Dec. 24, 1940. J. S. WRIGHT 2,225,850

ELECTRIC HEATER

Filed Dec. 22, 1939 3 Sheets-Sheet 1

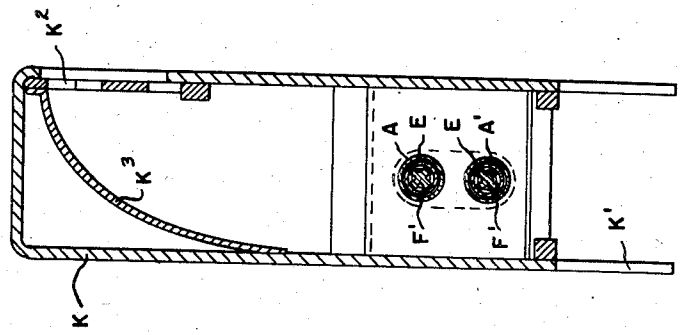


FIG. 2.

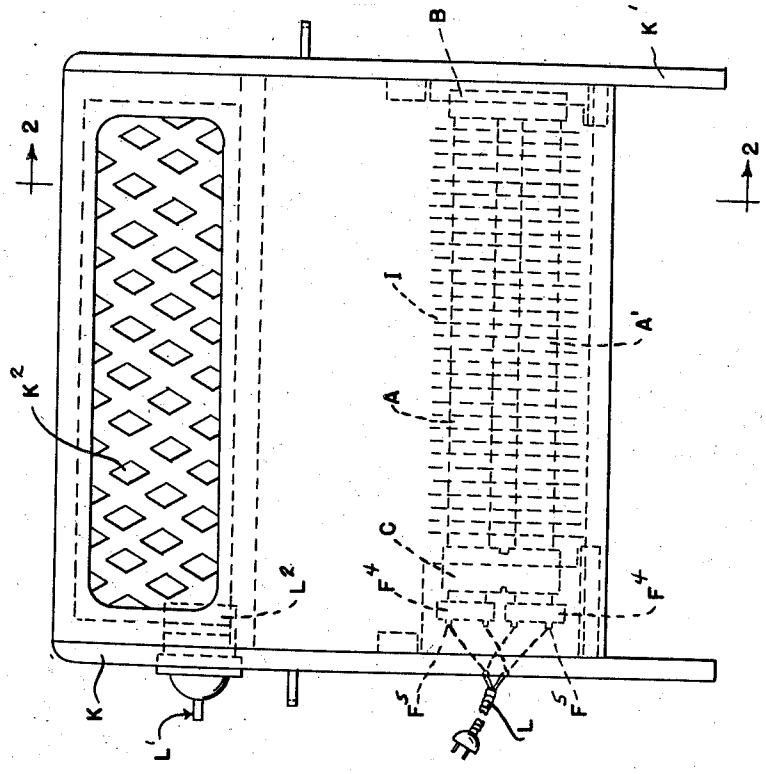


FIG. 1.

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ELECTRIC HEATER

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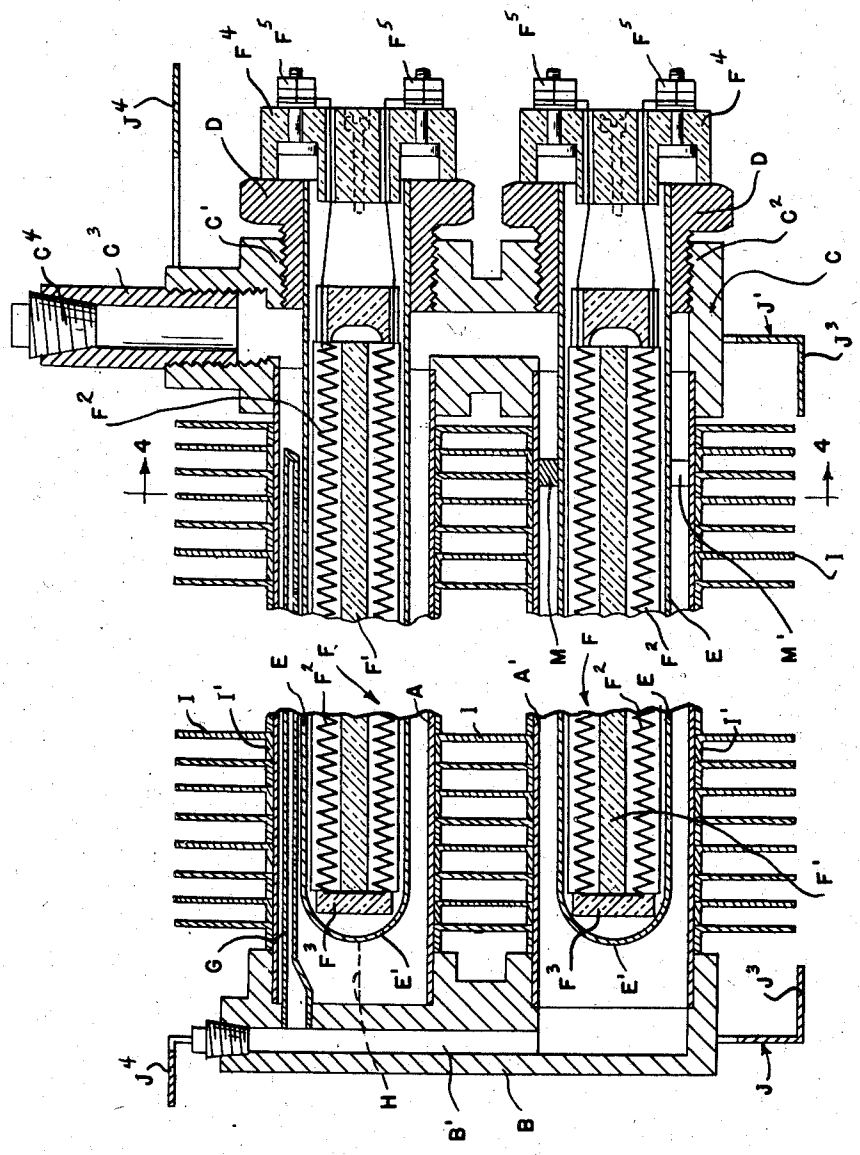


FIG. 3.

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ELECTRIC HEATER

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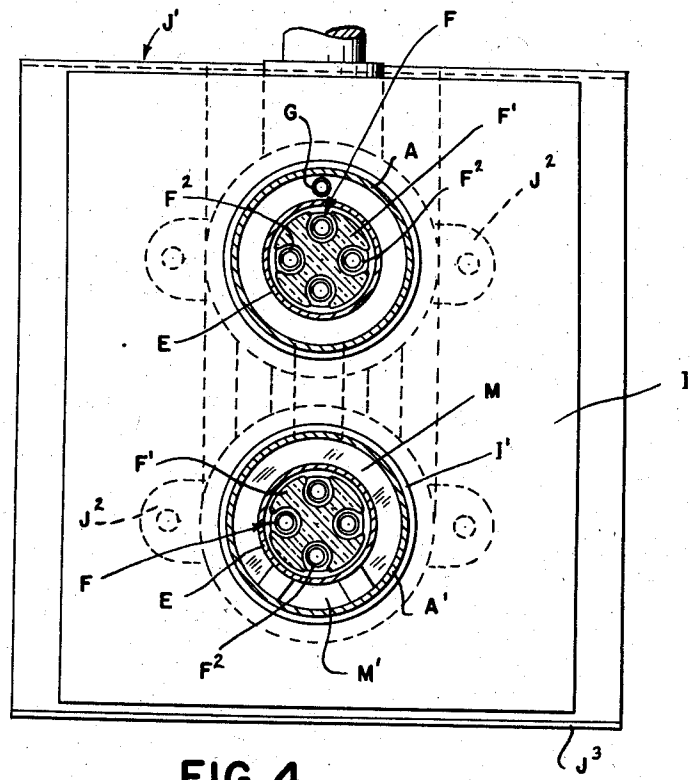


FIG. 4.

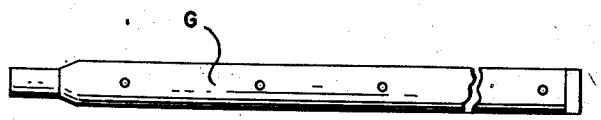


FIG. 5.

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Patented Dec. 24, 1940 2,225,850

UNITED STATES PATENT OFFICE

2,225,850

ELECTRIC HEATER

John S. Wright, Tacoma, Wash.

Application December 22, 1939, Serial No. 310,641

7 Claims. (Cl. 219—38)

The invention relates to electric heaters and the present application forms a continuation in part of a former application for patent Serial No. 300,280, filed October 19, 1939. More particularly, the invention has reference to heaters of that type designed for space heating, as distinguished from the local utilization of heat in the vicinity of the unit. It is the object of the invention to obtain a construction which has certain advantages over and is free from certain defects of constructions heretofore used for the purpose, and to this end the invention consists in the construction as hereinafter set forth.

In the drawings:

Figure 1 is a front elevation of my improved electric heater;

Figure 2 is a cross section on line 2—2 of Figure 1;

Figure 3 is a vertical longitudinal section through the heating unit;

Figure 4 is a section on line 4—4 of Figure 3;

Figure 5 is a bottom plan view of the spray tube.

Electric heaters are usually of the resistor type, the resistors having a relatively small superficial area and being heated to a fairly high temperature. The heat thus generated must be dissipated either by radiation, conduction or convection. Direct radiation is not satisfactory if it is desired to uniformly heat the surrounding space. Convection by air directly contacting the resistor is unsatisfactory as the high temperature of the resistor surface will injure the quality of the air by carbonizing the dust particles held in suspension therein. Also, the distribution of heat by this method is not efficient, and the exposure of highly heated surfaces may constitute a fire hazard. With my improved heater the heat generated in the electrical unit is transmitted through a medium which reduces its intensity to a desirable point before passing into the radiating or heat dissipating surfaces which come in direct contact with the air. Also, the construction is such as to produce an air current over the radiating surfaces without the necessity of employing a fan or other mechanically driven air propulsion means. The electrical resistors are completely encased within the unit and thoroughly insulated therefrom, thereby avoiding any fire hazard.

My improved heating unit comprises essentially an electrical heating unit, a surrounding hollow casing containing a fluid heat distributing medium and radiating fins or other heat dissipating means surrounding and extending outward from said casing. An important feature of the construction is the relation between the heat generating capacity of the electrical unit and the heat dissipating capacity of the radiating fins. This should be such as to prevent an accumulation of heat in the unit, which will raise the same to a dangerous temperature. I have found that if the electrical energy is limited to from twenty to twenty-five watts for each square inch of radiating surface, there will be no abnormal temperature in the unit. Another important feature is the means for reducing the temperature during transition of the heat from the generating unit to the walls of the outer casing from which the radiating fins extend. This is accomplished by the fluid transmission medium and depends upon the boiling point of the liquid and the pressure of the vapor. Thus, the temperature of the radiating surface which contacts with the air, is limited to a point that is not objectionable. Where water is used as the liquid medium its boiling point may be lowered by placing it under sub-atmospheric pressure so that the temperature of the outer casing will be less than 212° F.

As specifically illustrated in Figure 3, the outer hollow casing is formed of two cylinders A and A' arranged horizontally one above the other. These cylinders are connected at their opposite ends by headers B and C. The header C is provided with screw threaded nipples C' and C^2 for receiving hollow plugs D, which in turn have connected thereto tubes E extending concentrically within the cylinders A and A'. These tubes are closed at their inner ends as indicated at E', and within each tube is placed an electrical heating unit F. Any suitable construction of heater may be used, but as specifically shown, it comprises a refractory insulator F' having grooves in its periphery for receiving the resistor coils F^2. An insulator disk F^3 separates the ends of the coils from contact with the end of the tube, and insulator heads F^4 mounted on the plugs D provide for the mounting of the terminal connections F^5. Thus, the electrical units are enclosed within the outer casing and effectively insulated therefrom.

The header C provides a free communicating passage between the tubes A and A', and this header is also preferably provided with a filler tube C^3 through which the water or other liquid may be introduced, said tube being normally closed by a plug C^4. The header B provides no direct communication between the cylinders A

and A', but has a restricted passage B' leading from the lower cylinder upward and connected at its upper end with a spray tube G. This extends horizontally within the upper cylinder A above the tube E and is perforated on its underside for the discharge of jets of water onto said tube. The water level within the casing is preferably as indicated by the dotted line H, which is substantially at the center of the upper cylinder A and tube E therein, and below the level of the spray tube G. However, as will be hereinafter described, water will be elevated through the passage B' to enter the tube G to cause a sprinkling thereof through the jet apertures.

The radiating or heat dissipating fins I are preferably rectangular plates of some material of high thermal conductivity, such for instance as sheet copper. These plates are provided with apertures for registering with the cylinders A and A', each aperture having a surrounding annular flange I' which is sleeved upon the cylinder to form good thermal conductive contact therewith. End heads J and J', preferably formed of sheet metal, are attached to the headers B and C by suitable means, such as by bolting to brackets J^2 integral with said headers. These heads are provided with horizontally extending flanges J^3 and J^4, which form a means for mounting the unit within an outer casing. Within the cylinder A' and near the right end thereof, Figure 3, there is arranged within the annular space surrounding the tube E a baffle M, which seals the passage with the exception of a narrow opening M' at the bottom. This baffle is preferably curved in the vertical longitudinal plane of the cylinder, so as to deflect the liquid downward toward the restricted opening in movement from right to left.

As shown in Figures 1 and 2, I preferably arrange the heating unit in an outer casing K which provides a vertically extending air passageway, so that by placing the heater near the lower end of this passageway it will produce a chimney effect for stimulating the upward flow of air between the radiating fins I. The bottom of this casing is open and is raised above the floor level by legs K', while near the upper end and at the front is a grilled opening K^2. A curved plate K^3 is arranged opposite this opening to deflect the air current outward therethrough and for also reflecting outward any radiant heat.

Electrical current is supplied to the heating units through a suitable flexible conductor cable L. There is also provided a controlling switch L', which may be associated with a rheostat or choke coil indicated by the dotted line at L^2 and through which the volume of current supplied to the units may be varied.

With the construction as described, after water or other liquid has been introduced into the outer casing through the filling tube C^3 and to the level indicated by the line H, a partial vacuum is formed in the space above this level by the expulsion of air therefrom, after which the plug C^4 is inserted to hermetically seal the structure. The pressure within the casing will then be limited to that of the vapor above the water level which will be less than atmospheric pressure and will consequently lower the boiling point of the liquid. This will in turn limit the temperature correspondingly, so that the maximum temperature that can be attained in the walls of the cylinders is that of the boiling point of the liquid and the vapor thereof.

When the heater is in operation the heat from the lower unit will raise the temperature of the liquid surrounding the same to the boiling point, and by reason of the baffle M and passage B' there is only restricted communication between this portion and other portions of the casing. Consequently, a geyser effect will be produced in the tube B' to raise the liquid therein and force it into the sprinkler tube G from which it will pass through the jet ports downward onto the upper surface of the tube E in the upper cylinder. As the normal liquid level in the casing is at the dotted line H, this leaves substantially one-half of the surface of the tube E surrounding the upper heating unit exposed only to vapor and the liquid dropping onto it from the jets of the sprinkler tube G. Consequently, this liquid will be flashed into vapor, which latter coming in contact with the walls of the cylinder A, will be condensed after giving up its latent heat thereto. The condensation added to the liquid in the cylinder A will cause a downward circulation through the header C into the cylinder A' through the restricted passage M' in the baffle M into the left hand portion of said cylinder. Thus, there will be a continuous circulation of the liquid toward the left in the cylinder A' upward through the passage B' into the tube G, to the right in cylinder A and downward through header C. There will also be a continuous generation of vapor by the liquid from the jets impinging upon the more highly heated surface of the tube E in the cylinder A. This vapor will transmit heat units to the walls of the cylinder even more rapidly than it is transmitted through the liquid, for the reason that it gives up not only its sensible heat, but also its latent heat. Thus, while the boiling point of the liquid and the vapor pressure thereof will establish the upper temperature limit, the walls of the cylinder contacting with the vapor will be maintained at nearly the same temperature. The heat will then pass by conduction into the fins I from which it will be dissipated into the upwardly flowing air current. It is thus apparent that the air will be heated to a desirable temperature without contact with any highly heated surface, thereby avoiding carbonization of the dust particles and producing what may be described as soft heat. If automatic temperature control is desired, a thermostatic or pressure regulator may be placed within the tube C^3, which will control the supply of current to the units. Also, the switch L' controlling the choke coil L^2 may be adjusted to limit the amount of electrical energy supplied to the units and in that way to reduce the heating effect.

What I claim as my invention is:

1. The combination of a sealed hollow casing provided with a pair of horizontally extending cylindrical portions each having an inner cylindrical wall of smaller diameter to form a surrounding annular chamber within the casing, a header connecting said cylindrical portions and establishing communication between the annular chambers at one end thereof, a header at the opposite end of said cylindrical portions providing a conduit of restricted area therethrough communicating with the annular chamber of the lower cylindrical portion, a spray tube connected with the upper end of said conduit extending over the inner cylindrical wall of the upper cylindrical portion and provided with downwardly directed jet openings, a baffle in the annular chamber of the lower cylindrical portion providing only a restricted opening in the lower portion thereof, said casing containing a heat transmitting liquid the level of which is approximately

at the center of the upper cylindrical portion, radiating fins surrounding both cylindrical portions of said casing in thermal contact therewith and extending outward therefrom, and an electrical heating unit in the space within each of said inner cylindrical walls.

2. A heater comprising a heating unit consisting of first and second headers, upper and lower tubes connected to and between the headers, electrical heating elements supported from the first header and extending in the respective tubes in spaced relation to the tubes, said first header being formed at its upper end with an upper passage surrounding the upper tube, an intermediate passage, and a lower passage surrounding the lower tube, said intermediate passage connecting the upper and lower passages, seal means in the lower tube adjacent said lower passage for preventing movement of fluid in said lower tube toward said second passage, said first header being formed with a vertical passage with its lower end in communication with the adjacent end of the lower tube, and a spray tube fed by the upper end of said vertical passage, said spray tube being positioned in said upper tube above its electrical heating element and being formed with openings to spray fluid onto the electrical heating element.

3. A heater in accordance with claim 2 wherein said upper and lower tubes are surrounded by cooling fins.

4. A heater in accordance with claim 2 wherein said headers comprise brackets, and said heater further comprises a heater casing formed in its upper part with a hot air discharging opening and open at its bottom, said brackets having attachment to said heater casing to support said heating unit in the lower part of said casing.

5. A heater comprising a heating unit consisting of a pair of headers, an upper tube, a lower tube, said tubes being connected to and between said headers, an electrical heating element in and spaced from each of said tubes, said headers each having a passage connecting the upper tube with the lower tube, and a spray tube disposed in said upper tube and communicating with one of said passages, said spray tube being positioned over the upper heating element and having openings therein to spray fluid on the upper heating element.

6. A heater comprising a heating unit consisting of a pair of headers, an upper tube and a lower tube extending between and connected to said headers, the lower tube constituting a liquid chamber and the upper tube a liquid and vapor chamber, an encased electrical heating unit within and spaced from each of said tubes, a portion of the upper unit extending into the vapor space, a spray tube in said upper tube above said heating unit and directing its spray downward thereagainst, connecting passages between said upper and lower tubes and between said lower tube and spray tube, and means for creating a higher pressure in said lower tube than in said upper tube to force liquid upward from the former into said spray tube to be discharged on said unit.

7. A heater comprising a heating unit consisting of a pair of headers, an upper tube and a lower tube extending between and connected to said headers, an encased electrical heating unit within and spaced from each of said tubes, said headers each having a passage connecting the upper tube with the lower tube, a spray tube disposed in said upper tube and communicating with one of said passages, said spray tube being positioned over the upper heating element and having openings therein to spray fluid thereon, and means for creating in the lower tube a higher pressure than in said upper tube to force liquid upward from the former to the latter and to discharge it through the spray tube onto the encased electrical heating unit.

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