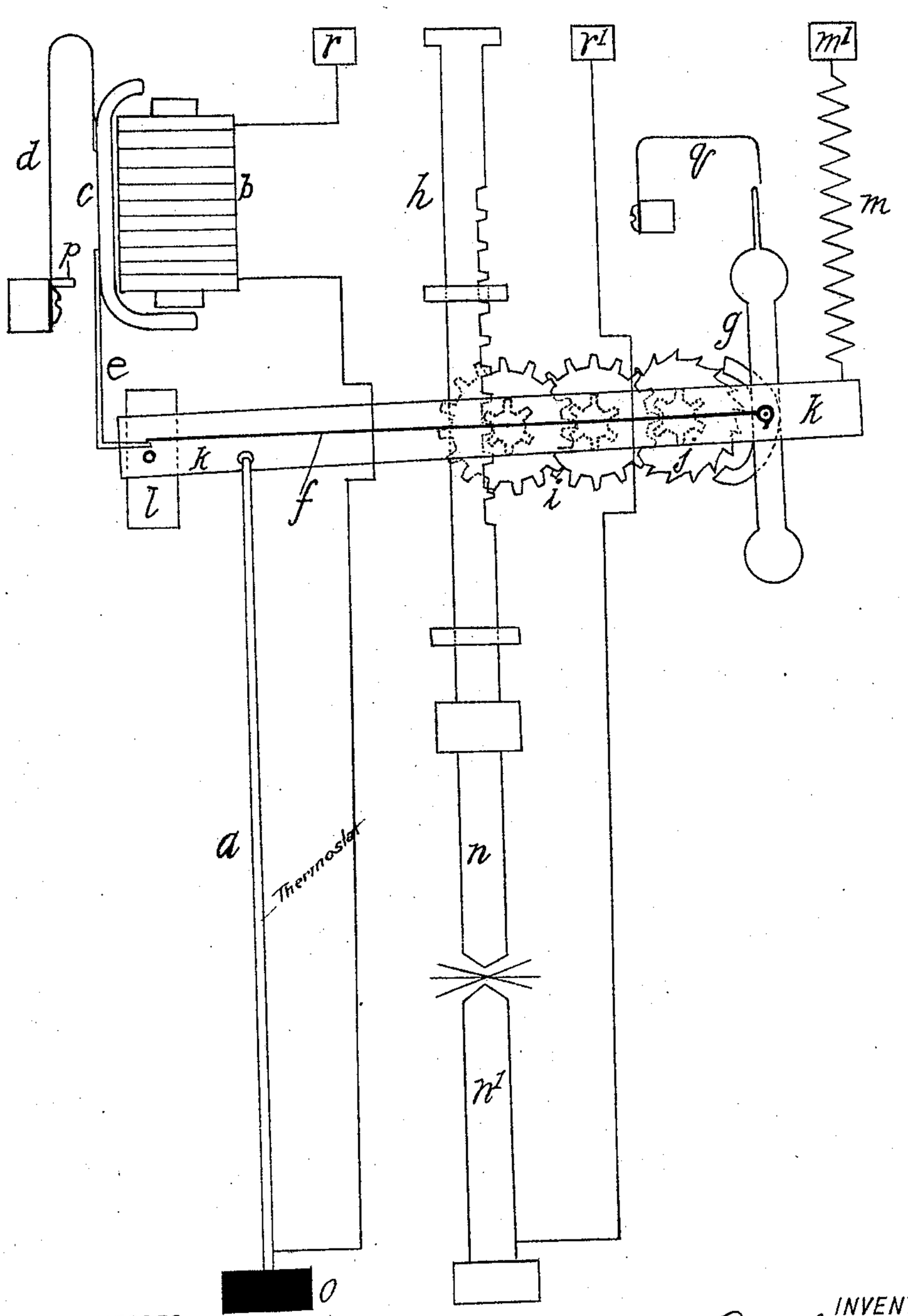
(No Model.)

R. O. HOOD.

ELECTRIC ARC LAMP.

No. 574,905. Patented Jan. 12, 1897.



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ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 574,905, dated January 12, 1897.

Application filed July 6, 1896. Serial No. 598,064. (No model.)

To all whom it may concern:

Be it known that I, RALPH O. HOOD, a citizen of the United States, residing at Danvers, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to electric-arc lamps particularly adapted for use on multiple-arc or constant-potential circuits.

The object of this invention is the production of a lamp which shall have the quality of steadiness in its operation, the ability to quickly and steadily draw and form the arc without the make-and-break effect which causes violent hammering of the parts that is liable to occur when lamps are operated across a low-potential circuit of approximately thirty volts, and which shall only necessitate the use in its construction of a small magnetic force for its operation, thereby doing away with the humming noise caused by strong alternating magnetic fields acting upon the metallic cover when the lamp is used on alternating circuits.

The invention consists of a device for holding the carbons which is acted upon by the expansion of a mass due to the heating effect of the electric current in such a manner as to draw and form the arc, and an electromagnetic device placed in series with the arc for drawing or feeding the carbons together as they are burned away.

It also consists in a device for preventing the overheating of the aforesaid mass in cases where the current is switched on and off so rapidly as to normally prevent the mass from cooling each time.

I hereinafter describe one of the many mechanisms in which my invention may be embodied; but it will be understood that I do not limit myself thereto, as many and various changes may be made without departing from its spirit and scope.

Reference is to be had to the annexed drawing, and to the letters marked thereon, forming a part of this specification.

The drawing shows diagrammatically the different parts of the lamp.

A mass, preferably in the form of a high-resistance wire, is represented by *a*. *b* is a magnet acting upon the armature *c*, which is supported by the spring *d*. Attached to the armature is the detent-arm *e*, arranged to engage with the escapement-arm *f*, which is rigidly connected to the escapement *g*, as hereinafter described. The carbon-rod *h* is connected by means of its rack and the gears *i* to the escapement-wheel *j*, the train of gears and the escapement being placed in the frame *k*, pivoted at one end upon the pivot-block *l* and held at its other end by the spring *m* from the stationary block *m'*. *n* and *n'* represent the upper and lower carbons, respectively. The wire *a* is fastened at one end to the frame *k* and at the other end to the insulated stationary block *o*.

The armature *c* is prevented from getting out of magnetic range of the magnet *b* by means of the stop *p*.

q represents a detent for engaging with the escapement when the wire *a* has expanded to an unusual degree.

The binding-posts or terminals of the lamp are shown at *r* and *r'*, the path of the current being from binding-post *r*, through magnet *b*, wire *a*, frame *k*, carbon-rod *h*, carbons *n n'* to binding-post *r'*.

The operation of the lamp is as follows: When the lamp is out of circuit, the carbons are together and the wire *a* is in a natural state of linear expansion, being shorter than is shown in the drawing, which represents the lamp in operation, and has therefore pulled the frame down from the position shown in the drawing, extending the spring *m*. Upon the establishment of a current the wire *a* is warmed, due to the current flowing through it, and by its expansion due to heat allows the spring *m* to bring the frame into the position shown in the drawing, thereby separating the carbons and forming the arc. If the arc becomes too long and the strength of the current falls below the predetermined amount that should flow through the lamp, the action of the magnet *b* is weakened to a sufficient extent to allow the spring *d*, which would hold the armature *c* against the stop *p* were no current passing, to move the armature in such a position as to free the escapement by means of the arm *e*, releasing the arm *f*. The carbons will then by force of gravity of the carbon-rod *h*, operating the gears *i* and the escapement, come together near enough to increase the current flow to a sufficient extent to cause the arm *e* to again engage the escapement mechanism on account of the increase of strength of the magnet.

In practice the feeding will be so gradual that the escapement will only feed one or two teeth at one action of the armature *c*, but should the feed be greater than is really necessary to keep the current constant the increase of current will expand the wire *a* to a greater extent and thereby preserve a balance.

It will be clearly seen that a very slight magnetic force will perform the above-described operation.

I have found that as the action of the wire *a* in drawing the arc is much slower than that of a magnet the arc is always drawn successfully from the first separation of the carbons, while were a magnet employed the establishment of a current would cause it to act so rapidly as to break the arc, owing to the quickness of the separation of the carbons. This would cause a rapid succession of endeavors to form an arc until a sufficient amount of carbon vapor had been formed to maintain the arc under the low potential which might be used.

I understand that dash-pots and retarders of different kinds could be used for retarding the action of a magnet, but said retarders would be less constant and reliable as well as more expensive than an expanding conductor.

If in the device which I have just described the current is switched off and then immediately turned on again, the carbons will touch each other before the wire *a* has come to the temperature of the surrounding air, and as said wire has to expand to a given amount to draw the arc it will start from a fairly high temperature and arrive at a temperature above the normal when the arc has been formed. If this operation be repeated successively, it will be seen that the wire will be increasing in temperature each time until a point is reached which will injure it. To avoid this, I place a stationary catch or detent *q* for engaging with the escapement when the wire is in a state of expansion above the normal and thereby prevent the feeding of the carbons together. This has the effect of avoiding the successive increments of heat in the wire *a* due to the continual rapid switching on and off of the current, for the reason that the wire must go down to its normal temperature before the carbons can come in contact, and said wire is so arranged as to safely stand the increase of temperature necessary to draw the arc when starting from said normal heating-point.

I am aware that a metallic mass expanding under the action of the electric current has been used to separate the carbons in an electric-arc lamp; but I believe that the feeding of the carbons together has heretofore been accomplished by other means than that of a magnet acting in series and in conjunction with the mass and possessing the advantages which I have pointed out.

Having thus explained the nature of my invention and described a way of constructing the same, though without attempting to set forth all the forms in which it may be made or all the modes of its use, it is declared that what is claimed is—

1. In an electric-arc lamp, the combination of a mass whose expansion under the action of the electric current separates the carbons employed therein and a magnet in series with the arc for feeding the carbons toward each other when the current flowing across the arc is at a predetermined value.

2. In an electric-arc lamp, the combination of a mass whose expansion under the action of the electric current flowing through said mass draws and forms the arc and a magnet in series with the arc for maintaining the arc and preventing the current from falling below a predetermined value.

3. In an electric-arc lamp, a mass expansible under the action of the electric current flowing through it for the purpose of moving a device which holds the carbons, under the control of a magnet in series with the arc, in such a manner as to strike the arc in combination with said magnet for releasing the hold of the carbons when the current flowing through said mass and the arc is at or below a predetermined value.

4. In an electric-arc lamp, a metallic mass expansible under the action of the electric current and operating a device for separating the carbons and thereby forming the arc in combination with an electromagnetic device placed in series with the arc for releasing or feeding the carbons when the current flowing between said carbons is at or below a fixed value.

5. In an electric-arc lamp, the combination of a metallic mass whose expansion due to the flow of the current separates and keeps the carbons apart, a clock-escapement device for feeding the carbons and a magnet in series with the arc arranged to permit of the operation of said escapement device when the current flowing through the metallic mass and the arc falls to a predetermined amount.

6. The combination in an electric-arc lamp of a wire, in series with the arc, whose expansion due to the heat caused by the flow of the current permits of the separation of the carbons and a magnet, in series with the arc, whose action, when the current falls below the amount desired to flow through the lamp, is to permit of the feeding of the carbons, substantially as and for the purpose described.

7. In an electric-arc lamp, the combination of a mass whose expansion under the action of the electric current separates the carbons employed therein, a magnet for feeding the carbons toward each other, with a detent for preventing said feeding when said mass has expanded to a degree above the normal, as and for the purpose described.

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