The present invention relates to gaseous electric discharge lamp devices generally and more particularly the invention relates to mercury vapor discharge devices capable of operation at vapor pressures in the order of atmospheres. Such devices are now known in the art and are of the air cooled or liquid cooled type. Both types are efficient light sources of high surface brightness useful in the illuminating arts generally and particularly in the picture projection field. The structural details and operating characteristics of discharge lamp devices of this type are described in co-pending application, Serial Number 46,952, filed October 28, 1935.

The containers of such devices are usually made of quartz to withstand the elevated container temperatures during the operation of the device. The light emitted by the device is rich in visible rays and rays of shorter wave length, such as ultra-violet rays. In order to increase the real or the apparent light brightness of the device it is desirable to mount two or more of such devices in closely spaced positions or to mount a reflector adjacent one of such lamp devices. In such arrangements part of the rays emitted by the other lamp devices or reflected by the reflector strike the lamp container and give up their energy thereto.

Theoretically the input of electrical energy into the lamp device could be reduced and the efficiency thereof increased by taking advantage of the energy input into the lamp by the rays from the associated elements. We have observed, however, that when this is done the operating life of the device is reduced to such an extent that it far outweighs any advantage resulting from the increase in efficiency.

The object of the present invention is to increase the efficiency of lamp units of the above type without reducing the long useful operating life of the lamp device. Still further objects and advantages attaching to the device and to its use and operation will be apparent to those skilled in the art from the following particular description.

We have discovered that the above object is attained when an ultra-violet absorbing medium is interposed between the lamp devices or between the lamp device and the reflector. Preferably the ultra-violet absorbing medium is of such nature that it also absorbs the shorter wave length, visible rays, such as the violet and blue rays. A filter which does not transmit rays having a wave length shorter than 4500 A is preferred because the maximum increase in the life of the lamp is then obtained. While any suitable substance having the desired light transmitting characteristics may be used we prefer a glass medium which will not transmit these rays. When it is desired to cut off the visible rays of short wave length a colored glass filter, such as a yellow glass filter; which does not transmit either ultra-violet rays or the visible rays of short wave length is used. When the lamp device is liquid cooled a cooling liquid having the desired light transmitting characteristics is used, when desired.

In the drawings accompanying and forming part of this specification two embodiments of the invention are shown, in which Fig. 1 is a side elevational, partly sectional view of an apparatus embodying the invention.

Fig. 2 is a sectional view along the line 2—2 of Fig. 1.

Fig. 3 is a side elevational view of another lamp unit embodying the invention, and

Fig. 4 is a sectional view along the line 4—4 of Fig. 3.

Referring to Figs. 1 and 2 of the drawings the lamp unit comprises three high pressure mercury vapor discharge lamp devices 1, 2 and 3 which are mounted in parallel positions in a receptacle consisting of a base plate 4, a cover 5 and a bowl shaped lens 6. The cover 5 is attached to the base plate 4 by the screws 7. A ring 8 of resilient material impervious to water, such as rubber, is interposed between said cover 5 and said plate 4. A similar ring 9 is interposed between the cover 5 and the lens 6 and said lens 6 is held in position by a nut 10.

Each of the discharge lamp devices 1, 2 and 3 comprises a tubular container of vitreous material, such as quartz, and has an internal diameter of about 1 mm. and an external diameter of about 3 mm. Two tungsten electrodes are sealed into said container 1, one at each end thereof, and the end of each of said electrodes projects a short distance from a starting gas, such as argon, at a pressure at room temperatures of about 50 mm. of mercury. Lamp devices having this structure are capable of operation at a current of 1.5 amp. and a current load of about 800 watts per cm. of the discharge path. When the lamp device has attained operating equilibrium the vapor pressure therein is about 120 atmospheres. The lamp devices 1, 2 and 3 are connected to a common current lead 11 at one terminal thereof and to separate current leads 12 and 13 at the other terminal thereof. Said leads 11, 12 and 13 pass through and base plate 4 and are connected to the proper terminals of a suitable current source.

An arched glass plate 14 which guides the stream of cooling water onto and along the lamp device is interposed between said lamp device and said lens 6. The cooling water is forced through
the tube into the apparatus and passes out of the tubes and 17.

The lamp devices and have therein between a glass plate having a thickness of about 1.5
3 mm. and which supports the arched glass plate 19 which has a like thickness and which is inter-
posed between the lamp device on one hand and the lamp device and 13 on the other hand. The
plates 18 and 19 consist of a glass having the following composition:

<table>
<thead>
<tr>
<th></th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica (SiO₂)</td>
<td>64.4</td>
</tr>
<tr>
<td>Sodium oxide (Na₂O)</td>
<td>13.9</td>
</tr>
<tr>
<td>Lead oxide (PbO)</td>
<td>15.1</td>
</tr>
<tr>
<td>Zinc oxide (ZnO)</td>
<td>2.3</td>
</tr>
<tr>
<td>Barium oxide (BaO)</td>
<td>4.3</td>
</tr>
</tbody>
</table>

About 0.5% of lead chromate is added to the glass
batch. This glass composition is a yellow glass
which cuts off the ultra-violet rays and the short
wave-length visible rays, such as the violet and
blue rays emitted by the discharge lamp devices.

At a thickness of 1.5 mm, the glass absorbs about
80% of the rays having a wave-length of 4100 Å,
about 74% of the rays having a wave-length of
4200 Å, and about 57% of the rays having a wave-
length of about 4400 Å.

The embodiment shown in Figs. 3 and 4 of the
drawings comprises a high pressure lamp device.
20 of which type is not liquid cooled and which comprises a tubular container of vitreous
material, such as quartz, having an internal diameter of about 3 mm. and an external diameter
of about 7.5 mm. A pair of activated, thermionic
electrodes is mounted in said container, one at
each end thereof, and said container has a
quantity of mercury therein in such amount that
it is completely vaporized when the lamp is at
operating equilibrium. When desired, a larger
quantity of mercury is used. A starting gas, such
as argon, is present in said container. The
lamp device illustrated in Figs. 3 and 4 is operated
at lower currents than the lamp device illustrated
in Figs. 1 and 2 and a current load thereon of
about 35 watts per cm. of the length of the dis-
charge path is preferred. The mercury vapor
pressure is then about 20 atmospheres. The lamp
device is mounted in an evacuated bulb of
vitreous material, such as a glass or quartz bulb
about 35 mm. in length and 21 mm. in diameter.
29 connected to the electrode leads of the
lamp device. Said leads 22 and 23 are sealed into the press 24 of the bulb 21. When
desired, the bulb 21 is provided with an inert
gaseous filling, such as nitrogen. A reflector is
mounted in said bulb 21 in a parallel position with said lamp device 20 to direct the light from said
lamp device in a desired direction. Said re-

The lamp devices described above are highly
efficient ones having a long useful operating life.

What we claim as new and desire to secure by
Letters Patent of the United States is:

1. A lamp unit comprising in combination a
gaseous electric discharge device of the high vapor
pressure type capable of emitting visible and ultra

2. A lamp unit comprising in combination a
gaseous electric discharge device of the high vapor
pressure type capable of emitting visible and ultra

3. A lamp unit comprising in combination a
gaseous electric discharge device of the high vapor
pressure type capable of emitting visible and ultra

4. A lamp unit comprising in combination a
gaseous electric discharge device of the high vapor
pressure type capable of emitting visible and ultra

5. A lamp unit comprising in combination a
gaseous electric discharge device of the high vapor
pressure type capable of emitting visible and ultra

6. A lamp unit comprising in combination, a
gaseous electric discharge device of the high vapor
pressure type capable of emitting visible and ultra

PIETER M. VAN ALPHEN.

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HENDRICUS J. LEMMENS.