Feb. 22, 1966 S. V. JOECKEL 3,237,144

INFRARED HEATING UNIT

Filed July 22, 1963

Fig. 1.

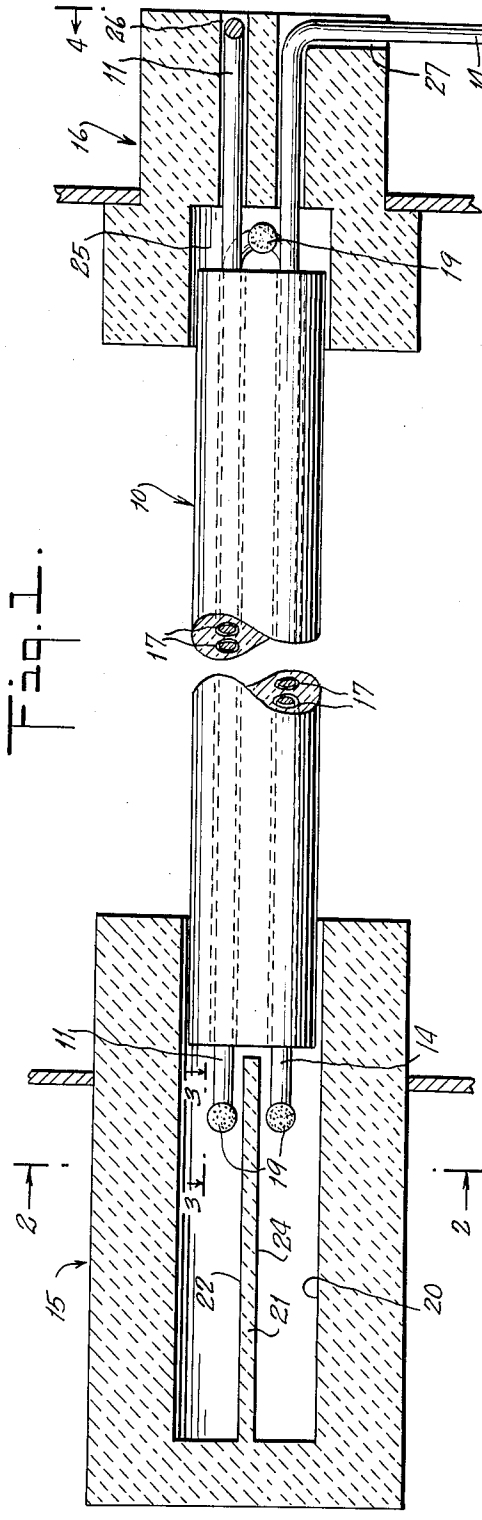



Fig. 4.

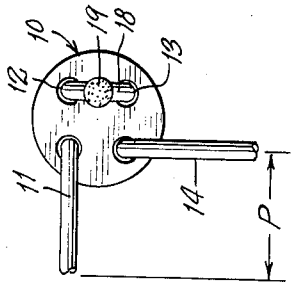



Fig. 3.

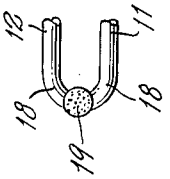
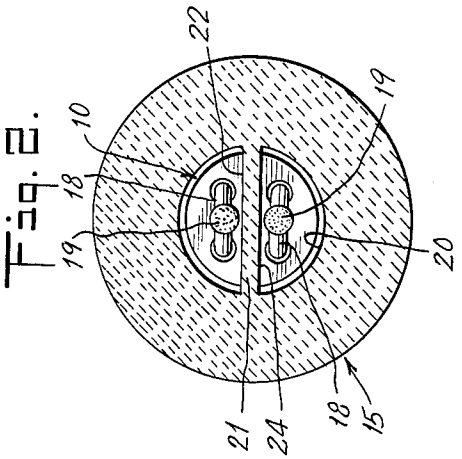



Fig. 2.

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United States Patent Office 3,237,144 Patented Feb. 22, 1966



3,237,144

# INFRARED HEATING UNIT

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Filed July 22, 1963, Ser. No. 296,579
7 Claims. (Cl. 338—316)

The present invention relates to electric lamps and, more particularly, to an improved infrared ray generating and directing unit of the elongate rod or tubular type for radiating heat.

Heretofore, numerous infrared heating units of the foregoing type have been proposed, but difficulty has been encountered in mounting and maintaining heating wires within quartz tubes or rods and in obtaining an efficient output from such wires without overheating of the units or impairment of the wires because of thermal expansion and contraction thereof, as well as sliding movement of the wires.

Accordingly, an object of the present invention is to provide an improved heating unit of the foregoing type which is not subject to the difficulties and objections heretofore encountered.

Another object is to provide such a unit wherein the heating wires have a high efficiency without overheating of the unit.

Another object is to provide such a unit wherein assembly and electrical connection of the heating wires is facilitated.

Another object is to provide such a unit wherein damage to the heating wires and their connections brought about by thermal expansion and contraction is eliminated.

A further object is to accomplish the foregoing in a simple, practical and economical manner.

Other and further objects will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawing, forming a part of the specification, wherein:

FIG. 1 is an enlarged fragmentary longitudinal sectional view of an infrared heating unit and mounting elements for the unit in accordance with the present invention.

FIG. 2 is a sectional view taken along the line 2—2 on FIG. 1.

FIG. 3 is a sectional view taken along the line 3—3 on FIG. 1.

FIG. 4 is an end view of the heating unit as viewed along the line 4—4 with the mounting element removed.

Referring now to the drawing in detail, there is shown a unit which generally comprises an elongate rod **10**, heating wires **11**, **12**, **13** and **14** mounted within the rod in the manner about to be described, a mounting element **15** at one end of the rod, and a mounting element **16** at the other end of the rod.

The rod **10** is constructed of quartz or equivalent material and preferably is circular in cross-section and has four identical longitudinal bores **17** extending therethrough which are preferably spaced equidistantly from the longitudinal axis of the rod.

The heating wires **11**, **12**, **13** and **14** are formed of a metal or alloy, such as 80% nickel and 20% chromium, having a high electrical resistance and adapted to emit infrared rays when electrically energized. Each of the heating wires extends through one of the bores **17** and outwardly thereof at the ends of the rod **10** and is formed with an arcuate portion **18** at one end. The arcuate portions **18** of the wires **11** and **12** and of the wires **13** and **14**, respectively, cooperate to provide U-formations (FIG. 3) at the left end of the rod and outwardly thereof and each pair of the respective arcuate portions is joined by a weld in the shape of a bead **19** which is composed of the same material as the wires. The wires **12** and **13** have arcuate portions **18** at the right end of the rod which may be joined in the foregoing described manner by a bead **19**.



In this manner the connections provided by the beads **19** as just described, the four heating wires are electrically connected in series in the ascending order of their reference numerals.

Preferably, the beads **19** are composed of the same material as the heating wires and are formed by heli-arc welding techniques.

As shown herein and described more precisely hereinafter, the diameter of the bores **17** slightly exceeds the diameter of the wires and the diameter of the beads **19** slightly exceeds the diameter of the bores **17**. The heating wires are mounted within the bores to expand and contract freely in a lineal direction due to changes in temperature of the wires; and the heating wires are in contact with the portions of the rod defining the bores **17** for about 75% of the length thereof. The latter arrangement enables the heat of the wires to be conducted to the rod and enables the rod to radiate the heat therefrom whereby heat generated by the wires is radiated from the unit.

The mounting elements **15** and **16** are constructed of ceramic or refractory material or the like adapted to withstand the heat of the heating wires **11** to **14** and the rod **10** and adapted to remain electrically non-conductive when so heated.

The mounting element **15** has a central bore **20** shaped to receive the left end of the rod **10** and the ends of the heating wires protruding therefrom, and has a diametrically extending bridge or partition portion **21** having flat surfaces **22** and **24** at opposite sides thereof adapted to be engaged by the respective upper and lower beads **19** (as viewed) to slidably support these beads upon thermal expansion and contraction of the heating wires.

The mounting element **16** has a central bore **25** shaped to receive the right end of the rod **10** and the connection between the protruding ends of the heating wires **12** and **13**, and has passageways **26** and **27** communicating with the bore **25** through which the heating wires **11** and **14** respectively extend to provide means for connection to an electric power supply P (FIG. 4).

The elements **15** and **16** are supported in lamp structure in any suitable manner (not shown).

In a specific embodiment of the present invention, the heating unit may be dimensioned as follows:

| | |
|---|---|
| Rod **10**: | |
| Length | 34 inches. |
| Diameter | 0.25. |
| Diameter of bores **17** | 0.050–0.070. |
| Radial distance from center of rod | 0.010–0.060. |
| Wires **11** to **14**: | |
| Diameter | 18–24 gauge (.0403"–.0201"). |
| Beads **19**: | |
| Diameter | 0.094 inch. |
| Distance from ends of rod | 0.125–0.25. |
| Element **15**: | |
| Diameter of bore **20** | 0.313". |
| Thickness of partition **24** | 0.063". |
| Element **16**: | |
| Diameter of bore **25** | 0.313". |

Such a unit, for example a 1.5 kw. unit, when con-

nected across a 115 volt supply of electrical power has a useful heat output of approximately 5,000 B.t.u. per hour and radiates infrared rays.

While the present invention has been described in connection with a unit having four heating wires, it will be understood the units embodying the subject matter of the present invention may have any number of heating wires. In cases where more than four heating wires are used the rod **10** may have a larger diameter and the element **15** may be provided with a suitable partition **21** having sufficient surfaces for supporting the beads **19** connecting pairs of wires at the left end of the rod.

From the foregoing description, it will be seen that the present invention provides an improved infrared heating unit of minimum dimensions which is highly efficient and durable in construction.

As various changes may be made in the form, construction, and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matters are to be interpreted as illustrative and not in any limiting sense.

What is claimed is:

**1.** An infrared heating unit comprising an elongate quartz rod having a pair of spaced longitudinal bores extending therethrough, a ceramic element at each end of said rod for receiving the respective ends of said rod and supporting said rod, and a heating wire extending through each of said bores with each wire having an arcuate portion at one end, cooperating with the other to provide a U-formation positioned outwardly of said bores at one end of said rod and being joined by a weld in the shape of a bead of larger diameter than said wires, said ceramic element at the end of said rod where said U-formation is located having a surface adapted to be engaged by said bead to slidably support said bead upon lineal thermal expansion and contraction of said heating wires, and means for connecting said heating wires to a supply of electrical power at the other of said ceramic elements.

**2.** An infrared heating unit comprising an elongate quartz rod having a pair of spaced longitudinal bores extending therethrough, a ceramic element at each end of said rod for receiving the respective ends of said rod and supporting said rod, a heating wire extending through each of said bores with each wire having an arcuate portion at one end, cooperating with the other to provide a U-formation positioned outwardly of said bores at one end of said rod and being joined by a weld in the shape of a bead of larger diameter than said wires, said ceramic element at the end of said rod where said U-formation is located having a surface adapted to be engaged by said bead to slidably support said bead upon lineal thermal expansion and contraction of said heating wires, and means for connecting said heating wires to a supply of electrical power at the other of said ceramic elements.

**3.** A unit according to claim **2**, including two pairs of bores in said rod each having a heating wire extending therethrough, each pair of wires providing said U-formation having said bead at the same end of said wires, said element having said surface for each of said beads, two of said wires being electrically connected to each other and the other two of said wires being connected to said connecting means at the other of said ceramic elements.



**4.** A unit according to claim **2**, wherein the diameter of said bores slightly exceeds the diameter of said wires and said wires are in contact with said rod for about 75% of the length thereof, whereby the heat of said wires is conducted to said rod and is radiated by said rod to dissipate the heat generated by said wires from the unit.

**5.** An infrared heating unit comprising an elongate quartz rod having four longitudinal bores extending therethrough each spaced equidistantly from the longitudinal axis of said rod, a first ceramic element at one end of said rod and a second ceramic element at the other end of said rod, said elements each being formed with a well for receiving the respective ends of said rod and supporting said rod, and a heating wire extending through and outwardly of each of said bores, to provide first, second, third and fourth wires within said rod, said wires at their ends adjacent said first element each having an arcuate portion with said first and second wires providing a U-formation and said third and fourth wires providing a U-formation with each U-formation being joined by a weld in the shape of a bead of larger diameter than said wires, said first element having a partition portion at the middle of its said well provided with opposite surfaces each adapted to be engaged by one of said beads to slidably support said beads upon lineal thermal expansion and contraction of said heating wires, said second and third wires being electrically connected to each other at their end adjacent said second element whereby said four wires are connected in series and said first and fourth wires are extended outwardly of said second element for connection to a source of electrical current.

**6.** A unit according to claim **5**, wherein the diameter of said bores slightly exceeds the diameter of said wires and said wires are in contact with said rod for about 75% of the length thereof, whereby the heat of said wires is conducted to said rod and is radiated by said rod to dissipate the heat generated by said wires from the unit.

**7.** A unit according to claim **5**, wherein said portion is a diametrically extending plate formed integral with said first element within its said well for maintaining said beads out of contact.


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