Jan. 27, 1959 F. DESVIGNES 2,870,520

RADIATION-PRODUCING DEVICE

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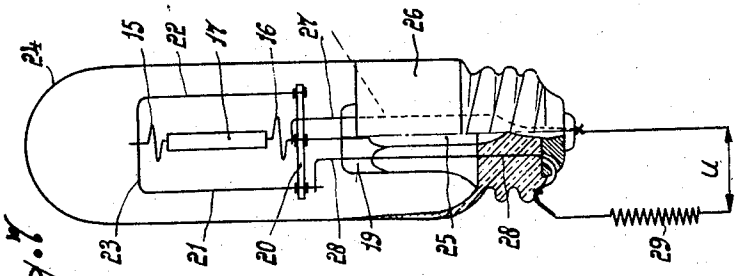


Fig. 1

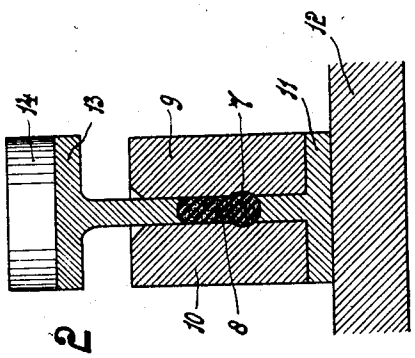


Fig. 2

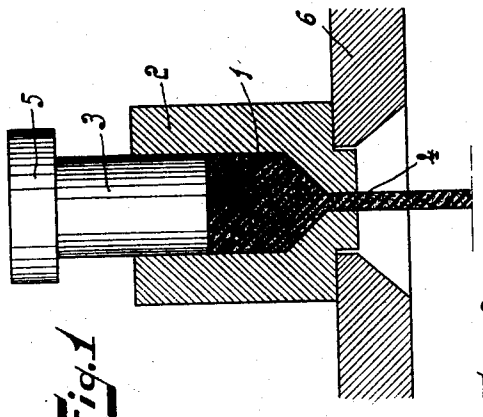


Fig. 3

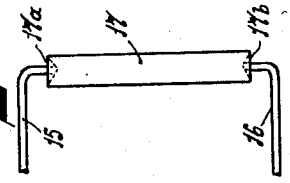


Fig. 4

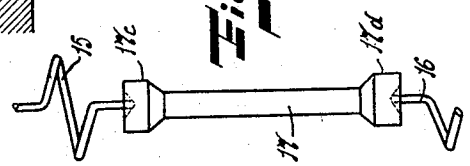


Fig. 5

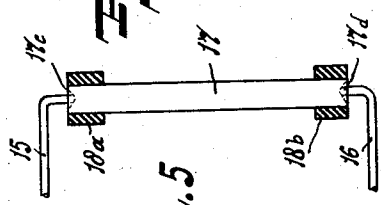


Fig. 6

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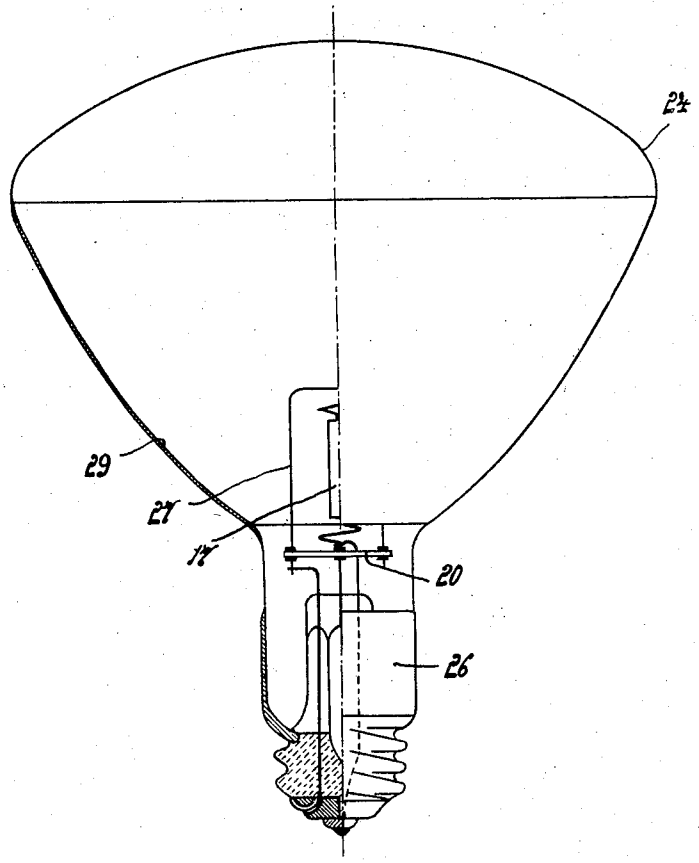
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Fig. 8



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RADIATION-PRODUCING DEVICE

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4 Claims. (Cl. 29—25.17)

The invention relates to a method of making a radiating element for a radiation-producing device. It relates, in particular, to the making of an incandescent body which, in the cold state, has such a conductivity that only the application of a suitable electric voltage suffices to pass the body from the cold state into the incandescent condition.

It has for its object to construct such devices in a manner such that they meet the practical requirements more satisfactorily and, more particularly, to simplify the ignition system.

According to the invention, the above mentioned incandescent body is constituted only by an oxide or a mixture of substantially homogeneous, refractory oxides, which has been subjected to a thermal treatment.

Preferably, according to an embodiment of the invention, the said heat treatment is carried out in oxygen under a pressure lower than the atmospheric pressure, and at a temperature and for a time which suffice to obtain a conductivity of the said body which is at least equal to 10^{-5} mhos/cm. at 20° C.

The invention will be described more fully with reference to the accompanying drawing, it being, however, not restricted to the embodiments shown therein.

Fig. 1 shows one embodiment of a ceramic body according to the invention.

Fig. 2 shows a further embodiment of a ceramic body according to the invention.

Figs. 3, 4, 5 and 6 show various embodiments and arrangements of ceramic bodies according to the invention.

Fig. 7 shows a lamp according to the invention.

Fig. 8 shows an infrared projector according to the invention.

The ceramic bodies according to the invention are provided with a sufficient quantity of compounds which are conductive or, if necessary, subjected to a suitable thermal treatment to render the electrical conductivity at the ambient temperature equal to at least 10^{-5} mhos/cm.

This conductivity is such that only the application of the line voltage to the ceramic bodies, a protecting impedance being preferably connected in series, permits of obtaining the ignition directly by Joule effect in the refractory material, so that any preheating device may be dispensed with.

Of the conductive oxides which are of greater interest for the invention to form the ceramic bodies concerned we may mention iron oxides, nickel oxides, chromium oxides, titanium oxides, cobalt oxides and oxides of affiliated metals; these bodies have a high emissive factor in the visible spectrum and in the adjacent infrared spectrum.

By way of example it may be assumed that the radiating bodies according to the invention have a high content of iron oxide and for practical purpose it may be assumed that the starting compound is constituted, prior to the thermal treatment, by pure, "black" iron oxide, i. e. without other metal or by chromium oxide to which

vanadium oxide, or titanium oxide or both are added to 5 to 10% by weight (preferably 7 to 8%).

The radiating bodies, shaped preferably in the form of a stick or a rod, may be manufactured by a wet method or by a dry method.

In the first case Fig. 1 shows an example of a die by which long rods of ceramic can be made: the plastic paste 1, consisting of the oxide, is introduced into a cylinder 2, in which a piston 3 moves freely. At the lower end of the cylinder is provided a die 4, the diameter of which is equal to that of the wanted ceramic body, the reduction of the latter owing to baking being taken into account. By means of a press, shown diagrammatically by its movable head 5 and its structure 6, the piston is urged in a manner such that the paste is pushed through the die.

In the second case (the dry method) use is made of moulds as shown in Fig. 2. This mould, shown in a vertical sectional view at right angles to the axis 7 of the ceramic rod 8, comprises two shoulders 9 and 10 and a staitonary piston 11, which bears on the structure 12 of a press. The ceramic powder is introduced into the mould, when the piston 13 is withdrawn. If this piston is positioned in place, it is pinched between the shoulders 9 and 10 by means of the press, the nose piece of which is designated by 14.

Irrespective of the method used, the ceramic body is heated subsequent to drying, if necessary, slowly to a temperature of 1200° C. in air in order to destroy by combustion the organic material which might be contained in it. This material is otherwise required for the wet manufacturing method, since the paste must contain binders or plastifiers. The ceramic stick thus obtained is usually heated to obtain a sufficient cohesion. For ceramic material of a particular composition it is advantageous in accordance with a particular aspect of the invention, to subject the body subsequently or simultaneously to a special thermal treatment by which it obtains eventually the desired conductivity and elasticity. It is, indeed, possible that by the aforesaid method of manufacturing, the ceramic body obtains a marked mechanical rigidity, so that the body may be manipulated without taking special precautions, but since the electric conductivity is insufficient to cause the ceramic body to ignite in the cold state, it is necessary to subject it to a thermal treatment affecting the structure of the oxides. To this end, in accordance with the invention, the ceramic body is baked, for example, at 1100° C. under a reduced pressure of oxygen (of the order of 2 cm. Hg) during a sufficiently long period.

Moreover, in accordance with a further important aspect of the invention, the ceramic stick is then mounted in a space where the oxygen pressure is low, for example of the order of 2 cms. Hg, and preferably lower than the oxygen pressure in the atmosphere. This applies for example to the lamp of Fig. 7, which will be described more fully hereinafter. Thus the obtained electric conductivity no longer varies, even after a few hundred operating hours at 1100° C.

According to the invention various arrangements of the ceramic rods, if necessary cut to the desired lengths, are possible. Figs. 3 to 6 show embodiments of these arrangements, the particular features of which may be interchanged.

From Fig. 3 it is evident that the current supply wires 15 and 16 of refractory metal are wound tightly in a helix around the ceramic rod 17. If necessary, the turns of each helix are spot-welded to one another.

According to Fig. 4 the ceramic rod 17 is provided at its ends with small cavities 17*a* and 17*b*, from which the ends of the refractory terminals 15 and 16 are sup-

ported. The shape and the dimensions of the latter are such that they constitute a spring; in this manner shocks and expansion do not change the constancy of the contact.

According to Fig. 5 the ceramic rod 17 is provided with flanges having a large diameter 17*c* and 17*d* in order to reduce the temperature of the ceramic material at the contact area of the metal. Such a shape may be obtained directly by dry moulding, as stated above (Fig. 2). The resilient arrangement is facilitated in this case by a helical shape of the ends of the supply wires.

According to Fig. 6 the increase in diameter of the ceramic body at the end of the rod, the purpose of which is described above, is obtained by shrinking a tube in rings 17*a*, 17*b* with collars around the rod. In this case use may be made of extruded rods made by the wet method, as stated above (Fig. 1).

Finally, Fig. 7 shows one embodiment of a lamp according to the invention, in which the particularly advantageous arrangement shown in Fig. 5 is used. The rod 17 is mounted between the supply wires 15 and 16, which constitute springs on a stem 19 of moulded glass. The insulation of the supply wires 15 and 16 and the rigidity of the arrangement are ensured by a frame comprising at least one cross-bar 20 of ceramic material and shoulders 21 and 22, secured thereto, to support a transverse piece 23. The base 19 is fused to a bulb 24, which serves as a recipient for the whole structure. By means of an exhaust tube 25 the lamp is first evacuated, then filled with a suitable oxygen atmosphere of low-pressure, as stated above, after which the exhaust tube 25 is closed. The lamp is then provided with a cap 26, to which the current supply wires 27 and 28 are secured. The wire 28 may be connected electrically to the supports 21, 22 and 23, which are made to this end of conductive metal.

In order to stabilize the operation of the lamp provision may be made of a series impedance connected to one of the wires, for example to the outlet of wire 28; this impedance may be a metallic resistor 29, if the supply voltage is a direct voltage, or preferably an inductor or a leakage transformer, if alternating voltage is supplied.

The invention has inter alia the effect that, although the ceramic body does not constitute a very low resistance at a high temperature it remains conductive at the ordinary temperature. Thus two practical advantages are obtained: the ceramic body can operate in a larger temperature range than if it were used in the open air and although it may be ignited at the ordinary temperature, the operational temperature remains high and thus with a comparatively high voltage and a low electric current, the sources obtainable have a fairly large length with respect to their diameter.

It is obvious that the invention is not at all limited to the special embodiments described above and that it includes all variants. For example an infrared projector as shown in Fig. 8 may be readily constructed on the basis of Fig. 7 by changing the shape of the bulb 24 and adding to it a parabolic reflector 29, in the focus of which is arranged the ceramic rod 17 in an axial direction, so that an advantageously directed beam is obtained.

What is claimed is:

1. A method of making a radiating element for a radiation-producing device, comprising preparing a wet mixture consisting essentially of a refractory metal oxide, thereafter molding said mixture into the desired form of the radiating element, heating said molded mixture at a temperature at which a hard body is formed and in an atmosphere containing oxygen at a pressure below that present in the outside atmosphere and for a time interval at which the electrical conductivity of the body increases to a value at least equal to 10^{-5} mhos/cm. at 20° C., and applying to the ends of said body terminals for applying a voltage thereto.

2. A method as set forth in claim 1 wherein the mixture comprises iron oxide.

3. A method as set forth in claim 1 wherein the mixture comprises chromium oxide and between about 5 and 10% of an oxide selected from the group consisting of vanadium oxide and titanium oxide.

4. A method of making a radiating element for a radiation producing device, comprising preparing a wet mixture containing a binder and a refractory metal oxide, thereafter molding said mixture into the desired form of the radiating element, heating said molded mixture at a temperature of about 1100° C. and in an atmosphere containing oxygen at a pressure of the order of 2 centimeters of mercury and for a time interval at which the electrical conductivity of the body increases to a value at least equal to 10^{-5} mhos/cm. at 20° C., and applying to the ends of said body terminals for applying a voltage thereto.

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