March 14, 1967 J. J. CARR 3,309,499

RADIANT HEATER

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FIG. 1

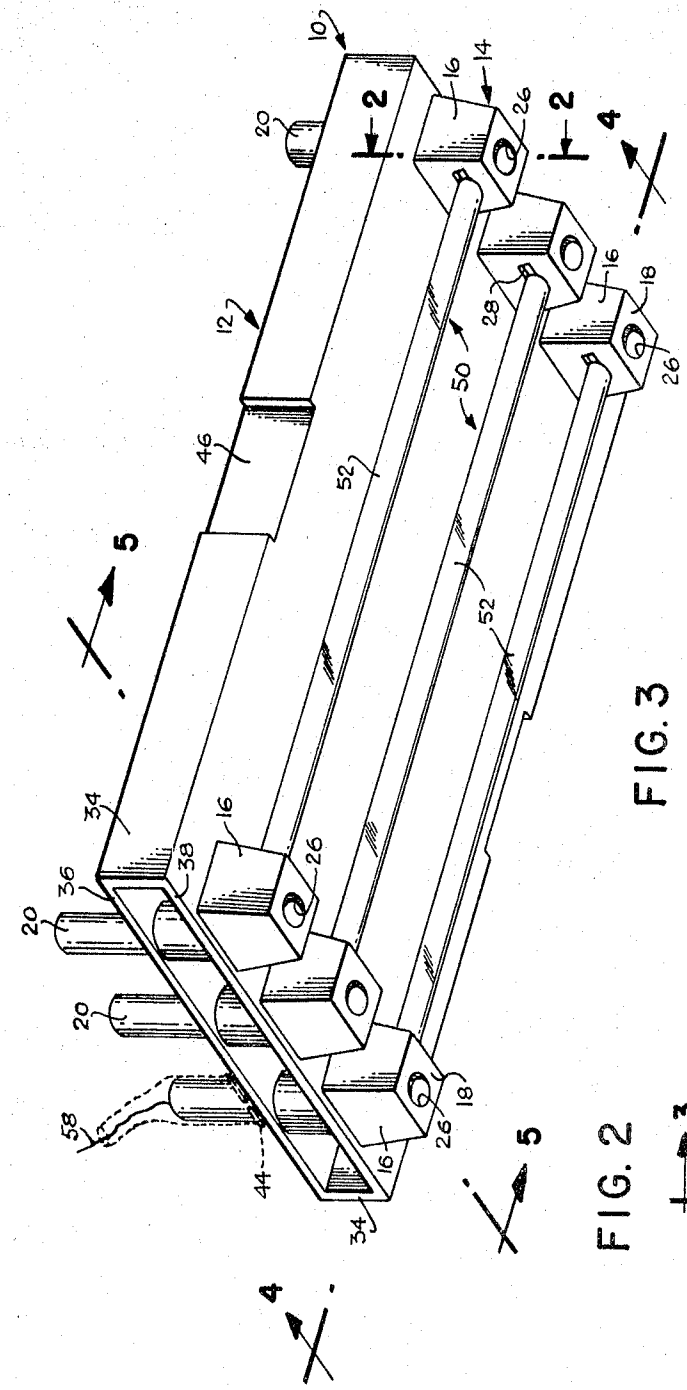


FIG. 3

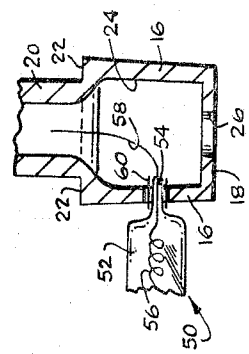
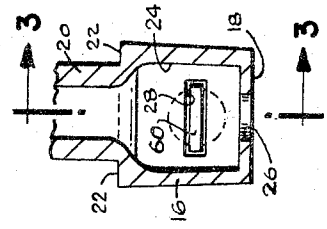


FIG. 2



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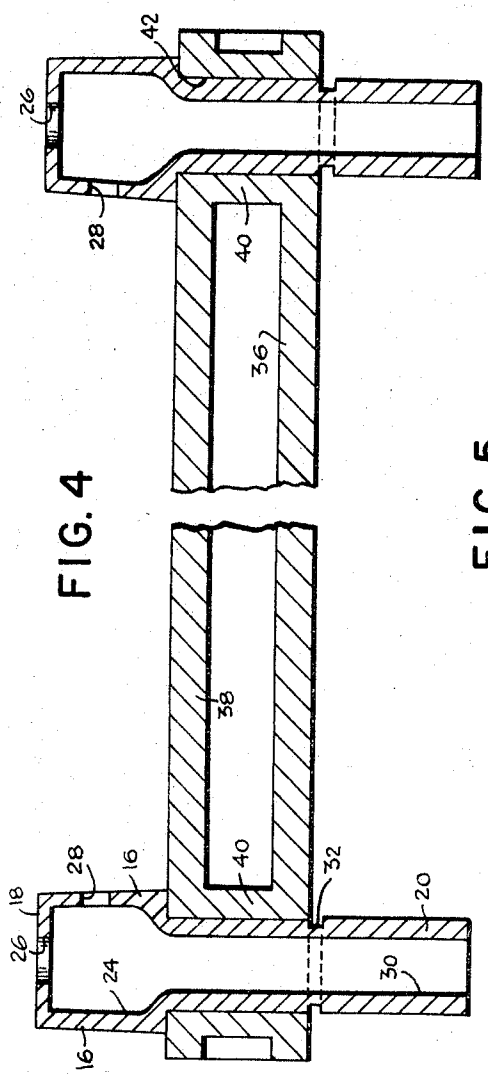


FIG. 4

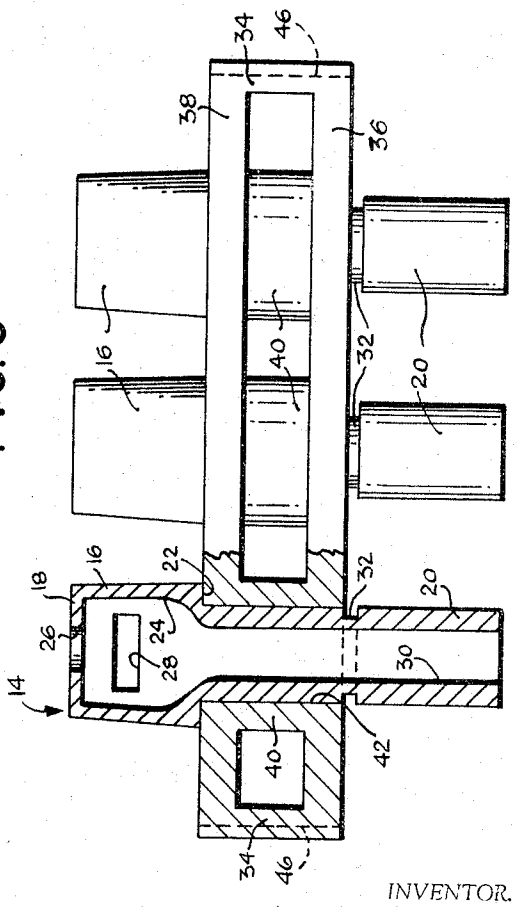


FIG. 5

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FIG. 6

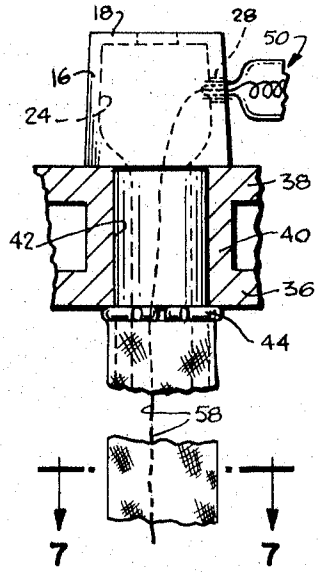


FIG. 7

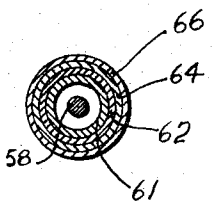
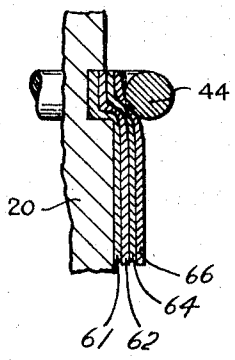


FIG. 8



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3,309,499

RADIANT HEATER

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5 Claims. (Cl. 219—343)

This invention is for a heating lamp which can realize a relatively high temperature of above about 2000° F. and also which lamp may be operated at a low pressure.

In the development of high speed aircraft, space craft and missiles, it is necessary to develop testing procedures and methods for testing the materials out of which these craft and missiles are made. One of the requirements in the testing procedure is to concurrently achieve a relatively high temperature of above about 2000° F. and also a low pressure or a high simulated altitude. One of the ways of realizing the high temperature is to use a quartz infrared heat lamp whereby there is an envelope of quartz, a heating element and an electrical connection leading from the heating element and through the quartz envelope. One of the shortcomings of such a heating lamp is a blowing out of the quartz envelope. More particularly, with the high temperature developed, there is a tendency for the quartz envelope to blow out in the vicinity of the electrical wire passing through the wall of the envelope. This is in the region of the end seal for the heating lamp.

Further, in realizing the high temperature from a quartz heating lamp, I have employed a high voltage on these lamps. For example, the lamps are designed to be used at a voltage of about 220 volts A.C. However, I have substantially doubled the voltage on the quartz heating lamp to approximtaely 440–445 volts A.C. and also I have used a three-phase source of electricity instead of single-phase source of electricity. One of the shortcomings of this is that there is a corona effect on the wires connecting with the lead-in wires of the quartz heating lamp. As is well known the corona decreases the effective voltage and the effective electrical power, and therefore, should be prevented in order to realize a high temperature. One of the additional factors in the realization of the high temperature is a factor of replacement of the quartz heating lamp. In the early development of this work I constructed a radiant heater where the quartz heating lamps were originally permanently positioned in the heater. With the use of these heaters, sooner or later one of the lamps or all of the lamps in the heater burned out or blew out. In order to compensate for this it was necessary to replace the entire radiant heater. As the only defective part of the radiant heater was the quartz lamp, this was both a waste of time and money. Therefore, I developed this particular type of radiant heater whereby it is possible, when a quartz lamp has become useless, to partially disassemble the heater, take out the worn-out lamp, insert a new lamp, and then assemble the heater. In this manner it is possible to re-use a heater except for the quartz heating lamp. Naturally, there is both a saving of time and money in this procedure. Accordingly, I have provided a radiant heater which can be used at a low pressure and also at a relatively high temperature; a radiant heater which is not subject to corona; a heater which is easily disassembled to remove a defective quartz heating lamp and then easily assembled; a heater which is relatively inexpensive to manufacture and also inexpensive to maintain in operating condition; a heater which may be operated at approximately two times the normal rated voltage for the heating lamp and also in a three-phase circuit instead of a single-phase circuit; and, a heater having means to shield the ends of

the heating lamp from high temperature so as to lessen the possibility of end-seal blowout.

These and other objects and advantages of the invention will be more particularly brought forth upon reference to the accompanying drawings, the detailed specification of the invention and the claims.

In the drawings:

FIGURE 1 is an isometric view of a specific embodiment of the heater constructed in accordance with the preferred teachings of the heater and shows the base and the sides of the heater with the heating tubes in position;

FIGURE 2, taken on line 2—2 of FIGURE 1, is a lateral vertical cross-sectional view of the inside of the housing for the end seal of the heating tube and shows the interior of the housing and the positioning of the end seal therein;

FIGURE 3, taken on line 3—3 of FIGURE 2, is a longitudinal vertical cross-sectional view of the housing for the end seal and illustrates the chamber inside of the housing and also the end seal projecting into said chamber;

FIGURE 4, taken on line 4—4 of FIGURE 1, is a longitudinal vertical cross-sectional view of the radiant heater and illustrates the base and the housing for the heating tube;

FIGURE 5, taken on line 5—5 of FIGURE 1, is a lateral vertical cross-sectional view of the base and the housing for the end seal of the tube and illustrates the positioning of these housings in the base and, also, the construction of one housing;

FIGURE 6 is a fragmentary vertical cross-sectional view of the base in the vicinity of the housing and also the housing with the interior walls in phantom to show the placing of the end seal in the housing the means for holding the housing on the base and also the insulation around the lead-in wire to the heating lamp;

FIGURE 7 is a transverse plan cross-sectional view taken on line 7—7 of FIGURE 6 and illustrates the lead-in wire with the layers of insulation surrounding said wire; and,

FIGURE 8, on an enlarged scale, is a lateral vertical cross-sectional view illustrating the housing for the lead-in wire; the means for positioning the housing with a snap ring; and also the layers of fibrous cloth enveloping the wire so as to provide insulation.

In the drawings it is seen that the invention comprises a radiant heater **10** having a base member **12** and a plurality of housings **14**.

The housing **14** comprises a portion having four sides **16**, a bottom **18**, a cylindrical portion or chimney **20**. At the junction of the parts of the sides **16** and the chimney **20** there is a shoulder **22**. The sides **14** taper inwardly upon passing from the shoulder **22** and define an interior chamber **24**. In the bottom **18** there is a pasageway or opening **26**. In one of the sides **16** there is a slot **28**. It is seen that the interior of the chimney **20** is hollow and that the chamber **24** extends into the hollow interior portion **30** of the chimney. Also, it is seen that the exterior part of the chimney at approximately the mid-portion between the end of the chimney and the shoulder **22** is recessed at **32** to form a groove.

The base **12** comprises a structure for positioning the housings **14**. More particularly, the structure may be considered to be a hollow box having sides **34** and a bottom **38** and a top **36**. The ends are of an open construction. In other words, the base **12** has a hollow interior with the direct access from either end. Between the top **36** and the bottom **38** there extends a number of tubes or casings **40**. Each tube or the casing **40** is integral with the top **36** and the bottom **38** and has a passageway **42** therein. The diameter of the pasageway

42 is slightly larger than the external diameter of the chimney 20 so as to allow the chimney to be slipped through and to co-fit with the passageway 42. It is seen that the passageways 42 and the sleeves 40 are near the ends of the base 12 and in a spaced-apart relationship with each other. Also, in FIGURE 1 it is seen that there are three sets of sleeves 40 at or near each end of the base 12.

In the assembled state the chimney 20 projects through the passageway 42 and is positioned therein by means of a spring clip 44, see FIGURE 8. In this manner the housing 14 is firmly positioned in the base 12 and yet the housing 14 can be removed when the circumstances demand it. In the side 34 it is seen that there is a recess 46. This recess 46 is at the middle of the side 34 and is adapted to receive a holder for the base 12 so as to permit positioning lamp 10 at various angles.

It is seen that in an assembled state the quartz heating lamp 50 is held between two spaced-apart housings 14. This lamp 50 comprises a tube 52 having a nipple 54 on each end. There is a filament 56 inside the tube 52 and the end of said filament projects through the nipple or the end seal 54 to form lead wire 58. The nipple 54 does not come to a point but is like a shelf, see FIGURE 2 and FIGURE 3. The lead wire 58 projects through the quartz in this shelf. Surounding the shelf 54 in a sleeve-like manner is a metal housing 60. It is seen that the shelf or nipple 54, the plates 60 and the lead wire 58 project through the opening 28 in the housing 14 and into the interior 24. Actually, the end of the quartz tube is positioned in the housing. The lead wire 58 runs through the opening 30 and the chimney 20. To decrease and eliminate the corona effect there is provided an insulation. This insulation may be of a number of different materials, preferably, in the form of a dielectric fibrous material. For example, these may be used an asbestos fibrous material, either cloth or mat, and other dielectric materials. I have found a particular success in using four layers of a fiberglass cloth in the form of a tube. In this regard there is employed a first layer 61 of fiberglass cloth, a second layer 62, a third layer 64 and a fourth layer 66 of the cloth. The cloth 60 may be a quarter-inch tube, the cloth 62 may be a half-inch tube, the cloth 64 may be a three-quarter-inch tube, and the cloth 66 may be a one-inch tube.

The materials of construction of the base 12 in the housing 14 may be dielectric insulating material. For example, these may be refractory materials such as silicon dioxide, magnesium oxide, zirconium oxide or other desirable refractory materials. One of the refractory materials I have used for a reflector comprises appoximately 99.8 pecent silicon dioxide and 0.2 percent of aluminum oxide. One of the advantages of this refractory material is that it has substantially the same coefficient of expansion as the quartz radiant heating lamp 50. Therefore, it is not necessary to design for differences in the expansion and contraction of the quartz tube and also the housing 14 and the base 12. It is seen that there is provided no positive cooling means for the quartz heating tube. One of the reasons for this is that the end seal of the shelf 54 and the lead wire 58 are inside of the housing 14 and, therefore, are not subjected to the reflected heat and the high heat of the base 12. As is recalled, one of the main failures of the quartz tube 50 is the end seal at the shelf or nipple 54. The temperature realized by this radiant heater 10 is limited mainly by the softening point of the quartz in the envelope 54 of the lamp 50. The softening point of the quartz is in the range of 2600–2700° F. with this radiant heater 10 I have raised the specimens to a temperature of above about 2100° F. The quartz tube 50 is designed to operate on a single phase, 220 volt alternating current source of electricity. However, to realize the high temperatures of above 2000° F. with the radiant heater 10, I operate the quartz tube 50 on a three-phase source of electricity with the peak voltage of about 680 volts and a root mean square voltage of about 480 volts. With this operation I have been able to achieve a power density of about 15.8 kilowatts per square foot. Even with this sufficiently high voltage and a high temperature I have found that it is possible to reduce and eliminate the corona effect by encasing the lead wires 58 inside of the housing 14 and inside of the chimney 20 and then inside of the insulating sleeves 61, 62, 64, and 66. Also, it has been possible by use of the housing 14 to eliminate the positive cooling means. Further, a big advantage from the practical operating standpoint is that, with the housing 14 being detachable from the base 12, it is possible to disassemble the radiant heater 10 so that when an infrared lamp 50 burns or blows and is no longer useful, then, a new lamp can be installed. Previously, to the best of my knowledge, it has not been possible to replace a heating lamp 50 in a radiant heater while in the field or in the experimental environment. To the best of my knowledge, infrared heating lamps have been so constructed for a low pressure and a high temperature condition that the radiant heater 10 has to be discarded or else a portion for holding the heating lamp 50 chiseled away or removed so as to take out the old lamp 50 in order to insert a new lamp 50. As is seen my heater results in both a saving of materials and time.

Having presented my invention, what I claim is:

1. A radiant heater, said heater comprising:
(a) a heating lamp;
(b) said lamp having a filament and lead-in wires at the ends of the lamp;
(c) a housing for the end of the lamp;
(d) said housing having a chamber, a chimney connecting with the chamber, and an opening in said chamber;
(e) a base;
(f) said base having two spaced-apart holes;
(g) a chimney in each hole;
(h) each end of the lamp projecting through the opening and into said chamber; and,
(i) more than three layers of fiberglass cloth insulation enveloping the lead-in wires.

2. A radiant heater, said heater comprising:
(a) a heating lamp;
(b) said lamp having a filament and lead-in wires at the ends of the lamp;
(c) a housing for the end of the lamp;
(d) said housing having a chamber, a chimney connecting with the chamber, and an opening in said chamber;
(e) a base;
(f) said base having two spaced-apart holes;
(g) means to removably position a chimney in said hole; and,
(h) each end of the lamp projecting through the opening and into said chamber.

3. A radiant heater, said heater comprising:
(a) a heating lamp;
(b) said lamp having a filament and lead-in wires at the ends of the lamp;
(c) a housing for the end of the lamp;
(d) said housing having a chamber, a chimney connecting with the chamber, and an opening in said chamber;
(e) at the junction of said housing and said chimney there being a shoulder;
(f) a base;
(g) said base having two spaced-apart holes;
(h) a chimney positioned in each hole;
(i) means to hold a chimney in its respective hole; and,
(j) each end of the lamp projecting through the opening and into said chamber of the housing.

4. A radiant heater, said heater comprising:
(a) a heating lamp;

(b) said lamp having a filament and lead-in wires at the ends of the lamp;
(c) a housing for the end of the lamp;
(d) said housing having a chamber, a chimney connecting with the chamber, and an opening in said chamber;
(e) at the junction of said housing and said chimney there being a shoulder;
(f) said chimney having a recess in its exterior surface and said recess being spaced apart from the shoulder;
(g) a base;
(h) said base having two spaced-apart holes;
(i) a chimney positioned in each hole;
(j) said chimney and said base being distinct units;
(k) a clip in said recess for holding said chimney in said hole in the base; and,
(l) each end of the lamp projecting through the opening and into said chamber of the housing.

5. A radiant heater, said heater comprising:
(a) a heating lamp;
(b) said lamp having a filament and lead-in wires at the ends of the lamp;
(c) a housing for the end of the lamp;
(d) said housing having a chamber, a chimney connecting with the chamber, and an opening in said chamber;
(e) at the junction of said housing and said chimney there being a shoulder;
(f) said chimney having a recess in its exterior surface and said recess being spaced apart from the shoulder;
(g) a base;

(h) said base having two spaced-apart holes;
(i) a chimney positioned in each hole;
(j) said chimney and said base being distinct units;
(k) a clip in said recess for holding said chimney in said hole in the base;
(l) each end of the lamp projecting through the opening and into said chamber of the housing; and,
(m) more than three layers of a fibrous dielectric material loosely enveloping said lead-in wire and with said layers of the fibrous dielectric material intermittently contacting each other.

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