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1,939,903

APPARATUS AND METHOD OF OBTAINING LIGHTING OF LUMINESCENT TUBES

Filed Jan. 31, 1928

2 Sheets-Sheet 1

Fig. 1

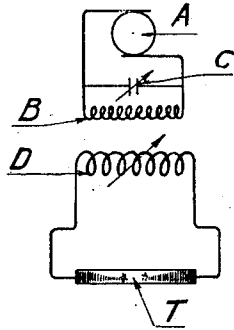


Fig. 2

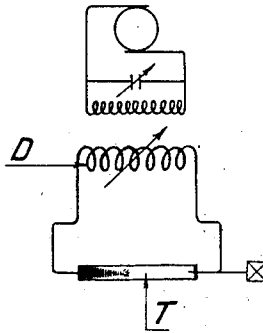


Fig. 3

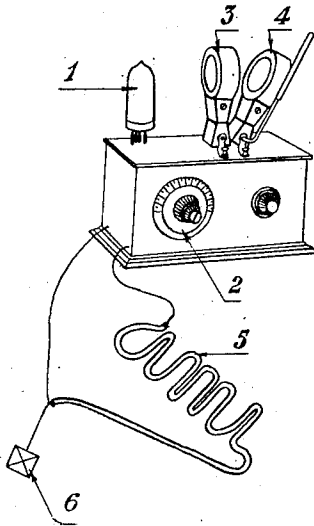
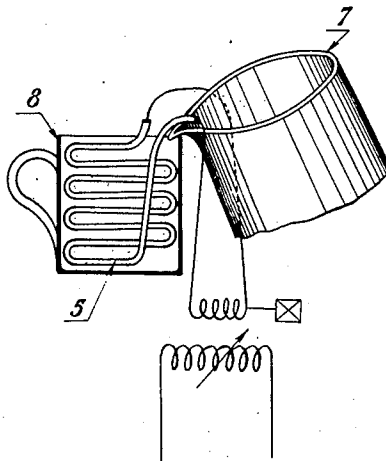


Fig. 4



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att'y

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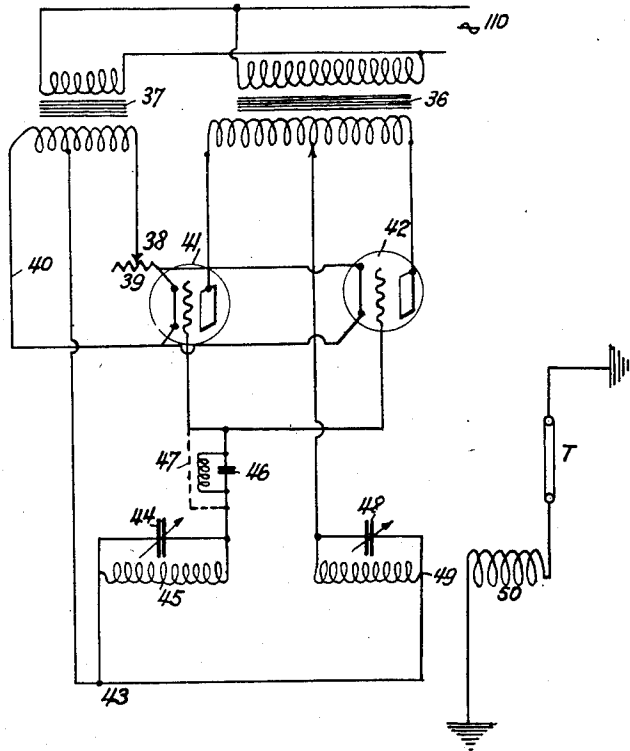
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2 Sheets-Sheet 2

Fig. 5



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# UNITED STATES PATENT OFFICE

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## APPARATUS AND METHOD OF OBTAINING LIGHTING OF LUMINESCENT TUBES

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Application January 31, 1928, Serial No. 250,874,  
and in France February 11, 1927

8 Claims. (Cl. 176—124)

My invention relates to an apparatus and method of obtaining lighting of luminescent tubes, such as neon tubes, over only a part of their length.

5 One of the objects of the invention is to provide an apparatus and a method of operating the same of the character indicated which shall permit of lighting the said tube over a certain length thereof at one extremity only, or over a certain  
10 length thereof at both extremities, and to permit increase in the length of the said lighted portion or portions as well as a decrease therein and more particularly to permit the luminescent space or spaces to be gradually extended until the entire  
15 length of tube is covered thereby.

Another object of the invention is to enable the luminous intensity of the tubes to be increased and diminished and to produce special bead and nodule effects by means of luminescent tubes.

20 Other objects of the invention will be obvious to those skilled in the art to which it relates in the following description taken in connection with the accompanying drawings forming a part of this specification and in which—

25 Figs. 1 and 2 are diagrams illustrating the principle upon which the invention is based;

Figs. 3 and 4 illustrate perspective views of a practical application of the invention;

30 Fig. 5 represents a diagram of an arrangement of the circuits and connections of the apparatus in which an oscillating current whose oscillations are continuously maintained through the medium of electronic tubes for feeding the tube to be operated according to the invention is provided.

35 The invention consists in causing a high frequency alternating E. M. F., whose frequency is on the order of that produced by means of electronic emission tubes, to act on the extremities of a luminescent tube. For this purpose the said  
40 tube receives its energy from an oscillator, a high frequency alternator or, in general, any source of high frequency current, either directly or through the medium of a transformer. The desired phenomena are produced by modifying a self-inductance, a capacity, or, if a transformer is  
45 used, by thus tuning the primary and secondary thereof or by changing the coupling of the primary and secondary thereof, or if an electronic tube is utilized, by altering the excitation of the  
50 filament thereof.

Referring to Figs. 1 and 2, an embodiment is therein shown wherein the tube receives its energy by the medium of a transformer. As represented in these figures an alternator or oscillator A, a  
55 transformer primary B and a transformer sec-

ondary D, are to be found. At C is placed a variable condenser destined to regulate the tuning of the primary circuit. In the secondary circuit is inserted the luminescent tube T.

In proportion as the condenser C is acted upon, 60 it will be seen that the tube T lights up at its two extremities, the two luminous portions increase progressively in length and the two said portions finally join each other abruptly when the distance therebetween becomes relatively small. 65

In the arrangement in Fig. 2, one of the extremities of the tube is grounded, so that the lighting of the tube is gradually produced, starting from the insulated extremity and moving toward the grounded extremity. In this embodiment also 70 when the end of the lighting operation approaches total illumination of the tube takes place abruptly.

Instead of connecting one extremity to the earth it might readily be connected to any bulk 75 of material suitable for forming a counterpoise.

When the lighting is incomplete, the luminous part or parts of the tube present an aspect of effluvia terminating in aigrettes.

It is also possible to produce operation in the 80 inverse sense, that is to say, diminish the length of the luminous part or parts of the tube by gradually leading the light toward the extremities or extremity of the tube. This effect is obtained by manipulating, for example, the tun- 85 ing element of the primary, or other appropriate analogous element, in the opposite direction to that which produced the increasing luminescence in the tube.

Likewise the radiancy of the tube may be in- 90 creased or diminished by varying the intensity of the current which feeds it.

By turning the movable element of the condenser in the proper direction when there is total luminosity in the tube, luminous effluvia 95 comes abruptly into view which runs along the tube detaching itself either toward the center with the arrangement shown in Fig. 1, or toward the grounded extremity in the arrangement of 100 Fig. 2, then gradually retrograding and finally the tube again becomes completely obscure.

By acting alternately on the condenser in both 105 directions, it is possible to advance and retard the luminous regions of the tube at will.

When the tube is totally luminous, it is possible to obtain fixed or movable bead and nodule effects by manipulating the tuning element C.

There is then obtained in the secondary circuit a sort of resonance, which has for an effect 110

to produce fringing or strata alternately brilliant or obscure.

By varying the setting of the condenser C still more, the dark and the brilliant portions differentiate from each other more and more, become larger and larger and finally the luminescence of the tube T presents the aspect of beads or nodules of luminous character separated by obscure portions.

When the said phenomena are obtained, a very light action on the condenser suffices to hold the said beads or nodules stationary or to cause them to be displaced in one direction or the other.

Fig. 3 shows how the various elements of the apparatus are arranged in practice. An electronic tube 1 is excited in the usual manner so as to give continuous oscillations. The oscillations of the said tube are received in a primary circuit including a variable condenser, of which the manipulating dial 2 only is visible and an inductance 3. The inductance 3 provides an adjustable coupling with the inductance 4. The elements thus far described are well known in the radio art and need no further detailed description.

The luminescent tube 5 is connected to the terminals of inductance 4. One extremity of tube 5 is grounded at 6. The apparatus being in operation, the condenser 2 is adjusted as well as the inductances 3, 4 in a manner to instigate progressive luminescence of the tube 5 moving from the grounded extremity thereof. As a result the letters which the tube forms produce the effect of the word "ami" being gradually written in space.

In Fig. 4, the tube 5 is arranged to produce the effect of a liquid being poured from a receptacle 7 into a cup 8 which appears to gradually become filled by the liquid.

When the luminescent tubes are fed by alternating current transformed into intermittent direct current by electronic tubes, only half of the alternating current wave can be utilized, such as, all values corresponding to the positive values of current.

As a result, obscure spots occur in the tube which produce very disagreeable luminous effects.

In order to overcome this disadvantage I have provided an arrangement which rectifies the current and permits both alternations of ordinary alternating current to be utilized for exciting the electronic tube. Such a device is represented diagrammatically in Fig. 5.

Adverting to this figure, ordinary alternating current circulates in the line 35 and feeds two transformers connected in shunt, the one 36 a high tension transformer and the other 37 a low tension transformer. By means of a conductor 38, a variable resistance 39 and a return conductor 40, transformer 37 supplies current to the two electronic tubes 41, 42.

The plates of tubes 41, 42 are connected to the terminals of the secondary of transformer 36. The grids of said tubes are connected to a central tap 43 of transformer 37 through a tuning circuit consisting of a condenser 44 shunted by an inductance 45. A second condenser 46 shunted by a resistance 47 may also be disposed in this circuit if desired.

The mid-point 43' of the secondary winding of transformer 36 is connected to mid-point 43 of transformer 37 through a second tuning circuit including a condenser 48 and an inductance

49. The two inductances 48 and 49 are disposed in inductive relation to each other producing an electro-magnetic inductive couple therebetween.

It will thus be seen that by means of this device, the tube 42 will be excited by one of the alternations of the alternating current supplied by line 35 and the tube 41 will be excited by the other alternation thereof, in such fashion that the arrangement of inductances 45, 49 will produce a continuous oscillating field.

By coupling a winding 50 with the said inductances, the said winding will be traversed by an oscillating current at a very high voltage capable of exciting the luminescent tube 51. In the event that the tube employed is of such a nature that its excitation does not necessitate a very high voltage, the said tube may then be excited directly by the current traversing the inductance 49.

It will be noticed that in principle the luminescent tubes may be kept illuminated by direct current or by low frequency alternating current of suitable voltage, once this illumination has been obtained by the high frequency current.

While I have disclosed what I believe to be the preferable forms of execution of my invention in the various examples set forth, I do not wish to be limited thereto, as various further changes may be made in the details of construction and the arrangement of parts without departing from the spirit of the invention comprehended within the scope of the appended claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is—

1. A method of operating luminescent tubes which comprises exciting the tubes with an oscillating current applied at each end of the tube, grounding one end of the tube and controlling the direction of travel of the luminous band emanating from the non-grounded end of the tube by varying the characteristics of said oscillating current in order to produce the phenomena substantially as disclosed.

2. A method of producing an advertising effect which comprises arranging a luminescent tube between two vessels to represent a liquid being poured from one vessel into the other, exciting the said tube with an oscillating current and varying the characteristics of said current in order to control the progressive travel of the liquid-representing luminous band thus formed for the purpose disclosed.

3. A method of producing an advertising effect which comprises arranging a luminescent tube between two vessels to represent a liquid being poured from one vessel into the other, exciting the said tube with an oscillating current, grounding one side of said tube in order that the luminous band representing a liquid emanate from a definite end of the said tube and varying the characteristics of said current in order to control the progressive travel of said luminous band for the purpose disclosed.

4. A method for operating luminescent tubes which comprises feeding the tubes with a high frequency current, varying the voltage of the said current in a slow and progressive manner according to the apparent movement and development which it is desired to give to the luminous portions of the tube, switching the high frequency current off when the tube is fully illuminated, and feeding simultaneously low frequency industrial current in a slow and progressive manner during operation according to the apparent

movement and development which it is desired to give to the luminous portions of the tube.

5 5. A method for controlling luminescent tubes which consists in exciting the tubes with oscillating current and controlling the direction of travel of the luminous band issuing from the ends of the tube by varying gradually the mean voltage of the oscillating current.

10 6. A method of operating a luminescent tube which comprises causing a high frequency current to flow through said tube, and slowly and gradually varying the tension of said current.

7. An illuminating device of the type described

comprising in combination, a luminous tube, a circuit for said tube; means for producing a high frequency current in said circuit, and means for causing slow and gradual variations of the tension of said current.

8. An illuminating device of the type described comprising in combination, a luminescent tube, a circuit for said tube, means for connecting one end of said tube to the ground, means for producing a high frequency current in said circuit, and means for causing slow and gradual variations of the tension of said current.

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