

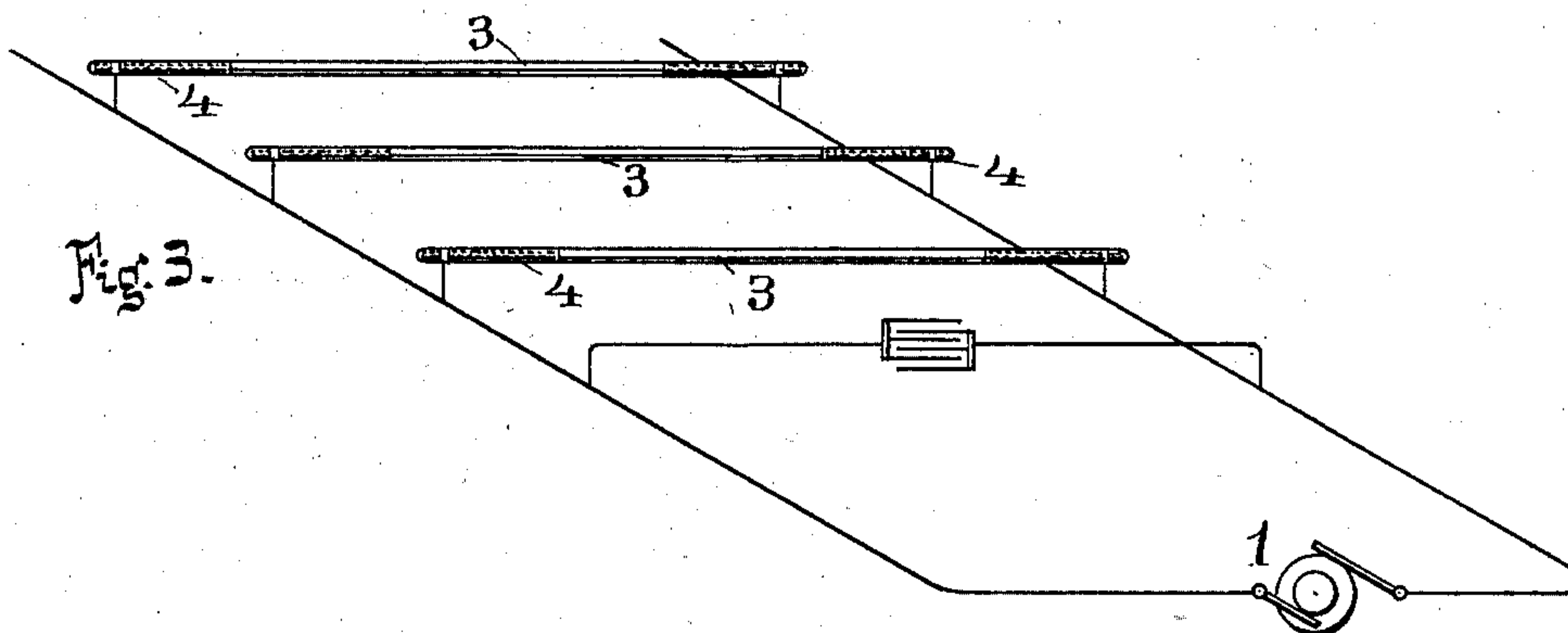
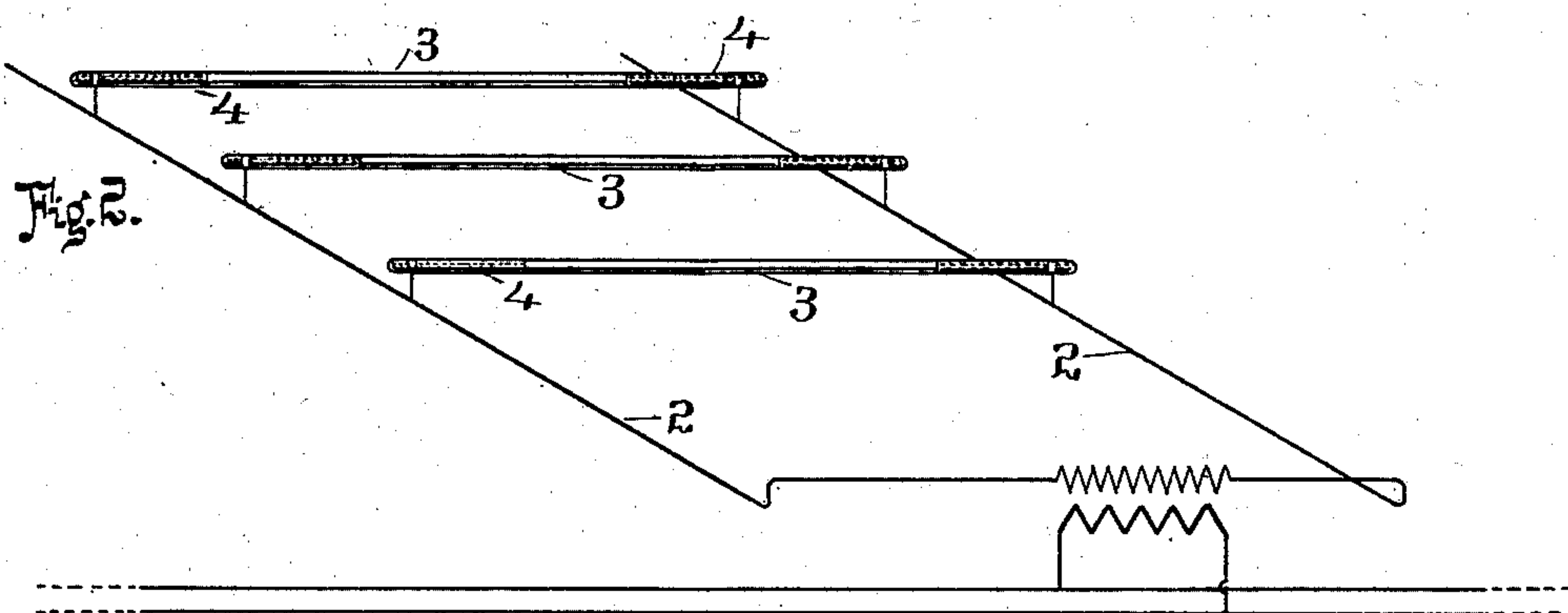
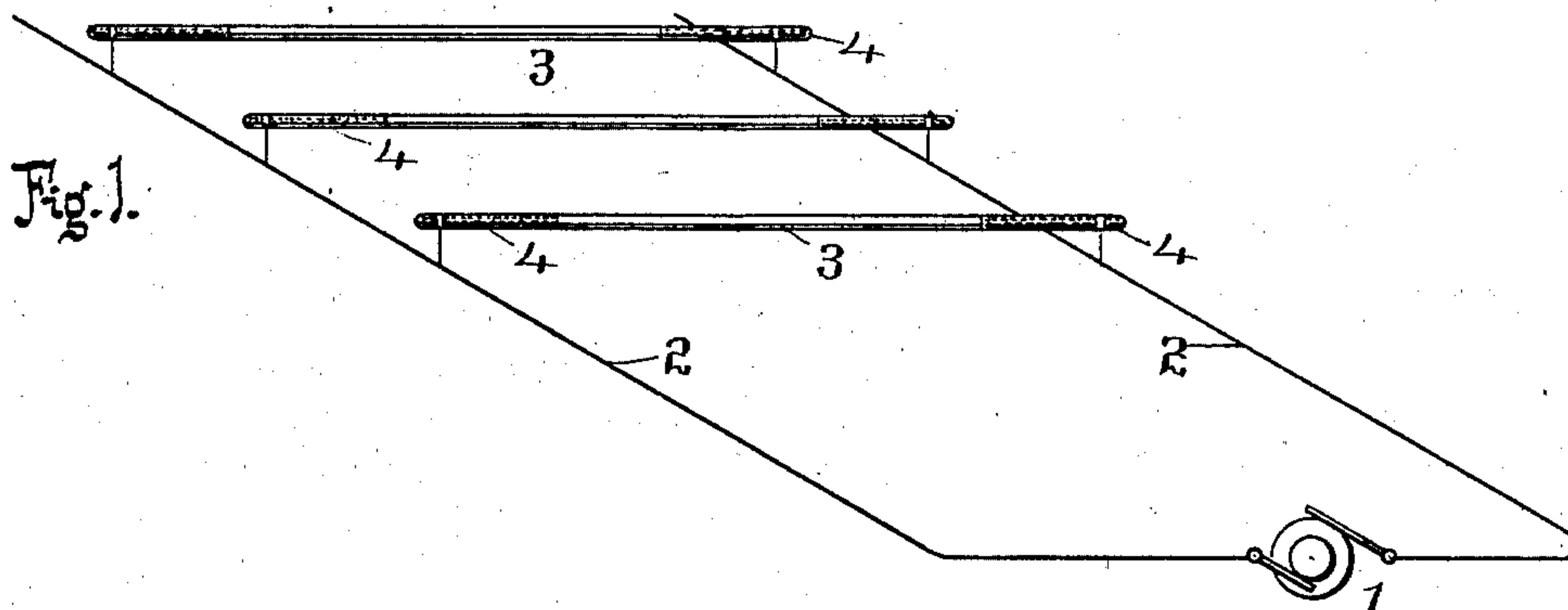
No. 702,317.

Patented June 10, 1902.

D. McF. MOORE.
ELECTRIC TUBE LIGHTING.

(Application filed Dec. 18, 1901.)

(No Model.)



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UNITED STATES PATENT OFFICE.

DANIEL MCFARLAN MOORE, OF NEWARK, NEW JERSEY.

ELECTRIC-TUBE LIGHTING.

SPECIFICATION forming part of Letters Patent No. 702,317, dated June 10, 1902.

Application filed December 18, 1901. Serial No. 86,360. (No model.)

To all whom it may concern:

Be it known that I, DANIEL MCFARLAN MOORE, a citizen of the United States, and a resident of Newark, in the county of Essex
5 and State of New Jersey, have invented certain new and useful Improvements in Electric-Tube Lighting, of which the following is a specification.

My invention relates to those systems of
10 electric lighting wherein the luminous agent is a column or body of gas rendered luminous by the application of a more or less rapidly varying electromotive force derived from any suitable source and applied to said column
15 by means of suitable conducting-electrodes at the terminals of the column to be rendered luminous.

My invention is designed more particularly for use with systems wherein the lamps consist of tubes of glass or other translucent material having the terminal conducting-electrodes combined therewith in the form of caps or sleeves of conducting material and of considerable area applied upon the outside of
25 the tubes at the ends thereof. My invention, however, is not limited to the use of electrodes of this particular form or applied in this particular way. Heretofore in this art the lamps have been excited by a varying
30 electromotive force whose periods of maximum value recur with considerable rapidity, the purpose being heretofore twofold, first, to secure a high degree of illumination by the rapidity of the attack of the impressed
35 electromotive force upon the contained molecules of rarefied gas or vapor, and, secondly, to produce in the luminous column discharges or emissions of light which will recur with such rapidity as to give a perfectly steady
40 and uniform illumination.

My present invention relates to means whereby a primary applied exciting electromotive force of comparatively low periodicity or frequency may be used.

45 My invention consists, essentially, in superposing upon the primary exciting electromotive forces the electromotive forces derived from the discharge of a condenser, which discharges itself through said column
50 in a manner to give an additional flash or flashes of light and with the practical effect of raising the frequency of the exciting-cur-

rents that render the gas column luminous. Such condenser preferably has its condenser-surfaces in immediate connection with the
55 lamp or with said gas column, so that there may be no obstacle to the free discharge from the presence of intermediate conductors having capacity, and its plates are of such area or condensing capacity or so adjusted with
60 relation to the length of the discharge-path through the luminous gas that they shall furnish a discharge electromotive force of sufficient potential to overcome the resistance of the gaseous column.

65 In the preferred manner of carrying out my invention the condenser plates or surfaces, which I employ for this purpose, consist of the conducting caps or terminals through which the electromotive forces from
70 the primary source are applied to the luminous column. However, the condenser employed for this purpose might be a separate device or structure connected in shunt across the terminals of the lamps or tubes.

75 In the accompanying drawings, Figure 1 illustrates a simple system embodying my present invention, the source of the primary electromotive force being typified, as shown
80 at 1, by an alternating-current dynamo connected to the main or supply wires 2, which in turn connect with the terminals of the lamp. Fig. 2 shows the same system, with this
85 difference only, that the mains supply energy to the lamp through a static transformer or converter. Fig. 3 shows a modification, wherein the condenser is connected in shunt across the terminals of the lamps or tubes.

Referring to Fig. 1, 3 indicates the glass tube of a lamp constructed on the general
90 plan heretofore employed by me, and 4 indicates caps or terminals of conducting material applied to the ends of said tube for the purpose of furnishing electric energy transferred by electrostatic action to the gaseous
95 contents of said tube.

The gas may be any simple gas or mixture of gases rarefied or made to have within the lamp a proper density, as well understood in the art, suitable for being rendered luminous
100 by rapidly-varying electromotive force derived from the supply-wires 2.

The lamp shown is of proportion suitable for carrying out my invention, although said

proportions may be greatly varied, depending largely upon the voltage of the applied electromotive force derived from the wires 2 and the inductance of the circuit exterior to the gas column, as also upon, but to a lesser extent, the actual length of the column of luminous gas in the portion of the translucent tube between the opaque conducting caps or terminals 4.

10 In determining the size or area of the cap or terminal 4 necessary in order to raise the frequency and obtain an additional number of flashes of light from the luminous gas column I may proceed in various ways. In one 15 of these ways I make use of the fact that a moving object seen by the successive luminous discharges of the column when excited by currents of comparatively low frequency will appear as a series of objects, the definition and distance of the successive images 20 being dependent upon the rapidity with which the object moves and the frequency or periodicity of the luminous discharges.

Assuming that the lamp is connected to a 25 suitable source of varying current adapted to excite the gas column to luminosity, a rotating mark or spot mounted to rotate synchronously with the periodicity of the applied electromotive force which excites the tube 30 will when seen by the flashes from the tube appear as a number of objects disposed in the circumference of rotation of the mark. If the caps or terminals be not sufficiently large to raise the frequency of the exciting-currents in 35 the luminous column, the number of images seen will be the same as the number of crests of applied electromotive force; but if the size of the cap be increased, so as to give a sufficient condenser capacity to produce the results aimed at by my present invention, the 40 number of said images appearing with a maintained or constant speed of revolution will be increased, and by adjusting the size of the cap the number may be made exactly double. 45 This will clearly indicate to the observer that by the presence of the condenser the number of exciting-currents operating upon the luminous column has been doubled, since the number of luminous flashes must evidently have 50 been doubled in order to give the double number of images.

It is possible to vary the capacity of the condenser so as to give a still further increase in the number of exciting-currents and number of flashes, which will be indicated by a 55 further increase in the number of images, although it will be ordinarily found that the additional images are less clearly defined, indicating that the further superposed exciting-currents are of less strength. The size of 60 the conducting-cap may be so adjusted as to get one additional set of images of practically the same strength or clearness of definition, which would indicate the production in the 65 tube of a double number of flashes of light, all of uniform luminosity.

The extent to which the frequency of the

flashes should be thus artificially multiplied will obviously depend upon the rate of alternations of the dynamo—that is to say, if the 70 rate be very low it may be desirable to adjust so as to produce three or more times the number of flashes which the lamp would give without this condenser action.

The adjustment of the size of the cap or 75 condenser - surface is very readily accomplished by using for the cap plumbago or other conductor mixed with proper liquid and applied as paint, thus permitting the size or length to be changed by wiping off or 80 applying additional paint, as desired.

It is obvious that by the use of my invention I am enabled to operate the tubes from generators having a lower periodicity or frequency than would be otherwise permissible, 85 owing to the fact that if the periodicity be too low a disagreeable effect will be produced by the discontinuity of the illumination produced by the gaseous column, which results in a moving object being seen as a number 90 of objects.

In my present invention I am not confined to the use of generators giving any particular form of electromotive force or current-wave. In fact, I have ascertained that by 95 the adjustment of the condenser capacity, as already described, to give the additional images I may use primary generators whose electromotive force or current - wave is of sinusoidal form. 100

The condenser when adjusted as above and used with this form of current-wave seems to have the additional function of changing the form of the exciting current-wave, so as to more readily excite the luminous column 105 by a sudden attack of the exciting electric energy upon the molecules thereof.

It will be seen from this consideration that my invention is not only of value in raising the frequency, and thereby lowering the voltage 110 necessary to produce a given luminous density of the gas, but also in practically changing the form of the current-wave and producing more efficient results when the original current is of sinusoidal form. 115

My invention is of special utility in permitting lamps of the character above described to be operated from alternating-current circuits carrying sinusoidal currents of the ordinary commercial frequency—say 120 seven thousand two hundred alternations per minute—because seven thousand two hundred flashes per minute through the tubes would give a disagreeable effect when moving objects are viewed by it, while by adjusting 125 the caps as described the number of flashes can be made anything desired within limits, thereby making the system thoroughly practical.

In Fig. 3 an artificial condenser 6 is shown connected in shunt across the terminals of 130 the lamp or lamps. This condenser may be adjusted in well-known ways and be made to produce the same results in respect to the frequency of pulses as are secured by the con-

denser action of the lamp-terminals themselves, as already described, said condenser being charged from the supply-wire and by its discharge action operating to give in the
5 lamp a distinct or added flash of light, which has the effect, already described, of definitely multiplying the flashes.

I claim as my invention—

10 1. In an electric-lighting system, the combination with a luminous gas column excited by regularly-recurring electromotive forces derived from a suitable prime source of energy, of a condenser charged from said source at each excitation of the luminous column by
15 the prime source and adjusted as described to cause additional flashes of light therein, as and for the purpose set forth.

20 2. The combination of a transparent tube or tubes containing a conducting gas or gases and subjected to a definite number of primary varying electromotive forces per unit of time, and a condenser connected to said tubes and adjusted as described to cause additional
25 flashes of light in said tube or tubes, as and for the purpose set forth.

30 3. The combination of a transparent tube or tubes containing a conducting gas or gases and subjected to a definite number of primary varying electromotive forces per unit of time, and conducting caps or sleeves for said tube adjusted as described to have a condenser action whereby additional flashes of light may
be produced in the tubes.

35 4. The combination of an alternating-current dynamo or transformer and a tube or tubes having terminals adapted to cause flashes of light additional to the number of dynamo-alternation per unit of time.

40 5. The combination of an alternating-current dynamo or transformer, a tube or tubes connected thereto and a condenser also connected thereto and designed to cause flashes of light in said tube or tubes additional to those of the dynamo.

45 6. The combination with an electric lamp comprising a luminiferous gas contained in a translucent receptacle and excited by rapidly-varying electric vibrations or disturb-

ances, of conducting-electrodes at the terminals of the luminous gas column operating as
50 condenser-plates and by discharging through said column acting to produce additional flashes of light, as and for the purpose described.

7. The combination with a translucent tube
55 containing a gas or vapor properly rarefied so as to be rendered luminous by rapidly-varying electric current passing through the same, of conducting caps or terminals upon said tube having a superficial area designed
60 with relation to the length of the luminous gas column and to the potential of the primary exciting electromotive force as described so as to act upon the column by an oscillatory condenser-discharge superposed
65 upon the original exciting electromotive force and to produce in said tube additional flashes of light.

8. The combination with an electric lamp containing a column or body of gas rendered
70 luminous by the application of electric energy at the terminals of said column, of a condenser in circuit with said column and with the primary exciting source of currents and having a definite capacity such as de-
75 scribed proper for increasing the frequency of the emitted flashes of light.

9. The combination in an electric-lighting system wherein the luminous agent is a column or body of gas, of a generator or source
80 of varying currents connected thereto, and a condenser connected also to the circuit of the generator and lamps, and having its capacity designed with relation to the length or resistance of the gas column and to the inductance
85 of the circuit so as to produce from said column a doubled frequency of emitted flashes of light.

Signed at New York city, in the county of New York and State of New York, this 16th
90 day of December, A. D. 1901.

DANIEL MCFARLAN MOORE.

Witnesses:

E. L. LAWLER,

H. C. TOWNSEND.

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