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ELECTRIC ARC LAMP

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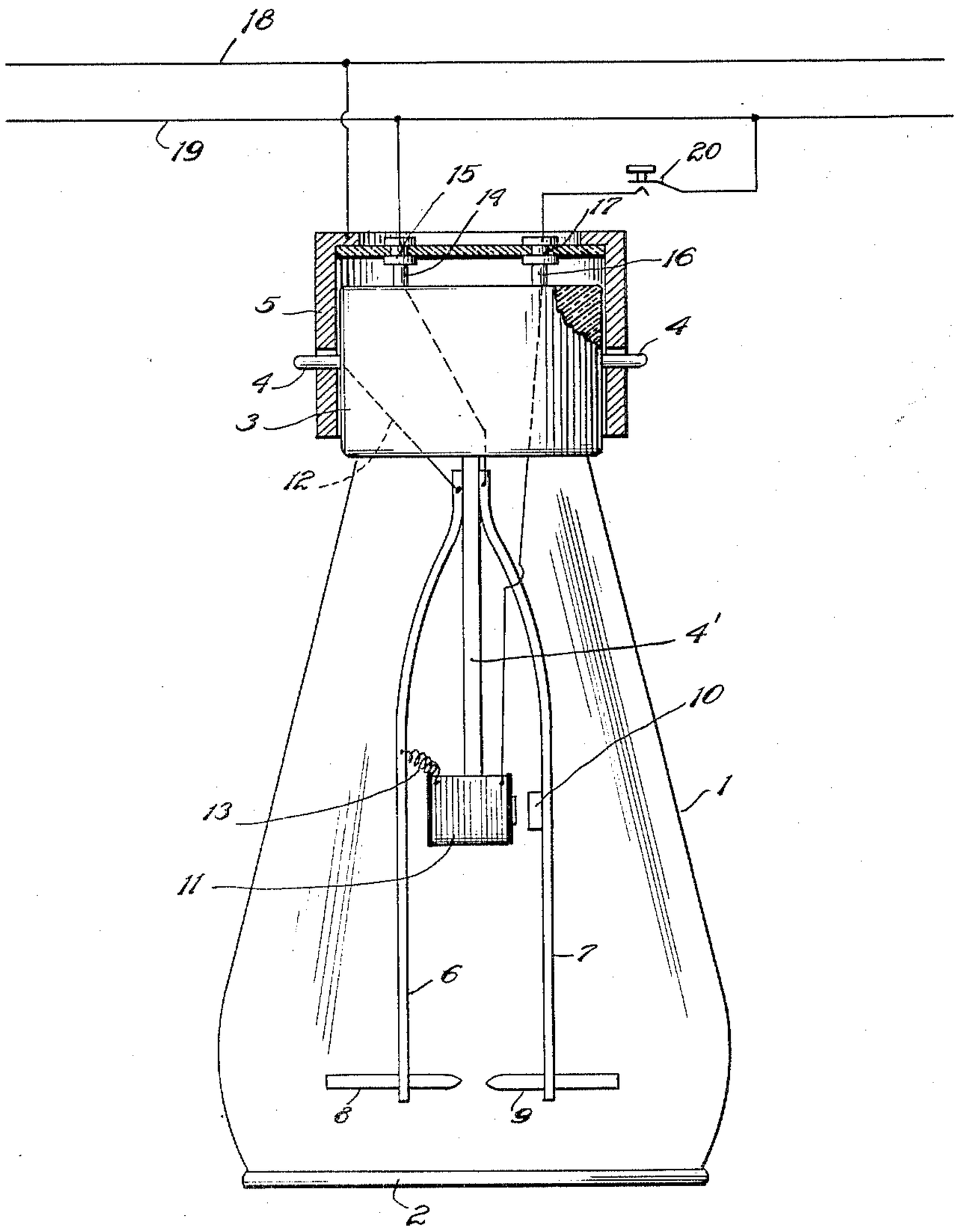

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UNITED STATES PATENT OFFICE.

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ELECTRIC-ARC LAMP.

Application filed October 1, 1924. Serial No. 740,982.

My invention relates to electric arc lamps.

It will be explained as applied to a lamp particularly adapted for therapeutic uses although not limited to this field.

One of the objects of my invention is to provide an improved electric arc lamp.

Another object is to provide an improved electrode for arc lamps.

Another object is to provide a method of making highly conductive electrodes composed of materials which are normally highly non-conductive under ordinary temperatures and voltages.

Another object is to provide a highly refractory electric arc electrode.

Another object is to provide an arc discharge whose spectral characteristics may be made to closely approximate those of sunlight at high altitudes.

Another object is to provide electrodes for arc discharges of various spectral characteristics.

A further object is to provide improved means for effecting the formation of the arc discharge between the electrodes.

Other objects and advantages will hereinafter appear.

The accompanying drawing illustrates somewhat diagrammatically one form which my improved lamp may assume.

I have found that intense and highly satisfactory arc discharges may be produced between electrodes which contain zirconium and yttrium oxides. At ordinary room temperatures of around 20 to 38 degrees centigrade zirconium and yttrium oxides are highly non-conductive but I have found that these oxides may be combined with other materials and so treated as to provide a substance which may be readily formed into electrodes and have sufficient conductivity to produce satisfactory arcs when subjected to normal service voltages at ordinary room temperatures. The arc is readily formed and easily maintained and its spectral characteristics will very closely approximate those of sunlight at high altitudes. Furthermore, I have found that by adding other substances the spectral characteristics of the arc discharge may be quite materially varied to meet special requirements of therapeutic and other fields of use.

The method which I have found suitable for providing my improved electrodes is as follows:

Zirconium oxide and yttrium oxide in finely powdered condition are mixed together with a suitable binder, such as hydrogel (zirconium hydroxide), to form a paste. I have found that the zirconium and yttrium oxides when powdered sufficiently fine to pass through a screen of 120 mesh will give good results. The proportions of the two oxides which I have found satisfactory are approximately 75 to 85 per cent chemically pure zirconium oxide and 25 to 15 per cent chemically pure yttrium oxide. Enough of the binder, such as hydrogel, is added so that the mixture of the three ingredients forms a paste which may be worked or molded into suitable sizes and shapes for the subsequent treatments.

The pasty mixture may then be worked, or compressed in suitable molds, to form electrodes of the desired shape. I have found that for therapeutic use substantially cylindrical electrodes of about $\frac{1}{8}''$ diameter give good results. The paste should be sufficiently plastic to permit its being formed into the proper size and shape and yet stiff enough to retain that form during the remainder of the treatment.

The formed electrodes are next dried at ordinary room temperature, such for example, as between 20 to 38 degrees centigrade for a sufficient length of time to thoroughly dry the mass. The length of time required will depend upon the consistency of the paste and the atmosphere humidity, but from two to four days will ordinarily suffice.

After being dried as above described the electrodes are placed in a suitable furnace and the temperature gradually raised, preferably a few degrees an hour, until the mass is dehydrated. Then the temperature is raised, more rapidly if desired, until the surface of the electrode is sintered. Ordinarily this sintering temperature will be between 1900 and 2200 degrees centigrade. The proper temperature will be evidenced by the glazing or vitrifying of the electrodes. After the electrodes are thoroughly glazed or vitrified they are ready for use.

If it is impracticable to obtain chemically

pure yttrium oxide free from the erbium or terbium groups of metals, the finished electrodes may not be sufficiently conductive at ordinary room temperatures and service voltages to give good results. However, the proper conductivity may be obtained by including in the pasty mixture a sufficient quantity of any of the following substances:—zirconium carbide, titanium carbide, tungsten carbide, or tantalum carbide, or ferro-alloys of any of these elements. The amount of any of these substances which may be required will depend upon the degree of purity of the yttrium oxide and the conductivity desired in the finished electrode. Ordinarily the amount will be small.

The electrodes produced by the foregoing method are conductive at ordinary room temperatures, such, for example, as 20 to 38 degrees centigrade and at ordinary service voltages, such, for example, as 110 to 220 volts. The arc produced when the electrodes are subjected to such voltages is intense, constant, and possesses very closely the spectral characteristics of sunlight.

In order to increase the intensity of the visible rays produced by the arc, calcium fluorid, or preferably titanium carbide, may be added to the mixture of zirconium and yttrium oxides. I prefer titanium carbide because it is a better conductor of electricity than the other substances.

The percentage of actinic or ultraviolet ray emission from the arc may be increased by adding tungsten, tantalum or molybdenum or their salts to the mixture of zirconium and yttrium oxides.

The percentage of infra-red ray emission may be increased by the addition of thorium, cerium or silicon.

The accompanying drawing shows one form of lamp particularly suited for therapeutic uses. It has an exhausted or inert gas filled bulb 1 forming a closed chamber for the electrodes. The bulb may be made of glass, quartz or other suitable transparent or translucent material. If an intense emission of ultra-violent rays is desired, the bulb may be made entirely of quartz, although I prefer to provide merely a quartz window 2 at the bottom which may be sealed to a glass side wall by suitable means such as nascent silver chloride under heat. The upper end of the bulb 1 is sealed in the usual manner and secured to a suitable metallic support and connector 3 of any appropriate type. I have shown a supporting connector having projecting pins 4 for cooperation with bayonet slots in the metal shell 5 of a suitable plug receptacle.

Within bulb 1 there is an insulating support 4′ which carries two conducting electrode supports 6 and 7. Electrode supports 6 and 7 may be formed from strips of suitable metal such as bronze or steel. Support 7 in particular is made flexible so that, although it is normally biased away from support 6, it may be moved toward the same to bring the electrodes together, as will be hereinafter described. Electrode pencils 8 and 9, formed as hereinbefore described, are secured to supports 6 and 7, respectively, by suitable means such as screw clamps.

Support 7 is provided with an armature 10 which is in a position to be attracted by a small electromagnet 11 rigidly secured to insulating support 4.

Support 6 is connected to the metal connector 3 by a conductor 12 sealed through the walls of bulb 1 and to one terminal of electromagnet 11 by a conductor 13. Support 7 is connected to a lamp contact 14 which is insulated from connector 3 and adapted to engage a contact 15 of receptacle 5. The other terminal of magnet 11 is connected to a lamp contact 16 which is insulated from contact 14 and connector 3 and is adapted to engage a receptacle contact 17.

One of the service wires 18 is electrically connected to the receptacle shell 3. The other service wire 19 is connected to receptacle contact 16 and, through a suitable switch 20, to a receptacle contact 17.

The lamp is operated by closing switch 20 which completes a circuit through electromagnet 11. The energization of electromagnet 11 attracts armature 10, bringing electrodes 8 and 9 into engagement and thereby completing a circuit therethrough. Switch 20 is thereupon opened de-energizing electromagnet 11 and permitting electrodes 8 and 9 to separate and drawing the arc therebetween.

I claim—

1. An electric arc electrode comprising a dehydrated and glazed mixture of zirconium and yttrium oxide.

2. An electric arc electrode comprising a dehydrated and glazed mixture containing zirconium and yttrium oxides in approximately the following proportions: zirconium oxide, 75% to 85%; yttrium oxide, 25% to 15%.

In testimony whereof I hereunto subscribe my name.

IAN JEAN LAVOISIER.