No. 865,367. PATENTED SEPT. 10, 1907.

T. A. EDISON.

FLUORESCENT ELECTRIC LAMP.

APPLICATION FILED MAY 19, 1896. RENEWED APR. 29, 1902.

Fig. 1.

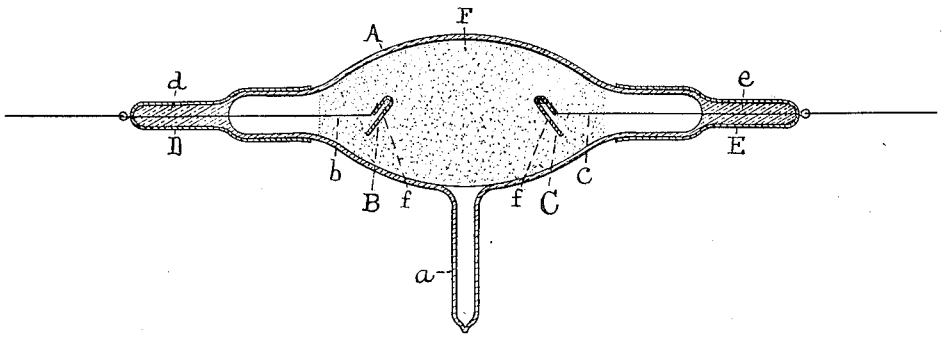
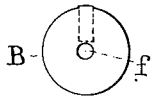


Fig. 2.



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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

FLUORESCENT ELECTRIC LAMP.

No. 865,367. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed May 19, 1896, Serial No. 592,112. Renewed April 29, 1902. Serial No. 105,233.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Fluorescent Electric Lamps, of which the following is a specification.

The object I have in view is to produce light by fluorescence. I have found that tungstate of calcium or strontium, when acted upon by molecular bombardment, or, if placed outside of the vacuum tube, when acted upon by X rays, will give a useful amount of light in tubes of moderate size and with a small expenditure of energy. I have found that most of the chemical substances which fluoresce when subjected to the action of the X ray of Röntgen, outside of a vacuum tube, are highly responsive to the molecular bombardment when placed within a vacuum tube, and that many of these chemical substances when placed within the vacuum tube may be utilized for the giving of light. In addition to barium platinocyanid, used by Röntgen, I have myself discovered the capacity of many chemicals to fluoresce when subjected to the X ray of Röntgen, and these chemicals are now well known through publications of my work. I prefer to employ the tungstate of calcium on account of its greater power of conversion of the vibrations, waves or rays into light, but the tungstate of strontium, although less powerful, acts in the same way. The tungstate crystals are preferably fused to the glass upon the inside of the vacuum tube. I may, however, fuse the crystals to the outside of the glass bulb, or may place them either on the inside or outside of an inclosing envelop surrounding the vacuum bulb, which envelop may be of glass or other transparent material, or it may be of a material opaque to light, in which case the crystals will necessarily be placed upon the outside of the envelop. The tungstate of calcium or strontium should be made by the fusion process, so that the crystals shall be transparent like glass, this being a well known process described in chemical work. I prefer to grind the crystals, and to use only those which will pass through a 40-mesh screen and which are excluded by a 150-mesh screen.

The preferred construction of the lamp for carrying out my invention is illustrated in the accompanying drawing, in which

Figure 1 is a sectional view of the lamp; and Fig. 2 is a face view of one of the electrodes.

A is a glass bulb exhausted and sealed off at the tube *a*, which tube may be used as a support. The bulb is preferably of lime glass.

B, C are metal electrodes preferably of aluminium. These are attached to the ends of platinum wires *b*, *c*, which pass through the ends of the bulb and are sealed into stems *d*, *e* located outside of the bulb. The electrodes B, C are placed oblique to the axis of the bulb, so that the foci of heat where the electric rays strike the glass shall not be a concentrated one, but shall be spread out over a large area due to the glancing angle between the rays and the glass. The electrodes B, C are provided with holes *f* at their centers. These holes also prevent sharpness of the heat foci. By sealing the platinum wires in stems outside of the glass bulb instead of by stems projecting inwardly from the walls of the bulb, as usual heretofore in vacuum tubes, the sparking of the wires where sealed in the glass, and the attendant cracking of the glass, its vaporization and the lowering of the vacuum are avoided. The vacuum bulb is narrowed at its ends, as shown, and the outside of these glass ends is covered with sections of metallic foil D, E which extend back over the glass stems *d*, *e* and are connected with the platinum wires. The sections of metal foil D, E form outside electrodes in the rear of the main electrodes B, C, and augment the action of the tube, and especially prevent the rays from being thrown back from the electrodes B, C towards the ends of the bulb, and causing them to be thrown with the greatest intensity towards the middle portion of the bulb. These outside electrodes also give what is called "relief" to the static charge.

F is the coating of powdered crystals of tungstate of calcium or strontium. This coating covers the entire interior surface of the bulb A, at least around its middle portion. It is fused to the inner surface of the bulb by placing in the bulb during its manufacture a quantity of the powdered crystals, and then heating the bulb red hot in a glass-blower's flame while the bulb is rotated. The rotation of the bulb causes the mass of crystals to spread out over the surface, to which they adhere by the softening of the glass. The bulb is subsequently exhausted to the proper degree of vacuum at which the so-called molecular bombardment effect is at its maximum, when the bulb is sealed off. When the tube is properly excited by oscillating waves of electricity, the effect of the bombardment of the molecules of the residual gas is to cause the powdered tungstate to fluoresce brilliantly with a pure white light. A single bulb of moderate size can, by this means, be made to give several candle-power of light with a very small expenditure of energy. If the crystals are fused to the outside of the bulb, the candle-power is not so great, but the lamp can be more readily exhausted of air.

Fluorescent lamps made in accordance with this invention may be operated singly or may be worked together in series or in multiple arc. The features of construction of the vacuum tube are also applicable to vacuum tubes for producing X rays and other effects.

What I claim is:

1. A fluorescent screen or surface composed of tungstate of calcium, substantially as set forth.

2. A fluorescent screen composed of glass with a fluorescent crystalline powder fused thereto, substantially as set forth.

3. In a fluorescent electric lamp, the combination of a vacuum tube and a fluorescent screen excited thereby and composed of glass, and a crystalline powder fused thereto, substantially as set forth.

4. A fluorescent electric lamp having in combination a vacuum tube and a crystalline fluorescent powder fused to the inner surface of the vacuum tube, substantially as set forth.

5. A fluorescent electric lamp having in combination a vacuum tube, chemicals placed within the vacuum, which fluoresce when subjected to the X ray of Röntgen, and electrodes placed at an angle, substantially as set forth.

6. A fluorescent electric lamp having in combination a vacuum tube, chemicals placed therein which fluoresce when subjected to the X ray of Röntgen, and electrodes having their centers cut away, substantially as set forth.

This specification signed and witnessed this 16 day of May 1896.

THOMAS A. EDISON.

Witnesses:
W. T. MALLORY,
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