

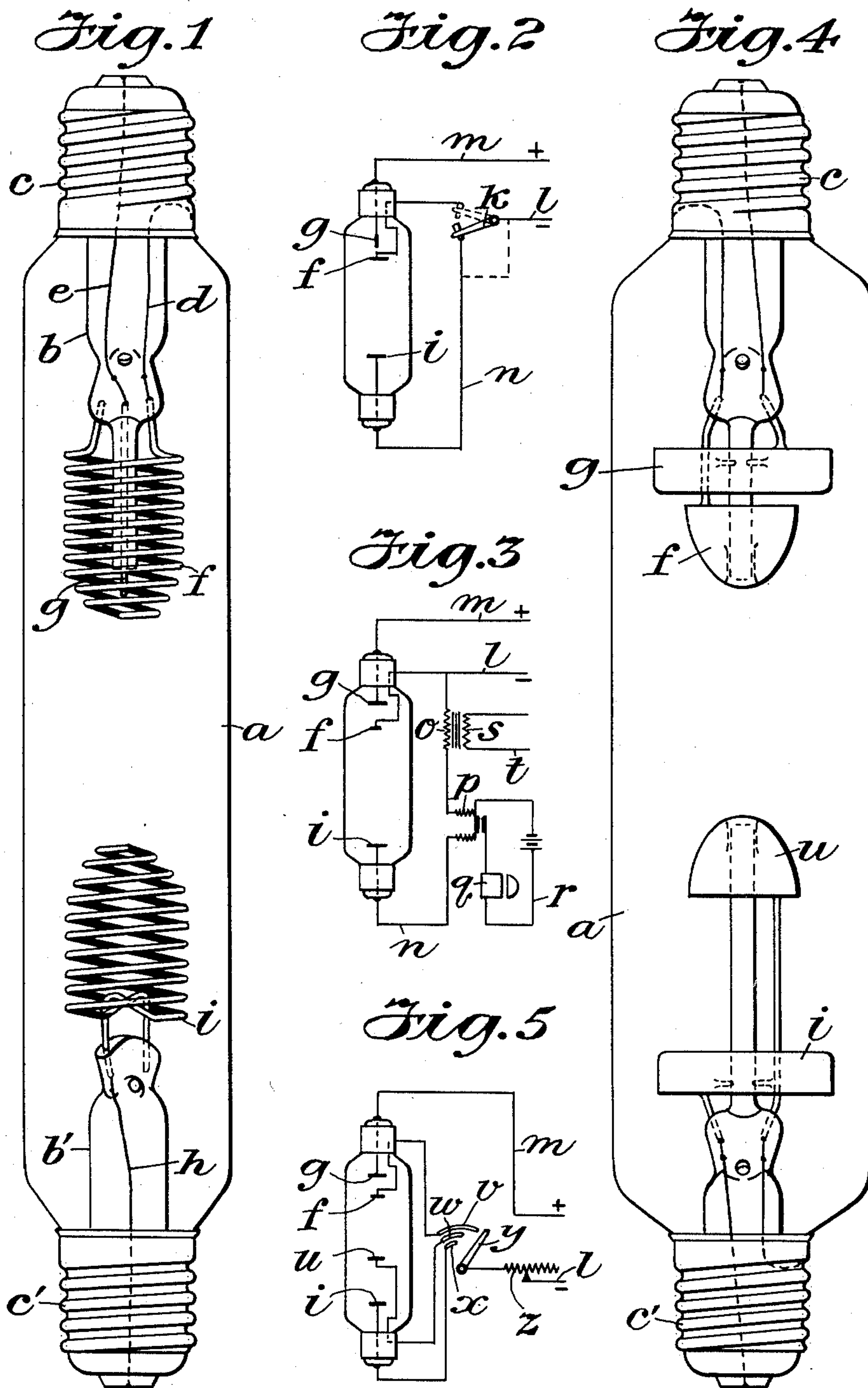
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ELECTRIC CATHODE GLOW LAMP

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## UNITED STATES PATENT OFFICE

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## ELECTRIC CATHODE GLOW LAMP

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## 1 Claim. (Cl. 250—27.5)

The present invention relates to electric cathode glow lamps.

Heretofore cathode glow lamps with a filling of rare gas or a mixture of rare gas have been provided generally with two electrodes, arranged at a distance of some millimeters from each other, with a short discharge section and have had resistance in series. In order to increase the efficiency of such glow light lamps, it is contemplated to so provide several series connected discharge sections in the lamp container that there can occur no discharge between neighboring discharge sections, and this results in the practical elimination of the said series resistance.

In accordance with the present invention there are likewise provided more than two electrodes and there are produced likewise two or more discharge sections. These sections are, however, connected in a novel manner in parallel and are of different length. This arrangement permits of the operation of the lamp with several voltages with the one or the other discharge section or also with several discharge sections simultaneously. As the separate discharge sections, which are of different length and which are connected in parallel, do not respond uniformly to various voltages, for example, the shorter discharge sections but not the longer discharge sections operating automatically on low voltages, the lamp is useful for voltage testing purposes and for signaling purposes.

There is shown in front view in Figure 1 an example of construction of a cathode glow light lamp made in accordance with the invention.

Figures 2 and 3 show two diagrams of connection for this lamp shown in Figure 1.

Figure 4 shows a somewhat different form of construction of the new lamp in front view and

Figure 5 an example of a connection diagram for the lamp shown in Figure 4.

The cathode glow light lamp has in the manner of the known ceiling lamps a tube-like glass container *a*, and at each end thereof there is provided stems *b*, *b'* and the usual screw bases *c*, *c'*. Through the stem *b* there are carried two current inlet wires *d*, *e*, of which the one *d* connects a spiral electrode *f* with the screw base and the other a pin-like electrode *g* with the bottom plate of the base *c*. Through the other stem *b'* there is carried a current inlet wire *h*, which produces the connection of a screw-wound electrode *i* with the bottom plate of base *c'*. Between the two electrodes *f*, *g* there exists the separation of a few millimeters usual in cathode glow light lamps whilst between the electrodes *g* and *i*, and between

the electrodes *f*, and *i* a much greater separation, that is of a few centimeters exists. The discharge sections between electrodes *g* and *f* on the one hand and *g* and *i* on the other hand are connected in parallel.

This can be done for example as shown in Figure 2 in that the electrode *i* together with electrode *f* is connected with the interposition of a switch *k* with a common line *l*. The other supply line *m* is in direct connection with the other electrode *g*. If a current of a low voltage, for example 110 volts, is available, then switch *k* is so placed (see dotted position) that the discharge passes over between the closely placed electrodes *g*, *f*. If a current of a higher voltage, say 220 volts, is available, then by connecting switch *k* to wire *n* there is produced a discharge section between the electrodes *g* and *i*.

When applying a higher voltage there could be produced also a discharge between the electrodes *g*, *f*, but there is then danger of an excessive stress and thus atomization of the cathode *f*. The possibility of switching over also allows, eventually without the harmful atomization and danger of blackening, the lamp bulb to produce a glow discharge each time commensurate with the voltage.

In order to shorten the construction length of the lamp and in order to reduce the distance between the third electrode *i* from the other two electrodes *f*, *g* to a few centimeters, the lamp is advantageously filled with a pressure exceeding the usual filling of cathode glow light lamps, thus with a rare gas or a rare gas mixture, of a pressure of more than 20 mm., and that advantageously with a pressure of about 50 mm.

The third electrode *i* can with another dimension of the electrode *g* be naturally connected together with the latter to a common supply line, whereby however care must be had, that with direct current operation the negative supply line is connected to the electrode *g*. Then too the line branch *n*, as indicated in Figure 2 in dotted lines, can be connected with the supply line *l*, omitting the switch *k*. In this case there will occur with a lower voltage a glow discharge between *g* and *i*, so that then with direct current operation the two cathodes *f* and *i* and with alternating current operation even all three electrodes *g*, *f* and *i* are covered with glow light and radiate light.

The possibility of an automatic operation of the second discharge section *g*, *i* when the voltage increases can also be usefully employed for signaling purposes. Then as shown for example in Figure 3 there can be put into the branch *n* leading to the third electrode *i* the secondary winding



o of a transformer and furthermore the electro-  
magnet *p* of an acoustic signal, for example a re-  
lay circuit *r* containing a bell *q*. If the primary  
winding *s* of the transformer is put under current  
5 by the closing of the circuit *t*, for example when  
exceeding a maximum speed or when passing  
through a stop signal, then there is induced in the  
secondary winding *o* a current, whereby the  
branch *n* is temporarily impressed with an in-  
10 creased voltage. This then results at once in a  
current flow from line *l* over branch *n*, the elec-  
trode *i*, *g* to the supply line *m* and thus the forma-  
tion of a glow discharge between the electrodes *i*  
and *g*. By the electrode magnet *p* now put under  
15 voltage the relay circuit *r* is put into circuit and  
the acoustic signal, for example a bell *q* is put  
into action. The circuit *t* containing the primary  
coils need not be permanently closed, but it suffices  
if the same is momentarily closed. For as soon  
20 as there occurs a discharge between *i* and *g*, the  
same persists even without additional voltage, as  
the burning voltage of glow lamps lies as is  
known considerably below the ignition voltage.  
There thus suffices the current normally fed by  
25 the lines *l*, *m* for the maintenance of the discharge  
between the electrode *i* and *g* initiated only by the  
current shock that is the temporarily higher volt-  
age. By the automatic operation of the second  
discharge section *i*, *g*, that is the appearance of  
30 the second glow light in the lamp bulb, eventual-  
ly in common with the sounding of the bell *q* there  
is obtained an extremely effective signal produc-  
tion. The steadily existing glow light at the dis-  
charge section between the closely placed elec-  
trodes *g*, *f* is thus a proof for the attendant and  
35 also possible controlling service, that the signal  
arrangement is in order and is under voltage.

The lamp shown in Figure 4 differs from that  
of Figure 1 only in that there are provided four  
40 electrodes *f*, *g*, *i*, *u* in the lamp container *a*. Again  
the discharge section provided between the two  
electrodes *f*, *g* has only the length usual in cathode  
glow light lamps of a few millimeters, whilst the  
parallel connected other discharge sections be-  
45 tween the electrodes *g* and *u* and *g* and *i* are  
longer by a multiple thereof.

Figure 5 shows an example of connection for  
the three discharge sections to be connected in  
parallel by means of a rotary switch *y* built into  
50 the supply line *l* and bridging over the three con-  
tacts *v*, *w*, *x* and a regulating resistance *z* con-  
nected in series with these. If there is to be pro-  
duced but one discharge between the electrodes *f*  
and *g*, then the switch *y* is turned slightly to the  
55 left and is so set, that only contact *v* is connected  
to the line *l*. By the actuation of the regulating  
resistance *z* the voltage is then throttled off to  
a great extent and brought to that degree which

just suffices for the maintenance of a discharge  
between the electrodes *f* and *g*. If additionally  
there is to be produced a discharge between the  
electrodes *g* and *u* then the switch *y* is turned  
somewhat further to the left, so that then also  
80 contact *w* is connected to the line *l*. The regulat-  
ing resistance must then naturally be displaced so  
that the voltage supplied increases and that the  
required quantity for the formation of a discharge  
between the electrodes *g* and *u* is obtained. 85

By a further turning of the switch *y* to the left  
there can then at the same time be brought into  
connection with the line *l* the contact *x*. The  
voltage supplied must then be increased so far  
by further displacement of the regulating re-  
90 sistance *z*, that there can also occur a discharge  
between the electrodes *g* and *i*. If the lamp is  
operated by direct current, then there are simul-  
taneously formed on all three parallel connected  
cathodes *f*, *u*, *i* glow light layers. If the lamp is 95  
operated by alternating current, then there natu-  
rally glows additionally the fourth electrode *g*.

If the rotary switch *y* is provided with simple  
button contacts arranged at certain intervals,  
then when operating the rotary switch *y* the dis-  
100 charge sections between the electrodes *g*, *f*, *g*,  
*u* and *g*, *i* can, as may be chosen, be separately  
connected up. It is merely necessary in this  
case to have a corresponding displacement of  
the regulating resistance *z*. 105

The three discharge sections of this lamp as  
of Figure 4 can similarly as shown in Figure 3  
be also automatically connected up in series, if  
corresponding auxiliary circuits are provided, by  
the closure of which there is then impressed upon 110  
the conductors leading to the electrodes *u* and *i*  
a voltage sufficient for the ignition of the cor-  
responding discharge section. There can then,  
as well when running over a preliminary signal  
as also a main signal, be brought to automatically 115  
light up each time another electrode of the lamp.

The number of electrodes and parallelly con-  
nected discharge sections, as also the shape of the  
electrodes and the enclosing gas container may  
be any chosen one according to the purpose of use. 120

What I claim as new and desire to secure by  
Letters Patent of the United States, is:—

An electric discharge device of the negative  
glow type comprising a container, a plurality of  
main discharge supporting electrodes sealed 125  
therein and disposed linearly along the central  
axis of the container and a gaseous filling therein,  
the main discharge paths between said electrodes  
being of different lengths, resistance, and striking  
voltage, and adapted to be operated simulta- 130  
neously in series.

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