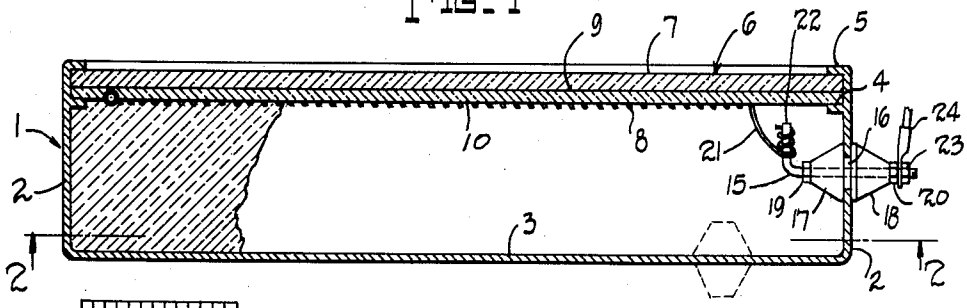
July 31, 1962 F. L. LEFEBVRE 3,047,702

PLATE HEATER

Filed Oct. 3, 1958

Fig. 1



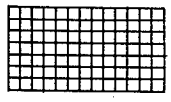
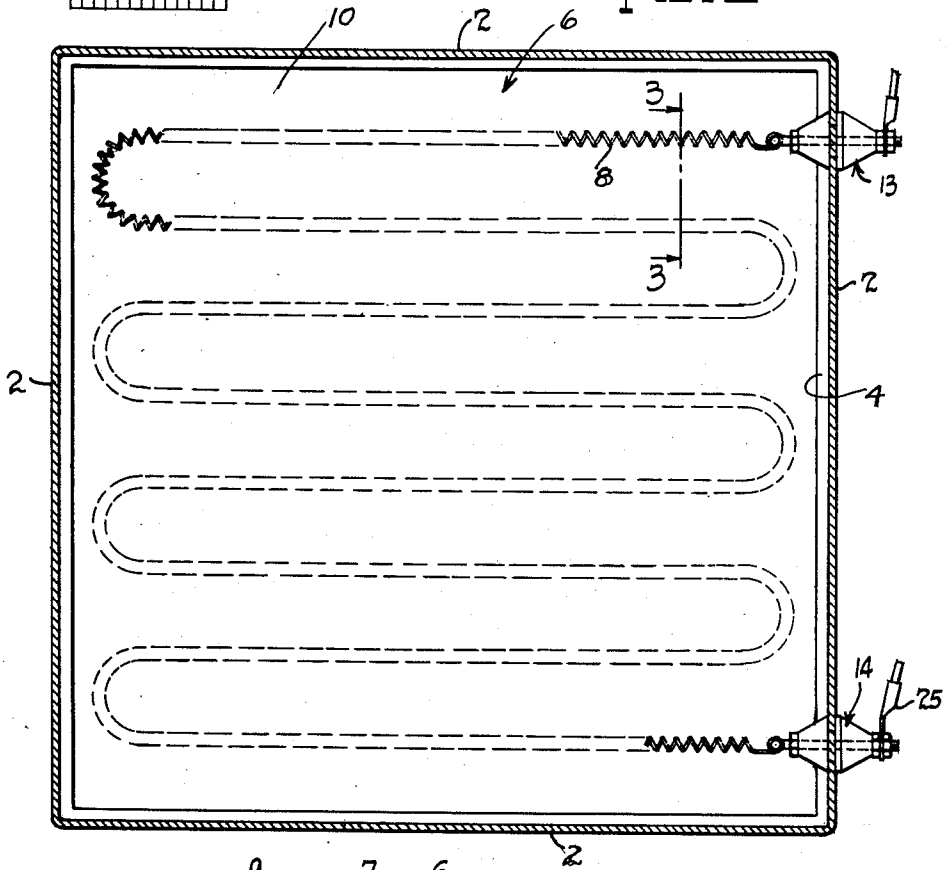


Fig. 4

Fig. 2



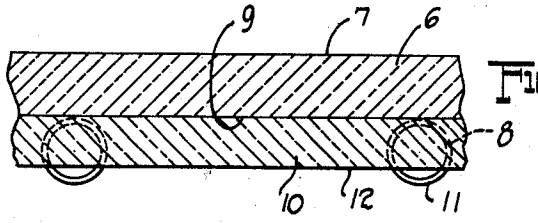


Fig. 3

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PLATE HEATER

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The broad object of this invention is to provide a source of radiation which may be used in industrial processing which will produce higher product temperatures without necessarily raising the temperature of the source. The source of temperature which in this particular concept, comprises a quartz heater, may also effectively produce rather high temperatures if desired or required.

In addition to the broad object hereinbefore set forth, further objects of the invention attain significance when it is considered that the concept hereof provides a much broader effective source of radiation without a proportional increase in actual area of the source, the source being more easily controlled as to direction and thus able to effect processing steps not heretofore obtainable by other types of heaters, and even though such heaters referred to are also of the quartz type.

An almost equally important advantage of the instant invention is the fact that with the source of radiation provided hereby, use of reflectors is obviated and thereby the losses incurred in connection with such use. Reflectors may absorb substantial amounts of radiation in the range produced by, or constructed of materials used in, heaters hereof.

While certain of the advantages generally referred to hereinbefore, as respects the heater of this invention over prior heaters may exist as compared with quartz tubular heaters, the improvements are even more evident in respect to bulb type heaters which produce radiation in a substantially different frequency range.

The quartz tubular heaters used heretofore have been found to be particularly effective in providing efficiently usable radiation, because the radiation produced is in the range of 2 to 3 or 4 microns, which has been determined to be the most satisfactory range for use in drying or baking of coatings or finishes applied to articles in various industries. The quartz tubular heaters heretofore availed of and found eminently satisfactory, usually required reflectors, and such reflectors of course absorb substantial quantities of radiation. While the reflectors in turn re-radiate certain portions of that radiation, it is at a somewhat lower frequency than is desirably produced by the heater itself as a primary source of such radiation. The reflectors have been necessary to properly direct the greatest portion of radiant energy as a means for drying various types of coatings applied to articles of various kinds.

One of the primary difficulties heretofore in respect to the use of bulb heaters which produce radiation at the relatively high frequencies of one micron or higher is that many materials being dried or baked thereby are not particularly responsive to such source. This is contrasted with the very ready absorption by such coating materials, of radiation produced in the range of 2 to 3 or 4 microns. Even though reflectors used with bulb heaters may reflect very well, the radiation thus reflected is not especially useful to carry out the drying of the most useful coatings.

One of the primary advantages of the instant invention involving the plate heater as a source of radiation, is the directional control which may be exercised with regard thereto. The advantages hereof which are suggested as accruing from the use of quartz in the form of a plate heater, are supplemented by the fact that quartz is transparent or nearly so to radiation in the range of 2 to 3 or 4 microns, and such radiation when produced by a suitable source is that which is sought for the primary

purposes of the invention hereof and thereby made available.

As a particular example of the advantage of the plate type heater, it is noted that under certain circumstances involving the coating of aluminum products with an enamel coating of suitable composition, the enamel composition, by reason of its characteristic of absorbing radiation in the range produced by the heater hereof, will thereby be raised to its best drying temperature more quickly than the article being coated. If the article is of aluminum for example, the enamel coating will be susceptible of being raised to and in some cases even beyond the point at which the aluminum would be distored before such distortion could occur. Even though the aluminum may be distored at temperatures in the range of 980 degrees F. it is possible hereby to raise the temperature of the coating material to approximately 800 degrees F. or somewhat higher without actually distorting the product coated, because of the speed with which such temperature rise is accomplished due to the absorption by the coating of radiation produced.

With the foregoing in mind it is a principal object of this invention to provide a heater, in which a source of radiation in the range of 2 to 4 microns is available, which heater will not require the use of reflectors and yet which will be susceptible of arrangement so as to produce directional control of the radiation therefrom.

Yet another object of this invention is to provide a source of radiation in the form of a plate unit, which produces radiation in the range of 2 to 4 microns and at temperatures that will result in higher product temperature without necessitating increasing the temperature of the source.

A still further object of the invention is to provide a plate heater which is comprised of a quartz plate having affixed thereto a source of radiation, which source will produce radiation at wave lengths of 2 to 4 microns and be adaptable for assembling with other units to produce radiation over a large area and with directional control.

Another object of the invention is to provide a plate heater, availing of the transparency to radiation of quartz, affixing a suitable generating source to the quartz and obviating breakage difficulties by using a number of such units in an assembly for producing radiation over a large areas.

A very important object hereof is to provide a heater in which the necessity of reflectors is obviated and thus convection heat such as is generated by air wiping over reflectors is eliminated.

A further object of this invention is to provide a heater unit which may be used as an individual member for heating small areas, or in multiples for construction of ovens by assembling a number of such heater units in any preferred pattern.

Other and further objects of the invention will be understood from a consideration of the specification appended hereto and shown in the drawing wherein:

FIGURE 1 is a sectional view showing a heater of this invention.

FIGURE 2 is a cross sectional view taken about on the line 2—2 of FIGURE 1 looking in the direction of the arrows to further illustrate the arrangement of the heater and its parts.

FIGURE 3 is an enlarged fragmentary sectional view taken about on the line 3—3 of FIGURE 2 looking in the direction of the arrows.

FIGURE 4 is a reduced sized somewhat diagrammatic illustration of a panel constructed of a series of the heater units hereof.

The heater unit comprising one of the basic components of this invention, consists of a rectilinear box-like

frame part generally designated **1**, which in plan is approximately square for purposes hereof and includes the sides **2**, connected to a bottom **3**, the portion of the frame part opposite the bottom **3** being open and provided with a ledge-like portion **4** which extends around and is connected to all four sides **2**.

Spaced above the ledge-like portion **4** is an inturned shoulder section **5** on each side, the shoulders and parts **5** thus providing for the support of the plate member generally designated **6**.

The plate member hereof, consists of a fused quartz part which will fit, as shown in FIGURE 1, between the ledge **4** and shoulders **5** and be supported therebetween with the face **7** of such quartz plate exposed and acting as the side from which the radiation produced by the heater is directed.

The quartz plate member **6** has a resistance element **8** secured to its inner face **9** by means of suitable cementitious material in a manner such as is illustrated in enlarged detail in FIGURE 3.

The cementitious material which is denoted **10**, is a layer in which the heating element **8** is embedded in such a manner that portions of the element **8** are in contact with the inner face **9**. The heating element **8** itself is a helically coiled element of wire, and may for the purposes hereof be formed of "Nichrome." The individual coils of the element being as an example approximately ⅛ of an inch in diameter, are further arranged with respect to the layer of cementitious material **10** so that a portion of such coil as indicated at **11** in FIGURE 3 extends beyond the surface of the layer **10**, the surface being designated **12**. The purpose of so arranging the element **8** is to provide for expansion and contraction of the same during operation, portion **11** extending about ⅓ the diameter of the coils, as a preferred amount. It is extremely desirable that the individual coils of the heating element **8** are arranged so as to contact the surface **9** of the plate member **6** since it has been found that the efficiency of the unit is substantially increased by such arrangement.

It will be noted from a consideration of FIGURE 2 that the heating element **8** is arranged in sinuous fashion throughout its length from the point of connection generally denoted **13** at one end of the element to the connection **14** at the other end.

The connections **13** and **14** are identical, and therefore only one of the same will be described in detail, the illustration of such connections in FIGURE 1 for example showing the connection as a whole extending through one of the sides **2** and consisting of a conductor **15** extending through an opening **16** in the side **2** with suitable insulators such as **17** and **18** at the inner and outer faces of the side **2** and maintained in position by means of nuts such as **19** and **20** which may be threaded on to the connectors and thus fix the insulators **17** and **18** with regard thereto.

The inner end of the conductor **15** may be bent at an angle such as is illustrated and receives the end **21** of the heating element **8**, with the same being coiled tightly about the end of the conductor **15** and the extremities of the conductor **15** and the element **8** being integrally united as at **22**. This type of connection has been found to be most efficient for the purposes hereof.

As will be readily apparent the other end of the connector **15** may be equipped with a further nut such as **23** by which lead wire such as **24** may be secured and provide the necessary supply of current to the device. It will of course be apparent that the circuit is completed by providing a further conductor such as **25** for the unit **14** the other elements of the unit **14** being duplicated as was previously suggested is the case.

It is of course readily understood that the units **13** and **14** may be mounted in the bottom **3** of the frame **1** to facilitate mounting of a number of units hereof in checker board manner with the edges **2** in contact with the edges

of adjacent heating units. This sort of an arrangement is diagrammatically illustrated in FIGURE 4 with no attempt being made to illustrate the suitable electric connections which would be readily provided by one skilled in the art.

The interior of the frame **1** is preferably supplied with suitable insulation material as suggested in FIGURE 1 whereby the radiation is directed from the face **7** of the plate member **6** as previously described.

With the foregoing description of the individual unit in mind, it should be further noted that of course the unit may be used by itself for various kinds of heating purposes and even may be used for cooking if desired or the unit may be assembled as shown in FIGURE 4 with a number of other units to provide an oven for baking finishes in industrial processing, further illustrating the versatility and adaptability of the unit hereof.

I claim:

1. In a heater of the class described, in combination, a relatively thin quartz plate member, a layer of cementitious material intimately adhered to one face of said member, and a resistance element comprised of a helically wound member embedded in said material, the coils constituting the member being arranged in contact with the face aforesaid, and likewise extending beyond the surface of the layer of material.

2. A heater as claimed in claim 1, wherein the resistance element is disposed in sinuous form with the coils in the condition stated.

3. A heater as claimed in claim 2, wherein the coils extend beyond the surface of the layer of the material in an amount approximating one-third the diameter of said coils.

4. A heater as claimed in claim 1, wherein the ends of the resistance element are tightly wound about contact parts, and the extremities of the element are integrally united with the corresponding ends of the parts mentioned.

5. In heater construction of the class described, in combination, a series of heater units, each of said units comprising a plate member transparent to radiation, a resistance element in contact with the surface of said member, means to maintain said element in positive contact with said surface, and means to support the said member and element in each unit for operation adjacent others of said series, each member comprising a relatively thin fused quartz plate, the resistance element comprising a helically wound wire and the means to maintain the contact mentioned consists of a layer of cementitious material adhered to the surface of the member and the element is embedded therein with the coils in contact with said surface.

6. The combination as claimed in claim 5, wherein each member is supported by a frame and insulation is provided within said frame adjacent the face of the plate member to which the resistance element is adhered.

References Cited in the file of this patent

UNITED STATES PATENTS

1,399,428	Hughes	Dec. 6, 1921
1,531,308	Rice et al.	Mar. 31, 1925
1,738,150	Phelan	Dec. 3, 1929
2,010,768	Morgan	Aug. 6, 1935
2,179,934	Jones	Nov. 14, 1939
2,445,086	Rodwick	July 13, 1948
2,547,402	Lucas et al.	Apr. 3, 1951
2,563,875	Salton	Aug. 14, 1951
2,799,765	Jenkins et al.	July 16, 1957

FOREIGN PATENTS

181,405	Great Britain	June 12, 1922
540,367	Italy	Mar. 3, 1956