Dec. 20, 1955 A. VANG 2,728,015

DISCHARGE TUBE SWITCHES

Filed June 27, 1952

Fig. 1.

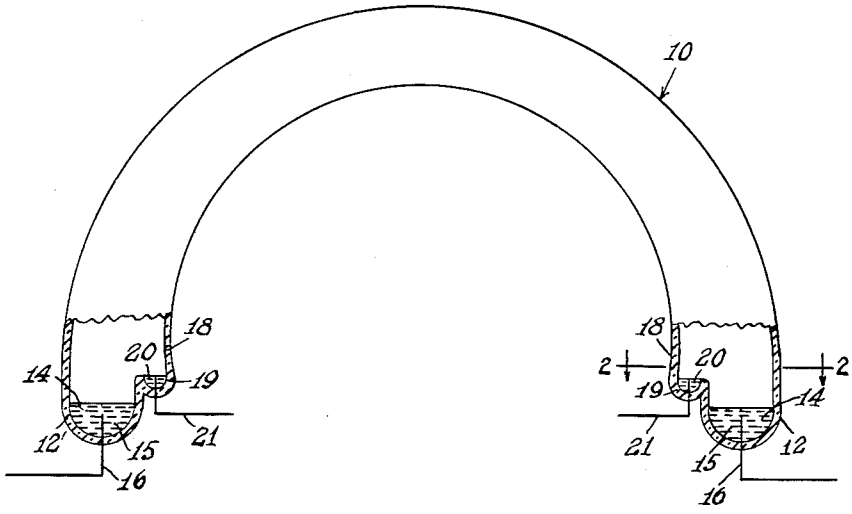


Fig. 2.

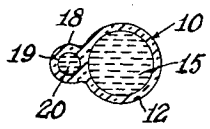


Fig. 3.

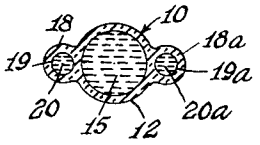
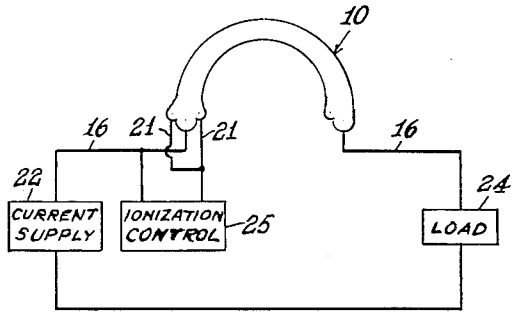


Fig. 4.



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2,728,015

Patented Dec. 20, 1955

2,728,015

DISCHARGE TUBE SWITCHES

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Application June 27, 1952, Serial No. 295,879

3 Claims. (Cl. 313—165)

This invention relates to discharge tube switches somewhat similar to those shown in my Patents Nos. 2,287,541, 2,423,858, 2,432,219.

While the tubes of the prior art have been satisfactory in a number of uses the externally ignited tubes suffer variations in required ignition potentials according to age, temperature, variations in composition of the glass envelope and the like. Ordinarily a potential high enough to assure ignition under the most adverse conditions can be used but when the ignition is to be effected by an oscillating current and close timing of the ionization of the tube is required, the externally fired tube is not always satisfactory.

Internally ignited tubes of the prior art are usually reliable in operation, when new, but have solid igniter electrodes at the surface of the mercury pools. Not only do the solid igniter electrodes disintegrate in use but their operation requires excessive ignition currents.

One object of the invention is to provide a discharge tube having the advantages of durability possessed by the externally fired tube.

Another object is to provide a tube which may be produced with a minimum variety of materials and with maximum economy.

The attainment of these and other objects and advantages is accomplished in the present invention which, briefly stated includes an envelope providing recesses or ends for widely separated main or working electrodes in the form of mercury pools and which provides a pocket near a main electrode for mercury serving as an igniter electrode.

In the accompanying drawing showing, by way of example, two of many possible embodiments of the invention,

Figure 1 is a side view, partly in section showing the tube;

Figure 2 is a transverse sectional view of one of the legs of the tube of Figure 1 the section being taken along the line 2—2 of Figure 1 and looking in the direction of the arrows of said line;

Figure 3 is a view similar to that of Figure 2 showing a modification of the tube, and

Figure 4 is a diagram showing a use of the tube.

The tube **10** comprises an arcuate or inverted U-shaped tubular envelope of insulating material such as glass having two closed extremities **12** and **12'** providing recesses **14** containing separated mercury pools **15** as main or working electrodes. The pools **15** are in contact with terminal conductors **16** of suitable material such as, say, tungsten passing through the envelope. The space within the envelope above the mercury contains mercury vapor and, if desired, a noble gas.

Near the normal level of each of the pools **15** is a lobe **18** depending from the lower wall of the tube to provide a small pocket **19** which is filled with mercury **20** to provide an igniter electrode which is in contact with a terminal conductor **21** passing through the lobe.

It is preferable that the lobe be situated in the inner

or lower wall, the wall having the least torroidal radius, so that condensing mercury will flow into the pocket and keep the conductor **21** well covered. However if a cooling medium, such as air, be applied to an area a lobe **18***a* may be provided where the mercury tends to flow, forming a second igniter pool **20***a*.

When two lobes are used adjacent one main electrode it is desirable that the mercury in the two pockets be electrically connected, externally, since one pocket may be better filled than the other and the fuller pocket, providing a lesser distance to the main electrode, will be the active firing electrode. In this way the potential required for firing will not become unduly varied since the idle firing electrode will become cooler and collect more mercury to bring its level electrically nearer that of the main electrode. Of course it is desirable in the mode of operation that the mercury pockets overflow at substantially the same distance from the main electrode.

There is a tendency for mercury to distil from one main electrode to the other. Consequently it is desirable that each main electrode be provided with an ignition electrode so that the polarity of the tube may be reversed from time to time and yet have an igniter adjacent the cathode at any time. However, under certain conditions of operation only one igniter need be provided for the whole tube.

In use, the tube is interposed between a current supply **22** and a load **24** as shown in Figure 4. An ionization control **25** supplies an ionizing potential between pools **15** and **20** to ignite the tube.

The cross sectional area of the main pool **15** is large compared with that of the igniter pool **20** or **20***a*. This is because pocket **19** or **19***a* can be kept substantially full and even overflowing as a result of mercury condensing in the upper portion of the envelope. Hence the mercury level in the pocket is substantially constant. By having a much larger surface area for the pool **15**, the losses therefrom by distillation do not greatly affect the level of pool **15** and the length of the electrical gap or path from igniter pool **20** and main pool **15** remains substantially constant, resulting in a fairly constant ionization-potential requirement. A main electrode exposed surface about 40 times greater than the igniter surface is satisfactory and a path or gap between the igniter and main electrode of about ¼ inch is satisfactory.

The invention claimed is:

1. A discharge tube comprising an envelope of insulating material in the form of a tube of generally inverted U-shape and closed at each end thereof, a lobe on one end portion of the tube and on the inner wall thereof and providing a pocket upwardly open to the interior of the envelope to catch trickling droplets of mercury condensed in the upper portion of the envelope and having a bottom above the adjacent closed end of the tube, mercury in said pocket and in the closed end of the tube, the level of mercury in the pocket being above that of the mercury in the closed end so that the mercury may cascade dropwise from the pocket into the closed end portion of the envelope, and conductors passing through the bottoms of said lobe and end portion and in contact with the mercury therein.

2. A discharge tube comprising an envelope of insulating material of inverted U-shape having main electrodes of mercury in the bottom of each leg of the envelope, a lobe on the envelope on the inner wall thereof and at a leg thereof providing a pocket opening upwardly to the interior of the envelope to catch condensed mercury descending from the upper portion of the envelope, mercury filling said pocket and having the top level of the mercury therein above the top level of the mercury forming the adjacent main electrode.

3. A discharge tube comprising an envelope of inverted U shape and main mercury electrodes in the bottoms of the legs thereof, at least two lobes on one leg of the envelope, one on the inner wall and one on the outer wall thereof, each forming a pocket upwardly open to the interior of the envelope to catch trickling mercury descending to the envelope walls, and containing mercury igniter electrodes spaced from the main electrode, the igniter electrodes being separated from each other but electrically connected to each other external of the envelope.

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