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F. J. METZGER

LUMINOUS VESSEL

Filed Nov. 17, 1922

Fig. 1,

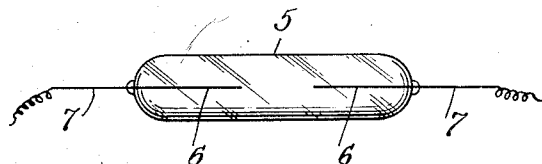


Fig. 2,

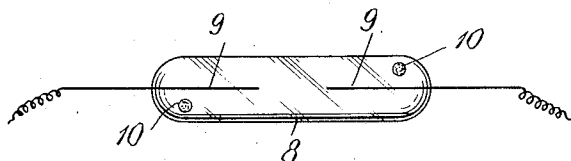
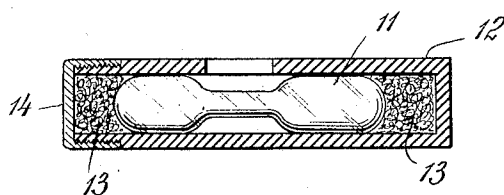


Fig. 3,



INVENTOR

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UNITED STATES PATENT OFFICE.

FLOYD J. METZGER, OF NEW YORK, N. Y., ASSIGNOR TO AIR REDUCTION COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

LUMINOUS VESSEL.

Application filed November 17, 1922. Serial No. 601,674.

To all whom it may concern:

Be it known that I, FLOYD J. METZGER, a citizen of the United States, residing at New York city, in the county of New York, State of New York, have invented certain new and useful Improvements in Luminous Vessels; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to vessels which are adapted to be rendered luminous by the passage of an electric discharge through the gases contained therein, such vessels being employed for illuminating purposes, for indicating the condition of electrical circuits or for permitting the discharge of high potential currents which might otherwise injure apparatus in electrical circuits to which the vessel is connected.

The invention is particularly applicable to tubes containing neon and similar gases, although it has a wider application and may, in fact, be utilized in connection with any gaseous medium through which an electrical discharge passes.

It is known that gases when ionized are more conductive with respect to electric currents than otherwise and that a higher potential is required to accomplish the initial discharge through a gas than is necessary to cause the discharge to continue after it has been initiated. This is due to the fact that the initial discharge ionizes the gas so that it becomes a good conductor.

It is the object of the present invention to avoid the resistance of the gas to the initial discharge, thus causing it to serve as a conductor at a uniform potential. In the application of the invention, for example, a neon tube which is to be subjected to an electrical discharge will normally require a considerably higher potential to effect the initial discharge than to insure the continued passage of current through the gas. When, however, the ionization is effected otherwise than by the initial discharge, the potential required to initiate the discharge is substantially that which will maintain the flow of current through the gas. In

other words, the "break-down" voltage of the gas becomes uniform with the difference in potential required to overcome the resistance of the ionized gas.

In order that the invention may be clearly understood, it is illustrated in the accompanying drawing in a diagrammatic manner, it being understood that the invention is not limited to the specific structures shown. In the drawing,

Fig. 1 represents a tube containing a gas such as neon;

Fig. 2 illustrates a similar tube in which the invention is differently applied; and

Fig. 3 illustrates in section a specific application of the invention to a device for detecting the condition of electrical circuits.

I have discovered that the initial ionization of the gas may be effectively accomplished by subjecting it continuously to the action of a radio-active substance. Many such substances are known, and the particular material employed is relatively unimportant so long as its radio-active strength is sufficient to insure the initial ionization of the gas in the receptacle through which the discharge passes. The preferred material is a radium salt such as chloride or bromide or mixtures of such salts with more or less inert materials.

In carrying out the invention it is sufficient to employ very minute quantities of the radio-active material. Thus the interior of the vessel may be washed simply with a water or other solution of a radium salt or of a soluble radio-active material. As a specific example, it may be noted that a solution of 25 micrograms of radium chloride in 50 cc. of water may be employed as a wash for the interior wall of the vessel. The strength of the solution may be varied considerably, solutions containing 25 micrograms of radium chloride in from 15 to 250 cc. of water having been utilized effectively for the purpose described. In applying radio-active material as described, the solution is introduced into the vessel and drained therefrom, leaving a mere film upon the surface. The vessel is thereafter dried and the minute quantity of the radio-active material thus left on the sur-

face of the vessel is found to be sufficient to ionize a gas such as neon and thus to accomplish the purpose of the invention.

Under certain circumstances it may be undesirable to employ a solution in the manner above described. The object of the invention may be as readily accomplished by applying the radio-active material to the outer wall of the vessel within which the gas is sealed. Thus a radio-active material may be supported in a carrier and mixed with a suitable vehicle to provide a paint. A mere spot of this paint applied to the outer wall of the vessel will serve effectively as an ionizer for the gas. As a paint it is preferable to employ a mixture of zinc sulfide with a radio-active material such as radium chloride or bromide. 40 to 50 micrograms of the radium salt may be thus mixed with each gram of zinc sulfide, and the pigment thus produced may be mixed to a suitable consistency with a vehicle such as linseed oil and turpentine. Such a paint is applied to the outer wall of the vessel as a spot or coating. Very little of the material is necessary to accomplish the purpose of the invention.

Referring to the drawing, 5 indicates a tube of glass or other suitable material which may contain, for example, neon under varying pressures. For most purposes a pressure of from 5 to 50 mm. may be employed and a pressure of 30 mm. of mercury is suitable for general purposes. Other gases such as helium, argon, nitrogen or rarefied air may be similarly employed. The tube may be provided with electrodes 6 sealed through its ends and adapted to be connected by conductors 7 to a circuit including a source of high tension current. In employing the tube, one electrode may be connected to such a source and the other to the ground which completes the circuit to the source of current. In preparing such a tube its internal surface is washed prior to the introduction of the gas with a radio-active solution such as has been described. The solution is drained from the tube which is thereafter dried and heated in an oven to drive off gases occluded in the glass before the introduction of neon. After the introduction of the neon at a suitable pressure, the tube is sealed. The film of radio-active substance on the inner wall of the tube is sufficient to ionize the neon, thus maintaining it in condition to permit the discharge between the electrodes at the minimum potential.

In Fig. 2 a slightly different form of the invention is illustrated, the tube 8 being provided with electrodes 9 as in the preceding form and containing neon or other gas. In preparing such a tube the step of washing the interior with a radio-active solution may be omitted, and one or more spots

10 of radio-active material in an adhesive form, such as a paint, are disposed upon the outer surface of the tube. The radio-active material in this form is equally effective to insure the ionization of the neon and the consequent maintenance of the gas in condition to permit the electrical discharge at a minimum voltage.

A specific application of the invention is illustrated in Fig. 3, in which a tube 11 of glass or other suitable material is supported in a casing 12 of insulating material such as vulcanite, fibre or a phenol condensation product. Before the introduction of the gas such as neon into the tube, the inner surface is treated with the radio-active solution as hereinbefore described. Alternatively, the radio-active material may be disposed on the exterior surface of the tube in the form of paint or other adhesive coating. A spot only of this radio-active material is necessary for the accomplishment of its purpose. The tube may be provided with electrodes, but preferably the electrodes are omitted and capacity media such as sheets of metal foil or wads of metal wool 13 are disposed at the ends of the tube. At one end of the casing a metal cap 14 is mounted on the tube in electrical conducting relation with the capacity medium at that end of the tube.

The purpose of this specific device is the determination of the condition of electrical circuits, such as those used in ignition systems of internal combustion engines. By applying the metal cap 13 to the terminal of a spark plug while the device is held in the hand, a discharge may be obtained through the tube as each spark occurs at the sparking terminals of the plug. If the plug is defective so that no spark occurs, there will be no corresponding flash in the neon tube.

From the foregoing it will be observed that I have provided for the ionization of the gas within a receptacle in which electrical discharges occur, and that owing to the ionization, such discharges may be effected without an initial increase in potential over that required to cause the discharge through the ionized gas. Various changes may be made in the details of the invention as described, and it may be utilized in a number of relations wherein it fulfills the function set forth.

I claim:

1. The method of reducing the resistance of a gaseous medium to electrical discharges, which comprises washing the surface of the container for the medium with a solution of a radio-active material, removing the surplus solution and drying the container.

2. The method of reducing the resistance of a gaseous medium to electrical dis-

charges, which comprises washing the inner surface of the receptacle for the medium with a solution of a radio-active material, removing the surplus solution, drying the receptacle and thereafter introducing the gaseous medium.

therein adapted to act as a conductor for an electrical discharge, and a film of radio-active material supported on the receptacle to continuously ionize the gas. 10

In testimony whereof I affix my signature.

3. In a device of the character described, the combination of a receptacle, a gas

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