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O. H. BIGGS ET AL

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HEAT LAMP

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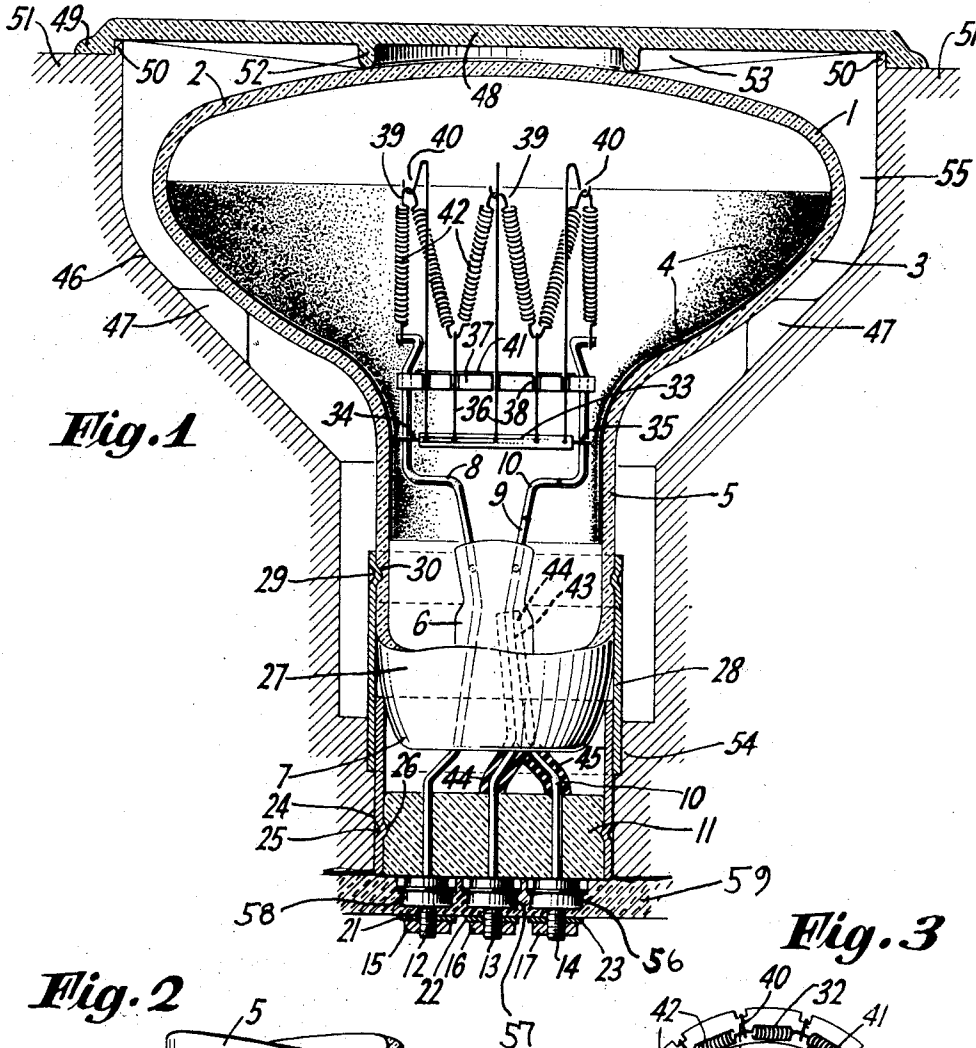


Fig. 1

Fig. 2

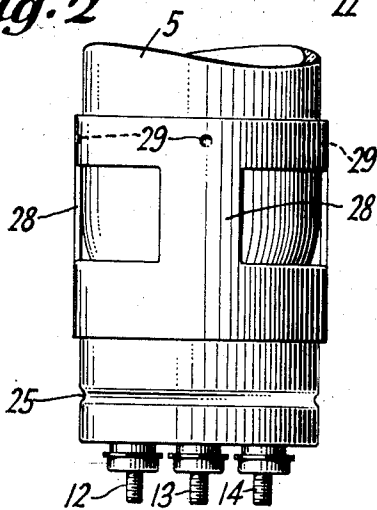
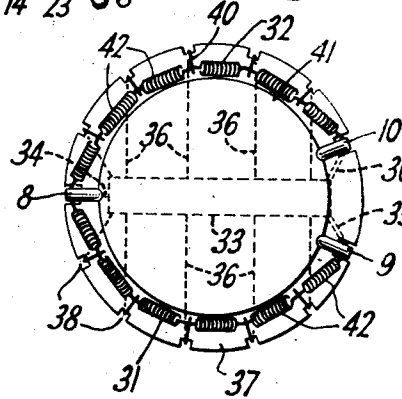


Fig. 3



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HEAT LAMP

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9 Claims. (Cl. 313—113)

This invention relates to reflector lamps and particularly to lamps of that type for use as heating elements in stoves, printing presses and other devices.

In the usual reflector incandescent lamp, the filament is designed to be as nearly a point source as possible, in order that it may be concentrated at the focal point of a parabolic reflector. Such an arrangement is generally considered as producing the greatest uniformity of beam, but we have found that the uniformity exists only at a considerable distance from the lamp, and that at distances very close to the lamp, the beam is not at all uniform.

Lamps of that type are accordingly unsuitable for use as heating units in stoves, printing presses and the like in which heat must be supplied uniformly to objects close to the lamp and of dimensions comparable with it. We have discovered that a suitable lamp for such purposes is one having a filament coil arranged in what we have called "drum" form, that is, a coiled filament strung back-and-forth in zig-zag or the like around the surface of an imaginary cylinder, especially when set inside a reflector whose surface is a hyperboloid of revolution. The diameter of the imaginary cylinder can be comparatively large compared with the maximum diameter of the reflector, although smaller than the latter.

Such a construction is found to give a reasonably uniform light pattern or distribution at short distances from the lamp, that is from the filament. The combination of drum filament and hyperboloid reflector is especially effective in that respect, although the advantages of such a filament can be obtained to some extent with a parabolic reflector when the heat is to be concentrated in a uniform manner at somewhat greater but still moderate, distances from the lamp.

The reflector used should be of a material which will reflect infra-red or heat rays efficiently, and we have found a reflector in the form of a thin but opaque gold film on the inside surface of an enclosing glass bulb to be highly satisfactory.

In order to concentrate enough heat to cook food and treat other materials satisfactorily at high temperatures, for example of the order of the boiling point of water, a very high wattage has to be put into the lamp filament, and since the bulb must be kept small to permit the food or other material to be placed as close to the source of heat as possible, the wattage per square inch of radiating surface of the glass is very large compared to that of the usual incandescent reflector lamp. Accordingly, the glass used, at least in the portions of the bulb through which the light passes, should be of a good infra-red transmitting type for best results, to keep the absorption in the glass as small as possible. This will also increase the output efficiency of the lamp.

Because of the high temperature at which the bulb will nonetheless operate, even with glass of high transmission, the glass used should be very refractory. The word "glass" is used in a broad sense, including quartz and quartz-like materials, such for example as vycor. Such materials have been found very satisfactory.

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A reflector near the neck of the bulb is used to protect the stem from excessive heating and to increase the forward radiation of light from the bulb. A reflector of a ceramic material coated with a gold surface on the side nearest the filament is satisfactory, and it can be carried by the filament support wires if the gold film is arranged to be out of contact with said wires.

The lamp can be supported on tabs extending from a second and external reflector, to insure that even the heat radiated from the glass of the bulb is reflected onto the object to be heated, and a glass plate can be set over the front or main radiating portion of the bulb, to provide a flat surface on which objects to be heated can be set. The glass plate can be of a colored glass which absorbs most of the visible light but transmits the infra-red, to prevent the user's eyes from directly viewing the high brightness and light output of the lamp. If a small amount of visible light is transmitted, however, the user can tell at a glance whether the heating unit is operating or not, an advantage which the radiant heating unit of our invention has over the common types of heater used in present-day electric stoves.

Other features, objects and advantages of the invention will be apparent from the following specification, taken in connection with the accompanying drawing in which:

Fig. 1 is a side view, partly in section of a lamp according to the invention;

Fig. 2 is a broken profile view of the base end of the lamp; and

Fig. 3 is a plan view of the drum filament, its supports and its reflector.

In Fig. 1, the glass bulb 1 has a relatively flat or shallow bowl portion 2 and a skirt portion 3, roughly in the form of a hyperboloid of revolution, the portion 3 having a layer 4 of metallic gold on its inner surface. The gold layer can be placed thereon by the evaporation process described in U. S. Patent 2,123,706 issued to O. H. Biggs, on July 12, 1938, or by some other suitable method.

The skirt portion 3 flares into the cylindrical neck portion 5 of the bulb 1, and the gold reflector layer 4 extends a considerable distance into the neck 5 in order to reflect any strong light incident thereon. The neck portion 5 is sealed to the reentrant stem 6 at the bottom 7 of the bulb 1, that is, the bottom when the bulb is in the position shown in Fig. 1. The stem can be made of pyrex glass, of lesser hardness and heat-resistance than the glass of the main portion 2, 3 of the bulb, to facilitate the sealing of lead-in wires 8, 9 and 10 therethrough, in which case the seal between the stem 6 and the more quartz-like portions 2 and 3 of the bulb may be a so-called "graded-seal" extending a considerable distance along the neck 5 of the bulb. A "graded seal" is made of a succession of several glasses of characteristics intermediate those of the glasses to be sealed, the coefficients of expansion of the various portions of glass in the seal progressing in a sequence from one glass to the next. The technique of graded-seals is well-known in the art, and need not be described further.

A refractory insulating terminal piece 11 carries the three contact terminals 12, 13, 14, connected respectively to the lead-in wires 8, 9, 10. The terminals 12, 13 and 14 are screw-threaded and carry the nuts 15, 16, 17, and the washers 21, 22, 23, to facilitate the making of connections thereto. The piece 59 is of insulating material, and can be omitted, if desired, so that the nuts 15, 16 and 17 and washers 21, 22 and 23 can be screwed directly against the flanges 58, 56 and 57, the connecting wires (not shown) being held between the washers 21, 22 and 23, and the flanges 58, 56 and 57. Because of the high lamp currents and temperature, positive connections of the screw type are provided.

The insulating terminal piece 11 is attached to the

metal cylinder 24 by the groove 25 spun into the corresponding groove 26 in the piece 11 itself. The cylinder 24 meets the tapered portion 27 of the bulb 1 and the metal band 28, attached to cylinder 24 by welding, by eyelets, or the like, grips the neck portion 5 of the bulb 1 firmly, the metal being punched or spun, as at 29, into the small circular depressions 30 moulded into the glass. This can be done as in U. S. Patent 1,832,751, issued November 17, 1931 to Ralph B. Thomas, for example, thus providing a heat-resistant cement-free seal of the purely mechanical type.

The lead-in wires 8, 9 and 10 extend from the external terminals 12, 13 and 14 through the seal to the filament 31—32, the upper portion of lead-in wire 10 being omitted in Fig. 1 for clarity, since in the view shown, the upper part of lead-in wire 10 would be directly behind lead-in wire 9. The back half 32 of the filament 31—32 is also omitted in Fig. 1 for clarity, but is shown in Fig. 3. The insulating-refractory bead 33 is supported at its ends by the wires 34, 35 and 36 sealed thereinto and welded to the lead-in wires 8, 9 and 10. The filament support wires 36 are sealed into the insulating bead 33 at spaced intervals and bent up around the insulating reflecting ceramic disk 37, through the slots 38 in the edges of said disk, to support the filament 31—32 at its looped portions 39, from the hooked ends 40 of said support wires 36.

The lead-in wires 8, 9 and 10 pass through the reflector disk 37, which has the gold layer 41 on its top surface to reflect light falling downward from the filament 31—32.

The filament 31—32 is composed of the portion 32 connected between the lead-in wires 8 and 10 and the portion 31 between lead-in wires 8 and 9. By dividing the filament into two halves in this manner, either half of the filament, or the entire filament may be used, thus allowing the power input to the filament, and hence the heat output, to be varied in steps. The filament is composed of the coils 42 of tungsten wire bent into a zig-zag pattern, the looped portions 39 of the tungsten wire serving to connect the coils in series. In order to direct as much of the radiation from the coil as possible against the large hyperboloid reflector layer 4, rather than against the flat reflector 41, the coils are preferably lined up as nearly parallel to the axis of the reflector as possible. A larger number of coils than shown (per unit diameter of the imaginary surface around which the filament is strung) can be used to reduce the angle between coils and make them more nearly parallel to each other.

About one-fourth of the maximum diameter of the hyperbolic reflector layer 4 has proven very satisfactory for the diameter of the imaginary cylinder around which the drum filament 31—32 is strung. The length of each coil 42 can be about the same as that of the vertical axis of the hyperbolic portion of the reflector layer 4.

The lamp is evacuated and filled with inert gas in the manner customary in the art, a suitable gas filling being of argon, krypton or nitrogen. The gas filling necessitates the use of fuse wire portions, for example 43, in the lead-in wires 9 and 10, the fuse portion being covered by the refractory insulating tubes 44, 45, which can be of woven asbestos fitting tightly between the insulating terminal piece 11 and the inner reentrant portion of the stem. The fuses are to prevent arcing on burnout, thereby reducing the possibility of explosion of the lamp.

In a stove the lamp can be set in the recess defined by an external refractory receptacle 46, for example a metallic receptacle, the skirt portion 3 of the lamp resting on tabs 47 struck up from the receptacle 46. A glass plate 48, transparent to infra-red radiation, but absorbing most of the visible light is placed over the bulb 1 and rests on the reflector 46, having a circumferential bead 49 fitting

outside the flange 50 of the receptacle 46 at the stove top 51. The glass plate has the circular bead 52 near its center, and the tapered radial ribs 53 extending therefrom. The insulating terminal piece 11 may extend through an opening 54 in the bottom of the reflector 46 in order to be protected from the heat in the main enclosed zone 55.

In a typical bulb of about six inches maximum diameter, 1250 watts have been used in the filament 31—32.

The words "top," "bottom," "side," and the like, used merely for convenience in description, refer to our device when in the position shown in Fig. 1.

What we claim is:

1. A heat-reflecting incandescent lamp comprising a sealed glass bulb having a portion of its surface in the form of a frustum of an hyperboloid of revolution having a central opening, a coating of heat-reflecting material on the inner surface thereof, a flat heat-reflector in said central opening, and a series of filaments in front of said flat heat reflector and set in a drum-type pattern around the axis of the hyperbolic reflector, each said filament being substantially offset from the axis of the hyperbola.

2. A heat-reflecting incandescent lamp comprising a sealed glass bulb having a flat bowl portion and a portion in the form of a hyperboloid of revolution, said bowl portion being transmissive of infra-red radiation, a coating of heat-reflecting material on the inner surface of said hyperboloid portion, and a drum filament within said hyperboloid portion.

3. The combination of claim 1, in which the heat-reflector has an opaque coating of gold.

4. The combination of claim 2, in which the coating of heat-reflecting material is opaque and of gold.

5. The combination of claim 2, in which the hyperboloid portion of the bulb terminates in a neck portion, and an opaque heat reflecting shield of gold at the neck of the sealed bulb.

6. The combination of claim 1, a metal receptacle around said bulb and tabs extending from said receptacle to space the bulb therefrom, and a flat glass plate over said bulb and forming a cover for said receptacle.

7. The combination of claim 6, in which the glass plate is transmissive of infra-red radiation and absorption of visible radiation.

8. The combination of claim 7, in which the bulb has a base at one end thereof, and the receptacle has an opening through which the base extends, thereby keeping it out of the hotter portion of the receptacle.

9. A heat-reflecting incandescent lamp comprising a sealed glass bulb, a coating of heat-reflecting material thereon, a drum type filament within said bulb, and three lead-in wires extending outside the bulb to different portions of said filament.

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