

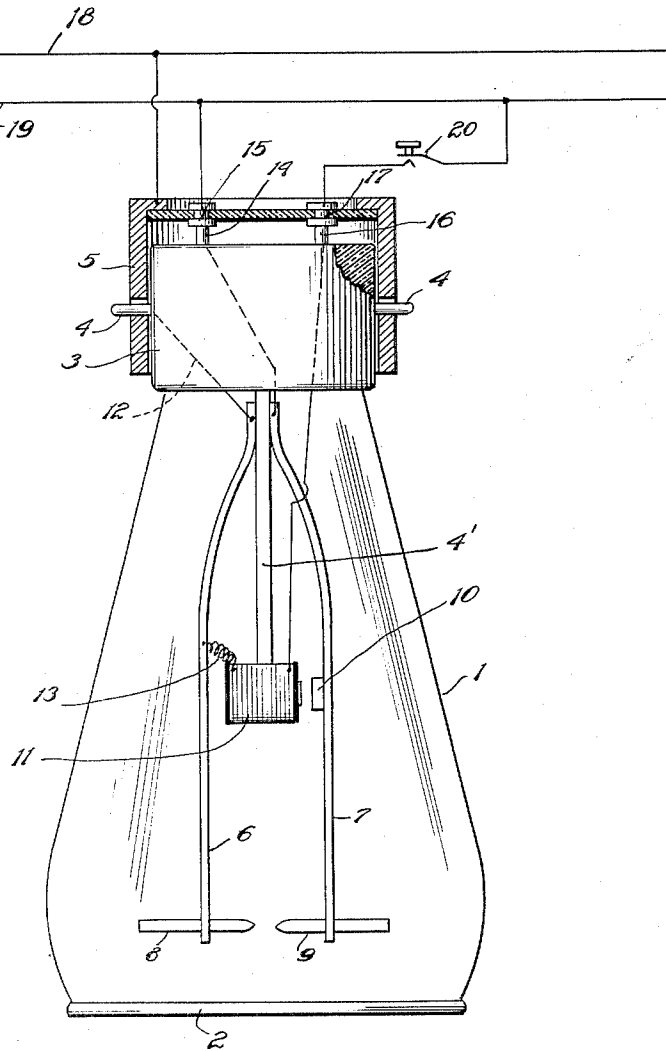
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ELECTRIC ARC LAMP

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ELECTRIC-ARC LAMP.

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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.

5 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.

10 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.

15 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.

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

25 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.

30 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 35 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 40 sufficient conductivity to produce satisfactory arcs when subjected to normal service voltages at ordinary room temperatures. The arc is readily formed and easily maintained 45 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 50 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 55 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 60 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. 65

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 70 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. 75

The formed electrodes are next dried at 80 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 85 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 90 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 95 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 100 they are ready for use.

If it is impracticable to obtain chemically

pure yttrium oxide free from the erbium or terbi-
um groups of metals, the finished elec-
trodes may not be sufficiently conductive at
ordinary room temperatures and service volt-
ages to give good results. However, the
proper conductivity may be obtained by in-
cluding in the pasty mixture a sufficient
quantity of any of the following sub-
stances:—zirconium carbide, titanium car-
bide, 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 conduc-
tivity desired in the finished electrode. Or-
dinarily the amount will be small.

The electrodes produced by the foregoing
method are conductive at ordinary room tem-
peratures, such, for example, as 20 to 38 de-
grees 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, con-
stant, 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 thera-
peutic 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-violet 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 se-
cured to a suitable metallic support and con-
nector 3 of any appropriate type. I have
shown a supporting connector having pro-
jecting pins 4 for cooperation with bayonet

slots in the metal shell 5 of a suitable plug
receptacle.

Within bulb 1 there is an insulating sup-
port 4' which carries two conducting elec-
trode 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 de-
scribed. Electrode pencils 8 and 9, formed
as hereinbefore described, are secured to sup-
ports 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 in-
sulating support 4.

Support 6 is connected to the metal con-
nector 3 by a conductor 12 sealed through the
walls of bulb 1 and to one terminal of electro-
magnet 11 by a conductor 13. Support 7 is
connected to a lamp contact 14 which is insu-
lated from connector 3 and adapted to engage
a contact 15 of receptacle 5. The other ter-
minal 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 recep-
tacle 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 electro-
magnet 11. The energization of electromag-
net 11 attracts armature 10, bringing elec-
trodes 8 and 9 into engagement and thereby
completing a circuit therethrough. Switch
20 is thereupon opened de-energizing electro-
magnet 11 and permitting electrodes 8 and 9
to separate and drawing the arc therebe-
tween.

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 approxi-
mately the following proportions: zirconium
oxide, 75% to 85%; yttrium oxide, 25% to
15%.

In testimony whereof I hereunto subscribe
my name.

IAN JEAN LAVOISIER.