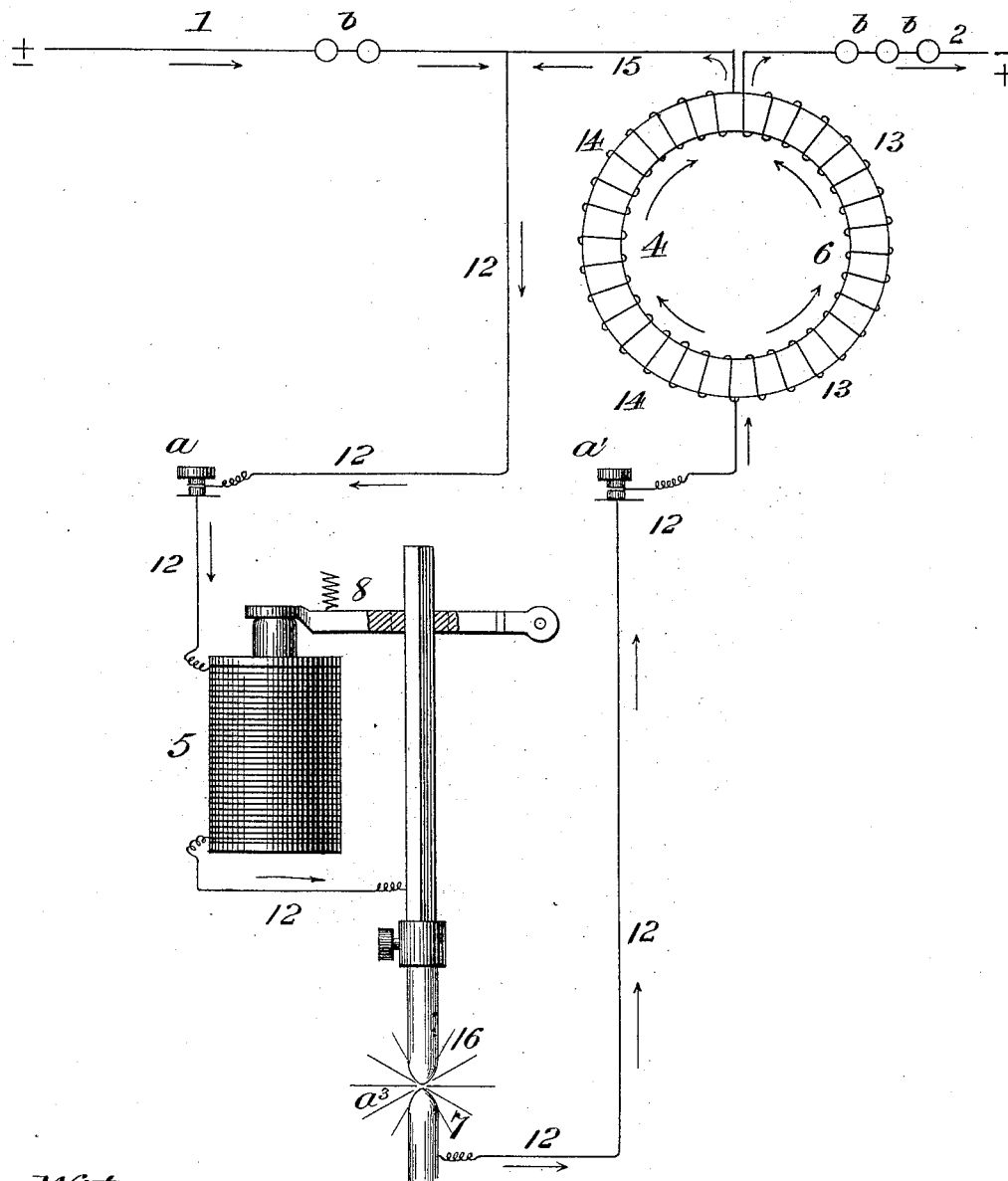


(No Model.)

W. S. HORRY.
METHOD OF WORKING ARC LAMPS.

No. 523,401.

Patented July 24, 1894.



Witnesses:

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METHOD OF WORKING ARC LAMPS.

SPECIFICATION forming part of Letters Patent No. 523,401, dated July 24, 1894.

Application filed October 17, 1893. Serial No. 488,361. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM SMITH HORRY, a subject of Her Majesty the Queen of England, residing at the city of New York, in the
5 county of New York and State of New York, have invented a new and Improved Method of Working Arc Lamps and other Electrical Devices, of which the following is a specification.

10 My present invention relates to a new method of working arc lamps in series from an electrical source of supply.

According to my invention, the lamp itself is automatically supplied with current that
15 varies both as regards amperes and volts within wide limits while in the ordinary working of each individual lamp the supply of watts is approximately constant.

In my invention, use is made of an induction coil magnetized substantially to saturation and of particular design. The functions of this coil are two-fold: first, it effects the transformation necessary to give the required current when the lamp is working, and second, it causes one or more constant potential
25 arc lamps to regulate properly in series upon a constant current alternating main or line. Such an induction coil may therefore be properly termed an "arc regulator." Use is also
30 made in carrying out my invention, of an ordinary constant potential or alternating current arc lamp, now well known in the art, such for example as is shown in the patent to C. Coerper, dated June 10, 1890, and numbered 429,787. However for the sake of clear-
35 ness, it may be remarked that such a lamp comprises a solenoid in series with the arc or carbons and a clutch operated by the core of the solenoid and adapted to permit one of the
40 carbons to approach the other when the core is drawn into the helix of the solenoid. This solenoid allows a certain or definite quantity of current to pass and since the voltage is constant, it will allow no more to pass than
45 such certain amount, for example, ten amperes. When a current of constant voltage is supplied to such a lamp, the carbons are shifted and the arc is properly regulated in the following manner: While the current of
50 ten amperes passes the solenoid, its core is

maintained in such position that the clutching device holds the carbons separated; when the carbons wear or burn away, the resistance at the arc increases, the voltage or electro-
motive force is constant as has been stated, 55 and the current consequently decreases, due to the fact that the current is equal to the electro-motive force divided by the resistance. This decrease of current in this instance to less than ten amperes, permits the core of the solenoid to loosen the hold of the clutch upon
60 one of the carbons, so that the carbons approach each other until the resistance of the arc is such that the required ten amperes pass again, whereupon the solenoid will again
65 cause the clutching device to hold the carbons and prevent their further approach. Such lamps as these are by far the best suited to and commonly employed for alternating currents, but prior to my invention, they
70 could only be used in connection with lines of constant voltage, because if the voltage were not constant, any increase of resistance at the arc would result in a corresponding increase of voltage in the secondary or lamp
75 circuit, so that the current would remain the same, ten amperes, and the lamp would not feed. By my invention such constant potential or alternating current arc lamps may be
80 used in series upon mains in which the current is kept constant by any means, and my improved method consists in magnetizing the core of the transformer substantially to saturation whereby an increase of voltage in the
85 secondary or lamp circuit is prevented, so that an increase of resistance at the arc results in a decrease of current passing the solenoid, which as has been already explained, causes the lamp to feed, and my invention
90 also contemplates other matters hereinafter fully set forth.

The nature, objects, and scope of my invention will be more fully understood from the following description taken in connection with the accompanying drawings forming
95 part hereof and in which is illustrated diagrammatically a form of apparatus by means of which my invention may be carried into effect. In this connection, it may be stated that only one arc lamp is shown in series with 100

the mains or line conductors, however, more arc lamps may of course be employed in series therewith.

Referring to the drawing, it is assumed that the current in the mains, line, or primary circuit 1—2, is maintained constant, for example, at five ampères. In the present instance, this current is passed untransformed by the conductor 12, through the constant potential arc lamp a^3 , *i. e.* by way of the binding posts a and a' , and through the coil of the solenoid 5, and the carbons 16 and 7, and through the portion 13, of the single coil of the transformer 4, and thence to the line conductor 2, as is indicated by the arrows. In traversing the portion 13, of the coil, the current very strongly magnetizes the core 6, and thus induces a current of five ampères in the portion 14, of the coil. These primary and secondary currents enter the lamp circuit 12, from opposite directions as indicated by the arrows and hence unite in parallel and give rise to a current of ten ampères in the lamp circuit 12. When the secondary current traversing the conductor 15, is five ampères, the core 6, is magnetized substantially to the point of saturation for purposes to be hereinafter described, and this result may be accomplished by having due regard to the ampère turns on the core 6. In this connection, it may be remarked that inasmuch as the lamp is supplied in part by the main or primary current directly from the mains or lines 1—2, and in part by a derived current, it follows that the transformer as a whole is comparatively small and therefore when its core is substantially saturated does not cause undue heating thereof.

The result attained by the employment of a saturated core is the automatic feeding of the constant potential lamp a^3 , which is interposed in series in a circuit of constant ampèrage, and the mode of accomplishing this result may be described as follows:

When the lamp is first started, the carbons are close together and the transformer effects the necessary transformation in the well understood manner and generates a secondary current of five ampères. As the arc becomes longer, the voltage between the carbons rises, or in other words, the resistance of the arc increases, and the core 6, approaches the point of saturation. In this condition, a further increase of resistance of the arc might cause a further rise of electro-motive force in the primary circuit 1—2, but the core is saturated and therefore the electro-motive force in the secondary circuit 15, cannot rise, so that the increased resistance of the arc is accompanied by a decrease of current (ampèrage) in the secondary circuit 15, which as before explained, effects a corresponding decrease of current (ampèrage) in the lamp circuit 12, which causes the lamp to feed through the intervention of the solenoid 5, and the pivotal spring balanced clutch 8. The satu-

ration of the core is absolutely essential to the success of this method.

If the core were not saturated, the device would operate in the following way: A current of ten ampères would always traverse the lamp irrespective of the distance between the carbons, because an increased resistance at the arc would be accompanied by a corresponding increase of voltage in the secondary circuit, as has been above explained. Under these circumstances, the lamp would not feed as the solenoid 5 would always receive ten ampères and the voltage in the secondary circuit would rise higher and higher and the arc would become longer and longer and would emit a roaring sound and give but little light and be very unsteady, so that no ordinarily operated transformer is suited to regulate the arc lamps as described.

It may be remarked that by using nine ampères instead of five ampères in the primary circuit 1—2, a very small arc regulator or transformer may be employed to generate the single extra ampère required, and in such case the heat that always accompanies a saturated transformer coil would be very greatly reduced in comparison with the employment of a larger arc regulator or transformer adapted to regulate and generate five ampères in its secondary circuit from five ampères in its primary circuit, in fact to derive the fullest possible benefit from the invention, the smallest possible current should be generated in the secondary circuit which will effect the regulation of the constant potential arc lamp.

b, are incandescent lamps which may be interposed in series upon the mains 1—2, and inasmuch as these mains are of constant ampèrage, it will be obvious that such incandescent lamps will operate advantageously, and in series with one or more constant potential arc lamps a^3 .

Although the apparatus as herein described, is suited to a current, the ampèrage of which is constant, yet it is obvious that the means by which the current is kept constant are quite immaterial, and it is known to the inventor that the apparatus can be so designed as to automatically keep the current constant in cases where a number of lamps are placed in series upon the mains, even when the latter are supplied with current from a constant potential dynamo and that whether the individual lamps in the circuit work properly or accidentally go out, this result is effected by designing the transformers in such manner that the resistance of the whole coil 13—14, thereof is equal to the resistance of the lamp and its accessories when working.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of suiting an alternating current to arc lamps which consists, in causing said current to generate a secondary current

by means of a transformer, continuously passing both currents through the lamp, and permitting the same to magnetize the core of the transformer to saturation whereby the current through the lamp decreases as the voltage between the lamp carbons increases, substantially as described.

2. The method of suiting an alternating current to arc lamps which consists, in causing said current to generate a secondary current by means of a transformer, and permitting said currents to magnetize the core of the transformer to saturation, whereby the current through the lamp decreases as the voltage or resistance between the lamp carbons increases, substantially as described.

3. The method of suiting an alternating cur-

rent of constant ampèreage to arc lamps of constant voltage which consists, in causing said currents to generate a secondary current by means of a transformer, and permitting said currents to magnetize the core of the transformer to saturation, whereby the ampèreage of the secondary current decreases as the voltage between the lamp carbons increases, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM SMITH HORRY.

Witnesses:

A. B. STOUGHTON,
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