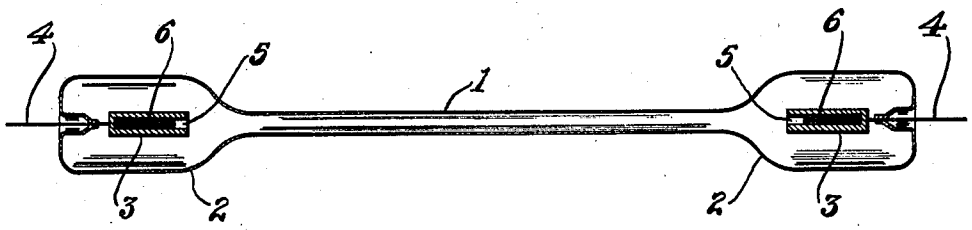
May 10, 1927. 1,628,256

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NEON TUBE

Filed Oct. 16, 1926



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Patented May 10, 1927. 1,628,256

UNITED STATES PATENT OFFICE.

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NEON TUBE

Application filed October 16, 1926. Serial No. 142,026.

My invention relates to certain new and useful improvements in neon tubes intended particularly for advertising purposes where the fiery orange color of the luminous gas is desirable. Particularly the invention relates to neon tubes using interior electrodes to which an alternating current of high voltage is supplied, whereby the conducting gaseous atmosphere of neon will be made luminous.

Usually, in the formation of neon tubes a pressure of about 8 millimeters of mercury is employed. Heretofore, in the manufacture of neon tubes, it has been assumed that a satisfactory life can be secured only by the use of gas of very great purity and by the employment of special methods by which gaseous impurities can be eliminated from the tube, and by which occluded gases can be removed from the walls of the tube and the electrodes themselves.

It was the belief generally accepted by the art that the presence of foreign gaseous impurities, contaminating the neon atmosphere, shortened the life of the tube, and hence it was considered of vital importance that precaution should be taken to prevent the presence or development of foreign gases in the tube.

I have discovered that the generation or presence of certain gases in a neon tube, are not only undetrimental to the operation thereof but actually result in securing much greater length of life of the tube than is possible if such foreign gases are not employed. Specifically, I have found that if a diatomic gas, such as carbon monoxide gas is caused to slowly evolve in the operation of the tube so as to be localized in the immediate neighborhood of the electrodes, it is possible to construct a neon tube having a life of from four to six or more thousand hours. Apparently, the foreign gas which is thus localized in the neighborhood of the electrodes, performs a beneficial function in connection with the transfer of energy from the metal electrodes to the neon gas.

The functioning of the foreign gas seems to be due to the phenomenon of ionization. Its presence may be observed with a spectroscope. Preferably, I provide for the slow evolution of the foreign gas by charging each electrode with a suitable supply of a salt, which, in the operation of the tube, will become chemically dissociated, so as to cause the desired gas to be evolved. Care is to be taken in the designing of the electrodes not to have them too small, because if too much heat is developed, the gas may be generated too freely and therefore will not be localized as required for successful operation. If this is the case, excessive foreign gas will be generated and will find its way into the neon column between the electrodes, and it will injuriously effect the color of the light as well as the operation of the tube.

In order that my invention may be fully understood, attention is directed to the accompanying drawing, in which I illustrate a conventional form of neon tube equipped with electrodes in which the desired salt may be carried. The body, 1, of the tube, is of suitable diameter and length and is generally formed in the shape of a letter or symbol for advertising purposes. The ends of the tube are enlarged as at 2 so as to form chambers for receiving the electrodes. The electrodes, 3, are made preferably of carbon and are carried on suitable conductors 4, extending through the end walls of the tube. Each electrode is formed with a cylindrical bore or chamber 5, therein for receiving a charge 6, of the desired salt for the generation of the foreign gas.

In actual practice, I have achieved excellent results by the use of magnesium carbonate, which upon dissociation and because of conditions within the tube results in the generation of carbon monoxide gas. Care should be taken that the gas which is thus generated will be localized in the immediate neighborhood of the electrodes so as to facilitate the transfer of energy therefrom to the neon atmosphere. Therefore, the electrode should not become too hot in operation. A very good proportion of electrode area for use is 10 square decimeters per ampere of current, although of course this proportion may be varied somewhat.

Other salts may of course be made use of, as for example sodium nitrite, which upon dissociation will result in the generation of nitrogen in the immediate neighborhood of the electrodes and will also act beneficially in prolonging the life of the tube. As a matter of fact, my observation is that generally any diatomic gas existing in limited quantities in the neighborhood of the electrodes will produce the desired ef-

fect, and therefore it is only necessary that the material carried within the electrode shall have a sufficiently low vapor pressure so as to cause the foreign gas to be slowly evolved.

In order to determine whether the electrodes are of proper proportion with respect to current used, a spectroscopic examination of the tube, if made, should disclose the spectrum of the foreign gas in the neighborhood of the electrodes and the absence of the same spectrum in the conducting neon column. If such an examination discloses the spectrum of the foreign gas in the neon column, it indicates that the electrodes are too small or else that a salt has been chosen whose vapor pressure is not adequate for the purpose.

It will be understood that before the neon gas is introduced into the tube, a vacuum should be first produced therein by means of suitable vacuum creating appliances, with which the art is familiar, after which substantially pure neon gas is allowed to enter the tube to fill the same at a pressure of about 8 millimeters of mercury. If this pressure is substantially increased, the resistance of the tube will be objectionably affected. A lower pressure is not approved because it has been found that in operation the pressure of the neon in the tube slowly diminishes until a point is reached where the tube becomes non-conducting. Therefore any initial reduction of pressure below 8 millimeters of mercury, results in shortening the life of the tube.

I find that it is desirable in pumping the tubes, to maintain a discharge between the electrodes resulting in the evolution of carbon monoxide gas therefrom, assuming that magnesium carbonate is utilized as the gas producing salt. Gradually the tube becomes filled with carbon monoxide gas, which effect can be observed by means of a spectroscope and the current between the electrodes is continued until the spectroscope indicates the presence in the tube of an atmosphere of pure carbon gas only, whereupon the passage of the current is discontinued, so that no further evolution of carbon monoxide takes place. The continued operation of the vacuum pump will remove such gas from the tube and result in the production of a vacuum therein which will be replaced, as stated, by the introduction of the neon.

The special treatment proposed above of generating from the electrodes the desired foreign gas in the tube until its formation and prior to the introduction of the neon, results in the elimination of hydrogen, water vapor and other contaminating influences which might tend to interfere with the correct operation of the tube. It is to be particularly noted that no special precautions are required in the way of baking the tubes or over-heating the electrodes for the removal of occluded gas and as a matter of fact in the operation of my improved neon tube the desirable effect is based upon the fact that gases are continuously emanating from the electrodes.

It is not necessary in the carrying out of my invention, to make use of absolutely pure neon gas, and in fact, in practice I prefer to make use of so called "neon-helium, spectralrein," in which the neon is associated with helium (frequently 10%) the presence of which can be determined spectroscopically. It will therefore be understood that where reference is made to neon in the appended claims I include such a mixture of neon and helium. While I prefer to make use of neon as the source of illumination, owing to its brilliantly colored radiation and to its desirable conducting properties, yet it will be understood that other monatomic gases of the so-called noble group, may be employed, such as argon, krypton, xenon or helium, all of which act the same as neon, except as to their distinctive spectra and in their conducting properties.

Having now described my invention, what I claim is new therein and desire to secure by patent, is as follows:

1. A luminous tube having a monatomic gaseous conducting atmosphere therein and having interior electrodes and means within the tube for supplying a foreign gas localized in the immediate neighborhood of the electrodes for facilitating transfer of energy from each electrode to the conducting gas, as set forth.

2. A luminous tube containing a monatomic gaseous conducting atmosphere therein and having interior electrodes within the tube and means for supplying carbon monoxide gas localized in the immediate neighborhood of the electrodes for facilitating the transfer of energy from each electrode to the conducting atmosphere, as set forth.

3. A luminous tube containing an atmosphere of neon therein, and having interior electrodes within the tube and means for supplying a foreign gas localized in the immediate neighborhood of the electrodes for facilitating transfer of energy from the electrodes to the neon atmosphere, as set forth.

4. A luminous tube containing an atmosphere of neon, interior electrodes within the tube and means for supplying carbon monoxide gas localized in the immediate neighborhood of the electrodes for facilitating the transfer of energy from the electrodes to the neon atmosphere, as set forth.

5. A luminous tube containing a conducting monatomic gas, interior electrodes within the tube and means for supplying a diatomic gas in the immediate neighborhood of the electrodes to facilitate transfer of energy

from the electrodes to the conducting atmosphere, as set forth.

6. A luminous tube containing neon, interior electrodes within the tube and means for supplying a diatomic gas localized in the immediate neighborhood of the electrodes to facilitate transfer of energy from the electrodes to the neon atmosphere, as set forth.

7. A luminous tube containing a monatomic conducting gas, interior electrodes within the tube and a salt carried by said electrodes which upon dissociation will furnish a supply of a foreign gas localized in the immediate neighborhood of the electrodes to facilitate the transfer of energy from said electrodes to the conducting atmosphere, as set forth.

8. A luminous tube containing a monatomic conducting gas, interior electrodes within the tube and a salt carried by said electrodes which upon dissociation will supply a diatomic gas localized in the immediate neighborhood of the electrodes to facilitate the transfer of energy therefrom to the conducting atmosphere, as set forth.

9. A luminous tube containing a monatomic conducting gas, interior electrodes within the tube, and a charge of magnesium carbonate in each electrode adapted to be dissociated in the operation of the tube to generate carbon monoxide gas localized in the immediate neighborhood of the electrodes to facilitate the transfer of energy therefrom to the conducting atmosphere, as set forth.

10. A luminous discharge tube having interior electrodes and containing a conducting atmosphere of a monatomic gas, said tube also containing in the neighborhood of the electrodes a localized body of a diatomic gas, as set forth.

RAYMOND R. MACHLETT.