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ELECTRON-GENERATING ELEMENTS FOR
PILOT FLAME SAFETY CONTROLS
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2,688,648

Fig. 1.

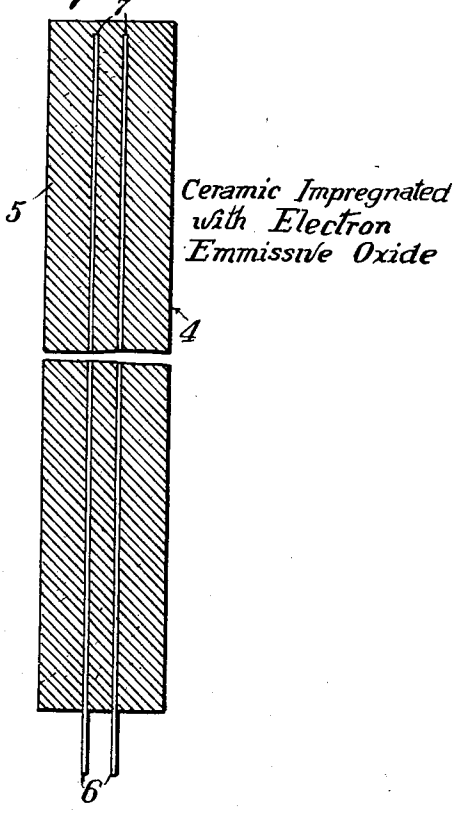


Fig. 2.

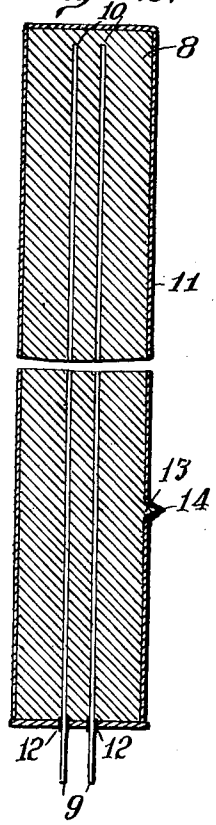
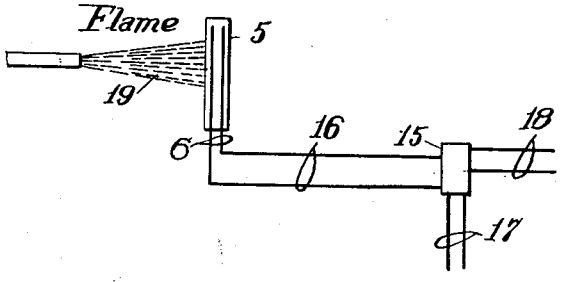


Fig 3.



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ELECTRON-GENERATING ELEMENT FOR PILOT FLAME SAFETY CONTROLS

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9 Claims. (Cl. 136—5)

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This invention relates to improvements in electron-generating elements for pilot flame safety controls, and particularly to an electron generating element which may be used to govern the operation of the burners in a furnace or the like having a pilot flame.

Heretofore in pilot flame safety controls, metal rods have been used which were located in the flame of the pilot burner and which were thermo-responsive and operated an electrical circuit that in turn controlled the functioning of the fuel burner proper.

One objection to metal rods now in use as a safety control for a fuel burner utilizing a pilot burner is that they are unreliable because carbon deposits form on the metal rods, thereby grounding the same and causing the electric circuit to remain closed at all times, or to affect so radically the sensitivity of the control as to render it utterly ineffective.

A further objection to present-day pilot flame safety controls is that, being only a thermo-responsive switch, it only opens or closes an electrical circuit in response to temperature changes.

The obect of this invention is to overcome the above objections by providing an improved pilot flame safety control which generates an electric current when heated.

To accomplish this object, I provide a pair of electrodes embedded in a ceramic body which is impregnated with an electron-emitting substance.

Other objects and advantages of this invention will become apparent as the discussion proceeds and when considered in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal section of one embodiment of my invention;

Fig. 2 is a similar view of a modified form of my invention; and

Fig. 3 is a diagrammatic view showing one form of my control in an electric circuit.

Referring now to a detailed description of the drawings, the numeral 4 designates a control. The main body of the control is made up of a ceramic block 5. This ceramic block 5 may be of any shape desired and the material used may be of any ceramic substance which is a good electrical non-conductor. Dispersed throughout and impregnating the ceramic block 5 is an electron-emitting substance, which preferably is one of the emissive oxides, such as barium, caesium, or the like.

It has been found most practical in producing my control to mix thoroughly the ceramic

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with the barium oxide, or the like, while the ceramic is in a mastic state. The block 5 is then formed into the shape desired and baked to harden. It has been found advisable also to use a substantially porous ceramic material which will permit the containing of the barium oxide, or the like, in substantially denser quantities within the cavities of the pores in the ceramic.

Embedded within the ceramic block 5 is a pair of wire electrodes 6. As shown in Fig. 1, these wires 6 are spaced apart from each other and are entirely surrounded by the ceramic block 5. The wires 6 may be of any size and material desired, but it has been found that a heat resistant wire of substantially small cross sectional diameter works more satisfactorily. As also shown in Fig. 1, it is preferred that the ends 7 of the wires 6 terminate just short of the end of the ceramic block, so that they are completely covered by the ceramic block 5, and the opposite ends of the wires 6 extend out of the ceramic block to permit of an electrical contact to each of said wires. The wires 6 are embedded in the ceramic 5 while it is in a plastic state and after the barium oxide or the like has been thoroughly mixed therein just prior to molding. The ceramic block 5 is finally baked at a desired temperature for the particular type of ceramic used to give a sufficient hardness to the body to maintain the same in its molded form. If desired, a metal case (not shown) may be provided around the ceramic block 5 and spaced from the wires 6 to give added rigidity thereto.

In the modified form of my control shown in Fig. 2, the numeral 8 refers to a ceramic block which has intermixed throughout an electron-emitting substance, such as barium oxide, or the like. A pair of wire electrodes 9, similar to the wires 7 in Fig. 1, are also molded within the ceramic block 8 in the same manner as set forth in describing Fig. 1. The ends 10 of the wires 9 terminate just short of the end of the block, so that they are completely covered by the ceramic block 8, as shown in Fig. 2. The opposite ends of the wires 9 extend out of the ceramic block. The wires 9 in the modification of Fig. 2 may be of the same size as the wires 6 shown in the form of my invention illustrated in Fig. 1, but are of a metal suitable for making a metal-to-glass seal.

Entirely surrounding the ceramic block 8 is a glaze 11 which is applied to the completed molded block and which is baked to a sufficiently high glaze to form an envelope therearound, impervious to air or the like. A metal-to-glass seal

12 is formed around the wires 9 by the glaze 11 in a conventional manner. After the glaze 11 has been baked on the ceramic block 8, a vacuum may be drawn on the inside of the envelope, if desired, through the opening 13, which is then "tipped off" at 14 in the usual manner. The envelope need not be evacuated, but may be gas filled. The control then may be operated like an electronic tube.

Fig. 3 illustrates schematically one way in which the control embodying my invention may be connected in a circuit to operate a fuel burner. The wires 6 or 9 are connected to the coil of an electro-magnetic relay 15, or solenoid, as to the grid of an electronic amplifier unit by means of wires 16, and the coil of the relay 15 in turn is supplied with any suitable source of current 17. The relay 15 may function to operate any suitable controls, such as valves or the like as desired (not shown) by means of wires 18 connected with the switch contacts thereof. A flame 19 from a gas pilot heats the ceramic block 5.

The operation of my device is as follows: My control is placed in such a position as to be heated by the pilot flame 19 and with the wires 6 or 9, depending on which form of my invention is used, being located so that carbon deposits from the flame do not accumulate thereon, although such carbon deposits will not harm the operation if they do collect. An electric current is generated in the ceramic block 5 by the barium oxide or other electron-emitting substance therein which flows through the ceramic between the wires 6 or 9 when heated. The electric current set up in the wires 6 or 9 is then utilized to energize the relay 15, which, in turn, controls the function or operation of the main burner in a furnace or the like. For example, as long as the pilot flame 19 keeps the ceramic block 5 heated, the barium oxide will emit electrons and generate an electric current between the wires 6 or 9. This electric current may then be amplified, if desired, and being connected to the relay 15, will control the current passing through the wires 18 only so long as the flame 19 maintains the ceramic block 5 above a predetermined temperature. Should the flame 19 become extinguished for any reason, the ceramic block 5 will then become sufficiently cool so as no longer to cause a flow of electrons from the barium oxide or the like, and no current will pass through the wires 16. Thus, the relay will operate to close the burner valve and make it impossible to open the same until the ceramic block 5 is again heated above a predetermined temperature, either by manually controlling the flame 19 or by an independent source of heat.

While I cannot explain with absolute assurance the scientific basis of the foregoing phenomenon, experiments have demonstrated that current does flow from one wire to the other when the device is subjected to heat of a substantial nature. Moreover, such experiments have demonstrated that the direction of flow of current between the wires is not dependent upon the relative sizes of the wires, inasmuch as the results described have been accomplished with wires of the same size and of the same material, and that current will flow in one direction or the other according to the placing of the source of heat with respect to the unit. The wires are shown in the drawings as of the same size for the purpose of illustration.

The modified form of my control shown in Fig. 2 functions in exactly the same manner as that described in connection with the above, except that where the envelope formed by the glaze 11 is evacuated, the wires 16 may be connected to a more sensitive electron control in the same manner as any vacuum tube.

It will be seen from the foregoing that my control, in addition to being self-generating, is completely unaffected by any carbon deposit which may be formed thereon by virtue of shorting across the wires 7 or 9.

It is to be understood that various changes in shape and substances used may be resorted to without departing from the spirit of my invention as set forth in the appended claims.

I claim:

1. An electron generating element responsive to a heating flame comprising a ceramic body having electron-emitting material dispersed substantially throughout said body, and spaced electrodes embedded in said ceramic body and separated thereby, said body being an insulator when cold and electron-emitting when heated.

2. An electron generating element for a gas pilot flame safety control comprising a ceramic block having an electron-emitting substance dispersed substantially throughout said ceramic block, and spaced electrodes embedded in said block and separated thereby.

3. An electron generating element for a gas pilot flame safety control comprising a porous ceramic block having an electron-emitting substance located in the cavities of said ceramic block, and spaced electrodes embedded in said block and separated thereby.

4. An electron self-generating gas pilot safety control comprising a porous ceramic block having an oxide electron-emitting substance located in the cavities of said ceramic block, and spaced electrodes embedded in said block and separated thereby.

5. An electron generating element for a gas pilot safety control comprising a porous ceramic block having barium oxide located in the cavities of said ceramic block, and spaced electrodes embedded in said block and separated thereby.

6. An electron generating element for a gas pilot flame safety control comprising an evacuated ceramic block having an electron-emitting substance dispersed substantially throughout said ceramic block, a glazed surface forming an envelope around said block, and spaced electrodes molded in said ceramic block and separated thereby.

7. An evacuated electron generating element for a gas pilot flame safety control comprising a ceramic block having an oxide electron-emitting substance dispersed substantially throughout said ceramic block, a glaze fused on the surface of said ceramic block, and spaced electrodes molded in said ceramic block and separated thereby, said electrodes extending through the glazed surface of said ceramic block and in metal-to-glass sealed contact with said glazed surface.

8. An electron generating element responsive to a heating flame comprising an insulating body having electron-emitting material dispersed substantially throughout said body, and spaced electrodes embedded in said insulating body and separated thereby, said material having the characteristics of generating voltage without outside voltage being connected therewith when heated.

9. An electron generating element for a gas pilot flame safety control comprising a ceramic block having an electron-emitting substance sub-

stantially throughout said ceramic block, and spaced electrodes embedded in said block and separated thereby, said substance having the characteristics of generating voltage without a source of voltage being connected therewith when heated.

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