106-84 CROSS REFERENCE EXAMINER

Dec. 26, 1950 J. M. COATS 2,535,268

INFRARED GENERATOR

Filed March 13, 1948

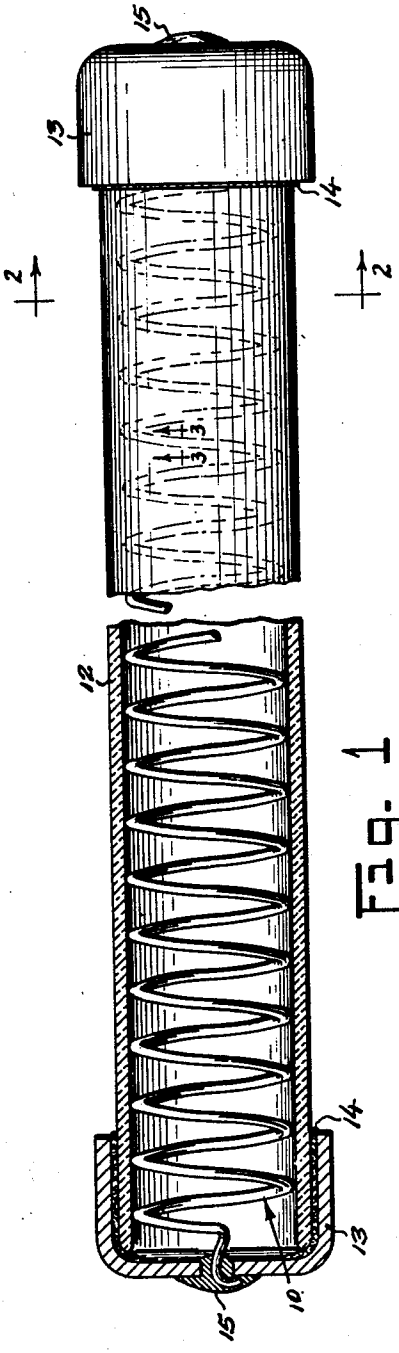

Fig. 1

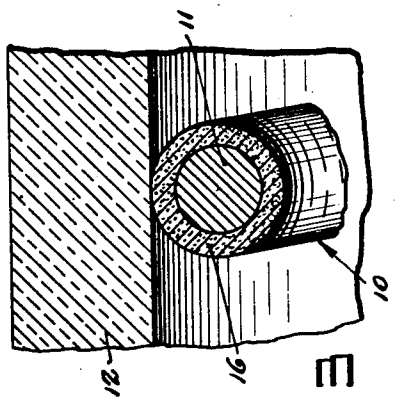

Fig. 3

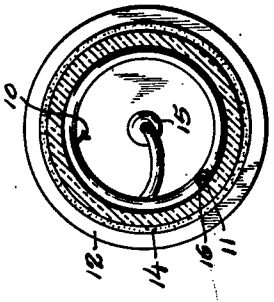

Fig. 2

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INFRARED GENERATOR

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5 Claims. (Cl. 201—67)

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This invention relates to the art of heating, and for its object aims to provide an infra-red generator, the transmitted heat of which, considered in point of its wave length, may be set at selective frequencies in accordance with the specific work to which the heater is applied, and furthermore to provide an infra-red generator which will serve to establish, simultaneously, two temperature conditions which, comparatively, are of high and low-intensities and hence to provide a generator which transmits on a multiple of two frequencies, this manner of heat transmittal, and namely with two frequencies in multiple, being found especially advantageous where the heater is utilized for drying purposes as, say, the drying of enamels, lacquers and certain phenol-base materials as well as in the hydration of foods.

The present invention is of that nature providing a heating coil energized by electricity and having this element encased in a glass tube of extended length, and it is a further and important object to so engineer the heater as to assure that both the high-frequency and the low-frequency heat waves, the one emanating from the element and the other from the tube, will each be held to a predetermined constant throughout the length of the generator and will operate to distribute the radiated heat such as to give substantially uniform penetration throughout the entire area to which the heat is directed.

The invention has the yet further object of devising an infra-red generator of the above character, and which is to say a generator comprised of an electrically energized coil encased in a glass tube, peculiarized in that the convolutions of the coil are coated with a jacketing substance permitting the coil, while operating under a condition of high heat transmittal, to safely contact the glass wall of the container free of any liability of either the coil failing or of the glass being disintegrated by the heat of the coil.

As a still further and important object, and which is ancillary to that last recited, the invention aims to provide an infra-red generator in which the coil derives its support from the glass wall of the container and hence obviates the need for any core or other auxiliary support placed central to the coil and which would perforce be disadvantageous from the fact of the said center support inherently absorbing a certain amount of

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heat and additionally constituting an interruptive agent precluding each section of the coil from radiating its emitted heat in all directions.

The invention has the yet further and important object of providing an infra-red generator in which, by the said jacketing of the heating element proper, there is provided a greater area of heat dissipation to responsively lower the surface temperature of the coil and give in addition a larger area for glass contact.

As an additional object still, the invention aims to provide an infra-red generator of the described character in which the coil is fixed only at the end limits of the enclosure tube, thus freeing the coil of destructive stresses in that the same is permitted to expand and contract freely within its length.

The foregoing, with other and still more particular objects and advantages, will appear and be understood in the course of the following description and claims, the invention consisting in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawing:

Figure 1 is a fragmentary view partly in side elevation and partly in longitudinal vertical section illustrating an infra-red heat-generating tube constructed in accordance with the now-preferred embodiment of the present invention.

Fig. 2 is a transverse vertical section thereof on line 2—2 of Fig. 1; and

Fig. 3 is a transverse vertical sectional view taken to an enlarged scale and detailing the filament wire of the coil with its integrated jacket.

According to the present invention, the coils, denoted generally by the numeral 10, are wound from Nichrome wire of a size determined from the wattage, voltage and temperature desired. Current is then passed through the coil to bring the same to operating temperature for thoroughly cleaning the surface. Following cooling, the wire 11 of the coil is jacketed with a coating 16 of porcelain-type cement, and for this purpose I employ Sauereisen cement mixed with magnesium oxide in the approximate proportion of 2 to 1, whereupon the coil is again brought to operating temperature until all moisture present within the coating has been evaporated. Sauereisen cement is a sodium silicate mixture which when thus

combined with magnesium oxide has an expansion characteristic close enough to that of the filament wire to prevent cracking of the coating at high temperatures due to unequal expansion of the said wire and coating thereon. Designated 12, the tube container for the coil has an inside diameter very nearly the same as the outside diameter of the coil, and is desirably composed of boro-silicate type glass, with Pyrex 25 m. m. tubing in 24" and 48" lengths being presently used for the purpose. In preparing this glass tube the procedure is to first wash and dry the same, following which the resistance coil is inserted. For forming the tube to accurate length, the ends of the tube are brought to a molten state under a temperature of 5000° F. and annealed, leaving the end extremities of the coil projecting therebeyond, and caps 13 of stainless steel, which are internally coated with a sealing cement, as 14, are thereupon fed over the projecting terminals of the wire onto the annealed ends of the tube. These caps are centrally apertured to allow the end extremities of the wire to project loosely therethrough, and moisture present within the tubes is now expelled through these end openings by placing the tubes in an atmosphere of dry heat. For the purpose of expelling the oxygen present there is next charged into one end of the tube a volume of nitrogen. Silver solder 15 is thereupon applied to the ends of the tube to seal the openings and secure the projecting ends of the wire to the terminal caps, with a minute pressure of nitrogen being left within the tube.

The tube, in use, has its terminal caps 13 removably fitted in mating sockets of a suitable mounting structure which is or may be provided with a reflector backing, the caps each making contact within the sockets with a respective terminal and through these terminals completing an electric circuit in which is contained the usual circuit-breaking switch. The size and material of the filament perforce determines the operating temperature. Such operating temperature establishes the wave length and these wave lengths serve in turn to determine the degree of penetration. The relation as between operating temperature of the coil and the length of the parent waves emanating therefrom is shown by the following table, wherein the letters μ, K, C, and F respectively denote microns, Kelvin, centigrade and Fahrenheit:

	μ	°K.	°C.	°F.
1		.55μ—Visible light		
2	1.0	2,896	2,623	4,753
	2.0	1,448	1,175	2,147
	2.5	1,267	994	1,821
	3.0	1,086	813	1,495
	3.5	905	632	1,170
	4.0	724	451	844
	4.5	679	406	763
	5.0	634	361	682
	5.5	589	316	601
	6.0	543	270	518
	6.5	498	225	437
	7.0	453	180	356
	8.0	362	89	192

Considering, now, that the coil rests by its coating directly upon the internal wall of the surrounding tube, there is conducted to the latter a certain amount of the heat generated by the coil, and in the instance of an 1100° F. operating temperature of the coil I find, for example, that the outside surface of the tube shows a temperature of 325° F. This tube temperature establishes a wave length of approximately 7 microns, and it thus develops that the heater is emitting two frequencies in multiple, the one of 3.5 microns and the other of 7 microns. In respect of the above table, it should, perhaps, be pointed out that Nichrome wire is applicable only with operating temperatures below 2000° F., wherefor wire of other material as, say, tungsten, is necessarily used in those instances where wave lengths of a frequency higher than 2.5 microns are desired. A characteristic of the present infra-red generator and which is deemed to be of considerable significance, particularly for home usage where appearance is of prime importance, is that the coating which jackets the wire is porcelain-white and remains so in both its operating and inactive state unless the temperature condition reaches 1500° F. whereupon the coating takes on a red glow without, however, developing any change from the white color when later de-energized.

It is thought that the invention will have been clearly understood from the foregoing detailed description of the procedural steps followed in producing the heating tube, but the invention feasibly admits of the use of a coating substance and of a containing tube composed of materials other than those herein expressly referred to. I intend that the hereto annexed claims be given a scope fully commensurate with the broadest interpretation to which the employed language fairly admits.

What I claim is:

1. An infra-red generator comprising a coil of filament wire jacketed with an insulator coating of cement and encased and sealed within a glass tubular container having an inside diameter approximating the outside diameter of the jacketed coil to establish touching engagement as between the jacketed coil and the inside surface of the tubular container throughout substantially the entire length of the coil.

2. An infra-red generator comprising the combination of a glass tubular container and a coil of filament wire sealed therein, the coil being jacketed with an insulator coating of cement and bearing by said jacket directly upon the inside wall of the container throughout substantially the entire length of the coil.

3. An infra-red generator comprising the combination of a glass tube sealed at both ends by terminal caps, and a coil of filament wire contained within the tube and connected one end with one terminal cap and the other end with the other terminal cap, the coil being jacketed with an insulator coating of a sodium silicate cement and bearing by said jacket directly upon the inside wall of the glass tube throughout substantially the entire length of the coil.

4. An infra-red generator comprising the combination of a glass tubular container and a coil of filament wire sealed therein, the coil being jacketed with an insulator coating of cement and bearing by said jacket directly upon the inside wall of the container, the filament wire being adapted to operate in a temperature range of such intensity as would, in the absence of the coating, cause a destructive cutting of the glass by direct contact of the wire with the latter.

5. An infra-red generator comprising the combination of a glass tubular container and a coil of filament wire sealed therein, the coil being jacketed with an insulator coating of cement peculiarized by having an expansion characteristic substantially identical to that of the said

filament wire and bearing by said jacket directly upon the inside wall of the container, the filament wire being adapted to operate in a temperature range of such intensity as would, in the absence of the coating, cause a destructive cutting of the glass by direct contact of the wire with the latter.

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