

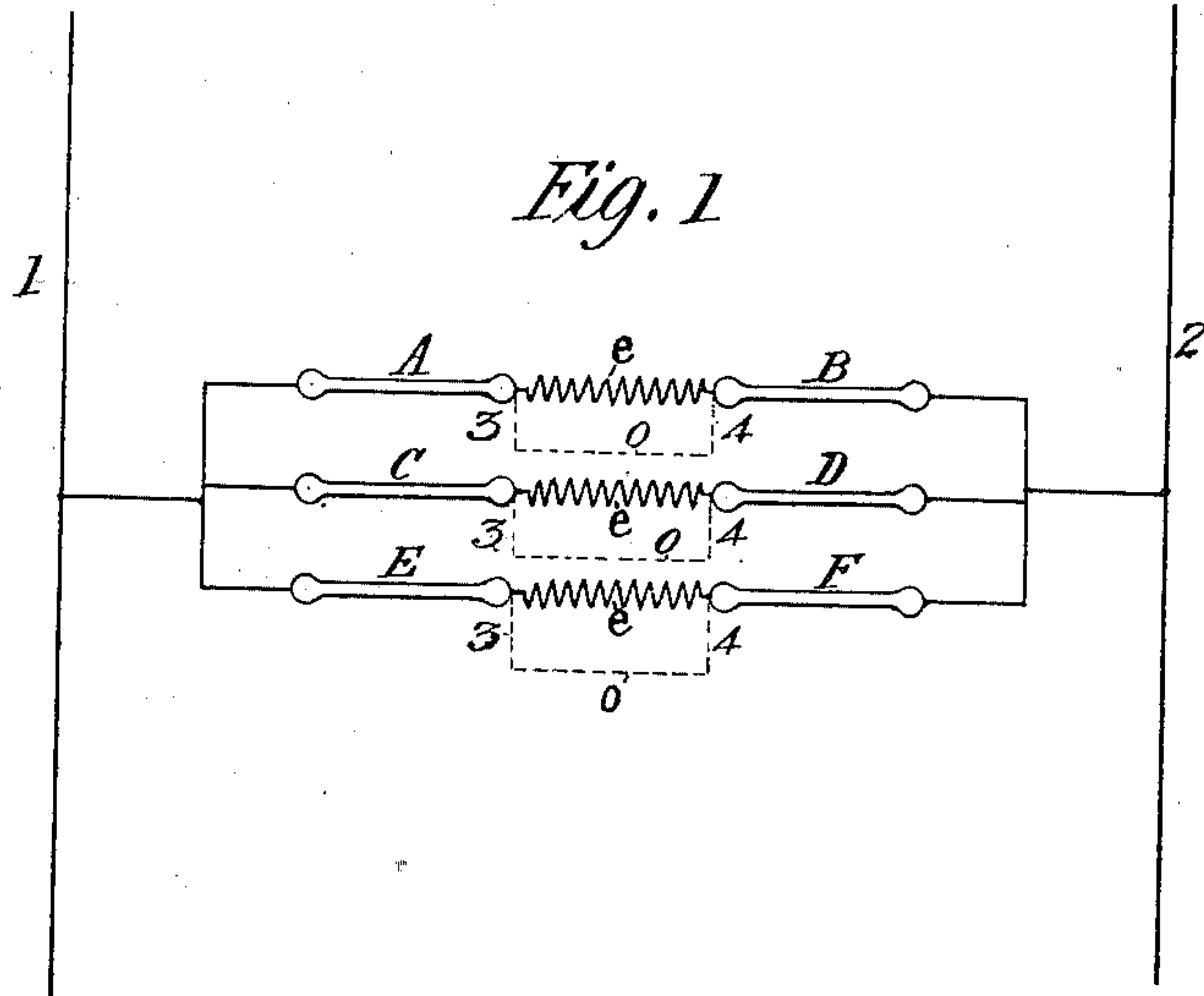
No. 668,246.

Patented Feb. 19, 1901.

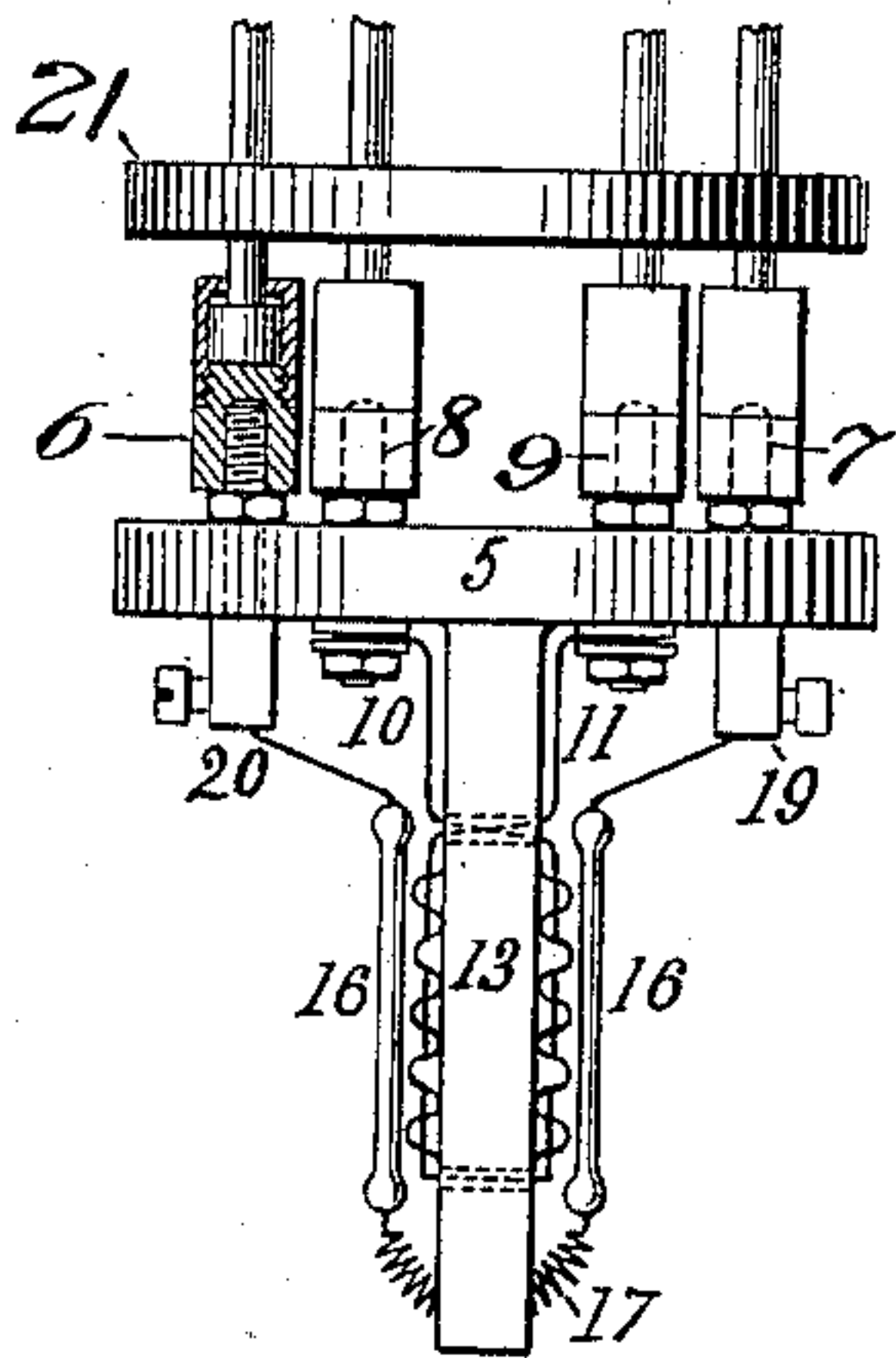
A. J. WURTS.  
ELECTRIC LIGHTING APPARATUS.

(No Model.)

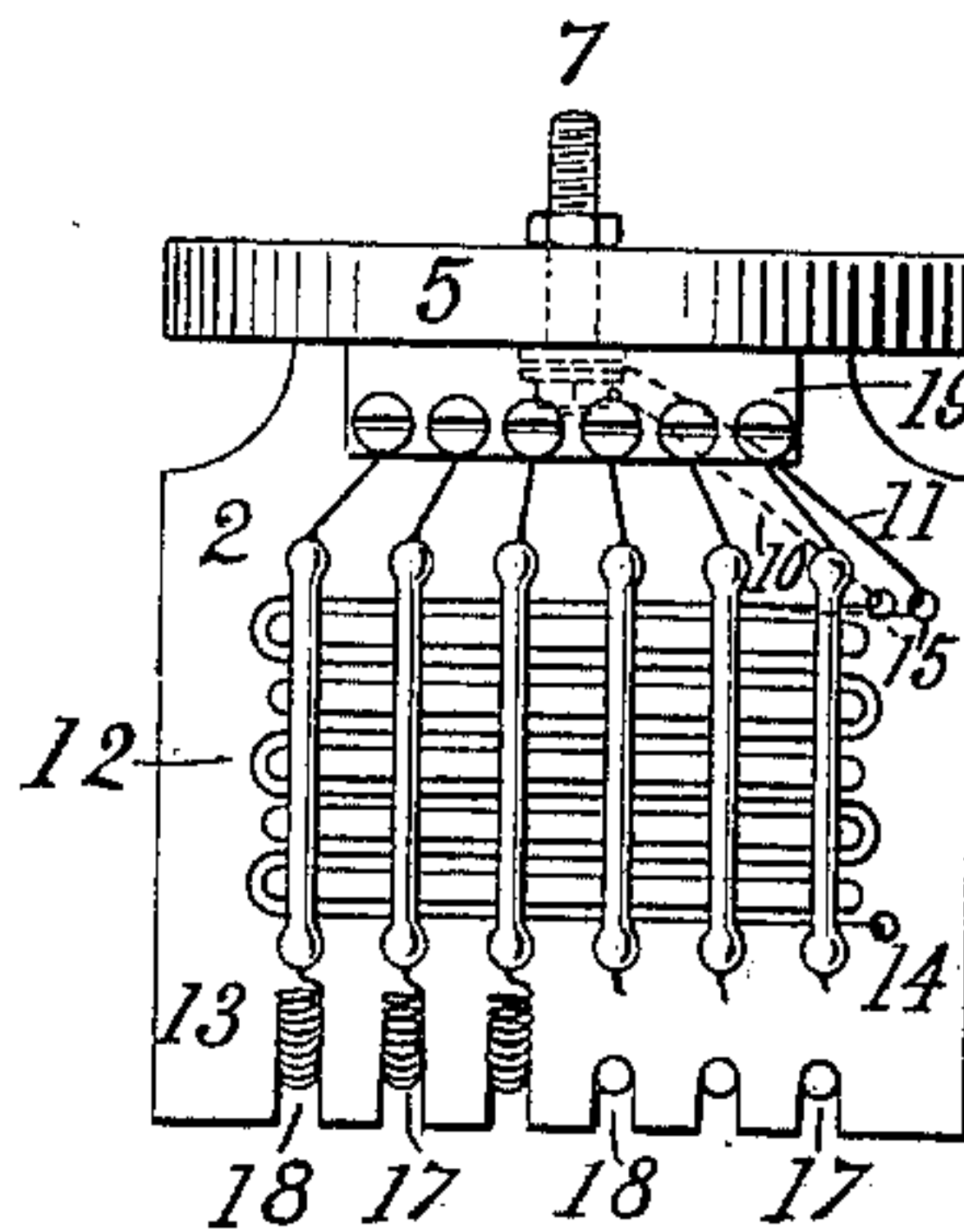
(Application filed Aug. 19, 1899.)



*Fig. 2.*



*Fig. 3.*



Witnesses:

Raphaël Ketter  
George H. Stockbridge

Inventor

Alexander J. Wurts  
by Charles A. Perry. Atty.

# UNITED STATES PATENT OFFICE.

ALEXANDER JAY WURTS, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO  
GEORGE WESTINGHOUSE, OF SAME PLACE.

## ELECTRIC-LIGHTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 668,246, dated February 19, 1901.

Application filed August 19, 1899. Serial No. 727,786. (No model.)

*To all whom it may concern:*

Be it known that I, ALEXANDER JAY WURTS, a citizen of the United States of America, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electric-Lighting Apparatus, of which the following is a specification.

My invention relates to that class of electric lamps in which glowers are used which are formed from material such as rare earths which are non-conductors of electricity when cold and become relatively good conductors when hot. A form of heating device which I have used for giving the initial temperature to the glowers to render them conductive consists of a disk or plate carrying circuit-terminals for making an electrical and mechanical connection between the fixed and removable parts of the lamp and of another plate or disk supporting the glowers, and also a heater-wire for bringing the glowers to a conductive state. In the present instance I arrange these two plates at right angles to each other, letting the heater-wire and the glowers be supported along the vertical walls of a plate which is formed in one piece with or connected to a horizontal plate or disk which carries the circuit-terminals. This arrangement I prefer where, as in the present instance, it is intended to arrange several glowers in multiple series within the same lamp structure.

The present invention relates, broadly, to a multiple-series arrangement of electric glowers, and specifically to the preferred structure of electric lamps embodying such a multiple-series arrangement.

In the employment of high-potential lamps or glowers it is usually undesirable to make the unit glowers of any very considerable length—that is, for a higher voltage than, say, two hundred and twenty volts. For higher voltages than this it is usually desirable for several reasons to connect unit glowers in series or multiple series—in series to take up the required voltage and in multiple to increase at need the candle-power for the given voltage. By arranging glowers in this manner economy in manufacture, economy in assembling, and economy in operation are

secured. I speak of economy in assembling because it would be difficult to handle very long glowers, while the operation is made cheaper, because it signifies less in the matter of costs to have a small glower burned out in use than a long and relatively expensive one.

In my multiple-series lamps I generally employ ballast-wires to prevent an undue flow of current by reason of the decreasing resistance of the glowers when hot, and in some instances I place each ballast-wire between the inner terminals of glowers that are in series.

I have illustrated my invention both diagrammatically as applied to glowers irrespective of any special lamp structure and also in connection with a specific removable part of a lamp of this class.

In the drawings, Figure 1 is a diagram of the connections for multiple-series-lamp glowers. Fig. 2 is an end elevation of the fixed and removable parts of a lamp, and Fig. 3 is a side elevation of the removable part.

In Fig. 1, A B C D E F are glowers arranged in series in groups of two between the main supply-wires 1 and 2. In the said figure, A and B form one pair of glowers in series, C and D a second pair, and E and F a third pair. Between the inner terminals of the respective members of each pair I arrange ballast-wires *e*, which may be spirally wound and connected directly to the said inner terminals. I find that this arrangement is very serviceable, particularly with small glowers, as it answers the purpose of making the ballast-wire serve as a glower lead-wire, thereby serving the purposes of economy and also of furnishing a very flexible connection for the glowers, allowing them to expand and contract longitudinally without strain. This feature is available in all lamps of this class without reference to the question of a multiple-series or other arrangement of the glowers. It may be applied also to a single glower with advantage. The respective inner terminals of the pairs or groups of glowers in series may be connected by lead-wires, which include the ballast-wires, outside or at a distance from the glowers. This arrangement I have indicated in dotted lines *o o o* in Fig. 1, the said parts *o o o* being the ballast-wires and



the lead-wires being shown at 3 and 4. While the inner ends or terminals of each pair or group of glowers are connected together, as shown, the said terminals are insulated from the other inner terminals to preserve the balance of the circuit in case any one or more glowers on the same side should burn out.

In Fig. 2, 5 is a plate or disk carrying circuit-terminals 6, 7, 8, and 9, making mechanical and electrical connection with the fixed portion 21 of an electric lamp. 8 and 9 are the terminals of the heater-circuit, the said terminals being connected by wires 10 and 11, respectively, with the ends of a heater-wire 12, which is supported along the opposite sides of a vertical plate 13. The parts 5 and 13 are of porcelain or some other heat-resisting material, and they will generally be made in one piece. The heater-wire 12 may pass through openings 14 and 15 and be wound back and forth upon the sides of the plate 13 and held in place by any suitable insulating-enamel. Outside the heater-wires are supported glowers 16 16, with their inner ends connected by lead or ballast wires 17. These wires pass through slits or openings 18 in the lower end of the plate 13, whereby all the lead or ballast wires between the inner terminals of the glowers are severally insulated from each other. The binding-post 7 is connected to a circuit-terminal 19, which is common to all the glowers, while the binding-post 6 is connected to a set or series of binding-posts 20, each connected to a separate one of the glowers 16 16.

It will be seen that the removable part illustrated in Figs. 2 and 3, together with the elements supported thereby, constitutes an embodiment of a multiple-series arrangement of electric glowers such as is diagrammatically shown in Fig. 1.

I claim as my invention—

1. In an electric lamp wherein glowers formed from one or more rare earths are the incandescing bodies, a plate of heat-resisting material and glowers mounted on opposite sides thereof, the said glowers being arranged in groups in series, different members of the same group being on opposite sides of the plate.

2. In an electric lamp wherein glowers formed from one or more rare earths are the incandescing bodies, a number of such glowers arranged in multiple series, and ballast-wires connecting the inner terminals of the members of each series.

3. In an electric lamp wherein glowers formed from one or more earths are the in-

candescing bodies, a number of such glowers arranged in multiple series between the terminals of the lamp and a heat-resisting plate, the members of each series of glowers being arranged on opposite sides thereof.

4. In an electric lamp wherein glowers formed from one or more rare earths are the incandescing bodies, a disk of heat-resisting material carrying circuit-terminals, a plate of similar material joined thereto at right angles, an electric heating device supported upon the said plate, and a number of glowers supported in proximity to the said heating device.

5. In an electric-lighting system, a number of glowers formed from one or more rare earths, the said glowers being arranged in multiple series, each group or series being provided with a ballast-wire between the glowers of that group or series.

6. In an electric-lighting system, a number of glowers which are non-conducting when cold and conductors when hot, the said glowers being arranged in multiple series, in combination with coiled ballast-wires interposed between the inner terminals of the members of the series.

7. In an electric lamp wherein glowers formed from one or more rare earths are the incandescing bodies, a disk or plate carrying lamp-terminals, a plate formed in one piece therewith and placed at right angles thereto, the last-named plate being notched at one end and having glowers in multiple series arranged on opposite sides of it, the members of each series being joined by ballast-wires which extend through the said notches.

8. In an electric-lighting system, a number of glowers formed from one or more rare earths, the said glowers being arranged in multiple series, with ballast-wires interposed between the glowers in each cross-circuit, the several cross-circuits being insulated from each other at all points between the branching points of the cross-circuits.

9. In an electric lamp wherein glowers formed from one or more rare earths are the incandescing bodies, a number of such glowers arranged in multiple series, the members of a series being separated from each other by a slab or plate of insulating material.

Signed at Colorado Springs, Colorado, this 15th day of August, 1899.

ALEXANDER JAY WURTS.

Witnesses:

LEONARD E. CURTIS,  
E. A. SUNDERLIN.