters, and more particularly to electric, forced draft air heaters. Such heaters usually comprise a grid or heating element and a motor driven fan for forcing a blast of air across the heating element to dissipate the heat and to circulate the air.

According to a preferred form of the invention, the heating element or grid may be circular or ring shaped in form, the circular body having a plurality of outwardly extending radial flanges and a plurality of inwardly extending radial flanges, certain of said inwardly extending radial flanges meeting at the center. The circular grid may be cast and shrunk around a circular sheath-wire heater. Such a sheath-wire heater may comprise an outer tubular sheath having powdered insulating material therein in which is imbedded a helical resistance wire through which the electricity is passed to generate the heat. A cylindrical tube or shroud may surround the circular grid and the fan may be disposed within this shroud so that all of the air discharged by the fan is constrained to pass through the grid and is available for cooling the convection surface of the grid. The motor driven fan and grid, together with suitable electric control devices, may be mounted in a suitable casing.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

- Fig. 1 is a front view of the heater;
- Fig. 2 is a vertical section on the line 2—2 of Fig. 1;
- Fig. 3 is a vertical section on the line 3—3 of Fig. 2;
- Fig. 4 is a horizontal section on the line 4—4 of Fig. 1;
- Fig. 5 is a horizontal section on the line 5—5 of Fig. 2;
- Fig. 6 is a front elevation of the grid; and
- Fig. 7 is a side elevation of the grid partly in section.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as

generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

In the drawings accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

Referring now to the drawings and more particularly to Figs. 1 to 5, the heater comprises a casing 10 having disposed therein a heat generating grid 11, fan 12, driven by motor 13, service switch 14 and safety switch 15.

The casing 10 is made up for the most part of suitable sheet metal. It comprises a front plate 18 and back plate 19 suitably secured to a U-shaped plate forming sides 20 and 21 and top 22. The front and back plates are provided with large openings into which screens 23 and 24 are suitably secured and the top 22 is provided with a handle 25 for convenience in moving the heater from place to place.

The front 18 and back 19 are secured to the sides and top 20, 21 and 22 in any desired manner. In the form shown for illustration, the front and back 18 and 19 are provided with a peripheral flange in which the sides 20 and 21 and top 22 fit. Suitable welding or solder may be provided for holding the parts of the casing in assembled relation.

The legs 26 are formed by cutting out large recesses or notches in the sides 20 and 21 and front 18 and back 19. Reinforcing these legs are tubes 27 suitably secured in position, in the lower ends of which are rubber plugs 28 held in position by compressional stress of nuts and bolts 29 passing therethrough. The legs thus made are sturdy and the rubber plugs 28 prevent marring of any surface on which the heater may be placed.

The casing may be provided with a bottom plate 31 which may be suitably secured, as by detachable screws, to flanges 32 bent inwardly from the front, back and sides of the casing. The service switch 14 is suitably secured to the back 19 with the finger-engaging tumbler projecting out through the casing. The safety switch 15 may be also suitably secured to the inside of the back 19 with its knob projecting through to the outside of the casing.

All of the enclosed apparatus is mounted on a pair of threaded rods 34 passing through the

front and back of the casing. The grid 11 is provided with a pair of long lugs 33. The motor 13 supporting the fan 12 is mounted on a suitable saddle 35 resting on the bolts 34. The bolts 34, the grid 11 and saddle 35 are suitably locked in position by lock nuts, as shown.

A cylindrical shroud 36 is secured to the inside of the circular grid 11 and has its rear end slightly flared. Within this flared portion, fan 12 has a close running fit, so that all of the air discharged by the fan must pass through the grid. The switch 14 is the ordinary service switch and may control both the motor 13 and the heater element 11. The safety switch 15 includes a rod 37 surrounded by a safety heating coil 38. The construction and operation of the safety switch 15 is explained more in detail in my Patent No. 2,061,258, issued November 17, 1936.

Referring now to Figs. 6 and 7, the grid 11 comprises a pair of sheath-wire elements 40. Each sheath-wire element comprises a metallic sheath 41 having powdered insulating material 42 therein. Imbedded within the insulating material is a coiled resistance wire 43. The electric insulating material 42 is high heat conducting and is packed tightly within the tubular sheath 41, as will be understood by those skilled in the art.

The grid 11 also includes a jacket 46 of aluminum or other high heat conducting material. The jacket 46 comprises a circular or tubular body 47 with outer radial heat dissipating flanges 48 and inner radial heat dissipating flanges 49, 50 and 51. Certain of these inner flanges 51 meet at the center forming a unitary construction for a purpose hereinafter described more in detail.

The sheath-wire elements 40 are cast within the body 47 during the process of manufacture so that the grid 11 forms a perfect heat conducting unit from the resistance wire 43, where the heat is generated, to the convection surface on the heat dissipating ribs or flanges. Thus, this construction permits the dissipation of immense quantities of electric energy within a small geometrical space.

A certain part of the jacket 46 is arranged for the binding posts 44. These binding posts have their shanks projecting into the sheath-wire elements to limit the generation of heat to those parts of the sheath-wire elements closely surrounded by the heat conducting jacket. Insulating washers 45 insulate the binding post 44 from the surrounding metal 41 and jacket body 47.

The electrical connections of the motor, switches and sheath-wire elements may be made in any desired manner. In certain cases, the two sheath-wire elements may be connected in series and in other cases in parallel, depending upon the voltage rating of these elements and on the voltage with which the heater is to be used.

In operation, when voltage is applied to the sheath-wire elements 40, the grid 11 will be heated. The operation of the motor 13 driving fan 12 draws air from the room in through the rear screen 24, discharging it through the shroud 36 and grid 11, through the front screen 23. A sufficient quantity of air is supplied to keep the temperature of the surface of the grid 11 down to comparatively low values, as for example, 250° F. The bowed shape of the screens 23 and 24 assists in increasing the area from which the air is drawn and also assists in diffusing the air

forced out of the heater, as indicated by the arrows in Fig. 2.

The sheath-wire heater elements 40 are operated at very high heat dissipating densities, as for example, 80 watts per square inch of surface of the sheath 41. This compares with the ordinary operation of sheath-wire heaters, when used alone in a blast of air, of about 10 watts per square inch of sheath surface. Because of the extremely high dissipating density, it is important that all parts of the jacket 46 be subjected to equal cooling. Accordingly, the convection surface of that part of the jacket lying outside of the center line of the body 47, including the ribs or flanges 11, is made substantially equal to the convection surface on the inside of the center line of the body, including principally the flanges 49, 50 and 51. Extending the flanges 51 to the center assists in providing this equal distribution of convection surface and also assists in making a stronger casting.

According to the invention, the resistance of different parts of the grid to air flow is made substantially uniform. Also the fan 12 is preferably designed to give substantially uniform velocity to the air blast throughout the entire cross sectional area of the air blast. The shroud 36 insures that substantially all of the air must sweep the convection surface of the grid. These factors, together with the equalized convection surface with respect to the heat generating sheath-wire elements, provide an arrangement by which immense amounts of heat may be dissipated with a heater of small geometrical dimension.

A further advantage of the invention is that only one grid casting is required for a single heater. Also, only one type of sheath-wire heater is required. One sheath-wire heater may be used, or two, as in the form illustrated, or, if desired, three or more sheath-wire heaters may be used. In some cases, a single sheath-wire heater may be used having a plurality of circular convolutions. In any event, care should be taken in spacing the adjoining sections of sheath-wire heater from each other to provide a sufficient amount of jacket to be interposed therebetween to insure proper heat dissipation. If adjacent parts of sheath-wire heater are disposed too closely, the jacket will not properly flow in between during the casting process, causing an air pocket at this point, which is fatal to the operation of the heater.

The provision of a comparatively low surface temperature on the grid of the heater assists in increasing the capacity of the heater by keeping the temperature gradient from the resistance wire, where the heat is generated, to the convection surface of the grid at a maximum. The air leaving the heater is not sufficiently hot to scorch anything with which it comes in contact. It will be seen that the ratio of convection surface to the surface of the sheath-wire heater is greatly increased. This ratio may be of the order of 18 or 20 to 1. This greatly extended convection surface, together with a sufficient air velocity, which may run as high as 800 feet per minute in ordinary requirements, and sometimes up to 1500 feet per minute for special purposes, permits great amounts of energy to be dissipated.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a heater, an annular heat generating grid comprising a cylindrical body having outwardly extending and inwardly extending, radial, heat dissipating fins, certain of said inwardly extending fins meeting in the center, and a motor driven fan spaced axially from said grid for maintaining a column of air therebetween.
2. In an electric heater, a casing, an annular heater grid in said casing, said grid comprising a single-wire, sheath-wire heater element, a jacket cast around said heater element and comprising a thin cylindrical body enclosing said heater element and having radial fins extending outwardly from said body and second radial fins extending inwardly from said body, certain of said inwardly extending radial fins meeting at a point in the center, a motor having a fan thereon in said casing, the heat dissipating surface of that part of said grid extending inwardly from the midpoint of said body being substantially equal to that part extending outwardly from the midpoint of said body.
3. In an electric heater, a casing, an annular heater grid in said casing, said grid comprising a sheath-wire heater element, a jacket cast around said heater element and comprising a thin cylindrical body enclosing said heater element and having radial fins extending outwardly from said body and second radial fins extending inwardly from said body, certain of said inwardly extending radial fins meeting at a point in the center, a motor having a fan thereon in said casing, the heat dissipating surface of that part of said grid extending inwardly from the midpoint of said body being substantially equal to that part extending outwardly from the midpoint of said body.
4. In an electric heater, a casing comprising a front wall, a back wall and a U-shaped wall secured thereto forming side walls and top wall, said front and back walls having outlet and inlet openings, respectively, screens in said openings for concentrating the intake air and diffusing the outlet air, a pair of horizontal rods on opposite side passing through the back and front walls, an electric heat generating grid mounted on and between said rods, a saddle mounted on and between said rods, a motor resting on said saddle and supporting a fan, and a cylindrical shroud surrounding said circular grid and said fan.
5. In a unit heater, a casing comprising a front wall, a back wall, a U-shaped wall secured thereto forming side walls and top wall, a separate bottom wall secured to certain of said aforesaid walls, said front and back walls having outlet and inlet openings, respectively, screens in said openings, a heat generating unit in said casing, a motor supporting a fan in said casing for maintaining a column of air through said openings and said unit.
6. In an electric heater, a casing, an annular heater grid in said casing, said grid comprising a plurality of separate, ring shaped, single-wire, sheath-wire heater elements arranged side by

side, a jacket cast around said heater elements and comprising a thin cylindrical body enclosing said heater elements and having radial fins extending outwardly from said body and second radial fins extending inwardly from said body, certain of said inwardly extending radial fins meeting at a point in the center, a cylindrical shell closely surrounding said grid, a motor having a fan thereon in said casing, said fan being located in said shell behind said grid with the outer ends of the fan blades disposed close to the shell, said fan being coaxial with said grid, the heat dissipating surface of that part of said grid extending inwardly from the midpoint of said body being substantially equal to that part extending outwardly from the midpoint of said body and the velocity of the air discharged by said fan being substantially uniform throughout all parts of the grid.

7. In an electric air heater, an annular grid comprising an annular jacket, electric heat generating elements within said jacket, said jacket being cast around said electric heat generating elements, outer heat dissipating flanges extending outwardly from said jacket, inner heat dissipating flanges extending inwardly from said jacket and utilizing substantially the entire heat dissipating space within said jacket, and a fan adjacent said grid for directing a stream of air over said grid.

8. In an air electric air heater, an annular grid comprising an annular jacket comparatively thin in section, electric heat generating elements within the body of said jacket, said jacket being cast around said electric heat generating elements, outer heat dissipating flanges extending outwardly from said jacket, inner heat dissipating flanges extending inwardly from said jacket and utilizing substantially the entire heat dissipating space within said jacket, an annular wall surrounding and adjoining the outer edges of said outer flanges, a fan adjacent and within said annular wall, the medial surfaces of said jacket, flanges and outer wall extending parallel with the direction of air flow.

9. In an electric air heater, an annular grid comprising an annular jacket, an electric, heat generating, sheath-wire heating unit comprising a metal sheath, a single resistance wire disposed within said sheath, electric insulating, heat conducting material packed within said sheath around said wire, said annular jacket being cast around said heating unit, outer heat dissipating elements cast integrally with said jacket and extending outwardly from said jacket, inner heat dissipating elements cast integrally with said jacket and extending inwardly from said jacket, an annular wall surrounding and adjacent the outer edges of said outer heat dissipating elements, a fan within said annular wall, the medial surfaces of said jacket, heat dissipating elements and outer wall extending parallel with the direction of air flow, and a drive motor for said fan spaced axially of said jacket and fan.

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